

**Critical Review:**  
**In children and youth with complex communication needs, does Augmentative and Alternative Communication (AAC) reduce challenging behaviour?**

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***Introduction***

Challenging behaviours may look like willful misconduct, attention seeking, manipulation, or laziness (Grey Bruce FASD Leadership Team, 2016); however, it is important to reframe how challenging behaviours are perceived, as they often serve a communicative purpose in individuals with complex communication needs (Walker, Lyon, Loman, & Sennott, 2018). For example, a challenging behaviour may be used to receive attention, to obtain a tangible reinforcement, or to escape from an undesired situation. Overall, challenging behaviours and communication deficits have been found to be highly related in the literature, with children and youth with complex communication needs more frequently engaging in problem behaviours than their peers (Walker et al., 2018).

In terms of academic success in the classroom, problem behaviours can interfere with the individual's learning progress and social relationships, as well as cause disruptions in the classroom environment that present additional obstacles for supporting personnel (Hetzroni & Roth, 2003). To facilitate changes in challenging behaviours and to increase functional outcomes, communication-based approaches have employed Augmentative and Alternative Communication (AAC) (Hetzroni, 2003): the two most common methods being the Picture Exchange Communication System (PECS) and Functional Communication Training (FCT). PECS teaches individuals to use pictures to request an item from a communication partner (Charlop-Christy, Carpenter, Le, LeBlanc, & Kellet, 2002), while FCT using AAC teaches individuals to replace a specific problem behaviour with a desired communicative response (Walker et al., 2018).

It can be hypothesized that giving children and youth with complex communication needs a more socially appropriate way to express themselves through AAC will reduce instances of problem behaviour (Hetzroni & Roth, 2003). Due to the importance of communication in reducing challenging behaviour, further research is needed to investigate the effectiveness of AAC (Frea, Arnold, & Vittimberga, 2001).

***Objectives***

The primary objective of this critical review is to investigate whether AAC reduces challenging behaviour in children and youth with complex communication needs.

***Methods***

Search Strategy

A variety of computerized databases, such as ERIC, Psych Info, and PubMed, were used to find relevant articles. Search terms included the following:

(augmentative) AND communication AND (problem behaviour OR challenging behaviour OR maladaptive behaviour)

Selection Criteria

In order to be included in this review, articles had to examine AAC use in relation to changes in challenging behaviour in children and youth with complex communication needs. Criteria for AAC was not limited to a specific device or system. Similarly, articles were not excluded based on what type of congenital disability they examined.

Data Collection

Seven articles met the specified selection criteria: single-subject study (5), meta-analysis (1), and single group pre-post test design (1).

***Results***

Single-Subject Studies

A single-subject study is an appropriate method to use in a rehabilitation setting when there is a limited number of available participants or when participants are heterogenous in nature (Logan, Hickman, Harris, & Heriza, 2008), such as when studying individuals with complex communication needs. However, due to small sample sizes, where each participant has a unique baseline, single-subject studies lack generalizability.

**Charlop-Christy, Carpenter, Le, LeBlanc, and Kellet (2002)** examined the influence of the Picture Exchange Communication System (PECS) on

spontaneous speech, imitative speech, social-communicative behaviour, and problem behaviour, of which only the latter was of interest to the current review. Over multiple baselines, three boys with autism (ages 3-12) completed biweekly 15-minute PECS training sessions. Training sessions continued until a criterion of 80% accuracy across 10 trials for each of the six PECS phases was achieved. Outcome measurements were taken during baseline, during PECS training, and during several post-treatment sessions that occurred in the weeks immediately after training. Outcome sessions were 10-minutes in length and occurred biweekly: once in an academic setting and once in a free-play setting. The order of the settings was randomized.

Each session was videotaped and later scored for percentage of 10-second intervals with tantrums and out of seat behaviour, as well as frequency of grabbing and disruptions. Tantrums and disruptions were measured in both academic and free-play sessions, while out of seat behaviour and grabbing was only measured in academic sessions. Data was not present for one of the three participants: however, interobserver agreement (IOA) was acceptable. Descriptive statistics and visual inspection suggested that the boys showed a reduction in all four types of problem behaviours. Percentage reduction scores were calculated for each behaviour in each setting by each participant (N=12). Calculations revealed a 70% or greater reduction for 10 of 12 behaviours, and four behaviours were eliminated.

In accordance with Logan, Hickman, Harris, and Heriza's (2008) guidelines for single-subject studies, problem behaviours were clearly operationally defined, each phase had an adequate number of data points (minimum of five), and visual analysis followed standard conventions. Several limitations of the study included ambiguity of the therapists' qualifications, ambiguity of the identity of the observers who scored data, and lack of clear procedure for post-training sessions. Additionally, data for problem behaviour during baseline was not stable and was very variable, which consequently made visual analysis difficult to interpret (Ganz, Parker, & Benson, 2009). The study would have also benefited from functional statistical analysis.

