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THE EFFECT OF SENSORY MONTAGE OCCUPATIONAL THERAPY ON FINE MOTOR SKILLS IN CHILDREN WITH DOWN SYNDROME AT SLB AISYIYAH SINGAPARNA

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ABSTRACT

Children with Down syndrome commonly experience difficulties in fine motor skills that may affect activities requiring hand coordination, manipulation, and precision. This study aimed to determine the effect of sensory montage occupational therapy on fine motor skills in children with Down syndrome at SLB Aisyiyah Singaparna. A pre-experimental study with a one-group pretest-posttest design was conducted involving 21 children selected using total sampling. Participants received six sessions of sensory montage occupational therapy, with each session lasting 30–60 minutes. Fine motor skills were assessed using a 24-item instrument. Data were analyzed using the Shapiro-Wilk test and paired *t*-test. The mean fine motor skill score increased from 63.76 ± 9.782 before the intervention to 70.29 ± 9.100 after the intervention. Statistical analysis showed a significant difference between pretest and posttest scores ($t = -13.158$; $p < 0.001$), indicating an average improvement of 6.524 points. The findings suggest that sensory montage occupational therapy can improve fine motor skills in children with Down syndrome through structured activities involving cutting, arranging, and pasting. Sensory montage occupational therapy may therefore be considered a practical activity-based approach to support fine motor skill development in school settings.

Keywords: Down syndrome; fine motor skills; occupational therapy; sensory montage

INTRODUCTION

Down syndrome is a genetic condition associated with developmental difficulties, including limitations in fine motor skills. These difficulties may be related to hypotonia, reduced muscle strength, differences in hand structure, and limitations in hand-eye coordination, affecting activities that require precision and manipulation, such as cutting, pasting, coloring, drawing, folding, and writing (Kamil et al., 2023; Desa & Amfotis, 2022; Nurhaliza & Naziiza, 2024). Fine motor skills are essential for functional activities, learning, and independence.

Various structured interventions have been used to improve fine motor skills in children with Down syndrome. Fine motor activity programs have demonstrated positive outcomes (Lersilp et al., 2016), while occupational therapy and occupational activities have also been reported to improve fine motor development (Mundzakir, 2020; Nurfadillah et al., 2023; Arief & Sahrul, 2024; Oktary et al., 2023). Other activity-based interventions, including motor programs, computer-based activities, and puzzle therapy, have also shown potential benefits for fine motor performance (Hashemi & Arabameri, 2019; Ramdana et al., 2023; Utami, 2023).

Montage is one occupational activity that directly involves selecting, manipulating, cutting, arranging, and pasting materials. These activities require finger control, grasping, manipulation, hand-eye coordination, and precision. Previous research has shown that occupational montage therapy can improve fine motor skills in children with Down syndrome (Mundzakir, 2020). Adding a sensory component may provide further opportunities for tactile exploration while children perform purposeful fine motor activities. Sensory-play research suggests that sensory activities can support fine motor development through manipulation, movement control, and hand-eye coordination (Iswahyuni et al., 2023; Fathia et al., 2024).

Although previous studies have examined occupational therapy, montage activities, and sensory play separately, evidence regarding the integration of sensory stimulation into montage occupational therapy for children with Down syndrome remains limited. Therefore, this study aimed to determine the effect of sensory montage occupational therapy on fine motor skills in children with Down syndrome at SLB Aisyiyah Singaparna.

MATERIALS AND METHODS

This study employed a quantitative approach with a pre-experimental one-group pretest-posttest design. Fine motor skills were assessed before and after the administration of sensory montage occupational therapy. The study was conducted at SLB Aisyiyah Singaparna, Indonesia. The population consisted of 23 children with Down syndrome who were enrolled as active students at the school. A total of 21 children participated in the study and were selected using total sampling. Participants were eligible if they were active students with Down syndrome at SLB Aisyiyah Singaparna and had parental or guardian consent to participate. Children who experienced health problems during the intervention or did not complete the study were excluded.

The intervention was sensory montage occupational therapy, which was administered in six sessions over a period of approximately one month. Each session lasted 30–60 minutes. The 21 participants were divided into four groups to facilitate the implementation of the intervention. Fine motor skills were assessed before the intervention. Participants then received six sessions of sensory montage occupational therapy, followed by a post-intervention assessment.

