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Sensory integration and sensory-adapted environments: The inclusion of children with autism spectrum disorders in early years education

Abstract. The study aimed to compare sensory integration therapy and sensory-adapted modification of the educational environment as approaches to enhancing the participation of children with autism spectrum disorders in pre-school education. The study was conducted as a theoretical and analytical review of scientific, professional, international and regulatory-educational sources, followed by a comparison of the two approaches in terms of their impact on the child's functional participation, adaptive behaviour and educational engagement. The study established that the participation of a child with autism spectrum disorders in pre-school education cannot be equated with mere physical presence in the group, as it entails genuine inclusion in educational, play, communicative and everyday activities. The study determined that sensory difficulties acquire pedagogical significance when they affect self-regulation, behavioural stability, contact with the teacher and peers, the ability to respond to instructions, and the ability to maintain participation in group situations. The study demonstrated that sensory integration therapy acts primarily at the individual level, creating the conditions for sensory regulation, adaptive response, praxis and the organisation of behaviour. Sensory-adapted modification of the educational environment operates at the level of the educational situation: it reduces sensory barriers, increases the predictability of routines, the structure of the space, the accessibility of instructions and the flexibility of participation methods. The study established that these approaches are not interchangeable: the first creates the internal conditions for participation, whilst the second ensures the accessibility of the pre-school activity. A model of a sensory-adapted pre-school environment has been developed, covering the identification of the child's sensory needs, analysis of the physical and organisational environment, selection of pedagogical and environmental adaptations, and assessment of the child's participation in daily activities. The practical significance of the results is determined by the possibility of using the proposed model to organise an inclusive pre-school environment in which support for children with autism spectrum disorders is directed towards expanding functional participation, adaptive behaviour and educational engagement, rather than merely reducing individual behavioural difficulties

Keywords: functional participation; adaptive behaviour; educational accessibility; pedagogical support; environmental barriers; self-regulation; inclusive practice

INTRODUCTION

In modern early years education, the participation of children with autism spectrum disorder (ASD) is becoming increasingly associated not only with the availability of an inclusive group or an individual development programme, but also with the extent to which the educational

environment addresses the sensory needs of the child. Sensory overload, difficulties with self-regulation, attention instability, and avoidance of tactile, auditory or visual stimuli can limit a child's inclusion in play, communication, activities, routine moments and interaction with peers.

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Therefore, the issue of sensory integration in the context of early years education goes beyond a narrowly remedial approach and concerns the organisation of conditions under which a child with ASD can functionally participate in daily activities. In this context, it becomes relevant to compare sensory integration therapy, focused on individual sensory regulation, with sensory-adapted modification of the educational environment, aimed at reducing barriers to participation in the pre-school group. The issue of sensory integration in children with ASD has already been addressed in Ukrainian studies; however, the focus in these works has been unevenly distributed.

For example, I.M. Hryhus & I.M. Kruk (2022) addressed sensory integration in children with early-onset autism as an area of rehabilitative support linked to the correction of sensory impairments and the development of functional activity. This approach highlights the individual level of sensory support, but leaves the educational context less well covered, where sensory difficulties manifest during group play, transitions between activities, communication with the teacher and contact with peers. A more comprehensive perspective is proposed in the study by O. Kasianenko (2025), where sensory integration is considered within the framework of early intervention programmes for children with ASD. In this framework, sensory support is linked to interdisciplinary collaboration, family involvement and the coordination of various forms of support; however, the focus of the analysis remains on early intervention, whereas pre-school education requires a separate consideration of sensory support as a prerequisite for daily participation in the educational environment.

Another research approach is notable in the study by O. Mamicheva & Yu. Butko (2025), in which sensory integration disorders in children with ASD are analysed in terms of causes, manifestations and intervention strategies. This approach details the behavioural manifestations of sensory disorganisation, in particular avoidance, hyper-reactivity, seeking of stimuli, or difficulties in adapting to change, but provides less insight into the link between these manifestations and barriers in the pre-school environment. The family-oriented aspect of support is highlighted in the study by L.I. Basenko & K.A. Tymruk-Skoropad (2024), in which a physical therapy programme for children with ASD is linked to family involvement, physical activity and specially organised therapeutic interaction. This approach emphasises the importance of coordination between specialists and parents, but relates more to therapeutic support than to the pedagogical organisation of a sensory-accessible environment in a pre-school education setting (PSE). The occupational therapy dimension of the issue is explored by N.R. Holod *et al.* (2026), analysing the theoretical and methodological foundations of intervention for children with ASD. This approach contributes to the research of children's functional activity and the role of professional support; however, the issue of modifying the educational environment as a daily condition for participation in a

pre-school group requires further theoretical and analytical consideration.

The psycho-corrective approach to supporting children with autism in Ukraine was discussed by V.Y. Bocheliuk *et al.* (2021), emphasising corrective approaches aimed at overcoming or reducing the manifestations of autism. This logic highlights the importance of specially organised psychological support, but it insufficiently explains how the everyday educational environment can prevent sensory overload and support the child's participation without constant remedial intervention. The classification aspect of the issue is explored by V.Y. Bocheliuk *et al.* (2022), where ASD is analysed through the systematisation of its types, manifestations and diagnostic characteristics. Such a classification framework can improve precision of delineation of the diversity of autism manifestations; however, a child's educational participation requires not only classification of the condition but also an analysis of how specific sensory and behavioural characteristics interact with the early years' education environment. The sensory design of inclusive educational environments is examined in a study by H.M. Abdou *et al.* (2026), which, based on a systematic review, analyses the transition from sensory spatial organisation to regulatory environmental architecture for children with ASD, ADHD and Down's syndrome. This approach is relevant for determining the conditions for a child's educational participation, as sensory support depends not only on individual characteristics but also on the noise, spatial, visual and organisational demands within the group. The link between sensory characteristics and behavioural manifestations is explored in the study by Y. Chen *et al.* (2024), which, based on a systematic review and meta-analysis, examines the relationship between differences in sensory processing and internalised and externalised difficulties in autism. This approach highlights the significance of assessing not only individual sensory responses but also their impact on self-regulation, behavioural stability and the child's participation in everyday activities within the pre-school group.

Thus, existing research provides a foundation for analysis of sensory integration, early intervention, remedial strategies, physiotherapy and occupational therapy support for children with ASD. At the same time, the scientific field does not sufficiently distinguish between two levels of intervention: individual sensory support for the child and modification of the educational environment as a condition for their daily participation in the pre-school group. This necessitates a theoretical and analytical comparison of sensory integration therapy and a sensory-adapted environment, not in terms of their general therapeutic effect, but in terms of their contribution to the child's functional participation, adaptive behaviour and educational engagement. This perspective clarified which tasks fall under therapeutic support, which under the pedagogical organisation of the environment, and how these approaches can complement one another within the system of inclusive pre-school education.

The study aimed to determine the role of sensory integration therapy and a sensory-adapted environment in supporting the participation of children with ASD in pre-school education. Following the aim of the study, the following research objectives were identified: to identify the sensory factors influencing the participation of children with ASD in pre-school education; to compare sensory integration therapy and sensory-adapted modification of the educational environment in terms of their contribution to the child's functional participation, adaptive behaviour and educational engagement; to substantiate a model of a sensory-adapted pre-school environment as a condition for supporting the participation of children with ASD in the daily activities of pre-school educational institutions.

MATERIALS AND METHODS

The study was based on a theoretical-analytical design incorporating elements of applied modelling and aimed to compare sensory integration therapy and sensory-adapted modification of the educational environment as approaches to enhancing the participation of children with ASD in pre-school education. Sensory-adapted modification of the educational environment was considered as the pedagogical dimension of "sensory environmental modification", i.e. as a change in the physical, organisational and interactive conditions of the pre-school group, considering the child's sensory needs. The study was based on a qualitative categorical analysis of scientific, professional, international and regulatory-educational sources within the fields of pedagogy, special education, developmental psychology and research into neurodevelopmental disorders. The source corpus was formed as a targeted selection of works and documents addressing sensory integration, sensory processing, sensory environmental modification, the child's participation in educational activities, adaptive behaviour, engagement, and pedagogical conditions for supporting children with ASD in the pre-school environment. The units of analysis were theoretical propositions, professional recommendations, regulatory requirements, criteria for the evidence base of interventions, and approaches to sensory support for children with ASD described in the sources. The analysis addressed three outcome measures: the child's functional participation in pre-school activities, adaptive behaviour, and educational engagement.