Overall, this study provides somewhat suggestive evidence that PECS decreases instances of problem behaviour in children with ASD. The sample size was very small, local, and specific with low relative diversity, which limits generalizability.

**Freya, Arnold, and Vittimberga (2001)** explored whether PECS was an effective method to reduce the severe aggressive behaviour of a 4-year-old boy with autism. The study employed a multiple baseline across situation design where aggressive

behaviour (e.g., biting, hitting, and kicking) was measured in two different classroom settings, the Manipulatives centre and the Daily Living centre, during daily classroom play routine. The Manipulatives center included large blocks and toy cars, while the Home Living center included pretend kitchen and cooking items. The number of occurrences of aggressive behaviour in both settings were taken during 10-minute baseline sessions. Following baseline measurements, the participant received two 1-hour PECS training sessions using PECS protocol for Phase 1 to Phase 3. Aggressive behaviour was measured again post-training during 10-minute intervention sessions where the therapist was allowed to verbally prompt the child to make a request. Acceptable IOA was reported. Descriptive statistics and visual analysis suggested that instances of aggressive behaviour towards peers reduced immediately after PECS training and was no longer occurring after six days.

A strength of this study is its use of a naturalistic environment, as behavioural measurements occurred within the participant's classroom during interactions with peers. Several limitations of this study included the fact that the participant had already practiced pointing to the stimuli to receive reinforcement with his SLP before the study, for which there was no available data. It is possible that the previous familiarity with the stimuli resulted in a practice effect. Unlike other studies, measures of aggressive behaviour were not taken in training sessions and there was no post-intervention measurement of behaviour where prompting was not used; thus, there were a limited number of data measuring phases. There was also no description of the participant's background history and no functional statistical analysis, which makes comparison to other studies difficult. While visual analysis was appropriate, behaviour was very variable during baseline.

The study by Freya et al. (2001) provides somewhat suggestive evidence that PECS is effective in reducing aggressive behaviour; however, the intervention effect is not generalizable, as the study only included one participant.

**Ganz, Parker, and Benson (2009)** investigated whether PECS instruction increased use of pictures for requesting, increased use of intelligible words or word approximations, and decreased maladaptive behaviour in three boys with autism (ages 3-6), of which only the latter variable was relevant to the current review. Using a multiple-baseline-probe design, the participants received 10 five-minute PECS training sessions, which followed PECS protocol for Phase 1. Following PECS training, five-minute intervention probe sessions were conducted using similar protocol to baseline sessions, where no

prompting was allowed. If the child did not meet criterion (i.e., used five or more pictures to make a request in three consecutive sessions), two additional five-minute PECS training sessions were provided before the next probe session. A generalization session occurred within two weeks of the intervention final probe to examine whether treatment effects would generalize to a novel adult communication partner. Maintenance sessions were provided 5-6 weeks after the final probe session, using the same protocol as probe sessions.

Data was collected for each instance of the following maladaptive behaviours: screaming, aggression towards self or others, and out of seat behaviour. IOA was acceptable for all three boys during intervention and maintenance sessions, however, IOA fell below 80% for one boy during generalization. Data was analyzed using descriptive statistics, visual analysis, and Improvement Rate Difference (IRD), which was an index that compared data points in baseline and intervention sessions (including maintenance and generalization) to determine the degree of difference. While one boy showed a rapid decline in maladaptive behaviour on visual analysis, the two other boys' behaviour were variable. Furthermore, IRD indicated questionable effects on maladaptive behaviour.

Ganz et al. (2009) clearly described operational definitions of maladaptive behaviour, eligibility criteria, and the materials and procedures used, which would allow for replication. However, there was a limited number of data points in both the maintenance and generalization phases (less than five), which limits analysis of the stability and generalizability of behaviours. Additionally, the study only included one of six PECS phases; thus, participants may have benefited from longer and more diverse PECS training. In general, due to lack of significant findings, this study provides equivocal evidence that PECS instruction leads to reductions in maladaptive behaviour.

**Hetzroni and Roth (2003)** examined the effectiveness of a positive AAC support system in reducing the challenging behaviours of five students diagnosed with moderate to severe mental retardation. Students were all male and were between the ages of 12-19. The school team collaborated to individualize the positive AAC support system to each student prior to baseline. Functional analysis was used to determine the reason for the behaviour, from interviews and observations in the classroom, and then to choose an appropriate communicative substitute. To replace challenging behaviours, voice output communication devices/aids (VOCAs) were used in conjunction with picture communication symbols (PCS). VOCAs allow

for prerecorded words or short phrases to be played by the individual.

