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Strengthening Literacy and Broadcasting Skills of Individuals with Visual Impairments through the Broadcast Braille Book

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Abstract

Inclusive education requires accessible learning media for persons with visual impairments. This community engagement program aimed to strengthen literacy, speaking, and public-speaking skills through Broadcast Braille Book. The program was conducted at PPS Pendowo Kudus using a participant active learning–project oriented approach involving teachers and beneficiaries. The activities included needs analysis, training, mentoring, media development, implementation, and evaluation. Broadcast Braille Book integrates Braille text, audio, and QR codes linked to instructional videos. The evaluation involved 15 teachers and 29 beneficiaries. The results showed that 24 beneficiaries (82.7%) experienced improved literacy skills, while 22 beneficiaries (75.8%) improved their speaking and public-speaking skills. In addition, 13 teachers (86.6%) improved their technological pedagogical competence, and 25 beneficiaries (86.2%) were able to use the media effectively. These results indicate that Broadcast Braille Book can support accessible learning, literacy development, communication skills, and learning independence among persons with visual impairments.

Keywords: artificial intelligence; biomechanics; computer vision; PostureSmart; posture analysis; TELOS

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INTRODUCTION

Inclusive education is not merely concerned with the provision of learning opportunities for individuals with disabilities, but also with the availability of learning environments, media, and strategies capable of accommodating their characteristics and learning needs. The principle of inclusive education positions accessibility as an essential element in ensuring every individual secures the opportunity to develop their competencies optimally. Within the context of sustainable development, individuals with disabilities constitute a group requiring access to quality, inclusive, equitable, and sustainable education. This aligns with the Sustainable Development Goals (SDGs), particularly the goal of quality education, as well as Indonesia's development agenda, which places the improvement of human resource quality, education, technology, and the empowerment of individuals with disabilities as a crucial facet of national development.

Based on the 2020 Long Form Population Census, there are approximately 23.5 million individuals with disabilities, representing around 8.6% of the Indonesian population, with approximately 6.9 million of them experiencing sensory disabilities (Statistik, 2024). This substantial number signifies that fulfilling the educational and skill development needs of individuals with disabilities is not an individual issue, but rather a part of a social and educational agenda requiring systematic intervention. Education for individuals with visual sensory impairments must be directed not only toward mastering basic skills but also toward the capacity to communicate, adapt to

technology, develop self-confidence, and actively participate in social life. One of the fundamental competencies for individuals with visual impairments is Braille literacy. Braille functions not only as a reading and writing system but also serves as a gateway for knowledge development, cognitive abilities, communication, and learning independence. Studies on inclusive education demonstrate that barriers to accessing appropriate learning resources and environments can diminish the opportunities for individuals with disabilities to develop their potential optimally (Croake et al., 2025). Furthermore, Croake et al. (2025) emphasize the importance of evidence-based pedagogy in Braille instruction for beginning readers. Meanwhile, a systematic review by Kana and Hagos indicates that the use of Braille in learning and assessment continues to encounter various barriers (Kana & Hagos, 2025). These barriers indicate that literacy issues among individuals with visual impairments cannot be adequately resolved merely by providing Braille materials but rather require learning media and approaches tailored to the learners' characteristics.

This issue was also identified at the Pendowo Social Service Institution (PPS Pendowo) in Kudus. This institution served as the partner in this community service activity, comprising 30 teachers and 41 Beneficiaries (*Penerima Manfaat* / PM) with visual impairments. The educational program at PPS Pendowo is aimed at equipping PMs with various skills to enable them to live independently in society. Literacy and technological adaptation constitute crucial components of this program. However, observations and interviews with the partner revealed that PMs continue to experience difficulties in reading, arguing, and conveying ideas in a structured manner. Conversely, PMs possess a relatively strong potential in oral communication. They demonstrate acute hearing sensitivity and are capable of storytelling, playing traditional *karawitan* music, becoming *sinden* (traditional singers), performing as comedians, opening events or serving as MCs (Master of Ceremonies), creating content, and utilizing mobile phones and social media. This condition highlights a discrepancy between the PMs' communication potential and the literacy and structured communication skills they have mastered.

