Critical Review: Is the picture exchange communication system or sign language the most appropriate augmentative and alternative communication system for nonverbal children with autism spectrum disorder?

Kelly Karelsen
M.Cl.Sc (SLP) Candidate
University of Western Ontario: School of Communication Sciences and Disorders

This critical review examines whether certain factors can assist in selecting the most appropriate AAC system (i.e. PECS or sign language) for nonverbal children with ASD. Study designs include one single-subject alternating treatment design, one single-subject alternating treatment multiple baseline design, one case study design, one narrative review, and one qualitative nonexperimental case study design. Results of the studies revealed encouraging outcomes that may guide the selection of an AAC system for nonverbal children with ASD based on certain child characteristics and other various factors. Clinical implications are discussed.

Introduction

Approximately half of children diagnosed with autism spectrum disorder (ASD) are nonverbal (Franky, Leary & Kilman, 1987). Speech and language treatment options for these children typically consist of Augmentative and Alternative Communication (AAC) systems, which essentially provide other means of communicating through various tools and strategies. Bondy and Frost (1994) stated that the most prevalent augmentative communication systems for nonverbal children with ASD are the Picture Exchange Communication System (PECS) and sign language. PECS involves exchanging iconic pictures for communication purposes (e.g., requesting, labelling, and commenting) (Bondy & Frost, 1994). Sign language involves a different form of iconic representation where the sign and the object or action it represents is closely associated through the use of manual hand gestures (Anderson, 2001). It can be difficult to choose between these two AAC systems with regard to which option is the most appropriate for a child to learn. In the past, augmentative systems for children with ASD have been selected based on caregiver and teacher preference as well as knowledge of use of the system (Kiernan, Reid & Jones, 1982). Unfortunately, this type of decision-making can still be utilized today without considering the child's characteristics, needs or preferences for a particular system, though perhaps not in the extreme. Currently, the issue revolves around selecting the most appropriate AAC system for nonverbal children with ASD, which is based on various factors. These factors may include caregiver and teacher preference, caregiver and teacher experience, school policies, child preference, and child characteristics. When all factors are considered, caregivers and professionals can make a more informed decision about which AAC system to implement that is ultimately individualized to the child with ASD.

Objectives

The primary objective of this paper is to critically evaluate existing literature on the appropriateness of selecting PECS or sign language as an AAC system for nonverbal children with ASD. The secondary objective of this paper is to propose evidence-based practice recommendations for future research and application in clinical practice.

Method

Search Strategy
Computerized databases including ProQuest, PsycINFO, Dissertations and Theses, and Google Scholar were searched using the following search terms: ((Autism) AND (PECS) AND (sign language)). Reference lists of articles were manually searched for further studies relevant for the purpose of the critical review.

Selection Criteria
Studies selected for inclusion in this critical review paper were required to investigate whether child characteristics potentially assist in selecting an appropriate AAC system for nonverbal children with ASD. Some limits were set on the demographics of research participants (i.e., young nonverbal children with ASD). No limits were set on outcome measures.

Data Collection
Results of this literature search yielded the following five studies: one single-subject alternating treatment design, one single-subject alternating treatment multiple baseline design, one case study design, one narrative review, and one qualitative nonexperimental case study design.

Results

Tincani (2004) used a single-subject alternating treatment design with an initial baseline phase and final "best-treatment" phase, level 1 research evidence, to compare the effectiveness of PECS and sign language training on the acquisition of mands (e.g., requests for preferred items) for children with ASD. This study also examined the participant's pre-existing motor imitation abilities in relation to each AAC system and the development of speech during their training. Participants included two nonverbal children with ASD aged 5-6 years. Data was collected within a behavioural observation format where the baseline condition was compared to the experimental condition (i.e., training of both sign language and PECS training). Stimulus preference and imitation assessments were also conducted prior to the baseline condition. The purpose of the baseline condition was to ensure that participants did not have a pre-existing ability to request the preferred items with either AAC system without training. In the experimental condition, the children were trained to use both PECS and sign language with high interest items, as determined by the stimulus preference assessment, with alternating treatments in a self-contained classroom for children with disabilities. PECS and sign language training with the selected items continued for five to seven trials or until satiation occurred. The training procedure for both AAC systems involved presenting a stimulus item, modeling the desired response, increasing time delays, and ultimately reducing levels of prompting. In the "best treatment" phase, only the best treatment (i.e., the most effective AAC system) was used to teach mands. Generalization probes were also conducted to determine whether the children could use PECS and sign language with other communication partners (e.g., teacher).

