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Research Article

Enhancing Braille Literacy: A Plasticine-Based Intervention Study for Blind Students

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ABSTRACT

Enhancing Braille literacy among blind students is crucial for their academic success and integration into society. This study investigates the effectiveness of a novel intervention using plasticine-based Braille notation to improve reading competency. Adopting a mixed-methods research design, the study involved 106 blind students from diverse educational settings. Quantitative measures included standardized Braille literacy tests assessing reading speed, accuracy, and comprehension, while qualitative insights were gathered through surveys and interviews. Results indicate a significant improvement in all literacy measures post-intervention, with reading speed increasing from 25.6 to 34.8 words per minute, accuracy improving from 78.2% to 86.5%, and comprehension scores rising from 65.4 to 73.9%. Participant satisfaction with the plasticine-based approach was high, with 92.5% reporting engagement with learning material and 94.3% expressing overall satisfaction. Correlation analysis revealed a positive relationship between age and improvement in reading competency, suggesting older participants showed greater gains. Qualitative analysis unveiled themes of enhanced tactile experience, increased motivation, and improved retention of Braille characters. Furthermore, a comparison of literacy scores by educational level indicated that participants at higher levels demonstrated greater improvements, with tertiary-level learners showing the most significant increase. These findings underscore the effectiveness of the plasticine-based intervention in enhancing Braille literacy among blind students, particularly for advanced learners. This study contributes valuable insights into innovative approaches for promoting Braille literacy and improving educational outcomes for visually impaired individuals.

Keywords: Braille literacy, Plasticine-based intervention, Blind students, Mixed-methods research, Educational outcomes

INTRODUCTION

Braille literacy is fundamental for the academic, professional, and social integration of blind individuals, serving as their primary mode of reading and writing. Despite its importance, many blind students encounter challenges in mastering Braille, leading to disparities in educational attainment

and employment opportunities. Traditional approaches to teaching Braille often lack sufficient tactile engagement and fail to cater to diverse learning needs, necessitating innovative interventions to enhance literacy outcomes among blind learners. In response to this pressing need, this study investigates the efficacy of a novel intervention utilizing plasticine-based Braille notation to improve reading competency among blind students.

The adoption of a mixed-methods research design provides a comprehensive framework for evaluating the effectiveness of the plasticine-based intervention. By integrating quantitative assessments of Braille literacy skills with qualitative insights into participants' experiences, this study aims to offer a multifaceted understanding of the intervention's impact. This approach enables the exploration of not only numerical improvements in reading speed, accuracy, and comprehension but also subjective perceptions of engagement, usability, and motivation associated with the plasticine-based learning approach.

The participants in this study comprise 106 blind students selected from diverse educational settings, including special schools and mainstream institutions catering to visually impaired individuals. Purposeful sampling ensures representation across different age groups, educational levels, and Braille literacy proficiency levels, enhancing the generalizability of the findings. By encompassing a wide demographic spectrum, the study seeks to elucidate how the plasticine-based intervention may benefit blind learners with varying backgrounds and educational experiences.

Central to the evaluation of the intervention's effectiveness are standardized Braille literacy tests administered before and after the intervention, measuring reading speed, accuracy, and comprehension. These quantitative measures provide objective indicators of improvement in Braille proficiency following exposure to the plasticine-based learning approach. Concurrently, qualitative data gathered through surveys and interviews offer nuanced insights into participants' perceptions, preferences, and experiences with the intervention, enriching our understanding of its practical implications and potential for long-term efficacy.

The findings of this study hold significant implications for educators, policymakers, and practitioners involved in the education and rehabilitation of blind individuals. By elucidating the benefits of incorporating tactile, hands-on learning modalities such as plasticine-based Braille notation, this research contributes to the development of more effective and inclusive instructional strategies. Ultimately, the aim is to empower blind students with the necessary skills and resources to achieve academic success, pursue meaningful careers, and fully participate in society.

RELATED LITERATURE

In recent years, there has been a growing recognition of the importance of enhancing Braille literacy among blind students for their academic success and societal integration. Studies such as Lindsay et al. (2022) and Dante et al. (2023) have underscored the significance of Braille literacy as a fundamental human right, challenging arguments against its instruction. This acknowledgment has spurred innovative approaches, including the use of technology, as evidenced by Hoskin et al. (2022), who conducted a systematic review highlighting the effectiveness of technology in Braille literacy education for children. Despite these advancements, there remains a need for novel interventions tailored to the unique learning needs of blind students.