Braille literacy barriers act as one of the factors exacerbating this discrepancy. Braille instruction at PPS Pendowo commences with the introduction of letters, numbers, and punctuation marks. According to the teachers, this process requires a relatively extensive duration; on average, PMs require approximately two semesters to achieve fluency in reading and writing Braille. This condition is further compounded by the limited availability of Braille books. Instruction still predominantly utilizes paper, reglets, and styluses, while materials manually developed by teachers face limitations in quantity and sustainable access. When PMs forget previously learned materials, the instructional process must be repeated.

The problem lies not only in the limited instructional materials. PPS Pendowo also confronts a shortage of Braille instructional resources. Based on the partner's situational analysis, there is only one teacher specifically teaching Braille characters. Should this teacher be absent, the instruction must be transferred to another teacher. Concurrently, teachers still require technological competency reinforcement to develop Braille learning media suited to the PMs' characteristics. This situation demonstrates that learning accessibility needs to be established through media that allow PMs to learn more flexibly and not rely entirely on the presence of a teacher.

The need for digital technology development is becoming increasingly critical for individuals with visual impairments. Individuals with visual sensory impairments possess the potential to utilize digital technology provided accessible technology and media are available. Studies on literacy among individuals with visual impairments indicate that access to information is a vital aspect in supporting their capacity to acquire, comprehend, and utilize information (Loh et al., 2024). Meanwhile, the impact of visual impairments on reading and literacy demonstrates that visual barriers can correlate with challenges in literacy development if unsupported by appropriate interventions and learning access (Isitan & Okyar, 2025). Consequently, the integration of technology into Braille media must be directed not merely as a technical innovation, but as a strategy to expand learning access, enhance independence, and reduce PMs' reliance on direct assistance.

Speaking and broadcasting (*kepewaraan*) skills constitute an inseparable aspect of literacy strengthening. Literacy enables PMs to acquire and comprehend information, while speaking skills allow them to articulate ideas clearly and structurally. Broadcasting then becomes the practical application of communication skills in real-life situations, such as hosting events, serving as an MC, conveying information, and communicating in public spaces. The community service proposal indicated that PMs actually possess the potential to execute broadcasting activities but still require reinforcement in literacy, argumentation, speaking skills, and self-confidence. Several previous studies

have provided an essential foundation for the development of more accessible learning. Croake, Gentle, and Duncan emphasized the use of evidence-based pedagogy in Braille instruction for beginning readers (Croake et al., 2025). Through a systematic review, Kana and Hagos identified various factors hindering the use of Braille for learning and assessment of students with visual impairments (Kana & Hagos, 2025). Meanwhile, research findings by Choi et al. (2023) also demonstrated the importance of bridging the literacy gap for individuals with visual impairments through appropriate information access. Additionally, Loh et al. (2024), through a systematic review, positioned visual impairment as a factor requiring attention in reading and educational literacy development. A study conducted by Anwar et al. (2025) concerning inclusive education policy in Indonesia also highlighted the importance of policy support to strengthen the implementation of education capable of accommodating the needs of individuals with disabilities.

Although these studies have provided a crucial foundation for the development of accessible education, there remains a gap in the integration of various forms of learning access and functional skills within a single learning medium. Previous research has tended to address Braille instruction, information access, literacy, or accessible technology separately. No approach has been found that specifically integrates Braille literacy, speaking skills, and broadcasting with instructional audio and video access within a single medium developed based on the actual needs of individuals with visual impairments. This gap becomes increasingly critical in the context of PPS Pendowo because the PMs' needs are not limited to accessing reading materials but also encompass the ability to utilize information to formulate and convey ideas in public communication. Thus, the partner's needs lie at the intersection of instructional material accessibility, literacy strengthening, functional communication development, and digital technology utilization. Research regarding digital accessibility innovation has demonstrated the potential of integrating QR codes with the Braille system as a form of access to digital learning resources (Fauziyah & Inawati, 2025).

