A Review of Augmentative and Alternative Communication Strategies for Children who have a Visual Impairment

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Abstract

The authors conducted a literature review in which we examined articles about visual impairment (VI) and augmentative alternative communication (AAC) to identify gaps in the existing literature. We hypothesized there would be many gaps in the literature regarding selection, awareness, and knowledge of appropriate AAC interventions for children with visual impairments. Boster et al. (2021) conducted a literature review examining AAC interventions and communication needs for individuals with cortical visual impairment (CVI). They concluded that there needs to be more peer-reviewed literature about CVI and AAC intervention. Furthermore, they urged future research to address individuals with CVI who require AAC. Still, there are very few empirical studies on the topic. We extended their work by including additional expert reviews and papers.

Keywords: Augmentative and alternative communication, visual impairment
A Review of Augmentative and Alternative Communication Strategies for Children who have a Visual Impairment

A visual impairment (VI) is a vision change, even with corrections such as glasses, that negatively impact a child's educational performance (Individuals with Disabilities Education Act [IDEA], 2017). Approximately 80–90% of early learning relies on vision to merge input from other senses, and children without vision must rely heavily on their remaining senses for learning (Goldware, 1998). More than 60% of students with VI have more than one disability (Hatton, 2007), as there is an increased risk of VI among individuals with developmental and acquired conditions (Beukelman, 2020). However, the number of children with VI and other disabilities is predicted to be even higher than reported. Cortical Visual impairment (CVI), for example, is the most common cause of visual impairment in children, although it is underreported and underdiagnosed (Good, 2001). Moreover, it is predicted that about 10.5% of children with developmental disabilities may also have CVI (Nielson, 2007).

Common co-occurring conditions of VI include autism spectrum disorder (ASD), orthopedic impairment (OI), cerebral palsy (CP), and intellectual disability (ID). The occurrence of ASD with VI, specifically, is 11.6% compared to 0.06% of individuals that have ASD without VI in the general population (CDC, 2007). The chance of ASD increases with increased severity of visual loss (Mukaddes, 2007). Moreover, it is 31 times more likely for an individual with a visual impairment to have ASD than the general population (Schaefer Whitby et al., 2019). Children with developmental disabilities often also have complex communication needs, which limits their ability to produce intelligible speech. These learners often benefit from augmentative alternative communication (AAC) to express themselves and communicate with the people around them (Blackstone, 2021).
More than two million individuals with complex communication needs rely on AAC in the United States (United States Society for Augmentative and Alternative Communication [USSAAC], 2022). Although AAC is often implemented with learners with communication disorders, learning outcomes are still heavily impacted. Children doubly diagnosed with VI and complex communication needs make learning even more challenging. Children who use AAC are also likely to have additional motor and sensory impairments (Erikson, 2016). Practitioners must take into consideration the child’s complex disability when making decisions about AAC intervention and accommodate their motor and sensory needs.

Less than 2% of individuals with VI are served under the Individuals with Disabilities Education Act (IDEA, National Center for Education Statistics, 2023). However, school-based practitioners working with children with VI must still be knowledgeable about services to enhance education and communication skills for individuals with VI who also have complex communication needs. Visual cues play a vital role in facilitating communication, and children with VI do not have access to visual cues, which is necessary for developing communication skills (Fraiberg, 1977).

Little information about the assessment and intervention process for communication support for children with visual impairments is known. Part of the assessment process requires examining the child's vision needs before determining intervention approaches (American Speech-Language-Hearing Association [ASHA], 2004). However, more practitioners express that they need more preparation to be involved in this process, and school and community-based professionals reported insufficient access to knowledge, support required, and relevant training opportunities to aid in intervention for children with CVI who need AAC (Blackstone, 2022). Overall, there is scarce peer-reviewed literature about clinical decision-making with AAC for
individuals with CVI (Boster et al., 2021), which leaves little data on the impact of VI on AAC selection. Boster and colleagues previously reviewed ten articles about children with CVI who use AAC. The authors of these studies did not consider the impact of their CVI on intervention, assessment, or the study’s results (Boster et al.). This is recognizable through the absence of CVI assessment data and discussions about aspects of the influence of CVI on the selection and design of AAC. As a result, little information about children with CVI who use AAC was identified to guide current assessment intervention procedures.

