

The Influence of Sandpaper Letter Media on Pre-Reading Skills in Children Aged 5-6

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Abstract:

Pre-reading skills are a crucial foundation for early childhood literacy development; however, conventional teaching methods often lack multisensory engagement, which limits their effectiveness. While previous studies have acknowledged the importance of sensory experiences, a gap remains in empirical evidence that quantitatively demonstrates the impact of specific tactile media, such as Sandpaper Letters, on pre-reading abilities in children aged 5-6 within localized educational contexts. This study aims to analyze the effect of Sandpaper Letter media on the pre-reading skills of children in this age group. Using a quasi-experimental method with a pretest-posttest control group design, the research involved 30 children from a kindergarten. The experimental group received learning interventions using Sandpaper Letters, while the control group used conventional methods. Data were collected through pre-reading skill tests and analyzed using normality tests (Kolmogorov-Smirnov) and an independent t-test. The results showed a significant improvement in the experimental group's letter recognition, phonemic awareness, and simple word formation skills, with a t-count of 1.934 exceeding the t-table of 1.729. The study concludes that Sandpaper Letter media is a practical, multisensory-based tool for significantly enhancing the pre-reading skills of children aged 5-6 years, offering a valuable strategy for early childhood educators.

Keywords: Sandpaper Letter, pre-reading skills, early childhood

Abstrak:

Keterampilan pra-membaca merupakan fondasi krusial bagi perkembangan literasi anak usia dini, namun metode pengajaran konvensional seringkali kurang melibatkan multisensori, sehingga membatasi efektivitasnya. Meskipun studi-studi terdahulu telah mengakui pentingnya pengalaman sensorik, masih terdapat kesenjangan bukti empiris yang secara kuantitatif mendemonstrasikan dampak media taktil spesifik, seperti Sandpaper Letter, terhadap kemampuan pra-membaca anak usia 5-6 tahun dalam konteks pendidikan lokal. Penelitian ini bertujuan untuk menganalisis pengaruh media Sandpaper Letter terhadap keterampilan pra-membaca anak pada kelompok usia tersebut. Dengan menggunakan metode kuasi-eksperimen dengan desain *pretest-posttest control group*, penelitian melibatkan 30 anak dari satu taman kanak-kanak. Kelompok eksperimen menerima intervensi pembelajaran menggunakan Sandpaper Letter, sementara kelompok kontrol menggunakan metode konvensional. Data dikumpulkan melalui tes keterampilan pra-membaca dan dianalisis menggunakan uji normalitas (Kolmogorov-Smirnov) dan uji-t independen. Hasil

penelitian menunjukkan peningkatan yang signifikan pada kelompok eksperimen dalam hal pengenalan huruf, kesadaran fonemik, dan kemampuan menyusun kata sederhana, dengan nilai t-hitung 1,934 yang melebihi t-tabel 1,729. Studi ini menyimpulkan bahwa media Sandpaper Letter merupakan alat berbasis multisensori yang efektif untuk meningkatkan keterampilan pra-membaca anak usia 5-6 tahun secara signifikan, sehingga menawarkan strategi yang berharga bagi pendidik anak usia dini.

Kata Kunci: Sandpaper Letter, keterampilan pra-membaca, anak usia dini

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Introduction

The foundational stage of early childhood literacy is increasingly recognized as a critical period for long-term academic success (Hutton et al., 2021), yet a significant challenge persists in engaging young learners through traditional, rote-memorization methods (Schmalz et al., 2021). The conventional approach often fails to accommodate diverse learning styles, leading to disinterest and suboptimal development of pre-reading skills among children aged 5-6 (Milankov et al., 2021). This gap highlights an urgent need for pedagogical transformation towards more interactive and sensory-rich learning strategies (Cuturi et al., 2022). For instance, multisensory methods, which integrate visual, auditory, and tactile stimuli, have gained prominence as they align with how young children naturally explore and understand their world (Farina, 2021). Evidence from studies on Montessori-based tools, such as Sandpaper Letters, demonstrates that tactile and kinesthetic experiences can significantly enhance letter recognition and phonemic awareness by creating stronger neural connections (Colucci-Gray et al., 2025). Consequently, adopting innovative media like Sandpaper Letters is not merely a trend but an essential solution to revolutionize early reading instruction (BAVLI & USLU KOCABAŞ, 2022). It moves learning beyond passive reception to active, hands-on discovery, thereby fostering a more inclusive, effective, and engaging foundation for literacy (Sternberg, 2022). This research is therefore pivotal in validating and promoting such multisensory approaches, equipping educators with practical strategies for the modern classroom.

