

Title: The Role of Tangible Symbols in Enhancing Communication among Children with Multiple Disabilities an Integrative Review

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ABSTRACT

Children with multiple disabilities have challenges in communication due to combined sensory, motor, and cognitive impairments that affect their ability to use traditional language or symbol systems. These challenges often result in limited participation in social and educational environments, leading to isolation and delayed development. Augmentative and Alternative Communication (AAC) systems are essential in addressing these barriers, providing accessible pathways for interaction and expression. Among AAC strategies, tangible symbols—three-dimensional or tactile representations of objects, people, or concepts—offer unique advantages for children with multiple disabilities. This integrative review synthesizes key research findings from 1989 to 2024, analyzing empirical and theoretical studies on tangible symbols and their impact on receptive, expressive, and social communication. The review explores their applications in diverse educational and clinical contexts, integration with AAC systems such as the Picture Exchange Communication System (PECS), and their role in literacy and cognitive development. Findings reveal that tangible symbols foster intentional communication, promote inclusion, and serve as a developmental bridge toward abstract language use. However, issues such as lack of standardized implementation, limited teacher training, and inconsistent follow-up restrict their widespread adoption. The review concludes that tangible symbols represent a practical, low-cost, and evidence-supported AAC tool that can significantly enhance communicative competence and independence among children with multiple disabilities when used systematically and collaboratively across settings.

Keywords: Tangible symbols, multiple disabilities, augmentative and alternative communication, communication development, special education, inclusion, expressive language

1. Introduction

Communication forms the foundation of social participation and learning. For children with multiple disabilities—defined as the coexistence of two or more developmental, sensory, or physical impairments—traditional communication systems often prove inadequate. Their ability to use speech, sign language, or visual symbols can be restricted by sensory or motor limitations (Bruce & Borders, 2015). Consequently, these children frequently remain at the presymbolic level, relying on gestures, behaviors, or idiosyncratic cues to express their needs and emotions (Rowland & Schweigert, 1989).

The advent of Augmentative and Alternative Communication (AAC) systems revolutionized opportunities for individuals with complex communication needs. AAC encompasses unaided methods, such as gestures or sign language, and aided systems, such as picture boards, speech-generating devices, and tangible symbols (Beukelman & Mirenda, 2013). Among these, tangible symbols stand out as a tactile and visually concrete modality that enables individuals with cognitive and sensory impairments to establish symbolic relationships and intentional communication.

Tangible symbols—objects or textures that represent people, activities, or ideas—bridge the gap between pre-intentional communication and abstract symbolic language. Because they rely on physical, tactile cues, they are particularly effective for individuals with visual impairments, deafblindness, or limited fine motor control (Trief, Bruce, & Cascella, 2013). This review integrates three decades of empirical evidence to understand how tangible symbols contribute to enhancing receptive, expressive, and social communication among children with multiple disabilities.

2. Methods

An integrative review design was adopted to combine and interpret findings from diverse research methodologies, including quantitative, qualitative, and case-based studies. This approach was selected because of its flexibility in accommodating both empirical evidence and theoretical insights (Whittemore & Knafl, 2005).

2.1 Search Strategy

Electronic searches were conducted in databases such as PsycINFO, ERIC, Scopus, and Google Scholar using combinations of keywords: tangible symbols, multiple disabilities, deafblindness, AAC, and communication development.

2.2 Inclusion and Exclusion Criteria

Studies were included if they:

- Focused on children or adolescents with multiple disabilities or deafblindness;
- Investigated tangible symbols as a component of AAC or communication intervention;
- Were peer-reviewed and published in English between 1989 and 2024.
- Studies focusing exclusively on adults or high-technology AAC systems without tangible symbol integration were excluded.

2.3 Data Analysis

A thematic synthesis approach was used to categorize findings into key themes:

- Tangible symbols and communication development,
- Educational applications,
- Integration with AAC systems,
- Effectiveness and generalization,
- Communication and literacy correlations, and
- Implementation challenges and future directions.