Research has shown that younger learners may prefer low-tech options, such as tactile AAC, and some parents prefer low-tech AAC options for routines and transitions at home (O’Neill, 2020). However, a limited and unclear rationale exists for selecting either high or low-tech AAC options (Boster et al., 2021). Early intervention (EI) is crucial to children’s development and success in school, especially for children with VI. Pairing these young children with a professional duly qualified to address a child’s visual impairment is critical (Ely, 2018) but difficult to find (Anthony, 2014). Without this specific knowledge and training, professionals lack the expertise to support children effectively. Preservice training and professional development for individuals who work with children with disabilities, including visual impairment, ensures professionals have the required skills and knowledge to increase academic achievement and performance for children with disabilities (IDEA, 2019).

Given a large percentage of early learning is based on visual input, challenges in learning and communication are prevalent among students with visual impairments. Children with VI often experience turn-taking difficulties in conversation, especially when they have other disabilities as well (Lund, 2007). Not only are visual cues more challenging to detect, but additional disabilities such as autism compound further social and learning difficulties. It is
estimated that 25% of individuals with autism spectrum disorder are minimally verbal (Deweerdt, 2013), and in these cases, AAC is often implemented as a primary form of communication.

AAC systems commonly rely on intact visual abilities for navigation and communication selection (Wilkinson, 2004). This makes selecting AAC increasingly difficult for service providers, speech-language pathologists, teachers, and parents. Adaptions can be made to AAC systems for children with VI, such as backlighting a microswitch, adding textures to calling devices, using three-dimensional objects, adding uncontracted braille to communication cards, using tactile sign language, and modifying communication boards by using large print with bold lines (Parker, 2009). Tangible symbols, which consist of three-dimensional objects on cards that represent a person, place, activity, object, idea, or action, are commonly used to modify AAC systems for individuals with VI (Trief, 2007). These can be used independently or with other forms of expressive communication, such as vocalizations or gestures (Trief et al., 2009).

Professionals can make best-guess decisions regarding adaptations. However, a gap exists between service providers and the implementation of best practice standards without proper guidelines and knowledge about AAC selection for children with VI.

Foundational information is scarce when working with individuals with VI and who have CCN (McCart, 2021). Boster et al. (2021) reviewed AAC interventions for included children with specifically CVI and reported the available information about participants’ vision, AAC systems, and communication skills. They found a lack of information to guide clinical decisions for using AAC. However, Boster et al. only included intervention studies that included participants with CVI or cortical blindness who used AAC. We have extended the work of Boster by including any children with any type of visual impairment who used AAC, while also
including intervention papers, survey studies, and position papers to answer the following question: what are the recommended practices for AAC intervention for children with VI and CCN?

**Methods**

**Inclusion Criteria**

Studies were eligible for inclusion in this review if AAC was used for individuals under 22 with vision loss. Studies with participants who were Deaf blind were not included in this review.

**Search Procedures**

First, the Northern Illinois University Library was searched with combinations of the following key terms: augmentative and alternative communication, vision loss, visual impairment, cortical visual impairment, low vision, blind/blindness, Picture Exchange Communication System (PECS), communication, and Standardized Tactile Augmentative Communication Symbols (STACS). Then, the following journals were hand-searched for the key terms previously listed: American Speech Hearing Association (ASHA), Perspectives on Augmentative and Alternative Communication, Augmentative and Alternative Communication, and the Journal for Visual Impairment and Blindness. These steps resulted in 17 articles that fit the inclusion criteria.

