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Comprehensive Sensory Integration in Corrective Work with Children with Autism Spectrum Disorders Using the Senspace Method

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ABSTRACT

Purpose of the study: The aim of this study was to investigate the effectiveness of the Senspace comprehensive sensory integration method as a community-applied intervention, utilizing standardized health technology tools for assessment.

Methodology: The research employed a quasi-experimental design in a community rehabilitation setting involving 50 children with ASD aged 4-7 years. The experimental group (n=25) received the 10-week Senspace program. Standardized health technology instruments (Sensory Profile, Vineland-3) and observational scales were used for evaluation.

Main Findings: Statistically significant improvements were observed across all evaluated indicators within the experimental group. Notable reductions in sensory hypersensitivity were recorded: tactile sensitivity decreased by 16.5%, vestibular sensitivity by 19.1%, and proprioceptive processing by 19.7%. Indicators of social-communicative skills exhibited marked improvement: contact initiation increased by 83.3%, and joint attention improved by 84.6%. The overall adaptive score on the Vineland-3 demonstrated a rise of 13.4%. Correlation analysis revealed strong links between the alleviation of sensory disorders and advancements in adaptive functioning (r ranging from -0.745 to -0.668, p<.001).

Novelty/Originality of this study: The scientific novelty of this work resides in the formulation and empirical validation of a therapeutic intervention program that combined structured play practices with elements of behavioral therapy, specifically designed to cultivate communicative and cognitive functions.

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1. INTRODUCTION

Autism spectrum disorders (ASD) represent intricate neurodevelopmental conditions [1-4]. They are delineated by a triad of impairments encompassing social communication, stereotypical behaviors, and distinctive sensory responses [5]-[7]. Children afflicted by these disorders frequently exhibit pronounced challenges in sensory integration, resulting in heightened sensitivity (hypersensitivity) or, conversely, diminished reactivity (hyposensitivity) to external stimuli. Disruptions in the processing of sensory information from the vestibular and tactile systems significantly impede daily activities and the development of adaptive skills [8]-10. Predominantly, the symptoms manifest as difficulties in executing daily tasks, self-care, and peer interactions, thereby detrimentally affecting overall quality of life [11]-[13].

These circumstances underscore the imperative for the exploration and empirical validation of effective corrective methodologies aimed at comprehensive sensorimotor organization [14]-[16]. These circumstances underscore the imperative for the exploration and empirical validation of effective corrective methodologies aimed at comprehensive sensorimotor organization [17]-[19]. This need is further amplified by well-documented healthcare system and community service challenges, including critical resource shortages and the lack of standardized, scalable intervention models accessible outside specialized clinical settings. Their implementation is recognized as a vital direction in contemporary corrective psychology, with innovative approaches particularly enhancing the adaptation of these children. In light of the escalating prevalence of diagnosed cases of ASD globally, there exists an urgent necessity to develop and implement efficacious psychocorrectional strategies. These should not only address behavioral manifestations but also enhance fundamental sensorimotor mechanisms [20]. Currently, modern psychology offers a variety of sensory-oriented methodologies. This landscape is increasingly influenced by technological trends, such as the use of virtual reality (VR) for immersive therapy and telehealth platforms for expanding service access, which set a new standard for innovation and reach. However, their efficacy remains contentious and necessitates experimental validation under conditions that align with current scientific standards [21]-[24].

Despite the proliferation of sensory-oriented approaches, a significant research gap persists at the intersection of three critical dimensions: methodological comprehensiveness, empirical rigor in community settings, and integration of standardized assessment. Specifically, there is a lack of adequately empirically substantiated, comprehensive sensory integration programs that move beyond focusing on isolated developmental facets. Prevailing methodologies often neglect to combine corrective, educational, and therapeutic approaches into a cohesive, standardized framework suitable for community application. Furthermore, the systematic examination of the influence of such holistic programs on the concurrent evolution of sensorimotor, communicative, and adaptive functions remains understudied, particularly within real-world, non-clinical environments. This gap is compounded by a frequent reliance on observational or non-standardized measures, limiting the objectivity and replicability of findings. Therefore, there is a pressing need for research that investigates a structured, multisensory intervention using standardized health technology assessment tools within a community context to generate robust, generalizable evidence. This research deficit necessitated scholarly contemplation and the pursuit of innovative resolutions.

The problem of the present research pertains to the inadequate empirical substantiation of comprehensive sensory integration programs. Prevailing methodologies frequently concentrated on isolated facets of development, neglecting the combination of corrective, educational, and therapeutic approaches into a cohesive framework. The absence of a systematic examination of the influence of such programs on the evolution of sensorimotor, communicative, and adaptive functions has engendered a considerable scientific gap. This research deficit necessitated scholarly contemplation and the pursuit of innovative resolutions.

The aim of this study is to explore the efficacy of the Senspace method, regarded as a pioneering instrument for holistic sensory integration in interventions with children diagnosed with ASD.

The scholarly novelty of this research resides in its systematic evaluation of the Senspace method's impact, facilitating the integration of sensorimotor, socio-communicative, and emotionally adaptive dimensions of child development. The proposed approach transcends the conventional emphasis on individual symptoms, providing a comprehensive analysis of developmental dynamics. Furthermore, the research amalgamated both quantitative and qualitative metrics, for the first time enabling a multidimensional assessment of sensory integration efficacy. This approach not only captured statistically significant transformations but also delved into the individual experiences of children, their guardians, and educators. In such a way, the thoroughness and objectivity of the data acquired was ensured.

