Sensory Integration as the Path for Nurturing Toddlers' Wellbeing

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Sensory development, activities, and stimuli are extremely important for toddlers' optimal growth and development. Sensory integration development is one of the fundamental neurobiological activities of toddlers that represents the basis for learning and presents a very important and actual research field in contemporary science and practice. At the same time, the early childhood educators' role and the sensory activities which are extremely important external stimuli for the sensory integration development. Considering the very small amount of scientific studies in this research field, especially research carried out by early childhood educators working with toddlers in everyday regular preschool class, this study was focused on testing the implemented sensory activities and stimuli in everyday teaching. Based on that study aim, a comparison was made between two toddler groups – the one that was exposed to all mentioned stimuli and the one that was not, so that the wellbeing for children's development could be determined. Generally, it was determined that there are significant differences between the control and experimental groups of children due to the application of sensory tools and materials in the experimental group of toddlers. Since there were no significant differences in all elements of sensory development, just in some, the discussion was based on the optimal conditions in nursery schools for the sensory integration for toddlers.

Keywords: toddlers, wellbeing, sensory integration, sensory activities and stimuli

Introduction

Although every child is born with the ability of sensory integration, the adults included in the child's development have the responsibility to ensure relevant relations with various items from the environment so that the child could learn how to adjust his own brain and body to the many challenges he faces during childhood in order to successfully develop his sensory integration. During the first seven years 'a child learns how to feel his own body and

the world around him, and how to move more effectively in it' (Ayres 2009, 27). Gaining sensory input from all of the items surrounding him (furniture, clothing, footwear, cutlery, toys, pencils, books, people ...), 'a child should develop sensory integration so he could use these information and act effectively' (Ayres 2009, 27). Our inner drive aiming for the sensory integration enables our entire development.

Sensory-motoric systems develop and form our own experiences, while at the same time being formed by them; therefore, if we really want to understand how we learn, first we need to learn how these systems develop. Hannaford (2007) emphasizes that thought, creativity, and learning develop from sensations through which the information is imported so that we could build neural networks and be able to use this information for better understanding of the world and how to succeed in it. We receive many experiences from our surroundings through our senses: eyes, ears, taste buds, nose, skin, and the nervous receptors in every muscle and organ; something like Proust's magical cookie that awakens all our early childhood memories all the way to maturity with its scent and taste – like it can magically stop the time and grant us our past in the palm of the hand.

The role of the preschool and, at the same time, the role of the preschool educator is crucial in gaining sensory integration in early childhood or, to be more exact, in the nursery school (Boyd and Sobieraj 2013). Contemporary childhood and children's needs are distinctly different in relation to children's needs in the past and many researches indicate the increased need of the sensory experiences domain, interrelations between them, and, finally, integration. Therefore, this research paper focuses on exploring the significance of sensory activities implemented in early childhood education and care as well as on an experimental testing of the implemented sensory activities in the nursery school, which are used to stimulate sensory integration. The implications of the research findings are more than significant, considering science and the everyday practice, which we need to be constantly attentive to and improve with relevant scientific knowledge.

Sensory Integration and the Wellbeing of Toddlers

Sensory integration theory, research, findings, interventions, and therapeutic equipment were originally developed by A. Jane Ayres (2009). This therapeutic approach is also known as the Ayres Sensory Integration (Ayres 1989) theory, which was implemented in her therapeutic work with individuals with special needs.

Sensory integration represents an organization of the senses of use, which

give us information about the physical state of our body in the environment (Bundy, Lane, and Murray 2002). For a person to move, learn, and act normally, his brain has to organize its senses, locate them, classify, regulate exceedingly many sensory information bits that enter his brain at every moment from all parts of the body. Well-organized or integrated form of senses development gives our brain the opportunity to use them in a way to form perception, behavior, and learning. Unorganized senses development results with a life that seems like a 'traffic rush hour' as Ayres (2009, 16) scenically points out.

Our senses are 'food to our brain,' which reassures energy and knowledge required to control our body and mind, and if our sensory process ritual is not well organized, our senses are be able to feed our brain. Dr. Ayres (2009, 15) continues to describe this in a simple way, explaining how a 'sense tells the brain what the body does' and how the 'brain tells the body what to do,' in the attempt to explain the way of mutual communication between the brain cells. Our brain has the ability to integrate sensory impulses in meaningful forms and relations, which grants us the possibility to perceive our own body, other people, and things, and exact integration is what turns the senses into perception (Bundy, Lane, and Murray 2002).

Primary features of the sensory integration process disorder are the presence of difficulties in detecting, coordinating, interpreting, and/or organizing sensory stimulating impulse, which are so strong that they make someone's life routine harder. Slower learning and bad behavior are often the result for unsuitable sensory integration in a child's brain. Sensory integration problems are not that obvious but are still present with children all over the world. They are the reason why many bright children have problems with learning and they are the cause of bad behavior despite the involvement of caring parents and beneficial social surroundings. Children have to effectively and successfully act on their environment (Ahn et al. 2004; Ben-Sasson, Carter and Briggs-Gowan 2009; Gouze et al. 2009).