Then, a backward search was conducted in which the references of all 17 articles were examined for eligibility for inclusion in this review. This yielded four additional studies, which were then backward searched, resulting in the finding of no additional studies eligible for inclusion. A forward search was conducted with all 21 articles found, discovering no new studies.
Coding Procedures

All 21 articles were coded for the title, author, year, and journal, the visual disabilities discussed, and AAC devices used. The articles were classified as interventions, surveys, literature reviews, or position papers. These categories were then further coded with the following information. Survey studies were coded for the number of people surveyed, type of participants, aim of the paper, findings, and author-reported recommendations. Position papers were coded for the topic discussed, theme, overall takeaway, recommendations for intervention, assessment, and future research. Intervention papers were coded for the number of participants, the disability of participants, research questions, intervention used, dependent variable, the design used, author-reported results, future directions, maintenance measures, generalization measures, and social validity measures.

Results

The majority (47.62%) of the 21 articles included were intervention papers involving children. Two of the papers were dissertations, two were thesis papers, and one was a white paper from a conference. Articles were gathered from nine different journals, the most prevalent being American Journal of Speech-Language Pathology (3), Augmentative and Alternative Communication (3), and Journal of Visual Impairment and Blindness (3). Other journals included: Education and Training in Autism and Developmental Disabilities (1), Language, Speech, and Hearing Services in Schools (1), Disability and Rehabilitation: Assistive Technology (1), Journal of Developmental and Physical Disabilities (1), Exceptional Children (1), and Journal of Autism and Developmental Disorders (1). The articles included were published between 1998–2023 and most (5) of the articles were published in 2021.

Survey Studies
Four survey studies were included in this review and ranged from 43 to 272 participants ($M = 163.5$). All surveys included school-based professionals and SLPs (see Table 1). In addition, Blackstone et al. (2021) included parents of individuals with VI, Trief et al. (2009) included advisory board members, and Luo et al. (2022) included community-based and university-based professionals. Hawkins (2023) and Luo intended to obtain more information on AAC for children with VI. Blackstone et al. and Trief et al. gathered data from professionals that work with individuals with VI to identify barriers and areas of improvement in implementation. Three out of four of the studies’ respondents indicated a lack of training and knowledge about VI in general (Blackstone et al.; Hawkins; Luo et al.). An understanding of appropriate assessment tools explicitly used with individuals with VI along with effective and knowledgeable training for professionals are areas in need of improvement (Hawkins; Luo et al.). Other identified barriers were lack of non-visual AAC methods, available services, hands-on experience, time, and interprofessional collaboration (Blackstone et al.; Hawkins; Luo et al.).

Two of the articles focused on tactile AAC use with VI. Correlations were found between students’ disability label and the type of AAC selected, such as individualized symbols for individuals with ID and VI (Hawkins, 2023). However, another article pointed out the importance of creating a standardized set of tangible symbols to promote quality across services (Luo et al., 2022). Suggestions for professionals on AAC selection for individuals with VI with complex communication needs remain unclear given this contradictory information.

**Position Papers**

Themes included AAC assessment and intervention (3) and AAC visual considerations (2) (see Table 1). Goldware and Silver (1998) and Wilkinson and colleagues (2023) stressed the importance of dynamic assessment. Whereas Blackstone and colleagues (2022) and Wilkinson et
al. suggested comparing the experiences of other individuals with VI that use AAC to help determine AAC design selection. Goldware and Silver also suggested that assessment should be done by an individual knowledgeable of VI and AAC. Blackstone et al. recommended that vision be assessed often and throughout assessment and intervention. McCarty et al. (2021) and Wilkinson & Wolf (2021) focused on the impact of ranging stimuli complexity and pointed out difficulties that complex stimuli may have for individuals with CVI. Both authors recommend individually determining the level of complex stimuli and stressed the importance of the use of eye-tracking technologies to determine gaze patterns. Additionally, McCarty et al. determined that social input could increase gaze behaviors for individuals with emerging functional vision.