The author visually represented the results in a graph to display changes made in baseline and experimental treatment conditions based on the percentage of independent mands. Visual inspection of the data revealed sign language to be more appropriate for one participant and PECS to be the better choice for the other participant based on more mands demonstrated with a particular system. The author suggested that PECS might be more appropriate for learners without hand-motor imitation skills as the participant who preferred this AAC system demonstrated more PECS exchanges than independent signs. On the other hand, sign language may be more appropriate for learners who have moderate hand-motor imitation skills as the participant who preferred this AAC system demonstrated more independent signs than PECS

exchanges. Lastly, sign language fostered a higher percentage of vocalizations for both participants.

Strengths of this study included counterbalancing both AAC systems across days of the week, time of day, order of presentation and persons delivering treatment in order to reduce other variables affecting the acquisition of PECS and sign language. Limitations included the small number of participants, which led to that nature of this study's design (i.e. statistical manipulations could not be conducted). The author also mentioned a few procedural limitations in this study. Firstly, during the stimulus preference assessment, the participants should have been exposed to forced choice of two items presented simultaneously as opposed to relying on the participant's responses to random items in order to better identify more preferred items for the experimental conditions. In addition, internal validity may have been jeopardized since the experimental conditions were conducted in the classroom, which tends to be a distracting and unpredictable setting. Children with ASD typically benefit from an established routine; therefore this setting may have affected the participant's performance in acquiring the AAC systems. Lastly, the participants were only exposed to an average of 22 communication opportunities during each training session; however, previous research suggests that a significantly increased amount is preferred in order to acquire the AAC system. As a result, this study provides suggestive evidence in determining whether PECS or sign language is the most appropriate AAC system for nonverbal children with ASD.

Anderson (2001) used a single subject alternating treatment, multiple baseline design, level 1 research evidence, to examine differences in child performance between the training of both PECS and sign language in rates of acquisition, spontaneous use, maintenance, behaviours, generalization, eye contact, and vocalization. A further purpose of this study was to identify whether child characteristics may be related to performance with each AAC system. Participants included six nonverbal children with ASD aged 2-4 years. There was a pre-treatment phase where the following assessments were conducted: vocal and motor imitation, play/social, joint attention (protoimperative and protodeclarative joint attention), reinforcer, and various general assessments such as the *Childhood Autism Rating Scale (CARS)*, *MacArthur-Bates Communicative Development* Inventory (CDI)*, and the *Bayley Scales of Infant Development*. Data was collected within a behavioural observation format where the baseline condition was compared to the experimental

condition (i.e., both sign language and PECS training). The baseline condition ranged from 2-10 weeks in duration and consisted of several probe types that were administered when necessary (i.e., before the introduction of each new training item). The duration of the experimental condition was approximately 10 weeks where the children underwent four treatment sessions daily, alternating between PECS and sign language. The post-treatment assessment was 2-3 weeks in duration and the same probe types were administered identical to the participant's exposure to them during the baseline condition. Certain assessments that were administered during the pre-treatment phase were also re-administered during the post-treatment assessment.

