Development of a Stylus to Enhance Braille Writing Skills in Eighth-Grade Students with Intellectual Disabilities at SLB-A YAPTI Makassar

Chaerunnisa K[1], Syamsuddin[2], Usman Bafadal[3]

[1] Departement of Special Education, Universitas Negeri Makassar, Makassar, Indonesia
[2] Departement of Special Education, Universitas Negeri Makassar, Makassar, Indonesia
[3] Departement of Special Education, Universitas Negeri Makassar, Makassar, Indonesia

Chaerunnisa K, Syamsuddin, Usman Bafadal
Universitas Negeri Makassar, Indonesia
E-mail: chaerunnisakarajang@gmail.com

Received: 17 October 2025
Accepted: 27 October 2025

Abstract

The issue examined in this study arises from the need for instructional media that can support the process of learning to write. In addition, it was found that eighth-grade students with multiple disabilities experienced academic difficulties, particularly in writing Braille letters or text. The research problem addressed in this study focuses on the analysis of needs, development stages, prototype design, validity, and effectiveness of a stylus designed to enhance Braille writing skills among students with multiple disabilities. The purpose of this study is to determine the results of the needs analysis, development stages, prototype design, validity, and effectiveness of the stylus in improving Braille writing abilities in these students. This study employed the 4-D (Four-D Model) development approach, which consists of four phases: define, design, develop, and disseminate. The findings of the study are as follows: (1) The needs analysis results indicate that eighth-grade students with multiple disabilities require a stylus of relatively large size to ensure an easier grip; (2) The development process involved the definition, design, and development stages, with this study limited to the development phase; (3) The stylus prototype was designed to provide an initial visual representation prior to further development; and (4) The validity test results show that the stylus meets the criteria of being highly valid, and its effectiveness is categorized as highly effective.

Keywords: Stylus; Braille Writing; Students with Multiple Disabilities; Research and Development; 4-D (Four-D Model)

Introduction

Education is a fundamental right for every individual, including those with visual impairments. This concept has been emphasized in various scholarly works asserting that all students, regardless of their conditions, are entitled to access educational facilities that meet their specific needs (Manirajee et al., 2024; Baykaldı et al., 2023). This underscores the importance of inclusive education that accommodates special needs, particularly for children with disabilities who experience physical, social, emotional, or mental challenges (Baykaldı et al., 2023; Hewett et al., 2023). With a comprehensive understanding of the right to education and a strong commitment to promoting accessibility, it is possible to create a more equitable and supportive learning environment for all individuals.

Children with special needs exhibit diverse characteristics, one of which includes students with visual impairments. The term *visual impairment* refers to individuals who experience partial or complete loss of vision, ranging from total blindness to low vision (McLinden et al., 2020; Hewett et al., 2023). This condition necessitates specialized educational approaches, in which instructional media must be tactile or auditory

in nature, such as the Braille writing system (Adejoke et al., 2024; Hewett et al., 2023). The significance of these approaches lies in their capacity to provide essential access to information, allowing students with visual impairments to participate effectively in learning activities.

Accessibility in education for students with visual impairments is particularly crucial in the process of developing writing skills. Research has shown that visually impaired students face distinct challenges in acquiring writing proficiency (Sim, 2020; Hewett et al., 2023). For instance, the tools used for Braille writing are often not ergonomically designed, leading to discomfort and difficulty in use (Olumorin et al., 2022). Existing styluses are generally produced in standardized sizes that do not fit children's hands and lack grip features that enhance stability during writing (Selvam & Piragasam, 2025; Olumorin et al., 2022). Hence, innovation in the design of assistive writing tools is essential to improve writing ability among visually impaired learners.

In this context, the role of assistive technology becomes particularly significant. Numerous studies have demonstrated that assistive technology plays a crucial role in facilitating the education of children with special needs, including those with visual impairments (Manirajee et al., 2024; Adejoke et al., 2024). The use of tools such as screen reader software and Braille displays enhances access to educational resources and fosters communication with teachers and peers (Khan & Mahmood, 2022). Through these technologies, students with visual impairments can access learning materials more effectively, thereby participating in curricula comparable to their sighted counterparts.

