

# Development of a User-Centered "Dini Talk" Alternative Communication System to Support Functional Communication in Children with Cerebral Palsy

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## Article Info

### Article history:

Received : November 12, 2025

Revised : December 12, 2025

Accepted : February 24, 2026

### Keywords:

Augmentative and Alternative ;  
Communication;  
Cerebral Palsy;  
Assistive Technology;  
Special Education;  
User-centered Design.

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## ABSTRACT

Children with cerebral palsy often face communication barriers caused by motor and speech impairments, which limit their participation in classroom activities and daily interaction. Although Augmentative and Alternative Communication (AAC) systems are widely used, many available devices are not sufficiently adapted to users' motor abilities and educational needs. This study aimed to develop and evaluate DiniTalk, a user-centered AAC system designed to support functional communication in a child with cerebral palsy in an educational setting. The study used a field-based research and development design adapted from the ADDIE model. Data were collected through observation, interviews, and documentation, and were analyzed qualitatively. DiniTalk was designed as a low-cost AAC device with large accessible buttons and auditory output to accommodate motor limitations. The findings showed that the child's AAC performance improved from 22% in the initial session to 88% in the final session, indicating increased communicative independence and more effective device use. These findings suggest that accessibility-driven AAC design can support functional communication and serve as an instructional aid in special and inclusive education.

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## INTRODUCTION

Communication is a fundamental component of human interaction and plays a central role in children's participation in learning, social engagement, and the development of autonomy. In educational settings, communication enables children to express needs, respond to instructions, interact with peers, and engage meaningfully in classroom routines. For children with disabilities, especially those with complex motor and speech impairments, access to effective communication support is essential to ensure equitable participation in educational activities. In this regard, augmentative and alternative communication (AAC) has been widely recognized as an important means of supporting children whose spoken language is limited or absent. AAC includes various strategies, symbols, communication boards, and speech-generating tools that help users express messages functionally in everyday contexts.

Children with cerebral palsy frequently experience barriers in functional communication due to impairments in motor control, speech production, and, in some cases, language processing. These barriers

may reduce their opportunities to participate in classroom interaction, respond to teachers' instructions, and communicate with peers effectively. Previous studies have shown that AAC can support communication participation in children with cerebral palsy and other individuals with complex communication needs by providing alternative pathways for expression and interaction (Riswari et al., 2022; Syahid, 2020; Choi et al., 2010). In addition, studies on communication media and therapeutic supports for children with cerebral palsy suggest that educational and assistive interventions need to be carefully adapted to users' physical and communicative characteristics in order to be effective (Saleh et al., 2024; Assabilia et al., 2024).

Although AAC has been increasingly discussed in special and inclusive education, many existing systems remain generic and are not sufficiently tailored to the user's motor accessibility, cognitive readiness, and instructional context. In many school settings, AAC tools are still positioned mainly as assistive devices for basic expression, rather than as pedagogical supports that facilitate participation in learning processes. Several development studies in Indonesia have reported the design of assistive products for children with cerebral palsy, such as educational communication aids, communication systems, and adaptive learning media (Mutiar, 2021; Warahmah et al., 2023; Azarah & Budi, 2025). However, many of these developments place stronger emphasis on product creation than on how the system functions as a contextually adaptive instructional support within classroom routines. Likewise, development studies using the ADDIE model have demonstrated the usefulness of systematic instructional design in educational media production (Juanda & Hendriyani, 2022; Rustandi, 2021; Rokhim & Rohmah, 2020), yet their application to AAC development for children with cerebral palsy in authentic learning settings remains limited.

Recent international literature also indicates that AAC should not be viewed solely as a compensatory communication tool, but as a medium that can support language development, participation, and instructional engagement when used consistently in natural contexts. AAC-based interventions have been associated with improvements not only in message expression but also in learning interaction and communicative competence development (Gibson et al., 2021; West et al., 2023; Von Tetzchner, 2025). Furthermore, school-based studies suggest that children who require AAC benefit from structured instructional support, repeated practice, and contextually meaningful communication opportunities within learning environments (Ulriksen et al., 2024). These findings imply that effective AAC systems should integrate accessibility, simplicity, and pedagogical relevance rather than focusing only on technical functionality.