Addressing this gap, this community service activity provides assistance in the development of the *Broadcast Braille Book* as a multimodal learning medium integrating alphabetical and Braille texts, audio, and QR codes linked to instructional videos. The novelty of this activity resides in the integration of three instructional functions within a single medium: (1) providing tactile access through Braille, (2) providing informational reinforcement through audio and video, and (3) connecting literacy with speaking and broadcasting skills that can be practiced by PMs. Beyond being user-oriented, media development also involved teachers in the production of instructional videos and media integration, ensuring the innovation did not cease at product provision but simultaneously built the partner's capacity to develop learning media sustainably.

The *Broadcast Braille Book* is designed not merely as a Braille book, but as a multimodal learning medium enabling PMs to read, listen to material explanations, access videos via QR codes, and conduct exercises more independently. Audio is utilized to provide material explanations accessible to PMs, while QR codes enable PMs to access instructional videos using mobile phones. The developed materials encompass literacy, speaking skills, and broadcasting so that the learning process is directed from the ability to access information, comprehend materials, formulate ideas, to conveying ideas orally. Through this approach, the *Broadcast Braille Book* functions not only as an access medium to instructional materials but also as a bridge between literacy and functional communication skills.

Strengthening literacy through the *Broadcast Braille Book* is not solely intended to improve Braille reading abilities but also to cultivate speaking and broadcasting skills as capital for communication and social participation. These abilities are expected to strengthen PMs' self-confidence, open spaces for self-actualization, and enhance their independence in social life. This program concurrently addresses the partner's primary issues comprising limited literacy, communication and broadcasting skills, limited accessible learning media, and teachers' needs for technology-based media development. Therefore, this article aims to describe the development and implementation process of the *Broadcast Braille Book* and analyze the program's achievements in strengthening literacy, speaking, and broadcasting skills of individuals with visual impairments through accessible, multimodal learning media that support learning independence.

METHOD

This community service activity utilized a participant active learning-project oriented approach, implemented in a participatory and collaborative manner with the partner at the Pendowo Social Service Institution (PPS Pendowo) in Kudus. This approach was selected because the teachers and

Beneficiaries (PM) were not merely positioned as program recipients, but were actively involved in the processes of needs identification, planning, development, implementation, and evaluation of the learning media. The activity partners consisted of teachers and PMs with visual sensory impairments at PPS Pendowo Kudus.

The activity was implemented through several stages. The first stage was a needs assessment, conducted through field observations, interviews with the partner, literature analysis, and the identification of learning barriers. This stage was directed at obtaining an overview of Braille literacy abilities, speaking and broadcasting skills, the availability of learning media, and the teachers' capabilities in utilizing technology.

The second stage consisted of training and mentoring, encompassing the reinforcement of literacy, speaking skills, broadcasting, and teachers' technological competencies. Teachers were mentored in developing educational learning videos and integrating these videos into QR codes. Subsequently, the team, alongside the partner, developed the *Broadcast Braille Book*, which integrated alphabetical and Braille texts, audio, and QR codes linked to the instructional videos.

The third stage was the implementation of the media to the PMs through the practice of reading Braille, literacy, speaking, and broadcasting. PMs were provided the opportunity to access materials via Braille, audio, and video using available devices, thereby enabling them to review the materials independently. The final stage was the evaluation, conducted to determine the implementation of the media utilization as well as changes in the PMs' literacy, speaking, and broadcasting skills. The program's success indicator was established at a minimum of 75% of PMs experiencing an improvement in skills after participating in the mentoring program.

The program evaluation was conducted to ascertain the participants' skill achievements, the teachers' capabilities in developing media, and the usability of the *Broadcast Braille Book*. The evaluation utilized instruments formulated based on the program's success indicators. The evaluation instruments encompassed several aspects, namely: (1) teachers' pedagogical technological competencies, (2) PMs' literacy skills, (3) PMs' speaking and broadcasting skills, and (4) PMs' ability to utilize the *Broadcast Braille Book*.

