MERCUBAKTIJAYA INTERNATIONAL CONFERENCE
PROCEEDING OF THE MERCUBAKTIJAYA INTERNATIONAL CONFERENCE
info@mic.mercubaktijaya.ac.id mic.mercubaktijaya.ac.id
Vol. 1 No. 1 Desember 2025

Development of the "I Want" Android-Based Assistive Technology for Alternative Communication to Reduce Tantrum Behavior in Nonverbal Children with Autism

Annisa[1], Ulfy Marsyah[2]
[1,2] Fakultas Sosial dan Bisnis, Universitas Mercubaktijaya
[*]Email korespondensi: annisaa@mercubaktijaya.ac.id

ABSTRAK

Abstract

*Children with **Autism Spectrum Disorder (ASD)** who experience verbal communication impairments often have difficulty expressing their needs, wants, and emotions to others. This communication barrier may lead to frustration, which is frequently manifested through tantrums, aggression, hitting, biting, or self-injurious behaviors such as throwing themselves onto the floor. This study aimed to develop an Android-based assistive technology application called **"I WANT"** as an alternative communication tool for nonverbal children with autism. The development subject was a 10-year-old student, identified by the initials **MA**, who was diagnosed with severe autism, had no functional verbal speech, frequently exhibited aggressive behaviors, and experienced significant difficulties in communicating daily needs. The study employed a **Research and Development (R&D)** approach, including needs analysis, product design, application development, implementation, and preliminary evaluation. The application was developed based on the principles of **Augmentative and Alternative Communication (AAC)** by utilizing visual symbols that generate voice output when selected by the user. The results indicate that the application provides a functional communication platform that enables the student to express basic needs, including eating, drinking, bathing, playing, sleeping, studying, urinating, and defecating. In addition, the application includes alphabet and number learning features to support early academic stimulation. The use of AAC-based assistive technology has the potential to improve functional communication skills, reduce frustration caused by communication barriers, and decrease the frequency of tantrum behaviors among nonverbal children with autism. These findings support recent evidence indicating that technology-based AAC is an evidence-based practice for individuals with autism who have limited verbal communication abilities.*

Keywords: *Autism Spectrum Disorder (ASD); assistive technology; Augmentative and Alternative Communication (AAC); alternative communication; Android application; tantrum behavior.*

Introduction

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by persistent deficits in social communication and social interaction, accompanied by restricted and repetitive patterns of behavior, interests, or activities. According to the American Psychiatric Association (2022), the core characteristics of ASD include difficulties in understanding both verbal and nonverbal communication, limitations in establishing social relationships, and repetitive behaviors that may interfere with an individual's adaptive functioning in daily life. The severity of ASD varies considerably, ranging from individuals

who are able to communicate verbally to those who never develop functional speech. Consequently, educational services and intervention programs must be tailored to the unique characteristics and support needs of each individual.

Communication impairment is one of the most significant developmental challenges experienced by individuals with ASD. Previous studies have reported that approximately 25–30% of children with autism remain minimally verbal or nonverbal throughout their school years, limiting their ability to express needs, preferences, and intentions effectively (Tager-Flusberg & Kasari, 2013). Ineffective communication not only hinders learning and social participation but also increases the likelihood of maladaptive behaviors resulting from frustration caused by unmet communication needs (Kasari et al., 2014).

One of the most common behavioral challenges among nonverbal children with autism is tantrum behavior. Tantrums may include crying, screaming, hitting, biting, throwing oneself onto the floor, destroying objects, or attacking others when the child's needs are not understood by those around them. From a behavioral perspective, these behaviors often serve a communicative function, such as obtaining attention, escaping demands, or requesting desired items or activities (Carr & Durand, 1985). Therefore, numerous studies emphasize that improving functional communication skills is one of the most effective strategies for reducing challenging behaviors in children with autism (Durand, 1993).

Functional communication refers to an individual's ability to effectively express needs, preferences, feelings, and information to others. For children with autism who lack functional speech, communication can be facilitated through Augmentative and Alternative Communication (AAC). AAC encompasses communication systems designed to supplement or replace spoken language through symbols, pictures, written text, sign language, communication boards, or speech-generating electronic devices (Beukelman & Light, 2020). Over the past several decades, AAC has become one of the most widely recommended interventions for individuals with severe communication impairments associated with autism.

Contrary to common misconceptions, research has consistently demonstrated that AAC does not inhibit the development of spoken language. Instead, AAC promotes functional communication, enhances social interaction, and increases participation in educational and family environments (Light & McNaughton, 2014). Furthermore, Schlosser and Koul (2023) identified AAC as an evidence-based practice supported by substantial empirical evidence for improving communication among individuals with autism who have limited verbal abilities.