Based on this gap, there is a need to develop an AAC system that is user-centered, low-cost, and aligned with the communicative as well as instructional needs of children with cerebral palsy in school settings. The present study addresses this need by developing DiniTalk, an alternative communication system designed to support functional communication in a child with cerebral palsy through accessible buttons, auditory output, and a contextually adaptive interface. The novelty of this study lies not only in developing an AAC device, but in positioning the device as an instructional scaffold that supports communication participation within educational activities. Therefore, this study aims to develop and evaluate the DiniTalk AAC system as a user-centered communication support for children with cerebral palsy in an educational context.

## **METHOD**

This study employed a research and development (R&D) approach with a single-case field-based implementation to develop and evaluate a user-centered augmentative and alternative communication (AAC) system for a child with cerebral palsy. This approach was appropriate because AAC development requires adjustment to the user's individual communication needs, motor characteristics, and educational context (Branch, 2009; Creswell & Poth, 2016; Ledford & Gast, 2024). The development procedure was adapted from the ADDIE model, consisting of analysis, design, development, implementation, and evaluation (Purnamasari, 2019; Juanda & Hendriyani, 2022; Branch, 2009). In the analysis stage, observations and semi-structured interviews with teachers and caregivers were conducted to identify the participant's communication barriers, motor limitations, and classroom communication needs. The findings were then used to design the DiniTalk system, including symbol selection, button size, layout, and auditory output. The prototype was developed and refined before being implemented in repeated communication sessions within the participant's natural learning setting. Continuous evaluation was conducted to assess usability and communication performance.

Table 1. Research Procedure

Stages	Main Activities	Output
Analysis	Observation and interviews to identify communication needs, motor limitations, and learning routines	User needs profile
Design	Selection of symbols, button layout, and audio output planning	Initial DiniTalk design
Development	Prototype construction and revision	Functional AAC prototype
Implementation	Repeated use in communication sessions	Field implementation data
Evaluation	Monitoring usability and communication performance	Final Evaluative Finding

The participant was one child with cerebral palsy who had limited functional speech and required communication support in learning activities. A single-case design was chosen because AAC intervention and development are highly individualized and are often examined intensively within a specific case context (Creswell & Poth, 2016; Ledford & Gast, 2024). Data were collected through observation, interviews, and documentation. Observation was used to record communication attempts, independence, and device accessibility during each session, while interviews with teachers and caregivers provided contextual information on the participant’s communication needs and progress. Documentation included field notes and prototype records. To enhance trustworthiness, the findings were interpreted through data triangulation (Creswell & Poth, 2016; Miles et al., 2014).

The main indicator in this study was AAC performance, defined as the percentage of successful independent communication attempts out of the total communication opportunities in each session. A successful attempt referred to the participant’s ability to independently select the appropriate symbol or button to express an intended message. This indicator was used because functional AAC use is closely related to communicative independence in context (Choi et al., 2010; Gibson et al., 2021). Data were analyzed qualitatively through data reduction, data display, and conclusion drawing, while descriptive percentages were used to support the interpretation of performance change (Miles et al., 2014; Creswell & Poth, 2016).

## RESULTS AND DISCUSSION

### Results

#### *Improvement in Functional Communication Performance Using DiniTalk*

The implementation of the DiniTalk augmentative and alternative communication (AAC) system showed a clear improvement in the participant’s functional communication performance during the intervention sessions. At the beginning of the implementation, the participant demonstrated limited ability to use the device independently, with AAC performance recorded at 22% in the initial session. This finding indicated that the participant still experienced considerable difficulty in accessing the device, selecting the intended symbol, and using the AAC system independently in response to communication opportunities. After repeated use of DiniTalk in structured communication activities, the participant’s performance gradually increased and reached 88% in the final session. This change shows that the participant became more able to operate the device and use it to convey intended messages in an educational context.