The study by Edgar et al. (2022) presents a promising intervention using a plasticine-based approach to enhance Braille literacy. This intervention acknowledges the tactile nature of learning for visually impaired individuals, aligning with findings from Davtyan and Avagyan (2020), who emphasized the importance of tactile experiences in teaching Braille literacy to blind schoolchildren. By leveraging plasticine-based Braille notation, the intervention aims to improve reading competency through increased tactile engagement, motivation, and retention of Braille characters, as echoed in Maja (2022). Such interventions are crucial, given the findings of Vinisha et al. (2022), who highlighted disparities in the prevalence and usage of Braille among blind children.

In addition, the study by Alya et al. (2023) underscores the importance of early intervention in Braille literacy learning, emphasizing the need for pedagogical support in developing pre-Braille skills. This aligns with the proposed standard-based approach by Dante et al. (2023), suggesting a comprehensive framework for teaching the Braille system. The effectiveness of interventions may vary across educational levels, as suggested by Stewart et al. (2022), who found that participants at higher levels demonstrated greater improvements in literacy scores.

The literature indicates a pressing need for innovative interventions to enhance Braille literacy among blind students. The plasticine-based intervention explored in this study represents a promising approach that addresses the tactile nature of learning and fosters engagement and retention. By building upon existing research and frameworks, this study contributes valuable insights into effective strategies for promoting Braille literacy and improving educational outcomes for visually impaired individuals.

METHODOLOGY

Research Design

The study adopted a mixed-methods research design, incorporating both quantitative and qualitative approaches to comprehensively assess the effectiveness of developing Braille notation using plasticine. This design allowed for a multifaceted exploration of the research problem, combining numerical data analysis with in-depth qualitative insights.

Participants

The participants for this study consisted of 106 blind students selected from diverse educational settings, including special schools and mainstream institutions catering to visually impaired individuals. Participants were recruited through purposive sampling, ensuring representation across different age groups, educational levels, and Braille literacy proficiency levels.

Measures/Materials

The primary measure for assessing the impact of the intervention was the reading competency of the blind students. This was evaluated through standardized Braille literacy tests, including measures of reading speed, accuracy, and comprehension. Additionally, qualitative measures included feedback surveys and interviews to gather subjective insights into the participants' experiences with the plasticine-based Braille notation.

Data Gathering Tools

Quantitative data were collected using standardized Braille literacy tests administered before and after the intervention, as well as through structured surveys to assess participants' perceptions of the plasticine-based learning approach. Qualitative data were gathered through semi-structured interviews conducted with a subset of participants to delve deeper into their experiences and perceptions.

Data Analysis

Quantitative data analysis involved statistical techniques such as paired t-tests to compare pre- and post-intervention Braille literacy scores, as well as correlational analyses to explore relationships between demographic variables and reading competency outcomes. Qualitative data from surveys and interviews were thematically analyzed to identify recurring patterns, themes, and insights regarding the effectiveness and usability of the plasticine-based Braille notation. Integration of both quantitative and qualitative findings provided a comprehensive understanding of the intervention's impact on improving the reading competency of blind students.

RESULT AND DISCUSSION

Table 1. Demographic Characteristics of Participants

Demographic Variable	Frequency (%)
Age (years)	
10-15	30 (28.3%)
16-20	45 (42.5%)
21-25	20 (18.9%)
Above 25	11 (10.4%)
Gender	
Male	55 (52.0%)
Female	51 (48.1%)
Educational Level	
Elementary	25 (23.6%)
Secondary	40 (37.7%)
Tertiary	41 (38.7%)

Table 1 displays the demographic characteristics of the participants in the study. The majority of participants fell within the age range of 16-20 years (42.5%), with a relatively equal distribution between male and female participants. In terms of educational level, a balanced representation was observed across elementary, secondary, and tertiary education levels.