The objective of the current research was to ascertain the effectiveness of the Senspace method as a mechanism for comprehensive sensory integration in remedial endeavors with children exhibiting ASD.

In order to achieve the stated objective, several key research tasks were pursued. The study aimed to analyze the dynamics of sensorimotor coordination and integration in children with Autism Spectrum Disorder (ASD) following their engagement with the Senspace methodology. Concurrently, it sought to identify changes within the social-communicative domain of these children resulting from the sensory integration program. Furthermore, the research was designed to assess the impact of comprehensive sensory integration on the development of adaptive skills and the improvement of emotional regulation in children with ASD.

The research hypothesis posited that the application of the Senspace method in therapeutic interventions with children diagnosed with ASD would facilitate the enhancement of sensorimotor integration, foster the development of communication abilities, and improve adaptive behaviors.

2. THE COMPREHENSIVE THEORETICAL BASIS

2.1. Sensory processing and its neurobiological foundations in autism

Recent scientific investigations indicate that children diagnosed with autism spectrum disorders frequently encounter challenges related to sensory integration. Specifically, they experience difficulties with issues pertaining to sensory gating and the variability of responses to stimuli [22]. An analysis conducted by Chen et al. [23] established a significant correlation between sensory discrepancies and both internal and external difficulties, such as anxiety and stereotypical behaviors. Both studies illuminate the multifaceted nature of sensory processing mechanisms. However, the majority of their findings are predicated on correlational models, which constrains the ability to draw definitive conclusions regarding causal relationships. This situation accentuates the necessity for a comprehensive analysis of the sensorimotor integration impacts .

2.2. Effectiveness of sensory-oriented interventions: Ayres Sensory Integration and related approaches

Modern randomized controlled trials (RCTs) substantiate the efficacy of Ayres Sensory Integration (ASI) for children diagnosed with Autism Spectrum Disorder (ASD). A significant enhancement in goal-setting, sensorimotor capabilities, and social interactions has been documented [21]. The investigation conducted by Mishra & Mishra [24] in India further corroborated advancements in self-care and socialization competencies. The existence of RCTs and standardized protocols constitutes a robust advantage of these studies. However, the variability in the interventions' duration and intensity complicates comparative analyses. For the Senspace project, this underscores the necessity for procedural unification.

2.3. Multisensory environments (sensory rooms) and their effects

Research substantiates the efficacy of multisensory environments in modulating the behavior of children with ASD. De Domenico et al. [25] observed a notable reduction in stereotypical behaviors and an enhancement in emotional regulation with optimal utilization of these spaces. A systematic review conducted by Stephenson & Carter [26] underscores the imperative for the users' stimulus control and active engagement. A salient aspect of both investigations is their pragmatic orientation and comprehensive recommendations for designing such environments. Nevertheless, there exists a conspicuous lack of longitudinal studies.

2.4. Technological solutions: virtual reality, adaptive environments, and tele-rehabilitation

Recent research conducted by Failla et al. [27] elucidates the promising potential of virtual reality in cultivating social and adaptive competencies among children diagnosed with ASD. A systematic review of virtual interventions by Minissi et al. [28] underscores their inherent flexibility and the capacity to safely replicate sensory scenarios. The implementation of innovative platforms and the stimuli customization represent notable strengths. However, challenges persist, notably the risks associated with sensory overload and technical variability. Consequently, this underscores the imperative for thorough pre-testing to ascertain the employed technology's safety in the current study.

2.5. Assessment of outcomes: tools, indicators, and research design

Currently, there exists a diverse array of methodologies for evaluating the efficacy of sensory interventions. Research conducted by Staunton et al. [29] employs standardized sensory scales alongside the Goal Attainment Scaling methodology. López Díaz & Parra-Esquivel [30] underscore the significance of integrating both objective and subjective indicators. The importance of the proposed studies is underscored by the combination of quantitative and qualitative data, which serves as a strong asset. At the same time, there exists a potential for subjectivity in assessments conducted by parents. For the present study, this highlights the necessity for a mixed-methods approach and the implementation of standardized protocols.

2.7. Community-Based Models and Public Health Frameworks in ASD Intervention

Beyond the efficacy of specific therapeutic techniques, a critical line of inquiry examines models for delivering interventions within real-world community and public health systems. Research increasingly highlights the gap between evidence-based practices developed in clinical settings and their accessibility in community-based services, which are often characterized by resource constraints and variable staff expertise [29]. Successful scaling of interventions like sensory integration requires not only proven protocols but also implementation strategies that consider workforce training, cost-effectiveness, and integration into existing educational or healthcare infrastructures [31-[34]. Furthermore, there is a growing emphasis on family-centered care and coaching models that empower parents within community settings, recognizing them as essential agents in their child's developmental trajectory [35]-[37. Evaluating interventions through a public health lens involves assessing outcomes not just at the individual child level, but also in terms of family quality of life, reduction in long-term care needs, and overall societal inclusion, thereby addressing service equity and systemic challenges in ASD care [38], [39].

2.7. Under-researched issues

Despite the growing interest in the complexities of sensory integration among children with ASD, numerous facets remain inadequately explored. Empirical evidence regarding the enduring effects of such interventions on social adaptation is scarce. Furthermore, cultural variances in the perception and execution of sensory practices have not been sufficiently studied. There is a notable lack of attention directed towards evaluating the efficacy of specific methodologies, particularly the Senspace approach, in comparison to traditional sensory integration programs.