The increase in performance was also reflected in observable changes during the implementation process. In the early sessions, the participant often required assistance or prompting to press the intended button and complete a communicative act. The participant’s responses were relatively slow and inconsistent, and several communication opportunities were not completed successfully. However, in subsequent sessions, the participant showed better control in accessing the buttons, improved accuracy in selecting symbols, and greater consistency in using the device to respond to prompts and express needs. By the final phase of implementation, the participant was able to perform more communication attempts independently, indicating improved communicative engagement and reduced dependence on external assistance.

These findings suggest that DiniTalk functioned effectively as an accessible communication aid for the participant. The progression from low initial performance to higher final performance demonstrates that the system was increasingly usable within the participant’s daily learning environment. This result is in line with previous studies reporting that AAC systems can support functional communication in individuals with complex communication needs when the tools are adapted to user characteristics and communication demands (Choi et al., 2010; Riswari et al., 2022; Shopianty, 2019). In the present study, the observed improvement provides empirical support that the DiniTalk device was able to facilitate more independent communication performance during the implementation period.

Table 1. Improvement of AAC Performance During DiniTalk Implementation

Indicator	Initial Session	Final Session
AAC performance (%)	22%	88%
Level of independence	Low	High
Need for prompting	Frequent	Minimal
Accuracy in symbol/button selection	Limited	Improved
Communication response consistency	Inconsistent	More Consistent

### Development and Features of the DiniTalk Device

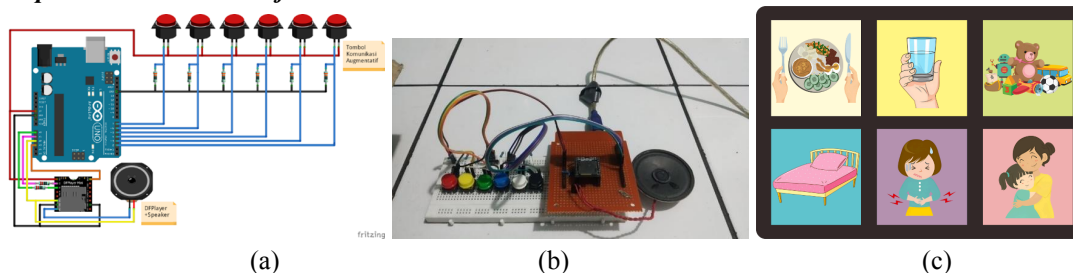


Figure 1. (a) Electronic schematic of augmentative communication device, (b) Electronics realization phase 1 augmentative communication device, (c) Casing dan menu display on the “dini talk” tool

The development process resulted in a functional DiniTalk augmentative and alternative communication (AAC) device designed to support the communication needs of a child with cerebral palsy in an educational setting. The device was developed as a user-centered and low-cost AAC system that prioritized accessibility, simplicity, and relevance to the participant’s daily communication activities. The final product consisted of a communication device with large accessible buttons, a simple visual menu, and auditory output to support message delivery during structured communication activities.

The physical and technical development of DiniTalk was carried out gradually, beginning with the preparation of the electronic system, followed by prototype realization, and ending with the completion of the outer casing and menu display. Figure 2 (a) presents the electronic schematic of the augmentative communication device, showing the arrangement of the main hardware components used to operate the system. Figure 2 (b) shows the initial realization phase of the electronics, in which the components were assembled and tested to ensure that the buttons, audio output, and control system functioned properly. Figure 2 (c) presents the final appearance of the DiniTalk device, including the casing and menu display used to support the participant’s communication choices.