3. Review Findings

3.1 Tangible Symbols and Communication Development

The earliest conceptualization of tangible symbols emerged from the work of Rowland and Schweigert (1989), who demonstrated that individuals with multisensory impairments could use concrete symbols to represent people and activities. Their studies provided a developmental sequence, moving from object-based representations toward abstract communication. In a subsequent longitudinal study, Rowland and Schweigert (2000) reported that 41 children with diverse disabilities successfully acquired tangible symbol systems that facilitated expressive and receptive communication beyond gestural communication alone.

Similarly, Ali (2009) and Ali, MacFarland, and Umbreit (2011) found that tangible symbols used in combination with PECS enhanced requesting behaviors among children with visual and multiple disabilities. Participants not only learned to make requests but also generalized

these skills across classroom settings and maintained them after training concluded. These findings established tangible symbols as an effective tool for functional and spontaneous communication.

3.2 Educational Applications

Tangible symbols have been widely employed in educational settings to foster inclusion and participation. Trief, Bruce, and Cascella (2013) conducted a field study involving 43 children with multiple disabilities, documenting significant progress in symbol identification and communicative intent following consistent exposure in daily classroom routines. Later, Trief et al. (2019) analyzed how educators selected tangible symbols for students with visual impairments and additional disabilities. Their findings underscored the importance of aligning symbol selection with the student's sensory profile, cognitive abilities, and lived experiences.

Robbins (2022) investigated preservice teachers' attitudes toward tangible symbols, revealing generally positive perceptions and a recognition of the need for systematic instruction. Educators who understood the symbolic relationships inherent in tangible systems were more confident in their implementation, suggesting the necessity of professional training in AAC methods.

3.3 Integration with AAC and PECS Systems

Integration of tangible symbols with established AAC frameworks such as the Picture Exchange Communication System (PECS) has produced encouraging results. Ivy, Robbins, and Kerr (2020) examined young children aged 4–7 with multiple disabilities, adapting PECS with tangible objects instead of pictures. Two of three children mastered the first two phases of PECS using tangible symbols and successfully generalized the skill to new partners. Similarly, Lund and Troha (2023) demonstrated that tactile PECS systems could be effectively utilized by young people who were blind and had autism. Although progress varied, tactile PECS enabled consistent request-making behaviors and improved engagement.

3.4 Effectiveness and Generalization

Comparative and systematic studies further validate the effectiveness of tangible symbols. Roche et al. (2013) compared tangible symbols, picture exchange, and direct selection methods for teaching requesting to children with autism. Although all methods were

effective, children showed a clear preference for tangible symbols, citing their tactile and concrete nature. A later systematic review by Roche et al. (2014) confirmed that over half of participants across studies (54%) effectively learned tangible symbol use.

In 2023, Roche and colleagues conducted another comparative study that reaffirmed tangible symbols as an equally efficient yet more preferred communication modality. Participants achieved comparable learning rates to picture-based AAC but demonstrated greater sustained engagement with tangible systems, suggesting enhanced motivation and accessibility.

3.5 Communication and Literacy Correlations

Research has increasingly explored the broader cognitive and literacy benefits of tangible symbol use. Bruce, Nelson, Pérez, Stutzman, and Barnhill (2016) reviewed communication and literacy outcomes for children with deafblindness and noted that tangible representations often serve as precursors to abstract language and literacy. These symbols facilitate early comprehension of referential relationships—critical for reading and writing development.

Sutter and Demchak (2023) evaluated the “System of Least Prompts” in teaching symbol differentiation to children with deafblindness. Their results demonstrated improved comprehension and communication turn-taking, reinforcing the value of tactile and concrete representations in both expressive and receptive language development.

3.6 Implementation Challenges

Despite robust evidence supporting tangible symbols, several barriers persist. Arthur-Kelly et al. (2009) identified inconsistent educator training and limited awareness as significant constraints. Teachers often lacked access to resources and time to develop individualized symbol systems. Similarly, Trief et al. (2019) reported variability in symbol selection across institutions, with few standardized protocols guiding practice. Robbins (2022) and Ivy et al. (2024) further emphasized the importance of team-based planning among teachers, therapists, and families to ensure sustained symbol use across environments.