Dr. Ayres (2009) explains the sensory integration term through neurobiological process – she described it as the way our central nervous brain system translates information into action. Her theory is based on the idea that our behavior is connected with neurological process and that the level of brain cells sensory treatment is enabling the development and improvement of the higher neuron centers. She claims that a disorganized neuron process leads to disorganized behavior.

She hypothesized that the assurance of rich sensory possibilities processed on the brain cells level and the stimulation of the child's motivation through the limbic system with exactly defined sensory and motoric chal-

lenges would lead to the a child providing a generally higher level of adaptive answers and him being prepared to cope with the challenges of everyday life. Her interventions focused on the activation of a child's inner motivation for learning and development through satisfactory but challenging sensory-motoric activities that lead to increasingly, complex motor-somatic adaptive reactions.

The Croatian *National Curriculum for Early and Preschool Care and Education* (Ministarstvo znanosti, obrazovanja i sporta 2014), accentuates the child's wellbeing assurance as one of its most important goals, defining it as a 'multidimensional, interactive, dynamic, and contextually process, which integrates healthy and successful individual functioning and positive social relations in quality preschool surroundings' (p. 24). Ensuring a child's wellbeing implies focusing the planning of the educational process on the child and his benefit, which makes the role of the early education institution more than significant. The educator must raise his awareness about his knowledge and expectations as well as the way he understands the child, childhood, socialization, and education. He also needs to direct the planning of the educational process towards a consideration of the wellbeing and ways it can be accomplished instead of on partial goals or areas and contents of learning, apart from individual characteristics of each child (Sylvester 2000). There is an accentuation in the *National Curriculum for Early and Preschool Care and Education* on personal, emotional, and physical wellbeing as well as on the educational and social wellbeing. Personal, emotional, and physical wellbeing implies a subjective feeling (to be healthy, satisfied, and to feel good) and it includes, among other things, 'motor skills development, enjoyment of different interactions and activities, a child's openness to the world around him and to new experiences, child's self-acceptance, self-respect and self-awareness, the ability to temporary put off satisfying his needs, identity development, development of independent thinking and doing, to be initiative and innovative, self-imitative and self-organized activities, consideration, and self-assessment of his activities and achievements' (Ministarstvo znanosti, obrazovanja i sporta 2014, 25). By developing sensory integration through different sensory activities and stimulation, we can influence a person's change – personal, emotional, and physical – while research shows us how to properly set the surroundings that enable movement with ease and exploration through all of his senses and various forms of stimulation, what influences a child's self-organization of his brain, and, finally, more efficient functioning of the brain as a whole (Cantu 2002; Fisher, Murray, and Bundy 1991).

By providing an overview of the existing studies from the neuroscientific and sensory integration area, we have tried to emphasize the significance of sensory integration growth from an early age. Also, this contributes to raising the educators' awareness about this highly important area for early age education because, 'if sensory-motoric processing is well organized in first seven years of our lives, a child will learn mental and social skills in the forthcoming time much easier' (Ayres 2009, 19). One more important goal to achieve, as highlighted in *National Curriculum for Early and Preschool Care and Education* (Ministarstvo znanosti, obrazovanja i sporta 2014), refers to integral development, children's education, and their competencies development, and it is based on understanding the child as the whole being and excepting the integrating nature of his various ways of learning in the organization of the educational process in the preschool institution. Ayres' (2009, 48) definition of sensory integration can be attached to this since she explains it as the process of sensory input organization, which classifies, arranges, and combines all of the sensory inputs in complete brain functioning. She concluded that, 'when the functioning of the brain is completely balanced, the body movement is highly adaptive, learning is easy, and good behavior is natural outcome.'

The Role of the Preschool/Nursery School in Sensory Stimulation and Activities with Toddlers

The research paper (Olson et al. 2016) that used 'the sensory processing measure – preschool test' (Miller Kuhaneck et al. 2010) for children in the age 2–5 years, is guided as the initial and final test so they could evaluate the effects of sensory processing challenges with four preschool children, in their home and in preschool institution. The selection and implementation of strategies based on the knowledge about sensory integration and from parents' and educators' point of view, during the three and a half months' period have been monitored. The results of the test conducted in the preschool institution have shown much more progress than the ones conducted at home. Parents and educators have highlighted the evident progress in social participation and the everyday activities that depend on the sensory processing as well as in the praxis, which is, according to dr. Ayres, the ability to understand, organize, and exhibit control in (for a child) new unknown everyday actions such as washing his teeth, eating, and sleeping. As the child displays difficulties in the sensory modulation at an early age, it can pose a challenge for his ability to focus on important senses and simulative incentives. Sensory modulation is the ability of regulating and organizing intensity and the nature of responses to sensory input in a way that the responses are appropriately di-

rected towards a constant change of the sensory experiences in everyday life (James et al. 2011).