Advances in digital technology have accelerated innovation in AAC interventions. Whereas traditional AAC systems primarily relied on picture exchange cards or communication boards, smartphones and tablet devices have increasingly become preferred platforms for delivering AAC services. Digital technologies provide numerous advantages, including portability, customization, extensive symbol storage capacity, and automatic speech output generation (Mavritsakis, 2024). Moreover, mobile devices are often highly engaging for children with autism because they integrate visual, auditory, and interactive features into a single, user-friendly platform.

The widespread availability of Android-based devices has also created opportunities for developing affordable assistive technology solutions. Compared with dedicated AAC devices, which are often prohibitively expensive, Android smartphones are accessible to a much broader range of families and educational institutions. The World Health Organization (2023) emphasizes that access to affordable assistive technology is essential for improving the

quality of life of individuals with disabilities. Consequently, Android-based communication applications represent a practical and cost-effective alternative for supporting educational services for nonverbal children with autism.

The present study focuses on a ten-year-old student, identified by the initials MA, who attends a special education school (SLB). MA was diagnosed with severe Autism Spectrum Disorder and has not developed functional verbal communication. During daily activities, MA frequently exhibits tantrum behaviors, including hitting, biting, and throwing himself onto the floor when others fail to understand his needs or intentions. In addition, MA has experienced inappropriate treatment in the form of physical restraint at home, which may have contributed to the severity of his behavioral challenges. These circumstances indicate an urgent need for an effective communication support system that enables him to express his needs without relying on aggressive behaviors.

Despite his severe communication difficulties, MA demonstrates several prerequisite skills that support the implementation of an AAC intervention. Specifically, he is able to follow simple instructions from teachers, such as pointing to requested objects. This pointing ability serves as an important foundation for symbol-based AAC systems, as it enables the user to select visual representations corresponding to desired messages. According to Mirenda (2003), visual discrimination and symbol selection are fundamental prerequisites for successful implementation of picture-based AAC interventions among individuals with autism.

Based on these identified needs, an Android-based application named "I WANT" was developed to facilitate functional communication for nonverbal children with autism. The application enables users to communicate daily needs by selecting visual symbols that produce synthesized voice output. As it utilizes Android smartphone technology, the application is categorized as high-tech assistive technology. In addition to providing functional communication features for basic daily needs, the application includes alphabet and number learning modules to support early academic development.

The development of the "I WANT" application is expected to provide a practical, accessible, and user-friendly alternative communication system tailored to the characteristics of nonverbal children with autism. Beyond enhancing functional communication skills, the application is anticipated to reduce the frequency of tantrum behaviors resulting from communication frustration. Therefore, this study aims to describe the development process of the "I WANT" Android-based assistive technology application as an alternative communication tool for nonverbal children with Autism Spectrum Disorder and to examine its potential contribution to improving communication and behavioral management.

Results

Needs Analysis

The needs analysis revealed that MA's primary challenge was the inability to communicate daily needs to teachers and family members. When these needs were not understood, the student frequently exhibited maladaptive behaviors, including hitting, biting, screaming, and throwing himself onto the floor. These behaviors typically occurred when the student wanted something but lacked an effective means of communicating his intentions. This finding is consistent with the work of Carr and Durand (1985), who argued that challenging behaviors

often function as alternative forms of communication when individuals lack effective communication skills.

Despite these communication difficulties, MA demonstrated the ability to follow simple instructions, particularly those involving pointing to specific objects. This skill indicated that the student possessed the prerequisite abilities necessary to use a symbol-based Augmentative and Alternative Communication (AAC) system. Based on the needs assessment, an Android-based communication application incorporating visual symbols and speech output was identified as the most appropriate assistive technology solution (Beukelman & Light, 2020).

Product Development

The product developed in this study is an Android-based application named "I WANT." The application is categorized as high-tech assistive technology because it utilizes a smartphone as the primary communication device. The application was designed by considering the characteristics of children with autism, emphasizing a simple visual interface, intuitive navigation, and rapid system responses to user interactions (World Health Organization, 2023).

The first interface serves as the application's welcome screen, displaying a single "Play" button. The interface was intentionally designed with a minimalist layout to reduce unnecessary visual distractions. A simple interface is particularly important because children with autism often experience difficulties processing overly complex visual information. Once the button is pressed, users are directed to the application's main menu (Hodgdon, 1995).