However, the need for improved accessibility remains pressing, particularly in developing Braille writing skills. Studies indicate that Braille writing requires specialized tools such as a stylus, yet many existing designs continue to present limitations (Kana & Hagos, 2024; Islam et al., 2024). Styluses are often standardized and not tailored to children's hand sizes, resulting in discomfort and limited control (Kana & Hagos, 2024; Hakobyan & Grigoryan, 2024). Furthermore, existing stylus needles are often too short, reducing writing comfort and precision. Hakobyan and Grigoryan (2024) emphasize that assistive writing tools should be ergonomically designed to enhance comfort and usability. Without such design improvements, visually impaired students may continue to face difficulties mastering Braille writing, which could negatively impact their academic achievement.

The importance of ergonomic design becomes even more evident in real educational contexts. An observation conducted on May 29, 2024, at SLB-A YAPTI Makassar revealed a case involving a student identified as M.A., aged 14, who has multiple disabilities—specifically severe low vision and physical impairment (paralysis). M.A. experienced considerable challenges in writing Braille characters due to both visual and motor limitations. The paralysis caused fine motor difficulties, leading to hand muscle weakness and reduced coordination, which hindered precise control when using the stylus. During observation, the stylus used by the student was of a standard size, making it difficult to grip and manipulate effectively. This condition clearly demonstrated the mismatch between available tools and the student's ergonomic needs, ultimately impeding the development of Braille writing skills necessary for academic learning.

Considering these challenges, this study aims to develop an effective and efficient stylus to enhance Braille writing skills among students with multiple disabilities at SLB-A YAPTI Makassar. The stylus to be developed is expected to help students write Braille characters more easily, comfortably, and in accordance with their individual physical conditions.

The term *media* originates from the Latin word *medium*, meaning an intermediary or channel for messages. When a medium facilitates message transmission during the learning process, it functions as educational media (Hasan et al., 2021). According to the National Education Association (NEA), media are defined as all forms that can be manipulated, seen, heard, read, or discussed, and serve as tools to support learning activities. A stylus, as described by Kuswara et al. (2021), is a needle-shaped instrument used to press on paper surfaces to create raised dot patterns corresponding to Braille symbols. This tool is particularly beneficial for students with visual impairments, as it enables them to write and take notes independently, supporting the development of their literacy skills.

Writing, as a communicative activity, employs written language as its principal medium. Tarigan (2021) defines writing as "a language skill used for communication that is conducted indirectly and does not involve face-to-face interaction with others." According to Hunt and Marshal (as cited in Setyawati, 2021), visually impaired children face persistent difficulties in obtaining information despite assistive tools, hence they rely on Braille for reading and writing. Braille, consisting of six dot cells that can be combined into different configurations and read by touch, serves as an essential medium for literacy among the visually impaired.

From a linguistic perspective, the term *tunanetra*—derived from the Indonesian words *tuna* (lacking) and *netra* (vision)—refers to individuals who experience total or partial visual impairment. Irvan (2020) describes visually impaired children as individuals whose visual functions are limited or non-functional, making it difficult for them to adapt to their environment through sight. Similarly, Praptaningrum (2020) defines visual impairment as a condition where the eyes or vision fail to function properly, resulting in limited or absent visual ability. In this context, *tuna* denotes a state of deficiency or absence of function.

Meanwhile, *tunadaksa* (physical disability) refers to impairments of the muscular, skeletal, joint, or nervous systems caused by disease, viral infection, or injury before, during, or after birth. Pratiwi (2025) defines physically disabled children as those whose body parts are undeveloped or impaired. Specifically, *lumpuh layu* (flaccid paralysis) is a condition that affects certain body parts such as the hands or legs, resulting in weakness, muscle flaccidity, and restricted motor function (Irhasana & Arlin Adam, 2025).

Given these conditions, it becomes evident that students with multiple disabilities—particularly those with visual and physical impairments—require specially designed learning media that accommodate both tactile and ergonomic needs. Therefore, this research was conducted to develop a stylus designed specifically to enhance Braille writing skills among students with multiple disabilities, ensuring accessibility, comfort, and functionality in the learning process.