In educational practice, there is a frequent need for developing the educators' competencies to identify those children at an early age so that they could be introduced to the early intervention (Mamić, Fulgosi Masnjak, and Pintarić Mlinar 2010, Tatalović Vorkapić, Vlah and Vujičić 2012). Experiences from the surroundings and the expectations from the child play an important role in enabling the exposure to different forms of sensory intensiveness. Surroundings shape the way the child learns to self-regulate and to develop strategies for coping with stress (Dawson, Ashman, and Carver 2000). Therefore, the combination or cooperation between environmental factors, genetic features, neural activities and behaviors, and probably the timing of their collaboration can explain certain outcomes, i. e., the first steps, activities that include new and smudging materials that expose an early-age child to a wide range and intensity of sensations (Kraemer 2001). Two-year-olds also have a better ability to communicate the cause of their difficulties through verbal and nonverbal ways. These discoveries give us the opportunity to form new questions about whether the early critical period for sensory adaptation development really exists in their childhood as Hensch (2004) has suggested. The preschool institution is a place that provides a complete development and education for the child if it enables continuous creation of appropriate educational environment, which gives him the opportunity to involve in various interactions with the space, materials, other children, and adults (Ministarstvo znanosti, obrazovanja i sporta 2014). Complete development is also enabled for children if the educational process is formed in a way that every activity encourages different parts of the integral development at the same time; if it connects and combines different areas of his learning and maintains different children's activities at the same time.

Methodology

The Research Aim, Problems, and Hypotheses

This research paper aims to examine the wellbeing of early-aged children who are introduced to sensory activities and incentives use. Regarding that, two research tasks were postulated: (a) to examine the wellbeing of early-aged children in the group in which sensory activities and incentives were implemented (experimental group) and in the group without that implementation (control group), in two measuring points: the initially and final phase (quasi-experimental research design), and (b) to compare experimental and control group results regarding: differences between groups and dif-

ferences within each group. Based on the theory and prior results in this area, the next hypotheses could be articulated: (a) application of sensory activities and incentives can influence the children's sensory integration and behavior so that they could cope better with everyday life tasks (there will be improvement in psychophysical development in children's early-age development) and (b) there is a difference between the experimental and control group. In the experimental group, a child's progress will be increased because of everyday implementation of sensory activities and the use of sensory-motoric incentives, while changes in children's behavior are not expected in the control group.

Participants

Toddlers. The research involved the experimental ($N = 17$) and control ($N = 13$) group of children. Altogether, 30 children were involved in the research ($N = 30$) within the age range between 2 and 4 years. Considering the gender variable, in the experimental group, there were 9 boys and 8 girls, while in the control group, there were 8 boys and 5 girls. In the experimental group, the mean age was 37.06 months ($SD = 4.72$) and it was in the range between 27 and 45 months. In the control group the mean age was 35.23 months ($SD = 3.39$), with the range between 29 and 40 months.

Early childhood educators. The research involved two preschool educators, both female, aged 33 and 47 years and the length of service of 10 and 22 years, respectively. They had about five years of experience of working with sensory materials. The educators' role was to design sensory materials, gadgetry, device, incentives, and activities in cooperation with the parents and the expert team in the preschool institution and to adjust the indoor space to this material so that the children could use them every day with ease. In the initial phase, one educator tested 30 children in all of the 11 elements and after four months, in the final phase, she re-applied the same testing on the same group.

Measure and Procedure

The scale used in this research was created for the purpose of the research. It included 54 items with specified sensory-motoric activities that would preferably be implemented in everyday early-age practice so that we could stimulate the sensory integration development. The scale-creating criteria were: (a) the use of those elements in everyday practice in organizations for children with special needs, (b) experts' and occupational therapists' experiences in sensory integration. Due to their own engagement in everyday

practice with children with certain developmental deviations and with the help to much conducted research in this area, the practitioners discovered the significance of using exactly these elements in accomplishing progress in children that have certain developmental deviations, which adds to dr. Ayres's (2009) discoveries from the sensory integration area. Items used in this questionnaire were recommended for use in the preschool practice by the following authors: Ayres (2009), Goddard Blythe (2008) and Biel and Peske (2007). These items are: trampoline, funnel spinning, therapy balls (a small ball, 'peanut-shaped' ball), balance board, platform swing, tactile paths, balancing pad, spongy stairs, and climbing cliff. Specified gadgetry allows primary sensory-motoric experiences, same as the higher level of vestibular and proprioceptive input through spinning, swinging, crawling, jumping, maintaining balance. In the first measurement, the scale showed a Cronbach alpha reliability $\alpha = 0.858$ and in the second, $\alpha = 0.921$, which is very satisfactory.

The research sample is convenient and comprises 30 children from one preschool in the Primorsko-Goranska County. The name of the institution is not revealed so as to ensure anonymity. In choosing the two groups of children (experimental and control), it was very important to fulfill the condition of homogeneity by age and gender. The children in the control group were not using sensory-motoric gadgetry and materials in the period between the first and the second measuring phase, while the children from the experimental group were able to use specified gadgetry and materials depending on their interest. Materials like those used in this research can be found in catalogues Ida Didacta, Astreja plus d.o.o., and Regoč. The testing started with referring an official letter from the Faculty of Teacher Education towards the preschool. The parents were thoroughly informed about the research aim and the way of examining both groups (experimental and control), after which their signed informed consent was collected. Children's anonymity was secured. The measurements were conducted in two phases: the initial and final phase during a four-month interval. In the experimental group, a preschool educator educated and licensed for applying sensory materials and activities conducted the measurement.