Using a multiple probe design, an independent observer collected data for challenging behaviour three times a week for 20 minutes, in both baseline and intervention phases. Behaviour was divided into 11 categories and measured as a percentage of 30 second intervals. A direct observation checklist was used during data collection. The AAC support plan was implemented by the school team until the child had at least a 30% reduction in frequency of behaviours for three consecutive sessions. Follow-up sessions were conducted one week after intervention and then again after six weeks. IOA was appropriate; however, results were limited to descriptive statistics and visual analysis. Visual inspection suggested that all participants showed a reduction in behaviour after intervention was provided.

The use of both the school team and classroom environment helped simulate naturalistic conditions. Eligibility criteria was clearly outlined, visual analysis followed standard conventions, behaviour was stable at baseline, and the results of intervention were replicated across more than three participants. In terms of limitations, baseline observations occurred at different times each day, creating a confounding variable. While the study used a direct observation checklist to measure behaviour, it was not provided; thus, the operational definition of each problem behaviour was not available. The implementation of intervention within daily classroom activity was not controlled, as it is unknown how much direct intervention each participant actually received. Additionally, procedure for the follow-up sessions was not stated and these sessions provided limited data points. The study would have also benefited from statistical analysis.

Hetzroni and Roth's (2003) study provides somewhat suggestive evidence that a positive AAC support plan implemented by the school team decreases problem behaviour.

**Olive, Lang, and Davis (2008)** measured changes in the language and challenging behaviour of a four-year old girl with autism spectrum disorder (ASD) following parent-implemented Functional Communication Training (FCT) in combination with a VOCA. Only the dependent variable of challenging behaviour was of interest to this review. Using a multiple probe design, challenging behaviour was measured across four activities in the child's home: reading, art, memory/matching, and puzzles. Functional analysis revealed that the function of the child's behaviour was to receive attention. Baseline measurements for all activities began simultaneously and occurred while the child engaged in the activity alone as her mother was doing chores nearby. Once the

frequency of behaviour was consistent for one activity, five-minute intervention sessions were provided for that activity, while the other activities remained in baseline. During intervention sessions, a graduate research assistant coached the mother on how to use prompting. When an intervention effect for the first activity was demonstrated, intervention for the second commenced. Procedure continued until intervention effects for all four activities had been measured. Each session was videotaped and later scored by a graduate research assistant who was not involved in intervention. IOA was acceptable and results were reported using visual analysis and descriptive statistics. For all activities, the frequency of challenging behaviour immediately decreased upon intervention.

The use of a multiple probe designed allowed the researchers to observe stimulus and response generalization, as training for one activity carried over to untrained activities. Challenging behaviour was operationally defined; however, the definition of “intervention effect” was not. There was also an insufficient number of data points (less than five) during baseline for art and book reading and for treatment for memory/matching and puzzles. There were no follow-up sessions; thus, it is unknown if intervention effects were maintained. The data coders were not blinded to the conditions of the study and functional statistical analysis was not employed, which reduced objectivity of outcome measurements.

Overall, Olive et al.’s study provides somewhat suggestive evidence that parent-implemented FCT in combination with a VOCA is effective in decreasing challenging behaviour.

#### Meta-Analysis

**Walker, Lyon, Loman, and Sennott (2018)** conducted a meta-analysis to review single-case intervention studies that used FCT with AAC to address challenging behaviours in school settings. Specifically, the authors were interested in providing a descriptive summary of participant, intervention, and quality-of-study characteristics, as well as analyzing intervention effect and study characteristics that moderate intervention effect. Two reviewers used online search engines to identify 234 relevant articles. After inclusion criteria was applied, 17 studies were included in the final review, which yielded measures of challenging behaviour for 43 participants. Any form of unaided or aided AAC was acceptable. Appropriate inter-rater reliability was reported for the selection of articles.

The quality of each study was assessed using the What Works Clearinghouse design standards (WWC), which provided an objective framework of evaluation; however, a quarter of studies did not meet design standards. Intervention effect for each participant was calculated using Tau-U with an inter-

rater reliability of 100%. The use of Tau-U for statistical analysis was appropriate. Calculations indicated that FCT in combination with AAC resulted in large changes in challenging behaviour. Moderator analysis suggested that the majority of participant and study characteristics did not contribute to intervention effect; however, several significant moderators of intervention effect included gender (greater for females than males), type of behaviour (greater for distracting than destructive), and intervention setting (greater in inclusive-school settings than non-inclusive).