Method

The type of research employed in this study is Research and Development (R&D), specifically in the development of instructional media. Research and Development is often defined as a systematic method or set of procedures aimed at developing a new product or improving an existing one (Zakaria et al., 2020). This study adopts the 4-D model (Four-D Model), which consists of four stages: Define, Design, Develop, and Disseminate. However, the research process in this study was conducted up to the development stage, considering the time limitations of the research period.

1. Define (Definition Stage)
   This stage aims to analyze learners' needs and identify the problems that underlie product development. Activities conducted include preliminary observations at SLB-A YAPTI Makassar and interviews with teachers to identify students' difficulties in writing Braille using the standard stylus. The data collected at this stage serve as the foundation for designing a more ergonomic and accessible stylus.
2. Design (Design Stage)
   During this stage, the initial prototype of the stylus was designed. The design was adjusted to meet the specific characteristics of students with multiple disabilities, particularly those with fine motor impairments. The design process involved determining the appropriate dimensions, materials, and ergonomic features to enhance comfort and stability during Braille writing activities.
3. Develop (Development Stage)
   The prototype stylus designed in the previous stage was further developed into a functional product. This stage includes expert validation and product testing.

   - Expert Validation

Validation was conducted to assess the feasibility of the product from both material and media perspectives.

- Material experts evaluated the content relevance, the functionality of the stylus within the context of Braille instruction, and its alignment with student learning competencies.
- Media experts assessed technical and design aspects, including physical form, usability, material safety, and efficiency in supporting Braille writing.

The validation instruments were questionnaires using a Likert scale, as presented in Table 1:

Tabel 1. Categories Table

Answer Categories	Score
Highly Appropriate	5
Appropriate	4
Quite Appropriate	3
Inappropriate	2
Very Unsuitable	1

Source: Arifin & Aunillah (2021)

The data obtained from the validation process were analyzed by calculating the percentage score using the following formula:

$$P = \frac{\Sigma x}{\Sigma y} \times 100\ \%$$

The results were used to determine the product's level of feasibility before proceeding to the testing phase.

- Product Effectiveness Testing
  After being validated and declared feasible by the experts, the product underwent limited trials to determine its effectiveness in improving students' Braille writing abilities. The testing was conducted with eighth-grade students with multiple disabilities (severe low vision and flaccid paralysis) at SLB-A YAPTI Makassar.

  The testing procedure included the following steps:

  1. Pre-test, to measure the students' initial ability to write Braille using a standard stylus.
  2. Treatment, where students used the developed stylus during Braille writing activities.
  3. Post-test, to measure improvements in Braille writing ability after using the developed stylus.

  The results of the pre-test and post-test were compared to determine the increase in students' writing proficiency. Data were analyzed using descriptive quantitative analysis, presented in the form of percentage improvements in writing performance.

- Disseminate (Dissemination Stage)

At this stage, the developed stylus that has been validated and tested for effectiveness will be disseminated to teachers and school administrators at SLB-A YAPTI Makassar as an alternative instructional medium for Braille learning. Moreover, the research findings are expected to serve as a reference for future developers in designing assistive learning tools for students with special needs.

Result

Needs analysis of the Stylus media to enhance Braille writing skills among students with multiple disabilities at SLB-A YAPTI Makassar

Tabel 2. Teacher Needs Analysis Questionnaire

No	Aspek yang dinilai	Penilaian
1.	Students with multiple disabilities and visual impairments require assistive tools for Braille writing	**5**
2.	The Braille stylus needs to be adapted to students' physical conditions and abilities	**5**
3.	A lightweight and easy-to-grip Braille stylus will help students learn more effectively	**4**
4.	Students often experience difficulties using the current Braille stylus	**4**
5.	Engaging learning media can increase students' motivation to write in Braille	**5**
6.	The Braille stylus should be durable and safe for students to use	**4**
7.	Students will be more interested in learning if the Braille stylus is designed according to their needs	**5**
8.	Teachers need practical and easy-to-use Braille writing tools for classroom use	**5**
9.	A specially designed Braille stylus can help students become more independent in their learning	**5**
10.	A suitable Braille stylus can improve students' Braille writing skills	**5**
	Total	47

