

**Coaching Parents to Implement Augmentative and Alternative Communication (AAC) Language  
Systems with Young Children with Complex Communication Needs.**

Harriet Korner

Bachelor of Applied Science - Speech Pathology

Department of Educational Studies

Faculty of Human Sciences

Macquarie University

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## REQUIREMENTS AND FORMAT OF A THESIS BY PUBLICATION

A thesis must form a distinct contribution to knowledge either by the discovery of new facts or by the exercise of independent critical power. The thesis as a whole should be focused on a single project or set of related questions and should present an integrated body of work, reflecting a coherent program of research.

The Master of Research degree provides the standard mode of entry to Doctoral programs at Macquarie University and offers the opportunity to evaluate the capacity of candidates for doctoral study. Students achieving a Distinction grade or above in their Master of Research program may be offered admission to a Doctoral program.

A typical thesis by publication for the Master of Research would be formatted as follows:

- A brief introduction providing a coherent overview of the background of the thesis, the research questions and the structure and organisation of the remaining chapters.
- Two chapters, each written in the format of a self-contained submission ready journal article. The first chapter would normally consist of a literature review and the second a pilot study, with the potential to lead into doctoral research. Each chapter should be prefaced by a brief introduction outlining how the chapter fits into the program of research, and in the case of jointly authored chapters, the student's contribution should be clearly specified.
- A brief chapter providing an integrative summary and conclusion, drawing together all the work described in the other parts of the thesis and relating this back to the issues raised in the Introduction.

The maximum length is 20,000 words.

For further details please see information on the Higher Degree Research website.

## SUMMARY

This thesis by publication consists of two papers. The first paper is a systematic review of parent-implemented symbolic augmentative and alternative communication (AAC) interventions for young children with complex communication needs. Twenty single case design and three group studies met the selection criteria. Overall, the literature supports the use of parent coaching as effective in supporting parents to implement AAC interventions and parents were able to implement AAC interventions accurately. Aided language interventions were the most effective for supporting ongoing language development. Limitations with the current research and needs for future research are discussed.

The second paper is a pilot study, using an AB single case design, investigating the effects of a parent training and coaching aided language stimulation intervention, using a pragmatic organisation dynamic display (PODD) communication system. The study involved two parent-child dyads, (children aged 4.5 years) in a home setting. Dependent variables were parent frequency of AAC symbol use, frequency of speech and use of two language stimulation strategies and children's symbolic utterances using five-minute samples of parent-child interaction during mealtime and play activities. An effect was demonstrated for both parent and child outcomes. The intervention approach investigated in this pilot study was successful.

## STATEMENT OF ORIGINALITY

I certify that this thesis entitled “Coaching Parents to Implement Augmentative and Alternative Communication (AAC) Language Systems with Young Children with Complex Communication Needs” is an original piece of research and my own work. All assistance from others in conducting the research and preparing this thesis has been appropriately acknowledged.

I also certify that the work in this thesis has not previously been submitted for a degree or diploma in any university. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made in the thesis itself.

The research presented in Chapter 3 of this thesis was approved by the Human Research Ethics Committee, Faculty of Human Sciences and Humanities, Macquarie University on the 18<sup>th</sup> January, 2018 (reference no: 5201701051; see Appendix 1).

(Signed)



Date: 8<sup>th</sup> October 2018

Harriet Korner

## STATEMENT OF CONTRIBUTION

This is a statement of my contribution to this thesis and the papers included in it. The following is a list of papers written in conjunction with Co-Supervisors Associate Professor Mark Carter and Associate Professor Jennifer Stephenson.

1. Parent-implemented Symbolic Augmentative and Alternative Communication (AAC) Interventions for Young Children with Complex Communication Needs: A Systematic Review.
2. Coaching Parents to Implement Augmentative and Alternative Communication (AAC) Language Systems with Young Children with Complex Communication Needs.

I conducted this systematic literature review, the pilot intervention study and wrote these papers with advice and input from Associate Professor Mark Carter and Associate Professor Jennifer Stephenson.

— Harriet Korner



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## Chapter One: Introduction

### **Chapter Overview**

This chapter outlines the purpose and background to the research reported in the two papers in this thesis.

### **Purpose of the Research**

The primary purpose of this research was to study the role of parents in implementing augmentative and alternative communication (AAC) interventions for their children with complex communication needs. The research focused on early intervention because of the opportunity early intervention presents to address the disadvantage experienced by young children with complex communication needs, and because the need for further research in this area had been emphasised recently (Behnami & Clendon, 2015; Ronski, Sevcik, Barton-Hulsey, & Whitmore, 2015). As the primary communication partners of their young children, parents play a key role in the early language development of their children. There are important questions relating to the education and support that parents need if they are to provide AAC interventions.

The research reported in this thesis began with a structured review of the literature, which was used to develop the scope and design of a pilot study of the efficacy of a parent-implemented AAC intervention using a pragmatic organisation dynamic display (PODD) communication system. This study addressed a gap in the literature as no previous experimental research had yet been done using PODD communication systems.

### **Structure of the Thesis**

This thesis consists of two self-contained manuscripts presented in a journal submission ready format, reporting the findings of a systematic review and a pilot intervention study.

## **Background to the Research**

### **Definitions**

In this thesis, young children are defined as children aged 0-6 years old who have not yet started school. Children with complex communication needs are children who have little or no speech and their communication impairments are often associated with developmental disabilities, such as autism, cerebral palsy, Down syndrome, global developmental delay or developmental apraxia of speech; they may also have an acquired disability, such as a brain injury (Australian Bureau of Statistics (ABS), 2017; Beukelman & Mirenda, 2013;). They may have motor planning impairments that make it physically difficult for them to speak and which may also affect use of their hands and mobility or hearing and/or vision impairments that affect their comprehension and ability to interact with others. Children with complex communication needs vary widely in their cognitive abilities, from children who have age level cognitive skills to those with severe to profound intellectual disability.

Beukelman & Mirenda (2013) define augmentative and alternative communication (AAC) as an area that “attempts to compensate for temporary or permanent impairments, activity limitations, and participation restrictions for individuals with severe disorders of speech-language production and/or comprehension, including spoken and written modes of communication. (2005, p.1)” (p. 4). AAC includes non-symbolic, informal behaviours such as facial expression and body language; and symbolic methods of communication, such as signing (unaided) and graphic symbols (aided), which can supplement speech that is difficult to understand or, for those who have no speech, provide an alternative (Speech Pathology Australia, 2012; Von Tetzchner & Jensen, 1996). For young children with complex communication needs, AAC provides a way to scaffold language learning that may only be required early in their life, as they acquire speech and language, or may be required throughout their life, to compensate for impairments related to physical, sensory or cognitive challenges (Beukelman & Mirenda, 2013; von Tetzchner & Grove, 2003).

## **AAC Language Systems**

This thesis is concerned with the introduction and use of AAC language systems in early intervention with young children who have complex communication needs. AAC language systems are methods of AAC that can assist young children to acquire language. Children need to have enough vocabulary in their environment for learning language. They require consistent efforts to be made over time to develop linguistic, operational, social and strategic competencies (Light & McNaughton, 2014). AAC systems are only available if people in the child's environment actively learn the skills required to use them. Planning is required to implement all AAC language systems. An example of an unaided AAC language system is key word sign, which requires parents to learn to sign key concepts as they provide spoken language input to their child (Tan, Trembath, Bloomberg, Iacono & Caithness, 2014). Aided AAC language systems require comprehensive graphic symbol resources to be used in the young child's everyday environments (Light, Beukelman & Reichle, 2003; Porter, 2007; Porter, 2017; Smith & Murray, 2016; von Tetzchner, 2018). The pragmatic organisation dynamic display (PODD) communication system (Porter, 2007; Porter, 2017;) was designed as an AAC language system that could be a tool for aided language stimulation to support language learning for young children with complex communication needs (Korner, 2011; Porter & Cafiero, 2009). PODD is the main aided AAC language system that is introduced during the intervention phase of the pilot study described in Chapter 3.

This thesis addresses several gaps in the research. Light and McNaughton (2015) called for more research investigating real-world outcomes in natural settings over longer time frames. They found that there was relatively little research focusing on the introduction of comprehensive AAC language systems, as many studies had focused on a narrow range of communication functions, such as requesting (Light & McNaughton, 2015). No researcher had yet carried out an experimental study using PODD communication systems, even though these resources are being used in clinical practice (Bayldon & Clendon, 2017). As the early years are considered critical in typical language development (Kuhl, 2011), and there was widespread

agreement about the value of early intervention for young children with complex communication needs (Behnami & Clendon, 2015; Ronski & Sevcik, 2015), an early intervention study investigating the introduction of the PODD communication system in a natural setting was required.

Light and McNaughton (2015) have focused attention on the need to consider the contexts of communication and the increased involvement of natural communication partners, recommending the International Classification of Functioning (WHO, 2001) as a framework for evaluating the usefulness of AAC research and interventions to improve long-term outcomes for people with complex communication needs. The emphasis on parent-implemented interventions was also motivated by the idea that a barrier to the introduction of AAC interventions can be an asymmetry of the modes of language stimulation to children, with parents providing spoken language input, and children being expected to learn to use AAC, without AAC modes being used by others in their environment (von Tetzchner & Grove, 2003; von Tetzcher & Stadsleiv, 2016; Sennott, Light & McNaughton, 2016). If AAC language systems were to be effective for young children, parents needed to learn how to use aided language resources with their children all the time in their natural everyday environments. Language input is critical for young children's language learning (Bruner, 1983; Tomasello, 2003; von Tetzchner & Grove, 2003; Von Tetzchner, 2018).

### **Theories of Language Acquisition**

The study is underpinned by theories of a transactional model of language learning (McLean & Snyder-McLean, 1978) combined with a view of language as a social construction (Vygotsky, 1978; Von Tetzchner & Stadsleiv, 2016). Language learning occurs within a two-way reciprocal relationship, where parent and child actively influence each other (McLean & Snyder-McLean, 1978). Constructivism proposes that children learn language through social interaction with more competent others (Bruner, 1975, Vygotsky, 1978; Tomasello, 2003; Von Tetzchner, 2018). Typical language learning occurs in everyday life, without planning, when parents interact with their children (Bruner, 1983; Tomasello, 1999). Children learn about the purposes

of communication (pragmatics) and word use, (morphology, syntax and semantics), from their social interactions and experience in everyday activities (Bruner, 1983; Tomasello, 1999; Von Tetzchner, 2018). Children develop language through a process of interacting with more competent others, usually their parents, who scaffold their use of language, co-constructing meaning, and shared understanding within genuine use of language (von Tetzchner & Grove, 2003). Language learning occurs in the context of language use (Tomasello, 2003). Vygotsky hypothesised that the “zone of proximal development” can help young children’s language learning, where the child co-constructs meaning while interacting with more capable others (Renner, 2003). A related idea is that parents scaffold their children’s language in typical language development (Bruner, 1983).

### **Aided Language Stimulation**

Aided language stimulation is an AAC technique where adults can model language using graphic symbols simultaneously with speech (Goossens, 1989). Parents interacting with their young children can use aided language stimulation as a form of scaffolding for their child’s language learning, using AAC modes and speech together with other language stimulation strategies (Porter, 2007; Porter, 2017; Von Tetzchner & Grove, 2003; Von Tetzchner & Stadskleiv, 2016). Recent reviews have identified aided language interventions, including aided language stimulation, as an evidence-based practice (Allen, Schlosser, Brock, & Shane, 2017; O’Neill, Light, & Pope, 2018; Sennott, Light & MacNaughton, 2016).

### **Parent Coaching in Early Intervention**

As parents are the people who interact with their young children most frequently, there has been increasing interest in ways of helping parents to implement communication interventions with their young children (Akamoglu & Meadan, 2018; Kaiser & Roberts, 2013; Roberts & Kaiser, 2011). Parent coaching communication interventions are a recommended practice in early intervention communication interventions (Akamoglu & Dinnebeil, 2017; ECIA, 2016; Kaiser & Roberts, 2013), for instance, with recent support for the Hanen program, *It Takes Two*

*to Talk*, (Pepper & Weitzman, 2004) as a responsive caregiver-led early communication intervention (Cologon, Wicks, & Salvador, 2017).

### **Background to the Systematic Review**

In AAC intervention research, recent systematic reviews (Shire & Jones, 2015) and meta-analyses (Kent-Walsh, Murza, Malani, & Binger, 2015) have reported that communication partners can learn to implement AAC interventions successfully. However, these reviews had not focused on parents or early intervention specifically and the most recent review of AAC early interventions, by Branson and Demchak, (2009), had been limited to infants and toddlers up to three years old. According to Behnami & Clendon (2015), early intervention across the first five years of life can make a critical difference for young children with complex communication needs. For young children with complex communication skills to learn to communicate effectively, so they can participate in a meaningful way at school and receive an education, early AAC interventions need to begin as early as possible (Behnami & Clendon, 2015; Cress & Marvin, 2003; Ronski & Sevcik, 2005; Ronski, Sevcik, Barton-Hulsey, & Whitmore, 2015). There was a need for a systematic review (Schlosser, Wendt, & Sigafoos, 2007) focusing on the early intervention period before children start school, which in young children with disabilities may include ages from 0-6 years. The systematic literature review in this thesis investigated the efficacy of parent-implemented early AAC interventions. It aimed to identify our current knowledge of research into early AAC interventions that supported language development and gaps in our knowledge, to inform the design of the pilot intervention study.

### **Pilot Intervention Study**

No previous research had been carried out that involved the introduction of PODD communication systems. When planning for an intervention study, it was decided that a pilot intervention study would be most appropriate, as there was no previous research to identify the time-frames involved in doing a single case design study. An AB design, which is the simplest single case design, was selected as the most suitable for an exploratory study, given that it was likely that flexibility in time-frames may be required (Alberto & Troutman, 2009). The aim was

to research the process of coaching parents to implement aided language stimulation using aided language displays and a PODD communication system in the pilot study, as a first step, in preparation for a more rigorous study into this approach in the future.

### **Questions Addressed in this Thesis**

#### **Systematic Review:**

1. What teaching strategies and approaches are effective in teaching parents to implement symbolic AAC interventions successfully?
2. What parent-implemented symbolic AAC interventions are effective in supporting the language development of young children with complex communication needs, aged 0-6 years?
3. What are the parent outcomes and child outcomes from these interventions?
4. What further research is required?

#### **Pilot Intervention Study:**

1. What is the feasibility of and the time-frames required for coaching parents to implement an aided language stimulation intervention using a PODD communication system in a single case design research study?
2. What is the effect of implementing aided language stimulation using aided language displays and a PODD communication system on the frequency of parents' use of AAC modes with their children?
3. What is the effect of implementing aided language stimulation using aided language displays and a PODD communication system on the child's frequency of symbolic utterances?
4. What is the social validity of an aided language stimulation intervention, using parent training, parent coaching, aided language displays and a PODD communication system?



### **Outline of Chapters**

Chapter 2 provides a systematic review to examine the research on parent-implemented symbolic AAC interventions for young children (aged 0–6 years), including an analysis of methods of parent training, parent and child outcomes from these AAC interventions and the extent to which AAC interventions can be implemented by parents successfully. Both aided and unaided AAC interventions were included in this review as both types of AAC can support language development and young children with complex communication needs may benefit from use of either or both types of AAC (Beukelman & Mirenda, 2013; SPA, 2012). The review assessed study quality with reference to the Cochrane Collaboration guidelines (Higgins & Green 2011, as adapted by Leong, Carter & Stephenson, 2015) for group studies and the What Works Clearinghouse Standards, (Kratochwill et al., 2013) for single case design studies.

The thesis contributes to the literature by providing a synthesis of our current knowledge on parent-implemented AAC interventions in early intervention. There was consistent support for parent coaching in the AAC early intervention research, with most success when all recommended coaching strategies were used, as outlined in recent research (Brown & Woods, 2016). Specifically, these strategies were to provide both verbal and written information, demonstration, guided practice, care-giver practice and opportunities for feedback and reflection to encourage joint problem-solving. The review also found that parent-implemented AAC symbolic interventions could be successful and that the most promising early AAC interventions for language development appeared to be aided language interventions. The findings of the review assisted in the design of the pilot project, for instance, highlighting the need to consider children's experience of AAC prior to the study, the need to consider procedural reliability and the fidelity with which the coaching and interventions were implemented when carrying out the pilot study. The review supported the efficacy of a focus on parent outcomes as well as child outcomes when carrying out AAC intervention research.

Chapter 3 is an empirical pilot study examining the use of parent coaching to support parent learning of an aided language stimulation intervention that involved the use of aided language

displays and the PODD communication system. An AB design was selected to allow for flexibility as experimental research using PODD communication systems had not been carried out previously.

Two parent-child dyads, with children aged 4.5 years, participated in the home-based parent coaching intervention. The study examined the implementation of the intervention during mealtime and play. Data was collected across the baseline and intervention phases of the study. Phase one of the intervention was the parents' implementation of single level aided language displays following initial parent training in aided language stimulation. In phase two, parents were coached in the use of PODD communication systems. This was the longest intervention period, involving weekly collection of data across three months. Phase two followed the progress of parents and children when the PODD communication system was added to the other methods of communication they were using, which included speech, key word signs and gestures.

The dependent variables were selected to measure the difference aided language stimulation made to parent and child communication. Primary dependent variables were the frequency of the parent's AAC symbol use, speech and targeted language stimulation strategies and the secondary dependent variable was the frequency of the child's symbolic utterances. The social validity and feasibility of the approach were also explored.

In the pilot study an experimental effect was indicated in relation to both parent and child outcomes, providing preliminary support for the use of the PODD communication system as a resource to assist the practical implementation of aided language stimulation in natural settings. Parents were able to implement this approach successfully. Use of aided language displays and the PODD communication system enhanced the communication and interaction patterns of parents and children in positive ways to meet their individual needs. Limitations of the study and future directions are outlined.

### Summary

The systematic review found that parent training and coaching in AAC interventions are supported in the literature and aided language interventions provide the most promise for facilitating young children's language acquisition and language development.

The pilot study concluded that parent training and coaching is effective in helping parents to successfully implement an aided language stimulation intervention using a PODD communication system. Parents found this to be a feasible and valued AAC intervention. The aided language stimulation intervention using a PODD communication system appeared to enhance the symbolic communication skills of young children with complex communication needs. This thesis contributes the first pilot study that includes use of PODD communication systems to the research literature and provides information that can be used to design more rigorous studies in the future.

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## Chapter Two: Parent-implemented Symbolic Augmentative and Alternative Communication (AAC) Interventions for Young Children with Complex Communication Needs: A Systematic Review

### Chapter Overview

The aim of this chapter is to provide a comprehensive literature review of both group and single case design research that investigates augmentative and alternative communication (AAC) interventions that included a component of parent-implementation in carrying out the intervention. The review has an early intervention focus and investigates current research into any parent-implemented AAC intervention that involves symbolic language, as compared to non-symbolic forms of AAC, such as facial expression and body language, or pre-linguistic behaviours of young children. This systematic review addresses a need to investigate early interventions that encourage parents to take a role in implementing AAC interventions with their children and to investigate the evidence on AAC interventions that support language development, in preparation for a pilot study. The systematic review considers both aided and unaided AAC interventions, for young children aged 0-6 years prior to children starting school.

This chapter includes an introduction to provide background to the questions asked in this review and provides a description of the methods used to systematically select and analyse the included studies. Results report on data extraction, including the methods of teaching parents to implement the interventions, parent and child outcomes from the studies and also analyse the quality of the included studies. The discussion section provides an analysis and synthesis of information found in this review and concludes by highlighting the findings of this review. Parent coaching and aided language interventions were supported as evidence-based practices that support young children's language development using symbolic AAC.

**Parent-implemented Symbolic Augmentative and Alternative Communication Interventions  
for Young Children with Complex Communication Needs:  
A Systematic Review**

Harriet Korner  
Department of Educational Studies  
Faculty of Human Sciences  
Macquarie University

**Author Note**

Correspondence concerning this article should be addressed to Harriet Korner,  
Department of Educational Studies, Macquarie University,  
North Ryde, NSW, 2109, Australia.  
Email: [hkorner@netspace.net.au](mailto:hkorner@netspace.net.au)

### **Abstract**

Augmentative and alternative communication (AAC) can help young children with complex communication needs to communicate, providing support for language comprehension and expression. As parents are the primary communication partners of young children, they play a vital role in early language learning. The purpose of this systematic review was to examine the research on parent-implemented symbolic AAC interventions for young children with complex communication needs (aged 0–6 years), including an analysis of methods of parent training, parent and child outcomes from these AAC interventions and the extent to which AAC interventions can be implemented by parents. A systematic search was conducted using three electronic databases: PsychInfo, Cinahl and ERIC. Twenty single subject case design and three group studies met the selection criteria. The main findings from this review were that coaching was an effective method of teaching parents how to implement interventions, parents were able to implement various symbolic AAC interventions accurately and aided language interventions were the most promising approach for supporting ongoing language development in young children with complex communication needs. Limitations with the current research and needs for future research are explored.

*Keywords:* augmentative and alternative communication, AAC, symbolic, language, aided language, coaching, training, parent, implementation, intervention, children, complex communication needs, communication disability, communication support needs.

## Chapter Two: Parent-implemented symbolic augmentative and alternative communication interventions for young children with complex communication needs: A systematic review.

Children with complex communication needs are children who have little or no speech and a range of physical, sensory and/or cognitive challenges, usually associated with developmental disabilities, such as autism, cerebral palsy, Down syndrome, global developmental delay, or developmental apraxia of speech; less frequently they may have an acquired disability, such as a brain injury or a stroke (Beukelman & Mirenda, 2013; Australian Bureau of Statistics (ABS), 2017). Augmentative and alternative communication (AAC) holds much promise as a means for learning language and providing access to all areas of life for young children with complex communication needs. AAC is “the use of non-speech modes as a supplement to, or a substitute for, spoken language” (Von Tetzchner & Jensen, 1996, p.1). AAC includes unaided communication, which can be non-symbolic, such as facial expression or body language, and symbolic, such as gestures and sign language. Aided AAC includes paper-based communication books or boards and electronic speech generating communication devices, such as tablets, computers and dedicated speech output devices (Beukelman & Mirenda, 2013; Porter, 2017). Aided communication systems, whether non-electronic or electronic, use symbolic forms of representation such as pictures or symbols for whole words or phrases, and/or spelling, as a means of generating messages.