RESULTS AND DISCUSSION

The implementation of the mentoring activity for the development of the *Broadcast Braille Book* yielded achievements in several primary aspects, namely teachers' competencies in media development, the literacy skills of Beneficiaries (PM), PMs' speaking and broadcasting skills, media utilization, and the availability of instructional products. The evaluation involved 15 teachers and 29 PMs. The program's success indicator was established at a minimum of 75% of participants experiencing skill improvements after the mentoring program. Overall, the majority of the quantitative indicators met or exceeded this target.

Table 1. Mentoring Activity Indicator Achievements

Achieved Aspect	Target	Achievement	Remarks
Teachers' TPACK Competency	≥ 75%	86.6%	Exceeded target
PMs' Literacy Ability	≥ 75%	82.7%	Exceeded target
Speaking and Broadcasting Skills	≥ 75%	75.8%	Exceeded target
Teachers' Technological Skills	≥ 75%	86.6%	Exceeded target
Media Utilization by PMs	≥ 75%	86.2%	Exceeded target
<i>Broadcast Braille Book</i> Product	100%	100%	Target achieved
Independence and Self-Confidence	Program sustainability	Directed to become role models	Sustainability reinforcement

The data demonstrate that all primary quantitative indicators met or exceeded the program targets. The highest achievement in the PM aspect was in speaking and broadcasting skills, comprising 22 out of 29 PMs (75.8%), while in the literacy aspect, 24 out of 29 PMs (82.7%) exhibited improvement. Meanwhile, within the teacher group, 13 out of 15 teachers (86.6%) experienced an increase in TPACK competencies and were capable of creating educational learning videos. The

primary product of the program, the *Broadcast Braille Book*, was also successfully made available according to the design, achieving a 100% product indicator. The findings indicate that the program was capable of addressing not only the availability of accessible learning media but also the capacity of teachers and PMs to utilize the media. However, these achievements cannot be interpreted as evidence that the media automatically caused the improvement. Instead, these results must be understood in relation to the participants' characteristics, the multimodal media design, the participatory implementation process, and the learning conditions at PPS Pendowo.

Enhancement of Teachers' Competencies in Media Development

One of the significant outcomes of the activity was the enhancement of the teachers' abilities to utilize technology in developing learning media suited to the characteristics of PMs with visual sensory impairments. A total of 13 out of 15 teachers, or 86.6%, experienced an improvement in their TPACK abilities. This achievement was 11.6 percentage points above the minimum target of 75%. In addition to TPACK enhancement, 13 teachers were also capable of creating educational learning videos. This achievement demonstrates that the mentoring was not solely oriented toward providing products to PMs but also building the teachers' capacities as media developers. This is crucial because the partner's initial problem related not only to limited instructional materials but also to the teachers' abilities to develop media aligned with the PMs' characteristics. In the program design, teachers were involved in identifying learning outcomes, developing videos, converting videos into QR codes, and compiling the *Broadcast Braille Book*.

This finding indicates that the activity contributed not merely to the provision of learning products but also to the partner's capacity building. This is essential because the initial issue at PPS Pendowo was not confined to a lack of Braille learning materials. Teachers also faced limitations in developing easily accessible learning media using technology. Therefore, involving teachers in the development process provided hands-on learning experiences in designing, producing, and integrating digital learning content. This participatory approach supports professional growth and improved educational outcomes (Chatmaneeerungcharoen, 2025; Abdullah et al., 2024; Michos et al., 2020).

This enhancement can be interpreted through the participatory and project-oriented characteristics of the program. Teachers were not only positioned as end-users of a finished product but were also involved in identifying learning needs, developing educational videos, integrating videos into QR Codes, and preparing the *Broadcast Braille Book*. When teachers engage in authentic, technology-integrated activities in designing lessons or assessments utilizing digital tools, they develop technological pedagogical content knowledge (TPACK) and other digital competencies directly linked to their teaching practices (Hilyana et al., 2026; Masfuah et al., 2024). This involvement creates opportunities for teachers to learn technology through authentic pedagogical tasks. Technological competencies were not developed in isolation from teaching practices, but through a process of solving actual instructional problems faced by the partner.