Numerous studies have established the foundational importance of multisensory approaches in early literacy development, particularly for pre-reading skills (Bowers & Ramsdell, 2023). The theoretical basis for this is strongly supported by the works of Bodrova & Leong (2024) and Gentaz & Richard (2022), who emphasize that direct, sensory-rich interactions are crucial for cognitive development and the internalization of concepts in young children. For instance, research by Gasco-Txabarri & Zuazagoitia (2023) demonstrated that the Montessori method, which incorporates tactile materials like Sandpaper Letters, effectively strengthens memory and letter recognition. This is because such methods engage multiple neural pathways simultaneously; a child not only sees the visual form of the letter 'A' but also feels its textured shape, creating a more robust and durable memory trace compared to visual or auditory input alone. Furthermore, Phutane et al. (2022) provided empirical evidence that consistent use of Sandpaper Letters cultivates emergent literacy

behaviors, significantly improving letter-phoneme association, which is a critical precursor to decoding words. However, a gap remains in the localized and contextual application of this media (Zhou & Deng, 2023). While the effectiveness of the multisensory principle is well-documented internationally, specific empirical investigations into its impact within diverse early childhood education settings, as well as direct comparisons with conventional local teaching methods, are less prevalent (Slutsky et al., 2021). Therefore, this study aims to address this gap by quantitatively analyzing the specific influence of Sandpaper Letter media on the pre-reading skills of children aged 5-6 in a targeted kindergarten, thereby contributing to a localized validation of a globally recognized pedagogical tool.

This study makes a distinct contribution to early literacy research by providing empirical, context-specific evidence for the effectiveness of Sandpaper Letter media, a tool often discussed in theory but less frequently validated through rigorous localised experimentation (Darling-Hammond et al., 2020). While the multisensory principles underpinning the media are well-established globally, a clear gap exists in data-driven studies demonstrating their practical impact within specific educational settings (Oh et al., 2022). This research directly addresses that gap through a quasi-experimental, pretest-posttest control group design, which quantitatively captured significant improvements in children's letter recognition and phonemic awareness (Edwards, 2020). Furthermore, it offers a tangible solution to the common implementation problem faced by educators by detailing a structured, replicable four-session intervention, thus bridging the theory-practice divide (Willocks, 2023). The statistically significant results ($t\text{-count} = 1.934 > t\text{-table} = 1.729$) from Vizahri Kindergarten provide compelling, localised proof of the method's efficacy, moving beyond generic recommendations to offer a validated strategy for improving pre-reading skills in a real-world classroom context (Kuby et al., 2019). Consequently, this work not only delivers findings but also a practical framework for educators, filling a critical void in applied pedagogical research for early childhood education.

This study is crucial as it addresses a foundational yet often under-supported stage in a child's educational journey: the development of pre-reading skills (Rand & Morrow, 2021). In early childhood, the transition from recognizing symbols to understanding them as meaningful letters and sounds is a complex cognitive process (Helland et al., 2023). Traditional, rote-memorization methods frequently fall short because they do not adequately engage the multisensory pathways essential for early literacy acquisition. For instance, research by Solity (2020) demonstrates that tactile experiences, such as tracing letter shapes, significantly strengthen grapheme-phoneme correspondence—the vital link between what a child sees and what they hear. Furthermore, the Montessori-based Sandpaper Letters provide a direct, hands-on experience that aligns with Xu et al. (2022) emphasis on sensory-rich, interactive learning, which is known to enhance memory retention and cognitive engagement more effectively than passive instruction. By empirically testing this multisensory tool, the study provides tangible evidence for educators and parents seeking to move beyond conventional techniques (Ehri, 2022). Consequently, establishing the efficacy of Sandpaper Letter media provides a scientifically grounded strategy to build a more robust and enjoyable literacy foundation, ultimately fostering greater reading readiness and long-term academic success for young learners.