The first years of life are considered critical for speech and language learning in typical development (Kuhl, 2011); it is suggested that these years are even more critical for young children with complex communication needs, who face additional challenges impacting on their speech and language development. Early intervention guidelines stress the importance of high-risk infants and toddlers receiving the intervention services they need as early as possible (Early Childhood Intervention Australia, 2016; Guralnick, 2011; Paul & Roth, 2011).

Behnami and Clendon (2015) and Romski, Sevcik, Barton-Hulsey and Whitmore (2015) recently explored early intervention and AAC, highlighting the importance of early introduction

of AAC in young children. Misconceptions about AAC continue to lead to delays in early intervention, with parents preferring to focus on speech development. AAC is still seen by many as a “last resort” intervention (Behnami & Clendon, 2015; Cress & Marvin, 2003; Ronski & Sevcik, 2005), despite research evidence that indicates that AAC supports speech development (Schlosser & Wendt, 2008; Ronski, Sevcik, Adamson, Cheslock, Smith, Barker, & Bakeman 2010).

Parent-implemented early language intervention has recently received wide support as a means of providing family-centred intervention within a child’s natural environment (Paul & Roth, 2011), acknowledging that the parents’ role is critical during the early years of life. Parents are the people who have the most influence and spend the most time interacting with their children (Akamoglu & Dinnebeil, 2017; Brown & Woods, 2016; Hampton & Kaiser, 2016; Roberts & Kaiser, 2011). Coaching is promoted as an effective means of providing parent education, because parents can learn strategies to support their children’s communication and language development (Akamoglu & Dinnebeil, 2017; Brown & Woods, 2016; Cologon, Wicks & Salvador, 2017; Pepper & Weitzman, 2004).

AAC interventions used in early intervention include key word signing (Tan, Trembath, Bloomberg, Iacono, & Caithness, 2014), functional communication training (Mirenda, 1997), the picture exchange communication system (PECS) (Bondy & Frost, 1994), and various aided language approaches, including aided language stimulation (Goossens, 1989), the system for augmenting language (Ronski & Sevcik, 1992), natural aided language (Cafiero, 1995) and more recently, aided AAC modelling (Binger & Light, 2007). Natural language paradigm (Koegel, O’Dea & Koegel, 1987 and pivotal response training (Koegel, Koegel, Harrower, & Carter, 1999) are early language interventions that may involve symbolic AAC, where signing or graphic signs are used within the intervention. These methods (in the hands of professionals) are supported as evidence-based practices (Beukelman & Mirenda, 2013). However, the question of what training or coaching is required to equip parents to implement evidence-based AAC interventions remains to be explored.

Several recent systematic reviews and meta-analyses have focused on aided AAC interventions across a range of disability types and ages, for example, Sennott, Light and McNaughton (2016) and Allen, Schlosser, Brock and Shane (2017). These researchers found evidence that aided language modeling was effective in supporting people to use a range of communication functions, relevant to learning to use language effectively in a range of situations. Allen et al. (2017) highlighted the need for future studies to address intervention intensity and dosage and for AAC research to focus on comprehension as well as expression, use of multi-word utterances and language outcomes.

Other recent reviews focused on AAC interventions for people with autism (Ganz et al., 2012; Logan, Iacono, & Trembath, 2017). In their meta-analysis Ganz et al. (2012) supported aided AAC interventions targeting behavioural outcomes, with stronger effects for PECS and speech generating devices compared to other picture-based systems. However, many studies included in this review had a narrow focus on challenging behaviours and requesting, rather than a broad focus on a range of communication functions. Logan et al. (2017) reviewed the research into AAC interventions for children with autism that involved a wider range of pragmatic functions. This review raised important questions about the need to consider the effectiveness of AAC interventions beyond immediate effects, and to consider generalisation, maintenance and social validity.

Kent-Walsh, Murza, Malaniand Binger (2015) and Shire and Jones (2015) recently published reviews of communication partner implemented AAC interventions. Their reviews covered a broad age range including school aged children. Kent-Walsh et al. (2015) focused on aided AAC interventions; Shire and Jones (2015) considered both unaided and aided AAC interventions, relevant when considering the use of AAC to support language acquisition, as both these types of AAC have the potential to support young children's language development. None of the systematic reviews described above focused specifically on parent-implemented symbolic AAC interventions or on early AAC interventions. An interesting feature of Shire and Jones (2015) review was that they investigated parent fidelity measures (i.e., measures of the

integrity of implementation) in addition to child outcomes. They highlighted the need to investigate the efficacy of parent-implemented AAC interventions.

The most recent review to focus on early intervention was by Branson and Demchak (2009), who reviewed both unaided and aided AAC research with young infants and toddlers across a range of disabilities up to and including three years of age. Only 12 studies met their inclusion criteria, suggesting the need for more early intervention research. They concluded that many of the studies were conducted by professionals in clinics and that there was a need for future research investigating parent-implemented interventions in the home environment, modeling AAC use within daily family routines. As the review is now around ten years old, and only included studies with children up to 3 years, it is timely to conduct a new systematic review into early AAC interventions that covers the whole period of early intervention before children start school.

This systematic review focuses on parent and child outcomes, recognising the vital role that parents play as their children's primary communication partners. There is a need to consider effective methods of parent education, parents' success in learning to implement early AAC interventions and how well these interventions support young children's language development. The following research questions are addressed in this review:

1. What teaching strategies and approaches are effective in teaching parents to implement symbolic AAC interventions successfully?
2. What parent-implemented symbolic AAC interventions are effective in supporting the language development of young children with complex communication needs, aged 0-6 years?
3. What are the parent outcomes and child outcomes from these interventions?
4. What further research is required?



## Method

This systematic literature review uses the protocol for systematic reviews outlined in Schlosser, Wendt, and Sigafoos (2007), in conjunction with guidelines from the Cochrane Collaboration (<http://www.cochrane.org>) to address the research questions outlined above. The main elements were a) stating the purpose of the review and related research questions, b) identifying the search strategy and selecting databases, c) defining inclusion and & exclusion criteria for selecting studies, d) data extraction with operational definitions to guide coding by reviewers and e) quality assessment to analyse level of certainty and effectiveness of current research.

### Search Strategy

The specific search string used was: a) "augment\* communication" OR "alternat\* communication" OR "AAC" OR "complex communicat\*" OR "aid\* communication" OR "aid\* language" OR "aid\* model\*" OR "augment\* language" OR "augment\* input" AND b) parent\* OR mother\* OR father\* OR caregiv\* OR "care giv\*" OR famil\* OR guardian\* OR spouse\* OR partner\* OR "communication partner\*" AND c) interven\* OR implement\* OR instruct\* OR train\* OR educat\* OR treat\* OR therap\* OR coach\* OR strateg\* OR Hanen OR "It Takes Two to Talk" OR "More Than Words" AND d) child\* OR infan\* OR toddler\* OR Preschool\* OR "Pre-school" OR babies OR baby. Psychinfo, ERIC and Cinahl databases were searched, as these are the most relevant. Schlosser et al. (2007) recommend a minimum of three databases for a systematic review. Ancestral searches were carried out after included studies were selected during the full-text screening phase.

### Inclusion and Exclusion Criteria

The initial database search located 541 items, of which five were duplicates, leaving 536 for initial screening. In the first step, two researchers independently screened the titles and abstracts of all items to determine which should be included for full-text review. All disagreements were discussed until consensus was reached. The following criteria were used: a) written in English; b) parent or caregiver implemented intervention relating to language or communication; c) child

with a disability aged 0-6 years, prior to attending school; d) intervention involves a symbolic AAC system; this can be aided or unaided; e) intervention involves an AAC system other than facilitated communication; f) study involves an experimental design for an intervention, with collection of data. Facilitated communication was excluded, as facilitator bias has been demonstrated to affect results (SPA, 2012). Studies reporting only on prelinguistic or non-symbolic communication were excluded as the focus of this systematic review was on parent implementation of symbolic AAC in the context of AAC language acquisition. In addition to peer-reviewed journal articles, other grey literature, such as a Masters' thesis, a PhD dissertation or a book chapter reporting results, was eligible for inclusion.

At the end of initial screening, 460 articles failed to meet inclusion criteria. Both reviewers agreed on including 30 articles. For 46 articles it was unclear if they met inclusion criteria and they were retained for full text review. Two researchers independently reviewed the full text of these 76 articles. One article was found to be a duplicate, leaving 75 articles. For the full text screening of studies, additional inclusion criteria were that articles include parent measurable outcomes and/or child measurable outcomes, and that relevant data for the child or the parent could be partialled to extract the relevant information. After full text screening, 49 items did not meet the inclusion criteria and two studies had to be excluded because they had data that could not be partialled (that is, the results relating to participants within the included age range could not be separated from results relating to participants who were older). Twenty articles and two dissertations met the final inclusion criteria.

An ancestral search was carried out by hand checking references of the included articles. Five additional articles and two dissertations were found that met the inclusion criteria. At the data extraction stage, two articles were excluded as, on detailed examination, the parent's role in implementation of the intervention was unclear. One other article was identified during the data extraction phase and was added to the ancestral search articles.

Overall 26 articles and four dissertations met the inclusion criteria. Eight articles reported results from three group studies, while 18 articles and four dissertations reported results from 20

single case design studies, giving 23 studies in all. A summary of the selection process is provided in Figure 1 (p.57).

### **Data Extraction**

Data were extracted from the papers relating to the following features: a) experimental design, b) parent/caregiver characteristics, c) child characteristics, diagnosis, communication abilities before study and assessments relating to receptive and expressive language, d) contexts for the AAC intervention (setting and activities); e) teaching methods, intensity and contexts for parent training/coaching/education before and during the AAC intervention, f) parent variables – intervention strategies, parent outcomes, g) child variables – focus of intervention, child outcomes, h) fidelity of researcher teaching/coaching of the parents; i) fidelity of the parent intervention; j) generalisation of parent and child outcomes, k) maintenance of parent and child outcomes; and l) social validity. In relation to teaching methods, five categories were used to code parent education components: a) verbal explanation; b) written information; c) demonstration / modelling; d) practice, either in role plays or through use with the child; and e) feedback/review (adapted from Brown & Woods, 2016). Coaching was operationally defined as a parent education strategy that involved all these elements.

Data were extracted on the particular intervention strategies involved in the intervention (e.g., follow child's lead, expectant pause, use of language modeling, aided language modeling, prompting) and the focus of the child outcomes – whether these involved a single communication function, such as requesting, more than one communication function, language skills, and the type and complexity of AAC used in the study.

Study quality was also rated as part of the data extraction process. Group studies were analysed using the Cochrane Collaboration Guidelines (Higgins & Green (Eds.). 2011, as adapted by Leong, Carter & Stephenson, 2015). Group studies were scored on the following criteria: randomization, blinding, attrition and pre-test equivalence. Table 1 (p. 56) provides the criteria for allocating scores for each criterion. Studies that scored 5 or more points out of 8 were rated as strong. Studies that scored 4 points or less were rated as weak.

Single case design studies were rated with reference to the What Works Clearinghouse Standards (Kratochwill et al., 2013). Single case design studies were rated as strong, moderate or weak/no evidence. To meet the WWC standards, studies needed to demonstrate: a) that an independent variable was systematically manipulated; b) each dependent variable was measured repeatedly over time by more than one assessor; c) sufficient information about inter-rater reliability agreement measures for at least 20% of the data were provided for baseline and intervention phases; d) inter-rater reliability measures were at least 80% overall on percentage agreement indices and 0.60 if measured with a Kappa index; and e) studies needed to demonstrate an intervention effect at three different times. Studies that met these guidelines were then further assessed to determine their quality. To fully meet the WWC standards, studies needed to provide at least 5 data points per phase; studies that only included 3-4 data points per phase were rated as meeting the WWC standards with reservations. Studies were then rated as “strong” (where there were three demonstrations of control and no instances of non-effect), “moderate” (where there were three demonstrations of control and at least one instance of a non-effect) or “no evidence” (where the study did not provide three demonstrations of control). The latter studies, and those that did not meet the initial assessment criteria were rated as “weak”.

Given the small number of group studies and considerable variability in interventions and dependent variables in the single case design studies, application of meta-analytic techniques was not considered appropriate.

The operational definitions used for data extraction and quality assessment are provided in the Appendix (p. 65). The coding spreadsheet is available on request from the author.

### **Reliability**

Inter-rater reliability was measured during each stage of the systematic review and was calculated using the formula:  $\text{agreements} / (\text{agreements} + \text{disagreements}) \times 100$ . Two researchers independently reviewed and coded against agreed operationally defined criteria for all articles at the abstract and full text screening stages. At the data extraction stage, which included quality assessment, two researchers independently reviewed and coded 23% of the

included reports. Reliability results were: a) abstract screening 91%; b) full text screening 86% and c) data extraction 89%. All discrepancies were discussed until consensus was reached.

## **Results**

Three group studies and 20 single case design studies, comprising research with 166 parents and 160 young children with complex communication needs, met the inclusion criteria. Tables 2 and 3 provide an overview of the included studies.

### **Research Design of Included Studies**

The group studies included two randomised controlled trials (RCTs) (Ronski et al., 2010; Schreibman & Stahmer, 2014) and one quasi-experimental group study (Bunning, Gona, Newton, & Hartley, 2014). The single case design studies included 14 multiple baseline or multiple probe designs, two changing criterion designs, 2 AB designs and two case studies.

### **Participants**

Child participants were 116 boys (72.5%) and 44 girls (27.50%). Parent participants were predominantly mothers (146 mothers, 88.5%; 19 fathers, 11.5%; one parent unspecified). Other demographic information provided in studies about parents varied widely. Parent age was reported in 12 studies and parent education level in 15 studies.

Across all the studies, the age range of children was between 1 year to 6 years old. The mean age for children in the two RCTs was approximately 2 years 6 months. The mean age of children in single case design studies was 3 years 9.5 months. Sixty-seven children (41.9%) across all the studies had a diagnosis of autism, which was the largest diagnostic group; other studies involved children with a range of diagnoses, including Down syndrome, cerebral palsy, genetic syndromes such as Rett syndrome, seizure disorders, developmental disability, global developmental delay and severe congenital motor impairments. One single case design study involved three children who had language disability as their primary diagnosis.

### **Quality Assessment**

The two RCTs both rated as relatively “strong” studies, scoring 6/8 points when assessed for quality (See Table 2, p.58). There was a lack of detail in relation to how randomisation was

carried out in both these studies. In one study (Schreibman & Stahmer, 2014) assessors were blinded to some aspects, but not all aspects, of the study and in the other (Ronski et al., 2010), the groups were statistically equivalent on some, but not all, pre-intervention measures. The quasi-experimental study (Bunning, 2014) was a group study with no comparison, rated as “weak”.

Quality assessment ratings for single case design studies are shown in Table 3 (p.59). Single case design studies rated as “strong” included two aided language studies (Binger et al., 2008; Kent-Walsh et al., 2010) and three functional communication training studies (Gerow, 2016; Simacek et al, 2017; and Olive et al. 2008 for one dependent variable). “Moderate” studies were an aided language study (Cafiero, 1995) and two natural language paradigm studies (Meadan et al., 2016; Meadan et al., 2014). Fourteen single case design studies were rated as “Weak”.

The methodological quality of each study did not necessarily correspond with the strength of its results. Some “Strong” studies provided relatively weak evidence for the AAC interventions that were examined. A summary of the quality assessment ratings and the level of evidence for AAC interventions is given in Table 4 (p.64).

### **Type of Speech and AAC Use Before the Study**

Before the study, children involved in the group studies had either no speech or little speech, which was defined as 10 spoken words/word approximations or fewer. Children in the group studies, who were generally younger (mean age 2 years, 6 months) than the children in the single case design studies (mean age 3 years, 9.5 months), had no experience of AAC before the study.

In the single case design studies, 22 children (40%) had no speech, 16 (29%) had little speech, 11 (20%) had speech that was unintelligible or echolalic and for 6 children (11%) the information provided was unclear. Descriptions of AAC modes used before the study included unaided gestures and body language which are informal and spontaneous methods of communicating without any formal training (15 children), signs (9), aided non-electronic objects, photos or pictures (8) and electronic speech generating devices (5). Where children had speech generating devices prior to the study, it was not clear that they were being used functionally.

### **Type of AAC Used in the Studies**

In the group studies, 41 children in the AAC groups for the biggest RCT (Ronski et al., 2010) used electronic speech generating devices, such as Cheaptalk, Gotalk, and Techtalk. The number of symbols on the displays at any one time was unclear. In the other RCT study (Schreibman & Stahmer, 2014), it was implicit that the 19 children in the PECS group used non-electronic picture cards, but no specific information was provided. The AAC in the quasi-experimental group study (Bunning et al., 2014) involved signs and objects (boards/containers).

In the single case design studies, 13 children used signing, 33 used non-electronic AAC resources and 11 used electronic speech generating devices (Table 3, p.59). Some children used a combination of a few signs and pictures. Non-electronic resources were often individual laminated cards designed to be used one or two at a time, occasionally in an array of up to six pictures. These were frequently nouns (for requesting or choice-making) and occasionally included target words for recurrence (more), acceptance (yes) and negation (no). Aided language interventions included a wider variety of syntactic and semantic concepts on the AAC displays compared to the other AAC interventions. Aided language displays varied from around 10-12 items per display to 20-40 symbols per display, with more symbols used in one study (Thunberg et al., 2007, 2009).

### **Settings**

Parent education and training was carried out in a combination of university clinic and home settings in the two RCTs and in several other studies. Interventions with the child were carried out at home in 18 of the 23 studies (78%). Information was unclear in relation to the setting of parent education in seven studies and in relation to the intervention in three studies. Two studies were carried out completely in the home of the participants, with coaching provided via telehealth (i.e., via audiovisual internet connection) (Meadan et al., 2016; Simacek, Dimian & McComas, 2017).

## **Independent Variables**

### **Parent training characteristics.**

Parent training is an independent variable, as researcher's teaching strategies enable parents to learn the knowledge and skills to implement the communication intervention. Coaching, defined as involving direct instruction in some form (verbal explanation, written information), demonstration/modelling, practice and feedback/review, was used in 17 (74%) studies, with several studies differentiating between initial didactic teaching (training) and ongoing support, practice and feedback (coaching) (i.e. Meadan et al., 2014; Meadan et al., 2016).

In two group studies and 13 single case design studies researchers provided written information to assist parents in implementation of the intervention. In their aided language interventions Binger et al. (2008) and Kent-Walsh et al.(2010) used a structured approach to teaching, using an 8-step instructional program including a mnemonic strategy (Read Ask Answer – RAA) to aid parent learning. Stiebel (1999) used a problem-solving intervention and Iacono et al. (1998) and Tait et al. (2004) used a collaborative consultation approach with joint planning, similar to coaching, but they did not incorporate practice as a teaching component. Sevcik, Ronski, and Adamson (2004) and Thunberg et al (2007, 2009) did not provide clear information about how they conducted parent education and some details were also unclear in other studies.

Length and intensity of training varied from a single one-hour training session before intervention (Barker, 2016) to 76 hours of parent education over a 23-week period (Schriebman & Stahmer, 2014). Coaching interventions usually provided an avenue for ongoing feedback during the intervention to improve parent implementation of the intervention.

Measurement of fidelity of parent coaching/training and fidelity of the interventionists' implementation of the communication interventions was not consistently reported in the included studies (see Table 4, p.64).



**Intervention characteristics.*****Level of parent involvement.***

Parent-implemented communication interventions were the independent variable in most studies. Communication interventions frequently involved parents learning one strategy at a time or implementing the strategy in one context or activity at a time, until proficiency was reached, with parent implementation changing over time (i.e. Meadan et al., 2016; Olive et al., 2008; Simacek et al., 2017). In Ronski et al. (2010) implementation was initially carried out by the experimenter/educator/therapist while parents were coached to take over and become the primary interventionist. Schreibman and Stahmer (2014) carried out substantial parent training (76 hours over about six months), but the precise role of parents in implementing the intervention was unclear. In Chang (2009) parent-implementation was a generalisation measure additional to the primary intervention, which was carried out by the experimenter.

***Intervention strategies.***

There were five main interventions in the included studies: a) aided language, involving specific augmentative communication modelling or prompting within a naturalistic context to encourage speech and language development using AAC; b) natural language paradigm strategies (including pivotal response training); c) functional communication training; d) PECS or research with PECS as a prerequisite; and e) signing. Information about the specific strategies used in the interventions is provided in Tables 2 and 3 (p.58) and examples are outlined below.

In their RCT, Ronski, et al. (2010) compared two aided language interventions: a) augmented communication – input, (AC-I) , where the interventionist and the parent modelled augmented and spoken word use of the individualised target vocabulary via an electronic speech-output communication device, which is an example of an aided language modeling intervention; and b) augmented communication – output (AC-O), where the interventionist and the parent used an electronic speech-output communication device and an individualised target vocabulary represented via symbols and spoken words to prompt the child to produce augmented and spoken words, which placed more emphasis on prompting child expressive language output, compared

to the AC-I intervention. Other aided language interventions involved a form of aided language modeling, varying in their use of additional incidental teaching strategies, such as use of time delay and prompts (e.g., Binger et al., 2008; Cafiero, 1995; Kent-Walsh et al., 2010).

Many of the other symbolic AAC interventions incorporated applied behaviour analysis teaching strategies. Studies grouped under the term “natural language paradigm” were those where the primary strategies were ones involving incidental teaching strategies, such as modeling, mand-model and time delay, within natural contexts (e.g., Meadan et al., 2016). Functional communication training interventions in the review (e.g., Simacek et al., 2017) mostly focused on the replacement of challenging behaviours using symbolic AAC as functionally equivalent behaviours. Three studies where the independent variable was related to PECS were grouped together (Chaabane et al., 2009; Carson et al., 2012; Park et al., 2011). There was one study (Barker, 2016) where introduction of signing was the primary focus of the intervention.

### ***Length and intensity of AAC interventions.***

There was great variability in the length and intensity of communication interventions, varying from short 10-minute sessions in one activity over 3–4 sessions (Kent-Walsh et al, 2010) or 4–11 sessions (e.g., Binger et al 2010) within one or two weeks, to interventions over a longer time-frame, such as 2 x 30 minutes sessions per week over 4 months (Meadan et al, 2016) or 10–30 minute sessions, one to three times daily, over 4 months (Chaabane et al., 2009). The longest intervention was a single case design study over a 9-month period (Sevcik, Ronski, & Adamson, 2004). Interventions in the two large group studies (Ronski et al., 2010; Schriebman & Stahmer, 2014) took 4 and 6 months respectively, but the intervention by Ronski et al. (2010) was far less intensive than that of Schriebman and Stahmer (2014). See Table 2 for details (p.58).