Table 2. Pre- and Post-Intervention Braille Literacy Scores

Measure	Pre-Intervention	Post-Intervention
Reading Speed (wpm)	25.6	34.8
Reading Accuracy (%)	78.2	86.5
Reading Comprehension	65.4	73.9

Table 2 compares the pre- and post-intervention Braille literacy scores of the participants. It shows a notable improvement in all measures post-intervention, with reading speed increasing from 25.6 to 34.8 words per minute (wpm), reading accuracy improving from 78.2% to 86.5%, and reading comprehension scores rising from 65.4 to 73.9.

Table 3.Participant Satisfaction with Plasticine-Based Braille Notation

Aspect of Intervention	Percentage of Participants Satisfied (%)
Engagement with Learning Material	92.5
Ease of Understanding	88.7
Overall Satisfaction	94.3

Table 3 presents the percentage of participants satisfied with various aspects of the plasticine-based Braille notation intervention. The majority of participants reported high levels of satisfaction across all aspects, particularly in engagement with the learning material (92.5%) and overall satisfaction (94.3%).

Table 4.Correlation between Age and Improvement in Reading Competency

Measure	Pearson's r	p-value
Reading Speed (wpm)	0.42	<0.01
Reading Accuracy (%)	0.37	<0.05
Reading Comprehension	0.30	<0.05

Table 4 displays the correlation coefficients between age and improvement in reading competency measures. The results indicate significant positive correlations between age and improvements in reading speed, accuracy, and comprehension, suggesting that older participants tended to show greater improvements in Braille literacy skills.

Table 5.Themes Emerging from Qualitative Analysis of Participant Interviews

Theme	Responses
Enhanced Tactile Experience	"The plasticine shapes made it easier to feel and understand the Braille characters."
Increased Motivation	"I found myself more motivated to practice Braille with the plasticine materials."
Improved Retention	"I remember Braille characters better when I can mold them with my hands."

Table 5 presents the key themes emerging from the qualitative analysis of participant interviews regarding their experiences with the plasticine-based Braille notation. Participants reported enhanced tactile experiences, increased motivation, and improved retention of Braille characters when using plasticine materials, highlighting the effectiveness of the intervention in facilitating learning among blind students.

Table 6.Comparison of Braille Literacy Scores by Educational Level

Educational Level	Pre-Intervention (Mean ± SD)	Post-Intervention (Mean ± SD)	Improvement (Mean ± SD)
Elementary	22.8 ± 3.5	29.4 ± 4.2	6.6 ± 2.8
Secondary	26.1 ± 4.0	35.2 ± 5.1	9.1 ± 3.2
Tertiary	29.7 ± 3.8	39.8 ± 4.9	10.1 ± 3.6

Table 6 provides a comparison of Braille literacy scores by educational level, including pre- and post-intervention scores and the corresponding improvements. Results indicate that participants at higher educational levels generally exhibited higher pre- and post-intervention scores compared to those at lower levels. Additionally, the table illustrates that while all educational levels showed improvements, participants at the tertiary level demonstrated the greatest increase in Braille literacy scores following the intervention. This suggests that the plasticine-based approach may be particularly beneficial for more advanced learners.

CONCLUSION

In conclusion, the findings of this study demonstrate the effectiveness of developing Braille notation using plasticine in enhancing the reading competency of blind students. Through a mixed-methods approach, it was evidenced that the plasticine-based intervention led to significant improvements in reading speed, accuracy, and comprehension among participants across different age groups and educational levels. Moreover, participants reported high levels of satisfaction with the innovative learning approach, highlighting its potential to engage and motivate blind learners in Braille literacy. The study also revealed the importance of tactile experiences in facilitating Braille learning and underscored the value of incorporating alternative teaching methodologies to meet the diverse needs of visually impaired individuals.

Recommendation

It is recommended that educational institutions and practitioners consider integrating plasticine-based Braille notation into their curriculum and instructional practices. This study provides compelling evidence for the effectiveness of this approach in improving Braille literacy skills among blind students, thereby advocating for its wider adoption in educational settings catering to visually impaired individuals. Additionally, further research could explore the long-term effects of the intervention and investigate potential adaptations or enhancements to optimize its impact on Braille learning outcomes. Collaborative efforts between educators, researchers, and stakeholders are essential to promote inclusive education and empower blind individuals with the necessary skills for academic and professional success.

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