The study was conducted in three stages. In the first stage, a theoretical and conceptual framework for the analysis was developed. Sources were reviewed that explore the basic concepts of sensory integration, sensory processing, child functioning, participation and inclusive education: A.J. Ayres (1972), World Health Organisation (2007; 2023), A. Ayres & J. Robbins (2005), Convention on the Rights of Persons with Disabilities (2016). These sources were selected because they provide the conceptual foundation for the study and can be used for an examination of a child's sensory characteristics in relation to functioning, participation, environmental barriers and the right to inclusive education. Based on these materials, the primary analytical categories

were identified: sensory processing, self-regulation, adaptive behaviour, participation, engagement, environmental barriers and the accessibility of educational activities.

The second stage involved a comparative analysis of sensory integration therapy and sensory-adapted modification of the educational environment. For this purpose, professional sources and evidence-based summaries were used, which differentiated individualised support for sensory regulation, the child's sensory profile, and pedagogical changes to the conditions of educational participation: W. Dunn (2014), R. Watling *et al.* (2018), A. Bundy *et al.* (2019), National Institute for Health and Care Excellence (2013). These sources were selected as they clarify the professional interpretation of sensory support and provide a basis for evaluating approaches in terms of functional participation, adaptive behaviour and engagement. The comparison was conducted using an analytical matrix covering the approach's objective, mechanism of action, level of implementation, support providers, the role of the teacher and support specialists, level of individualisation, conditions of application, expected impact on participation, adaptive behaviour and engagement, as well as the potential for integration into the daily practice of early years education settings. The effectiveness of the approaches was compared by contrasting the effects described in the sources across three outcome measures: functional participation, adaptive behaviour, and the child's engagement in pre-school activities. This matrix was used to compare two approaches using the same criteria and differentiated therapy-oriented sensory integration and pedagogical modification of the sensory environment.

The analysis procedure involved reading the sources in sequence, identifying meaningful passages, matching them to specific categories, noting recurring themes, and comparing the two approaches against the parameters of the analytical matrix. During the coding process, aspects relating to sensory overload, sensory sensitivity, predictability of the routine, spatial organisation of the group, noise and light levels, visual richness of the environment, sensory breaks, pedagogical support, team interaction and the child's participation in pre-school activities were addressed. In the third stage, the results of the comparative analysis were interpreted in the context of the practical organisation of a sensory-adapted pre-school environment. The materials for this stage were Comprehensive Programme for the Development of Pre-school Children with Autism "Rozkvit" (2013), Division for Early Childhood (2014), Convention on the Rights of Persons with Disabilities (2016), Resolution of the Cabinet of Ministers of Ukraine No. 530 (2019), Order of the Ministry of Education and Science of Ukraine No. 33 (2021), Law of Ukraine No. 3788-IX (2024). These sources were selected as they determine the pedagogical, organisational and regulatory conditions for creating an accessible, flexible and inclusive pre-school environment.

The applied modelling aimed to construct a structure for a sensory-adapted environment in which the

child's sensory needs were matched with the barriers and resources of the pre-school group. The model comprised four interrelated components: identifying the child's sensory needs, analysing the physical and organisational environment, selecting environmental and pedagogical adaptations, and assessing the child's participation in educational, play, communication and daily living activities. Thematic coding, categorical comparison, a comparative analytical matrix and applied modelling were used as research tools. Microsoft Excel 365 was used for the technical systematisation of sources, the recording of categories and the structuring of results. Given the theoretical and analytical nature of the material, the results were analysed using qualitative methods without applying statistical hypothesis testing procedures. The reliability of the analysis was ensured by reviewing the source corpus, cross-checking categories across different groups of materials, applying uniform comparison criteria to both approaches, and verifying the alignment of the applied model with international and Ukrainian educational guidelines. The ethical foundations of the work were determined by the principles of academic integrity, the transparent use of open sources, and the accurate description of children with ASD in accordance with the European Code of Conduct for Research Integrity (2023). This ensured the reproducibility of the analytical procedure, consistency between the materials and the research objective, and the practical relevance of the results obtained.

RESULTS

Analytical framework for the factors influencing the participation of children with ASD in early years education. The participation of children with ASD in pre-school education is determined not only by access to the facility or the child's inclusion in a group. Genuine engagement is shaped by children's ability to cope with the sensory conditions of the environment, maintain self-regulation, respond to educational instructions, interact with adults and peers, and perform age-appropriate actions in play, communication, educational and everyday situations. In this context, the sensory characteristics of children with ASD are not an isolated individual trait, but a factor in the child's functioning within a specific educational environment. Therefore, an analysis of participation requires a shift from describing individual sensory reactions to identifying the conditions under which these reactions either limit or support the child's inclusion in pre-school activities. Classical sensory integration theory views sensory processing as the basis for the organisation of a child's behavioural, motor and learning responses. In the study by A.J. Ayres (1972), sensory integration was related to the nervous system's ability to organise information received through various sensory channels and use it for an adaptive response. Under this approach, difficulties in sensory processing are not reduced to increased or decreased sensitivity to a particular stimulus, but manifest themselves in the complexity of

organising behaviour, attention, motor activity, and interaction with the physical and social environment.

A.J. Ayres & J. Robbins (2005) emphasised that sensory difficulties often remain hidden, as they may manifest externally as avoidance, impulsivity, resistance to new activities, emotional instability or rapid exhaustion. For early years education, this means that a child's behaviour, which is interpreted as a reluctance to participate, may be linked to being overwhelmed by noise, light, tactile stimuli, the number of people in the space, or the unpredictability of transitions between activities. The functional approach, as outlined in the World Health Organisation (2007) report, describes a child's development through the interplay of functions, activities, participation and environmental factors. Within this approach, ASD does not predetermine a child's level of participation in pre-school life. Participation depends on the extent to which environmental conditions support or hinder the child's inclusion in specific activities: play, collaborative tasks, communication, self-care, transitions between routine activities, and participation in group work. Sensory characteristics take on pedagogical significance when they interact with the organisation of space, routine, intensity of stimulation, the manner of presenting instructions, and the nature of social interaction.

The legal and educational rationale for inclusion, as stipulated in the Convention on the Rights of Persons with Disabilities (2016), views inclusive education not merely as placing a child within a mainstream educational setting, but as a transformation of educational culture, policy and practice to remove barriers to participation. For children with ASD, access to early years education cannot be limited to formal attendance in a group. An indicator of inclusion is the child's ability to participate in meaningful activities at a level appropriate to them, incorporating their sensory, communicative, behavioural and social needs. Sensory support in pre-school education should be assessed not by the number of individual adaptations, but by whether they reduce barriers to participation and enhance the stability of the child's inclusion in the educational process. The current international context for supporting children with developmental disabilities, as presented by the World Health Organisation (2023), guides education systems towards a shift from marginalisation to the participation of children in mainstream social and educational settings. The sensory characteristics of children with ASD should not be a reason for isolating them from group activities or lowering educational expectations. They require a more precise adaptation of the environment so that the pre-school group fulfils not only a care-giving function, but also developmental, communicative and socialising functions. In this sense, sensory support is regarded as a prerequisite for the accessibility of pre-school education. By combining these approaches, it is possible to identify a system of interrelated categories through which the participation of children with ASD in early years education can be effectively analysed. The first category is sensory processing, which determines how a child perceives auditory, visual, tactile, proprioceptive and

vestibular stimuli. The second is self-regulation, as sensory overload or poor sensory organisation can affect a child's ability to maintain emotional stability, attention, motor activity and readiness to interact. The third is adaptive behaviour, which manifests itself in the child's ability to adapt to routines, follow achievable instructions, transition between activities, use available means of communication, and participate in daily activities. The fourth is participation, that is, the child's actual involvement in educational, play, communicative and everyday situations. The fifth is engagement, which reflects not only presence in a situation but also activity, focus of attention, and connection with the task, the teacher, the material or peers. The sixth is environmental barriers, which include excessive noise, bright or unstable lighting, high visual stimulation, unpredictable transitions, close physical contact, complex instructions, or an insufficiently structured space. The seventh is the accessibility of educational activities, which determines whether a child can participate in an activity in a way that is compatible with their sensory and communicative abilities.