The design of the device was adjusted to the participant’s communication profile and motor limitations identified during the analysis stage. The use of large buttons was intended to make access easier for the participant, while the simple menu display was designed to reduce operational complexity during communication attempts. In addition, the auditory output feature allowed the selected message to be expressed more clearly, enabling the device to function not only as a technical tool but also as a practical support for communication in learning activities. Overall, the product development stage demonstrated that DiniTalk was successfully developed into an accessible AAC device that was feasible for implementation in the participant’s natural educational environment.

## DISCUSSION

### DiniTalk and the Improvement of Functional Communication

The findings of this study indicate that the DiniTalk augmentative and alternative communication (AAC) device contributed positively to the improvement of the participant’s functional communication performance. The increase in AAC performance from 22% in the initial session to 88% in the final session suggests that the device was increasingly accessible and usable for the participant in responding to communication opportunities. This result supports previous studies showing that AAC can facilitate message expression, requesting behavior, and functional communication in individuals with complex communication needs when the system is adapted to the user’s condition (Choi et al., 2010; Riswari et al., 2022; Shopianty, 2019).

The improvement observed in this study may be understood in relation to the accessibility-oriented design of DiniTalk. The use of large buttons, a simple visual layout, and auditory output appears to have reduced the operational barriers typically experienced by children with cerebral palsy during communication tasks. In this regard, the present finding is consistent with previous work suggesting that communication

media for children with cerebral palsy should be adjusted to their motor and communicative characteristics in order to function effectively in practice (Syahid, 2020; Hijriyah & Marlina, 2023). The gradual reduction in prompting and the increased consistency of independent communication attempts in the present study indicate that an AAC system becomes more functional when its design aligns with the user's physical access needs.

In addition, the findings suggest that DiniTalk functioned not only as a compensatory communication aid but also as a support for communication learning within educational activities. Repeated use of the same interface in structured situations may have enabled the participant to become more familiar with the relationship between action, symbol selection, and communicative outcome. This interpretation is in line with studies emphasizing that AAC can support communicative competence development when it is embedded in meaningful and repeated contexts of use (Gibson et al., 2021; Von Tetzchner, 2025). Similarly, research in educational settings has shown that learners who use AAC benefit from structured communication opportunities that allow them to participate more actively and independently in instructional interactions (Ulriksen et al., 2024).

From a pedagogical perspective, the findings reinforce the importance of designing AAC systems that are not only technically functional but also contextually relevant to learning activities. In school environments, especially in PAUD and SLB contexts, children with cerebral palsy often face limitations in participating in classroom routines because of communication barriers (Riswari et al., 2022; Delima et al., 2024). The present study shows that a user-centered AAC device such as DiniTalk can support more active communication participation when it is developed based on the learner's actual needs, motor profile, and communication context. Therefore, the contribution of this study lies in demonstrating that AAC may serve as an instructional support within inclusive and special education settings, rather than being positioned solely as an assistive device.

Although the findings are promising, they should be interpreted within the scope of the present study. Because the implementation involved only one participant and was conducted over a limited period, the findings cannot be generalized broadly to all children with cerebral palsy. Nevertheless, the study provides preliminary evidence that a low-cost, accessible, and contextually adaptive AAC system can support the development of functional communication in a natural educational setting. This result also strengthens previous arguments that AAC interventions should prioritize personalization, usability, and ecological relevance in order to achieve meaningful communication outcomes (West et al., 2023; Warahmah et al., 2023).

### **Accessibility, Repetition, and Instructional Support in DiniTalk Use**

The findings of this study suggest that the effectiveness of DiniTalk was closely related to its accessibility-oriented design and its repeated use in meaningful communication situations. The device was developed with large accessible buttons, a simple visual layout, and auditory output, which appear to have reduced the participant's difficulty in operating the system during communication tasks. For children with cerebral palsy, communication barriers are often not limited to speech production, but also involve physical access to communication tools. In this regard, the present findings support earlier studies emphasizing that assistive and communication media for children with cerebral palsy need to be adapted to users' motor conditions and functional characteristics in order to be practically usable (Syahid, 2020; Hijriyah & Marlina, 2023; Saleh et al., 2024).

