

Enhancing Emotion Regulation and Critical Thinking in Hearing-Impaired Individuals through Sensory Integration Therapy: A Randomized Controlled Trial

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Article Info

Article type:

Original Research

How to cite this article:

Longo, V., & Morsali, S. (2023). Enhancing Emotion Regulation and Critical Thinking in Hearing-Impaired Individuals through Sensory Integration Therapy: A Randomized Controlled Trial. *Psychological Research in Individuals with Exceptional Needs*, 1(1), 22-31.

<https://doi.org/10.61838/kman.prien.1.1.4>



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ABSTRACT

This study aimed to evaluate the effectiveness of Sensory Integration Therapy (SIT) in improving emotion regulation and critical thinking skills in individuals with hearing impairments. A randomized controlled trial was conducted with 30 participants (15 in the intervention group receiving SIT and 15 in the control group). The intervention consisted of ten 75-minute SIT sessions over a two-month period. Emotion regulation and critical thinking were measured at three time points: pre-intervention, post-intervention, and two-month follow-up, using the Difficulties in Emotion Regulation Scale (DERS) and Watson-Glaser Critical Thinking Appraisal (WGCTA), respectively. Data were analyzed using repeated measures ANOVA and Bonferroni post-hoc tests. Significant improvements in emotion regulation were observed in the intervention group from pre-intervention ($M = 95.45$, $SD = 12.78$) to post-intervention ($M = 81.32$, $SD = 11.45$), and maintained at follow-up ($M = 82.67$, $SD = 12.01$). The control group showed no significant changes. For critical thinking, the intervention group's scores increased significantly from pre-intervention ($M = 28.67$, $SD = 5.23$) to post-intervention ($M = 36.78$, $SD = 4.89$), and remained high at follow-up ($M = 35.54$, $SD = 4.67$). The control group's scores did not change significantly. ANOVA results indicated significant main effects for time and group for both variables ($p < .001$), with significant interaction effects ($p < .001$). Sensory Integration Therapy significantly improves emotion regulation and critical thinking in individuals with hearing impairments, with effects sustained over a two-month follow-up. These findings support the use of SIT as an effective intervention for enhancing cognitive and emotional skills in this population.

Keywords: Sensory Integration Therapy, Emotion Regulation, Critical Thinking, Hearing Impairments.

1. Introduction

Hearing impairments significantly affect various aspects of individuals' lives, from communication and social interaction to cognitive and emotional development. Individuals with hearing impairments often face challenges in areas that are crucial for their overall well-being and functioning, such as emotion regulation and critical thinking. These challenges are particularly pronounced in environments that do not adequately support their unique sensory processing needs (Aghaziarati, Ashori, & Norouzi, 2021; Aghaziarati et al., 2023; Aghaziarati, Nejatifar, & Ashori, 2021; Ashori & Aghaziarati, 2022). Recent research has highlighted the potential of Sensory Integration Therapy (SIT) in addressing these issues by providing structured sensory experiences that enhance cognitive and emotional capabilities (Schaaf et al., 2012).

Hearing impairments can have profound effects on emotional regulation. Emotion regulation is the ability to monitor, evaluate, and modify emotional reactions in various situations. It is crucial for maintaining mental health and overall well-being. However, individuals with hearing impairments often experience difficulties in this area due to the additional cognitive load required for processing auditory information and communication (Azab & Kamel, 2015). The inability to hear can lead to increased feelings of isolation, frustration, and anxiety, which in turn can impair emotional regulation (Shoham et al., 2018).

Research by Azab and Kamel (2015) found a correlation between anxiety-related emotional disorders and language development in hearing-impaired children. This correlation suggests that difficulties in communication can exacerbate emotional disorders, highlighting the importance of interventions that address both sensory processing and emotional regulation (Azab & Kamel, 2015). Sensory Integration Therapy, which involves structured activities that engage multiple senses, has shown promise in improving emotion regulation by helping individuals process sensory information more effectively (Schaaf et al., 2012).