The relationship between these categories is systemic in nature. Characteristics of sensory processing can influence self-regulation: excessive noise, bright light or a large number of simultaneous stimuli increase tension, reduce stamina and make it difficult to maintain attention. Difficulties with self-regulation may manifest as avoidance of group activities, crying, motor agitation, freezing, withdrawal, a need for solitude, or a sharp decline in performance. In an educational setting, these manifestations affect adaptive behaviour: it is more difficult for the child to follow instructions, wait their turn, transition from play to a lesson, participate in group activities, or complete a task they have started. As a result, participation is limited, although the primary cause may not be a lack of interest in the activity, but rather a mismatch between the sensory environment and the child's needs (World Health Organisation, 2007; Dunn, 2014).

The environment in this system fulfils a dual role. It exacerbates difficulties when there is a high level of noise, chaotic movement of children, an excessive number of visual stimuli, sudden changes in activities, or unclear rules of conduct. At the same time, the environment reduces sensory overload and supports participation if the space has a clear structure, the routine is predictable, transitions are accompanied by visual or verbal cues, instructions are given in small doses, and the child has access to a sensory break or recovery area. Sensory support in early years education encompasses not only working with the child's individual response but also changing the conditions in which this response arises and influences behaviour. The concept of participation in the context of children with ASD is not equivalent to mere presence in the group, performing tasks that are the same for everyone, or outward compliance with the routine. For a child with sensory difficulties, participation can vary in intensity: observing activities, brief involvement, performing a single action, supported joint play, non-verbal response, choosing materials, completing

a daily activity, or interacting with a teacher or peer. Engagement reflects the quality of participation: maintaining contact with the situation, reduced avoidance, stability of behaviour, and an expanded range of activities in which the child can participate. This perspective is substantial for the comparison of sensory integration therapy and environmental sensory modification, as both approaches must be evaluated in terms of their contribution to genuine pre-school participation (World Health Organisation, 2007).

The analytical framework developed encompasses three interrelated levels. The first level consists of the child's individual sensory responses: sensitivity to stimuli, the need for sensory seeking or avoidance, and difficulties with information processing and self-regulation. The second level relates to the behavioural and functional organisation of participation: the child's ability to engage in play, learning activities, communication, self-care and group situations. The third level encompasses environmental characteristics that may act as barriers or resources for participation. Within this framework, sensory integration therapy is analysed in terms of its potential to support individual sensory regulation and adaptive behaviour, whilst sensory-adapted environmental modification is analysed in terms of its ability to reduce barriers, increase predictability, and create conditions for daily participation. The analytical framework presented in Figure 1 summarises the relationship between sensory processing, self-regulation, adaptive behaviour, environmental barriers and the participation of children with ASD in early years education. As shown in Figure 1, the participation of children with ASD in pre-school education is shaped by the interaction of three levels: the child's individual sensory responses, their behavioural and functional organisation, and the characteristics of the educational environment. Sensory processing influences self-regulation; self-regulation determines the stability of adaptive behaviour; and adaptive behaviour is linked to the child's ability to participate in play, communication, activities and daily routines. At the same time, the environment can exacerbate difficulties through noise, light, unpredictability, visual overload and chaotic transitions, or mitigate them through spatial structure, sensory breaks, visual support, predictable routines and flexible ways of participating.

It is therefore appropriate to view the sensory factors affecting the participation of children with ASD as a system of interrelationships between sensory processing characteristics, self-regulation, adaptive behaviour, and the accessibility of the pre-school environment. Within this system, a child's behavioural manifestations cannot be interpreted solely as a reluctance to interact or perform tasks, as they often reflect a mismatch between the child's sensory needs and the conditions of the educational situation. Excessive sensory overload can reduce stamina, make it difficult to sustain attention, cause avoidance of activities, and reduce stability in participation in group interaction. In contrast, an adapted environment creates conditions in which the child can gradually engage in educational, play, communication and daily activities without excessive overload.

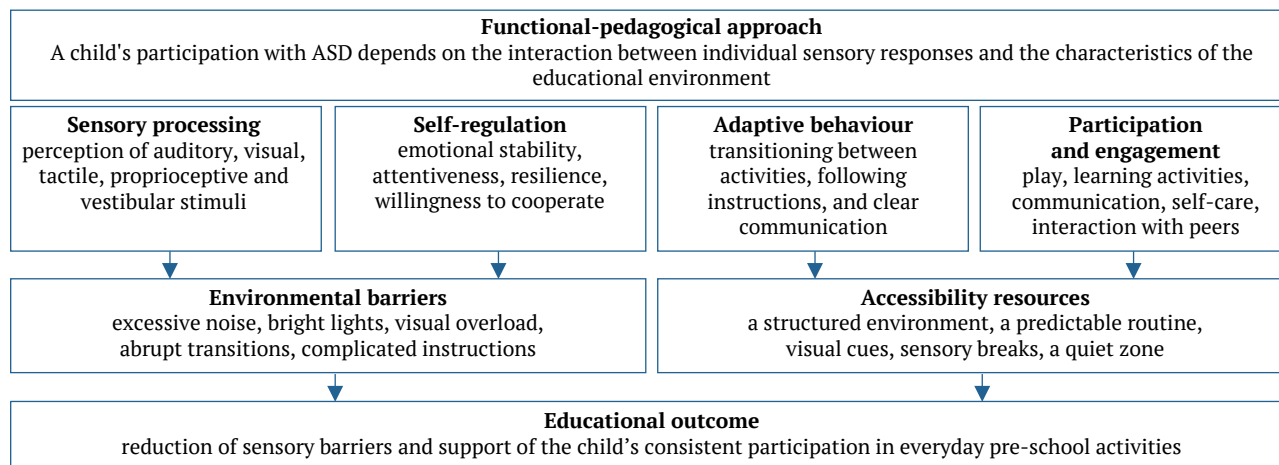


Figure 1. Analytical framework for the factors influencing the participation of children with ASD in early years education

Source: compiled by the author based on A.J. Ayres (1972), A.J. Ayres & J. Robbins (2005), World Health Organisation (2007), Convention on the Rights of Persons with Disabilities (2016), World Health Organisation (2023)

A comparative assessment of the effectiveness of sensory integration therapy and sensory modification of the educational environment. A comparison of sensory integration therapy and sensory-adapted modifications to the educational environment revealed different mechanisms of influence on the participation of children with ASD in pre-school education. Sensory integration therapy is linked to the individual level of support, as its primary focus is the child's ability to receive, organise and use sensory information for adaptive behaviour. Sensory modification of the environment belongs to the organisational-pedagogical level, as its focus is not the child's sensory reaction, but the conditions in which this reaction arises, intensifies or weakens. This distinction determines the differing effectiveness of the approaches: the first approach primarily creates the conditions for participation through sensory regulation, whilst the second directly alters the accessibility of pre-school activities. Sensory integration therapy is most significant when limitations on participation are linked to the child's insufficient organisation of sensory responses. In such cases, difficulties in joining in with play, activities or communication arise not only due to external conditions, but also due to the complexity of processing stimuli, planning actions, regulating motor activity and maintaining a consistent behavioural response.