The results of the questionnaire showing the percentage of teachers' needs analysis toward the stylus media are as follows:

Tabel 3. Respondents' Results

• **No.**	• **Responden**	• **Skor**

• 1	• Muh Ayub K., S.Farm	• 94 %

Respondents' Eligibility Percentage (%) = $P = \frac{\Sigma x}{\Sigma y} \times 100\ \%$

$= \frac{47}{50} \times 100\%$

= 94 %

Based on the previously established needs analysis criteria, the percentage results from respondents indicate that the learning media in the form of a stylus falls into the *"highly needed"* category, with a score of **94%**.

Development Stages of the Stylus Media to Improve Braille Writing Skills in Students with Multiple Disabilities

One of the characteristics used to determine the quality of the developed stylus media is the validity criterion. After the initial prototype of the stylus media aimed at improving Braille writing skills is created, the process continues to the development stage, which aims to refine the initial prototype. The steps to be carried out include evaluation (validation) by experts of the initial prototype. After revisions are made based on expert feedback, the final product of the stylus media to improve Braille writing skills will be produced.

Stylus Media Prototype to Improve Braille Writing Skills

The initial product design was created using the **Medibang Paint** application to edit and refine the first prototype. The stylus was designed in an ergonomic cylindrical shape with a length of **5.5 cm**, featuring a slightly pointed pen tip of **2.5 cm**. An essential component, a **ring**, was added to the upper part of the stylus to serve as a finger rest, preventing the stylus from slipping easily and helping maintain consistent finger positioning. The stylus body was designed using durable wood, with an overall length of **8 cm**, and given an attractive base color to enhance visual appeal.

Twenty-three teachers rated the reflection form on the suitability of the course material on the SDL Platform. Data regarding this reflection was also confirmed with the participants during a focused-synchronized discussion. In this component, there were two closed-questions and three open-questions. Answers were designed in four scales: a). not suitable; b). less suitable; c). suitable; and d). very suitable.

The results shown in percentages cover the suitability of course materials for creating learning-friendly and inclusive schools. 28% of participants stated that the course materials were very suitable for building learning-friendly and inclusive schools, 52% acknowledged that the materials were suitable for their needs in implementing inclusive education, and 20% did not provide an answer. In addition, 36% of teachers stated that the material was very suitable for creating a learning-friendly and inclusive classroom, while 64% stated that the material was suitable.

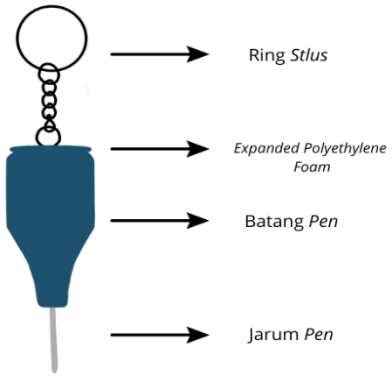

Figure 1. Stylus Prototype Design

Validity and Effectiveness of the Stylus Media in Improving Braille Writing Skills for Students with Multiple Disabilities

The aspects assessed in validating the stylus media to enhance Braille writing skills for students with visual and multiple impairments include the shape or design dimensions and content assessment aspects. The media validator was Dr. Faizal, M.Si, and the content validator was Prof. Dr. H. Abdul Hadis, M.Pd, both lecturers from the Department of Special Education, Faculty of Education, Makassar State University. This stage aims to determine the validity of the stylus media and to obtain comments and suggestions from the validators for further improvement.