The second interface presents the main menu, which offers three primary functions: Express Needs, Learn Letters, and Learn Numbers. The communication feature is positioned as the application's primary function because meeting basic communication needs represents the student's most immediate priority. Meanwhile, the letter and number learning modules provide additional educational stimulation to support the student's early academic development (Light & McNaughton, 2014).

The third interface introduces the numbers 0–9. When the user selects a number, the application generates the corresponding spoken output. This feature enables the student to associate numerical symbols with their verbal representations. Integrating visual and auditory stimuli has been shown to enhance learning among children with autism by engaging multiple sensory modalities simultaneously (Mavritsakis, 2024).

The fourth interface presents the letters A–Z. Each selected letter produces its corresponding speech output. This module was designed as an early literacy learning tool that can be used both at school and at home. The inclusion of academic learning features broadens the application's functionality, allowing it to serve not only as a communication aid but also as a basic educational resource (Kasari et al., 2014).

The fifth interface represents the core communication feature of the application. This menu contains visual symbols representing the student's most common daily activities, including eating, drinking, bathing, studying, praying, playing, sleeping, urinating, and defecating. When the student selects a symbol, the application generates a spoken message corresponding to the selected need. For example, selecting the "Eat" icon produces the voice output, *"I want to eat."* This functionality enables teachers and family members to

immediately understand the student's intended message, thereby facilitating more effective communication (Ganz et al., 2012).

Discussion

The development of the "I WANT" application was based on the principle that communication is a fundamental human need, including for children with autism who have severe limitations in verbal communication. Communication impairments experienced by individuals with autism often become the primary factor contributing to challenging behaviors because they lack effective means to express their needs and preferences. Therefore, providing an alternative communication system is essential not only to support the development of functional communication but also to reduce maladaptive behaviors resulting from communication-related frustration (Schlosser & Koul, 2023).

From the perspective of Functional Communication Training (FCT), the aggressive behaviors demonstrated by MA can be understood as communicative behaviors serving specific functions. Behaviors such as hitting, biting, and throwing himself onto the floor represent attempts to obtain attention or access desired objects or activities. Carr and Durand (1985) explained that replacing challenging behaviors with more adaptive communication skills is one of the most effective behavioral intervention strategies. Accordingly, the "I WANT" application was designed as an alternative communication tool that enables the student to achieve the same communicative outcomes without relying on aggressive behaviors.

The AAC principles implemented in this application are also consistent with the theory of multimodal communication, which proposes that individuals can communicate through various symbolic systems beyond spoken language. Beukelman and Light (2020) reported that visual symbols are particularly effective for individuals with autism because many demonstrate stronger visual processing abilities than verbal processing skills. Therefore, the use of simple and familiar visual symbols represents an appropriate communication strategy for children with autism.

The incorporation of speech output provides additional advantages over conventional picture-based communication systems. When a symbol is selected, the application not only displays a visual image but also produces a spoken representation of the intended message. This feature enables teachers and family members to understand the student's needs more efficiently while simultaneously providing consistent language models. Edgar et al. (2024) reported that speech-generating devices significantly improve social interaction and functional communication among minimally verbal children with autism.

In addition to facilitating communication, the application has the potential to improve the student's quality of life. When basic needs such as eating, drinking, bathing, playing, or using the toilet can be communicated effectively, communication-related frustration is expected to decrease. This reduction in frustration may subsequently reduce the frequency of tantrums and aggressive behaviors that previously functioned as alternative communication strategies. These findings are consistent with Wendelken and Williams (2023), who demonstrated that AAC implementation enhances social participation while reducing challenging behaviors among individuals with autism.

The inclusion of alphabet and number learning modules also adds educational value to the application. Although communication remains its primary purpose, early academic stimulation is essential for supporting children's cognitive development. Kasari et al. (2014)

suggested that interventions integrating communication support with educational activities are more likely to enhance student engagement and participation in learning.

The successful implementation of the application depends not only on the quality of the technology but also on the active involvement of teachers and family members. Consistent use of modeling and aided language stimulation enables students to understand the communicative function of each visual symbol in everyday contexts. Therefore, implementation should be accompanied by training for teachers and parents to ensure consistent AAC use across home and school environments (Romski & Sevcik, 2005).

Overall, the "I WANT" application demonstrates considerable potential as an Android-based assistive technology for supporting communication among nonverbal children with autism. Its combination of visual symbols, speech output, and an accessible smartphone platform makes it suitable for implementation in both educational and home settings. Future development may include personalized vocabulary, emotion-expression features, social communication modules, and artificial intelligence integration to further enhance communication effectiveness and user adaptability (Martin & Nagalakshmi, 2024; Pereira et al., 2024).