A.C. Bundy *et al.* (2019) provide grounds for interpreting sensory integration therapy as an approach in which sensorimotor experience is used to support praxis, adaptive behaviour and functional activity. In the context of early years education, this means that the therapy's impact on participation is predominantly indirect: it does not alter the structure of group activity but may increase a child's readiness to participate through improved self-regulation, greater stamina, a reduction in disorganised reactions and a more stable response to sensory stimuli. Sensory-adapted environmental modification operates on a different

logic of effectiveness. Its impact begins not with individual change in the child, but with a change in the educational situation. If noise levels are reduced in the pre-school group, the space is organised, visual overload is reduced, clear transitions between activities are provided, and visual cues and sensory pauses are introduced, then participation becomes more accessible without waiting for the child to change first. This is the key pedagogical advantage of the environmental approach: it ensures engagement of the child within a real group context, where most difficulties arise not during the isolated performance of a task, but in interaction with the space, pace, noise, other children, instructions and routine.

A comparison of the two approaches has shown that the concept of "effectiveness" in this context cannot be limited to a general assertion regarding a reduction in sensory difficulties. In early years education, only an approach that influences a child's functional participation, adaptive behaviour and engagement in specific activities can be considered effective. Sensory integration therapy can enhance functional participation by improving internal conditions: the child organises movement better, maintains attention more easily, responds more consistently to stimuli, and recovers more quickly from sensory overload. Sensory modification of the environment enhances functional participation through external conditions: activities become shorter, clearer, more predictable, less overwhelming and open to different ways of responding. Therefore, one approach works primarily by developing the child's readiness to participate, whilst the other works by altering the situation of participation itself.

Distinguishing between these mechanisms is particularly relevant for interpreting the behaviour of children with ASD in a pre-school setting. If a child avoids group play, fails to respond to instructions, leaves the session, or displays sudden agitation during transitions between activities, such behaviour does not always indicate a lack of

motivation or defiance. It may be the result of sensory overload, a lack of predictability in the situation, or a mismatch between the mode of participation and the child's sensory profile. The model by W. Dunn (2014) of sensory profiles explains that children react differently to the intensity, novelty and quantity of stimuli: some children need a reduction in stimuli, some require additional sensorimotor organisation, and some need a clearer structure and repetition. Consequently, the pedagogical effectiveness of support depends not on the number of sensory tools used, but on the suitability of these tools to the child's profile and the situation in which they are participating. Therefore, sensory integration therapy and sensory modification of the environment have varying degrees of effectiveness across different outcome measures. In terms of adaptive behaviour, sensory integration therapy is substantial for development of a more organised response to sensory information. Its effects may manifest as a reduction in chaotic motor activity, an improved ability to plan actions, reduced reactivity to stimuli, and a greater willingness to complete tasks or move on to a new activity. Environmental modification also influences adaptive behaviour, but through a different mechanism: it reduces the number of situations in which the child is forced to respond to excessive or unpredictable stimuli. If the demands of the environment become manageable, the child's behaviour stabilises without additional pressure, restrictions or constant correction from an adult.

In terms of engagement, sensory adaptation of the environment has particularly significant educational potential. Engagement in early years education depends not only on whether a child can perform a specific action, but also on whether they can maintain a connection with the situation, the materials, the adults or their peers. Even with individual sensory support, a child may remain disengaged if the environment is overstimulated, instructions are given too quickly, transitions between activities are abrupt, and group interaction requires prolonged exposure to a noisy space. Environmental adaptation directly influences these conditions: it reduces background noise, structures expectations, provides the child with points of reference for orientation, and creates the opportunity to remain engaged for longer or to join in gradually. The professional guidelines by R. Watling *et al.* (2018) are substantial for distinguishing between the therapeutic and pedagogical logic of sensory support. In early years education practice, sensory integration is often equated with individual sensory exercises, objects or brief pauses. Such an equating narrows the scope of the approach and may create the false expectation that any sensory activity automatically increases the child's participation. A comparative analysis reveals something different: sensory integration therapy requires individual assessment, the professional selection of sensorimotor activities, and an emphasis on adaptive responses; environmental modification requires an analysis of group barriers, the coordination of pedagogical actions, and the systematic organisation of the environment. Both approaches have a

sensory basis, but differ in their objectives, practitioners, mechanisms and outcome measures.

The National Institute for Health and Care Excellence (2013) (NICE) guidance emphasises the significance of the environmental dimension, as the sensory characteristics of children with autism are considered a factor that must be covered in day-to-day support. In a pre-school setting, the daily routine is crucial: the child encounters repetitive transitions, noise, physical proximity, alternating activities, group instructions, waiting their turn, and sharing materials. If these situations remain sensory-unsupported, even high-quality individual therapeutic support does not always translate into educational participation. If, however, the environment becomes predictable and less overwhelming, the child's abilities – developed or supported through individual interventions – are given the space to flourish. A comparative analysis has clarified the relationship between “internal” and “external” conditions for participation. Internal conditions relate to the child's ability to regulate sensory information, maintain a state of readiness, organise actions and respond adaptively. External conditions relate to the organisation of space, routine, stimulation, instructions and interaction. Sensory integration therapy primarily addresses internal conditions of participation; sensory modification of the environment addresses external ones. For a child with ASD, these levels do not exist in isolation: even a well-developed capacity for self-regulation can be disrupted in an overstimulating environment, whilst a well-adapted environment may be insufficient in the context of significant difficulties with sensory organisation. Therefore, the effectiveness of support increases when the individual and environmental levels are not pitted against one another. In an educational context, sensory adaptation of the environment has another substantial distinction: it alters not only the conditions for a single child, but also the overall quality of the group's organisation. Clear transitions reduced excessive noise, a clear spatial layout, measured instructions, visual support and the opportunity for brief rest periods are beneficial not only for children with ASD but also for other children who experience difficulties with attention, self-regulation, speech or behavioural adaptation. Consequently, environmental modification has a broader inclusive effect: it does not single out a child as “problematic” but changes the conditions of participation for the group as a whole. Sensory integration therapy, by contrast, remains more individually focused and requires a separate professional support pathway.

The assessment of effectiveness through functional participation, adaptive behaviour and engagement helps to avoid the oversimplification whereby effectiveness is equated solely with a reduction in undesirable behavioural manifestations. A reduction in crying, avoidance or motor agitation is only meaningful when accompanied by an increase in genuine participation: the child remains active for longer, responds more frequently to prompts, transitions more easily between routine activities, participates in shared play, completes daily tasks or maintains

contact with the teacher. In this context, sensory integration therapy and sensory modification of the environment can yield different but interrelated results: the former increases the child's readiness for action, whilst the latter makes the action itself more accessible. The identified difference between the approaches is significant for organising support in early years settings. If therapeutic logic alone dominates, the responsibility for participation is effectively shifted onto the child: it is expected that, following individual work, they will cope better in a group setting. If environmental logic alone dominates, the need of individual children for deeper, individualised support with sensory regulation may be underestimated (Division for Early Childhood, 2014; Watling *et al.*, 2018; Bundy *et al.*, 2019). A balanced model suggests a different approach: sensory integration therapy is viewed as a resource for developing individual regulation, whilst environmental modification is defined as a condition for transferring this regulation into daily participation. Such interaction

is consistent with the functional nature of early years education, where children's development takes place not in an isolated therapeutic setting, but within recurring situations involving play, communication, daily life and learning. The comparative effectiveness of the two approaches lies not in the superiority of one over the other, but in the different ways in which they contribute to the child's participation. Sensory integration therapy provides an individual foundation for more organised behaviour and sensory regulation. Sensory modification of the educational environment ensures accessibility of activities, reduces overload and supports stability of engagement in a group context. For early years education, the most productive approach is a combination of these levels, as the functional participation of children with ASD depends both on the child's ability to regulate responses and on the environment's ability to avoid creating excessive sensory barriers. A summary of the differences between the two approaches is presented in Table 1.