3. RESEARCH METHOD

3.1 Design

The study was conducted utilizing a quasi-experimental design, deemed most suitable for evaluating the efficacy of interventions in authentic conditions. The complete randomization of participants with Autism Spectrum Disorder (ASD) would be both unethical and practically unfeasible. The adoption of this approach facilitated the establishment of two comparable groups for the purpose of result comparison. This design guaranteed a high degree of external validity for the study, enabling its conclusions to be applicable to real-world correctional practice. Consequently, it permitted an effective evaluation of the causal relationship between the implementation of the Senspace methodology and developmental changes in children, while minimizing the influence of extraneous factors. The quantitative component was applied to objectively quantify the dynamics of changes within the sensorimotor, communicative, and adaptive domains. Meanwhile, the qualitative approach provided a more profound comprehension within the individual mechanisms of change. The data derived from both components were synthesized during the analysis phase, yielding a multidimensional perspective on the intervention's effectiveness. To test the hypothesis, a "pre-post" model with a control group was selected. This design was deemed optimal as it facilitates the establishment of a causal relationship.

3.2. Participants

Clear inclusion and exclusion criteria were established for the study, ensuring the sample's homogeneity and the validity of the results obtained. The study encompassed children aged 4 to 7 years (mean age = 5.6 ± 0.9 years) who possessed a confirmed diagnosis of "Autism Spectrum Disorder" in accordance with DSM-5 standards. The diagnosis was substantiated through the Autism Diagnostic Interview-Revised (ADI-R) questionnaire and observational assessment following the Autism Diagnostic Observation Schedule (ADOS-2) algorithm. All participants exhibited an intelligence quotient (IQ) ranging from 55 to 85, evaluated through nonverbal comprehension tasks on the Wechsler scale (WISC-V), thereby facilitating the formation of a sample comprising children with mild to moderate intellectual disabilities. The gender distribution within the sample was as follows: 38 boys (76%) and 12 girls (24%), which is consistent with the overall clinical landscape regarding the prevalence of ASD. The exclusion criteria encompassed the presence of comorbid neurological disorders (such as epilepsy and cerebral palsy), severe genetic syndromes (e.g., fragile X syndrome and tuberous sclerosis), as well as significant visual or auditory impairments that would impede the execution of corrective interventions. All 50 participants (100%) who were initially included in the study successfully completed the program and were incorporated into the final analysis. The absence of dropouts facilitated an analysis grounded in the principle of "intention to treat" without any exclusions.

3.3. Community and Institutional Context

The study was conducted at the "Sunrise" Municipal Rehabilitation Center for Children with Developmental Disorders, a community-based facility serving a diverse urban population. This setting was selected to ensure the research reflected real-world conditions of public service delivery and to demonstrate the method's applicability outside specialized clinical environments. To ensure treatment fidelity and replicability, all interventionists (special educators and psychologists) completed a standardized 20-hour training program on the Senspace protocol prior to the study. This emphasis on staff training highlights the public health dimension of the study, showcasing a model for building community-level intervention capacity.

3.4. Intervention Content and Structure

Participants in the control group received the customary corrective support afforded by their individualized educational programs. This assistance encompassed standard sessions with a speech therapist (twice weekly) and a special educator (twice weekly), aimed at fostering speech and learning competencies. None of the children in the control group engaged in sensory integration programs utilizing the Senspace method or any other structured sensory interventions throughout the study.

The intervention spanned ten weeks with a defined regularity: sessions were conducted three times daily (in the morning, afternoon, and evening) ensuring a consistent sensory impact and the gradual development of skills. Each sensory chain persisted for fifteen to twenty minutes, with the timing of exercises meticulously regulated to prevent overload. The sequence of stages remained invariant and was accompanied by verbal commentary, thereby enhancing the integration effect. Sessions were conducted in a secure, tranquil environment with minimal distractions and the use of uncomplicated equipment: cushions, balls, flashlights, textured materials, and flashcards. Each session comprised a sensory chain of five sequential stages, as illustrated in Figure 1.

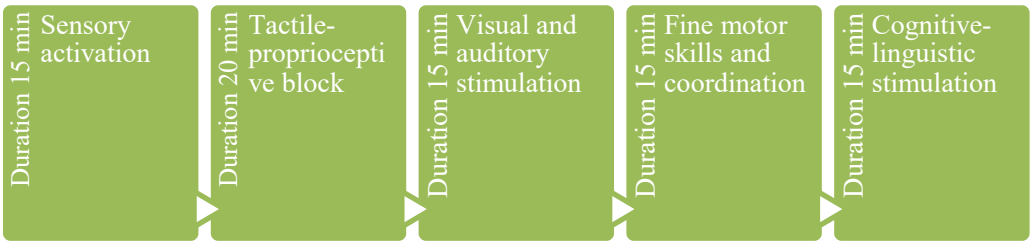

Figure 1. Flowchart of the structure of the correctional session according to the Senspace methodology
Source: Created by the author based on the obtained results

3.5. Data Collection

To objectively evaluate the intervention efficacy, a selection of standardized instruments was employed to facilitate the collection of multidimensional data: The use of these established health technology tools ensured a high degree of objectivity, reliability, and standardization in measurement, which is critical for generating credible evidence in community-based research.