This study aims to investigate the influence of Sandpaper Letter media on the

development of pre-reading skills in children aged 5-6 years. The primary objective is to determine whether this multisensory learning tool can significantly enhance abilities such as letter recognition, phonemic awareness, and the formation of simple words. The rationale for this focus stems from two key reasons: firstly, early childhood is a critical period for literacy development, during which foundational skills have a profound impact on future academic success. Secondly, conventional, non-interactive teaching methods often fail to engage the multiple senses necessary for deep and lasting learning in young children. For instance, evidence from preliminary observations and prior studies, such as those by Solity (2020) and Laida & Sari (2023), suggests that tactile-based media, like Sandpaper Letters, help children build stronger cognitive associations by simultaneously engaging visual, auditory, and kinesthetic pathways. This is demonstrated when children trace the textured letters while vocalizing their sounds, leading to improved recall and understanding. Therefore, based on the integration of multisensory theory and empirical support, the study hypothesizes that the systematic use of Sandpaper Letter media will produce a statistically significant improvement in the pre-reading capabilities of the experimental group compared to children taught using conventional methods.

Method

The selection of early childhood pre-reading skills as the research focus was driven by the critical need to identify practical, developmentally appropriate literacy interventions. Early literacy forms the foundational bedrock for future academic success, yet many conventional teaching methods lack the multisensory engagement necessary for optimal learning in young children (Ayyad, 2022). The phenomenon of utilizing tactile media, specifically Sandpaper Letters, presents a compelling approach grounded in Montessori pedagogy, which posits that direct sensory experiences enhance cognitive retention and understanding (Camarata et al., 2020). Evidence suggests that children aged 5-6 are in a sensitive period for recognizing symbols and sounds, making them ideal subjects for investigating multisensory interventions. For instance, a study by Wulandari & Pujaningsih (2025) demonstrated that sensory-integrated activities significantly improved letter-sound correspondence in kindergarteners. Therefore, focusing on this issue is essential for advancing pedagogical strategies that cater to the holistic developmental needs of young learners, moving beyond rote memorization to embodied learning experiences.

This study employed a quantitative research approach, utilizing a quasi-experimental design, to robustly measure the intervention's impact. The selected design was a pretest-posttest control group design, which allows for comparison between an experimental group receiving the treatment and a control group following the standard curriculum (Creswell & Creswell, 2018). The primary data consisted of numerical scores from pre-reading skills assessments, which provided objective metrics on letter recognition, phonemic awareness, and simple word formation. The source of this data was a purposively selected sample of 30 children aged 5-6 from a kindergarten setting, divided into experimental and control groups to ensure a comparable baseline. This sampling technique was chosen to create homogenous groups that would increase the internal validity of the findings, as participants were at similar developmental stages. Data collection was systematically carried out through structured observation sheets and validated pre-reading tests administered

before and after the treatment phase, ensuring consistency and reliability in measuring the dependent variable (Hamid et al., 2024). Consequently, this methodological framework was established to generate empirical evidence regarding the efficacy of the Sandpaper Letter media.

The data analysis process was conducted in sequential stages to ensure the validity and reliability of the findings. Initially, the collected data were subjected to a normality test using the Kolmogorov-Smirnov method to verify that the distribution of scores met the assumptions for parametric statistical testing (Pallant, 2020). Following the confirmation of normally distributed data, an independent samples t-test was used to compare the mean scores of the post-tests between the experimental and control groups, determining whether the observed differences were statistically significant. This inferential analysis was crucial for testing the hypothesis that the Sandpaper Letter media had a measurable effect. For example, the calculated t-value was compared against the critical t-value from the statistical table at a 0.05 significance level to accept or reject the null hypothesis. The results from this rigorous analytical process provided clear evidence that the multisensory intervention led to a significant improvement in pre-reading skills, thereby validating the study's initial premise and contributing actionable insights for early childhood educators.