These findings concurrently reinforce the argument that media innovation for individuals with disabilities must consider the readiness of the human resources utilizing it. Accessible media will not yield optimal impacts if teachers lack the competencies to operate, develop, and adapt them to the PMs' needs (Kuryanto et al., 2023). Consequently, the enhancement of teachers' TPACK in this activity became a vital component complementing the development of the *Broadcast Braille Book*.

The program's contribution lies in bridging media development with capacity building. Easily accessible technology tends to emphasize technological functionality, whereas this program positioned teachers as part of the accessibility ecosystem. Teachers play a pivotal role in the accessibility ecosystem. Their involvement goes beyond merely using accessible technology; they are responsible for integrating these tools into teaching practices, tailoring them to individual students' needs, and fostering inclusive learning environments (Shaheen, 2025). This circumstance ensures that the future existence of the *Broadcast Braille Book* does not rely entirely on the program team, as the teachers have acquired experience in producing and adapting supporting learning content. This aspect strengthens the practical contribution of the program beyond the mere production of a single learning product.

Strengthening Beneficiaries' (PMs') Literacy

The evaluation demonstrated that 24 out of 29 PMs (82.7%) experienced an improvement in literacy skills. This figure exceeded the program target of 75% by a margin of 7.7 percentage points. The literacy indicators utilized in this program included literacy skills, Braille reading, and scientific

literacy. Prior to the mentoring, Braille instruction relied heavily on paper, reglets, and styluses, while the availability of Braille learning materials was limited. The learning process also required a relatively long time. Based on information from the teachers, PMs generally required approximately two semesters to achieve fluency in reading and writing Braille. As a result, when learners reviewed previously studied materials, they were relatively dependent on the availability of teachers and learning materials.

The *Broadcast Braille Book* provided an alternative to these conditions by combining alphabet letters and Braille within a single medium, as well as providing audio and QR codes directing to instructional videos. Thus, PMs gained multiple pathways to access information. The material did not stop at Braille text but could be reinforced through auditory and audiovisual information. The combined utilization of several features in a learning medium provides flexibility for participants to learn independently (Fardani et al., 2025).

The 82.7% literacy improvement also indicates that the developed media was quite relevant to the PMs' learning characteristics. In prior studies, Croake et al. (2025) emphasized the importance of evidence-based pedagogy in Braille instruction for beginning readers. Meanwhile, Kana & Hagos (2025) identified various barriers to using Braille in learning and assessment for students with visual impairments. These research findings indicate that Braille instruction cannot be separated from the availability of appropriate teaching strategies and accessible learning conditions. This program complements these findings by demonstrating a practical model where Braille is combined with auditory and digital access, rather than being used as the sole learning channel.

This finding also aligns with Loh et al. (2024), who emphasized the connection between learning access and the development of reading and literacy among individuals with visual impairments. In this program, accessibility was implemented not merely by converting printed materials into Braille, but by providing various modalities for PMs to access, review, and practice learning content.

Nevertheless, the 82.7% achievement also reveals that the mentoring did not yield uniform outcomes for all PMs. Five out of the 29 PMs (17.3%) were not included in the group demonstrating improvement according to the program indicators. The available evaluation data indicated that some participants experienced visual impairments acquired from workplace accidents rather than congenital conditions, while some newly enrolled PMs had joined the institution less than a month prior to the intervention and were still adapting to the learning environment. This condition suggests that differences in initial experiences and adaptation can influence learning outcomes.

Current findings cannot yet prove that the *Broadcast Braille Book* is universally superior to conventional Braille instruction. Rather, these results suggest that integrating Braille with audio and digital access is a relevant practical strategy to respond to the limitations of learning materials identified at PPS Pendowo. Integrating Braille, audio, and digital formats allows visually impaired students to access a broader range of educational materials, overcoming the shortages of traditional Braille books and high-quality audio resources (Liu et al., 2023; Cuhazriansyah et al., 2026). The program's contribution lies in the integration of various accessibility modes into a single learning medium and its application within an actual learning context involving PMs with heterogeneous abilities.