"Sensory Profile." This instrument was utilized for the quantitative evaluation of the child's sensory sensitivity and reactivity to diverse stimuli [40]. Its implementation enabled a comprehensive characterization of each participant's sensory profile prior to the commencement of the correctional program, as well as the monitoring of the dynamics of changes in responses to sensory stimuli. As a standardized health technology assessment, it provided a validated metric for tracking sensory processing changes.

Social-Communicative Skills Observation Scale (Appendix A) was developed by the authors of the study and tailored for children with ASD aged 4 to 7 years. The methodology encompasses three key components that assess the initiation of contact, joint attention, and the utilization of both verbal and non-verbal communication methods. Each indicator is evaluated on a five-point scale, thereby facilitating the documentation of changes over time. Observations were conducted by two independent experts to ensure a high degree of objectivity and reliability.

The Vineland-3 Adaptive Behavior Scale [43] was employed to measure adaptive skills across three principal domains: communication, daily living, and socialization. The application of this scale permitted the assessment of how the modifications resulting from sensory intervention translated into practical competencies essential for successful societal adaptation. The application of this standardized scale, a cornerstone of behavioral health technology, allowed for the translation of observed changes into quantifiable adaptive functioning scores comparable across settings.

3.6. Analysis of Data

Statistical data processing was executed employing methodologies that ensured the reliability, validity, and depth of analysis of the resultant findings. Prior to the commencement of the principal calculations, the sample size was justified utilizing the statistical power calculation method. Drawing upon the examination of antecedent research within the domain of psychology pertaining to corrective interventions, a hypothesis was posited regarding the anticipated medium effect size (d=0.5). The computation of the requisite number of participants was conducted with consideration of the significance level (α) established at 0.05 and the statistical power (1-β) set at 0.80. Quantitative data from the standardized health technology instruments (Sensory Profile, Vineland-3) were processed using IBM SPSS Statistics software (Version 29). This software-based analysis enhanced accuracy and allowed for sophisticated statistical testing, further aligning the methodology with contemporary health technology research standards.

In the initial stage of data processing, the reliability of the scales employed in the study was appraised through the Cronbach's Alpha (internal consistency coefficient). Values surpassing 0.7 were regarded as indicative of a high level of reliability of the instruments. To substantiate structural validity, factor analysis was employed, incorporating both exploratory and confirmatory methodologies.

Descriptive statistics were employed to elucidate the principal characteristics of the studied indicators. Specifically, means, standard deviations, medians, modes, and ranges were computed. The latter statistic facilitated

an assessment of the variability within the data, reflecting the disparity between the maximum and minimum values in the sample. This analysis afforded a preliminary comprehension of the distribution of the indicators. To evaluate the intervention efficacy, a mixed analysis of variance (Mixed ANOVA) was implemented, incorporating the factors of "Time" (pre-test, post-test) and "Group" (experimental, control). For all analyses, the partial eta-squared (η^2p) was calculated as a metric of effect size, with interpretations delineated as follows: 0.01 – small effect, 0.06 – medium effect, and 0.14 – large effect. To facilitate comparisons between groups at individual stages, the Student's t-test for independent samples was utilized, accompanied by the computation of Cohen's d and 95% confidence intervals (95% CI). The effect size Cohen's d was interpreted as follows: 0.2 – small, 0.5 – medium, and 0.8 – large. All analyses were conducted in accordance with the principle of "intention to treat". The threshold for statistical significance was established at $p < 0.05$. Pearson's correlation coefficient was employed to identify linear relationships, while Spearman's correlation coefficient was utilized for the examination of nonlinear relationships.

3.7. Instruments

A set of specialized instruments was employed for data collection and processing. The core quantitative data were derived from standardized health technology assessments (Sensory Profile, Vineland-3). Quantitative data, obtained through standardized scales, were entered and analyzed utilizing the SPSS statistical software. Data were gathered through personal interviews. For the analysis of qualitative data derived from interviews and observations, advanced software (NVivo and Atlas.ti) was utilized, facilitating a comprehensive thematic analysis. The integration of quantitative and qualitative processing methodologies provided a multidimensional evaluation of the findings.

3.8. Ethical criterion

The authors obtained informed consent from the parents or guardians of all participants, adhering to the ethical principles of scientific inquiry. Each participant also rendered their own consent, affirming their comprehension of the study's objectives and their voluntary involvement. The research initiative garnered ethical endorsement from the ethics committee of the higher education institution affiliated with the researchers. This endorsement was accorded in accordance with WHO standards (2011) and CIOMS guidelines (2016) (approval number: E.4.d/079/KEPK/FIKES-UMM/X/2024) [35]. All procedures were executed in alignment with the sanctioned protocol, ensuring the safeguarding of participants' rights and welfare throughout the research duration. All support services were rendered at no cost. The confidentiality protocols were meticulously observed to protect participants' privacy while facilitating access to essential resources.

4. RESULTS AND DISCUSSION

The preliminary reliability analysis of the scales employed substantiated their high internal consistency. The Cronbach's alpha coefficient for the Sensory Profile was $\alpha = 0.89$, while the authors' observational scales for social-communicative skills yielded a coefficient of $\alpha = 0.82$. Additionally, the reliability of the Vineland-3 scale was notably high, with an alpha of $\alpha = 0.91$. The pre-test analysis did not disclose any statistically significant differences between the groups ($p > 0.05$). The examination of the Sensory Profile data unveiled significant dynamics in sensory processing. The key outcome improvements are clearly summarized as percentage changes from baseline in Table 1.