Results and Discussion

Descriptive Results of the Sensory Activities Application on Toddlers from the Experimental and Control Group

The obtained results demonstrated the frequency display of certain children's behaviors in the following activities: trampoline, funnel spinning, therapy balls (a small ball, 'peanut-shaped' ball), balance board, platform swing,

Table 1 Presentation of the Achieved Results in the First and Second Measuring in the Experimental ($N = 17$) and Control Group ($N = 13$) of Children According to 11 Activities and Their Tasks

(1)	(2)	Experimental group				Control group			
		1st measurem.		2nd measurem.		1st measurem.		2nd measurem.	
		+ = 1	- = 0	+ = 1	- = 0	+ = 1	- = 0	+ = 1	- = 0
Trampoline	1	16	1	17	0	13	0	13	0
	2	9	8	17	0	5	8	9	4
	3	6	11	0	17	11	2	2	11
	4	5	12	15	2	3	10	4	9
	5	11	6	17	0	8	5	13	0
	6	0	17	11	6	0	13	2	11
	Mean	0.46		0.75		0.51		0.55	
Therapy ball – 'small'	1	16	1	17	0	10	3	13	0
	2	16	1	17	0	10	3	13	0
	3	14	3	17	0	7	6	13	0
	4	12	5	17	0	6	7	7	6
	5	9	8	17	0	6	7	12	1
	6	4	13	17	0	3	10	2	11
	7	0	17	13	4	0	13	0	13
	8	0	17	3	14	0	13	0	13
	Mean	0.52		0.86		0.40		0.57	
Therapy ball – 'peanut-shape'	1	16	1	17	0	12	1	12	1
	2	13	4	17	0	10	3	9	4
	3	16	1	17	0	8	5	12	1
	4	13	4	17	0	8	5	13	0
	5	9	8	17	0	6	7	9	4
	6	4	13	17	0	0	13	3	10
	7	0	17	13	4	0	13	0	13
	8	0	17	8	9	0	13	0	13
	Mean	0.52		0.90		0.42		0.55	

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balancing pad, obstacle course, walking and climbing on slopes and substrates (spongy stairs, climbing cliff, tactile paths), lifting and carrying, and pushing. All of the results frequencies of every task in the first and second measuring of children in the experimental ($N = 17$) and control group ($N = 13$) are shown in Table 1.

Experimental group. In the first measuring of the first activity 'trampoline,' in the experimental group, 16 out of 17 children participated in the activity,

Table 1 *Continued from the previous page*

(1)	(2)	Experimental group				Control group			
		1st measurem.		2nd measurem.		1st measurem.		2nd measurem.	
		+= 1	- = 0	+= 1	- = 0	+= 1	- = 0	+= 1	- = 0
Balance board	1	15	2	17	0	12	1	13	0
	2	0	17	12	5	1	12	0	13
	3	14	3	5	12	8	5	12	1
	Mean	0.56		0.66		0.54		0.64	
Funnel spinning	1	16	1	17	0	13	0	13	0
	2	3	14	17	0	6	7	6	7
	3	3	14	17	0	2	11	1	12
	4	0	17	6	11	0	13	0	13
	Mean	0.32		0.83		0.40		0.38	
Balancing pad	1	16	1	17	0	12	1	13	0
	2	9	8	12	5	0	13	0	13
	3	4	13	16	1	1	12	10	3
	4	1	16	16	1	0	13	4	9
	Mean	0.44		0.89		0.22		0.30	
Platform swing	1	16	1	17	0	13	0	13	0
	2	15	2	17	0	11	2	11	2
	3	6	11	16	1	5	8	8	5
	4	4	13	16	1	1	12	2	11
	Mean	0.60		0.97		0.57		0.65	
Obstacle course	1	10	7	16	1	7	6	11	2
	2	11	6	17	0	8	5	12	1
	3	16	1	17	0	12	1	13	0
	4	11	6	17	0	9	4	10	3
	5	2	15	13	4	0	13	1	12
	6	0	17	7	10	0	13	0	13
	Mean	0.49		0.85		0.46		0.60	

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while only one was not willing to participate. In the activity 'trampoline' in the second measuring in exercises 1, 2, and 5, all of the 17 children made progress. In the second measuring of the same activity in the exercise 4 ('a child jumps inside the circle'), 15 children made progress, unlike the first measuring where only 5 of them achieved results in the exercise. In exercise 3 ('a child jumps with the help of the educator') in the same group, in the second measuring, all of the 17 children made progress, while all of them jumped without

Table 1 *Continued from the previous page*

(1)	(2)	Experimental group				Control group			
		1st measurem.		2nd measurem.		1st measurem.		2nd measurem.	
		+ = 1	- = 0	+ = 1	- = 0	+ = 1	- = 0	+ = 1	- = 0
Walking and climbing on slopes and substrates	1	9	8	16	1	2	11	1	12
	2	3	14	16	1	3	10	3	10
	3	17	0	17	0	11	2	12	1
	4	7	10	17	0	6	7	11	2
	5	10	7	16	1	3	10	7	6
	6	5	12	17	0	3	10	10	3
	7	0	17	17	0	0	13	3	10
	Mean	0.50		0.97		0.30		0.52	
Lifting and carrying	1	12	5	17	0	13	0	13	0
	2	4	13	13	4	2	11	4	9
	Mean	0.47		0.88		0.57		0.65	
Pushing	1	12	5	17	0	7	6	10	3
	2	6	11	15	2	0	13	8	5
	Mean	0.53		0.94		0.25		0.69	