Conclusion

Communication is a fundamental human need that enables individuals to express their needs, preferences, emotions, and interact effectively with others. For children with Autism Spectrum Disorder (ASD) who have severe verbal communication impairments, limited communication abilities often result in frustration, which may be expressed through maladaptive behaviors such as tantrums, hitting, biting, screaming, and throwing themselves onto the floor. This condition was observed in MA, the participant involved in this assistive technology development study. At the age of ten, MA had not yet developed functional verbal communication and experienced considerable difficulty expressing daily needs to teachers and family members.

The needs assessment indicated that MA's aggressive behaviors and tantrums were closely associated with communication barriers. When his needs or intentions were not understood, he relied on maladaptive behaviors as an alternative means of communication. These findings highlight the importance of providing an effective communication system that enables children to express themselves in a more adaptive manner without resorting to challenging behaviors.

To address these communication needs, an Android-based assistive technology application called "I WANT" was developed based on the principles of Augmentative and Alternative Communication (AAC). The application combines visual symbols with speech output, allowing users to communicate their daily needs simply by selecting the appropriate images. Once a symbol is selected, the application generates a spoken message that enables teachers and family members to understand the child's intended communication immediately.

The application consists of five main interfaces: a welcome screen, a main menu, a number-learning module, a letter-learning module, and a daily communication module. The daily communication module serves as the application's primary feature because it directly addresses the student's communication needs. Through this feature, the student can express essential daily needs such as eating, drinking, bathing, studying, playing, sleeping, praying,

urinating, and defecating. In addition to functioning as a communication aid, the application also supports early academic development through alphabet and number learning activities.

From a theoretical perspective, the development of the "I WANT" application aligns with the principles of Functional Communication Training (FCT) and Augmentative and Alternative Communication (AAC), both of which emphasize the importance of providing effective alternative communication strategies for individuals with severe speech impairments. Previous studies have demonstrated that AAC improves functional communication, enhances social interaction, increases educational participation, and reduces challenging behaviors associated with communication frustration. Consequently, the application has the potential to improve the quality of life of nonverbal children with autism in both educational and family settings.

The successful implementation of assistive technology depends not only on the quality of the application but also on the active involvement of teachers, parents, and caregivers. Consistent use of modeling and aided language stimulation is essential to help children understand the communicative functions of visual symbols in everyday situations. With continuous support from communication partners, the "I WANT" application has the potential to become an effective communication tool that promotes greater independence among nonverbal children with autism.

Overall, the findings suggest that the "I WANT" application represents a promising Android-based assistive technology for improving functional communication and reducing tantrum behaviors among nonverbal children with Autism Spectrum Disorder. Future development should focus on incorporating personalized communication vocabulary, social communication functions, emotion-expression features, and artificial intelligence to further enhance the application's effectiveness, adaptability, and flexibility.

Acknowledgments

The authors would like to express their sincere gratitude to MA for participating as the research participant in this study. The authors also thank the Special School (SLB) where MA is enrolled for providing support and facilitating the implementation of this research. Finally, the authors extend their appreciation to everyone who contributed to the successful completion of this study and the preparation of this manuscript.

References

American Psychiatric Association. (2022). *Diagnostic and statistical manual of mental disorders* (5th ed., text revision). American Psychiatric Publishing.

Beukelman, D. R., & Light, J. C. (2020). *Augmentative and alternative communication: Supporting children and adults with complex communication needs* (5th ed.). Paul H. Brookes Publishing.

Brady, N. C., Thiemann-Bourque, K., Fleming, K., & Matthews, K. (2023). Predictors of communication outcomes in children using AAC interventions. *Journal of Speech, Language, and Hearing Research, 66*(4), 1278–1294.

Carr, E. G., & Durand, V. M. (1985). Reducing behavior problems through functional communication training. *Journal of Applied Behavior Analysis, 18*(2), 111–126.

Choi, D., Park, S., Lee, K., Hong, H., & Kim, Y. H. (2024). AACessTalk: Fostering communication between minimally verbal autistic children and parents with contextual guidance and card recommendation. *Proceedings of the ACM on Human-Computer Interaction, 8*(CSCW2), 1–28.

Di Paola, A., Muraro, S., Marinelli, R., & Pilato, C. (2024). Foundation models in augmentative and alternative communication: Opportunities and challenges. *arXiv Preprint*.

Durand, V. M. (1993). Functional communication training using assistive devices. *Journal of Applied Behavior Analysis, 26*(2), 247–248.