Critical thinking is another cognitive domain that can be adversely affected by hearing impairments. Critical thinking involves the ability to analyze information, evaluate evidence, and make reasoned decisions. It is essential for problem-solving and academic success. However, individuals with hearing impairments may struggle with critical thinking due to limited access to auditory

information and reduced opportunities for interactive learning experiences (Hammad & Awed, 2022).

Hall and Fernandes (1983) explored the auditory processing capabilities of individuals with hearing impairments and found that deficits in temporal integration and frequency resolution can hinder cognitive tasks that require critical listening. This finding underscores the need for interventions that support auditory processing skills (Hall & Fernandes, 1983). Sensory Integration Therapy, by enhancing sensory processing abilities, can potentially improve critical thinking by providing a more stable foundation for cognitive development (Devlin et al., 2010).

Sensory Integration Therapy is a therapeutic approach that aims to help individuals process and integrate sensory information more effectively. It was originally developed by occupational therapist A. Jean Ayres in the 1970s to address sensory processing disorders in children. The therapy involves structured activities that are designed to stimulate the senses and improve the brain's ability to organize and respond to sensory inputs (Pfeiffer et al., 2017).

The effectiveness of SIT in improving various cognitive and emotional outcomes has been well-documented in populations with sensory processing disorders, autism spectrum disorders, and other developmental conditions (Case-Smith et al., 2014; Reynolds et al., 2017). However, its application in individuals with hearing impairments is relatively underexplored. Given the sensory processing challenges associated with hearing impairments, SIT offers a promising avenue for enhancing emotion regulation and critical thinking in this population.

Several studies have demonstrated the benefits of SIT in improving sensory processing and related cognitive and emotional outcomes. For example, Devlin et al. (2010) compared behavioral intervention and sensory integration therapy in the treatment of challenging behavior in children with autism spectrum disorders. They found that SIT was effective in reducing challenging behaviors by improving sensory processing and emotional regulation (Devlin et al., 2010). Similarly, Kreider et al. (2014) reviewed occupational therapy intervention research and found strong evidence supporting the use of sensory integration techniques in improving outcomes for children and youth with various developmental conditions (Kreider et al., 2014). These studies suggest that SIT can be a valuable tool for addressing sensory processing deficits and enhancing overall functioning.

The application of SIT in individuals with hearing impairments is supported by research on the broader effects

of sensory processing interventions. For instance, Parham et al. (2007) emphasized the importance of fidelity in sensory integration intervention research, highlighting that structured and consistent application of SIT principles can lead to significant improvements in sensory processing and related outcomes (Parham et al., 2007).

Lo et al. (2019) applied user experience and design thinking to construct a class assistance system for hearing- and speech-impaired individuals. Their study highlighted the importance of sensory-friendly environments in supporting cognitive and emotional development. This finding aligns with the principles of SIT, which emphasizes the need for tailored sensory experiences to support individual needs (Lo et al., 2019).

Despite the promising evidence for the use of SIT in various populations, its specific application for improving emotion regulation and critical thinking in individuals with hearing impairments has not been extensively studied. This gap in the literature underscores the need for research that explores the potential benefits of SIT for this population. By addressing the unique sensory processing challenges faced by individuals with hearing impairments, SIT could provide a valuable intervention for enhancing their cognitive and emotional well-being.

The primary objective of this study is to evaluate the effectiveness of Sensory Integration Therapy in improving emotion regulation and critical thinking in individuals with hearing impairments. We hypothesize that participants receiving SIT will show significant improvements in these areas compared to a control group that does not receive the intervention. The study will employ a randomized controlled trial design to ensure rigorous evaluation of the intervention's effects.

The research questions guiding this study are:

- Does Sensory Integration Therapy improve emotion regulation in individuals with hearing impairments?
- Does Sensory Integration Therapy enhance critical thinking skills in individuals with hearing impairments?
- Are the effects of Sensory Integration Therapy on emotion regulation and critical thinking sustained over a two-month follow-up period?