Notes Column headings are as follows: (1) sensory materials, (2) sensory activities.

holding the educator's hand, while 6 of them jumped holding the educator's hand in the first measuring. In the activity therapy ball – small, in the second measuring, all of the 17 children of the experimental group made progress in all exercises. The biggest progress was recoded in exercises 6 ('a child gets off the therapy ball onto the floor and makes 2 to 4 steps on his hands') and 7 ('a child gets off the therapy ball onto the floor and makes 4 to 6 steps on his hands') considering that, in the first measuring, 13 of them didn't achieve results in exercise 6, nor 17 of them in exercise 7.

In exercise 8 ('a child gets off the therapy ball onto the floor and makes 6 to 8 steps on his hands'), three of them have shown better results unlike the first measuring where, in the same exercise, children did not achieve any results. In the activity peanut-shaped therapy ball, all of the 17 children of the experimental group made progress in all exercises. The children showed the biggest progress in the second measuring, in the exercises 6 ('a child gets off the peanut-shaped therapy ball onto the floor and makes 2 to 4 steps on his hands') and 7 ('a child gets off the peanut-shaped therapy ball onto the floor and makes 4 to 6 steps on his hands'). Considering the first measuring in exercise 6, 13 children achieved no results, while in the same exercise, in the second measuring, all of the 17 children of the experimental group achieved

results. In exercise 7, in the second measuring, 13 children of the experimental group made progress, while, in the first measuring, no one achieved results. Five children showed better results as opposed to the first measuring, where, in the same exercise, children achieved no results. In exercise 8 ('a child gets off from the peanut-shaped therapy ball onto the floor and makes 6 to 8 steps on his hands'), while examining certain behavior of the same group children, eight of them showed better results as opposed to the first measuring, where, in the same exercise, children achieved no results. In the activity balance board, in exercise 2 ('a child is standing on the balance board by himself'), in the second measuring, 12 children of the group managed to 'stand on their feet on the balance board by themselves,' while, in the first measuring, none of the 17 children managed to do that. In the second measuring, twelve children managed to 'stand on their feet on the balance board without holding onto the wall,' while in the first measuring, 14 children could do that. The activity funnel spinning has shown the biggest progress among the children of this group in exercise 2 ('a child is using the funnel according to direction') and 3 ('a child is inside of the funnel for 1 minute'), in the second measuring, in which all of the 17 children 'used the funnel according to direction,' and the same number of children were inside of the funnel for 1 minute. In the same exercises (2 and 3), in the first measuring, 14 children of the experimental group did not achieve any results. In exercise 4 ('a child is inside of the funnel over 1 minute'), six children made progress in the second measuring as opposed to the first measuring where, in the same exercise, children achieved no results. In the activity balancing pad, the children of this group showed significantly better results in the second measuring in exercises 2, 3, and 4. In exercises 3 ('a child is holding onto the balancing pad with his hands and is alternately lifting his left then right leg') and 4 ('a child is lying on his stomach on the balancing pad with his arms and legs raised above the floor ('a plain'), 16 of the 17 children performed the specified tasks. In the first measuring in exercise 3, 13 children did not achieve any progress, while in exercise 4, in the first measuring, 16 children did not achieve any results. In the activity platform swing, in the second measuring, in which 17 children participated, 16 of them did not achieve any results in exercise 3 ('a child is rocking in a swing lying on his back') and 4 ('a child is spinning in the swing'). In the first measuring, 13 children achieved no results in exercise 3, while 16 children made no results in exercise 4. In the activity obstacle course, progress was recorded in exercise 5 ('obstacle course – walking backwards around peanuts') and 6 ('backwards obstacle course – jumping backwards in hoops'). In exercise 5, thirteen children in the second measuring achieved the task, while, in the first

measuring, 15 children did not achieve progress in the same exercise. Seven out of 17 children accomplished the result in the experimental group in exercise 6, while, in the first measuring, in the same exercise, none of the children achieved a result. In the ninth activity walking and climbing on slopes and substrates, in the second measuring of the experimental group, 17 children participated, in exercise 4 ('walking on the sensory tactile path with three different substrates without holding onto something and picking items off the floor'), 16 children in exercise 5 ('climbing on a diagonal mat and jumping'), 17 children in exercise 6 ('climbing up and down the spongy stairs') and also 17 children in exercise 7 ('climbing onto the climbing rock by yourself'). In the second measuring, in exercise 7, all of the 17 children made substantial progress as opposed to the first measuring, where, in the same exercise, the children achieved no results. In the activity lifting and carrying, in the experimental group, in which 17 children participated, in exercise 2 ('lifting and carrying a therapy ball – prickly'), in the second measuring, 13 children achieved results, while in the first measuring the same number of children achieved no results. In the activity pushing, progress is evident in the second measuring in the experimental group, in the exercise 2 ('pushing a 5 kg box with your feet') in 15 children, while, in the first measuring, 11 children achieved no results in the same exercise.