### **Dependent Variables**

Dependent variables for parents and children are summarised in Tables 2 and 3 (p.58). Accurate parent implementation of the AAC intervention was measured as a dependent variable in many studies, but in others it was an integrity measure, which did not involve the same level

of measurement rigour (i.e., a sample of 20% rather than measurement of 100% of sessions). The broader term “outcomes” used in Tables 2 and 3 refers to both dependent variables and integrity measures. Bunning et al. (2014) did not include a direct measure for child outcomes, but used a parent perceptions measure. In the single case design studies (see Table 3, p.59) all child outcomes were dependent variables. For two single case design studies an additional article reporting secondary analysis of outcomes was published after the original study.

The parent and child outcomes of the RCT by Ronski et al. (2010) were reported across six articles. Only the main study is summarised in Table 2. Results from the other related studies (Adamson, Ronski, Bakeman, & Sevcik, 2010; Ronski, Sevcik, Adamson, Cheslock, & Smith, 2007; Ronski, Sevcik, Adamson, Smith, Cheslock, & Bakeman, 2011; Smith, Ronski, Sevcik, Adamson, & Bakeman, 2011; Whitmore, Ronski, & Sevcik, 2014) are described below.

### **Parents.**

The most frequently measured parent outcome was the accuracy of parent implementation of the intervention measured as a dependent variable in seven of 22 single case design reports and as an integrity measure in six single case design reports and in the RCT of Ronski et al. (2010).

Other parent-related outcomes were measures of language and turn-taking (Ronski et al., 2010; Iacono et al., 1998), parent satisfaction with the communication intervention (Meadan et al., 2016; Park et al., 2011; Schriebman & Stahmer, 2014), parent perceptions of their child’s language abilities before and after intervention (Bunning et al., 2014 Ronski et al., 2011) and parent stress related to their child’s communication abilities before and after intervention (Cafiero, 1995; Smith et al., 2011).

### **Children.**

Dependent variables in aided language studies related to language learning, including frequency of multi-symbol utterances (Binger et al., 2008), semantic concepts (Kent-Walsh et al., 2010), receptive and expressive vocabulary, speech and AAC modes (Ronski et al., 2010), and level of engagement in the parent-child interaction (Adamson, Ronski, Bakeman, & Sevcik,

2010). A secondary analysis of the Ronski et al. (2010) RCT results, by Whitmore, Ronski, and Sevcik (2014), analysed potential secondary motor outcomes for children associated with using AAC in the augmented communication groups.

Turn-taking, indicated by the number of initiations and/or responses, was a frequent child dependent variable across the studies, measured in six of the seven aided language studies and four of the seven natural language paradigm studies. Barker (2016) measured spontaneous and prompted use of signs, which involved signs initiated by the child.

Schriebman and Stahmer (2014) compared the effectiveness of two interventions (pivotal response training and PECS) by measuring increases in speech and language as the dependent variables, using several standardised speech and language measures before and after these interventions. For the PECS group, the PECS phase reached by the end of the intervention was also reported.

Thirteen reports (65%) of the 20 single case design studies focused on requesting as a communicative function to be taught by the parent: three PECs studies, four functional communication training studies, five of the six natural language paradigm studies and the one signing study. In addition to requesting, two of the four functional communication training studies (Simacek et al, 2017; Tait et al., 2004) included several other early pragmatic functions within their dependent variables.

## **Findings**

### **Fidelity of Parent Coaching/Training.**

None of the group studies reported directly on the fidelity of parent coaching/training, although fidelity of parent coaching was implied in Ronski et al. (2010) by the high level of accuracy achieved across all phases of the study in results of the Treatment Implementation Rating Scale (Ronski et al., 2010, p.356) for both interventionists and parents.

Six single case design studies reported on the fidelity of parent training: Binger et al. (2008), Gerow (2016), Kent-Walsh et al. (2010), Meadan et al. (2014), Meadan et al. (2016), and Park et al. (2011). These studies all reported high levels of fidelity (90% or more).

**Fidelity of Parent Implementation.**

Thirteen studies reported on the fidelity of parent implementation of the interventions, with seven studies reporting this as a dependent variable and six studies reporting it as an integrity measure. A high level of fidelity (80% or more intervention steps implemented accurately) for parent implementation was reported in four of seven studies where this was a dependent variable: two aided language studies (Binger et al., 2008; Kent-Walsh et al., 2010); one natural language paradigm study (Meadan et al., 2016); and one functional communication training study (Gerow, 2016). A high level of fidelity for parent implementation was reported in five of six studies where this was an integrity measure: the RCT by Ronski et al. (2010); two functional communication training studies (Olive et al., 2008; Simacek et al., 2017); two PECS studies (Chabaane et al., 2009; Park et al., 2011); and one signing study (Barker, 2016). Overall, nine of the 13 studies reported a high fidelity of parent implementation.

**Other Parent Outcomes.**

Parents increased turn-taking, reducing the length of their turns and increasing the number of turns (Ronski et al., 2008; Ronski et al., 2010; Thunberg et al., 2007), increasing the quality of their interactions (Adamson et al., 2010; Sevcik et al., 2004; Thunberg et al., 2009) and increasing communication opportunities (Stiebel, 1999; Tait et al., 2004).

In the Ronski et al. RCT (2010), parents in both the augmented communication groups (AC-I and AC-O) had more positive perceptions of their children's language abilities after intervention than did parents in the spoken communication group.

Parents had slightly reduced levels of stress after their children's intervention across all the groups, but the difference was not significant (Smith et al., 2011, related to Ronski et al., 2010). Cafiero (1995) also had inconclusive results relating to parent stress, with a significant decrease in parent stress only associated with the family experiencing the biggest language gains (Cafiero, 1995, p.160).

**Child Outcomes.**

Children increased their use of speech (Binger et al., 2008; Ronski et al., 2010) and their use of AAC vocabulary in several studies (Binger et al. 2008; Olive et al., 2008; Nunes & Hanline 2007; Park et al., 2011; Ronski et al 2008; Ronski et al., 2010; Sevcik et al., 2004; Stiebel, 1999; Simacek et al., 2017). Ronski et al. (2010) found that children in the augmented communication-input (AC-I) and augmented communication-output (AC-O) groups both demonstrated bigger increases in their vocabulary than children in the spoken communication group. Studies that focused on language learning beyond single words were aided language studies, with the strongest evidence provided by Binger et al. (2008) and Kent-Walsh et al. (2010).

Children increased their communication turns (Cafiero, 1995; Kent-Walsh et al., 2010; Ronski et al., 2010; Sevcik et al., 2004), engagement (Adamson et al 2010; Sevcik et al., 2004) and initiation of communication (Meadan et al., 2014; Meadan et al., 2016; Barker, 2016). Time delay was a strategy associated with children learning to initiate communication (Meadan et al., 2014; Meadan et al., 2016 ),which was not always maintained over time (Meadan et al., 2014). In relation to frequency of children's responses, Meadan et al. (2014) and Meadan et al. (2016) found that although the mand-model strategy increased children's responses initially, there was a tendency for children's responses to decrease over time.

Schreibman and Stahmer (2014) found that both pivotal response training and PECS interventions were equally effective in encouraging speech, concluding that one intervention was not superior to the other. They found that on average children gained about 80 words in vocabulary over six months, but that outcomes were highly variable and may not have been better than maturation (Schreibman & Stahmer, 2014).

Among the PECS-related studies, results were variable. Intervention effects were reported in Chabaane et al. (2009) although prerequisites for this study were that all the children were familiar with PECS and able to recognise the characteristics used in the study (i.e., size and colour), so the task of using characteristics cards to make requests was not necessarily difficult

for children to learn. Of the other PECS studies (Carson et al., 2012; Park et al., 2010), children made gains in learning to request using pictures, but there was no consistent increase in vocalisations or speech.

Two functional communication training studies succeeded in decreasing challenging behaviours, while replacing them with more appropriate AAC modes of communication (Simacek et al., 2017; Olive et al., 2008); one other study had mixed results, but decreased challenging behaviours successfully when parents implemented the intervention accurately (Gerow, 2016). Tait et al. (2004) found that children's inconsistency in performance was associated with limitations in parent implementation of the intervention.

### **Generalisation and Maintenance.**

A summary of reporting of generalisation and maintenance data is given in Table 5 (p.64). The two RCT studies included some consideration of generalisation and maintenance, but neither reported this information clearly. Ronski et al. (2010) built generalisation from the clinic to the home setting into the design of their study. Adamson et al. (2010) reported a generalisation measure related to the RCT by Ronski et al. (2010) in their study of symbol-infused joint engagement. Symbol-infused joint engagement refers to the child's language development, typically between 18 to 30 months, where a child acts in a way that demonstrates attention to the symbolic language used by another person, such as responding correctly when the child is asked by the parent to "put the doll to bed" (Adamson, et al, 2010) In their study, Adamson et al. (2010) indicated that the amount of time parents and children spent in symbol-infused joint engagement was greater after intervention (p.1771). Schriebman and Stahmer (2014) did not report on generalisation, but their study involved both clinical and home settings. Schriebman and Stahmer (2014) collected maintenance data at three months on the language measures in their study, which demonstrated continued improvement across both intervention groups.

In the single case design studies, 35% reported on generalisation of parent outcomes and 55% reported on generalisation of child outcomes. Maintenance data was collected for parent outcomes in 40% of single case design studies and, for child outcomes, in 55% of these studies.

In the two aided language studies, Binger et al. (2008) and Kent-Walsh et al. (2010) found that parents could generalise the book-reading strategy to other books with at least 80% accuracy and were able to maintain implementing the intervention accurately for two months. Two of the functional communication training studies (Gerow, 2016; Olive et al., 2008) considered maintenance, but not generalisation. Meadan et al. (2014) took the longest amount of post-intervention maintenance data over an 11-month period. Their results indicated that, although correct parent implementation decreased after the coaching phase for each strategy, some strategies were maintained at a higher level compared to the baseline phase. Different parents varied in the strategies they maintained; time delay and visual teaching strategies were the least maintained.

### **Social Validity.**

Social validity was assessed using parent questionnaires or other parent report tools. All three of the group studies and 12 (60%) of the single case design studies reported on measures that assessed social validity, although they did not all refer to these as social validity measures. For instance, Schriebman and Stahmer (2014) and Meadan et al. (2016) measured parent satisfaction as a dependent variable. High levels of social validity were reported for all communication interventions. Parents reports about the interventions were positive, with parents often feeling the interventions were useful and valuable.



## Discussion

This review investigated a range of aspects related to parent implementation of AAC in young children with complex communication needs. Results relevant to parent teaching methods and strategies, parent and child outcomes and the relative effectiveness of the various AAC interventions in relation to young children's language development will be discussed. In addition, observations that emerged from this review are highlighted and limitations and recommendations for future research are suggested.

Analysis of parent teaching methods suggested that coaching was an effective method of teaching parents. Coaching was defined as a parent education strategy that involved five elements (verbal explanation; written information; demonstration/modelling; practice, either in role plays or through use with the child; and feedback/review). Studies that included coaching included all the studies rated "Strong" or "Moderate". Fidelity of parent coaching was high in the seven single case design studies where this variable was reported (see Tables 2 & 3).

Specific coaching methods varied, with some studies providing more didactic teaching (Schriebman & Stahmer, 2014) and greater roles of interventionists in the implementation of the interventions, while others phased in parents' involvement in implementation of the AAC strategies over time (e.g., Ronski et al., 2010). This review suggests the need to include all five elements in parent coaching methodology. Some studies, rated as "Weak" in quality assessment of this review and with variable results, were studies where one or two elements had not been used in the parent training, such as Sevcik et al. 2004, which involved verbal and written instruction and feedback, with no reference to modelling/demonstration or practice; and the collaborative consultation studies, (Iacono, et al., 1998; Tait et al., 2004), where there was no reference to practice. AAC interventions were not consistently maintained in several studies which measured maintenance (for instance, Meadan, 2014, Nunes & Hanline, 2007). It was interesting to note that two different studies in this review found that parents were able to learn effectively at a distance, with coaching provided successfully via the internet (Meadan et al., 2016; Simacek et al., 2017) in both these studies.

Parent outcomes usually involved dependent variables that measured accuracy of parent-implementation. For instance, 14/17 (82%) studies using coaching were studies that measured parent implementation of the AAC intervention. High levels of parent implementation fidelity were reported in the Ronski et al., (2010) RCT group study, all (100%) of the “Strong” single case studies and 2/3 (66%) of the “Moderate” single case studies. The 14 studies that examined parent implementation found that parents could implement the interventions accurately - 11/14 (79%) studies reported consistent results in relation to this variable. The two Meadan et al. studies (2014; 2016) found that coaching increased correct implementation of teaching strategies; Gerow (2016) found that parent self-monitoring and performance feedback, increased accuracy of parent implementation of the intervention. Meadan et al. (2014; 2016) observed that parent implementation accuracy did not increase significantly following initial training but improved once individual coaching with feedback commenced.

In relation to child outcomes, aided language interventions were supported as symbolic AAC interventions that promoted language development. Improved child skills related to speech development, vocabulary acquisition, multi-symbol utterances (syntax), semantic concepts, initiation and turn-taking were demonstrated in one group study (Ronski et al., 2010) and two single case studies (Binger et al., 2008; Kent-Walsh et al., 2010) that were rated as “Strong” evidence, and one single case study (Cafiero, 1995) rated as “Moderate” evidence. found. Other aided language studies were inconclusive, due to methodological limitations, however, they provided descriptive information suggesting aided language may promote language learning across a range of pragmatic syntactic and semantic functions, which is necessary for young children to learn language. Aided language interventions were a feasible method for young children with complex communication needs to learn language, as indicated by the positive results in Ronski et al. (2010) as well as strong results in brief interventions, such as Binger et al. (2008) and Kent-Walsh et al. (2010).

The findings in relation to natural language paradigm (or pivotal response training) and the picture exchange communication system (PECS) interventions were more equivocal. Although

Schriebman and Stahmer's RCT (2014) was rated as a strong study, the results which compared pivotal response training to PECS were not unambiguous. Whilst Schriebman & Stahmer (2014) found these interventions equally effective, both intervention groups had much variability in the increases in child speech and language. Taking into account the inclusion criteria that children may have had as many as nine words before the intervention, the overall results that 78% of children who participated had at least ten words at the end of the study was not necessarily an arresting result. They did get a significant increase in child speech and language outcomes overall across the group but indicated they could not be sure that results were better than maturation. Considering this intervention was implemented at a much higher intensity level compared to Ronski et al.'s RCT (2010), these interventions may not have been effective for some of the children involved.

Results were also mixed in single case design studies involving natural language paradigm interventions and PECS. Two natural language paradigm interventions (Meadan et al., 2014; Meadan et al., 2016) were rated as "Moderate" evidence, with 6/8 (75%) natural language paradigm interventions and 3/3 (100%) of the PECS studies rated as "Weak" in relation to the quality of the evidence for these interventions. Some strategies appeared to be effective in stimulating increased child communication outcomes whilst others were not as effective. For instance, time delay was supported as being effective in encouraging children to initiate communication in both Meadan et al. (2014; 2016) studies, although the strategies were not maintained over time in Meadan et al. (2014). Mand-model was associated with mixed success, with a decrease during intervention across several of the studies (Chang, 2009; Nunes & Hanline, 2007; Tait et al., 2004).

Functional communication training was another symbolic AAC intervention with stronger evidence, with two single case design studies (Gerow, 2016; Simacek et al., 2017) rated as "Strong" evidence and another (Olive et al., 2008) providing "Strong" evidence for decreasing challenging behaviours and "Moderate" evidence for an increase in language skills. Taken together, these studies provided strong evidence that functional communication training

decreased challenging behaviours and children successfully replaced these with more appropriate communication behaviours using AAC modes. Pragmatic functions in these interventions involved learning to request; they also included other early functions, such as requesting recurrence and cessation. A strength of these studies was the functional assessment prior to intervention, identifying genuine needs for communication within real world contexts, that helped to shape the intervention. Parents were able to implement the interventions with high levels of fidelity, with some need for additional self-monitoring strategies in one of these studies. Gerow (2016) found that child outcomes improved when parent implementation of the intervention was accurate. Tait et al. (2004) provided inconclusive evidence supporting functional communication training in children with cerebral palsy. The main purpose in this study was to make the children's communication behaviours easier to interpret, rather than to replace challenging behaviours. They achieved mixed results with some increase in children's quality of communication, however, it is possible that a more sophisticated language intervention may have produced clearer results. Two of the functional communication training studies considered generalisation, however, a weakness was that none of them reported on maintenance of the intervention.

A limitation with many of the included studies was the narrow language focus they had on requesting an object or activity. When analysed with a view to language development, the most relevant studies were the aided language studies, which were more likely to focus on a range of pragmatic, semantic and syntactic functions. However, even with these studies, the evidence is slight in relation to parent-implemented studies and there is a great need for more research with long term language development in mind. The AAC interventions such as natural language paradigm, functional communication training and PECS examined in this review, tended to focus on teaching requesting or were associated with regulation of behaviour. Whilst these interventions sometimes included a small number of alternative functions, they did not provide a strong roadmap for ongoing language development.

In the current systematic review, aided language approaches offered the strongest option to develop broad-based language skills. Studies that used an aided language intervention focused on a broader range of child outcomes, in comparison to the other symbolic AAC interventions analysed in this review. For instance, the RCT by Ronski et al. (2010) provides the strongest evidence available in this review, and demonstrated positive outcomes relating to speech outcomes, receptive and expressive vocabulary. In the two other “Strong” aided language single case studies, Binger et al.’s (2008) study provided evidence that a parent-implemented aided language intervention increased children’s use of multi-word utterances and increased speech and Kent-Walsh et al.’s study (2010) found parent-implemented aided language interventions were successful in increasing children’s language skills in relation to pragmatic and semantic functions. However, at present, the available evidence is limited to specific situations over short time frames, with some evidence of generalisation and maintenance of learning beyond the initial intervention phases in the stronger studies. In the future there is a need for further research that looks in more depth at the process of acquiring language using AAC in real world settings and over longer intervention periods.

While this systematic review found some well-designed group and single case design studies that were of high quality, they were in the minority of the included studies. Out of the 23 studies reviewed, there were two RCT’s that were rated as “Strong”, with one of these (Ronski et al., 2010) provided convincing evidence about the efficacy of the approach they were investigating; and there were 5/20 single case studies rated as “Strong”, which supported the efficacy of aided language stimulation and functional communication training as evidence based AAC interventions. The review highlighted that there is a need for more AAC research studies of high quality. There were promising indications that more recent studies were recognising the need for increased rigour to meet current evidence-based guidelines, such as the What Works Clearinghouse (Kratowill et al., 2013). Studies varied widely in the clarity and detail of reporting their methods and results and a suggestion for future research is to improve the consistency of research reports, with clear information about participants, settings, materials,

procedures, training methods, intervention length and intensity, independent variables, dependent variables and results, including clear visual analysis of results, to make it easier to compare studies. Increased reporting of generalisation and maintenance would be helpful in the future.

A number of limitations of this review should be acknowledged. Due to the small number of studies that were found to be of high quality, and the wide variation of the included studies, it was decided that examination of effect sizes would not be meaningful. Another limitation was the methods of quality assessment used. These were stringent in relation to study methodology but did not always allow comparison of the relative strengths of studies where the methods were strong, but the results were weak or mixed. Some researchers summarised their results as stronger than was evident on detailed examination of the data. Mixed results potentially indicate a clear change in behaviour, but this is often not clearly reported.

An area to consider for future research is the age of the children when AAC interventions are introduced. The research reviewed included studies of children with mean ages between 2½ and 3¾, but the first year of life is a critical period for young children. Only one study in this review involved children between 1 and 2 years of age. Future research into parent-implemented symbolic AAC interventions should focus on introduction of AAC strategies as early as possible during the first two years of life. Some children's complex communication needs are not identified at this age, but many children are born with disabilities that are identified at birth or during the first six months of their lives. Given the critical nature of communication and evidence that intervention should commence as early as possible, investigating AAC interventions in the first year of life should be a high priority for future research.

Another area requiring further research is the relative effectiveness of the different AAC modes. In this review, studies which used both non-electronic and electronic communication aids found that both were equally effective (e.g., Kent-Walsh et al., 2010). Some studies found signing effective, but in this review the evidence for signing was inconclusive. Multi-modal AAC interventions, using both aided and unaided AAC modes are supported as an evidence-based practice (Beukelman & Mirenda, 2013; Mirenda & Iacono, 2009). In relation to early

intervention, there is a need for further research looking at the benefits of both unaided and aided AAC during the early language acquisition period, what skills are needed by the parents and the children to use the various forms of AAC, what modes will best support language development, and what operational demands do the various AAC modes make on both parents and children.

### **Conclusion**

The main findings of this review were that: a) coaching was an effective method of teaching parents to implement symbolic AAC interventions; b) parents were able to implement symbolic AAC interventions with high fidelity; and c) aided language approaches and functional communication training were supported as effective interventions. Aided language approaches may have more scope for ongoing language development in young children with complex communication needs.

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**Table 1: Criteria for Rating Quality of Group Studies**

**Randomization:** Rate as one of the following:

- **2 Points:** Participants are randomized to groups using an acceptable method (eg, random number table, coin tossing).
- **1 Point:** Claims participants are randomized but method not detailed.
- **0 Zero:** Participants not randomly allocated to groups or allocated using inappropriate method (eg, by date of referral, birth date).