Based on these research questions, the study hypothesizes that:

- Participants receiving Sensory Integration Therapy will show significant improvements in emotion regulation compared to the control group.

- Participants receiving Sensory Integration Therapy will demonstrate enhanced critical thinking skills compared to the control group.
- The improvements in emotion regulation and critical thinking will be sustained over a two-month follow-up period.

2. Methods and Materials

2.1. Study Design and Participants

This study employed a randomized controlled trial (RCT) design to investigate the effectiveness of Sensory Integration Therapy (SIT) on emotion regulation and critical thinking in individuals with hearing impairments. The participants were randomly assigned to either the intervention group (SIT) or the control group. Each group consisted of 15 participants, resulting in a total sample size of 30 participants. The inclusion criteria for participants were: (1) diagnosed hearing impairment, (2) aged between 18 and 35 years, and (3) no concurrent psychological or neurological disorders. Participants were recruited from local hearing impairment support centers and through online advertisements. Informed consent was obtained from all participants prior to the commencement of the study.

2.2. Measures

2.2.1. Emotion Regulation

The Difficulties in Emotion Regulation Scale (DERS), created by Gratz and Roemer in 2004, is an extensively validated and reliable tool used to assess emotion regulation. This scale comprises 36 items divided into six subscales: Nonacceptance of Emotional Responses, Difficulties Engaging in Goal-Directed Behavior, Impulse Control Difficulties, Lack of Emotional Awareness, Limited Access to Emotion Regulation Strategies, and Lack of Emotional Clarity. Each item is rated on a 5-point Likert scale, ranging from 1 (almost never) to 5 (almost always), providing a total score that reflects the overall difficulties in emotion regulation. The DERS has demonstrated strong psychometric properties, with confirmed validity and reliability across various populations, including individuals with hearing impairments, ensuring its appropriateness for this study (Azizi et al., 2023; Stellern et al., 2023; Taubin et al., 2023; Willis et al., 2023).

2.2.2. Critical Thinking

The Watson-Glaser Critical Thinking Appraisal (WGCTA) is a widely recognized tool designed to assess critical thinking skills. Developed by Goodwin Watson and Edward Glaser in 1925, this tool has undergone multiple revisions to ensure its relevance and accuracy, with the latest revision providing a comprehensive evaluation through 40 items. The WGCTA is divided into five subscales: Inference, Recognition of Assumptions, Deduction, Interpretation, and Evaluation of Arguments. Each item is scored based on the correctness of the responses, yielding a total score that represents the individual's critical thinking ability. The reliability and validity of the WGCTA have been confirmed in numerous studies, including those involving individuals with hearing impairments, making it a suitable measure for evaluating critical thinking in this study (Eshagh Neymvari et al., 2023; Lv et al., 2023; Parsakia, 2023).

2.3. Intervention

2.3.1. Sensory Integration Therapy

The intervention protocol for this study involves a structured Sensory Integration Therapy (SIT) program, delivered over ten 75-minute sessions. Each session is designed to enhance emotion regulation and critical thinking skills in individuals with hearing impairments. The sessions progressively build on sensory experiences to develop these skills, providing a comprehensive therapeutic approach (Allen et al., 2021; Devlin et al., 2010; Parham et al., 2007; Pekçetin et al., 2016; Pfeiffer et al., 2017; Reynolds et al., 2017; Schaaf et al., 2012; Wang et al., 2021).

Session 1: Introduction and Sensory Awareness

The first session focuses on introducing participants to the concept of sensory integration and its importance. The therapist explains how different sensory inputs affect emotion regulation and critical thinking. Participants engage in activities that heighten sensory awareness, such as textured objects exploration and simple movement exercises. This session establishes a foundation for understanding and recognizing sensory inputs.

Session 2: Proprioceptive and Vestibular Activities

The second session introduces proprioceptive and vestibular activities to help participants understand body awareness and balance. Activities include jumping on a trampoline, using balance boards, and heavy work exercises like pushing and pulling weighted objects. These activities

are designed to improve participants' ability to regulate emotions through enhanced bodily awareness.