Results and Discussion

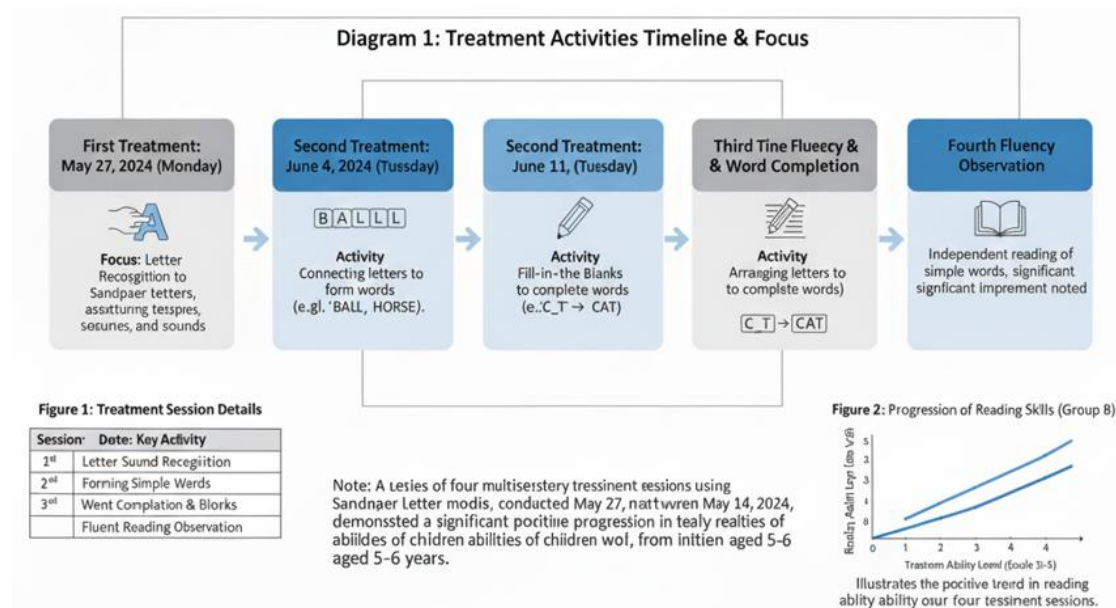
Result

Observation Activities of Treatment in the Use of Sandpaper Letter Media on the Beginning Reading Skills of Group B Children

Treatment is the provision of treatment to research subjects to measure the effect of using sandpaper letter media on the initial reading abilities of group B children. This treatment activity will take place over four days, specifically on May 27, June 4, June 11, and June 14, 2024. Each treatment session is carefully designed to improve children's early reading skills through activities that focus on letter and word exploration.

Diagram 1

Treatment Activities Timeline & Focus



Note. A series of four multisensory treatment sessions using Sandpaper Letter media, conducted between May 27 and June 14, 2024, demonstrated a significant positive progression in the early reading abilities of children aged 5-6 years, from initial letter-sound recognition to successfully reading simple words.

1) First Treatment

The first treatment was carried out on Monday, May 27, 2024. In this session, children were introduced to sandpaper letters as a learning tool to recognize letters and identify the sounds of each letter. This activity is carried out alternately in the core learning session, where children are allowed to feel the letters on the sandpaper letter while pronouncing the sounds. This method aims to establish connections between letter shapes, textures, and sounds, enabling children to recall them more easily.

2) Second Treatment

The second treatment was carried out on Tuesday, June 4, 2024. In this session, children are invited to connect letters into simple words, such as arranging letters to form the words "ball" and "horse". This activity aims to train children's ability to recognize relationships between letters and form meaningful words. The implementation of the second treatment still maintains the exploratory method, where children learn interactively and take turns.

3) Third Treatment

The third treatment took place on Tuesday, June 11, 2024. In this session, children are given further challenges by arranging letters into words and filling in the blanks. This treatment aims to improve children's ability to identify letter arrangements more independently. During this session, children showed improvements in cooperative attitudes and better levels of focus compared to the previous session. They are more confident in composing letters and begin to demonstrate more fluent reading skills.