Control group. In the activity trampoline, in exercise 3 ('a child is jumping with the help of the educator'), 11 out of 13 children jumped by themselves in the second measuring, while two of them couldn't do it. In the first measuring in the same exercise, 11 children out of 13 jumped with the help of the educator. In the second measuring in this group, in exercise 5 ('a child jumps up to 10 times'), all 13 children jumped up to 10 times, while, in the first measuring, only 8 of them could do it. In the activity therapy ball – small, in exercise 3 ('a child is moving on the ball back and forth while lying on the stomach') and 5 ('a child gets off the therapy ball onto the floor with his hands'), in the second measuring of the control group children, small progress was noted although they were not using specified gadgetry same as of the experimental group of children. In the activity peanut-shaped therapy ball, in the second measuring, in exercises 3 ('a child is lying on his stomach on a peanut-shaped therapy ball') and 4 ('a child is moving on the peanut-shaped therapy ball back and forth while lying on the stomach'), small progress can be noticed. None of the children from the control group achieved results in exercises 7 ('a child gets off the peanut-shaped therapy ball onto the floor and makes 4 to 6 steps on his hands') and 8 ('a child comes off the peanut-shaped therapy ball onto the floor and makes 6 to 8 steps on his hands'), unlike the

children from the experimental group. In the activity balance board, in exercise 3 ('a child is standing on the balance board while holding onto the wall'), in the second measuring in the control group, 12 children stood on the balance board while holding onto the wall, while in the same exercise, in the experimental group of children, the same number of children (12) stood on the balance board by themselves. Almost the same results were achieved in the first and second measuring in all the exercises of the activity funnel spinning. In the activity balancing pad, 10 children achieved results in exercise 3 ('a child is holding onto the balancing pad with his hands and is alternately lifting his left and then his right leg') in the second measuring, while only one child has achieved results in the first measuring in the same exercise. In the activity platform swing, the children achieved almost the same results in all of the exercises. In the activity obstacle course, the children achieved small progress in exercises 1 and 2, while in the other exercises, they achieved almost the same results in the first and second measurement. In the activity walking and climbing on slopes and substrates, the children achieved small progress in the second measurement, in exercises 4 ('walking on the sensory tactile path with three different substrates without holding onto something and picking items off the floor') and 6 ('climbing up and down the spongy stairs-walking'), while they achieved almost the same results in the first and second measuring in other activities. In the activity lifting and carrying, they achieved almost the same results as in first and second measuring, and in the activity pushing, they achieved small progress in exercise 2 ('pushing a 5 kg box with your feet').

Differences between the Experimental and Control Group in two Measurements Regarding the Applications of Sensory Stimulation

Two statistical analyses were conducted with the aim of determining possible differences in children's psychomotor abilities. The Mann-Whitney (independent samples) test was applied to test the differences between the experimental and control group, separately for the first and second measurement, while the Wilcoxon test (dependent samples) was conducted to test the differences within the same group (separately for experimental and control) regarding the first and second measurement.

Experimental group – two measurements. Neither the children from the control nor from the experimental group had used the specified sensory-motoric gadgetry before the testing. After implementing the sensory-motoric activities, children from the experimental group ($N = 17$) were able to use the sensory-motoric gadgetry and devices on a daily basis. The statistically

Table 2 The Results of Testing the Difference Significance in the Experimental Group Regarding the two Measurements

Sensory materials	Measurement		z	p
	1st	2nd		
Trampoline	2.76 (1.09)	4.53 (0.62)	-3.695	0.000
Therapy ball – 'small'	4.17 (1.70)	6.94 (0.66)	-3.656	0.000
Therapy ball – 'peanut-shape'	4.17 (1.63)	7.23 (0.83)	-3.648	0.000
Balance board	1.70 (0.68)	2.00 (0.00)	-1.633	0.102
Funnel spinning	1.29 (0.84)	3.35 (0.49)	-3.391	0.001
Balancing pad	1.76 (0.97)	3.58 (0.61)	-3.656	0.000
Platform swing	2.41 (1.06)	3.88 (0.33)	-3.246	0.001
Obstacle course	2.94 (1.14)	5.11 (0.78)	-3.691	0.000
Walking and climbing*	3.00 (1.41)	6.82 (0.39)	-3.647	0.000
Lifting and carrying	1.76 (0.44)	1.76 (0.43)	0.000	1.000
Pushing	1.88 (0.33)	1.88 (0.33)	0.000	1.000

Notes *On slopes and substrates (spongy stairs, climbing cliff, tactile paths). Standard deviations in parenthesis.

significant difference regarding all exercises except in the activities 'balance board,' 'lifting and carrying,' and 'pushing' were determined in this group between two measurements. Table 2 shows the differences between the first and second measurement in the experimental group. Statistically significant differences were determined in the activities that included the trampoline, a therapy ball – small, a peanut-shaped therapy ball, funnel spinning, a balance pad, a platform swing, an obstacle course, walking and climbing on slopes, and substrates. In other words, it has been confirmed that children's progress will be enhanced in the experimental group because the children were exposed to everyday conduct sensory activities and the use of sensory-motoric incentives. However, before running the test of significant differences in the control group between the two measurements, it could not be concluded that the changes in the experimental group are due only to activities implementation. Therefore, further analyses will reveal that. In addition, no change was recorded in the activities 'balance board,' 'lifting and carrying,' and 'pushing.' This can be explained in two ways that should be verified empirically in future studies. First of all, it is possible that these activities don't really contribute significantly to a child's development and, secondly, the result can be assigned to measurement limitations in this study (the test items or the small group of participants), and to the educator's way of assessment.