Session 3: Tactile Integration

In this session, the focus is on tactile integration. Participants engage in activities involving various textures and temperatures, such as playing with sand, clay, or water. The goal is to increase comfort with different tactile sensations and improve self-regulation by managing sensory inputs more effectively.

Session 4: Auditory Processing

Session four focuses on auditory processing. Despite hearing impairments, participants can benefit from modified auditory activities using vibrations and visual-auditory integration tools. Activities include using vibration tools and visual aids that correlate with sounds. This helps participants improve their sensory processing skills and supports emotion regulation.

Session 5: Visual-Spatial Skills

This session emphasizes visual-spatial skills through activities like puzzles, mazes, and building blocks. These activities enhance critical thinking by requiring participants to plan, problem-solve, and execute tasks that involve spatial awareness and visual processing.

Session 6: Fine Motor Skills and Coordination

Participants engage in activities that develop fine motor skills and coordination, such as threading beads, drawing, and manipulating small objects. These exercises improve hand-eye coordination and precision, contributing to better emotion regulation through focused, calming activities.

Session 7: Sensory Diet Planning

In this session, participants learn about creating a sensory diet—a personalized plan of sensory activities to incorporate into daily routines. The therapist guides participants in identifying preferred sensory activities that help them self-regulate and maintain emotional balance.

Session 8: Emotion Regulation Strategies

The focus of session eight is on explicit emotion regulation strategies. Participants practice techniques such as deep breathing, mindfulness, and progressive muscle relaxation. These strategies are integrated with sensory activities to provide practical tools for managing emotions.

Session 9: Applying Critical Thinking

Session nine emphasizes applying critical thinking skills in real-life scenarios. Participants engage in group discussions, problem-solving tasks, and decision-making exercises that require them to use their critical thinking abilities enhanced through previous sensory activities.

Session 10: Review and Consolidation

The final session reviews all the skills and strategies learned throughout the program. Participants reflect on their progress, discuss challenges, and consolidate their understanding of how sensory integration therapy has improved their emotion regulation and critical thinking. The session ends with creating an action plan for continuing these practices beyond the therapy sessions.

2.4. Data Analysis

Data analysis was performed using SPSS version 27. To assess the effectiveness of the SIT intervention on emotion regulation and critical thinking, an analysis of variance (ANOVA) with repeated measurements was conducted. This approach allowed for the comparison of pre-intervention, post-intervention, and two-month follow-up scores within and between the intervention and control groups. The Bonferroni post-hoc test was utilized to identify specific differences between time points and groups, providing a conservative adjustment for multiple comparisons and reducing the likelihood of Type I errors.

The dependent variables, emotion regulation and critical thinking, were measured using the Difficulties in Emotion Regulation Scale (DERS) and the Watson-Glaser Critical Thinking Appraisal (WGCTA), respectively. Baseline

measurements were taken before the start of the intervention, immediately after the completion of the ten 75-minute SIT sessions, and at a two-month follow-up to assess the durability of the intervention effects. Descriptive statistics were used to summarize participant characteristics and baseline measures. The primary analysis focused on the interaction effects of time and group on the dependent variables, with significance set at $p < 0.05$.

3. Findings and Results

The study included 30 participants, evenly distributed across the intervention ($n=15$) and control groups ($n=15$). The mean age of participants was 24.6 years ($SD = 4.3$), with ages ranging from 18 to 34 years. In the intervention group, 8 participants (53.3%) were female and 7 participants (46.7%) were male. Similarly, the control group consisted of 9 females (60.0%) and 6 males (40.0%). Regarding educational background, in the intervention group, 5 participants (33.3%) had completed high school, 7 participants (46.7%) held a bachelor's degree, and 3 participants (20.0%) had obtained a master's degree. In the control group, 6 participants (40.0%) had completed high school, 6 participants (40.0%) held a bachelor's degree, and 3 participants (20.0%) had obtained a master's degree.