The gradual improvement observed during implementation also indicates the importance of repetition and consistency in AAC use. In the present study, the participant interacted with the same device interface across repeated sessions, allowing increased familiarity with the button positions, communication choices, and response patterns required during activities. This repeated exposure likely contributed to more stable and efficient device use over time. Previous studies have likewise shown that repeated and contextually meaningful AAC practice can support the development of communicative independence and more consistent message production (Choi et al., 2010; Gibson et al., 2021). In this sense, the improvement observed in DiniTalk use was not merely a technical outcome of using a device, but also part of a gradual learning process supported by stable access and repeated communication opportunities.

Another important aspect of the findings is the role of DiniTalk as an instructional support rather than only a compensatory communication tool. The simplified interface and limited communication options helped structure the participant's communication behavior within manageable demands. Such a design may reduce operational complexity and allow the user to focus more directly on communicative intent. This finding is consistent with studies suggesting that AAC can function as a support for participation and language-related development when it is embedded in structured and meaningful contexts of use (Von Tetzchner, 2025; Ulriksen et al., 2024). The present study therefore reinforces the view that AAC systems in

educational settings should be designed not only for technical functionality, but also for instructional usability.

From a special and inclusive education perspective, these findings highlight the importance of integrating accessibility and contextual relevance into AAC development. In school-based settings, communication support becomes more effective when it is connected to daily routines, learning participation, and the actual interaction demands faced by the learner. Previous studies in educational contexts have similarly emphasized that children with complex communication needs benefit from communication supports that are practical, personalized, and responsive to real participation barriers (Riswari et al., 2022; Delima et al., 2024; West et al., 2023). Accordingly, the DiniTalk device may be understood as an example of how low-cost AAC development can bridge the gap between assistive technology and pedagogical support in classroom-related communication.

Despite these contributions, the interpretation of these findings should remain cautious. The present study was conducted with a single participant, and the observed effectiveness was closely connected to that participant's specific communication profile, motor access, and learning environment. Therefore, while the study offers useful evidence regarding the value of accessible and contextually adapted AAC design, further research involving more participants and more diverse school settings is needed to examine the wider applicability of this approach (Warahmah et al., 2023; Ulriksen et al., 2024).

## CONCLUSION

This study concludes that the DiniTalk augmentative and alternative communication (AAC) device was able to support the improvement of functional communication in a child with cerebral palsy within an educational setting. The findings showed an increase in AAC performance from 22% in the initial session to 88% in the final session, indicating that the participant became more capable of using the device independently to express intended messages. These results suggest that an AAC system designed with accessible buttons, a simple interface, and auditory output can facilitate more effective communication participation for children with motor and speech limitations. This study also highlights that AAC should not be viewed merely as a compensatory communication aid, but as a form of instructional support that can enhance participation in learning activities. By integrating user-centered design, accessibility, and contextual adaptation, DiniTalk functioned as a practical communication support aligned with the participant's needs and classroom communication demands. In this regard, the study contributes to the development of low-cost and pedagogically relevant AAC models for special and inclusive education. However, the findings of this study are limited by the use of a single participant and a relatively short implementation period. Therefore, further studies are recommended to involve more participants, longer intervention duration, and broader educational contexts in order to examine the wider applicability of contextually adaptive AAC systems for children with complex communication needs.

## ACKNOWLEDGEMENTS

The authors would like to express their sincere gratitude to the academic institutions that supported this study, particularly the university and research units that facilitated the research process. Appreciation is also extended to the mentors and academic supervisors whose guidance and scholarly insights contributed significantly to the conceptual development and methodological rigor of this research. The authors are grateful to the partner PAUD and special education institutions (SLB) for their cooperation and support during data collection and implementation. Their openness and collaboration were essential to the successful completion of this study.

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