Control group – two measurements. Table 3 shows the differences be-

Table 3 The Results of Testing the Difference Significance in the Control Group Regarding the Two Measurements

Sensory materials	Measurement		z	p
	1st	2nd		
Trampoline	3.07 (0.95)	3.31 (0.95)	-0.952	0.341
Therapy ball – ‘small’	3.23 (2.31)	4.61 (0.51)	-2.055	0.040
Therapy ball – ‘peanut-shape’	3.38 (1.75)	4.46 (1.26)	-1.750	0.080
Balance board	1.61 (0.65)	1.92 (0.27)	-1.414	0.157
Funnel spinning	1.61 (0.76)	1.53 (0.66)	-0.333	0.739
Balancing pad	1.000 (0.41)	2.07 (0.76)	-2.739	0.006
Platform swing	2.31 (0.75)	2.61 (0.87)	-0.962	0.336
Obstacle course	2.76 (1.30)	3.61 (1.04)	-2.636	0.008
Walking and climbing*	2.15 (1.77)	3.61 (1.32)	-2.625	0.009
Lifting and carrying	1.30 (0.48)	1.31 (0.48)	0.000	1.000
Pushing	1.38 (0.86)	1.38 (0.87)	0.000	1.000

Notes *On slopes and substrates (spongy stairs, climbing cliff, tactile paths). Standard deviations in parenthesis.

tween the first and second measurement in the control group ($N = 13$). Statistically significant differences were obtained in the following activities: ‘therapy ball – small,’ ‘balance pad,’ ‘walking and climbing slopes and substrates,’ and ‘obstacle courses.’ Here are evident developmental enhancements in some exercises although the children in the control group were not using the specified sensory-motoric gadgetry and devices. Precisely because of these significant differences, the differences in these activities in experimental group could not be ascribed to the effect of the use of the sensory-motoric equipment, but rather to the maturation effect. Some progress can be noticed in the specified four activities just because of maturation and regardless of what the stimulation from the surroundings might be.

Experimental and control group – first measurement. The primary assumption for this research was that there wouldn’t be any differences between the children in the experimental and in control group before introducing sensory activities. One of the prerequisites of the experimental design is to have an experimental and control group that are equal with regards to the critical variables, such as age, gender, and psychomotor abilities so that the final differences between the groups could be ascribed precisely to the effect of the sensory activities and not something else, such as maturation. Well, it was determined that this is not the case in this study, since the groups were significantly different from the starting point of the measurement due to non-

Table 4 The Results of Testing the Difference Significance in the First Measurement Regarding the Two Groups

Sensory materials	Group		z	p
	Experimental	Control		
Trampoline	2.76 (1.09)	3.07 (0.95)	-0.465	0.680
Therapy ball – 'small'	4.17 (1.70)	3.23 (2.31)	-1.048	0.320
Therapy ball – 'peanut-shape'	4.17 (1.63)	3.38 (1.75)	-1.313	0.213
Balance board	1.70 (0.68)	1.61 (0.65)	-0.679	0.621
Funnel spinning	1.29 (0.84)	1.61 (0.76)	-1.453	0.229
Balancing pad	1.76 (0.97)	1.000 (0.41)	-2.598	0.020
Platform swing	2.41 (1.06)	2.31 (0.75)	-0.245	0.837
Obstacle course	2.94 (1.14)	2.76 (1.30)	-0.307	0.773
Walking and climbing*	3.00 (1.41)	2.15 (1.77)	-1.582	0.123
Lifting and carrying	1.76 (0.44)	1.30 (0.48)	-2.461	0.035
Pushing	1.88 (0.33)	1.38 (0.86)	-1.840	0.183

Notes *On slopes and substrates (spongy stairs, climbing cliff, tactile paths). Standard deviations in parenthesis.

random sample. This could be observed in the activities: 'lifting and carrying' and 'balance pad' (Table 4) since there had been significantly higher results already in the first, initial measuring with the children from the experimental group. For these two activities, it isn't possible to explain their changes in the experimental group by means of activities implementation, but rather with the starting differences between the children.

Experimental and control group – second measurement. In two activities, 'balance pad' and 'lifting and caring,' changes cannot be taken into consideration because the children from the two groups weren't on the same primary level of sensory-motoric abilities, i.e., they weren't equal considering their abilities. In other activities, children from the experimental and control group were equal and it is later possible to analyze the differences just from the perspective of the sensory activities' influence, which were introduced in the everyday practice with the experimental group. According to the results in Table 5, which shows the differences between the experimental and control group in the second measurement, it is possible to sum up the results and isolate those activities that show how the everyday use of specified sensory gadgetry, equipment, and activities affects the differences between the results in the experimental and control group. The used gadgetry included: a trampoline, a therapy peanut-shaped ball, and a platform swing.