**Intervention Papers**

Among the ten included intervention articles, 45 participants were included, ranging from 1–25 participants per study ($M = 4.5$). All participants had a visual disability as well as additional disabilities, including one or more of the following: cognitive disabilities (33), motor delays (18), autism (9), seizure disorders (7), intellectual disabilities (6), developmental delays (6), and cerebral palsy (4). See Table 3 for a description of the participants.

Several authors examined adaptations of PECS to support request making among children with VI and other disabilities (Ali et al., 2011; Caradine, 2021; Ivy et al., 2014; Lund & Troha, 2007; Parker, 2009). In addition to PECS, two studies utilized preferred items (Ali et al.; Parker), tactile symbols (Lund & Troha), tangible symbols (Ivy et al.), and a textured speech-generating device (Caradine). All authors implemented a different dependent variable to measure their results including the percentage of correct responses (Ali et al.), the number of requests for a preferred item (Caradine), the number of times an individual either picked up, reached for, released, or moved items (Ivy et al.), the level of support required (Lund & Troha), and the
percentage of communication exchanges, distance traveled, and communication progress (Parker). Findings indicated that adapted forms of PECS were beneficial for individuals with VI and other disabilities in requesting skills.

Two sets of researchers focused on educational implications for individuals with VI and other disabilities (Bresee, 2019; Hudson et al., 2016). Bresee implemented music-based interventions and used the amount of prompting needed as the dependent variable. Hudson et al. analyzed the implications of individualized instructions on learning numeracy skills, using the number of independent correct responses as the dependent variable. Bresee concluded that music supports educational success for children with multiple disabilities, and Hudson et al. concluded that individualized instructions benefit children with complex communication needs.

The remaining authors used a fabric-based SGD (Fleury et al., 2017), tangible cues (Trief, 2007), and object exchange (Schaefer Whitby et al., 2019) to elicit communication. Fleury et al. implemented a fabric-based SGD and measured the number of uses as the dependent variable. Trief implemented tangible cues for communication with the acquisition of the cues as the dependent variable. Schaefer Whitby et al. used object exchange to elicit requests, measuring the percentage of requests per session as the dependent variable. Fleury et al. concluded a fabric-based SGD included advantages such as tactile and color variability and individual personalization. Trief concluded that there was a challenge in identifying eligible candidates for this intervention since only 15 of the 25 participants successfully learned the cues. Schaefer Whitby et al. determined that object exchange was an effective communication intervention for one individual.

**Discussion**
Peer-reviewed resources about assessment and intervention considerations for children with VI that require AAC are limited. A visual disability is prevalent among children with developmental and acquired conditions (Beukelman, 2020), and AAC would be beneficial for most of this population (Blackstone, 2021). However, there is a need for more information and training to inform intervention practices in this area (Blackstone, 2022). We analyzed 21 articles that focused on children with VI that also used AAC, concluding there are gaps within the literature involving selection, awareness, and knowledge of appropriate interventions. These findings are consistent with the previous literature review conducted by Boster et al. (2021); given the limited information available, the impact of VI on AAC intervention and assessment is unknown (Boster et al.). Through the additional expert papers included in this review, there is an apparent need for more professional training and opportunities to work hands-on with children with VI who require AAC. Like Boster et al., we urge researchers to continue investigating best practices related to AAC intervention for children with VI.

Although ten data-based articles were included in this review, little empirical data is available to support professionals in AAC selection for children with VI. Nine of the ten studies only included 1-4 participants, and four only included one. Trief et al. (2007) included 25 participants; however, 40% were unsuccessful with the tangible cues used in the study. Trief et al. experienced difficulties determining which students would benefit from their intervention strategy due to a lack of data on VI and AAC. This review aimed to summarize the current practices implemented for children with VI who need AAC. The summarized findings across all articles are listed below.