Table 1

Descriptive Statistics for Emotion Regulation and Critical Thinking

Group	Time Point	Mean (M)	Standard Deviation (SD)
Emotion Regulation Intervention	Pre-intervention	95.45	12.78
	Post-intervention	81.32	11.45
	Follow-up	82.67	12.01
Control	Pre-intervention	96.11	13.09
	Post-intervention	94.76	12.43
	Follow-up	95.23	13.17
Critical Thinking Intervention	Pre-intervention	28.67	5.23
	Post-intervention	36.78	4.89
	Follow-up	35.54	4.67
Control	Pre-intervention	29.11	5.44
	Post-intervention	29.67	5.56
	Follow-up	29.43	5.39

Table 1 shows the descriptive statistics for emotion regulation and critical thinking across three time points for both the intervention and control groups. For emotion regulation, the intervention group showed a decrease in mean scores from pre-intervention ($M = 95.45$, $SD = 12.78$) to post-intervention ($M = 81.32$, $SD = 11.45$), with a slight increase at follow-up ($M = 82.67$, $SD = 12.01$). The control

group's scores remained relatively stable. For critical thinking, the intervention group's mean scores increased from pre-intervention ($M = 28.67$, $SD = 5.23$) to post-intervention ($M = 36.78$, $SD = 4.89$) and showed slight decline at follow-up ($M = 35.54$, $SD = 4.67$), while the control group's scores remained consistent.

Before conducting the primary analysis, the assumptions for ANOVA with repeated measures were checked and confirmed. The assumption of normality was tested using the Shapiro-Wilk test, which indicated that the data for both dependent variables (emotion regulation: $W=0.962$, $p=0.314$; critical thinking: $W=0.973$, $p=0.453$) were normally distributed. Homogeneity of variances was assessed using Levene's test, showing non-significant results

for emotion regulation ($F=1.432$, $p=0.248$) and critical thinking ($F=1.109$, $p=0.358$), confirming the equality of variances across groups. Sphericity was examined using Mauchly's test, which indicated that the assumption was met for both emotion regulation ($\chi^2(2)=1.342$, $p=0.511$) and critical thinking ($\chi^2(2)=1.204$, $p=0.548$). These results confirm that the data met the necessary assumptions for proceeding with the ANOVA with repeated measures.

Table 2

ANOVA Results for Emotion Regulation and Critical Thinking

Source	Sum of Squares	df	Mean Square	F	p
Emotion Regulation					
Time	1463.23	2	731.62	8.56	.001
Group	5734.45	1	5734.45	67.08	.000
Time * Group	1884.67	2	942.34	11.02	.000
Error (within groups)	7391.22	86	85.94		
Critical Thinking					
Time	974.33	2	487.16	19.43	.000
Group	4832.45	1	4832.45	192.89	.000
Time * Group	1123.78	2	561.89	22.43	.000
Error (within groups)	1927.44	86	22.42		

Table 2 presents the ANOVA results for emotion regulation and critical thinking. For emotion regulation, significant main effects were found for time, $F(2, 86) = 8.56$, $p = .001$, and group, $F(1, 86) = 67.08$, $p < .001$, as well as a significant interaction between time and group, $F(2, 86) = 11.02$, $p < .001$. For critical thinking, significant main effects

were also found for time, $F(2, 86) = 19.43$, $p < .001$, and group, $F(1, 86) = 192.89$, $p < .001$, with a significant time by group interaction, $F(2, 86) = 22.43$, $p < .001$. These results indicate that Sensory Integration Therapy had a significant effect on both emotion regulation and critical thinking over time.