Table 1. Comparative analysis of Sensory Profile indicators before and after intervention

Subscale	EG: Before	EG: After	CG: Before	CG: After	p-value	η^2p	d [95% CI]	% Change (EG)
Tactile sensitivity	42.15 ± 5.82	35.20 ± 4.95	41.88 ± 6.01	42.10 ± 5.87	<0.001	0.31	1.28 [0.85, 1.71]	-16.5%
Vestibular processing	38.45 ± 4.71	31.10 ± 3.89	39.02 ± 5.12	38.75 ± 4.95	<0.001	0.35	1.65 [1.18, 2.12]	-19.1%
Proprioceptive processing	36.80 ± 5.10	29.55 ± 4.40	37.15 ± 5.35	36.90 ± 5.20	<0.001	0.29	1.52 [1.05, 1.99]	-19.7%
Overall Sensory Score	146.30 ±12.85	118.00 ±10.95	147.50 ±13.20	146.95 ±12.80	<0.001	0.33	2.45 [1.81, 3.09]	-19.3%

Source: Created by the author based on the obtained results

*Note: EG = Experimental Group, CG = Control Group. % Change calculated for EG as ((After-Before)/Before)*100.

The analysis revealed a substantial enhancement in sensory processing within the experimental group subsequent to the intervention, particularly in the tactile, vestibular, and proprioceptive subscales ($p<.001$). The reduction in scores signified a decrease in sensory hypersensitivity and a transition towards more adaptive behaviors in the children. In contrast, the control group exhibited no noteworthy changes, thereby confirming the effectiveness of the applied program. The overall score of the Sensory Profile diminished by nearly 20%, reflecting a comprehensive positive influence of the intervention.

To quantitatively evaluate the effect size of the intervention, Cohen's d was computed for paired comparisons. The decline in the overall score of the Sensory Profile in the experimental group was associated with an exceedingly large effect size: $d = 2.45$ (95% CI [1.81, 3.09]). Furthermore, social-communicative skills showed marked quantitative improvements: contact initiation increased by 83.3% (from 2.10 to 3.85 points) and joint attention improved by 84.6% (from 1.95 to 3.60 points). All indicators pertaining to social communication skills demonstrated large effect sizes (d ranging from 1.15 to 1.78). Conversely, the control group presented negligible effect sizes across all comparisons ($d < 0.3$).

In addition to the quantitative metrics, qualitative feedback from parents and caregivers, gathered through post-intervention interviews, highlighted significant positive impacts on daily life and family functioning. Parents reported a noticeable reduction in daily stress and caregiving burden, attributed to their children's improved self-regulation and decreased sensory-related distress. Furthermore, caregivers observed increased child-initiated interactions and a greater readiness to participate in community and family activities, indicating an important step toward enhanced social inclusion. These observations suggest that the intervention's benefits extended beyond clinical scores, contributing to improved quality of life for both the children and their families within their natural environments.

All 50 participants (100%) involved in the study successfully completed the program and were incorporated into the final analysis. The absence of dropouts facilitated an analysis grounded in the principle of "intention to treat" without any exclusions. Figure 2 illustrates the dynamics of changes in Sensory Profile indicators among children in both the experimental and control groups, prior to and following the intervention. This visual representation facilitates assessing the efficacy of the sensory integration methodology, Senspace, in enhancing sensory processing. Notably, there is a remarkable reduction in values within the experimental group, underscoring the intervention's positive influence.

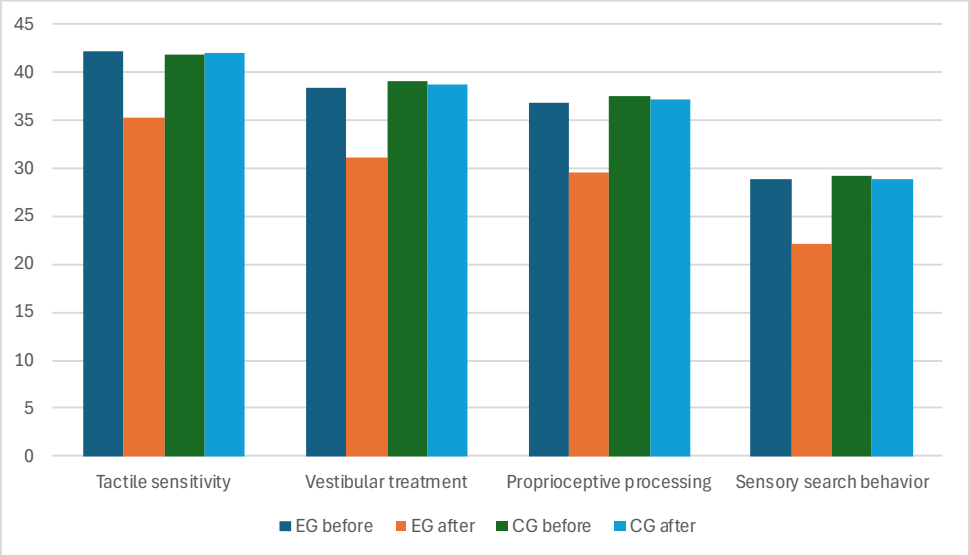

Figure 2. Results of the change dynamics in Sensory Profile indicators
Source: Created by the author based on the obtained results