**Recommendations for Practice**

*Modified AAC*
Modifying existing AAC systems is commonly the answer for individuals with VI. Some modifications included adapted forms of PECS, music-based interventions, textured SGDs, tangible cues, and object exchange for communication. Half of the intervention papers included implemented modified PECS by adding tangible symbols (Ali et al., 2011; Ivy, et al., 2014), tactile symbols (Lund & Troha, 2007), textured SGDs (Caradine, 2021), or preferred items (Parker, 2009). All authors found using modified PECS in teaching requesting skills to individuals with VI and other disabilities a successful intervention (Ali et al.; Caradine; Ivy et al.; Lund & Troha; Parker).

Bresee (2019) focused on the impact of music-based intervention for a child with multiple disabilities and a visual impairment. The author concluded that music therapy helped the child progress toward their individualized education plan goals by showing independence when using their AAC system during the adapted music component. Fleury et al. (2017) included a wearable fabric-based speech-generating device. They concluded that although the parents preferred their child to use an app on an iPod, the participant preferred the fabric-based system due to the personalization of colors, textures, and functionality. Trief (2007) implemented tangible cues for students with VI and found that tangible cues were beneficial for most (60%) students with more vision than those with total blindness or very low vision. The author also expressed difficulty in determining which individuals will likely benefit from tangible cues due to the scattered results. Schaefer Whitby, et al. (2019) implemented object exchange and found that this was beneficial for one individual when making independent requests. A parent reported generalization of this skill at home as well.

**AAC with VI Training**
Four papers concluded a lack of knowledge in VI with AAC in training (Blackstone et al., 2021; Hawkins, 2023) and general information on the subject (Blackstone et al.; Hawkins; Luo et al., 2022; Wilkinson et al., 2023). Knowledge of the impact of VI on AAC selection is pertinent to determining intervention selection. Current professionals are left to their opinions and the little empirical data available.

**Intervention Planning**

Intervention considerations should include gaze patterns (McCarty et al., 2021; Wilkinson & Wolf, 2021), non-visual forms of AAC (Wilkinson et al., 2023), larger pictures (Goldware & Silver, 1998), and regular vision evaluations (Blackstone et al., 2022). Combined, these strategies encourage practitioners to create an individualized approach to intervention that focuses on that individual’s needs; intervention should not be a generalized one-size-fits-all approach. Individually adapted instructions have proven beneficial in early learning for children with complex communication needs (Hudson et al., 2016).

The articles included in this review were found through hand searching. Therefore, there is no guarantee that all existing studies related to this review were included. A more thorough systematic review should be considered when examining results. Additionally, this review did not include adults with visual impairments who use AAC.

Professionals who work with children with VI that require AAC must provide adequate communication support, which requires an understanding of VI with AAC selection. However, the literature shows a need for more in-depth research on assessment and intervention in this area. There is a need for more specific training, experience, and empirical literature to reference for guidance.
References


Individuals with Disabilities Education Act (2017). Sec. 300.8 (c) (13).


Lund, S. K., Troha, J. M. (2007). Teaching young people who are blind and have autism to make requests using a variation on the picture exchange communication system with tactile