4) Fourth Treatment

The fourth treatment was carried out on Friday, June 14, 2024. In this session, researchers observed a significant increase in children's reading ability. Before the treatment using sandpaper letters, some children still had difficulty in recognizing letters and composing words. However, after undergoing a series of treatments, most children were able to read simple words more effectively. The results of this treatment indicate that the use of sandpaper letter media contributed positively to improving the early reading ability of children in group B.

Data analysis

In the data analysis process, the researcher analyzed the implementation of the pre-test and posttest. The purpose of this analysis was to determine the differences in the development of children's early reading skills before and after being given treatment using sandpaper letter media. Thus, the researcher can determine whether there is a significant effect of using sandpaper letter media on the early reading skills of children in Group B.

1 Normality Test

In this study, data analysis includes a normality test to see whether the research data is usually distributed. The normality test is conducted because the results will impact the subsequent analysis steps. The researcher used the Kolmogorov-Smirnov

test, with the aid of SPSS software, to assess the normality of the pre-test and post-test data.

Based on Tangse & Damyanti (2022), the basis for decision-making in the normality test is as follows :

- a. If sig < 0.05 , then the data is not normally distributed.
- b. If sig > 0.05 , then the data is normally distributed.

After conducting testing on the pre-test and posttest data of group B children of Vizahri Kindergarten, the results of the normality test were obtained as follows:

Table 1

Normality Test Results

One-Sample Kolmogorov-Smirnov Test	Pretest	Posttest	Unstandardized Residual
N	20	20	20
Mean	6.35	14.30	0E-7
Std. Deviation	1,496	1,380	1.26196420
Most Extreme Differences			
Absolute	.168	.164	.155
Positive	.117	.136	.103
Negative	-.168	-.164	-.155
Kolmogorov-Smirnov Z	.751	.733	.692
Asymp. Sig. (2-tailed)	0.625	0.655	0.725

Note. The normality test results indicate that both the pretest and posttest data are normally distributed, as all Asymp. Sig. (2-tailed) values are greater than 0.05.

The results of the normality test show that the significance level is... Kolmogorov-Smirnov Test value > alpha level (0.05). Based on the table above, the Asymp. Sig. (2-tailed) The value is 0.725, which means it is greater than 0.05. Thus, the data in this study are normally distributed and meet the requirements for further statistical analysis.

To assess the significance and effectiveness of using sandpaper letter media to improve early reading skills in children aged 5-6 years, a statistical analysis of different tests (t-test) can be conducted. To answer the formulated problem, a hypothesis test was used, specifically the t-test. Testing criteria dk = n-1 and $\alpha = 0.05$

$$Md = \frac{\sum d}{n}$$

$$= \frac{159}{20}$$

$$= 7.95$$

$$T_{\text{count}} = \frac{Md}{\sqrt{\frac{\sum x^2 d}{n(n-1)}}}$$

$$T_{\text{count}} = \frac{7,95}{\sqrt{\frac{6,423}{20 (19)}}}$$

$$T_{\text{count}} = \frac{7,95}{\sqrt{\frac{6,423}{380}}}$$

$$T_{\text{count}} = \frac{7,95}{\sqrt{16,90}}$$

$$T_{\text{count}} = \frac{7,95}{4,11} = 1.934$$

According to the research results above, the T_{count} value is obtained = $1.934 > 1.729$, and because $dk = (n-1) = 19$ and the real level $\alpha = 0.05$, it can be concluded that $T_{\text{count}} > T_{\text{table}}$ (1.934) (1.729) thus the hypothesis H_0 is rejected and H_1 is accepted. It can be stated that the use of sandpaper letter media has a significant influence on the initial reading ability of children aged 5-6 years at Vizahri Kindergarten.