Table 4. Results of Validation by Material Expert

Assessment Aspects	Indicators	Evaluation
Content Dimention	a. *The stylus can increase students' learning motivation*	**4**
	b. The size and shape used are appropriate	**4**
	c. The media display is attractive	**4**
	d. Ease of use of the media	**4**
	e. Suitability of the design	**4**

Table 5. Results of Validation by Media Expert

Assessment Aspects	Indicators	Evaluation
	a. The length and width of the stylus are suitable for the users' needs	**5**

	b. The ring is strong and flexible enough so it does not come off easily but remains comfortable to use	**4**
	c. The ring is well-attached to the stylus and does not interfere with hand movement	**4**
Form Dimension	d. The stylus is made of durable material and comfortable to hold	**5**
	e. The pen needle length is appropriate for the users' needs	**5**
	f. Matches the characteristics of a stylus	**5**
	g. Designed for practicality	**4**
	h. The stylus shape is appropriate	**5**
	i. Lightweight and easy to grip	**5**
	j. Overall appearance	**4**

Table 6. Results of Validation by Media and Material Experts

No.	Validator	Nilai Validator	Keterangan
1	Media Expert	92%	Very Good
2	Material Expert	80%	Good

Table 6 shows that the validation score from the media expert is categorized as *very good*, and the validation score from the material expert is categorized as *good*. Based on the validation results from both experts—regarding both the appropriateness of the media and the content accuracy for students with multiple visual impairments—the stylus media is considered *feasible* to be used and tested in the next stage. It can be concluded that the developed stylus media to improve braille writing skills is of *very good quality* and can be effectively used to enhance braille writing ability among students with multiple visual impairments.

To determine the effectiveness of the stylus in improving braille writing skills for students with multiple visual impairments, a trial was conducted with grade VIII students at SLB-A YAPTI Makassar through a *pretest* and *posttest*.

Table 7. Comparison of Pretest and Posttest Results on Braille Writing Ability Using the Stylus

No	Assessment Aspect	Score		Keterangan
		Pretest	*Posttest*	
1	A ⠁	0	1	Improved
2	B ⠃	0	1	Improved
3	C ⠉	0	1	Improved
4	D ⠙	0	1	Improved
5	E ⠑	0	0	Not Improved
	Average Score	0	4	

Based on the data above, it can be concluded that there was an *increase* in braille writing ability among grade VIII students with multiple visual impairments at SLB-A YAPTI Makassar after the stylus development was implemented. This result demonstrates that the developed stylus is *effective* in improving braille writing skills.

Discussion

The stylus developed for students with multiple visual impairments was designed using the 4-D (Four D Models) development model. Based on the results of the needs analysis, it was found that students with multiple visual impairments require media that can support the writing learning process. The stylus developed for these students followed the 4-D model proposed by Thiagarajan, which consists of four stages: define, design, develop, and disseminate. However, this research was limited to the development stage due to time considerations and the research objective, which was to produce and validate a feasible instructional media product. Similar methodological adaptations have also been made in previous studies (Haris et al., 2021; Dewi, 2024).

The define stage began with a field study, which included a front-end analysis and a learning analysis. This stage involved interviews with eighth-grade students with multiple visual impairments at SLB-A YAPTI Makassar to identify the difficulties they faced in writing Braille. The findings revealed that students experienced challenges in using standard-sized styluses, such as frequent errors in pressing Braille dots, difficulty holding the stylus due to its small grip size, and discomfort caused by the short needle tip, which sometimes touched their fingernails. The students expressed the need for a new stylus that is lighter, easier to hold, and more comfortable to use for accurate Braille writing. A needs assessment was also conducted with teachers using a questionnaire to identify their perspectives on the required stylus design. The results showed that 94% of teachers believed that the stylus plays a crucial role in supporting the learning process, particularly in improving Braille writing skills among students with multiple disabilities.

The design stage aimed to create the stylus prototype and develop validation instruments. During this stage, the researcher designed the stylus by applying effective instructional media design principles. Additionally, validation instruments were prepared, including the media expert validation sheet, material

expert validation sheet, and teacher response questionnaire. These instruments were used to evaluate the design's feasibility and ensure that it met both pedagogical and ergonomic standards.

The development stage focused on producing and refining the initial stylus prototype based on the experts' feedback. The revisions were made to improve usability, ergonomics, and alignment with the learning objectives. The researcher refined the prototype according to the predetermined design specifications, ensuring that the stylus was practical, comfortable, and functional for the target users.