**Blinding:** Rate as one of the following:

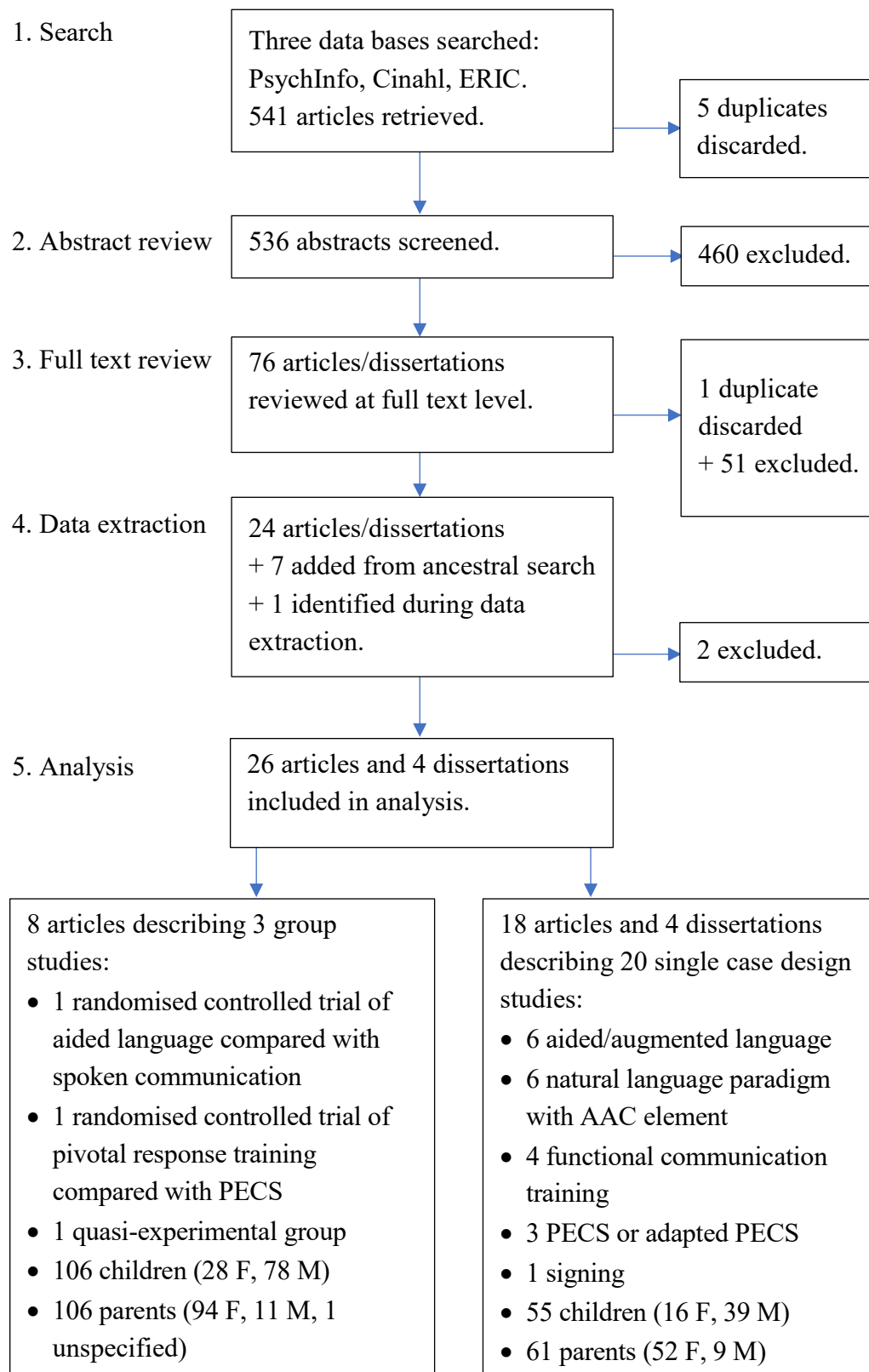
- **2 Points:** Assessors were blind to group allocation on all measures.
- **1 Point:** Assessors were blind to group allocation on some (but not all) measures.
- **0 Zero:** Assessors were not blind to group allocation; or this was not reported.

**Attrition:** Rate as one of the following:

- **2 Points:** Differential attrition was within 10 % for all study groups.
- **0 Zero:** Differential attrition was greater than 10 % for all study groups.

**Pre-test equivalence:** Additional criteria — rate as one of the following:

- **2 Points:** Groups were statistically equivalent on all outcome measures.
- **1 Point:** Groups were statistically equivalent at pre-test on some outcome measures.
- **0 Zero:** Pre-test equivalence was not examined or differences were unadjusted.

**Figure 1: Selection of Studies Flowchart**

**Table 2: Summary of Group Studies**

Study & design	Children			Intervention						Outcomes measured			Level of evidence
	Gender	Age (y:m)	Diagnosis	Prior comm.	Strategy	AAC mode	Parent teaching	Activity	Intensity	Parent	Child	Findings	
Bunning et al., 2014; QE	4F, 1M	5.6 6.0 6.0 6.0 6.0	All HI 2 CP 1 DS 1 ID 1 GDD	No speech	Varied; AAC modelling with signs and objects	Signing, & NE (Object-symbols)	Coaching, a, c, d, e	Everyday activities, unspecified	7 hours per participant. Initial teaching session (1- 1.5 hours), then monthly coaching sessions (40-60 min).	Parents' perceptions of child's skills.	Goals (e.g.): communicate basic needs, build vocabulary, range of expressive functions, request, make choices, initiate, imitate speech & sign.	Improved scores for body function & structure and activities for communication. No significant changes in participation in communication, but parents reported increased skills & confidence re child's skills.	Weak
Romski et al., 2010; RCT	19F, 43M (n=62)	1.9 – 3.4, mean 2.6	CP DS GS SD UE	No or little speech	3 groups AC-I AC-O SC all with NLP strategies	E (SGDs)	Coaching, a, b, c, d, e (phases for intervention led, parent-supported and parent-led)	Reading Play Mealtime	24 x 30 min sessions over mean of 16 weeks.	Mean length of utterances and turn-taking (DVs). Proportion of intervention features appropriately implemented (IM).	Target vocabulary: number of speech and AAC words/session. Turn-taking & proportion of intelligible utterances. (DVs)	AC-O & AC-I groups more effective than SC group for increasing speech and vocabulary. eg 23 or 22 new words, compared to 16 for learning vocabulary. Parents had shorter but more turns. Parents implemented interventions accurately.	Strong
Schriebman & Stahmer, 2014; RCT	5F, 34M	1.8 – 3.9, mean 2.6	Autism	No or little speech (no more than 9 intelligible words)	2 groups PRT PECS	NE picture cards, unclear	Coaching, a, b, c, d, e (Primary intervention by therapist).	Everyday activities, unclear	247 hours over 23-weeks, included 76 hours parent education.	Parent satisfaction (DV).	Expressive language, spoken vocabulary & adaptive communication before and after intervention (DV). PECS phase at end of treatment (DV).	PRT & PECS found to be equally effective with increases in spoken language skills. Results highly variable in both groups and may not have been better than maturation. Parents satisfied with both programs but found PECS more difficult to implement.	Strong

AC-I = augmented communication – input; AC-O = augmented communication – output; comm = communication; CP = cerebral palsy; DS = Down syndrome; DV = dependent variable; E = electronic communication; F = female; GDD = global developmental disability; GS = genetic syndrome; HI = hearing impairment; ID = intellectual disability; IM = integrity measure; M = male; NE = non-electronic communication; NLP = natural language paradigm; PECS = picture exchange communication system; PRT = pivotal response training; QE = quasi-experimental design; RCT = randomised controlled trial; SC = spoken communication.

Coaching: a = verbal explanation; b = written information; c = modelling/demonstration; d = practice; e = feedback/reflection.

**Table 3: Summary of Single Case Design Studies**

Study & design	Children			Intervention						Outcomes measured		Level of evidence	
	Gender	Age (y:m)	Diagnosis	Prior communication	Strategy	AAC mode	Parent teaching	Activity	Intensity	Parent	Child		Findings
Aided language													
Binger et al, 2008; MP across participants	2F, 1M	3:4, 2:11, 4:1	2 SCMI, 1 PPPD	Unintelligible speech, idiosyncratic signs & gestures	Read-ask-answer	1 NE, 2 E, 30-35 symbols/ display	Structured coaching: a,b,c,d,e	storybook reading	4-11 10 min sessions	Accuracy of Read-ask-answer (DV)	Frequency of multi-symbol utterances, initiation	Parents learn to implement; increase child AAC & speech	Strong WWC with reservations
Cafiero, 1995; MP across participants	1F, 3M	4:10 5:11 4:11 5:0	Autism	3 No speech 2 Echolalic Gestures All NE pictures 1 E portable keyboard	Natural aided language stimulation	All NE 3 children 12 larger or 36 small PCS per display	Information sessions clinic; Home coaching: a,b,c,d,e.	play mealtime	7-10 hours instruction over 8 weeks	1 Acquisition of NALS 2a. Turn-taking: % initiations & responses 3. Parent stress	2b. Turn-taking: % child initiations, imitations & responses	Parents varied in accuracy of implementation. 3/4 children increased communication. Parents' stress decreased.	Moderate WWC with reservations
Kent-Walsh, Binger, Hasham, 2010; MP across participants	1F, 3M	5:0 5:4 4:7 5:11	1 CP 3 DS	Little speech, 3/4 gestures 2/4 NE 3/4 E	Read-ask-answer	1 NE, 3 E 20 - 40 symbols/ display	Structured coaching: a,b,c,d,e	storybook reading	Average 2.2 hours in 3-4 sessions, 2-3 sessions per week.	Accuracy of Read-ask-answer strategy (DV)	Communicative turns. Semantic concepts.	Parents learn to implement; increase child turns, language	Strong WWC with reservations
Romski et al, 2008; Case study within RCT Romski et al., 2010.	1M	3:4	CP, ID HPE	No speech E, no symbols	Augmented Communication Output: (AC-O)	PCS, E. 8 symbols, x 2 levels	Coaching, a,b,c,d,e	book-reading play snack	24, 30-minute sessions over 23 weeks.	Mean length of turn in utterance, total turns.	Frequency of speech and AAC, communicative turns. Range of language measures.	Understanding and expressive use of 13 symbols, 1.14 utterances/min. Increased RL.	Weak Suggestive
Sevcik, Romski & Adamson, 2004; Case study	1M	4:0	DD, SD	No speech, Gestures NE	System for Augmenting Language (SAL)	E 34 - 47 symbols multi-level	Instruction a, b, c	Reading Play, snack & SLP therapy	Over 9-month period.		Frequency of AAC, engagement & number of turns per minute.	Increased child engagement and number of utterances/min.	Weak

Thunberg, Ahlsen & Sandberg, 2007; AB	2M	4.11 5.6	Autism ( & dyspraxia)	Little speech, unintelligible speech, gestures	System for Augmenting Language (SAL)	E 279 & 176 symbols.	Unclear, a, e	reading, mealtime sharing experiences of preschool	½ day course x 2. Data 15 min x 4 weeks/ activity.		Engagement Turn-taking, commun'n. mode, 12 pragmatic functions, AAC, effectiveness	Increased communication. Many language variables measured.	Weak
Thunberg, Ahlsen & Sandberg, 2009*; AB	As above	As above	As above	As above	As above	As above	As above	As above	As above	Parent or child-initiated topic.	Quality and frequency of topics; Topic Segment length	Increased quality of interactions	Weak
<b>Natural language paradigm studies</b>													
Chang 2009; MB across participants and settings	3M	5:9 5:9 3.6	Autism	No or little speech, signs & gestures 1 - pictures RL		NE Photo cards, to request 3 x 2 activities/ items/child	Coaching a, b, c, d, e	play snack bath, TV colouring	3 training sessions over 1-2 weeks. 3 x daily practice by parents.	Correct use & maintenance of strategies: CT, TD, M & PP. (DV)	Requests	Accuracy of parent implementation varied: high level for one, declining trend for 2/3 participants; children mostly generalised use.	Weak
Iacono, Chan & Waring, 1998; MB across participants	1F, 4M	2:8 2:4 2:7 3:0 3:7	3 DS 2 DD	Little speech & signs	Naturalistic strategies based on EMT (Kaiser 1993).	Signs. NE symbols. No specific information	Collaborative consultation a, b, c, e	play	5 x 10 min, SP training phase, then 3-11 10 min weekly sessions for parent phase .	Parents use of questions, models, directives, strategies (expectant pause, imitation, attention, acknowledgment) (DV)	Unclear. Increase in production using speech, signs or symbols. All modes measured together as <i>linguistic units</i> .	Variable results, not all children improved. Limited changes in parents' behaviours. Frequency of parent strategy use reported, but no information re accuracy.	Weak
Meadan et al. 2016; MB across strategies	1F, 2M	2 nearly 3, 4 years	Autism	No or little speech, signs & gestures		Signs & gestures	Coaching a, b, c, d, e	unclear, everyday activities	45 min training; then 2 x 30 min/week for 10-15 weeks.	Quality & rate of strategies: EA with TD, M & M-M ❖ ▲ (DV) Parent satisfaction (SV)	Initiations & responses (requests)	Coaching increases parents correct use of strategies. Time delay increased child initiations.	Moderate
Chung et al, 2016; † MB across strategies	1F, 1M	as above	as above	As above		as above	as above	as above	as above	Intentionality of mother's strategy use	Topography of responses, speech, signs	Quality of child's responses improved.	Weak

Meadan et al. 2014; MB across strategies	3F, 2M	3:1 4:0 4:0 3:2 5:0	DS	No or little speech, signs & gestures		Visual supports (schedules, rules, tasks analysis)	Coaching a, b, c, d, e	play snack washing hands brushing teeth	3 hours training, then coaching 2-3 times/ week over 4 months	Correct use of strategies: EA with TD, M & M-M ❖ and visual supports (DV)	Initiations & responses (requests)	Coaching increases parents correct use of strategies, not maintained; time delay increases child initiations.	Moderate
Nunes & Hanline, 2007; MB across activities	1M	4.6	Autism	No speech, gestures		NE 3-10 photos, PCS /activity nouns, verb, modifier	Coaching a, b, c, d, e	play mealtime handwash	Around 16 sessions, 8 min each	Frequency of use of strategies: EA, M-M, MAAC, M (VP & PP) (DV)	Turn-taking (initiations & responses) imitation and modes	Parent increased use of two strategies, but declining trend over time, may not be maintained. Accuracy of implementation implied by procedure, but not quantified. Child increased use of AAC pictures, gestures.	Weak
Stiebel, 1999; MB across participants	2M	4:2 4:6	Autism	No speech picture cards made by parents		NE photo cards, objects nouns, verbs	Instruction & problem solving a,b,c, e	play mealtime morning routine	1-2 60–90 min training sessions; then 2-3 15 min sessions/ week for 16-20 weeks.	% Communi- cation opportunities, using EA, Q, M or gestures. (DV); rating of perception of parent (and child) skill (DV)	Spontaneous card use (initiation); (mainly to request)	Increase in communication opportunities; increase in using AAC cards; positive perceptions re communication skills.	Weak
Signing													
Barker, 2016; Series of ABs	3M	1.0 1:5 1:6	SLD	No or little speech	Language modelling using speech and signs, prompts & labelling. (IV)	Signing 3 signs/child	Coaching a, b, c, d, e	Reading play daily routines	Training 1 hour, parent practice for 1 week, intervention over 5 days.	Reliability and integrity of primary caregiver-implemented signing intervention (IM)	Prompted & spontaneous responses, speech & /or signs. (requests)	Parents learnt intervention, with mean integrity over 80% prior to corrections & 100% after this; 2/3 children improved spontaneous responses.	Weak

Functional Communication Training												
Gerow, 2016 MB across participants	2/3M	2.3 2.1	1 Autism 1 ND, SLD	No speech, challenging behaviour	NE picture cards	Coaching a, b, c, d, e	play, preferred items	30 min initial meeting; all 6-7 8 min sessions; one 9 extra self- monitoring sessions.	FCT strategies: TD, VP, PP differential reinforcement (ignoring behaviours; reinforcing AAC) (DV)	1 -decrease behaviours 2 -increase AAC request	2/3 parents implemented with accuracy $\geq 80\%$ after performance feedback & 1/3 after additional self- monitoring; children increased communication & decreased behaviours.	Strong
Olive et al., 2008; MP across activities	1F	4.0	Autism	Echolalia, challenging behaviour.	E – 4 button device, 4 pictures for activities	Coaching a, b, c, d, e	reading play, preferred items	32 five min. sessions over 110 min in first 22 sessions	Implement FA & FCT using most to least prompts PP, VP GP. (IM).	1 -decrease behaviours 2 -increase AAC request - increase in language	Parent implemented intervention correctly in 95.9% of opportunities. AAC replaced behaviours; language skills increased.	DV1 Strong DV2 Moderate Meets WWC with reservations
Simacek et al., 2017; MP across contexts/requests	3F	3:5 4:0 3:5	2 Autism 1 Rett Syndrome	Little speech, signing, E & NE, challenging behaviour	2 NE, 2-4 picture cards 1E single message.	Coaching via telehealth a, b, c, d, e	play mealtime TV, video. break	1-2 weeks, with seven 5min sessions/day	Implement FCT with TD, contingent reinforcement (IM)	-decrease behaviours - AAC or speech 1-3 pragmatic functions	Parents implemented accurately, implementing 93% critical components or more. Children learnt appropriate form; Coaching via telehealth successful.	Strong
Tait et al., 2004; MP across three communication functions	3F, 3M	1:4 3:0 3:11 2:2 1:11 2:7	CP: also 1 mild HI 2 CVI 1 mild VI 2 SD	No speech, body language (note: FCT replacing prelinguistic behaviours)	Speech or gesture (Y/N) signs, NE photos/symbol cards	Collaborative consultation/ a, b, c, e	play mealtimes social interaction	30 min weekly session for up to 12 weeks.	Number of communication opportunities Q, EA, least to most prompts – VP, M, PP (DV) Correct implementation (IM)	Use of AAC / speech / clearer signal for pragmatic function eg request, protest, answer make choice	Mixed results. Suggested children increased target behaviours when parents correctly implemented.	Weak

Picture Exchange Communication System													
Chaabane et al., 2009; MB across symbol categories	1M	5.0	Autism	No information re speech; NE PECS for 4 months		NE – Picture cards preferred items descriptor cards colour, shape, function	Coaching a, b, c, d, e	Unclear 10 – 15 preferred and neutral items	16 weeks: 10 to 30 min sessions, 1 - 3 times / day	Prompting to teach use of descriptor cards. (IM)	“mand” (request) using descriptor card.	Parent correctly implemented intervention: children learned target behaviour.	Weak
Carson et al., 2012; Changing criterion	3M	3:5 3:5 2:4	Autism	No speech, gestures.		NE - Pics for PECS cards, as per PECS manual.	Instruction using PECS manual a, b, c, d, e	reading play mealtime	5-6 days per week 4-6 or 10- 12 hours per day.	Parents implemented PECS: verbal-free PP & discrimination training. (IM)	Frequency of speech (to request); relation between speech and prior skills	No clear results, as baselines not stable. Small gains may not be more than maturation.	Weak
Park et al., 2011; Changing criterion	3M	2:5 2:7 2:6	Autism	No or little speech, gestures.	Parents implemented PECS: verbal-free PP & discrimination training.	NE - PECS cards using photos or line-drawing	Coaching a, b, c, d, e	Unclear preferred items / activities	10 trials/ session for 10 to 22 sessions.	Fidelity of mother and experimenter implementation was measured (IM)	Independent picture exchange to request. Words or word approximations	Parents able to implement accurately (over 99%); children learnt to request; results re vocalisations not clear.	Weak

\* Secondary analysis of original study, located above this study in table. Information should be considered together.

† Secondary analysis of original study, located above in the table and related to 2/3 children. Information should be considered together.

❖ Natural language paradigm / Milieu teaching strategies.

▲ Two non-effects: Mand-model - behaviour decreased compared to baseline in Meadan et al 2016 (and Chung et al 2016).

Coaching: a = verbal explanation; b = written information; c = modelling/demonstration; d = practice; e = feedback/reflection.

AB= AB study design; CT = communication temptations; DV = dependent variable; E= electronic; EA= environmental arrangement; F = female; FCL = follow child's lead; FCT = functional communication training; IM = integrity measure; IOA = interobserver agreement; IV = independent variable; M = male; M-M = mand-model; MAAC = Mand/Comment with AAC; MB = multiple baseline study design; MP = multiple probe study design; NALS = natural aided language stimulation; NE = non-electronic communication; PECS = picture exchange communication system; PP = physical prompt; Q = questions; SLD = specific language disorder; TD = time delay; VP = verbal prompt; WWC = What Works Clearinghouse guidelines.



**Table 4: Quality Assessment / Level of Evidence for AAC Interventions**

Intervention	Strong		Moderate		Weak	
	Supportive	Inconclusive	Supportive	Inconclusive	Supportive	Inconclusive
Aided Language	1 RCT Ronski et al. 2010 2 MP Binger et al., 2008; Kent-Walsh et al., 2010		1 MP Cafiero, 1995		1 AB Thunberg et al., 2007 & 2009 2 Case studies Ronski et al., 2008 Sevcik et al., 2004	
PECS	1 MB Chaabane et al., 2009	1 RCT Schreibman & Stahmer, 2014			1 MB Park et al 2011	1 MB Carson et al., 2012
Natural Language Paradigm		1 RCT Schreibman & Stahmer, 2014	1 MB Meadan et al., 2016 Meadan et al., 2014 Stiebel, 1999		3 MB Chung et al., 2016	1 QE (Bunning et al 2014) 3 MB Chang, 2009 Iacono et al., 1998 Nunes & Hanline, 2007 (? AB)
Functional Communication Training	2 MB Simacek et al, 2017; Olive et al., 2008 (DV1)	1 MB Gerow, 2016	1 MP Tait et al, 2004 Child DV 1 MB Olive et al., 2008 (DV2)		1 MP Tait et al, 2004 Parent DV	
Signing						1 QE (Bunning et al 2014) 1 AB (Barker, 2016)
AB = AB study design; MB = multiple baseline; MP = multiple probe; PECS = picture exchange communication system; QE = quasi-experimental study; RCT = randomised controlled trial.						

**Table 5: Studies Reporting Generalisation and Maintenance Information**

Type of study	Generalisation parents		Generalisation - children		Maintenance - parents		Maintenance - children	
	Yes	No	Yes	No	Yes	No	Yes	No
Group	1	2	1	2	1	2	1	2
Single case design	7	13	11	9	8	12	11	9
Total	8	15	12	11	9	14	12	11

## Appendix: Instructions and Operational Definitions for Data Extraction

**To complete the spreadsheet:**

**Only include information about children and measures that meet the inclusion criteria.**

**Y for Yes:** indicate answer using a **Y** if it was present in the study, and/or to identify it as the item that best describes an aspect of the study.