The sensory montage occupational therapy used a prepared montage medium consisting of a user guide and eight montage themes, together with scissors and adhesive. The activities involved manipulating materials, cutting paper, and attaching materials according to predetermined patterns. The intervention was designed to provide activities involving hand and finger movements and visual-motor coordination through structured montage tasks.

Fine motor skills were measured using a 24-item observational instrument developed to assess children's fine motor abilities. The assessed activities included finger movements, squeezing paper, grasping and transferring small objects, tracing and imitating lines and shapes, writing numbers and letters, folding origami paper, coloring, holding scissors, cutting paper according to straight-line, circular, and square patterns, and attaching circular and square patterns. The instrument was tested on 15 children with Down syndrome at SLB C YKB Garut before the study. All 24 items were declared valid, with item correlation values exceeding the *r*-table value of 0.514 at $\alpha = 0.05$. The instrument demonstrated high internal consistency, with a Cronbach's alpha coefficient of 0.975 for the 24 items.

Fine motor skills were assessed before the intervention and after completion of the six sensory montage occupational therapy sessions. Data were entered and processed using Statistical Package for the Social Sciences (SPSS). Descriptive analysis was used to describe the characteristics of the participants and fine motor skills scores. The Shapiro-Wilk test was used to assess data normality because the sample size was less than 50. Normally distributed paired data were analyzed using a paired *t*-test, while the Wilcoxon test was planned for non-normally distributed data.

The Shapiro-Wilk test showed that both pre-intervention and post-intervention fine motor skills scores were normally distributed ($p = 0.912$ and $p = 0.960$, respectively). Therefore, the paired t-test was used to examine the difference in fine motor skills scores before and after the intervention. Statistical significance was determined at $p < 0.05$.

This study received ethical approval from the relevant health research ethics committee under approval number **DP.04.03/F.XVIII.20/KEPK/207/2025**, valid from 14 April 2025 to 14 April 2026. Written informed consent was obtained from the parents or guardians of the participants before data collection. Participant anonymity and confidentiality were maintained throughout the research process.

RESULTS AND DISCUSSION

Participant Characteristics

A total of 21 children with Down syndrome participated in this study. The majority of participants were male, comprising 14 participants (66.7%), while 7 participants (33.3%) were female. Based on age group, 8 participants (38.1%) were aged 6–12 years, another 8 participants (38.1%) were aged 13–18 years, and 5 participants (23.8%) were aged 19–22 years. The distribution of participant characteristics is summarized in Table 1.

Table 1 Characteristics of participants

Characteristic	n	%
Sex		
Male	14	66.7%
Female	7	33.3%
Age Group		
6-12 years	8	38.1%
13-18 years	8	38.1%
19-22 years	5	23.8%

The predominance of male participants was presented as a descriptive characteristic of the study sample and was not analyzed as a determinant of fine motor performance or treatment response. Similarly, the broad age range reflects the characteristics of participants recruited from the study setting. Differences in age may be relevant to developmental experience and opportunities for motor practice; however, age was not analyzed as a predictor of intervention response in this study.

Fine Motor Skills Before and After Sensory Montage Occupational Therapy

Descriptive analysis revealed a notable increase in fine motor skill scores following the intervention. Prior to therapy, the mean score was 63.76 ± 9.782 (range: 45–87). Following six sessions of sensory montage occupational therapy, the mean score increased to 70.29 ± 9.100 (range: 54–91), as detailed in Table 2.

Table 2 Fine motor skills scores before and after sensory montage occupational therapy (n = 21)

Measurement	Mean ± SD	Min-Max
Pre-intervention	63.76 ± 9.782	45-87
Post-intervention	70.29 ± 9.100	54–91

Note: *Scores represent the total fine motor skill score assessed using the study instrument*.

The descriptive analysis demonstrated an increase in fine motor skills following six sessions of sensory montage occupational therapy. The mean score increased by 6.53 points, from 63.76 before the intervention to 70.29 after the intervention. The score range also shifted upward, with the minimum score increasing from 45 to 54 and the maximum score increasing from 87 to 91. These findings indicate an overall improvement in observed fine motor performance following the intervention.

The improvement in the mean score should be interpreted as a change in overall fine motor performance rather than as an equal improvement across all assessed skills. The individual indicators showed different patterns of change, with the greatest increases occurring in several activities involving cutting and visual-motor coordination. This variation is important because it provides information about which specific components of fine motor performance may have been particularly responsive to the intervention.