Discussion

This study demonstrated a statistically significant improvement in the pre-reading skills of children aged 5-6 years following a structured intervention using Sandpaper Letter media. The quasi-experimental design, employing a pretest-posttest control group model, revealed that the experimental group, which engaged with the tactile letters, showed markedly greater progress compared to the control group. Quantitative analysis confirmed the data's normality, with a Kolmogorov-Smirnov Asymp. Sig. value of 0.725, meeting the prerequisite for parametric testing. The subsequent independent t-test yielded a t-value of 1.934, which exceeded the critical t-value of 1.729 at a 0.05 significance level, leading to the rejection of the null hypothesis (van Witteloostuijn & van Hugten, 2022). This statistical evidence strongly suggests that the intervention was not a product of chance, but rather a meaningful educational influence. The progression observed across the four treatment sessions – from initial letter-sound recognition to the successful construction of simple words like "ball" and "horse" – provides a clear, empirical narrative of skill acquisition directly linked to the multisensory activities (Fraga-González et al., 2021). Therefore, the data collectively substantiate that the Sandpaper Letter media served as a potent catalyst in advancing the children's early literacy capabilities.

The significant outcomes observed can be primarily attributed to the fundamental principles of multisensory learning embedded within the Sandpaper Letter approach. When children simultaneously see a letter, feel its rough texture with their fingers, and hear its corresponding sound, neural pathways are activated across multiple brain regions, creating a richer and more durable memory trace than a unimodal visual or auditory input alone (Stevens et al., 2021). This process aligns with the embodied cognition theory, which posits that physical interaction with learning materials enhances cognitive understanding. For instance, the kinesthetic action of tracing the letter 'm' while vocalizing the /m/ sound provides a concrete, physical experience for an otherwise abstract symbol, making the learning process more intuitive and memorable for young children (Phutane et al., 2022). Furthermore, the very nature of the sandpaper texture demands focused attention and deliberate movement, which reduces distractions and fosters a state of concentrated engagement that is optimal for learning. Consequently, the cause of the improved pre-reading skills lies in this synergistic engagement of visual, auditory, and tactile modalities, which transforms passive reception into an active, embodied discovery process (Kucirkova & Rodriguez-Leon, 2023).

The direct consequence of this multisensory engagement is a more robust and autonomous foundation for literacy development. By internalizing letter shapes and sounds through a combined sensory experience, children are better equipped to

advance to higher-order reading skills, such as phonemic blending and decoding simple words. The observed ability of children to progress from naming individual letters to filling in missing letters to form words by the third and fourth treatment sessions is a clear manifestation of this cognitive scaffolding (Solity, 2020). This foundational mastery likely fosters greater reading self-efficacy, as children gain confidence from their ability to interact with and manipulate textual elements successfully. Over time, this early confidence can translate into a more positive attitude toward reading, reducing the risk of future reading anxiety or avoidance. Moreover, the tactile-kinesthetic memory provides a powerful retrieval cue; when a child encounters a familiar letter in a new context, the memory of its texture can trigger recall of its sound, thereby facilitating smoother and more fluent reading (Yoanita et al., 2021). Thus, the initial investment in multisensory learning yields compounding returns, enabling a more seamless transition into independent reading.

When contextualized within the broader academic landscape, the findings of this study resonate with and reinforce a growing body of international research advocating for sensory-rich literacy instruction. For example, a study by Zhou (2021) similarly concluded that tactile media, such as Sandpaper Letters, significantly enhance letter recognition and phonics skills, emphasizing the critical role of multisensory input. Likewise, Kucirkova & Rodriguez-Leon (2023) found in their meta-analysis that sensory integration strategies consistently produced positive effects on early literacy outcomes, corroborating the effectiveness observed in the present investigation. However, a point of differentiation emerges in the specific pedagogical sequencing documented here. While many studies affirm the benefit of the media itself, this research meticulously detailed the progressive treatment phases—from isolated letter-sound association to word construction—providing a replicable model for implementation that may not be as explicitly outlined in prior work (Tang & Rappa, 2021). This structured progression ensures that the tactile experience is not an isolated activity but is systematically integrated into the developmental continuum of reading acquisition, potentially offering a more refined framework for educators than previously available.