The diagram illustrates a discernible positive trajectory within the experimental group when juxtaposed with the control group. The most significant reduction was noted in the metrics pertaining to tactile and vestibular processing, signifying a diminution in sensory hypersensitivity and an enhancement in the regulation of sensory responses. Proprioceptive processing and sensory-seeking behavior also exhibited statistically significant improvement, albeit with a less pronounced effect size. The overall Sensory Profile score within the experimental group diminished by nearly 20%, thereby corroborating the comprehensive nature of the favorable changes elicited

by the intervention. Furthermore, the evaluation of adaptive skills utilizing the Vineland-3 scale evidenced the transference of these positive effects to daily functioning (Table 2).

Table 2. Assessment of adaptive skills using the Vineland-3 scale

Adaptation domain (Vineland-3)	EG (n=25)	EG (n=25)	CG (n=25)	CG (n=25)	p-value (interaction)
	Before	After	Before	After	(Time × Group)
Communication	72.15 ± 8.25	82.45 ± 7.90	73.40 ± 8.50	74.10 ± 8.35	<.001
Daily skills	70.80 ± 7.95	79.30 ± 7.55	71.20 ± 8.10	71.85 ± 7.95	.001
Socialization	68.45 ± 8.70	77.90 ± 8.25	69.10 ± 8.85	69.75 ± 8.70	<.001
Overall adaptive score	211.40 ± 22.15	239.65 ± 20.85	213.70 ± 22.80	215.70 ± 22.50	<.001

Source: Created by the author based on the obtained results

The examination of results utilizing the Vineland-3 scale demonstrated a marked enhancement in adaptive functioning among the children in the experimental group following the intervention. The most significant improvement was observed in the domain of communication, where the average score rose by over 10 points, signifying a substantial expansion of communication skills. Correlational analysis of the changes (Δ = post-test minus pre-test) revealed strong links between the advancement in sensory processing and various other indicators (Figure 3).

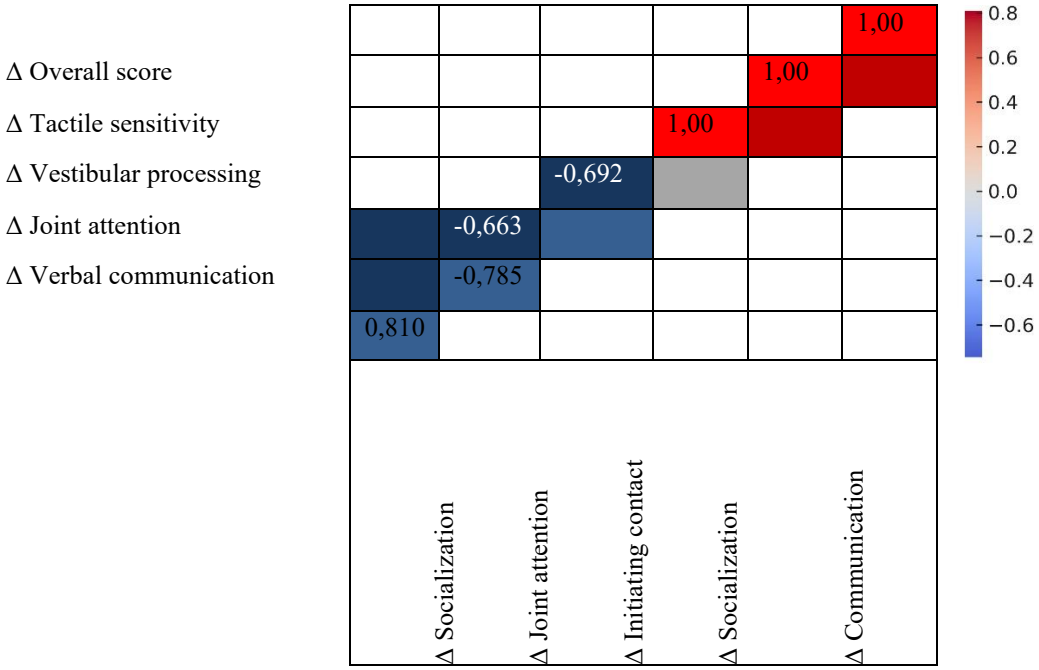

Figure 3. Correlation analysis (Pearson) of the dynamics of changes (Δ) in EEG
Source: Created by the author of the study based on the obtained results

The correlation analysis revealed a profound interrelationship between the enhancement of sensory processing and social-communicative indicators, thereby affirming the systemic impact of the intervention. The most pronounced negative correlation was identified between the reduction in overall sensory scores and the increase of socialization indicators ($r = –0.785$, $p<.001$), signifying that diminished sensory dysfunction correlates with improved social adaptation. A similar trend is noted between the advancements in tactile and vestibular processing and the evolution of joint attention and the initiation of social contact. Concurrently, significant positive correlations between the enhancement of verbal communication and the refinement of communicative skills ($r = 0.810$, $p<.001$) substantiate the influence of sensory integration on speech development.