**Blank:** Leaving a column blank means it was not relevant, not included or not reported.

**Numbers:** Enter exact numerical information if available. **Names:** Include name of participant to identify “who did what” in relation to age, results, etc.

**Descriptions:** can be added to columns if this is most relevant to the item on the spreadsheet, but will not be included in reliability ratings. These may be added to “other” columns to avoid confusion or can included be in the relevant column under the main answer.

**Columns labelled ‘Other’ and ‘Unclear/unspecified’:** Optional – exclude from reliability testing.

### Inclusion criteria:

- English language
- Parent or caregiver implemented intervention relating to language or communication
- Child with disability aged 0–6 years, not yet at school
- Intervention involves symbolic AAC; can be aided or unaided
- Intervention involves an AAC system other than facilitated communication (FC)
- Involves an experimental design; intervention with data.

### Experimental studies definition for inclusion:

- Need to manipulate an independent variable
- Need to have quantitative data.

If concerned that the article may not meet the inclusion criteria, as you are coding, write “Check” in Section 1. We will discuss these during reliability check.

### 1. Study Author, Date and Title

Title can be abbreviated but must be easy to identify.

### 2. Experimental designs

As described by Alberto & Troutman, 2009 & Gersten, Baker & Lloyd, 2000.

Group:

- Randomised controlled trial
- Non-equivalent comparison group
- Group single — no comparison group

Single (no comparison group):

- Single subject research design

- Multiple baseline: can include multiple probe. Note the type of multiple baseline it is. (e.g., across participants).
- Alternating
- Changing criterion
- AB
- ABA
- ABAB
- Case studies: Single subject - participant descriptions may be with pre-test and post-test – so may be experimental or may just be descriptive with data. However, case studies are not a formal single case design study. Do not complete Section 15a for case studies.
- Other: Any other design used in the study. Note if there is a qualitative element or if it is a mixed methods study.

### 3. Parent/caregiver characteristics

**N:** number of parent or caregiver participants in study

**Gender:** female, male or numbers of each group; Use names to differentiate people.

**Age:** Age at the beginning of the study, if this is reported; this may be an actual age or a mean age for a group study).

**Education:** Highest level of education attained at the time of the study.

**Cultural background:** Describe the cultural group participants identify with.

**Languages spoken at home, if not English:** Describe the main language spoken at home, if it is not English. If a family speak more than one language, include both, with the most frequently spoken language listed first. (If English is the primary language, leave this section blank).

**Country where the study was done:** Country where the research study was carried out.

**Other: (not for reliability - optional)** Other parent or caregiver characteristics described in the research study.

### 4a. Child participant characteristics and diagnosis

**N:** number of child participants in study

**Gender:** female, male or numbers of each group. Use names to differentiate people.

**Age:** Age as reported in the study (just include the age at the beginning of the study if both pre- and post are reported; this may be an actual age or a mean age for a group study).

**Hearing:** Y if information provided. Briefly indicate information provided in the study about hearing. For instance:

- WNL = Within normal limits or
- WFL = within functional limits or
- Describe the hearing impairment, as reported in the study, eg, severe hearing loss.

Leave blank if no information provided.

**Vision:** Y if information provided. Briefly indicate information provided in the study about vision. For instance:

- WNL = Within normal limits or

- WFL = within functional limits or
- Describe the vision impairment, as reported in the study.

Leave blank if no information provided.

**Diagnosis: Y** (yes) to confirm that a type of disability was in the study; include the numbers of each diagnosis if available.

- **A:** autism or autism spectrum disorder or Asperger's syndrome or PDD-NOS
- **CP:** cerebral palsy
- **DS:** Down's syndrome
- **ID:** intellectual disability. May be referred to as developmental disability or mental retardation in some studies.
- **Other:** Any other diagnoses or description of a disability/disorder of child participants can be listed here.

#### **4b. Child participant characteristics — communication modes before the study**

- **Non-speech: Y** if this applies all or some of the participants before the study. Not talking at all; has no functional speech.
- **Little speech: Y** if this applies all or some of the participants before the study. A few words, defined as 10 or fewer spoken words.
- **Speech: Y** if this applies all or some of the participants before the study. More than 10 spoken words or word approximations. Speech may be unintelligible, but the participants may have more than 10 spoken words.
- **Unaided: Y** if unaided AAC was used by all or some of the participants before the study. Optional: Include names of who used what and describe the type of gestural or signing used: eg. Natural gestures, Makaton, Key Word Sign, Auslan, American Sign Language, fingerspelling.
- **Aided – Non-electronic: Y** if aided Non-electronic AAC was used by all or some of the participants before the study. Optional: Include names of who used what and describe AAC resources using objects and/or photos and/or symbols; this may be any form of paper or tangible non-electronic display. Describe the type of symbols and/or complexity of display being used.
- **Aided – Electronic: Y** if aided electronic AAC was used by all or some of the participants before the study. Optional: Include names of who used what, to briefly indicate the type of device used. This could be any single message or multiple message electronic communication device/s, whether computer, tablets, phones, ipods or dedicated devices. You can include description of software and/or hardware, as reported.

#### **Standardised assessment results – receptive language**

- **Y** - if a standardised test was used. Standardised means that there is a formal protocol to the assessment; it doesn't necessarily need to be norm-referenced. Level of receptive communication, as assessed before the study. Include information about the test used.
- **Non** - if a non-standardised assessment or description was provided – optional to include a brief description as reported in the study.
- Leave blank if no information was provided about receptive language assessment.

### Standardised assessment results – expressive language

- **Y** if a standardised test was used. Standardised means that there is a formal protocol to the assessment; it doesn't necessarily need to be norm-referenced. Level of expressive communication, as assessed before the study. Include information about the test used.
- **Non** - if a non-standardised assessment or description was provided – optional to include a brief description as reported in the study.
- Leave blank if no information was provided about expressive language assessment.
- **Other – Optional:** Any other relevant information re child's communication before study.
- **Unclear/unspecified:** Indicate **Y** if this best describes the situation for some participants. No clear information of the child's communication before the study was provided, and/or communication modes were not reported on before the study.

### 5a. Child context – setting

Describes the setting where the study was conducted.

- **Home:** The study was conducted at home.
- **Other:** The study was conducted in place other than home, such as a pre-school or a clinic. Provide information about where it was conducted if this is available (optional).
- **Unclear/ Unspecified:** Information about the setting is not clear or not provided.

### 5b. Child context – activities

Indicate the activities used as the context for the study.

- **Reading:** Any type of story-book reading, used as the context for the study.
- **Play:** Any type of play or leisure activity eg game, toys, puzzle, peek a boo, used as the context for the study.
- **Mealtime:** Any type of meal, such as snack, lunch or dinner, used as the context for the study.
- **Other:** Any other activities used as the context for the study. Optional: list the ones used (e.g., toileting, personal care, bedtime).
- **Unclear/ Unspecified:** Information about the context for intervention is not clear or not provided.

### 6a. Teaching parents - name: & length

- **Name of strategy** for teaching parents. This is optional in relation to reliability. (e.g., Hanen, Eight-step instructional strategy). Leave blank if no specific name is used.
- **Length & intensity** of teaching parents, before and during intervention. Describe how much training was provided, in whatever way this is reported in the study (e.g., two two-hour coaching sessions, for four weeks before intervention; one-hour coaching session per week during intervention). Put in the actual times per participant.

### 6b. Teaching parents - setting

Where is the parent teaching conducted?

- **Home:** Parent teaching is conducted in their home
- **Other:** Any other setting where the parents are taught intervention strategies eg university clinic.
- **Unclear/ Unspecified:** Information about the setting for parent training is not clear or not provided.

## 6c. Teaching parents - method

Descriptions are adapted from Brown & Woods (2016).

- **Didactic teaching:** Direct instruction by the instructor/coach to the parents/caregivers. Instructor/coach provides print, verbal, visual, and video information on “how to” and “why” content about specific strategies and how these will support the child’s communication and development of new skills.  
[We were unclear about this category, as it is open to different interpretations and some “telling” is involved in all instruction. Decided to exclude from coding. You can still use the column to describe teaching, if relevant.]
- **Demonstration/modelling:** Instructor/coach shows parents/caregivers how to do strategies. Interventionist may work directly with the child, with the parent/caregiver present and actively observing. Instructor/coach may narrate her/his actions while modeling the strategy with the child and describes what she/he is doing while the caregiver observes. The explanation can occur immediately before the model, simultaneously with the actions, or immediately following the actions. This could occur as part of a “role play” demonstration without the child being present.
- **Practice:** Parents practice strategies either during a role play or when interacting with their child. Instructor/coach offers encouragement and feedback to the parent/caregiver – child dyad while the parent/caregiver is the primary partner with the child. Instructor/coach offers specific recommendations or suggestions to help the parent/caregiver implement the strategy. The parent/caregiver and instructor/coach may be jointly supporting the child or taking turns. Feedback may be specific to the child’s or caregiver’s participation or performance.
- **Feedback/review:** Instructor/coach gives parents/caregivers feedback on what is working, and on what needs to change to improve the intervention. This may also involve the instructor/coach and parent/caregiver jointly describing the child from their perspective. The parent/caregiver and the instructor/coach evaluate results and may make recommendations. This may occur at any time, either during the training, after the training or as the intervention is being monitored.
- **Other:** Any other strategies used to teach parents/caregivers. These may be to establish rapport, get to know them, answer questions not relating directly to the intervention, but of concern, etc.
- **Unclear/unspecified:** Study report of the method for teaching the intervention to the parents/ caregivers does not provide enough information to know what it was.

## 7. Parent variable - parent intervention strategies – parent outcomes

- **Parent intervention approach:** this is the **independent variable**. Provide the overall name of the intervention used in the study (e.g., PECS; Natural Language Milieu Strategies; Aided Language Stimulation; Key Word Sign). If there is no specific name, provide description as reported in study.
- **Length & intensity of intervention:** How many days, weeks or months was the intervention provided? What was the intensity of the intervention? (e.g., two one-hour sessions per week for 12 weeks). Check graphs to work this out, if required.
- **AAC modes used in study:** **Y** to indicate if a communication mode was used by the parent and child during the study. If a communication mode was the same as before the study, **write Y & "as in 4b"**.
  - **Unaided:** **Y** if this was used by all or some of the participants during the study.  
Optional: Include names of who used what and describe the type of gestural or

signing used (e.g., Natural gestures, Makaton, Key Word Sign, Auslan, American Sign Language, fingerspelling).

- **Aided – Non-electronic: Y** if this was used by all or some of the participants during the study. Optional: Include names of who used what and describe AAC resources using objects and/or photos and/or symbols; this may be any form of paper or tangible non-electronic display. Describe the type of symbols and/or complexity of display being used.
- **Aided – Electronic: Y** if this was used by all or some of the participants during the study. Optional: Include names of who used what, to briefly indicate the type of electronic device used. This could be any single message or multiple message electronic communication device/s, whether computer, tablets, phones, ipods or dedicated devices. You can include description of software and/or hardware, as reported.

### Other parent strategies involved in the intervention/parent outcomes

Report all strategies included in study results and whether they were reported as **DV** or **I**.

Indicate how it was reported in the study.

- **DV = dependent variable:** this code indicates the item was recorded as a parent outcome measure – as a **dependent variable** of the instructor/coach's teaching/intervention.
- **I = integrity:** this code indicates the item was used as a measure of intervention integrity or fidelity.
- **Code this as it is reported in the study.** If it is included as a DV and they have written a treatment integrity section about it, you can include it as both.

Also code for:

- **S = supplementary data:** this code indicates that the item was measured using supplementary data (e.g., discontinuous data or some other form of reporting) rather than continuous data that was presented in a graph.
- **Y = Yes:** Where items are described as part of the intervention, but are not included specifically in the DV definition, mark them as Y = Yes only.

### Parent strategies/outcomes:

**Follow child's lead:** Parent/caregiver communicates about activities or objects the child is attending to or interested in.

- **Expectant pause:** Parent/caregiver waits and may look towards the child, for a 3-10 second interval or longer, before doing something or communicating, to give the child an opportunity to take a turn or do something or communicate in some way.
- **Turn-taking:** Parent /caregiver uses other strategies to encourage the child to take turns in the conversation. Focus of the intervention is on taking – turns in whatever way is possible, rather than only one participant doing all the communicating.
- **Initiating:** Parent/caregiver demonstrates a strategy to initiate communication that they want the child to learn, such as *looking at the communication partner (child)* to get their attention and then using the communication aid; or using a body movement, touching a switch, using a vocalisation, saying a word out loud or using an unaided or an aided communication mode to say something to begin an interaction.
- **Language modelling- speech:** Parent/caregiver talks to the child, using speech alone. May include natural gestures, but no formal signing.
- **Language modelling - speech + unaided AAC (sign):** Parent/caregiver talks to the child, using speech in combination with gestures and formal signs. These may be

Makaton, key word signs, or any formal signing system, such as Auslan, American Sign Language or Signed English.

- **Language modelling - speech + aided AAC – non-electronic:** Parent/caregiver talks to the child, using speech in combination with equipment such as object symbols or any paper-based communication resource using photos, symbols, written words or spelling. Indicate the type of resources used.
- **Language modelling - speech + aided AAC – electronic:** Parent/caregiver talks to the child, using speech in combination with a single switch or a multiple message speech generating device. Indicate the type of resources used.
- **Prompt:** Any explicit prompt used by the parent/caregiver to assist the child to communicate. This may involve a gestural, verbal or physical prompt to use an AAC system.
- **PECS:** If an intervention is described in the study as “PECS” write PECS here. Can note reference to the PECS manual, PECS phases or if intervention is adapted version of PECS.
- **Question:** Use of a closed question (C – Y/N) or an open question (O – eg Wh-Question) to encourage a response.?
- **Labelling:** Parent/caregiver names an item that the child is looking at or interested in.
- **Recast:** Rephrasing something the child has said, perhaps turning it into a question or restating the child's immature utterance in a more grammatical sentence (adapted from Wikipedia [https://en.wikipedia.org/wiki/Language\\_development](https://en.wikipedia.org/wiki/Language_development)); this may not be a longer utterance than the original, but just more correct or another way to say it. Use this term if this is how it was described in the study.
- **Expansion:** Restating, in a linguistically more sophisticated form, what a child has said. For example, a child may say "car move road" and the parent may respond "A car drives on the road." This usually involves a longer utterance than the original. Use this term if this is how it was described in the study. Expansion may simply describe that the intervention is aiming to expand from one to two-word utterances.
- **Mean length utterance (MLU):** Mean length of utterance of the parent's communication measured during the study.
- **Frequency of AAC use:** The percentage of time when the parent/caregiver is using AAC to interact with the child, compared to the whole time they are interacting.
- **Other:** Any other parent intervention strategy measured in the study. This column can be used to include parent outcomes for items in Section 8 where they are parent outcomes in the study, or any other parent outcomes not already covered in this section.
- **Unclear/unspecified:** Study report of the parent intervention does not provide enough information to know what it was.

## 8. Focus of intervention and child outcomes

As reported in the study, using some form of data. Use the columns that best reflect how an item was reported in the study. Indicate if it was:

- **DV = dependent variable:** this code indicates the item was recorded as a child outcome measure – as a **dependent variable** of the parent teaching/intervention. Only record DV for the item that was specifically referred to.
- **Y = Yes:** Where items are described as part of the intervention, but are not included specifically in the DV definition, mark them as Y = Yes only.



- **S = supplementary data:** this code indicates that the item was measured using supplementary data (e.g., discontinuous data or some other form of reporting) rather than continuous data that was presented in a graph.

Report all items included in study results.

Pragmatic Functions are adapted from Pragmatic Profile, Dewart & Summers, 1995; Linguistic categories are also referenced to Paul & Norbury, 4th Edition, 2012.

- **Receptive language:** Focus of the intervention is to increase child's comprehension or understanding of language. Optional: Include any standardised results about the increase in receptive language reported. Optional: include descriptions of changes in the child's comprehension.
- **Turn taking:** Focus of the intervention is for the child to increase their turn taking within a communicative interaction or conversation.
- **Initiating:** Focus of the intervention is for the child to begin a communication. Indicate if initiating communication is reported as targeted or an outcome in the study. Optional – describe the behaviour being targeted. Examples: spontaneously communicating – using whatever mode of communication is possible; touching or reaching for their communication book, looking at the communication partner; or using a body movement, touching a switch, vocalising, saying a word out loud or using an unaided or an aided communication mode to say something to begin an interaction.
- **Responding:** Focus of the intervention is for the child to respond, using some form of communication behaviour. Include here, if this is how the targeted behaviour or outcome was described in the study.
- **Choice-making:** Focus of intervention is for the child to learn to make choices. Choice-making is a way to express a preference, from an available/ limited range of options. Include in this column if this is how the intervention target /outcome was reported.
- **Pragmatic function - request (object, activity, attention):** Focus of the intervention is for the child to make a request. This may be for a preferred item or an activity. PECS is an example of an intervention that focuses on learning to make a request. This could also be the focus of aided language modelling. Focus may be on requesting an object or an activity. This can also be used to request attention.
- **Pragmatic function – comment:** Focus of the intervention is for the child to make a comment. This may be expressing an opinion, describing, labelling or referencing something.
- **Pragmatic function – recurrence:** Focus of the intervention is for the child to request something to continue or to happen again (e.g., “more”, “do it again”).
- **Pragmatic function – reject/protest:** Focus of the intervention is for the child to reject or protest about something (e.g., “No”, “I don't want it”).
- **Pragmatic function – ask question:** Focus of the intervention is for the child to ask a question. This may be a **closed question**, requiring a “yes/no” answer (e.g., “Do you want to go to the toilet?”) or it may be an **open question**, requiring an answer that uses words or choices from objects/activities in the environment (e.g., “What do you like?”).
- **Pragmatic function – answer question:** Focus of the intervention is for the child to answer a question. This involves understanding the question and responding appropriately. If the question is an open question, this involves being able to use words to answer the question. If it is a closed question, this involves being able to answer ‘yes’ or ‘no’.

- **Pragmatic function – other:** Any other pragmatic function that an intervention targets or measures (e.g., telling a joke; telling a story; another aspect related to the social use of language in context). This can include learning appropriate social interaction skills, introducing a topic, taking turns within a conversation, finishing a conversation, etc.
- **Multi-symbol utterance:** The focus of intervention is for the child to learn to use multi-symbol utterances. An example is using two symbols/words to express a message and involves indicating two items on a display. An example outcome may involve measuring the number of different multi-symbol utterances, compared to the overall number of multi-symbol utterances. Optional: you can indicate if these involved semantic, syntactic or morphological features of language, described below:
- **Semantic functions:** Focus of the intervention is semantic relations. What were they? For instance, they may involve **agent** (I, name of a person), **action** (verbs – go, like, see, want), **object** (noun/an item or a person – apple, biscuit, pencil, puzzle, Xena). Optional – briefly describe the semantic functions that the intervention focused on.
- **Syntactic functions:** Focus of the intervention is for the child to use new types of words, such as nouns, verbs, adjectives, adverbs, prepositions and/or to learn the grammatically correct way to put the words together.
- **Morphological markers:** Focus of the intervention is for the child to use word endings or word forms that are required for grammatically correct sentences (e.g., -ing ending, -ed for regular past-tense verbs or use of irregular past-tense verbs such as “went”, rather than “goed”).
- **Vocabulary:** Focus of the intervention is for the child to learn new word. For instance, there may be a goal to learn 10 new words; outcomes may be measured in relation to the number of new words a child understands and/or uses expressively.
- **MLU – mean length of utterance:** Mean length of utterance of child’s language measured.
- **Frequency of child’s speech:** Y if this was a focus of the intervention. Briefly indicate what was reported (e.g., number or percentage the child is speaking during the interaction; extent of the increase in child’s use of speech over the period of the intervention).
- **Frequency of child’s AAC:** Y if this was a focus of the intervention. Briefly indicate what was reported (e.g., number or percentage the child is using AAC during the interaction; extent of the increase in the child’s use of AAC over the period of the intervention).
- **Other:** Any other focus of communication intervention or child outcome described in the study.
- **Unclear/unspecified:** Study report of the focus of the intervention and/or child outcomes does not provide enough information to know what it was.

## 9. Fidelity of researcher teaching/coaching

This section records the reporting in the study about the fidelity of the researcher’s teaching/coaching of the parents to carry out the intervention. Reference is: adapted from Lieberman-Betz, 2014, p 16.

Was **fidelity or integrity of teaching/ instruction/ coaching** by the researcher **reported**?

Answer **Y** = yes or **N**=no.

If NO – go to the next section.

If YES – complete information re the report of procedural fidelity.

- **Acceptable:** Did the study report that at least 80% or more of the prescribed elements of a training were delivered accurately, measured in at least 20% of the sessions? Optional: Describe the level of accuracy reported.
- **Dosage:** Was information about the amount of training reported? Optional: Describe (e.g., was the planned amount of training provided? Was this sufficient?) Include relevant comments re dosage.
- **Other:** Include any other information about fidelity of teaching that was reported.

## 10. Fidelity of parent intervention

Was **fidelity** of parent intervention **reported**?

Only complete this section if the study reported on **treatment fidelity** or **treatment integrity**. (Note: If this was reported as a dependent variable, do not include here.)

Answer **Y** = yes or **N**=no.

If NO – go to the next section.

If YES – complete information re the report of procedural fidelity.

- **Acceptable:** Did the study report that at least 80% or more of the prescribed elements of the parent intervention were delivered accurately, measured in at least 20% of the sessions? Optional: Describe the level of accuracy reported.
- **Dosage:** Was information about the amount of parent intervention provided? Optional: Describe (e.g., was the planned amount of intervention provided? Was this sufficient?) Include relevant comments re dosage.
- **Other:** Include any other information about fidelity of the parent intervention that was reported, that does not fit the previous items in this section.

## 11. Generalisation – parent

Generalisation needs to be formally stated and measured as such in the study, with some form of data or numerical information.

Comments can be included, but these are descriptive only, not necessarily a measure of generalisation.

- **People:** Was the parent intervention carried out with other people eg other children. **Y** or **N**
- **Settings/places:** Was the parent intervention carried out in other locations? **Y** or **N**
- **Activities:** Was the parent intervention carried out in other activities? **Y** or **N**

## 12. Generalisation – child

Generalisation needs to be formally stated and measured as such in the study, with some form of data or numerical information.