The observed improvement is consistent with the structure of sensory montage occupational therapy, which requires participants to perform purposeful activities involving cutting, arranging, manipulating, and pasting materials. These activities provide repeated opportunities to practice controlled hand movements, manipulation, visual-motor coordination, and task completion. Motor development is influenced not only by biological maturation but also by experience and opportunities for practice (Reswari et al., 2022). Previous studies have likewise reported positive changes in fine motor performance following structured fine motor activities and occupational interventions in children with Down syndrome (Lersilp et al., 2016; Mundzakir, 2020; Nurfadillah et al., 2023; Arief & Sahrul, 2024; Oktary et al., 2023).

Indicators Showing the Greatest Improvement

Analysis of individual indicators showed that the greatest improvements occurred in cutting-related activities. Cutting a circular pattern (Q18) showed the largest increase of 13 points, followed by cutting a square pattern (Q21) with an increase of 12 points and cutting a straight-line pattern (Q20) with an increase of 11 points. Two other indicators, tracing the letters A, I, U, E, O (Q10) and imitating an X shape (Q14), each increased by 9 points. The fine motor skill indicators showing the greatest improvement are summarized in Table 3.

Table 3 Fine motor skill indicators showing the greatest improvement

Fine Motor Skill Indicator	Mean
Cutting a circular pattern (Q18)	+13
Cutting a square pattern (Q21)	+12
Cutting a straight-line pattern (Q20)	+11
Tracing the letters A, I, U, E, O (Q10)	+9
Imitating an X shape (Q14)	+9

The predominance of improvement in cutting activities is particularly relevant to the intervention because cutting was directly incorporated into the sensory montage activities. Cutting requires the child to

control finger movements, manipulate scissors, maintain hand position, and continuously coordinate visual information with hand movement. The different cutting patterns also require different levels of motor control: straight-line cutting requires maintaining a consistent direction, square cutting requires changing direction at the corners, while circular cutting requires continuous adjustment of movement direction. The improvement in cutting-related indicators may also be viewed in relation to the manipulative characteristics of montage-based activities. Similar findings were reported by Dwi Utami et al. (2021), who demonstrated improvement in fine motor skills through mosaic activities in children with Down syndrome. Mosaic and montage activities share several functional demands, particularly the manipulation, arrangement, and attachment of materials to form a structured product. These similarities suggest that activities requiring purposeful manipulation of small materials may provide repeated opportunities to practice fine motor control and visual-motor coordination.

This finding is consistent with Mundzakir (2020), who reported improvement in fine motor abilities following occupational montage therapy involving activities such as cutting, pasting, and coloring. Similar positive findings have been reported in other occupational therapy-based interventions targeting fine motor development (Nurfadillah et al., 2023; Arief & Sahrul, 2024; Oktary et al., 2023). The present findings extend these observations by showing that the improvement was particularly apparent in specific skills that closely corresponded to the motor demands repeatedly practiced during sensory montage activities.

The improvement in tracing letters and imitating an X shape, although smaller than that observed for cutting activities, is also noteworthy. Both tasks require the child to translate a visually presented form into controlled hand movements. This suggests that the intervention may have influenced not only directly practiced manipulation skills but also other fine motor tasks involving visual-motor integration. Thus, the pattern of item-level changes provides a more specific understanding of the overall increase in fine motor scores and forms an important basis for interpreting the specificity of the intervention.

Effect of Sensory Montage Occupational Therapy on Fine Motor Skills

Normality testing using the Shapiro-Wilk test demonstrated that both pre-intervention and post-intervention scores were normally distributed ($p = 0.912$ and $p = 0.960$, respectively). Since both p-values exceeded 0.05, a paired t-test was conducted to analyze the differences between pre- and post-intervention scores. The results are presented in Table 4.