Table 1. Comparative matrix of sensory integration therapy and sensory-adapted modification of the educational environment

Comparison criteria	Sensory integration therapy	Sensory-adapted modification of the educational environment	Estimated contribution towards the child's participation	Analytical conclusion
Main focus	Child's individual sensory regulation, the organisation of an adaptive response, praxis, and the ability to use sensory information for purposeful action	Physical, organisational and interactive conditions within the group: space, noise, lighting, schedule, transitions, instructions, visual aids	Therapy creates the internal conditions for participation; adapting the environment changes the accessibility of the activity	These approaches operate at different levels: child – environment
Influence mechanism	Selection of sensorimotor activities that support adaptive responses, motor planning, arousal regulation and behavioural organisation	Reduction of the intensity of stimuli, spatial organisation, predictability of transitions, and adaptation of participation methods	The first mechanism indirectly increases participation through self-regulation; the second directly lowers the barriers to participation	Effectiveness is achieved through a combination of internal regulation and external accessibility
Level of implementation	Primarily one-to-one or small-group sessions led by a qualified specialist	Day-to-day management of the group environment by teachers, an assistant, a psychologist and the support team	Therapy supports the child either outside or alongside group settings; the environment influences daily participation in the group	An environment-based approach offers greater pedagogical integration within the early years education system
Role of an educator	The teacher addresses the specialist's recommendations, observes how skills are applied in group activities, and ensures consistency in the learning environment	The teacher directly structures the space, the pace of activities, instructions, transitions, methods of communication and recovery	In an inclusive approach, the teacher becomes the key facilitator of accessible participation	Educational practice applies sensory support to real-life educational situations
Personalisation	It is based on the child's sensory profile, the nature of their responses to stimuli, their level of praxis, and their need for sensorimotor organisation	It is based on observing the group's barriers and selecting appropriate adaptations for specific situations of participation	Personalisation of therapy relates to the child's responses; the personalisation of the environment relates to the conditions in which the child participates	It is necessary to assess not only the child, but also the situation in which the difficulties arise
Functional participation	This is due to the child's improved ability to organise their actions, tolerate stimuli, complete tasks and switch between activities	Increases due to easier access to the activity, reduced cognitive load, visual cues and alternative ways of responding	Therapy fosters a willingness to participate; the environment makes participation a real possibility within a group setting	Greatest effect is expected when individual regulation is translated into adapted activity
Adaptive behaviour	Promotes a more organised response to sensory stimuli, a reduction in chaotic motor activity, and better regulation of responses	Reduces the number of situations in which a child's behaviour becomes disrupted due to excessive or unpredictable stimuli	Behaviour stabilises through addressing child's response and by reducing the sensory complexity of the situation	Behavioural difficulties should be viewed as the interaction between a child's profile and the group environment

Table 1. Continue

Comparison criteria	Sensory integration therapy	Sensory-adapted modification of the educational environment	Estimated contribution towards the child's participation	Analytical conclusion
Educational engagement	Helps children engage with an activity, material or adult for longer by improving their self-regulation	Directly promotes engagement through a predictable routine, step-by-step instructions, sensory breaks and a reduction in background noise	Engagement depends on the child's ability to maintain contact with the situation and on how well that situation is organised	Adapting to the environment is particularly relevant for consistent participation in a group setting
Risk of oversimplification	This may be mistakenly interpreted as referring to any sensory activities or objects without professional assessment or specific objectives	This may amount to isolated adjustments without a systematic analysis of the barriers, the regime and the child's involvement	Both approaches lose their effectiveness if they are applied as a set of techniques without any connection to participation	Criterion for selecting interventions should be a change in engagement, rather than the mere presence of sensory activity
Pedagogical implementation	Requires collaboration with a specialist and the application of recommendations to the group's day-to-day situations	Can be integrated into timetables, spaces, instructions, communication, group rules and team interaction	Environmental adaptations are more practical for day-to-day use in early years settings, but they do not replace professional support	Optimal support combines professional assessment with pedagogical implementation
Scope of application	Insufficient as standalone if the group environment remains sensory-overloaded and unpredictable	Inadequate as a sole intervention for significant individual difficulties with sensory regulation	Limitations of each approach are offset by their functional complementarity	Not competition between approaches is needed, but their coordination
Overall performance	Strengthens the individual prerequisites for participation: self-regulation, adaptive response, endurance, coordination of actions	Increases accessibility: reduces barriers, structures the environment, promotes predictability and flexible ways of inclusion	Functional participation, adaptive behaviour and engagement are enhanced when individual and environmental support are combined	Support for children with special educational needs should be structured as a system comprising "the child's profile – the group environment – the outcome of participation"

Source: compiled by the author based on National Institute for Health and Care Excellence (2013), W. Dunn (2014), R. Watling *et al.* (2018), A.C. Bundy *et al.* (2019)

As shown in Table 1, sensory integration therapy and sensory-adapted modifications to the educational environment have varying degrees of impact on the participation of children with ASD in pre-school education. Sensory integration therapy is primarily aimed at individual sensory regulation, adaptive response and the child's ability to organise their behaviour in conditions of sensory overload. In contrast, sensory-adapted environmental modification works by altering external conditions: space, routine, noise and light levels, the predictability of transitions, and how the child is included in activities. Therefore, the first approach creates the internal conditions for participation, whilst the second ensures the accessibility of the educational setting itself.

The comparison also shows that these approaches differ in terms of their pedagogical feasibility. Sensory integration therapy requires an individualised assessment, specialist training and targeted efforts on the child's sensory profile. Environmental modification can be integrated into the daily practice of early years settings through coordinated action by teachers, teaching assistants, psychologists, support specialists and parents. Its effectiveness is demonstrated by a reduction in sensory barriers, stabilisation of behaviour, and an expansion of the child's opportunities to participate in play, communication, activities and daily living tasks. Thus, the comparative effectiveness of

sensory integration therapy and sensory-adapted environmental modification does not lie in the superiority of one approach over the other, but in their different functions within the support system for children with ASD. Sensory integration therapy provides an individualised approach to sensory regulation and adaptive behaviour, whilst environmental modification creates the conditions for transferring this regulation into everyday participation within a pre-school group. To enhance the functional participation, adaptive behaviour and educational engagement of children with ASD, the most appropriate approach is to ensure that these approaches complement one another within a unified psychological and pedagogical support system.

A model of a sensor-adaptive environment as an applied outcome of a comparative analysis

A sensory-adapted pre-school environment is conceived as a system for organising the participation of children with ASD, in which sensory needs are aligned with the demands of the educational context. This model is not merely a matter of adding individual sensory aids, as it is based on a shift in the conditions of participation: from definition the child's sensory needs to assessing their inclusion in real pre-school activities. Sensory integration therapy creates individual conditions for better self-regulation and adaptive behaviour; however, the child's day-to-day

participation takes place in a group setting, where there is noise, movement, instructions, changing activities, social interactions and routine requirements. Therefore, the applied model must combine an individual interpretation of sensory needs with the pedagogical configuration of the environment. In the Division for Early Childhood (2014), support for young children is viewed through a combination of assessment, environment, interaction, instruction, team collaboration and family involvement. For a sensory-adapted preschool environment, this means that support must be integrated into the natural situations of preschool life: play, mealtimes, getting dressed, waiting, group activities, going for a walk, and interacting with peers. The Convention on the Rights of Persons with Disabilities (2016) elaborates on this approach through practices in which a child receives support within their real-life environment, rather than being removed from it to conduct tasks in isolation. In this model, sensory adaptation becomes part of the daily educational routine, rather than an additional regime separate from group life.

The principles of the Universal Design for Learning Guidelines Version 3.0 provide a basis for viewing the pre-school environment as a flexible system of ways to participate, interact and respond. For children with ASD, this means that the same educational activity may be accessible or inaccessible depending on how it is organised. A child may not be able to cope with prolonged group instruction but can participate through visual cues; avoid a noisy game but join in after a short sensory break; or not respond verbally but demonstrate a choice through an object, a gesture or an action. In this context, sensory adaptation does not simplify the content of pre-school education, but changes the way it is accessed. The flexibility of the environment ensures the possibility of participation without standardising the child's ways of responding. Resolution of the Cabinet of Ministers of Ukraine No. 530 (2019), Law of Ukraine No. 3788-IX (2024), Order of the Ministry of Education and Science of Ukraine No. 33 (2021) and the Comprehensive Programme for the Development of Pre-school Children with Autism "Rozkvit" (2013) form the regulatory and pedagogical framework within which a sensory-adapted environment can be justified as a component of inclusive pre-school education. The legislative framework defines pre-school education as a space for a child's development, upbringing, learning and socialisation. The procedures for organising inclusive education in pre-school educational establishments ensure a team-based approach to supporting children with special educational needs. The core component of pre-school education focuses the educational process on activity, interaction, independence and the inclusion of children in various types of activities. The "Rozkvit" programme emphasises the importance of structure, consistency and specially organised support for children with autism. Together, these documents highlight a sensory-adapted environment not as an optional extra, but as an integral part of the accessibility of pre-school education.