The final phase was the evaluation stage, where the stylus was assessed through media and material validation as well as limited field testing. This process aimed to determine the validity, effectiveness, and user acceptance of the developed media. Validation was carried out by media and material experts who evaluated the design, function, and overall appropriateness of the stylus. After receiving input and recommendations from the experts, the researcher revised the product to enhance its quality and feasibility. Subsequently, a limited trial was conducted with eighth-grade students with multiple visual impairments at SLB-A YAPTI Makassar to evaluate the stylus's effectiveness in improving Braille writing skills.

The results of the limited trial demonstrated that the developed stylus was highly effective in enhancing students' Braille writing abilities. However, this research has several limitations that must be acknowledged. The stylus has only been tested in a limited trial setting; therefore, the findings cannot yet be generalized. Further studies with broader implementation and larger sample sizes are required to comprehensively confirm the stylus's effectiveness and potential for wider educational application.

Conclusion

Based on the findings of this study, it can be concluded that through the development process carried out, the results from the define stage—which involved both literature review and field study—indicated a clear need for a stylus to enhance Braille writing skills among students with multiple visual impairments. The outcome of the design stage was the creation of a stylus prototype design ready for expert validation. During the development stage, the stylus product underwent validation by experts to ensure its feasibility and quality. After two stages of validation, the stylus media was declared valid and ready for testing. The effectiveness trial results demonstrated that the use of the developed stylus was highly effective, showing a strong positive impact on improving students' Braille writing abilities. This finding indicates that the stylus is feasible to be used as an instructional aid to support Braille learning for students with multiple disabilities.

From a practical perspective, the implementation of this stylus provides significant implications for teaching in special education schools (SLB) and similar institutions. Teachers can utilize this stylus as a more ergonomic and accessible learning tool to facilitate Braille writing instruction, especially for students who experience motor and tactile difficulties. Furthermore, the product can serve as a model for developing other adaptive learning media that address the diverse physical and sensory needs of students with disabilities.

For future researchers, it is recommended to extend the development process to the dissemination stage, to test the stylus on a broader scale and gather more comprehensive evidence regarding its long-term effectiveness and applicability across different educational settings.

References

Adejoke, B., Gbolaga, R., & Oluwabunmi, O. (2024). *The impact of assistive technologies on academic and social outcomes of deaf-blind students in Nigeria. Acta Humanitatis et Linguarum, 1*(1), 138–157. https://doi.org/10.69760/aghel.024060

Arifin, M. B. U. B., & Aunillah. (2021). *Buku ajar statistik pendidikan* (pp. 1–102). Umsida Press. https://doi.org/10.21070/2021/978-623-6292-33-4

Baykaldı, G., Çorlu, M., & Yabaş, D. (2023). *An investigation into high school mathematics teachers and inclusive education for students with visual impairments. British Journal of Visual Impairment, 42*(1), 124–134. https://doi.org/10.1177/02646196231175327

Dewi, N. A. S. (2024). *Jurusan Pendidikan Khusus Fakultas Ilmu Pendidikan Universitas Negeri Makassar 2024.*

Hakobyan, L., & Grigoryan, N. (2024). *Innovative solutions for learners with visual impairments. Armenian Journal of Special Education, 8*(1), 31–42. https://doi.org/10.24234/se.v8i1.15

Haris, B., Bakry, A., & Riska, M. (2021). *Pengembangan media pengenalan huruf braille untuk anak-anak tunanetra berbasis mikrokontroler. Jurnal Pendidikan dan Profesi Keguruan, 1*(1), 16. https://doi.org/10.59562/progresif.v1i1.27452

Hasan, M., Milawati, M., Darodja, D., Harahap, T. K., Tahrim, T., Anwari, A. M., Rahmat, A., Maasdiana, M., & Indra, I. M. (2021). *Media pembelajaran.* Tahta Media Group. http://eprints.unm.ac.id/20720/

Hewett, R., Douglas, G., McLinden, M., & James, L. (2023). *Development of a new curriculum framework for children and young people with vision impairment: A United Kingdom consultation using the Delphi approach. British Journal of Visual Impairment, 42*(1), 3–19. https://doi.org/10.1177/02646196231157168