**Table 1**

*Survey Studies*

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Participant Details</th>
<th>Aim of Study</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blackstone</td>
<td>2021</td>
<td>Parents; school-based professionals</td>
<td>Gather information from individuals who work with children with CVI and parents' perspectives on services</td>
<td>Respondents indicated they lacked knowledge and training related to AAC and CVI. Parents reported their children primarily use body-based communication strategies, which contradicts primarily vision-based AAC options. There is a lack of necessary services available to children with CVI that use AAC.</td>
</tr>
<tr>
<td>Hawkins</td>
<td>2023</td>
<td>Teachers of students with VI, SLPs, severe disabilities teachers</td>
<td>Identify correlation of initial selection and decision-making process of tactile AAC symbols for students with CCN</td>
<td>There were correlations between students’ disabilities and tactile AAC type and no correlations with the professionals’ demographics. Students with VI and ID were more likely to use individualized symbols compared to those with VI and other disabilities. Students’ expressive communication levels were consistently lower than their receptive communication levels. Some respondents did not base decisions on appropriate assessment tools with children with VI due to lack of knowledge, protocols, and hands-on experience.</td>
</tr>
<tr>
<td>Luo et al.</td>
<td>2022</td>
<td>School-based, community-based, and university-based professionals</td>
<td>Better understand availability, barriers, and potential improvements of educational and clinical services to children with CVI that use AAC</td>
<td>School and community-based professionals encounter several barriers while implementing services including lack of knowledge, time limitations, and collaboration between multi-disciplinary teams and family centered approaches. Community-based professionals reported less useful training with CVI. University-based professionals reported CVI content was not prioritized, required for accreditation, and not easy to find clinical practicum placements. Respondents indicated</td>
</tr>
<tr>
<td>Author</td>
<td>Year</td>
<td>Number of Participants</td>
<td>Participants</td>
<td>Aim of Study</td>
</tr>
<tr>
<td>-----------</td>
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<td>------------------------</td>
<td>--------------------------------------------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>Trief et al.</td>
<td>2009</td>
<td>43</td>
<td>Teachers, SLPs, advisory board members</td>
<td>Analyze tangible symbols implemented to determine a need for standardization</td>
</tr>
</tbody>
</table>

*Note. CVI= cortical visual impairment; AAC= augmentative alternative communication; VI= visual impairment; SLP= speech-language pathologist; CNN= complex communication needs; ID= intellectual disability*
Table 2

Position and Investigative Papers

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Theme</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blackstone et al.</td>
<td>2022</td>
<td>AAC Assessment and Intervention</td>
<td>The evaluation of vision in students with CVI should be done regularly, and with quality, during AAC assessment and intervention processes to properly determine goals. Examining differences and similarities amongst individuals with CVI that use AAC can be beneficial in determining how AAC design and intervention is selected.</td>
</tr>
<tr>
<td>Goldware &amp; Silver</td>
<td>1998</td>
<td>AAC Assessment and Intervention</td>
<td>A multimodal intervention plan that aligns with the larger educational picture is crucial when considering the goals of intervention with AAC. Assessment should be dynamic and performed by an individual knowledgeable of VI and AAC.</td>
</tr>
<tr>
<td>McCarty et al.</td>
<td>2021</td>
<td>AAC visual considerations</td>
<td>When choosing an AAC system design for an individual with CVI, consider the individual's response to complex stimuli and gaze patterns. If applicable, ensure that a ranging complexity of meaningful stimuli is available. Social cues can enhance gaze behavior.</td>
</tr>
<tr>
<td>Wilkinson &amp; Wolf</td>
<td>2021</td>
<td>AAC visual considerations</td>
<td>Automated eye tracking technologies can be used to better comprehend gaze patterns of individuals with CVI through engagement with ranging complexity. Other considerations such as movement, color, and luminosity should be examined. Research should be done to examine communication partner influence.</td>
</tr>
<tr>
<td>Wilkinson et al.</td>
<td>2023</td>
<td>AAC Assessment and Intervention</td>
<td>There is a need for more in-depth knowledge regarding appropriate interventions for individuals with CVI. Dynamic assessment is crucial. Research is needed exploring others’ experiences and AAC design options. Non-visual forms of AAC should be considered.</td>
</tr>
</tbody>
</table>

Note. AAC= augmentative alternative communication; VI= visual impairment; CVI= cortical visual impairment
### Table 3