The model comprises four interrelated components. The first is the identification of the child's sensory needs. In educational practice, this does not involve clinical diagnosis, but rather the identification of conditions that hinder or facilitate participation: reactions to noise, light, touch, movement, smells, close contact, visual overload, novelty of the situation, and changes in activities. Sensory needs should be identified through behavioural manifestations in specific pre-school situations: the child leaves the circle during group play, covers their ears, avoids drawing due to the tactile sensation of the materials, does not join in group activities after a loud signal, or loses focus after several transitions between zones. Such an analysis links the sensory response not to an abstract characteristic of the child, but to a specific condition affecting participation. The second component is an analysis of the physical and organisational environment. Barriers may include not only the physical parameters of the space, but also the daily routine, the sequence of scheduled activities, the pace of instructions, waiting times, the way group interaction is organised, and the number of simultaneous demands placed on the child. High visual stimulation on the walls can make it difficult to maintain attention; a sudden transition from play to an activity can intensify protest reactions; the absence of clearly defined zones can increase disorientation; prolonged exposure to a noisy group can cause fatigue and avoidance. The environmental analysis is not aimed at identifying "problematic behaviour", but at identifying the conditions under which participation becomes excessively difficult for the child (World Health Organisation, 2007; Division for Early Childhood, 2014).

The third component involves the selection of environmental and pedagogical adaptations. In the model, these are viewed as targeted solutions addressing specific barriers. If participation is limited by noise overload, appropriate measures include reducing background noise, creating a quieter area, and gradually integrating the child into group activities. If difficulties arise during transitions, support is provided by a visual schedule, warning signals, and consistent rituals for the start and end of activities. If a child loses engagement due to complex verbal instructions, short phrases, demonstrations of the action, visual cues, or a choice between two options are used. If a child becomes quickly exhausted, sensory breaks, reducing the duration of participation with a gradual increase in time, and a sensory recovery zone are appropriate. Adaptations should correspond not to the general diagnosis of ASD, but to the specific link between sensory needs, environmental barriers, and expected participation. The fourth component is the assessment of the child's participation. The result of a sensory-adapted environment cannot be considered merely a reduction in external tension or short-term calming. The indicator of effectiveness is an increase in actual participation: the child remains active for longer, responds more frequently to prompts, transitions more easily between activities, joins in play, performs age-appropriate actions, uses accessible means of communication, and

maintains contact with the teacher or peers. The assessment should record not only the child's current behaviour, but also changes following adaptation to the environment: the duration of engagement, the number of activities in which the child participates, the level of adult support, the ability to return to a task after becoming overwhelmed, and the quality of interaction with the teacher or peers.

A sensory-adapted environment does not replace individual therapeutic support, nor does it transfer the role of a therapist to the teacher. Its purpose is to create conditions in which a child's sensory regulation can be supported in everyday situations within the nursery group. Even with individual work on sensory regulation, a child needs an environment in which established or supported skills can be used in real-life interactions. At the same time, environmental adaptations should not replace professional support in cases of significant sensory integration difficulties (Division for Early Childhood, 2014). The practical significance of the model lies in combining these levels: individual support facilitates regulation, whilst an adapted environment provides the opportunity to apply it within the group. For early years settings, such a model has organisational significance. It shifts sensory support from the level of situational response to that of pedagogical planning. The teaching team can not only respond to sensory

overload once it occurs but also anticipate the conditions under which it is most likely to arise. This changes the nature of the task: instead of constantly correcting the child's behaviour, a structure is created in which the need for such corrections is reduced. The child's participation is supported through a clear environment, a consistent routine, coordinated adult actions, accessible means of communication, and a regulated sensory load.

The model also has inclusive potential for the group. The structured layout of the space, predictable transitions, visual cues, flexible instructions, sensory breaks and quiet zones can be beneficial not only for children with ASD. They support children with varying rates of development, speech difficulties, attention issues, heightened anxiety or low tolerance for group activities. Consequently, this sensory-adapted environment does not isolate a child with ASD as a separate case requiring support but rather enhances the overall accessibility of the pre-school environment. This approach aligns with the logic of inclusive education, in which adapting conditions is seen as a means of expanding participation, rather than as an exception to the general organisation of the group. The developed model links the child's sensory needs, environmental barriers, adaptive solutions, and the outcome of participation in group activities. This logic is illustrated in Figure 2.

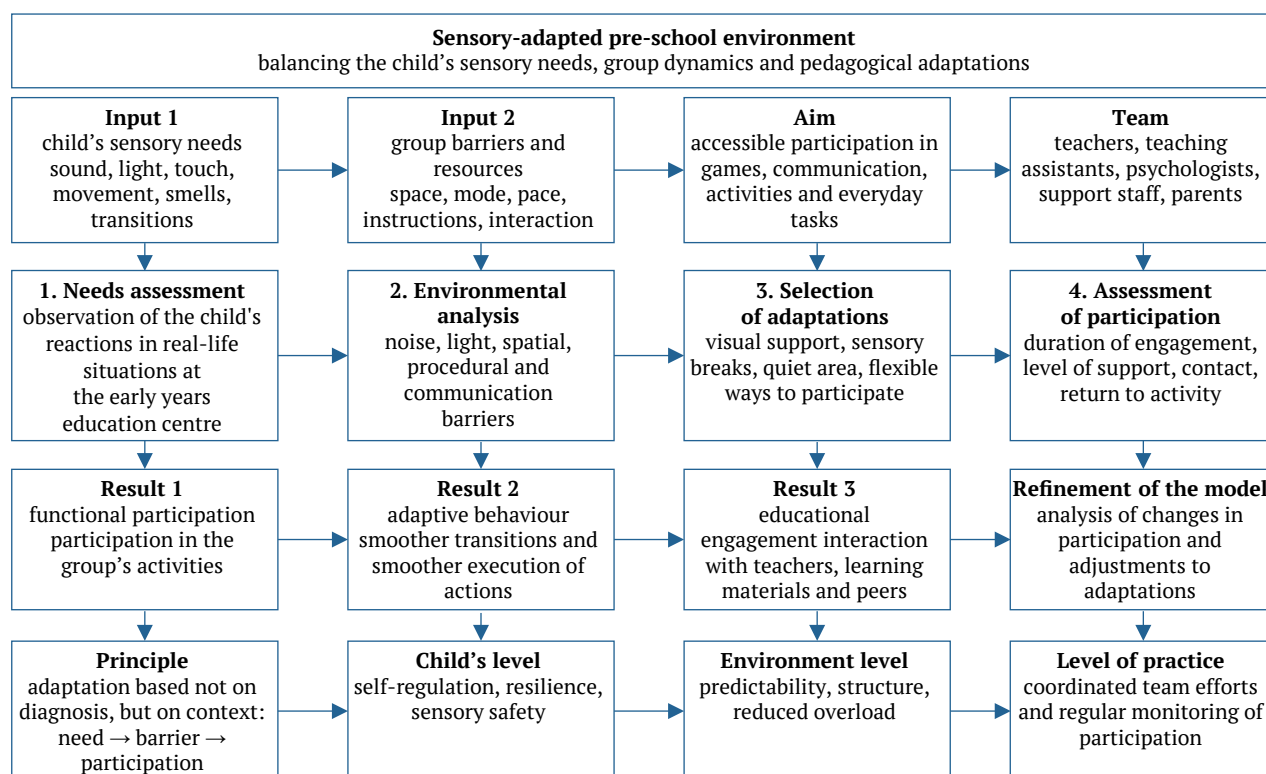


Figure 2. Model of a sensory-adapted pre-school environment to enhance the participation of children with ASD

Source: compiled by the author based on Comprehensive Programme for the Development of Pre-school Children with Autism "Rozkvit" (2013), Division for Early Childhood (2014), Convention on the Rights of Persons with Disabilities (2016), Resolution of the Cabinet of Ministers of Ukraine No. 530 (2019), Order of the Ministry of Education and Science of Ukraine No. 33 (2021), Law of Ukraine No. 3788-IX (2024)

As shown in Figure 2, the model of a sensory-adapted pre-school environment has a sequential structure: identification of the child's sensory needs, analysis of environmental barriers and resources, selection of pedagogical and environmental adaptations, and assessment of participation in pre-school activities. This structure shifts the focus from situational responses to behavioural manifestations to a preliminary analysis of the conditions in which these manifestations arise. Sensory support in this model is linked not to individual aids, but to the organisation of space, routines, instructions, transitions, communication and ways of including the child in group activities.