Table 4 Paired t-test of fine motor skills before and after sensory montage occupational therapy (n = 21)

Comparison	Mean Difference	SD Difference	95% CI	t	df	p-value
Pre-Post intervention	-6.524	2.272	−7.558 to −5.490	-13.158	20	<0.001

The paired *t*-test demonstrated a statistically significant difference in fine motor skill scores between the pre-intervention and post-intervention assessments, with a mean improvement of 6.524 points (95% CI: 5.490–7.558; $p < 0.001$). The positive mean change indicates that the increase observed after the intervention was unlikely to be attributable to random variation alone. The confidence interval further indicates that the estimated improvement remained consistently positive across the study sample. The finding can be understood in relation to the structured and repetitive nature of sensory montage occupational therapy. Participants performed purposeful activities involving cutting, arranging, manipulating, and pasting materials. These activities require coordinated use of the fingers and hands, visual guidance, manipulation, precision, and sustained attention. Repeated opportunities to perform these components within a meaningful activity may facilitate practice and refinement of fine motor performance. Reswari et al. (2022) emphasized that motor development is influenced not only by biological maturation but also by experience and opportunities for practice.

The statistical finding provides quantitative support for the descriptive improvement observed after six intervention sessions. However, the result should be interpreted as an overall change in fine motor performance rather than evidence that every component of the assessed skills improved equally. The item-level findings demonstrated variation in the magnitude of improvement across indicators, suggesting that the response to the intervention may depend on the specific motor demands practiced during the activity. This distinction is important when interpreting the effectiveness of a multidimensional activity such as sensory montage occupational therapy.

Interpretation and Practical Implications of Sensory Montage Occupational Therapy

The findings can be interpreted in terms of the activity-specific nature of the intervention. Sensory montage occupational therapy combines purposeful manipulation with a defined sequence of tasks, allowing children to repeatedly practice motor actions within a meaningful activity. The improvement pattern observed in this study suggests that the intervention may be particularly relevant for skills that are directly practiced during the sessions. This interpretation is consistent with the principle that motor development is influenced

not only by biological maturation but also by experience and opportunities for practice (Reswari et al., 2022). Rather than indicating a generalized improvement in every fine motor component, the findings suggest that structured activities may provide greater opportunities for improvement in skills that closely correspond to the demands of the intervention.

The sensory component provides an additional dimension to the intervention by allowing children to interact with different material characteristics while performing purposeful activities. Previous studies on sensory play suggest that sensory-based activities can provide opportunities for manipulation and visual-motor coordination (Iswahyuni et al., 2023; Fathia et al., 2024). However, the present design does not allow the independent contribution of sensory stimulation to be determined because there was no comparison with conventional montage occupational therapy. Therefore, the sensory component should be interpreted as a complementary element of the intervention rather than as an independently established cause of improvement.

From a practical perspective, sensory montage occupational therapy may be considered for integration into school-based developmental activities for children with *Down syndrome*. The intervention uses relatively accessible materials and can be adapted according to the child's individual ability, allowing task difficulty to be modified progressively. Opportunities for motor practice are also influenced by the environment in which children perform daily activities, as supportive environments can provide affordances for motor development (Beach et al., 2021). Therefore, the intervention may be reinforced through collaboration among teachers, health professionals, and families to provide children with additional opportunities for purposeful motor practice beyond the intervention sessions.

Several limitations should nevertheless be considered. The study included only 21 participants from a single special education school and used a one-group pretest-posttest design without a control group. Therefore, maturation, repeated exposure to the assessment instrument, and other uncontrolled factors cannot be completely excluded. Practical factors such as scheduling, attendance, and the intervention environment may also have influenced implementation. Furthermore, the study could not separate the contribution of the sensory component from the montage activity itself. Future studies should therefore use larger and more diverse samples, comparison groups, and designs that allow the specific contribution of sensory stimulation to be examined.

CONCLUSION

Sensory montage occupational therapy significantly improves fine motor skills in children with Down syndrome at SLB Aisyiyah Singaparna. Following six intervention sessions, the mean fine motor score increased significantly from 63.76 ± 9.782 to 70.29 ± 9.100, with a mean difference of 6.524 points ($p < 0.001$). The most substantial gains occurred in cutting tasks and visual-motor coordination indicators, demonstrating that structured, task-specific activities provide optimal practice for motor execution. Scientifically, these findings contribute to the growing evidence of neuroplasticity and motor learning in neurodevelopmental disorders, proving that task-oriented sensory interventions can drive targeted functional gains. Practically, sensory montage therapy offers an accessible, activity-based protocol for fine motor stimulation in special education and clinical rehabilitation settings. Future studies incorporating larger sample sizes and randomized control groups are recommended to enhance causal inference and broader generalizability.

CONFLICT OF INTEREST (if any)

The authors declare that there is no conflict of interest regarding the publication of this article.

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