Strengthening PMs' Speaking and Broadcasting Skills

Strengthening speaking and broadcasting skills was a primary focus in the implementation of the *Broadcast Braille Book*. The evaluation results showed that 22 out of 29 PMs, or 75.8%, experienced an improvement in speaking and broadcasting skills. This achievement met the established program success indicator, specifically a minimum of 75% of PMs experiencing skill improvement. Thus, although the achievement in this aspect did not show an increase as high as some other indicators, the program successfully met the set target.

This finding is highly relevant because the PMs' initial condition was not characterized by a lack of oral communication abilities. Interview results revealed that several PMs already had experience in storytelling, performing as *sinden*, playing *karawitan*, entertaining audiences, hosting events, producing content, and utilizing mobile phones and social media. Therefore, the main challenge was not merely the ability to speak, but the ability to organize ideas, control delivery and intonation, and use oral communication in a structured context.

The *Broadcast Braille Book* bridges literacy activities with speaking and broadcasting practices. PMs access information via Braille, audio, and video, then use that information as material to organize and express ideas orally. The subsequent learning sequence begins with accessing information,

comprehending the content, organizing ideas, conveying information, and practicing public speaking. This explains why the medium is relevant not only for literacy but also for functional communication. Enhancing good communication skills requires several essential aspects, one of which is experience in social interaction (Salikhova et al., 2023; Efrat & Zait, 2024).

This finding is consistent with Salikhova et al. (2023), who emphasized the role of communication tools and social interactions in developing communication competencies. It also aligns with Efrat & Zait (2024), demonstrating the importance of interaction and training experiences in developing interpersonal communication skills. Additionally, Roysa et al. (2026) specifically highlighted the importance of strengthening public speaking competencies through structured training. These findings provide a theoretical basis for understanding why the use of learning content must be followed by opportunities for communication practice.

However, this mentoring differed in terms of the subjects' initial competencies. Previous research discussed communication competencies, interaction, or public speaking training, whereas the *Broadcast Braille Book* sought to establish a connection between accessible literacy and public speaking practice. Literacy materials were not treated merely as reading content but as resources that could be transformed into oral communication. In this regard, the program expanded the function of accessible learning media from facilitating access to information toward facilitating the functional use of information.

Nonetheless, the 75.8% achievement must be interpreted cautiously. Because the result was only slightly above the predetermined threshold, it suggests that speaking and broadcasting skills may require more intensive and repetitive practice than merely having access to learning materials. Therefore, this finding indicates that the *Broadcast Braille Book* functions as a supportive medium rather than a complete substitute for direct communication practice. Repeated practice, feedback on intonation, delivery pacing, self-confidence, and audience interaction remain vital components in developing public speaking abilities.

Thus, compared to previous studies, this program's contribution is not a claim of superior effectiveness, but rather a demonstration of a functional relationship between literacy access and communication practice for individuals with visual impairments. This relationship is highly relevant to the context of PPS Pendowo, where visually impaired individuals already possess oral communication potential but require support in developing more structured communication. Through this pattern, literacy is not positioned as a standalone capability, but as a foundation for building functional communication (Cuhanazriansyah et al., 2026).

Availability and Utilization of the Broadcast Braille Book

The production process of the *Broadcast Braille Book* began with designing an interactive book that integrated Braille text and an audio system within a single learning medium. Each page of the book was equipped with Braille writing and a sound player button functioning as audio access for the material on that page. The electronic system was then assembled using an Arduino Mega 2560 R3 as the main controller, a DFPlayer Mini as an MP3 file player stored on a Micro SD Card, speakers for sound output, and several push buttons, each linked to a book page. These components were neatly housed within the book's casing and connected using cables and a 5–9V battery or power bank power source. Once the circuit was installed, the Arduino program was uploaded via a computer to map the relationship between each button and the corresponding audio file. The workflow dictates that when a user presses a button on a specific page, the Arduino reads the button input and sends a command to the DFPlayer Mini to play the corresponding MP3 file from the Micro SD Card; subsequently, the learning material's audio is output through the speaker. Consequently, the production process yielded an Arduino-based interactive Braille book enabling PMs to access materials tactilely via Braille while simultaneously auditorily via the audio system, ensuring the media can be utilized more interactively, educationally, and support independent learning for individuals with visual sensory impairments.