Thus, the model of a sensory-adapted environment puts into practice the findings of a comparative analysis of the two approaches. Sensory integration therapy provides an individualised level of support for sensory regulation, whilst environmental modification creates the conditions for this regulation to be utilised in the everyday life of a pre-school group. The practical value of the model lies in the fact that a child with ASD's participation is assessed not by formal presence or a short-term reduction in tension, but by their ability to engage in play, communication, activities, self-care and interaction with peers. In this approach, sensory adaptation takes on not a supportive but an organisational significance, as it influences the very structure of the educational situation: making it more predictable, less overwhelming, and more accessible to different ways of responding and participating. This demonstrates a sensory-adapted environment as a component of inclusive pre-school education, within which support for a child with ASD is provided not through isolation from group activities, but through changes to the conditions of their inclusion. The model also emphasises the importance of team coordination: the teacher, assistant, psychologist, support specialists, and parents should focus not only on reducing behavioural difficulties, but on expanding the child's actual participation in daily activities. Therefore, the result of a sensory-adapted environment is not merely the adaptation of the space or routine, but the child's more stable functional involvement in pre-school life.

DISCUSSION

The findings are consistent with studies in which the sensory characteristics of children with ASD are considered a factor influencing educational participation, attention and behavioural organisation. In a systematic review, C. Mallory & B. Keehn (2021) demonstrated that differences in sensory processing and attention in autism have implications for the academic environment, particularly regarding maintaining engagement in learning situations, responding to instructions and coping with sensory overload. These findings align with the results of the present study, in which a child's participation with ASD was defined as functional inclusion in educational, play, communicative and daily living activities under conditions of sensory accessibility of the environment. The conclusion regarding the need to distinguish between individual sensory support

and environmental modification aligns with the results of a randomised study by E. Randell *et al.* (2022), in which sensory integration therapy for children with autism and sensory processing difficulties was evaluated as a separate structured intervention. In this study, sensory integration therapy was presented not as general sensory activity, but as a specifically organised therapeutic approach that supports the distinction between professional therapy and pedagogical environmental adaptations in a pre-school group. The findings regarding the identification of a child's sensory needs are consistent with the systematic review by N. Soler *et al.* (2023), which analysed tools for assessing sensory manifestations in children and adolescents with neurodevelopmental disorders based on adult reports. In the present study, sensory needs were also examined through observable manifestations in everyday functioning; however, the focus was shifted to pre-school settings: participation in play, response to a group environment, transitions between activities, following instructions, and interaction with the teacher or peers.

Conclusions regarding the role of sensory integration therapy are consistent with the systematic review by J. Camino-Alarcón *et al.* (2024), which summarised approaches to supporting children with ASD through sensory processing and sensory integration. In the present study, sensory integration therapy is also considered a professional approach to support; however, its role is clarified in the context of early years education: the therapeutic effect is linked to the development of the prerequisites for sensory regulation and adaptive response, whilst stable participation in the group also depends on the organisation of the educational environment. The findings regarding environmental adaptation are consistent with the brief review by K. Unwin *et al.* (2024), which formulated recommendations for supporting schoolchildren with sensory processing difficulties in educational settings. A comparison with the present study reveals a shared emphasis on the regulation of noise, lighting, spatial organisation, routine predictability and modes of participation. The difference lies in the pre-school focus of the present work, where the child's participation encompasses not only learning tasks but also play, self-care, communication and transitions between routines. The findings regarding the importance of specially organised sensory conditions align with the systematic review by S. Leonardi *et al.* (2025), which analysed the use of multisensory environments for children and adolescents on the autism spectrum. In the present study, the sensory-adapted pre-school environment is considered more broadly than a separate sensory room or an isolated recovery area. The focus is shifted to the day-to-day organisation of the group: space, routine, instructions, transitions, communication and ways of involving the child in activities. The significance of play as a space for participation corresponds to the review by L. López-Nieto *et al.* (2022), which examined play-based interventions for children with ASD. The findings of the study indicate that engagement in play depends not only on the social and communicative

structure of the game, but also on the sensory accessibility of the play situation. Noise, unpredictability, physical proximity or an overload of stimuli can limit participation even when there is an interest in the game.

The data on the experiences of autistic pupils in mainstream educational settings, summarised in the systematic review by F. Horgan *et al.* (2023), align with the findings of this study regarding the significance of environmental barriers to meaningful participation. That study demonstrated that inclusion in mainstream education does not guarantee a positive educational experience without incorporating social, sensory and organisational conditions, and the present study specifies this conclusion for the pre-school level through a model of a sensory-adapted environment. The inclusive dimension of support for children with ASD aligns with the scoping review by M.I. Vidal-Esteve & L. Kosyvaki (2023), which identified the key components of inclusive education for pupils with autism. The results of this study develop this logic in the direction of sensory accessibility, as a child's participation in a pre-school group depends not only on general inclusive principles, but also on the regulation of noise, space, routine, transitions and methods of pedagogical interaction. The issue of observing the social interactions of children with ASD in inclusive educational settings was addressed in the review by S. Tsamitrou & M.-H. Plumet (2024). This study highlighted the complexity of recording social interaction in a natural pre-school environment, which correlates with the study's conclusion regarding the need to assess participation not merely by the child's physical presence, but by the quality of their inclusion in play, communication, joint action and contact with peers. The issue of children with ASD transitioning from nursery to school, as analysed in the review by S. Chahboun *et al.* (2024), underscores the importance of predictability, consistent support and the readiness of the educational environment. The results of the present study complement this line of research in that a sensory-adapted environment in a pre-school setting is viewed as a condition not only for current participation but also for the development of more stable ways of responding to routines, instructions, transitions and group situations. The scoping review by K.L. Williams *et al.* (2024), which summarised the use of sensory adaptive environments for children with ASD, is directly relevant to the developed model. In the present study, this idea is specified through the pedagogical structure of the preschool environment: identifying sensory needs, analysing barriers, selecting adaptations, and assessing participation in educational, play, communication, and daily life activities. The issue of inclusive early education for children with autism, presented in the study by M. Siller *et al.* (2021), correlates with the findings of the present study regarding the combination of progress in inclusion with the presence of persistent barriers. The aforementioned study emphasised the need for further development of inclusive practices in early childhood, and the results obtained clarify one of the mechanisms of such development – sensory adaptation of the educational

environment as a prerequisite for the functional participation of children with ASD.

The sensory parameters of the physical educational environment, summarised in the systematic review by D. Adams *et al.* (2025), correspond with the findings of this study regarding the relationship between environmental characteristics, learning and the well-being of children with ASD. In the present study, this logic is applied specifically to early years education: noise, lighting, spatial density, visual richness and routine predictability are considered not as background conditions, but as factors influencing a child's functional participation, adaptive behaviour and engagement. A systematic review by A. Piller *et al.* (2025), focusing on sensory-oriented interventions for children and young people from 2015 to 2024, aligns with the conclusion regarding the need to distinguish between different types of sensory support. In the present study, this distinction takes on pedagogical significance: sensory integration therapy is linked to individual sensory regulation, whereas sensory-adapted environmental modification is linked to the accessibility of group activities, the organisation of routines and the reduction of barriers to participation. The impact of the quality of the school environment on the behaviour of children with ASD, examined in the systematic review by R. Al Qutub *et al.* (2024), correlates with findings regarding the role of the physical and organisational environment in stabilising a child's behaviour. In the present study, this relationship is applied to the pre-school context, where behavioural manifestations are viewed not merely as an individual characteristic of the child, but as the result of the interplay between sensory input, spatial organisation, the pace of activities, and the nature of pedagogical support.