Comments can be included. These are descriptive only, not necessarily a measure of generalisation.

- **People:** Was the child able to carry out the communication skills with other people/other communication partners? **Y** or **N**
- **Settings/Places:** Was the child able to carry out the communication skills in other locations? **Y** or **N**

- **Activities:** Was the child able to carry out the communication skills in other activities? **Y** or **N**

### 13. Maintenance

Must be formally measured and reported, with some form of data or numerical information.

Comments can be included, but these are descriptive only, not necessarily a measure of maintenance.

- **Parent:** Does the study report on the level of parents continuing the intervention over time, after the formal intervention has been completed?
- **Child:** Does the study report on the level of child continuing to learn or use communication skills over time after the formal intervention has been completed?

### 14. Social validity

Was **social validity** measured? **Y** or **N**?

- **Description of what they did:** Describe how social validity was measured (e.g., questionnaire, type of statistical measure or level of agreement/support that intervention was suitable).

### 15a. Quality of study – single subject case design – What Works Clearinghouse Part One

#### What Works Clearinghouse criteria:

- i) Independent variable is systematically manipulated - researcher controls how & when independent variable conditions change – **Y** or **N**? If **Y**, then optional **P** (**parent**), **C** (**child**) or **P & C**
- ii) Each dependent variable measured repeatedly over time by more than one assessor – **Y** or **N**? If **Y**, then optional **P**, **C** or **P & C**
- iii) Measure of inter-observer agreement reported for each eligible dependent variable for at least 20% of the data points in each condition (e.g., baseline and intervention) – **Y** or **N**? If **Y**, then optional **P**, **C** or **P & C**
- iv) Reported level of inter-observer agreement must be at least 80% for percentage agreement indices and 0.60 if measured with a Kappa index – **Y** or **N**? If **Y**, then optional **P**, **C** or **P & C**
- v) Must include at least three attempts to demonstrate an intervention effect at three different points in time – **Y** or **N**? If **Y**, then optional **P**, **C** or **P & C**

Reference: Maggin, et al 2012 & WWC, Version 4 draft, 2017 for operational description of each criteria.

Does the single subject case design study meet the What Works Clearinghouse criteria?

Answer **Y** = yes or **N**=no.

If Yes, then continue to assess study in the following sections.

If a study does not meet any criteria in column 15a – stop coding.

If it is a case study – do not code as not a single case design study.

**Only studies that are Y for all the points above are rated in section 15b.**

**Notes:**

- Criteria relate to dependent variables only.
- Integrity measures – reliability would not need to be done.
- Document **dependent variables** separately & number them if they varied.
- Optional: indicate whether DVs relate to Parent (P) or Child (C).

**Summarise as either:**

- **Meets standards:** if it has 5 or more data points per phase, for baseline and intervention – Y or N
- **Meets standards with reservations:** if it has three or four data points per phase, for baseline and intervention – Y or N
- **Does not meet standards:** if two or less data points per phase, for baseline and intervention – Y or N

**15b. WWC Part Two (iv): level of evidence of study:**

Indicate whether the study is:

- **Strong:** Three demonstrations of a treatment effect are observed with no instances of a non-effect.
- **Moderate:** Three demonstrations of treatment effect and includes at least one instance of a non-effect
- **No evidence:** Does not provide three demonstrations of control.

**16a. Quality of study — Cochrane Collaboration Standards for Group Studies**

**Randomization:** Rate as one of the following:

- 2 Points:** Participants are randomized to groups using an acceptable method (e.g., random number table, coin tossing).
- 1 Point:** Claims participants are randomized but method not detailed.
- 0 Zero:** Participants not randomly allocated to groups or allocated using inappropriate method (e.g., by date of referral, birth date).

**Blinding:** Rate as one of the following:

- 2 Points:** Assessors were blind to group allocation on all measures.
- 1 Point:** Assessors were blind to group allocation on some (but not all) measures.
- 0 Zero:** Assessors were not blind to group allocation; or this was not reported.

**Attrition:** Rate as one of the following:

- 2 Points:** Differential attrition was within 10 % for all study groups.
- 0 Zero:** Differential attrition was greater than 10 % for all study groups.

**Pre-test equivalence:** Additional criteria — rate as one of the following:

- 2 Points:** Groups were statistically equivalent on all outcome measures.
- 1 Point:** Groups were statistically equivalent at pre-test on some outcome measures.
- 0 Zero:** Pre-test equivalence was not examined or differences were unadjusted.

**16a. Group studies overall score**

Report overall quality rating of this study numerically by adding up the above numbers for each item together into a single score.

**16b. Group studies evidence rating**

Describe the group study – was there are low or a high risk of bias in this study? (e.g., was it relatively strong or weak?)

If it has a high score = low risk of bias. That means a relatively strong study.

If it has a low score = high risk of bias. That means a relatively weak study.

**Note:** Initially rate the studies individually, based on the information provided in each article alone.

Where there are two or more articles reporting data from related studies, or the same studies, we can combine the 2 or more articles later to provide an overall rating.

**Reliability Data will be measured only on information up to here.**

**17. Take-away:** Summarise the findings or main results of the study. Optional.

**18. Limitations:** Optional to complete – Indicate if any major limitations that they report or that you notice.

**19. Future directions:** Optional to complete – Indicate future research directions the study highlights.

**20. Notes:** Optional to complete - Add any other information that was of interest.

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Chapter Three: Coaching parents to implement augmentative and alternative communication (AAC) language systems with young children with complex communication needs

**Chapter Overview**

Chapter Three is a single case design research paper reporting on a pilot study to examine the process of training, coaching and supporting parents to implement an aided language stimulation intervention, using aided language displays and pragmatic organisation dynamic display (PODD) communication systems. As this was an exploratory study, an AB design was used. The paper provides an introduction defining the relevant parameters of this study and providing brief theoretical background most relevant to understanding the basis of the aided language stimulation intervention in the study. Dependent variables measured both parent and child outcomes were measured and parent feedback about the intervention was obtained using a questionnaire. The study involved two parent-child dyads (children aged 4.5 years) and was implemented in the families' home setting within two natural routine activities, mealtime and play. An experimental effect was demonstrated in relation to parent AAC symbol use, parent use of the language stimulation strategies sabotage and self-talk, and children's use of symbolic utterances. The pilot study also found support for the social validity of this approach. The results, limitations and suggestions for future research are discussed. Overall, the pilot study supported the parent training, coaching and intervention approach used and provided a rich source of information about the process of introducing PODD resources to families and young children with complex communication needs.



**Coaching Parents to Implement Augmentative and Alternative Communication (AAC) Language Systems with Young Children with Complex Communication Needs.**

Harriet Korner

Department of Educational Studies

Faculty of Human Sciences

Macquarie University

Author Note

Correspondence concerning this article should be addressed to Harriet Korner,

Department of Educational Studies, Macquarie University,

North Ryde, NSW, 2109, Australia.

Email: [hkorner@netspace.net.au](mailto:hkorner@netspace.net.au)

### **Abstract**

The aim of this research was to explore the process of coaching parents to implement an aided language stimulation intervention with young children with complex communication needs, using aided language displays and a pragmatic organisation dynamic display (PODD) communication system. The effects of a parent training and coaching intervention on parent and child communication outcomes was investigated in a pilot study using an AB design. Two parent–child dyads, with children aged 4.5 years, participated in the home-based parent coaching intervention. Data were collected in two routine activities, mealtime and play. Dependent variables were frequency of parents’ AAC symbol use, speech and language stimulation strategies and frequency of children’s symbolic utterances. A clear experimental effect was demonstrated for parents’ AAC symbol use in mealtime and for one parent in play. The strongest result for language stimulation strategies was for parent self-talk. One parent increased her spoken language input during intervention, while the other parent reduced his speech rate. Both children demonstrated increased symbolic utterances, with clearest results in the mealtime activity. Measurement and implementation issues were encountered that will need to be considered in future research. Implications of the results for further study of parent implemented aided language stimulation are discussed.

*Keywords:* augmentative and alternative communication, AAC, aided language stimulation, aided language, pragmatic organisation dynamic display, PODD, communication intervention, language intervention, key word sign, gesture, children, complex communication needs, communication impairment, communication disability, communication support needs.

### Chapter Three: Coaching parents to implement augmentative and alternative communication (AAC) language systems with young children with complex communication needs

Children with complex communication needs have little or no speech and may have a range of physical, sensory and/or cognitive challenges caused by developmental disabilities, such as autism, Down's syndrome, cerebral palsy, genetic syndromes, global developmental delay and/or developmental apraxia of speech (Beukelman & Mirenda, 2013; Australian Bureau of Statistics (2017). Children with complex communication needs may require augmentative and alternative communication (AAC) so they can interact with other people and participate in everyday life; AAC is described as way to access communication (Smith & Murray, 2016; Solarsh & Johnson, 2017).

AAC is multi-modal and involves both unaided and aided forms of communication. Unaided communication does not require equipment and includes non-symbolic behaviours such as eye-gaze, facial expression, body language and symbolic language conveyed using conventional gestures, key word signs and sign language. Aided communication uses external equipment with visual symbols, such as pictures, written words, and letters for spelling. These are accessed via paper-based communication displays, multi-level communication books and/or electronic communication devices with speech-output (Speech Pathology Australia, 2012; Porter, 2017). AAC strategies can support language comprehension for people who struggle to understand spoken communication and provide a means of expression for people who have little or no speech. AAC can also support speech and language development, enhance speech intelligibility and provide an alternative form of communication when speech is limited or not possible (Beukelman & Mirenda, 2013; Schlosser & Wendt, 2008; Von Tetzchner & Stadsleiv, 2016).

Language learning occurs within a two-way reciprocal relationship, where parent and child actively influence each other (McLean & Snyder-McLean, 1978). Typical language learning occurs in everyday life, without planning, when parents interact with their children (Bruner,

1983; Tomasello, 1999). Parents provide “scaffolding” for their child’s problem-solving and language acquisition, by demonstrating ways to accomplish tasks and use words to talk about their experiences (Wood, Bruner & Ross, 1976). It is suggested that parents of young children with complex communication needs are supported to learn how to use AAC modes themselves, with other language stimulation strategies, to provide an AAC language model, to encourage their children to understand the AAC modes and to learn to use AAC expressively. AAC should be available within natural contexts and for genuine purposes (Von Tetzchner & Grove, 2003; Von Tetzchner & Stadkleiv, 2016). Using AAC for real messages during the usual parent-child interactions that occur in everyday contexts would provide parents with communication tools to enable the mechanism for language and communication development suggested by Tomasello (2003) to be adapted and implemented for young children who have complex communication needs.

A barrier to successful implementation of AAC identified in the literature is an asymmetry in the modalities used for language input and language output (Allen, Schlosser, Brock & Shane, 2017; Sennott, Light & McNaughton, 2016; Smith & Grove, 2003). An example of this asymmetry is that parents and teachers tend to talk to children who have complex communication needs using speech, then expect children to express themselves using AAC. This can limit the adoption of AAC systems. AAC requires planning and effort — people need to learn how to use it. O’Neill, Light & Pope (2018) recently found evidence supporting the efficacy of aided language in reducing input–output asymmetry.

Aided language approaches are supported as an effective evidence-based AAC practice according to a number of recent systematic reviews and meta-analyses (Allen, Schlosser, Brock & Shane, 2017; Korner, 2018; O’Neill et al., 2018; Sennott, Light & McNaughton, 2016). There are various aided language approaches described in the literature (Binger & Light, 2007; Cafiero, 1995; Drager et al., 2006; Goossens, 1989; Ronski et al., 2010; Ronski & Sevcik, 1992). The specific method used in the current study is “aided language stimulation” (Goossens, 1989).

Aided language stimulation emphasises the need to provide receptive language input using AAC

modes as the basis of intervention (Porter, 2017). Goossens described aided language stimulation where a person speaks and points to symbols on an aided display simultaneously, in conjunction with other language stimulation strategies, as being equivalent to total communication in manual signing, (Goossens, 1989, p.16). Dodd and Gorey (2014) identified aided language stimulation as an immersion model and suggested the language stimulation strategies of self-talk, parallel talk, modelling and expansion play a role in the process of aided language learning (p.106). Porter (2007, 2017) emphasised language stimulation strategies such as expectant pauses to encourage initiation of communication, with use of frequent repetition and expansion when using aided language, to promote language development. Porter (2007, 2017) also referred to the need for “natural feedback”, where the adults describe their own or the child’s communication (verbal reference) or recap the message, repeating all the words the child has expressed so far, so the child hears the whole message. The latter strategy assists language learning and provides an opportunity to clarify the message, should this be needed.

Recent studies have demonstrated the efficacy of communication partner implemented aided AAC modeling in a shared book-reading activity with aided language input provided using activity-specific vocabulary (Binger, Kent-Walsh, Berens, Del Campo & Rivera, 2008; Kent-Walsh, Binger & Hasham, 2010; Sennott & Mason, 2016). There is an urgent need for research focused on early introduction of a robust aided AAC language system with young children, to explore the efficacy and value of implementing aided language stimulation across a range of everyday activities. One such system is the Pragmatic Organisation Dynamic Display (PODD) communication system (Porter, 2007, 2017). Multi-level communication books can be introduced, in conjunction with single-level aided language displays during the early stages of implementation.

PODD communication books are specifically designed for implementing aided language stimulation at any time and in any context (Porter, 2007, 2017). PODD focuses on language development, providing explicit strategies for scaffolding pragmatic functions and a robust vocabulary to enable development of semantic, syntactic and morphological language functions.

The resources are organised to be developmentally and functionally appropriate for use with young children, including children with severe intellectual disabilities and those with age level receptive language skills. PODD systems are designed with a large vocabulary, with frequently used “core” words that are used across contexts and a large pool of extended or “fringe” words, which enable a person to talk specifically (Porter, 2017). The robust vocabulary enables communication partners to model both predictable and unpredictable messages. This helps to develop children’s comprehension and build shared meanings, using the aided vocabulary within natural contexts. Children develop their expressive use over time. PODD systems have been described as a promising practice (Beukelman & Mirenda, 2013; Mirenda, 2009; Porter & Cafiero, 2009), but this method of aided language stimulation is only beginning to be formally researched (Bayldon & Clendon, 2017). To date, there are no early intervention studies published using PODD communication systems.

Parents are critical to the success of any communication intervention designed for young children. In their meta-analysis, Roberts and Kaiser (2011) supported the efficacy of parent implementation of language interventions as an evidence-based practice. Kent-Walsh, Murza, Malani and Binger (2015) and Shire and Jones (2015) conducted a meta-analysis and systematic review respectively, investigating the effectiveness of communication-partners implementing AAC interventions. They concluded that communication partners, including parents, can be taught to implement AAC interventions successfully and highlighted future needs for research. In their meta-analysis, Kent-Walsh, et al. (2015) found that communication partner interventions were highly effective across a range of participants using AAC and intervention approaches and suggested that partner instruction should be viewed as an integral part of AAC assessment and intervention. Shire and Jones (2015) found that communication partners, including parents, could implement AAC interventions successfully, with positive outcomes for both the parents and children. However, there was limited information about the communication partner’s experience of AAC before the intervention and little explicit reporting of the protocols used to help partners to navigate the AAC systems in the studies. Timing of partner training was highlighted as a

relevant variable, with some support for initial training and guidance when AAC was introduced, with communication partners/parents transitioning to a leading role by the end of the intervention. Shire and Jones (2015) highlighted the need for AAC to be used across contexts and across time if it is to be a successful real-world intervention. They suggested future researchers should investigate whether there is an interaction between the increasing skills of the communication partner and the increasing skills of the child in AAC interventions. They also suggested research should more clearly delineate the instructional strategies provided to partners, and the quality of the child's outcomes. Consistent with these previous reviews, Korner (2018) found a need for future research to more clearly describe parents' and children's experience and knowledge of AAC before the research study and methods of parent training used in the intervention.

A coaching approach to teaching parents is supported in the language intervention literature (Akamoglu & Dinnebei, 2017; Cologon, Wicks & Salvador, 2017; Kaiser & Roberts, 2013; Lieberman-Betz, 2014) and was supported in Korner's (2018) systematic literature review of parent-implemented early symbolic AAC interventions. Parent coaching is recommended as a best practice in early intervention (Early Childhood Intervention Australia, 2016; Paul & Roth, 2011), as it is consistent with principles of adult learning and family centred practice (Brown & Woods, 2016; Early Childhood Intervention Australia, 2016; Friedman, Woods, & Salisbury, 2012). Specific coaching strategies include: a) direct teaching, using verbal and written information, to inform parents about the "how" and "why" of the intervention; b) demonstration; c) practice with feedback; and d) problem-solving and reflection (Brown & Woods, 2016, p.119).

Korner (2018) found parent coaching appeared to be effective in supporting parent learning and was associated with improved communication outcomes for parents and children. In her systematic review (2018) she found that aided language interventions were an evidence-based approach and that further research into parent-implemented aided language interventions was needed.

As PODD communication systems are being used in clinical practice as a tool for implementing aided language stimulation, but no experimental studies using PODD have yet been reported, research on PODD communication systems is needed. As a first step, the pilot study reported here was designed to explore the feasibility of coaching parents to implement an aided language stimulation intervention using a PODD communication system, as preparation for a more rigorous study in the future.

The pilot study provided an opportunity to explore and refine methods of parent training and coaching when supporting parents to use aided language stimulation, trial dependent variables including reliability of measures, and determine time frames for obtaining measurable outcomes. Questions the pilot study aimed to address are:

1. What is the feasibility of and the time-frames required for coaching parents to implement an aided language stimulation intervention using a PODD communication system?
2. What is the effect of aided language stimulation using aided language displays and a PODD communication system, implemented in conjunction with unaided AAC, on parent's symbolic AAC language input and their spoken language input to their child?
3. What is the effect of aided language stimulation using aided language displays and a PODD communication system, implemented in conjunction with unaided AAC, on the child's use of symbolic language, including speech, key word signs and aided symbols?
4. What is the social validity of this aided language stimulation intervention using parent training, parent coaching, aided language displays and a PODD communication system?



## Method

### Research Design

An AB single case design was selected to allow for trial of measurement methods and to avoid the need for children to wait for long periods before commencing intervention, as may have been the case with a multiple baseline study. As no previous experimental studies have been published using a PODD communication system and given this was a pilot study, an AB single case design study allowed for flexibility with time-frames, to adjust the parent coaching intervention if required and to evaluate dependent variables.

### Participants

The participants were two parent/child dyads (James and Mark, Jade and Isabel). Ethical approval was obtained from the Macquarie University Human Ethics Research Committee before recruiting participants for the research project. The selection criteria were that (a) each dyad consists of one parent or carer who is the primary caregiver and their child; (b) parents speak English as their first language at home; (c) children are aged between 1 and 5 years, with little (15 words or fewer) or no speech and an associated developmental disability, such as cerebral palsy, autism spectrum disorder or Down syndrome and (d) children can point directly to a display.

Both participant dyads lived in Sydney. James, Mark's father and primary caregiver, was aged 43 years, university educated, and worked full-time in a professional role. Jade, Isabel's mother and primary caregiver, was aged 47 years, and worked part-time in a professional role as well as studying for a postgraduate degree. Both parents had completed the Hanen program *It Takes Two to Talk* (Pepper & Weitzman, 2004) as an early intervention when their children were around 3 years old.

Mark was a boy with Down Syndrome aged 4 years 6 months at the beginning of the study. Mark had a moderate conductive hearing loss, with intermittent use of a conductive hearing aid. Mark demonstrated good visual skills, being able to recognise pictures (2-3 cm<sup>2</sup>) on visual displays. Mark was mobile, with delayed gross and fine motor skills. He used both hands to point

to pictures. Mark had limited vocalisations and his speech pathologist had recently suggested he had a motor planning disorder (dyspraxia). Mark was introduced to key word signs when he was 18 months old. Mark attended preschool three days per week and day care two days per week. Mark attended a weekly applied behaviour analysis (ABA) program and an ABA support worker visited twice weekly at home. ABA therapists introduced a PECS communication book 12 months before the study, which Mark used with them to request food and play activities, but PECS was not used by Mark's parents. At home Mark used a song board, with ten pictures of his favourite songs, to request songs.

In formal assessment using the Vineland Adaptive Behaviour Scales, Second Edition (VABS-II) (Sparrow, Cicchetti & Balla, 2005) Mark achieved a standard score of 59, in the 1<sup>st</sup> percentile, with significant delays across all domains and with relative strengths in his socialisation skills. Mark's receptive language age level was 1 year, 9 months and his expressive language was at an age equivalent of 1 year, 1 month. Results on the MacArthur-Bates Communicative Development Inventories – Words and Gestures (MB-CDI) (Fenson et al., 2007) were consistent, indicating Mark understood 100 everyday words; he produced one speech approximation and 25 sign approximations that were imprecise and hard to recognise. Information obtained using the Pragmatic Profile of Everyday Communication Skills in Pre-School Children (Dewart & Summers, 1995) found Mark used mostly non-symbolic behaviours such as facial expression, body language, and eye contact with some gestures and signs to communicate his everyday needs using early pragmatic functions in the “here and now”. He was not able to relate information or use symbolic concepts to comment.

Isabel was a girl with a rare genetic disorder, involving a deletion of approximately 30 genes on Chromosome 17, aged 4 years 8 months at the beginning of the study. Isabel had developmental delays affecting her gross and fine motor skills and her speech, which appeared to be a motor planning speech disorder (dyspraxia). Isabel's hearing had been formally assessed and was normal. Visual assessment indicated Isabel's visual acuity was adequate for her to identify pictures (e.g., 2-3 cm<sup>2</sup>) on grid displays (e.g., 8 x 5, 40 pictures per A4 page). Isabel was

mobile and could point to pictures using her right hand. Isabel attended a Montessori preschool three days per week and had weekly speech and occupational therapy sessions intermittently during the study. Key word signs had been introduced in the previous 12 months. About ten single aided language displays (around 12–20 items per page) had been provided, but they were not being used prior to the study. Isabel used jargon-like sounds while playing. Her limited speech included rote words such as counting (e.g., “one, two, three”). Isabel briefly trialled the Lamp and Proloquo2Go apps on an iPad just before the study commenced. A PODD communication system had been recommended just before Jade and Isabel’s participation in the pilot study.