Viewed from a functional aspect, this medium provides two primary forms of direct access and one additional digital pathway. PMs can access information tactilely via Braille, listen to audio content through the integrated audio system, and access instructional videos via QR Codes using mobile phones. The integration of these features is relevant to the PMs' learning conditions because the participants possess heterogeneous Braille reading abilities and are already familiar with mobile phone technology.

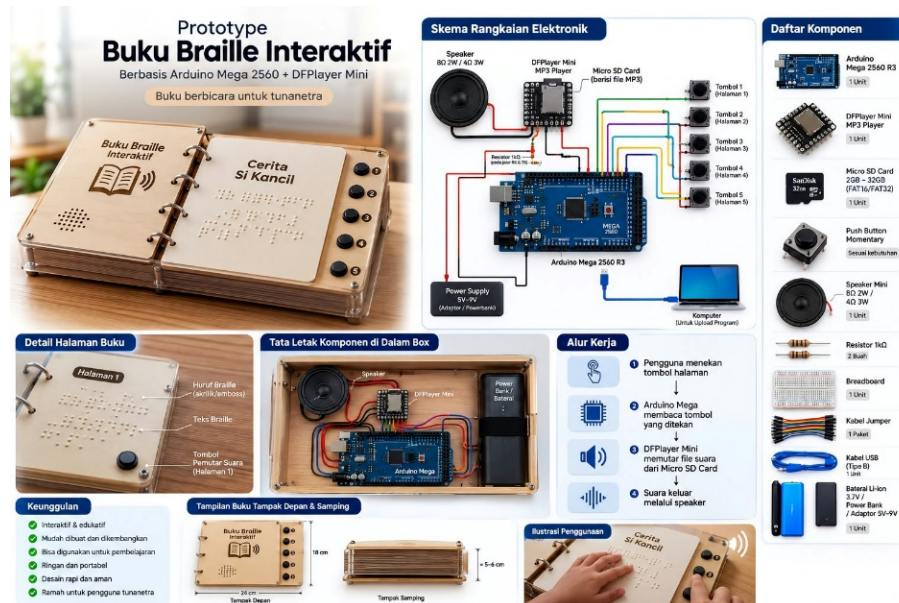


Figure 1. Flowchart of the Broadcast Braille Book

This finding is supported by Fauziyah & Inawati (2025), who demonstrated the potential of digital access technology, including QR Code-based approaches, to enhance information accessibility for visually impaired individuals. This program broadens that approach by embedding QR Code access within Braille learning media and combining it with an integrated audio system. As a result, the QR Code is not positioned as a standalone technology, but as a component of a broader multimodal learning environment.

Further utilization data revealed that 25 out of 29 PMs (86.2%) were able to use the media effectively. This achievement exceeded the 75% minimum target. The relatively high utilization rate indicates that the technical complexity of the system did not deter the majority of participants from interacting with the media. This may be related to the use of simple physical controls, namely push buttons, alongside familiar mobile phone functions to access the QR Code content.

This finding is consistent with broader arguments in accessible technology research asserting that technology becomes meaningful when aligned with user characteristics and access practices (Shaheen, 2025; Liu et al., 2023). However, this result cannot be interpreted as evidence that the technology itself determines learning success. The high utilization rate occurred within a program encompassing training and mentoring. Therefore, this finding demonstrates the feasibility and usability of the developed media within the specific context of PPS Pendowo, rather than proving that identical utilization rates would automatically occur in other environments.

The position of the *Broadcast Braille Book* based on previous research is complementary. This medium merges Braille, Audio, and Technology into an integrated learning environment. This integration is a critical practical contribution because the accessibility issues identified at PPS Pendowo were multidimensional: limited Braille materials, reliance on teacher assistance, and the need for more flexible access to learning content. This product addresses these issues simultaneously.