Irhasana, I., & Adam, A. (2025). *Analisis peran pemangku kepentingan dalam pencegahan penyakit lumpuh layu di Indonesia. Jurnal Kesehatan dan Kedokteran, 4*(1), 36–42. https://doi.org/10.56127/jukeke.v4i1.1940

Irvan, M. (2020). *Urgensi identifikasi dan asesmen anak berkebutuhan khusus usia dini. Jurnal Ortopedagogia, 6*(2), 108–112. https://doi.org/10.17977/um031v6i22020p108-112

Islam, M., Jahangir, R., Mohim, N., Wasif-Ul-Islam, M., Ashraf, A., Khan, N., … & Shin, J. (2024). *A multilingual handwriting learning system for visually impaired people. IEEE Access, 12*, 10521–10534. https://doi.org/10.1109/access.2024.3353781

Kana, F., & Hagos, A. (2024). *Factors hindering the use of braille for instruction and assessment of students with visual impairments: A systematic review. British Journal of Visual Impairment, 43*(2), 396–406. https://doi.org/10.1177/02646196241239173

Khan, G., & Mahmood, A. (2022). *The role of assistive technology in the English language learning experience of blind and visually impaired students in Pakistan: A qualitative study. Journal of Social Sciences Review, 2*(4), 313–321. https://doi.org/10.54183/jssr.v2i4.106

Kuswara, R. S., Panjaitan, T., Lubis, M. S., & Audiva, R. (2021). *Merancang alat stylus mekanik Braille pen untuk penyandang tunanetra dengan metode brainstorming. EE Conference Series, 4*(1), 401–404.

Manirajee, L., Shariff, S., & Rashid, S. (2024). *Assistive technology for visually impaired individuals: A systematic literature review (SLR). International Journal of Academic Research in Business and Social Sciences, 14*(2). https://doi.org/10.6007/ijarbss/v14-i2/20827

McLinden, M., Douglas, G., Hewett, R., Lynch, P., & Thistlethwaite, J. (2020). *Teaching learners with vision impairment: An analysis of evidence-based practice.* https://doi.org/10.1093/acrefore/9780190264093.013.1233

Olumorin, C., Babalola, E., & Amoo, B. (2022). *Availability and use of assistive technology for learning amongst special students in Kwara State School for Special Needs. Indonesian Journal of Community and Special Needs Education, 2*(2), 79–88. https://doi.org/10.17509/ijcsne.v2i2.42776

Praptaningrum, A. (2020). *Penerapan bahan ajar audio untuk anak tunanetra tingkat SMP di Indonesia. Jurnal Teknologi Pendidikan: Jurnal Penelitian dan Pengembangan Pembelajaran, 5*(1), 1. https://doi.org/10.33394/jtp.v5i1.2849

Pratiwi, S. A. (2025). *Program Studi Bimbingan Penyuluhan Islam Fakultas Ushuluddin, Adab dan Dakwah Universitas Islam Negeri K.H. Abdurrahman Wahid Pekalongan.*

Selvam, B., & Piragasam, G. (2025). *Augmented reality's potential for addressing writing challenges in students with learning disabilities. British Journal of Special Education, 52*(2), 147–156. https://doi.org/10.1111/1467-8578.70005

Setyawati, N. R. (2021). *Peran guru dalam menumbuhkan minat membaca dan menulis Braille pada siswa tunanetra.*

Sim, I. (2020). *Analysis of the coping process among visually impaired individuals using interpretative phenomenological analysis (IPA). International Journal of Environmental Research and Public Health, 17*(8), 2819. https://doi.org/10.3390/ijerph17082819

Tarigan, H. G. (2021). *Menulis sebagai suatu keterampilan berbahasa.* Bandung: Angkasa.

Zakariah, M. A., Afriani, V., & Zakariah, K. H. M. (2020). *Metodologi penelitian kualitatif, kuantitatif, action research, research and development (R&D).* Yayasan Pondok Pesantren Al Mawaddah Warrahmah Kolaka. https://books.google.co.id/books?id=k8j4DwAAQBAJ