On the VABS-II Isabel achieved a standard score of 69 in the 2<sup>nd</sup> percentile (confidence interval 90%), with significant delays across most domains around a 2 to 3-year level, with particularly low scores for expressive language (age equivalent to 1 year, 5 months). In contrast, her receptive language score was her highest score, (age equivalent to 4 years, 7 months), indicating Isabel’s receptive language skills were near her chronological age level. On the MB-CDI-Words & Gestures Isabel understood 274 everyday words, produced seven speech approximations and 56 signs. On the pragmatic profile, Isabel demonstrated strong interaction and problem-solving skills using a range of early pragmatic functions, and expressing messages using facial expression, body language, gestures, speech approximations, key signs and pointing to pictures in books to assist expressing her messages. She was expressing herself at a one-word level, with occasional two-word combinations using signs.

### **Setting and Materials**

The study was conducted at the family home for all phases, except for a one-day parent training session for Mark’s parents, conducted in a university training room. Parent training for Isabel’s parents was conducted in her home at their request. Baseline and intervention sessions were carried out in two to three locations within the family home, during a mealtime and play activity for each child. Coaching and data collection were carried out in the relevant area of the

family home (e.g., dining room, outside table, living room and play room). The activities were usually carried out at similar times of day across all phases of the study.

Materials for the intervention included laminated A4 aided language displays, with 12 or 20 pictures per page, for home routine and play activities from *CHAT-Now* (Porter & Cameron, 2007) and *Pragmatic Organisation Dynamic Display Communication Books — Direct Access Templates* (PODD) (Porter, 2007).

For the parent training sessions, a full set of the direct access PODD templates (Porter, 2007) was used for demonstration purposes. James and Mark used 12-per-page aided language displays for general interaction, mealtime, reading, music, blocks and ball play. PODD resources used by James and Mark were a slightly customised paper one-page early functions PODD 12 communication book (12 pictures per page), a partial version of a laminated one-page expanded functions PODD 20 communication book (20 pictures per page) and a laminated template one-page expanded functions PODD 16 communication book (16 pictures per page). Symbols varied in size from 4 to 6cm, in a 4 x 3, 4 x 4 and a 5 x 4 grid in a landscape format. Mark's customised expanded functions PODD 16 book, used for the maintenance probe, was made smaller and more portable (80% of an A4 page size with laminated and monsoon pages) and used 3cm<sup>2</sup> symbols arranged in a 4 x 4 grid.

Jade and Isabel used 20-per-page aided language displays, including ones for general interaction, mealtime, reading, music and playdough. PODD resources used by Jade and Isabel were a laminated template two-page with side-flap PODD 36 communication book (36 pictures per page) and a laminated template one-page expanded functions PODD 20 communication book (20 pictures per page). Symbols varied in size from 3cm<sup>2</sup> to 4 x 5cm, on a 6 x 6 grid and a 5 x 4 grid. Isabel's customised expanded functions PODD 20 was used during the final week of her intervention. This was made smaller for portability (80% of an A4 page in size with laminated and monsoon paper pages) with symbols 3cm<sup>2</sup> in a 5 x 4 grid. All aided AAC resources used coloured Picture Communication Symbols (Mayer-Johnson, 2011).

### **Independent Variables**

The independent variables were the initial parent training and the parent coaching in aided language stimulation intervention. Aided language stimulation involved parents interacting with the children using a combination of speech, gestures, key word signs and the aided language displays and/or a PODD during everyday activities. Parents were also encouraged to use specific language stimulation strategies as part of the aided language stimulation intervention. See Procedures for more detail (p.94).

### **Dependent Variables**

The primary dependent variables were (a) frequency of parent AAC symbol use; b) frequency of parent speech; c) frequency of parent use of targeted language stimulation strategies. The secondary dependent variable was frequency of child symbolic utterances. Language stimulation definitions in the study were adapted from Paul and Norbury, (2012) and Dodd and Gorey (2014). Measurement of parent and child outcomes was carried out within everyday mealtime and play activities (see Procedures below). Mealtime was a consistent routine activity, while parents were asked to play with their children as they usually do, so play activities varied across the study for each parent-child dyad and were less predictable situations.

Frequency of parent AAC symbol use was coded as an event each time the parent used an individual sign, conventional gesture or an aided AAC symbol on a display. Parent use of aided AAC was operationally defined as pointing to or touching a picture on a communication display. Each aided word or phrase on a single display item was counted as a separate event. On PODD resources individual items were either a word or a phrase – including vocabulary for messages and for navigational links. Signs were defined as key signs or gestures documented in *Getting Started with Key Word Sign* (Auslan edition) (Caithness, Brownlie, & Bloomberg, 2012) or the *Key Word Sign Australia App*, using Auslan signs. Each sign was coded as a separate event.

For the third primary dependent variable (parent use of a targeted language stimulation strategy) strategies were selected for each parent based on preliminary observation of parent-child interactions during baseline videos by the experimenter/clinician. The strategies selected

were ones that the clinician felt may be helpful in the intervention that were not currently being used frequently.

For James, two targeted language stimulation strategies were selected — wait and sabotage. Wait was used as a term to describe an expectant pause. This was operationally defined as the parent looking at the child expectantly and waiting for the child to do something: parent is silent and uses an “encouraging pause” for at least 3 seconds. Sabotage was a term used to describe when the parent purposefully makes something different to usual or unavailable, such as forgetting to bring an item or omitting a step in an activity, to create an opportunity for the child to communicate something, such as making a comment or requesting an item to solve the problem. Both strategies were selected to assist James to create increased communication opportunities for Mark, to help scaffold his emerging use of symbolic language.

For Jade, the targeted language strategies selected were self-talk and expansion. Self-talk was defined as “parent uses language to describe their own actions and feelings as they engage in play or interaction with the child”. Language used for self-talk could involve any modality — speech alone, key signs and/or pointing to a graphic symbol on a display. Expansion was defined as “after the child has an expressive turn, using a symbolic utterance, parent repeats the child’s utterance with an additional language element, word or phrase, so it has more semantic or syntactic information”.

The secondary dependent variable was the frequency of the child’s use of symbolic utterances. This was operationally defined as any attempt to communicate by the child using symbolic language in any modality, including spoken words, intelligible speech approximations, key word signs and recognisable sign approximations and pointing to aided symbols on an aided language display or a PODD communication book. Intelligible speech approximations included utterances such “wee” for “three” or “oo” for “two”. Speech approximations that were concurrent with use of another modality were counted as one utterance. Speech approximations that were used on their own or consecutively, before or after another modality, were counted as separate utterances. Conventional gestures were included, such as nodding head for “yes” or

shaking head for “no”, but the behaviour of pointing to real objects or to pictures in a book were not included. Informal communication behaviours, such as vocalising sounds, jargon-like vocalisations, participating in a “Hi-5” interaction or using idiosyncratic gestures, such as hands on ears to indicate “noisy” were not included.

## **Procedures**

The researcher who carried out the training and coaching was a speech pathologist experienced in using unaided and aided AAC and a certified PODD presenter. Prior to baseline, the researcher met with the parents at their home and loaned them a Sony video camera and tripod for the duration of the study, with related written instructions. James’ was a Sony HDR-CX405 HD Camcorder; Jade’s was a Sony HDR-SR11E handycam. The researcher assisted parents with initial set up and use, to ensure parents were confident about videoing during the pilot study. Most coaching sessions were conducted face to face in the families’ home, but some were conducted using Skype.

**Baseline.** Video observations were recorded of the parent interacting with her/his child at home during mealtime and play activities at a consistent time each day for 3–5 days per week. Each activity was coded from the first to the sixth minute of each recording. Baseline observations continued until at least five data points were recorded for each activity.

**Parent Training.** Parent training was conducted with both the children’s parents and without the children present. A questionnaire (Appendix 1) was given to parents before the training session, to obtain information about parent’s attitudes, knowledge and experience of AAC and any concerns prior to the parent training. This assisted the researcher to address their needs during the training.

A training session of about 6 hours was delivered to parents before the intervention phase of the study. For Mark’s parents, this was held on one day and included a lunch break between the morning and afternoon sessions. For Isabel’s parents, training was carried out over two half day sessions and each was three hours in length.

Parent training content included a) definitions of communication, language and AAC; b) rationale for using an aided language stimulation approach; c) introduction to aided language displays and the PODD communication system; d) introduction to language stimulation strategies, including wait, sabotage, self-talk, parallel-talk, repetition, imitation and expansion; e) introduction to aided language modelling f) an outline of the pilot project phases and g) discussion of parent/child goals to guide parent implementation of aided language stimulation with their child. The presenter used videos and face-to-face models to demonstrate how to use the resources and the language and aided language stimulation strategies. Parents practiced use of the aided language displays during meal breaks and were given an opportunity for “hands-on” use of the PODD communication resources during the second half of the training. Written materials were provided at the parent training session including a copy of the PowerPoint slides, operational definitions of language stimulation strategies, adapted from Paul and Norbury (2012), a one-page aided language stimulation handout and the *CHAT-Now* resource called “Using Aided Language Stimulation at Home” (Porter & Cameron, 2007). Two articles were provided to parents for background reading to provide information about the use of AAC in early intervention (Cress & Marvin 2003; Ronski & Sevcik 2005).

**Intervention Phase One.** The first phase of intervention was the introduction of single level aided language displays immediately after the initial parent training session/s. Aided language displays included general interaction, mealtime, book-reading and play activity displays. Video-recording continued as per baseline conditions throughout the phase, with the addition of the aided language displays. Videos were reviewed by the researcher/therapist prior to the first coaching session, to guide the parent coaching.

**Intervention Phase Two.** Parent coaching commenced on a weekly basis one week after the parent training session for James and Mark, and 10 days after the second parent training session for Jade and Isabel. Interruptions due to factors such as illness and moving home meant that there were intermittent breaks in these sessions. James and Mark had 13 coaching sessions over 18 weeks. Jade and Isabel had 12 coaching sessions over 16 weeks. Coaching strategies



included providing information and explanation, demonstration, guided and caregiver practice, problem solving and reflection (Brown & Woods, 2016). Video-recording continued throughout the phase as per baseline and phase one conditions with the addition of the PODD resources, from the first week for Jade and Isabel and from the second week onwards for James and Mark. Data were usually recorded for three to five sessions per week.

The first week of phase two included finalising parent goals to guide parent implementation. James's goals were a) to provide receptive language input, using aided language stimulation; b) to create opportunities for Mark to initiate communication by using wait and sabotage strategies; a stand was provided to assist in positioning of the aided language displays, as Mark was sometimes throwing them onto the floor. Jade's goals were a) to provide an aided language model, including the use of the language stimulation strategies self-talk and expansion; b) to create opportunities for Isabel to initiate communication by making the aided language display/PODD available and modeling initiation, using a signal, hand up, and saying "I've got something to say". Each coaching session also had a specific focus of the week to assist parents' learning of pragmatic functions/sections of the PODD and/or operational skills related to using the PODD resource.

Weekly information sheets (Theodorsen, 2016) provided written information to support parent learning and included the following patterns: commenting (like and don't like); requesting (I want); something's wrong; initiating communication (using a signal such as hand up saying "I've got something to say"). Towards the later weeks of phase two, other patterns were practiced including: do something, I'm asking a question and I'm telling you something – using categories. Information was also provided on verbal referencing. All strategies were practiced using guided practice during the coaching sessions. Although there were occasional exceptions, due to illness, etc, in most weeks the researcher viewed videos from the previous week, in preparation for the next coaching session; coaching sessions sometimes included watching videos together with parents to share insights about progress, encourage parents in their implementation of the strategies, and to jointly decide on the focus for the next week.

The aided language stimulation intervention used in the study was consistent with the *Two Day Introductory PODD Workshop Manual* (Porter, 2017). Following parent training, aided language displays were introduced initially to allow parents opportunities to practice providing aided language models with concurrent use of speech and key word signs. From the first (Jade & Isabel) and second (James & Mark) coaching session in phase two onwards, PODD resources were provided to families and trialled until the type of PODD to be customised was selected and made. For Mark, James selected an expanded functions PODD 16; for Isabel, Jade selected an expanded functions PODD 20. The researcher and parents worked collaboratively to customise and make the child's PODD resources, which were finally completed during the second or last week of Phase Two.

### **Data Collection**

For each parent-child dyad five baseline sessions were selected for coding for each activity. If more than five sessions had been recorded, sessions were selected for coding on a random basis. In Intervention Phase one, fewer than five sessions were video-recorded, so all available sessions were selected and coded. In Intervention Phase Two, three to five videos per activity were usually recorded each week following a coaching session, with some exceptions and gaps in recording videos, particularly for the play activity. The first mealtime and play session of each week was selected for coding, including weeks in which coaching had not occurred.

### **Reliability**

#### **Inter-rater reliability.**

Inter-rater reliability was measured for each dependent variable. Inter-rater reliability measures need to be at least 80% to be considered adequate for measuring an experimental effect (Kratochwill et al., 2013). Two researchers independently coded at least a 20% sample of the data for baseline and each of the intervention phases. Across all the phases of the pilot study, inter-rater reliability was 86.3% (84.5% for James and Mark and 88.0% for Jade and Isabel). Inter-rater reliability measures for each participant and each phase and combined mean measures are provided in Table 1 (p.119).

**Procedural reliability.**

A parent training plan and fidelity checklists were prepared to assist checking whether all elements of the initial parent training were completed. All essential components of the training were delivered. During intervention, a fidelity checklist was prepared before each coaching session and was checked by the researcher immediately after the coaching session. Coaching sessions delivered at least 90% of planned components for each session, with some changes to suit the specific needs of participants in each session.

**Social Validity**

All four parents (participants and their partners) completed a pre-training questionnaire to assess their expectations before the study and another questionnaire to give their evaluation of the parent aided language training session at the beginning of phase one. At the end of phase two, the main parent participants provided feedback about their perceptions of the intervention by completing a final questionnaire. Copies of the questionnaires are provided in Appendices 1 to 3.

## Results

The number of parent AAC symbol uses, uses of a targeted strategy, and child symbolic utterances in each five-minute session at baseline, intervention phase one and intervention phase two are shown in Figures 1 to 4 (p.120). Mean rates of parent speech, parent AAC symbol use, and child symbolic utterances at baseline, intervention phase one and intervention phase two are shown in Table 2 (p.122). A breakdown of parent AAC symbol use (into key word signs and gestures, and aided AAC) and child symbolic utterances (into key word signs and gestures, aided AAC and speech) is given in Tables 3 and 4 (p.123). These results are described below.

### Parents

For James, there was variability in his AAC symbol use (i.e., key signs and gestures) at baseline for the predictable mealtime activity, with relatively high levels of signing in some sessions, and a lower and declining rate during baseline for play. When aided language displays were introduced in phase one, James increased his overall AAC symbol use in both activities. A further increase in parent AAC symbol use accompanied the introduction of the PODD 12 resource, particularly in the mealtime activity the first week the PODD was introduced, when the operational demands were kept simple, as James was asked to focus on using the quick-chat section, which are the first two pages of the PODD. Parent AAC symbol use declined slightly in subsequent weeks, but remained higher in most intervention sessions compared to baseline sessions. Overall a clear experimental effect is evident for James in relation to increased parent AAC symbol use during intervention.

For James, the amount of parent speech compared to AAC symbol use varied, with a higher mean speech count during baseline and phase one for mealtimes and during baseline for play, compared to phase two in both activities. There was an increase in AAC symbol use relative to the speech count from baseline to phase two (see Table 2).

Regarding the two targeted language stimulation strategies, it was not possible to establish adequate inter-rater reliability for coding the wait strategy, so data are only presented for the sabotage strategy. James implemented the sabotage strategy intermittently during phase two in

mealtimes. He rarely used sabotage during play. When James implemented sabotage, it was mainly in the form of not providing a book during mealtimes, to encourage Mark to initiate a request for a book. Although this strategy was not used frequently, the graph in Figure 1 shows a possible relationship between implementation of sabotage, increased parent AAC symbol use and increased child symbolic utterances.

Examination of the data suggested some differences in use of symbolic AAC modes between the activities, with initially increased signing in the predictable mealtime activity and mostly reliance on aided AAC in the less predictable play activity, once aided resources were introduced. In later sessions, use of AAC modes across both activities varied, with examples of repetition of words using signs and pictures concurrently or sequentially. Introduction of aided language resources appeared to coincide with an increase James' modeling of two-word symbolic AAC utterances.

For Jade, baseline measures for AAC symbol use were varied, with relatively high levels of signing at baseline in some sessions — more stable in the mealtime activity but not stable for the play activity. The high levels of AAC symbol use (key signs and gestures) in the first three baseline play sessions were due to Jade singing counting songs with Isabel, which played to Isabel's strength, as Isabel loved counting. Numbers such as "one", "two", "three" and "four" were her more intelligible speech approximations. The results for Jade are suggestive of an experimental effect for parent AAC symbol use during the mealtime activity, with increased levels of parent AAC symbol use in phases one and two compared to the baseline measures. The lack of a stable baseline for the play activity means that an experimental effect cannot be claimed for this activity. There is a suggestion of an increasing trend in the data for the play activity during the final month of the intervention, as Jade consolidated her skills using the PODD 20.

Jade's speech count increased during intervention, with a marked increase during phase two (see Table 2). This occurred in both the routine mealtime activity and the varied play activity, with particularly high speech count in the play activities. It was observed that the PODD resources facilitated Jade's introduction of new vocabulary, allowing exploration of pages with

fringe vocabulary related to their interests, such as food and drink, when customised pages were provided, and description, with adjectives for tastes, colours, shapes and numbers. Once aided language resources were introduced, Jade began to model increased two to three-word symbolic AAC utterances, using either pictures or signs, in conjunction with her increased receptive language spoken input.

Regarding the two targeted language stimulation strategies, it was not possible to establish adequate inter-rater reliability for coding the expansion strategy, so data are only presented for the sabotage strategy. In relation to self-talk, an experimental effect was indicated for Jade in both activities during phase two of the intervention. A marked increase in self-talk accompanied the introduction of the PODD communication book. This appeared related to the operational demands of the PODD resources, which involved talking while navigating from one section to another. Self-talk also involved explaining what she was doing (as she was doing it) when looking for words and modeling initiation of communication, saying “I’ve got something to say” and using the link on page one “more to say”, to move to the pragmatic branches. The increase in self-talk contributed to Jade’s increased speech count during phase two.

Informal observations of the data indicated that both parents appeared to increase their use of two-word symbolic AAC models when aided language displays and the PODD resources were introduced. As they became more familiar with using aided language, it was observed they started to model two (James and Jade) to even three-word (Jade) aided language utterances more frequently.

## **Children**

At baseline, Mark had a little symbolic communication during mealtime and minimal use of symbolic communication during play. There was a slight reduction in Mark’s symbolic utterances during phase one, when the aided language displays were first introduced. A clear experimental effect was evident, particularly in the mealtime activity, when the PODD 12 resource was introduced in session two of phase two, with a marked increase in Mark’s symbolic utterances. This was followed by a slight decline in symbolic utterances during introduction of

the more complex PODD 20 and PODD 16 resources. During mealtimes, Mark's symbolic utterances reflected requests for "book", "music" and "iPad". During the last month of the intervention Mark was observed to use two-symbol utterances, such as "picture book" and "different book".

Isabel had a stable baseline for symbolic utterances in the mealtime activity and a declining baseline in the play activity. Results for play were affected by three sessions of counting songs, as explained above. A clear experimental effect for Isabel's symbolic utterances is indicated from inspection of the data in Figure 3 for mealtime, with levels of symbolic utterances slightly above baseline during phase one, when aided language displays were introduced, and a larger increase during phase two, with the introduction of the PODD resources. Although there was an unstable declining baseline for play, an increasing trend for Isabel's symbolic utterances in play during phase two was suggested compared to her baseline levels. Isabel had a higher level of symbolic utterances in both mealtime and the play activities, when the mean and range for this data are compared across phases (see Table 1), but an experimental effect can only be claimed for the mealtime activity.

Isabel appeared to develop her understanding of the navigational links during the intervention and began to use them independently. By the end of the intervention, while most of Isabel's utterances were still single words, emerging use of two and three-word utterances was observed, for instance, pointing to her PODD to indicate "more cake" during mealtime and saying "round and stop" as she was drawing the letter "o" during a writing activity. Anecdotally, Isabel's mother agreed with the experimenter's observations that Isabel's speech attempts were more frequent by the end of the intervention compared to baseline.

### **Social Validity**

Parents indicated a high level of satisfaction with the aided language stimulation approach used in the intervention that involved the use of aided language displays and learning to use a PODD communication book at home. In their evaluation of the initial aided language parent training session, parents reported that the training had increased their knowledge of aided

language stimulation and that they felt confident that they could implement the intervention. They commented on the usefulness of written information, demonstration of techniques, video examples of aided language stimulation and the “hands-on” practice with resources.

At the end of the intervention a social validity measure was used, the Communication Intervention Questionnaire. See Table 5 (p.125) for detailed results. Parent perspectives about the outcomes at the end of phase two were different for each family, reflected in the final comments made by Jade and James. Jade wrote: “The structure of the intervention, breaking the process into smaller tasks....made it a manageable, steady learning process in which I felt I was succeeding at introducing and modelling each skill each week,” and “The time set aside for filming was a lovely structure for sitting down and concentrating on dedicated PODD time, “ and “Customising Isabel’s PODD has made it into a very precious and special, loved belonging. It contains all her favourite things and people... a powerful thing for her to use for communicating with everyone she loves about everything she loves”. James wrote: “The investigator’s help has... made the difference between success and failure,” and “Progress is very slow, but there are glimmers of hope, so we anticipate a good outcome”.

## **Discussion**

The parent coaching intervention in this pilot study yielded positive results. All parents and children demonstrated increases in their communication skills within the interactions that were measured in this study. Observations from the pilot study, for instance, about the parent training and coaching methods used and changes to the quality of parent-child communication and interaction patterns during the intervention, provide information to assist in the implementation of a more rigorous research study into parent-implemented aided language stimulation interventions in the future.

An increase in parents’ use of AAC symbols was found in three of the four contexts, in mealtime (both parents) and play (one parent). The parent coaching intervention assisted both parents to implement aided language stimulation successfully using aided language displays and



PODD communication books. The data indicated that parents immediately started modeling language using the aided language resources, once they were available, and continued to use speech and key word signing as well. Once aided language modes were available, overall AAC symbol use increased.