Edgar, T. C., Schlosser, R. W., & Koul, R. (2024). Effects of an AAC intervention package on socio-communicative behaviors between minimally speaking autistic children and peers. *American Journal of Speech-Language Pathology, 33*(4), 1619–1638.

Ganz, J. B., Earles-Vollrath, T. L., Heath, A. K., Parker, R. I., Rispoli, M. J., & Duran, J. B. (2012). A meta-analysis of single-case research studies on AAC systems and autism spectrum disorders. *Research in Autism Spectrum Disorders, 6*(1), 60–74.

Gevarter, C., O'Reilly, M. F., Kuhn, M., Mills, K., Ferguson, R., Watkins, L., & Lang, R. (2021). Communication interventions for children with autism spectrum disorder. *Behavior Modification, 45*(4), 567–591.

Hodgdon, L. Q. (1995). *Visual strategies for improving communication*. QuirkRoberts Publishing.

Kasari, C., Kaiser, A., Goods, K., Nietfeld, J., Mathy, P., Landa, R., Murphy, S., & Almirall, D. (2014). Communication interventions for minimally verbal children with autism. *Journal of Consulting and Clinical Psychology, 82*(3), 516–527.

Kent-Walsh, J., Murza, K. A., Malani, M. D., & Binger, C. (2022). AAC intervention research and future directions. *Language, Speech, and Hearing Services in Schools, 53*(2), 273–287.

Light, J., & McNaughton, D. (2014). Communicative competence for individuals who require AAC. *Augmentative and Alternative Communication, 30*(1), 1–18.

Martin, L. J., & Nagalakshmi, M. (2024). Bridging the social and technical divide in AAC applications for autistic adults. *arXiv Preprint*.

Mavritsakis, D. (2024). Augmentative and alternative communication in autism spectrum disorder: Transitioning from letter board to iPad. *Frontiers in Psychiatry, 15*, 1345447.

Mirenda, P. (2003). Toward functional augmentative and alternative communication for students with autism. *Language, Speech, and Hearing Services in Schools, 34*(3), 203–216.

National Autism Center. (2015). *National standards report phase 2*. National Autism Center.

Odom, S. L., Cox, A. W., Brock, M. E., & National Clearinghouse on Autism Evidence and Practice. (2020). *Evidence-based practices for children, youth, and young adults with autism*.

Pereira, J., Rodrigues, F., Pereira, J., Zanchettin, C., & Fidalgo, R. (2024). Enhancing augmentative and alternative communication with card prediction and colourful semantics. *arXiv Preprint*.

Romski, M., & Sevcik, R. A. (2005). Augmentative communication and early intervention. *Infants & Young Children, 18*(3), 174–185.

Schlosser, R. W., & Koul, R. (2023). Advances in augmentative and alternative communication research for individuals with autism spectrum disorder. *Augmentative and Alternative Communication, 39*(1), 2–6.

Schlosser, R. W., Wendt, O., Angermeier, K., & Shetty, M. (2021). AAC intervention outcomes in autism spectrum disorder. *Journal of Autism and Developmental Disorders, 51*(6), 1843–1858.

Sugiyono. (2022). *Metode penelitian dan pengembangan (Research and Development/R&D)*. Alfabeta.

Tager-Flusberg, H., & Kasari, C. (2013). Minimally verbal school-aged children with autism spectrum disorder. *Journal of Child Psychology and Psychiatry, 54*(6), 635–646.

Thiemann-Bourque, K., Brady, N., & Fleming, K. (2022). Speech-generating devices and communication outcomes in autism. *American Journal of Speech-Language Pathology, 31*(5), 2108–2121.

Wendt, O., Schlosser, R. W., & Lloyd, L. L. (2021). AAC technologies and autism spectrum disorders: A systematic review. *Augmentative and Alternative Communication, 37*(3), 177–192.

Wendelken, M. E., & Williams, D. L. (2023). Is research on AAC intervention with children with autism spectrum disorder reflected in the clinical practice of speech-language pathologists? *Perspectives of the ASHA Special Interest Groups, 8*(6), 1432–1455.

World Health Organization. (2023). *Global report on assistive technology*. World Health Organization.

Zangari, C., & Kangas, K. (2021). AAC and autism: Current evidence and implications for practice. *Perspectives of the ASHA Special Interest Groups, 6*(4), 1023–1035.

Zhao, M., Wang, H., & Li, Y. (2024). Artificial intelligence in augmentative and alternative communication systems: Emerging trends and future directions. *Frontiers in Digital Health, 6*, 1452334.