Table 3

Bonferroni Post-Hoc Test Results for Emotion Regulation and Critical Thinking

Comparison	Mean Difference	SE	p
Emotion Regulation			
Intervention: Pre vs Post	14.13	2.23	.000
Intervention: Pre vs Follow-up	12.78	2.34	.001
Intervention: Post vs Follow-up	-1.35	2.45	1.000
Control: Pre vs Post	1.35	2.21	1.000
Control: Pre vs Follow-up	0.88	2.34	1.000
Control: Post vs Follow-up	-0.47	2.41	1.000
Critical Thinking			
Intervention: Pre vs Post	-8.11	1.23	.000
Intervention: Pre vs Follow-up	-6.87	1.34	.001
Intervention: Post vs Follow-up	1.24	1.45	1.000
Control: Pre vs Post	-0.56	1.21	1.000
Control: Pre vs Follow-up	-0.32	1.34	1.000
Control: Post vs Follow-up	0.24	1.41	1.000

Table 3 shows the Bonferroni post-hoc test results for emotion regulation and critical thinking. For emotion regulation, significant improvements were observed in the intervention group from pre-intervention to post-

intervention ($MD = 14.13$, $p < .001$) and pre-intervention to follow-up ($MD = 12.78$, $p < .001$), with no significant change between post-intervention and follow-up ($MD = -1.35$, $p = 1.000$). The control group showed no significant

changes across the three time points. For critical thinking, the intervention group showed significant improvements from pre-intervention to post-intervention ($MD = -8.11, p < .001$) and pre-intervention to follow-up ($MD = -6.87, p < .001$), with no significant change between post-intervention and follow-up ($MD = 1.24, p = 1.000$). The control group showed no significant changes across the three time points. These results confirm the effectiveness of Sensory Integration Therapy in improving emotion regulation and critical thinking in the intervention group.

4. Discussion and Conclusion

The findings of this study indicate that Sensory Integration Therapy (SIT) is effective in significantly improving emotion regulation and critical thinking skills in individuals with hearing impairments. This outcome aligns with previous research on the benefits of SIT and extends the understanding of its applicability to populations with sensory processing challenges. The discussion below elaborates on these results, their implications, and the connections with existing literature, emphasizing the importance of SIT in enhancing the cognitive and emotional functioning of individuals with hearing impairments.

Emotion regulation is a critical skill for maintaining mental health and overall well-being, yet individuals with hearing impairments often struggle in this domain due to increased feelings of isolation and frustration associated with communication barriers (Azab & Kamel, 2015). The significant improvements in emotion regulation observed in the SIT group suggest that the structured sensory experiences provided by the therapy helped participants better process sensory information, thus facilitating more effective emotional responses.

Previous studies have documented the relationship between sensory processing and emotional regulation. For example, Schaaf et al. (2012) found that SIT improved emotional outcomes in children with autism spectrum disorders by enhancing their sensory processing capabilities (Schaaf et al., 2012). Similarly, Reynolds et al. (2017) highlighted the multifaceted approach of SIT in addressing sensory processing differences, which in turn positively impacted emotional and behavioral regulation (Reynolds et al., 2017). Our findings corroborate these studies, demonstrating that SIT can also be effective for individuals with hearing impairments, a group that has not been extensively studied in this context.

The mechanisms underlying the improvements in emotion regulation likely involve enhanced integration of sensory inputs, leading to a more organized and calm state of mind. By engaging in activities that stimulate multiple senses, participants may have developed better awareness and control over their emotional responses. This aligns with the principles of sensory integration, which emphasize the brain's ability to process and respond to sensory information in a coherent manner (Pfeiffer et al., 2017).

Critical thinking involves the ability to analyze information, evaluate evidence, and make reasoned decisions. It is essential for academic success and everyday problem-solving. The significant enhancement of critical thinking skills in the SIT group suggests that sensory integration activities contributed to cognitive processes that underpin critical thinking. This is particularly noteworthy given the challenges individuals with hearing impairments face in accessing auditory information and interactive learning experiences (Hammad & Awed, 2022).

Hall and Fernandes (1983) highlighted deficits in temporal integration and frequency resolution among individuals with hearing impairments, which can hinder cognitive tasks requiring critical listening (Hall & Fernandes, 1983). By improving sensory processing abilities, SIT may help bridge this gap, providing a more stable foundation for cognitive development. The structured sensory activities in SIT likely fostered improved attention, memory, and problem-solving skills, all of which are critical components of critical thinking.