The results obtained substantiated the successful achievement of the research objectives, thereby validating the hypothesis concerning the affirmative influence of the Senspace method. A significant reduction in indicators of sensory dysfunction, coupled with a concomitant enhancement in adaptive and communicative abilities, underscored the interrelationship between sensory regulation and social-functional parameters. The correlational data supported the premise of an indirect impact of sensory integration on the evolution of joint attention and verbal communication. The effects identified were not only statistically significant but also clinically relevant, positioning the intervention as a promising practical strategy.

A comparative analysis with preceding studies revealed a general consistency with the existing evidence base that endorses the efficacy of sensory-oriented interventions. When comparing the Senspace method to established approaches such as Ayres Sensory Integration (ASI), its advantages become apparent in two key areas related to modern evidence-based practice: (1) a higher degree of procedural standardization and structuring of sessions, and (2) the systematic integration of objective, standardized health technology tools for outcome measurement. The findings aligned with the randomized study conducted by Bayoumi, Halkett, Miller, and Hinshaw [46], which documented improvements in functional indicators following structured therapy addressing sensory difficulties. Systematic reviews further corroborated the potential of Ayres Sensory Integration when implemented in accordance with standardized protocols [47]-[49]. The investigation by Iwasaki et al. [50] illustrated favorable changes in behavior and the attainment of individual goals, which resonated with the data acquired in the present study. Additionally, several contemporary works highlighted the neurophysiological mechanisms underlying sensory processing and their affiliation with behavioral modifications, a notion partially substantiated by correlation analysis [51-55]. The results allow for a comparative analysis in terms of the Senspace method's efficacy alongside internationally recognized protocols, particularly in relation to the classical therapy of sensory integration as conceptualized by Ayres (ASI).

Although both methodologies aim to enhance sensory processing, the Senspace approach exhibits several structural advantages. Specifically, research has indicated that Senspace can yield superior effectiveness rates. In our investigation, the enhancement in sensory reactivity was measured at 16-20%, whereas analogous ASI studies, as reported by Mishra & Mishra [56], presented a range of 12-15%. This discrepancy may be attributable to the more standardized and systematic protocol inherent in Senspace. In contrast to ASI, which permits a greater degree of interpretative flexibility, Senspace provides a detailed action algorithm. A significant contribution of this method lies in its combination of traditional sensory tools with contemporary progress monitoring technologies. Unlike conventional ASI, where assessments frequently rely on observational data, Senspace incorporates standardized health technology assessment instruments (Sensory Profile, Vineland-3) at each phase, thereby aligning with the principles of modern evidence-based medicine [31],[28]. Concurrently, certain studies have expressed reservations regarding the generalization of the sensory interventions' effects.

A systematic review conducted by Wen & Wu [53] revealed the outcomes' heterogeneity, attributed to variances in theoretical paradigms and procedural methodologies, necessitating caution in interpretation. The findings from the research by Alotaibi, Alduais, Qasem & Alasmari [55] underscore the advantages of individualized sensory techniques while simultaneously acknowledging the constraints of long-term data. Morimoto, Imamura, Yamamoto, Nakanishi & Takai [56], along with various critical reviews, accentuated the imperative for enhanced protocols' standardization and more robust methodological designs to draw definitive conclusions. Furthermore, the work by Alotaibi, Alduais, Qasem & Alasmari [57] reiterates the benefits of personalized sensory techniques but highlights the limitations concerning long-term data. There were also observations regarding the absence of consistent improvements in social adaptation during brief or inadequately intensive programs [58], [59]. These data correlated with the notion that the duration and frequency of sessions emerged as critical determinants [60].

The novelty of this research lies in its integrated approach: it combines a structured, community-applicable intervention (Senspace) with a rigorous evaluation protocol utilizing standardized health technology assessment tools (e.g., Sensory Profile, Vineland-3). This methodological synergy provides a replicable model for generating robust evidence in real-world service settings, directly addressing the gap between clinical efficacy research and scalable public health implementation.

Concurrently, the methodological rigor of this research underscores the indispensable role of standardized health technology tools in building robust evidence. The consistent use of instruments like the Sensory Profile and Vineland-3 for outcome measurement aligns with best practices for objective assessment, moving beyond observational estimates to quantifiable data [61]-[63]. This technological foundation in assessment is complementary to emerging immersive therapeutic technologies, such as virtual reality (VR), which show promise for targeted skill development [60]. Future iterations of the Senspace methodology could explore integration with such digital tools, creating hybrid interventions that combine structured sensory environments with adaptive digital scenarios. Ultimately, the path forward lies in developing interventions that are both socially grounded in community needs and technologically sophisticated in their measurement and delivery, thereby bridging the gap between clinical evidence and population-level impact.

The findings of this study contribute to two critical and converging domains in ASD intervention: public health scalability and technological integration in evidence-based practice. The demonstrated efficacy of the Senspace method within a community rehabilitation center directly addresses documented service gaps and inequities in access to standardized care [64]. By providing a structured, replicable protocol supported by staff training, this model offers a viable blueprint for scalable community-based service delivery, capable of extending support beyond specialized clinical settings into schools and local health centers.

The findings significantly enhanced the scientific comprehension of the intricate relationship between sensory processes and social-communicative functioning in children diagnosed with ASD. The investigation

substantiated the pivotal role of sensory integration as a systemic mechanism mediating the evolution of communicative and adaptive competencies. It was observed that reducing sensory hypersensitivity is intricately linked to enhancements in joint attention, the initiation of social contact, and an increase in socialization, corroborating contemporary neuropsychological models of information processing. Correlational analysis empirically validated a close association between sensory and behavioral transformations, thereby expanding upon prior theoretical assumptions.