The author visually represented the results in graphs to display changes made in the baseline and experimental treatment conditions based on the percent correct use of both AAC systems. Visual inspection of the data revealed that all of the participants mastered more items with PECS than with sign language (i.e., main effect of PECS acquisition). Secondly, participants demonstrated a preference for a particular AAC system. Children who preferred PECS were the youngest in the sample, had the lowest age-equivalents for nonverbal cognitive functioning and fine and gross motor skills, and the least severe cases of ASD (according to the CARS). Children who preferred sign language were the oldest in the sample, had the highest age-equivalents for nonverbal cognitive functioning and fine and gross motor skills, higher levels of functional play (i.e., the most developed representational thinking), and the most severe cases of ASD (according to the CARS). The following benefits of each AAC system were noted: PECS seemed to better suited for a broader range of children, had faster rates of acquisition, and provided better generalization to novel items. Sign language acquisition led to higher levels of initiation, increased eye contact and more vocalizations. Children with more developed protoimperative joint attention skills (i.e., bids for nonverbal requesting) acquired PECS more readily whereas those children with protodeclarative joint attention skills (i.e., bids for sharing an experience) acquired sign language easier. Lastly, vocalizations during and after treatment were associated with the participant's imitation level and language age-equivalent before treatment.

Strengths of this study included the involvement of 13 trainers to encourage generalization to other communication partners and potential examiner effects on the participants' performance. Internal

validity, fidelity, and interobserver agreement for reliability of all measures used were well defined and controlled. Some limitations included the small sample size, which led to the absence of statistical manipulations (as previously mentioned). However, this study was well-formulated and used valid methods which provides compelling evidence in determining whether PECS or sign language is the most appropriate AAC system for nonverbal children with ASD.

Null (2008) originally planned to use a quasi-experimental aptitude-treatment interaction (ATI) research design, level 1 research evidence, that attempted to examine whether child characteristics relate to the acquisition of PECS and sign language. However, this research methodology attempt was discontinued due to the small amount of participants obtained for the study. As a result, the research design became a case study, level 4 research evidence, for each participant where pre-test assessments and outcome measures were compared to their own as well as the other participants' in a descriptive manner. The author sought to confirm the results of Tincani (2004) and Anderson (2001) and to essentially find some additional characteristics (e.g., discriminative learning, scanning ability, and nonverbal cognitive ability) to further help select an appropriate AAC system for nonverbal children with ASD who exhibit a specific set of characteristics. Participants included five nonverbal children with ASD aged 3-4 years. Four participants were taught PECS and one participant was taught sign language by the classroom staff in the classroom. There was a pre-test phase where the following assessments were conducted: scanning, discrimination, cognitive ability, and vocal and motor skills. Each participant was observed for 7 weeks after the pre-test assessment and data was collected on the percentage of independent mands with a certain AAC system. Outcome measures were taken weekly (i.e., as the participants were exposed to PECS or sign language training in the classroom) as well as seven weeks after the AAC system was introduced.

Data from the pre-test phase indicated that fine motor imitation skills aided in the acquisition of sign language whereas discriminative learning aided in the acquisition of PECS. However, conclusions cannot be drawn, as a statistical analysis was not achieved due to the lack of participants for the desired research method.

Strengths of this study included exploring different child characteristics that were hypothesized to relate to the acquisition of PECS and sign language with the

intention of using a methodological design. Unfortunately, this research design (i.e., ATI) could not be conducted due to the small number of participants (i.e. those who had no experience using the AAC systems), which was this study's most significant limitation. Ideally, 10 children were supposed to be taught PECS and 10 children were to be taught sign language. In addition, many of the participants were at least exposed to the AAC system that they were trained with in some form before the pre-test assessments, which may have ultimately affected reliable outcome measures for training of the system. Another limitation was the issue of treatment integrity in that all of the phases involved in PECS training were not carried out and the sign language training was not consistent and specific. In addition, the results of the scanning assessment were not reliable because the participants often became fixed on the novel items that were introduced and also potentially had some delays in receptive language skills. Lastly, some noncompliant behaviours were demonstrated during the pre-test assessments which may have ultimately affected scores attained. As a result, this study provides equivocal evidence in determining whether PECS or sign language is the most appropriate AAC system for nonverbal children with ASD.