4. Discussion

The cumulative evidence supports tangible symbols as an effective and developmentally appropriate AAC tool for children with multiple disabilities. Their tangible, permanent, and

manipulable nature accommodates the sensory and cognitive profiles of learners who may not yet grasp abstract symbolic systems. Tangible symbols require recognition rather than recall, reducing cognitive load and enabling individuals with limited working memory to engage meaningfully in communication (Beukelman&Mirenda, 2013).

When embedded within consistent routines, tangible symbols can transform passive learners into active communicators. Their success, however, depends heavily on the fidelity of implementation and the responsiveness of communication partners. The reviewed studies consistently emphasize adult modeling, repetition, and reinforcement as critical components. Another key theme is the developmental bridge tangible symbols provide—from presymbolic gestures to more abstract language forms. Through repeated pairing of objects with spoken words or activities, children begin to internalize symbolic representation, eventually transitioning to visual symbols, sign language, or speech. This sequential progression underscores the importance of tangible symbols as an early stage in AAC development (Rowland &Schweigert, 2000).

The research also highlights the inclusive potential of tangible symbols. Their low-cost and non-technological nature make them particularly valuable in low-resource educational environments. Teachers can adapt locally available materials—such as fabrics, miniature objects, or textured cards—to represent familiar concepts. This flexibility allows for individualized and culturally relevant AAC interventions.

Nonetheless, implementation fidelity remains inconsistent across contexts. Some educators report difficulty generalizing symbol use beyond structured classroom activities. Others cite challenges in sustaining collaborative communication plans between school and home (Robbins, 2022). These findings align with global AAC literature emphasizing the need for transdisciplinary collaboration and consistent modeling (Bruce et al., 2016).

5. Implications for Practice

Personalized Symbol Design:

Tangible symbols should be tailored to each learner’s sensory, cognitive, and motor profile. Selection of materials must consider tactile discrimination, cultural relevance, and familiarity.

Collaborative Team Approach:

Effective use requires coordination among educators, therapists, and caregivers. Regular communication ensures continuity across home and school settings.

Integration in Daily Routines:

Embedding tangible symbols in everyday contexts—mealtime, play, classroom transitions—enhances generalization and functional use.

Professional Development:

Ongoing teacher training is essential to build competence in AAC methods. Simulation and coaching models can improve implementation fidelity.

Transition to Advanced AAC:

Tangible symbols can serve as preparatory tools for higher-level AAC systems. By establishing foundational symbolic understanding, children can later transition to picture-based or digital communication systems.

6. Research Gaps and Future Directions

While tangible symbols are widely recognized as effective AAC tools, several research gaps remain:

Longitudinal Outcomes: Few studies track long-term communication development after tangible symbol interventions. Future research should examine retention, progression, and transition to more abstract symbol systems.

Cultural Adaptation: There is limited research from non-Western contexts. Studies in diverse cultural and linguistic settings could explore adaptations using indigenous materials or culturally relevant referents.

Technological Integration: Emerging technologies such as 3D printing and haptic feedback devices could be leveraged to create standardized, durable tactile symbols.

Training Models: Research should evaluate the impact of teacher and caregiver training programs on symbol use consistency and learner outcomes.

Holistic Impact: Beyond communication, tangible symbol interventions may influence social participation, emotional well-being, and academic readiness—areas deserving further exploration.

7. Conclusion

Tangible symbols represent a crucial step in the continuum of AAC for children with multiple disabilities. Their tactile, permanent, and concrete nature enables learners to engage in

meaningful communication despite cognitive, sensory, or motor challenges. Decades of research affirm their role in developing expressive, receptive, and social communication. Moreover, tangible symbols serve as developmental scaffolds, guiding children from concrete representations toward abstract language and literacy.

For practitioners, tangible symbols offer a practical and inclusive solution adaptable to varied educational and cultural settings. For researchers, they remain a fertile area for innovation—especially through integration with tactile technology and culturally contextualized design. As educational systems move toward inclusive practices, tangible symbols provide an accessible, equitable pathway for communication, ensuring that every child, regardless of ability, has a voice.

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