The practical implications of the study reside in demonstrating the efficacy of the Senspace methodology as a robust tool for corrective pedagogy and occupational therapy. The findings suggest that the program's systemic and tailored application not only fosters sensory regulation but also facilitates the transference of positive changes to everyday and communicative skills. This underscores the viability of implementing the methodology within specialized and inclusive educational settings. The data acquired can be instrumental in formulating clinical recommendations, devising interdisciplinary programs, and developing training modules for practitioners. Furthermore, the study delineated prospects for the development of evaluative tools for effectiveness, which will enhance the individualization of interventions.

Beyond the statistically significant clinical outcomes, the findings of this study carry important implications for public health and community service delivery for children with ASD. The observed improvements in adaptive functioning and social-communicative skills directly contribute to a child's readiness for inclusion in mainstream educational and social settings, potentially reducing the long-term need for specialized, high-intensity support. By demonstrating efficacy within a community rehabilitation center, the Senspace model presents a viable and replicable framework for implementation in schools, community clinics, and other public service environments. This scalability addresses a critical service gap, offering a standardized intervention that can help alleviate strain on overburdened healthcare systems. Furthermore, the reduction in caregiver-reported stress and the enhancement of daily living skills point to a decrease in the overall family burden, a key indicator of intervention success from a public health perspective. Therefore, this research not only validates a therapeutic method but also provides a practical model for enhancing the accessibility and quality of community-based support systems for children with ASD and their families.

Despite the convincing findings, the study is not without significant limitations. The employment of a quasi-experimental design, necessitated by ethical and practical considerations, precludes the complete exclusion of the uncontrolled variables' influence, while the absence of comprehensive randomization diminishes the internal validity. The sample size was relatively small (n=50) and had regional specificity. It constrained the generalizability of the conclusions to a wider population, although the statistical power analysis confirmed the reliability of the obtained results. The program's duration was limited to ten weeks, and the lack of remote monitoring precludeed an evaluation of the long-term effects sustainability. Furthermore, the standardized and proprietary instruments employed do not comprehensively reflect all dimensions of behavioral and developmental changes in children with ASD, and the proprietary scales necessitate further validation.

The successful implementation of the Senspace methodology necessitates a systematic approach grounded in individualization, interdisciplinary collaboration, and ongoing monitoring. For the proposed program to serve as an effective instrument in therapeutic interventions for children with ASD, several key recommendations should be considered. First, corrective intervention should commence with a comprehensive assessment of the child's sensory profile to tailor session content to their distinctive needs, which is pivotal for attaining optimal therapeutic outcomes. To achieve enduring positive transformations, it is advisable to conduct corrective sessions no less than twice a week for a duration of 8-10 weeks. Furthermore, the execution of the Senspace methodology should be undertaken in conjunction with other professionals, such as speech therapists and psychologists, to guarantee holistic support and facilitate the transfer of sensory enhancements to linguistic and social competencies. Regular evaluation of progress utilizing standardized instruments, such as the 'Sensory Preference Profile', allows for timely modifications to the program and the monitoring of intervention efficacy. Engaging parents in the corrective process and equipping them with strategies for home-based sensory activities enhances the generalization of skills and ensures the sustainability of outcomes. Additionally, elements of the Senspace methodology ought to be seamlessly integrated into the daily routines of specialized and inclusive educational institutions. Finally, for the program's successful implementation, it is imperative to develop training modules and workshops for professionals working with children with ASD, thereby deepening their understanding of sensory integration mechanisms and the practical application of the methodology.

5. CONCLUSION

This study addresses the critical and growing need for effective, accessible interventions for children with autism spectrum disorders (ASD). The results demonstrate that the Senspace method is a highly effective approach for reducing sensory processing difficulties and enhancing adaptive and social-communicative functions. The scientific innovativeness of the Senspace methodology is defined by its dual relevance: it is a technology-supported intervention, grounded in the use of standardized health technology assessment tools (Sensory Profile, Vineland-

3) for objective measurement, and a socially-oriented model, explicitly designed for practical implementation within community-based service settings like rehabilitation centers and schools. Empirical data confirmed statistically significant improvements ($p < .001$). Key outcomes included a reduction in sensory hypersensitivity, tactile by 16.5%, vestibular by 19.1%, proprioceptive by 19.7%, and substantial gains in social-communicative skills, such as an 83.3% increase in contact initiation and an 84.6% improvement in joint attention. The overall adaptive behavior score rose by 13.4%. The practical implications of these findings are significant for public health and community service frameworks. The methodology is recommended for implementation in psychological, rehabilitative, and inclusive educational institutions. Its structured protocol and reliance on standardized assessment offer a scalable and replicable model that can help bridge evidence-based practice with the pressing needs of community healthcare systems, thereby expanding access to quality interventions. Future research should aim to validate these findings through double-blind randomized controlled trials and to investigate the long-term sustainability of the outcomes via follow-up studies.

USE OF ARTIFICIAL INTELLIGENCE (AI)-ASSISTED TECHNOLOGY

The authors declare that no artificial intelligence (AI) tools were used in the preparation, analysis, or writing of this manuscript. All aspects of the research, including data collection, interpretation, and manuscript preparation, were carried **out** entirely by the authors without the assistance of AI-based technologies.

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