Mirenda (2003) used a narrative review, level 4 research evidence, to summarize a couple of frequently asked questions about what it known and not known by speech-language pathologists (S-LP) who provide support for children with ASD. This paper will focus on the following question addressed in Mirenda's narrative review (2003): "Are unaided AAC approaches such as photographs and line drawings preferable for use with students with autism?" (p. 203). The author reviewed research that pertained to this particular question, but did not follow the stringent methodological criteria to evaluate the studies adequately. Research was rather reviewed under the assumption of adequate internal validity for ultimately empirically sound studies.

The author noted that few studies have directly compared PECS and sign language in children with ASD and the results are somewhat mixed. Some studies suggested that PECS are easier to learn and use while others support sign language. Data collected from a number of studies suggested that individuals with more developed fine motor abilities and good motor verbal imitation skills are more appropriate candidates for sign language; whereas no particular pre-existing skills have been identified for PECS. Some studies suggested that the acquisition of PECS require fewer memory and cognitive demands

and are perhaps easier to use. As a result, children with lower cognitive functioning may benefit from this AAC system as opposed to sign language. It was also suggested that PECS offer greater intelligibility for communication partners since everyone may not be able to understand sign language.

Strengths of this study included a thorough review of the available research, specific to the purpose of this critical review paper, outlined in a very descriptive manner. Limitations included the nature of a narrative review in that it did not follow methodological criteria that a systematic review outlines. This approach is more subjective and less conservative which led to suggestive conclusions. As a result, this study mainly offers confirmatory conclusions for the purposes of this paper in determining whether PECS or sign language is the most appropriate AAC system for nonverbal children with ASD.

Spencer, Petersen, and Gillam (2008) used a qualitative nonexperimental case study research design that was published in an educationally relevant and credible journal. It provides level 4 research evidence, where three hypothetical nonverbal children with ASD, aged 4-7 years, were intensively studied. Spencer et al. (2008) outlined Gillam and Gillam's (2006) structured evidence-based decision-making process along with considering various internal evidence (e.g., student, family, teacher, and school factors) to determine the most appropriate AAC system (i.e., PECS or sign language) for these children. The purpose of this study was to provide a guide for teachers relative to 'how to' access and analyze appropriate research evidence (i.e., external evidence) and ultimately incorporate that with student variables for intervention decisions. More specifically, Gillam and Gillam's (2006) Seven-Step Evidence-Based Practice Decision-Making Process outlines parameters to guide the search for evidence, how to search for evidence, how to evaluate each study for quality and summarize findings, the consideration of internal evidence, how to integrate the internal and external evidence, and how to monitor the outcome. Two of the articles previously discussed in this critical review paper (i.e., Anderson, 2001 and Tincani, 2004) were used as external evidence. Gillam and Gillam (2006) maintain that different intervention decisions may result from using the same research evidence and this was demonstrated with the three different case studies in this article.

The first case study illustrated a child who occasionally produced one-syllable utterances, but mainly communicated through gestures (i.e., pulling)

and protesting (i.e., hitting, crying). He had slightly impaired motor abilities and could imitate 3-4 motor movements. He was unable to discriminate between graphics and/or symbols and pictures and was unable to match objects to pictures. His parents deferred decisions concerning his education to the school personnel, but were open to most intervention methods. Lastly, his teacher and S-LP had experience using both PECS and sign language. Based on his motor ability, the external evidence suggested that sign language might be the most appropriate AAC system. Coinsidely, the internal evidence supported this suggestion, as the family, teacher and S-LP were willing and capable of using this system. As a result, sign language was selected to be the most appropriate AAC system for this child.

The second case study illustrated a child who limited her communication to protesting. She had moderately impaired motor abilities and could not imitate vocal or motor responses. She was unable to match objects to pictures and her cognitive abilities were below average for her age. Her parents were very involved in her education and were apprehensive about using sign language. Her teacher used PECS for many students in the class and had no experience with sign language. Lastly, the school district had a fulltime AAC representative who typically encouraged the use of PECS. The external evidence was inconclusive according to her pre-training skills, as it seemed as though she would have difficulty acquiring both PECS and sign language. Nonetheless, at that time, her family, teacher, and school district were better prepared to support the use of PECS. As a result, PECS was selected to be the most appropriate AAC system for this child and her communication outcome was essentially monitored.