Those activities in which changes were observed in the control group and

Table 5 The Results of Testing the Difference Significance in the Second Measurement Regarding the Two Groups

Sensory materials	Group		z	p
	Experimental	Control		
Trampoline	4.53(0.62)	3.31(0.95)	-3.311	0.001
Therapy ball – ‘small’ (+)	6.94(0.66)	4.61(0.51)	-4.777	0.000
Therapy ball – ‘peanut-shape’	7.23(0.83)	4.46(1.26)	-4.549	0.000
Balance board	2.00(0.00)	1.92(0.27)	-1.144	0.742
Funnel spinning	3.35(0.49)	1.53(0.66)	-4.602	0.000
Balancing pad (o)	3.58(0.61)	2.07(0.76)	-4.100	0.000
Platform swing	3.88(0.33)	2.61(0.87)	-4.044	0.000
Obstacle course (+)	5.11(0.78)	3.61(1.04)	-3.765	0.000
Walking and climbing* (+)	6.82(0.39)	3.61(1.32)	-4.829	0.000
Lifting and carrying (o)	1.76(0.43)	1.31(0.48)	-2.461	0.035
Pushing	1.88(0.33)	1.38(0.87)	-1.840	0.183

Notes *On slopes and substrates (spongy stairs, climbing cliff, tactile paths). Standard deviations in parenthesis.

these differences can be only assigned to maturation and not to sensory stimulations are marked with a plus: therapy ball – small, obstacle course, and walking and climbing on slopes and substrates (spongy stairs, climbing cliff, tactile paths). In two activities, ‘balance pad’ and ‘lifting and carrying’ (marked with a circle) no changes can be taken into consideration because the children from the two groups weren’t on the same primary level of sensory-motoric abilities. These results might have been obtained due to the child’s possibility of conducting these activities on a daily basis, such as climbing, walking, jumping, lifting, throwing, etc. so that they develop their own specified biotic motoric knowledge. In addition, in the activity lifting and carrying, no differences were observed between the two series of measuring in the experimental group.

Conclusion

Our primary research hypothesis was that there would be differences between children in the experimental and control group before the introduction of sensory activities. It was clearly determined that the implementation of specified sensory activities at an early age could significantly affect an advanced sensory integration development in the nursery school. The inability to confirm this hypothesis with some materials and activities indicates the significance of carefully and accurately selected materials and activities in

everyday practice, which is one of the most significant contribution of this research paper. Although this research has its own limitations (non-random and relatively small sample of children, choice of specific activities done with children), still, six activities and different materials indicate the significance of stimulating sensory-motoric activities in early-aged children.

It would be beneficial if future studies would make changes to some activities within the measuring instrument that did not render the expected results ('balance board,' 'lifting and carrying,' 'pushing'); or, more precisely, to formulate some exercises in the same measuring instruments in a different way. After the overview of research results, it appears desirable to formulate all the examination activities with the same number of exercises, at least six, so that the children's progress would be more noticeable while using the sensory materials and activities in the initial and final phase. Also, it would be advisable for future studies to maximally adjust the terms of assessment to the terms and the number of children in the group and, also, to the part of the day the examination is done, and to design the way of recording during the exercise presentation with another evaluator. One of the major contributions of this research is seen in the fact that similar research on this topic has not been carried out in Croatia, and the results show the evident effect of the pursuit of early-aged children's wellbeing, which is why sensory activities and incentives from an early age in everyday practice are recommended.

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Senzorna integracija kot pot k zvečanju dobrobiti otrok prve starostne skupine

Senzorični razvoj, dejavnosti in spodbude so več kot pomembni za optimalni razvoj otrok predšolske dobe. Realizacija senzorične integracije je ena od osnovnih nevrobioloških dejavnosti predšolskih otrok, ki je v sodobni znanosti ter praksi temelj za učenje ter danes predstavlja zelo pomembno in aktualno področje raziskav. Pri tem je vloga vzgojiteljev in uporaba različnih senzoričnih materialov in pripomočkov izredno pomembna zunanja spodbuda za otrokove dosežke. Glede na zelo majhno število raziskav na tem področju, zlasti z vidika dela vzgojiteljev v rednih otroških skupinah otrok, je cilj te študije preveriti uporabne senzorične dejavnosti in spodbude za delo z otroki v zgodnji mladosti. Na podlagi tega cilja je narejena primerjava skupin otrok zgodnjega otroštva, v katerih so navedene spodbude prisotne, in tistih, v katerih niso, v namen določitev prednosti razvoja otrok. Eksperimentalna skupina je sestavljala sedemnajst otrok in nadzorna trinajst, starih od enega do dveh let. Na splošno je bilo potrjeno, da obstajajo znatne razlike med kontrolno in eksperimentalno skupino ravno zaradi uporabe senzoričnih materialov in naprav v eksperimentalni skupini. Ker razlike niso prisotne v vseh pregledanih elementih senzoričnega razvoja, je razprava temeljila na zagotavljanju osnovnih pogojev v vrtcu, da bi spodbudila razvoj senzorične integracije otrok zgodnjega otroštva.

Ključne besede: otroci zgodnjega otroštva, dobro počutje, čutno povezovanje, senzorične dejavnosti in spodbude