Program Contribution to Independence and Sustainability

The final contribution pertains to learning independence and program sustainability. The implementation of the *Broadcast Braille Book* created opportunities for PMs to review learning materials via Braille, audio, and digital videos without having to rely entirely on direct teacher explanations. At the institutional level, teachers' involvement in producing instructional videos and integrating them into the media also provided a foundation for the sustainable adaptation of learning content.

The potential for increasing PMs' learning independence is theoretically linked to the availability of flexible information access. When learners can review learning materials through more than one access mode, learning is no longer entirely dependent on teacher instruction time. Integrated Braille and audio learning resources empower visually impaired students to learn independently, improve comprehension, and access a wider range of educational materials, making them essential tools for

inclusive education (Liu et al., 2023). This is highly relevant to the initial conditions at PPS Pendowo, where the limited number of teachers with specialized Braille expertise created potential bottlenecks for continuous learning.

This finding is consistent with other literature emphasizing the importance of accessible information and learning resources for individuals with visual impairments. Loh et al. (2024) highlighted the importance of access in supporting reading and literacy development, while Croake et al. (2025) emphasized the necessity of appropriate pedagogical support in Braille learning. This program adds an implementation perspective by demonstrating how accessibility can be integrated into physical learning media combining tactile, auditory, and digital access.

However, learning independence and sustainability must be distinguished from measured outcomes such as reading, speaking, and media utilization abilities. This evaluation did not quantitatively measure long-term independence or program sustainability beyond the intervention period. Therefore, contributions to independence must be interpreted as potential and programmatic implications, rather than directly measured causal outcomes.

Sustainability potential was reinforced by teachers' involvement in media development. Instead of leaving a finished product to the partner, this program transferred a portion of the knowledge required to produce supporting digital learning content. This approach is vital because accessible media can become difficult to maintain when their development relies entirely on external facilitators. Teacher participation creates the possibility to adapt the media according to future learning needs.

Overall, the findings suggest that the *Broadcast Braille Book* operates on three interrelated levels. First, at the accessibility level, it combines Braille, audio, and QR Code-based digital content to provide multiple information access pathways. Second, at the competency level, it supports literacy, speaking, and public speaking practices. Third, at the capacity-building level, it strengthens teachers' abilities to participate in developing accessible learning content. These three levels distinguish this program from approaches that focus solely on producing accessible materials.

Overall, these findings should be positioned as evidence of the feasibility and contextual relevance of integrated multimodal learning media, rather than definitive proof of superiority over conventional Braille instruction or other accessible technologies. The results are generally consistent with previous studies emphasizing Braille accessibility, information access, digital accessibility, and communication development. Furthermore, extended discussions are required regarding the integration of elements within the *Broadcast Braille Book* designed specifically for the literacy and public speaking needs of individuals with visual disabilities at PPS Pendowo Kudus.

CONCLUSION

The community service activity through the *Broadcast Braille Book* successfully strengthened learning access and skills for individuals with visual sensory impairments through the integration of Braille, audio, and digital technology. The program's implementation demonstrated that 82.7% of Beneficiaries (PMs) experienced an improvement in literacy, and 75.8% experienced an improvement in speaking and broadcasting skills, thereby achieving the minimum success indicator of 75%. Furthermore, 86.6% of teachers experienced an enhancement in TPACK competencies, the *Broadcast Braille Book* medium was successfully developed in its entirety, and 86.2% of PMs were able to utilize it optimally. Thus, the *Broadcast Braille Book* functions not only as an accessible literacy medium but also as a vehicle for developing PMs' communication skills, broadcasting abilities, and learning independence.

DECLARATION OF GENERATIVE AI

During the preparation of this work, the author(s) utilized Google Gemini to assist in the creation of Figure 1. Furthermore, Grammarly was employed to proofread the manuscript and enhance the overall language quality. Following the use of these tools, the author(s) thoroughly reviewed and edited the content as needed and take(s) full responsibility for the final content and integrity of the publication.

CONFLICTING INTEREST STATEMENT

The authors states that there is no conflict of interest in the publication of this article.

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