Walker et al (2018) clearly outlined their methods and procedures, including search terminology, search engines, inclusion criteria, inter-rater disagreement resolution, and data analysis. Appropriate inter-rater agreement was reported for all aspects of data coding and analysis. Overall, this meta-analysis provides compelling evidence that FCT in combination with AAC reduces challenging behaviour in school settings.

#### Single Group Pre-Post Test Design

**Hetzroni (2003)** investigated whether the implementation of AAC strategies, as part of a school-wide positive behaviour support plan, increased communicative behaviour and reduced behavioural problems in students with intellectual disabilities, which only the latter variable was relevant to the current review. Using a single group pre-post test design, 67 students (ages 6-21) at a school for individuals with intellectual disabilities were evaluated by the school team using an inventory before and after intervention. On the inventory, the student’s behaviour problems were scored into 13 categories (e.g., spitting, hitting, biting). The severity of the student’s problem behaviour was scored on a scale of 1-5. The whole school staff collaborated to use functional analysis to determine the function of each student’s behaviour and to create an appropriate AAC support plan, which was implemented in classroom curriculum across the school year. Graphic symbols were included in all classroom activities and students were provided with communication boards and devices, based on their needs. Two speech-language pathologists were designated as trainers and continued to provide support throughout intervention. Once post-intervention inventories were completed at the seventh month, two independent coders collected the data.

IOA was appropriate. Descriptive statistics suggested a decrease in problem behaviour, and the elimination of specific behaviours, such as hitting and biting. Statistical analysis using the Wilcoxon Two Sample Test indicated that there was a significant reduction in problem behaviour between pre and post intervention, while the Kruskal-Wallis Test revealed

that there were no significant differences in the decrease of problem behaviour between the age groups.

The study used a naturalistic environment, used appropriate statistical analysis, and had an appropriate sample size. However, the overall assessment procedure was not clearly outlined in the study. The study provided no supporting information on the validity or reliability of the inventory. Ratings of severity appeared fairly subjective as they were derived from teacher report not direct observation, which has potential for bias. Additionally, intervention procedure was ambiguous, as it was unclear how the school staff supported the students, which would make replication difficult. The type of communication devices used and the amount of training students received was not specified.

While the study demonstrated that the school-wide implementation of AAC had a significant impact on challenging behaviour, caution is warranted when considering the study's implications. Due to ambiguous assessment and intervention procedures, this study only provides somewhat suggestive evidence, which borders on equivocal, that a positive AAC support plan is effective in reducing challenging behaviour.

### ***Discussion***

Overall, the seven articles included in this review provided somewhat suggestive evidence that AAC reduces challenging behaviour in children and youth with complex communication needs. The majority of studies included in this review had a single-subject design, which is appropriate due to the heterogeneity of the targeted population; however, single-subject studies lack generalizability. Furthermore, four of the five single-subject studies used descriptive statistics and visual analysis only, which limits objectivity of results. The single-subject study by Ganz et al. (2009) that did use statistical analysis found no significant impact of AAC on challenging behaviour. With one exception, the participants in the single-subject studies were all male; thus, there is a potential for a gender effect. In ASD research specifically, the impact of gender on challenging behaviour has been controversial, with many studies finding that the rate of challenging behaviour is higher in males with ASD but with some studies finding no gender effect (Kozlowski, Matson, & Rieske, 2012).

In comparison to the single-subject studies included in this review, the single group pre-post design study by Hetzroni (2003) and the meta-analysis by Walker et al. (2018) included larger and more diverse sample sizes. Unfortunately, due to weaknesses in procedure, the applicability of the single group pre-post test design by Hetzroni (2003) is unknown. Of all the studies reviewed, the meta-analysis by Walker et al.

(2018) had the strongest methodology and provided the most compelling evidence that AAC leads to reductions in problem behaviour. This study also implicated several variables that can moderate the impact of AAC which future researchers should consider. Moderating variables include gender, type of challenging behaviour, and intervention setting.

### ***Recommendations***

In the current review, four of the seven studies included descriptive statistics and visual analysis only. It is recommended that future studies increase objectivity and comparability of results by incorporating functional statistical analysis, such as IRD for single-subject studies. Furthermore, five of the seven studies had very small and specific sample sizes. In order to increase generalizability of results, future studies should aim to include more diverse and larger samples of participants, particularly focusing on creating equal gender distributions.

### ***Clinical Implications***

While more research is needed to investigate the effectiveness of AAC in reducing challenging behaviour in children and youth with complex communication needs, clinicians should consider the potential of AAC in reducing challenging behaviour. Evidence is not strong enough to validate using AAC solely to reduce challenging behaviour; however, if using AAC to improve communication outcomes, clinicians should be conscious of potential secondary effects on behaviour.

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