**Intervention Papers**

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Number of Participants</th>
<th>Disability of Participants</th>
<th>Dependent Variable</th>
<th>Author Reported Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ali et al.</td>
<td>2011</td>
<td>4</td>
<td>4, cognitive disabilities; 3, autism; 2 blindness; 2 VI; 1 cerebral palsy</td>
<td>Percentage of correct responses</td>
<td>Adapted PECS with tangible symbols for individuals with MD is beneficial. All students learned to make requests for preferred items.</td>
</tr>
<tr>
<td>Bresee</td>
<td>2019</td>
<td>1</td>
<td>VI; cerebral palsy; epilepsy; autism; hydrocephalus</td>
<td>Amount of prompting</td>
<td>Music based interventions support educational success for a child with MD, including VI.</td>
</tr>
<tr>
<td>Caradine</td>
<td>2021</td>
<td>1</td>
<td>Down Syndrome; autism; ID; seizure disorder; VI; nystagmus</td>
<td>Request for preferred item</td>
<td>Textured SGD and PECS can help teach children with VI and autism how to request.</td>
</tr>
<tr>
<td>Fleury et al.</td>
<td>2017</td>
<td>1</td>
<td>Acquired brain injury; seizure disorders; CVI; hemiparesis</td>
<td>Number of uses</td>
<td>The participant indicated preference for fabric-based SGD. Advantages of the device included tactile and color differentiability, and personalization.</td>
</tr>
<tr>
<td>Hudson et al.</td>
<td>2016</td>
<td>2</td>
<td>2 CVI; 2 seizures; 1 stroke in utero; 1 nystagmus; 1 optic atrophy; 1 cerebral palsy</td>
<td>Total independent correct responses</td>
<td>Individually adapted instructions were beneficial for learning of early numeracy skills for individuals with CCN.</td>
</tr>
<tr>
<td>Ivy et al.</td>
<td>2014</td>
<td>4</td>
<td>2 SOD; 3 ONH; 1 cognitive delay; 3 GDD; 1 optic atrophy; 1 cerebral palsy; 1 hormone deficiency; 1 hypotonia; 1 nystagmus</td>
<td>Number of times they pick up, reach for, release, or move items</td>
<td>All learned to independently request using tangible symbols within PECS context.</td>
</tr>
<tr>
<td>Lund &amp; Troha</td>
<td>2007</td>
<td>3</td>
<td>3 blind; 3 autism; 2 cognitive impairment; 1 cognitive delay; 1 apraxia of speech</td>
<td>Level of support required</td>
<td>Tactile symbols based on PECS can be effective for requests for individuals that are blind with autism.</td>
</tr>
<tr>
<td>Author</td>
<td>Year</td>
<td>Number of Participants</td>
<td>Disability of Participants</td>
<td>Dependent Variable</td>
<td>Author Reported Results</td>
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<td>--------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Parker</td>
<td>2009</td>
<td>3</td>
<td>2 ONH; 2 seizure disorders; 1 microcephaly; 1 CVI; 1 nystagmus; 1 craniofacial anomaly; 1 Conradi-Hunermann Syndrome</td>
<td>Percent communication exchanges, distance traveled, communication progress</td>
<td>Use of preferred items to build communication of requests through an adapted form of PECS benefits this population.</td>
</tr>
<tr>
<td>Trief</td>
<td>2007</td>
<td>25</td>
<td>Total blindness; low vision; cognitive delays; motor impairment; language delay; no expressive language</td>
<td>Acquisition of tangible cues</td>
<td>Tangible cues were learned by 15 students. The 10 that did not learn were considered to have more severe impairments. It is challenging to determine which students are candidates to effectively learn tangible cues.</td>
</tr>
<tr>
<td>Schaefer</td>
<td>2019</td>
<td>1</td>
<td>Balanced chromosomal translocation; functional blindness; hydrocephalus; GDD; ID; autism</td>
<td>Percent of requests per session</td>
<td>Object exchange was an effective intervention for communication. The individual’s mother reported generalization at home.</td>
</tr>
</tbody>
</table>

Note. VI= visual impairment; PECS= Picture Exchange Communication System; MD= multiple disabilities; ID= intellectual disability; SGD= speech generating devices; CVI= cortical visual impairment; CCN= complex communication needs; SOD= septo-optic dysplasia; ONH= optic nerve hypoplasia; GDD= global developmental delay