Approaches to inclusion and social participation of pupils with autism, summarised in J. Lüddeckens' (2021) review, correspond to the conclusion that the formal inclusion of a child in the educational environment is insufficient. In the present study, this approach is refined through the sensory dimension of participation: a child may be physically present in a group but remain under-engaged if noise, unpredictability, complex instructions, or an insufficiently structured space limit the possibility of interaction. The social participation of pupils with ASD in mainstream settings, analysed in the study by C. Mamas *et al.* (2021), aligns with the findings of this study regarding the distinction between presence and actual participation. For early years education, this distinction has an additional sensory dimension, as engagement in play, communication and collaborative activities depends on the environment's ability to support self-regulation, reduce sensory overload and provide the child with accessible ways to participate. The accessibility of care and early support services for children with disabilities aged 0 to 5 years, as examined in the scoping review by F. Routhier *et al.* (2025), is consistent with the findings of this study regarding the importance of the early and pre-school environment for a child's participation. In this study, accessibility is specified in terms of sensory, organisational and pedagogical

parameters: a child requires not only access to the facility, but also conditions under which participation in everyday activities is not hindered by overload, unpredictability or a lack of adapted support. The systematic review by E. Leifler *et al.* (2021), dedicated to adaptations of the learning environment for children on the autism spectrum in mainstream schools, aligns with the conclusion regarding the importance of environmental solutions for educational participation. In the present study, this logic is adapted to the pre-school level, where environmental changes should encompass not only learning tasks but also play, self-care, transitions, communication, sensory breaks and the organisation of daily group life.

A comparison with previous studies shows that sensory support for children with ASD requires analysis at two levels: individual sensory regulation and the organisation of the educational environment. The first level relates to professional support for adaptive responses, behavioural stability and functional activity. The second level relates to the modification of the space, routine, instructions, transitions and modes of participation, which reduce sensory barriers in the pre-school group.

CONCLUSIONS

The study found that the participation of children with ASD in pre-school education should be viewed as the result of the interaction between sensory processing, self-regulation, adaptive behaviour and the accessibility of the educational environment. The study determined that sensory difficulties take on pedagogical significance when they limit a child's ability to participate in play, communication, activities, self-care, transitions between routines, and interaction with adults and peers. This has made it possible to define the participation of a child with ASD not as a formal presence in the group, but as functional inclusion in everyday pre-school activities at a level accessible to them. The main sensory factors influencing the involvement of a child with ASD in pre-school education have been identified: characteristics of sensory processing, level of self-regulation, capacity for adaptive behaviour, presence of environmental barriers, predictability of the routine, spatial organisation, intensity of noise and light exposure, method of presenting instructions, and the possibility of flexible participation in activities. The study demonstrated that behavioural manifestations which may be perceived as refusal to participate or low motivation often reflect a mismatch between the child's sensory needs and the conditions of the pre-school environment. A comparative analysis has shown that sensory integration therapy and sensory-adapted modification of the educational environment have different mechanisms of influence on the functional participation, adaptive behaviour and educational engagement of children with ASD. Sensory integration therapy focuses primarily on individual support: sensory regulation, the organisation of adaptive responses, praxis and behavioural stability. Sensory-adapted environmental

modification operates at the level of the educational setting: it reduces sensory barriers, increases predictability, structures the space, regulates the intensity of stimuli and creates conditions for different modes of participation.

The study confirmed that these approaches are not interchangeable. Sensory integration therapy fosters the internal prerequisites for participation by supporting individual sensory regulation, whereas environmental modification ensures the accessibility of the preschool activity itself. Individual therapeutic work can promote better self-regulation and adaptive behaviour, but its impact is limited if the group environment remains overwhelming or unpredictable. At the same time, environmental adaptations create the conditions for daily participation, but do not eliminate the need for individual children to receive specialised support for sensory regulation. The developed model of a sensory-adapted pre-school environment encompasses four interrelated components: identifying the child's sensory needs, analysing the physical and organisational environment, selecting pedagogical and environmental adaptations, and assessing the child's participation in educational, play, communication and daily living activities. The effectiveness of such a model should be assessed not by a short-term reduction in tension, but by an expansion of genuine participation: the duration of engagement, the ability to return to activity after being overwhelmed, the level of independence, the quality of contact with the teacher and peers, and participation in various types of pre-school activities.

The findings provide grounds for considering a sensory-adapted environment as a component of inclusive pre-school education, focused on planning the conditions for participation in advance, rather than merely reacting to behavioural difficulties as they arise. This approach helps to reduce sensory overload, increase the predictability of the educational process, stabilise behaviour, and expand the child's opportunities to participate in group life without being isolated from shared activities. The limitations of the study are related to its theoretical and analytical nature and the lack of empirical testing of the proposed model in early years settings. Further research on this topic should verify the model of a sensory-adapted environment in Ukrainian early years settings, developing indicators to assess the participation of children with ASD in pre-school activities, comparing the effectiveness of specific environmental adaptations, and studying the interaction between the teaching team and parents in supporting the child's sensory needs.

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CONFLICT OF INTEREST

The author declares that there is no conflict of interest.

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**Сенсорна інтеграція та сенсорно-адаптоване середовище:
залученість дітей з розладами аутистичного спектру
до дошкільної освіти**

Анотація. Метою дослідження було порівняння сенсорної інтеграційної терапії та сенсорно-адаптованої модифікації освітнього середовища як підходів до підвищення участі дітей з розладами аутистичного спектру в дошкільній освіті. Дослідження виконано як теоретико-аналітичне опрацювання наукових, професійних, міжнародних і нормативно-освітніх джерел із подальшим зіставленням двох підходів за їхнім впливом на функціональну участь, адаптивну поведінку й освітню залученість дитини. Встановлено, що участь дитини з розладами аутистичного спектру в дошкільній освіті не може ототожнюватися з формальною присутністю у групі, оскільки вона передбачає реальне включення в освітні, ігрові, комунікативні й побутові активності. Визначено, що сенсорні труднощі набувають педагогічного значення тоді, коли впливають на саморегуляцію, поведінкову стабільність, контакт із педагогом і однолітками, здатність реагувати на інструкції та підтримувати участь у групових ситуаціях. Показано, що сенсорна інтеграційна терапія діє переважно на індивідуальному рівні, формуючи передумови для сенсорної регуляції, адаптивної відповіді, праксису й організації поведінки. Сенсорно-адаптована модифікація освітнього середовища діє на рівні освітньої ситуації: зменшує сенсорні бар'єри, підвищує передбачуваність режиму, структурованість простору, доступність інструкцій і гнучкість способів участі. Встановлено, що ці підходи не є взаємозамінними: перший формує внутрішні передумови участі, другий забезпечує доступність самої дошкільної активності. Сформовано модель сенсорно-адаптованого дошкільного середовища, що охоплює визначення сенсорних потреб дитини, аналіз фізичного й організаційного середовища, добір педагогічних і середовищних адаптацій, оцінювання участі дитини в щоденних активностях. Практична значущість результатів полягає в можливості використання запропонованої моделі для організації інклюзивного дошкільного середовища, у якому підтримка дитини з розладами аутистичного спектру спрямовується на розширення функціональної участі, адаптивної поведінки й освітньої залученості, а не лише на зменшення окремих поведінкових труднощів

Ключові слова: функціональна участь; адаптивна поведінка; освітня доступність; педагогічна підтримка; середовищні бар'єри; саморегуляція; інклюзивна практика