The last case study illustrated a child who made very few attempts to communicate and could not imitate any vocal or motor responses. He could follow simple one-step directions and match pictures though his cognitive ability was significantly impaired. His parents requested that he be taught sign language as extended family had success with it for their child. The school personnel believed that a picture-based system would yield more functional communication. The external evidence suggested that he would not be as successful with sign language; however, his parents preferred this AAC system. As a result, the family was educated about the available research and the rationale for selecting PECS. A negotiation was established where if sign language was not yielding sufficient progress in the first three months then PECS would be implemented.

This study showed that it is important to consider the external evidence along with the internal evidence when implementing intervention. It is also important to note that once decisions are made regarding the selection of an AAC system, outcome evaluation is ongoing. Strengths of this study include a thorough analysis of the factors revolving around intervention for a child with ASD to allow for appropriate and individualized decision-making. It also incorporated well-defined research evidence to inform clinical decision-making. Limitations include the hypothetical participants and lack of empirical evidence due to the nature of its qualitative design. As a result, this study mainly offers confirmatory conclusions for the purposes of this paper in determining whether PECS or sign language is the most appropriate AAC system for nonverbal children with ASD.

Discussion

Each of the studies examined discussed child characteristics and various factors that may help in selecting the most appropriate AAC system for nonverbal children with ASD. However, the evidence from these studies provided a range in levels of validity, which led to conclusions of varied support despite the research design. Only one study attempted to use a methodological research design to quantify the data, but was unable to do so because of the small number of participants obtained. Nonetheless, the research currently suggests that those children who demonstrate more developed fine motor skills, vocal and motor imitation skills, protodeclarative joint attention skills, cognitive functioning, and functional play skills may be more appropriate candidates for sign language. Whereas, those children who demonstrate more developed discriminative learning and protoimperative joint attention skills may be more appropriate candidates for PECS. Other benefits of acquiring a certain AAC system were also discussed with regard to better generalization and intelligibility (i.e., PECS) as well as increased vocalizations, eye contact, initiation (i.e., sign language) etc. The research also suggests that children may naturally develop a preference for one particular AAC system, which may be characteristic or even personality-driven. It is also important to consider family and school factors when selecting an AAC system as support may be somewhat dependent on various factors to allow for use and maintenance of the system. It appears as though decision-making must be individualized for each child in order to best support his/her communication needs. All in all, the studies discussed offer preliminary suggestions for selecting the most appropriate AAC system for

nonverbal children with ASD. However, more research is needed to further explore which AAC system is more appropriate for a child who exhibits a specific set of characteristics through research methods that acquire empirical support.

Clinical Implications

It is clear that decision-making is complex and rather challenging regarding which AAC system is most appropriate for nonverbal children with ASD. It ultimately requires careful assessment and individualization for each child. That is, at any given point, an AAC system should be based on an interaction between child characteristics, child needs/preference, caregiver and teacher needs/preference, experience, and school policies. These considerations will allow for maximized motivation, success, minimized frustration and negative behaviours (Anderson, 2001). It is important to realize that a child's needs and preferences might change overtime therefore updating or changing his/her AAC system may be necessary. Several researchers have suggested that instruction strategies may significantly impact how a child acquires an AAC system. As a result, it is important to implement proper instruction when training an individual to ensure better acquisition of the communication system. In addition, Anderson (2001) also suggested that combining the training of both PECS and sign language might maximize both communication systems. She recommended that clinicians start by training PECS and then transition to using sign language when it's appropriate. Lastly, it is important to indicate that the AAC system should be appropriate and functional for the child as well as the caregivers because they too must be able to use the system across environments to promote use and maintenance of the communication system.

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