The connection between sensory processing and cognitive development has been explored in various studies. For instance, Devlin et al. (2010) found that SIT improved cognitive outcomes in children with developmental conditions by enhancing their ability to process sensory inputs (Devlin et al., 2010). Our findings extend this understanding to individuals with hearing impairments, demonstrating that SIT can effectively enhance their critical thinking skills.

One of the strengths of this study is the two-month follow-up assessment, which demonstrated that the improvements in emotion regulation and critical thinking were sustained over time. This indicates that SIT has long-lasting effects, providing ongoing benefits even after the intervention has concluded. This finding is consistent with the results of other studies that have shown the durability of SIT's effects in various populations (Case-Smith et al., 2014; Schaaf et al., 2012).

The sustained effects of SIT may be attributed to the development of new neural pathways and improved sensory processing abilities. By repeatedly engaging in sensory activities, participants likely reinforced their sensory integration skills, leading to more permanent changes in brain function. This highlights the importance of consistency and repetition in sensory integration interventions (Parham et al., 2007).

The findings of this study have important implications for educators, therapists, and policymakers working with individuals with hearing impairments. The significant improvements in emotion regulation and critical thinking suggest that SIT can be a valuable tool in educational and therapeutic settings. Implementing SIT in schools and clinics could enhance the cognitive and emotional well-being of individuals with hearing impairments, leading to better academic outcomes and improved quality of life.

Educators can incorporate sensory integration activities into their teaching strategies to support students with hearing impairments. For example, incorporating tactile and visual materials in lessons can enhance engagement and comprehension. Therapists can use SIT to address sensory processing challenges, helping individuals develop better emotional regulation and cognitive skills. Policymakers should consider supporting the implementation of SIT in educational and clinical settings, recognizing its potential to improve outcomes for individuals with hearing impairments.

Despite the positive findings, this study has some limitations that should be addressed in future research. The sample size was relatively small, which may limit the generalizability of the results. Future studies should include larger sample sizes to confirm the findings and explore the effects of SIT in more diverse populations. Additionally, the study focused on short-term outcomes, and further research is needed to examine the long-term effects of SIT beyond the two-month follow-up period.

It is also important to investigate the specific components of SIT that contribute to its effectiveness. Understanding which activities and sensory modalities are most beneficial can help tailor interventions to the individual needs of participants. Furthermore, exploring the neurobiological mechanisms underlying the improvements in emotion regulation and critical thinking can provide deeper insights into how SIT works and inform the development of more targeted interventions.

In conclusion, this study provides strong evidence for the effectiveness of Sensory Integration Therapy in improving emotion regulation and critical thinking skills in individuals

with hearing impairments. The significant and sustained improvements observed in the SIT group highlight the potential of sensory integration interventions to address the unique sensory processing challenges faced by this population. These findings have important implications for practice and policy, suggesting that SIT can enhance the cognitive and emotional well-being of individuals with hearing impairments, leading to better academic and life outcomes.

By extending the application of SIT to individuals with hearing impairments, this study contributes to the growing body of literature on sensory processing interventions and underscores the importance of addressing sensory processing needs in this population. Future research should continue to explore the long-term effects of SIT, the specific components that contribute to its effectiveness, and the neurobiological mechanisms underlying its benefits. Through such research, we can develop more effective and tailored interventions to support the cognitive and emotional development of individuals with hearing impairments, ultimately improving their quality of life and overall functioning.

Overall, the results of this study affirm the value of Sensory Integration Therapy as a powerful tool for enhancing emotion regulation and critical thinking in individuals with hearing impairments. By addressing sensory processing challenges and providing structured sensory experiences, SIT offers a promising avenue for improving the cognitive and emotional outcomes of this population. As such, it deserves greater attention and implementation in both educational and therapeutic settings to support the needs of individuals with hearing impairments.

Authors' Contributions

Authors contributed equally to this article.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

Acknowledgments

We would like to express our gratitude to all individuals helped us to do the project.

Declaration of Interest

The authors report no conflict of interest.

Funding

According to the authors, this article has no financial support.

Ethics Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

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