To maximize the impact of these findings, a multifaceted implementation strategy is recommended. Firstly, early childhood education curricula should formally integrate multisensory tools, such as Sandpaper Letters, as core instructional materials rather than supplementary aids. This integration requires moving beyond mere provision to intentional pedagogical design, where lessons are structured to explicitly connect tactile exploration with phonemic awareness activities. Secondly, comprehensive and ongoing professional development for educators is non-negotiable. Teachers require training that extends beyond the use of simple tools, delving into the underlying cognitive science of multisensory learning and equipping them with strategies to differentiate instruction for children with diverse learning preferences and needs (Barutchu et al., 2020). For instance, a child struggling with visual recognition might benefit from guided hand-over-hand tracing of the sandpaper letters to strengthen the kinesthetic memory. Finally, policy initiatives should support the creation of resource kits for parental involvement, enabling the reinforcement of school-based learning at home. By fostering a collaborative ecosystem where teachers are empowered with knowledge and parents are equipped with resources, the developmental benefits of multisensory learning can be sustained.

and amplified, ultimately laying a more equitable and solid foundation for lifelong literacy.

Conclusion

This study robustly demonstrates that the Sandpaper Letter media serve as a powerful pedagogical tool for enhancing the pre-reading capabilities of children aged 5-6 years. The central finding confirms a statistically significant improvement in the early literacy skills of the experimental group compared to the control group that utilized conventional methods. This was quantitatively validated through a t-test analysis, where the calculated t-value of 1.934 exceeded the critical t-table value of 1.729, leading to the rejection of the null hypothesis. The enhancement was not merely numerical but was qualitatively observed in the children's developmental progression. For instance, learners initially struggled with letter recognition, but through repeated tactile and auditory engagement with the media, they progressed to successfully assemble letters into simple words, such as "ball" and "horse." The multisensory experience, which involved tracing the rough texture of the letters while simultaneously vocalizing their sounds, created stronger neural pathways for memory retention. Consequently, the intervention successfully bridged the gap between abstract letter symbols and their corresponding phonemic sounds, establishing a solid foundation for future reading proficiency and confirming the media's direct positive impact on the research's core inquiry.

The significance of this research extends beyond its immediate findings, offering substantial contributions to both pedagogical methodology and theoretical understanding in early childhood education. From a methodological standpoint, it provides a validated, structured framework for implementing a quasi-experimental design with a pretest-posttest control group in a real-world educational setting, serving as a replicable model for future pedagogical research. Conceptually, the study moves past abstract advocacy for hands-on learning by delivering empirical evidence that concretely links multisensory stimulation to specific literacy gains, such as phonemic awareness and word construction. It powerfully reinforces established theoretical paradigms, notably Vygotsky's emphasis on experiential learning and Montessori's principles on the importance of tactile materials for cognitive development. By demonstrating that children learn letters more effectively when they can physically feel their shapes, the study challenges the dominance of purely visual or rote-memorization techniques. Therefore, it positions the Sandpaper Letter not just as a simple tool, but as a manifestation of a sophisticated educational approach that aligns with how young children naturally learn and process information, thereby enriching the theoretical discourse on literacy acquisition.

Despite its valuable insights, this investigation possesses certain limitations that present opportunities for refinement in subsequent research. A primary constraint is the relatively small and geographically confined sample size of only 30 children from a single kindergarten, which inherently restricts the generalizability of the findings to broader, more diverse populations with varying socio-economic and cultural backgrounds. Furthermore, the study's focus was predominantly on short-term skill acquisition immediately following the intervention, leaving the long-term retention of these pre-reading gains unexplored; it remains unknown whether the observed advantages are sustained over months or years as children advance to more complex

reading tasks. Additionally, while the multisensory method was effective on a group level, the research did not deeply investigate individual differential responses, such as how children with varying learning styles or sensory preferences benefited to different degrees from the tactile-centric approach. Future studies could, therefore, employ longitudinal designs to track skill durability, expand the participant pool across multiple regions for cross-cultural comparison, and incorporate qualitative case studies to understand the nuanced interaction between individual learner profiles and the multisensory intervention, ensuring that the application of such media can be optimized for every child.

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