Variability in the level of parent AAC symbol use may have been due to a combination of factors: a) changes in the focus of each week; b) changes in the PODDs being trialled; c) health issues and d) family events, such as moving home. For James and Mark, the decision to trial more complex PODD resources meant James needed to learn new skills related to an expanded functions PODD. Higher operational demands may have reduced the level of AAC symbol use temporarily. The trend in the data suggested that as James consolidated his learning, his AAC symbol use increased. For Jade and Isabel, the initial decision to trial a PODD 36 communication book initially made it more difficult for Jade to use the PODD resource for aided language modelling. Once Jade started using the PODD 20 one-page book she found it easier to learn the vocabulary organisation and to use the PODD to model different pragmatic functions. In relation to parent AAC symbol use, this pilot study provides new evidence related to parents' uptake of aided language modes in a multi-modal language environment using a PODD communication system.

Parents' speech use varied across the two parent-child dyads. Over the intervention, James slowed his rate of speech for Mark, while increasing his use of AAC strategies. This suited Mark's learning requirements, as Mark had a severe delay to his receptive language. Mark's hearing impairment may have made him more reliant on AAC modes for his language input compared to Isabel. In contrast, Jade's speech rate increased during the intervention. The aided language resources may have assisted Jade, by acting as a vocabulary bank, giving Jade ideas about things to say; her increased use of self-talk may also have contributed to her increased speech. Isabel had age level receptive language and it is hypothesized that she may have benefited from the additional spoken language input. The aided language resources assisted Jade to create a rich language environment.

Parents increased their use of targeted language stimulation strategies, particularly self-talk for Jade. Self-talk was selected as it was hypothesized the use of self-talk would stimulate Isabel's language learning. James slightly increased his use of sabotage in the mealtime activity. Sennott and Mason (2016) recently provided convincing evidence of an experimental effect in educational assistants' learning of language stimulation strategies within a more structured shared book-reading context, which may provide a stimulus for further development of the techniques related to language stimulation strategies. It is suggested that coaching methods for the language stimulation strategies used in the pilot study could be improved in the future.

The children both increased their use of symbolic utterances during intervention in the mealtime context. The results for the play context were not as clear for either child. Health issues may have contributed to fluctuations in Mark's performance, particularly for the last intervention play session. Play was a less structured and predictable context compared to mealtime, and that may have contributed to the reduced clarity of results. For Isabel, difficulties with baseline measurements meant that there was too much overlapping data to draw any conclusions about her performance in that activity. Overall, the results demonstrated that the aided language resources increased children's symbolic utterances in the mealtime context, with suggestive, but not conclusive evidence, in the play context. Ronski et al. (2010) used multiple contexts for their randomised controlled trial, across mealtime, play and book-reading. They did not report as much variation in their results across contexts. This may have related to the aided language resources they were using with use of single level displays in each activity. The protocols they used for implementation may have maintained more consistent conditions across each context.

AAC experts and researchers highlight the need to create a rich language environment, with receptive language input (Porter, 2007; Porter, 2017; Smith & Grove, 2003; Clendon & Anderson, 2016). If children are to learn language using AAC systems, parents must first learn to use the AAC systems themselves (von Tetzchner & Stadsleiv, 2016). The increased access to graphic symbols for the parents and children in this pilot study appeared to support language

learning, with more frequent opportunities to introduce new vocabulary and repetition of vocabulary using either the same or different modes.

Aided language displays were very useful during the early learning stages of the intervention, allowing parents to practice their skills without the more complex operational demands of the PODD resources. PODD communication systems supported the practical implementation of aided language stimulation, providing flexible access to vocabulary that allowed parents to model language. Once parents started using PODD resources they were comfortable with, they stopped using the aided language displays during the observed activities, as PODD was more efficient and flexible. Parents continued to use aided language displays in some activities, for instance, related to self-care, and used activity-based vocabulary pages in the PODD.

Children require opportunities for learning receptive language as well as using language (Porter, 2017). Despite differences in the children's levels of receptive language at the beginning of the study, the aided language displays and PODD resources worked well for them both. Fringe vocabulary created opportunities for language enrichment, for instance, talking about tastes, actions, colours or shapes. PODD provided vocabulary to assist in clarifying misunderstandings, joint problem-solving and development of shared understanding and shared meanings, in the context of communication for genuine purposes (Von Tetzchner & Stadskleiv, 2016).

In relation to development of multi-word utterances (Binger et al., 2008; Binger & Light, 2007; Clendon & Anderson, 2016), introduction of the aided language resources, and particularly the PODD resources, appeared to encourage parents' increased modelling of two and three-word utterances, using pictures and/or signs. An observation in this study was that as parents became more skilled in using AAC, they started to provide increased two and three-word AAC language models in addition to their full spoken language models. Towards the end of the intervention, the children both started to express themselves using two (Mark and Isabel) and even three-word utterances (Isabel).

It was observed that the pattern of parent-child interactions also varied across the dyads: James had a higher frequency of AAC symbol use compared to Mark; Isabel's increasing symbolic utterances meant that she developed a more equal share of the conversation as the intervention progressed. In addition to increased use of AAC, Isabel's speech appeared to increase over the course of the intervention. Mark, who had less speech across the study, also appeared to start vocalising more with slightly increased speech approximations towards the end of the intervention.

The pilot study took up the challenge to increase research of real-world outcomes in real-world settings (Light & McNaughton, 2015). It was carried out in the children's homes, with parents as the main implementers of the intervention. The intervention in this pilot study was less structured compared to other recent aided language stimulation studies (Binger et al., 2008; Kent-Walsh et al., 2010; Sennott & Mason, 2016).

The use of multiple contexts allowed for naturalistic observations of the parent-child dyads. The use of both predictable and less predictable contexts allowed comparison of the learning requirements for aided language in these situations. The approach was successful, but there may be ways in which the intervention could be enhanced to increase the rate of AAC uptake by parents and children. Further exploration of the communication opportunities and the demands of different natural contexts could further refine the aided language stimulation intervention used in this study.

The pilot study provided the opportunity to explore the feasibility of researching an aided language stimulation intervention using aided language displays and PODD communication systems. At the outset of the pilot study, the lack of previous experimental research using PODD resources, and the multi-faceted nature of implementing these resources, meant there was uncertainty about attempting an experimental study. An important finding of this study was that it is feasible to do experimental research using a PODD communication system. Although this pilot study was described as an AB design, it was more of an ABCD study, with various stages

and changes to the intervention as parents were introduced to using the aided language displays and PODD resources one step at a time. This pilot study provides a basis for further research.

In relation to time-frames, the data suggested it may have been beneficial to spend more time consolidating the initial introduction of the aided language displays and the PODD book. A shorter study, concentrating on the initial introduction of aided language displays and the first few pragmatic branches could be undertaken. In this pilot project, the four-month time-frame allowed the whole process of the initial trial, selection and customisation of the children's PODD resources to be observed and measured. This was a unique contribution to the field. A longer study in the future could examine the difference it makes when a customised PODD is introduced. A one-year time-frame is suggested for a systematic study of the impact of this intervention in relation to children's speech and language development. This would allow for measurement of changes in pragmatic, semantic and syntactic language functions.

This pilot study provided the opportunity to trial a variety of ideas related to contexts and measurement. In the play condition, where Jade and Isabel's baseline measures were relatively high for the first three sessions, analysis indicated the counting songs in those sessions involved frequent repetition of numbers and may have reflected a higher than usual level of AAC symbol use. Possibly, the last two baseline sessions were more typical. Further refinement of methods, with more specific instructions to the parents and more careful baseline measurements are recommended for future research.

Overall, measurement of parent and child behaviours achieved high levels of reliability in this study. The decision to focus on frequency of use of AAC symbols across modalities by parents and children allowed for "broad brushstroke" comparison of performance before and after the introduction of the aided language resources. Although high levels of reliability were achieved for most variables, the need to further refine operational definitions became evident for some variables. Disagreements during inter-rater reliability checks were due to: a) researchers missing a behaviour that occurred; b) the need to clarify if a behaviour was "symbolic"; c)

differences in familiarity with the children's speech and AAC use by the researchers. Another factor was the number of separate behaviours being coded at once in some moments. Coding may have slightly under-represented the amount of AAC use, as disagreements most often related to a behaviour missed. The researchers found it difficult to accurately code "wait" and "expansion", although coding for "wait" improved somewhat with additional practice. The "wait" behaviour being measured involved the parent looking at the child "expectantly", in silence that was maintained for at least three seconds. In their study, Sennott & Mason (2016) provided a more specific operational definition, including a longer five second pause. Measurement of wait could be further refined in a future study. Difficulties in coding "expansion" indicated the need for refinement of the operational definitions and more time to establish reliability between the researchers early in the study.

The design of the study was a limitation. An AB design is a weak experimental design, but it was suited to the purpose of a pilot study. Other limitations included the difficulties establishing a stable baseline in play, and inconsistencies in the time-frames used for measurement across the phases of the study. Baseline and phase one occurred over one to two weeks, whereas phase two measurements were taken from the first mealtime and play session each week. Additional data were collected, but within the time-frames of the study it was not possible to analyse additional sessions. Increased consistency in collection and analysis of data would have strengthened the pilot study. There was a lack of formal procedural reliability measures, such as methods for monitoring the extent to which the planning training, coaching and parent-implementation was implemented correctly. A weakness of this study from a research viewpoint was that the participants continued to participate in existing interventions over the course of the pilot study, but this was a condition of the ethical approval for the pilot study.

Finally, another limitation was the lack of formal measurement of generalisation and maintenance in this pilot study. Further exploration of maintenance and generalisation is recommended for future research.

There is a need for further research into the use of aided language stimulation interventions and the impact they have on helping to create a rich, multi-modal language environment. Suggestions for future research include extending this study to examine the impact of having access to a robust aided vocabulary on the frequency of symbolic communication across the different modalities. This could examine in more depth the interaction between the modalities and the potential benefits of implementing a multi-modal intervention. It would also be beneficial to examine the quality of communication opportunities and interactions in different natural contexts.

Further research across both shorter and longer time-frames would allow for further study of the process of introducing a PODD communication system. Observations in this study indicated that introducing customised PODD resources could enhance the aided language stimulation intervention and should be explored in a longer research study in the future.

This pilot project supported the social validity of using PODD communication systems when implementing an aided language stimulation intervention. The communication intervention questionnaire provided positive parent feedback. Importantly, parents reported that the intervention was manageable and beneficial to their children. They identified the need for future training of other family members and staff working with their children in other environments, such as preschool, day care, and when preparing for school in the future.

The research in this pilot study provides preliminary experimental evidence supporting the use of PODD communication systems within the context of an aided language stimulation intervention in a natural home setting. It explored the process of coaching parents to introduce a parent-implemented aided language stimulation intervention. There is a need for further research into the most efficient ways to provide training, coaching and support to parents and to other communication partners involved in the implementation of this AAC intervention.

### **Conclusion**

Coaching parents to implement an aided language stimulation intervention was supported by the results of this pilot study. Parent-implementation of aided language displays and a PODD communication system enabled parents to increase their use of AAC and children to increase their language skills. This pilot study addresses a significant gap in the AAC literature, by providing preliminary findings supporting the effectiveness of PODD communication systems. A more rigorous multiple-baseline research study, with further development of the procedures and measurements developed in this pilot study is recommended for the future.



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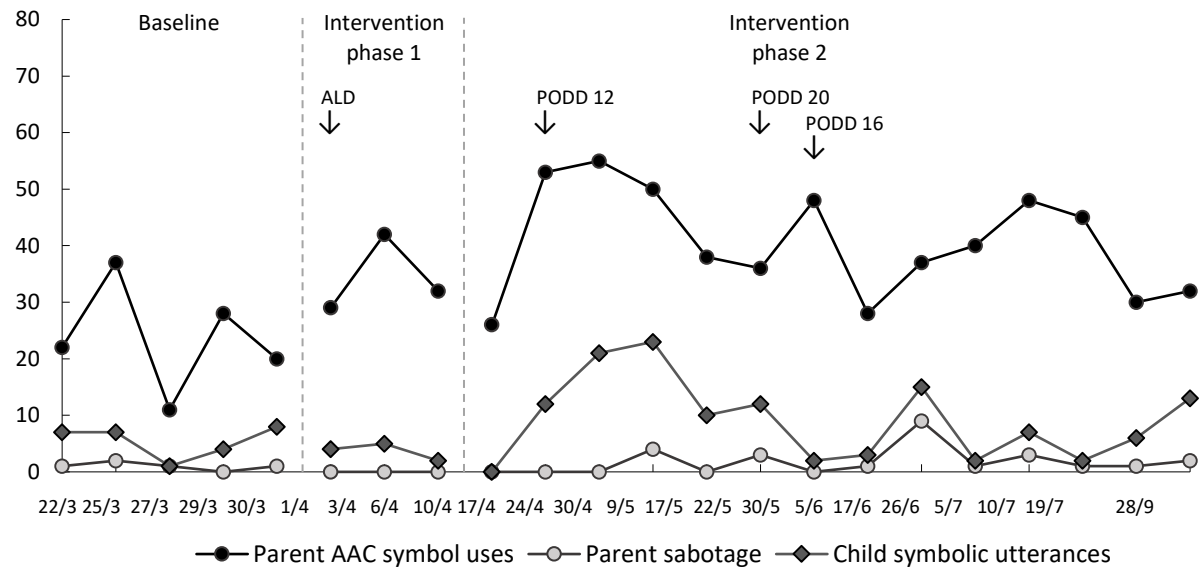
**Table 1: Reliability for Dependent Variables**

<b>Dependent Variables*</b>	<b>James &amp; Mark Mean</b>	<b>Jade &amp; Isabel Mean</b>
Parent symbolic AAC utterances	81.5%	89.9%
Parent speech	97.1%	94.0%
Parent wait	59.5%	
Parent sabotage	87.0%	
Parent self-talk		83.5%
Child symbolic utterances	85.3%	75.0%
<b>Phases</b>		
Baseline	94.2%	92.0%
Phase one	83.6%	91.1%
Phase Two	75.8%	81.1%
Combined	<b>84.5%</b>	<b>88.0%</b>

\* Coding of the variable ‘Parent expansion’ was abandoned in phase 1 when it became apparent that inter-rater reliability for this strategy was very low.

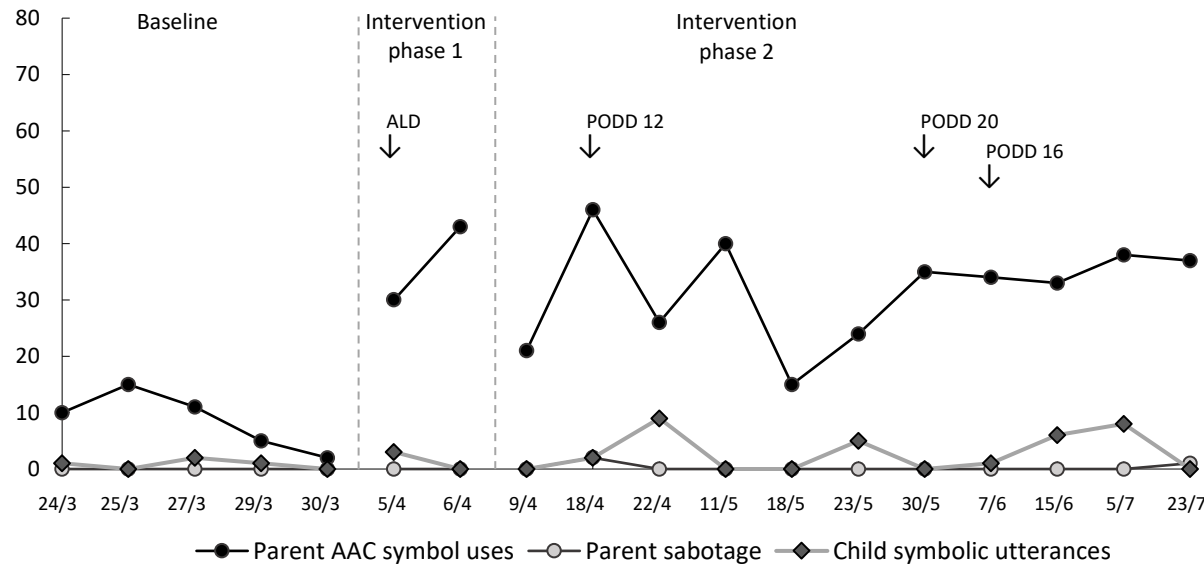


**Figure 1: James and Mark, Mealtime – Number of Parent AAC Symbol Uses, Parent Self-Talk, and Child Symbolic Utterances in each Five-Minute Session**



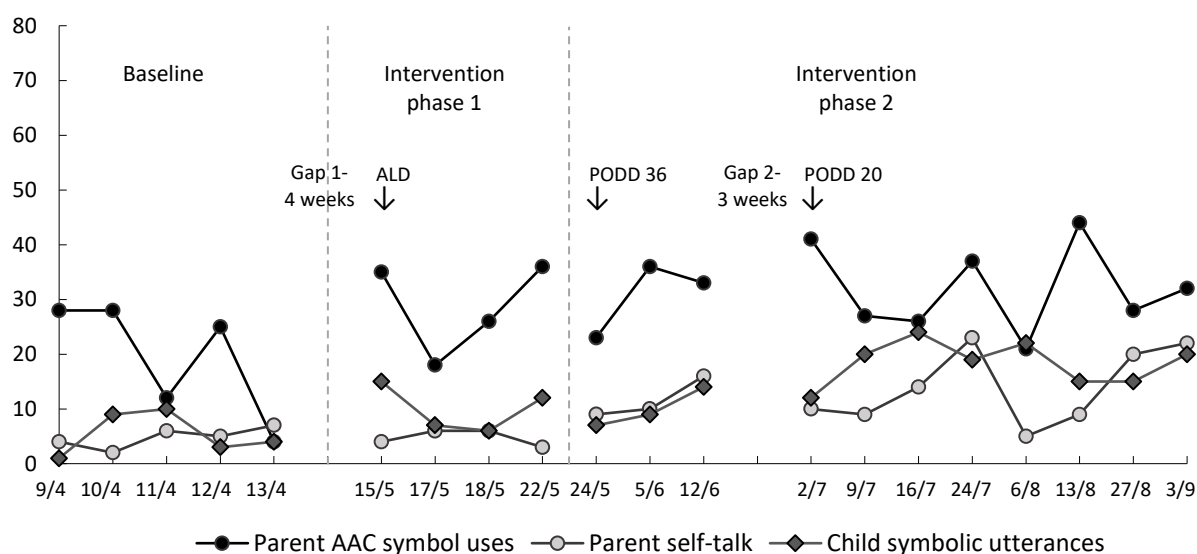
ALD = aided language display. PODD = pragmatic organisation dynamic display communication book.

**Figure 2: James and Mark, Play – Number of Parent AAC Symbol Uses, Parent Self-Talk, and Child Symbolic Utterances in each Five-Minute Session**



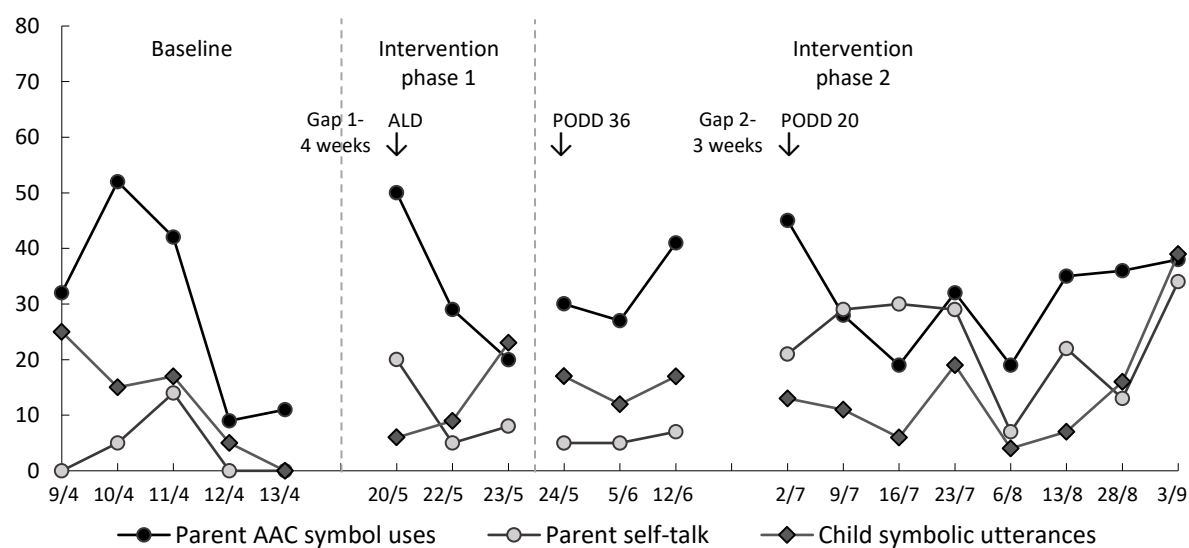
ALD = aided language display. PODD = pragmatic organisation dynamic display communication book.

**Figure 3: Jade and Isabel, Mealtimes – Number of Parent AAC Symbol Uses, Parent Self-Talk, and Child Symbolic Utterances in each Five-Minute Session**



ALD = aided language display. PODD = pragmatic organisation dynamic display communication book.

**Figure 4: Jade and Isabel, Play – Number of Parent AAC Symbol Uses, Parent Self-Talk, and Child Symbolic Utterances in each Five-Minute Session**



ALD = aided language display. PODD = pragmatic organisation dynamic display communication book.

**Table 2: Mean Rates of Parent Speech, Parent AAC symbol Use, and Child Symbolic Utterances at Baseline, Intervention Phase One and Intervention Phase Two**

	<b>Baseline mean, range</b>	<b>Phase one mean, range</b>	<b>Phase two mean, range</b>
<b>James and Mark mealtime</b>			
Parent speech	274 253–297	299 287–323	260 211–309
Parent AAC symbol use	23.6 11–37	34.3 29–42	40.4 26–55
Child symbolic utterances	5.4 1–8	3.7 2–5	9.1 0–23
<b>James and Mark play</b>			
Parent speech	280 224–376	240 206–273	233 176–309
Parent AAC symbol use	8.6 2–15	36.5 30–43	31.7 15–46
Child symbolic utterances	0.8 0–2	1.5 0–3	2.8 0–9
<b>Jade and Isabel mealtime</b>			
Parent speech	197 132–251	209 159–249	271 208–348
Parent AAC symbol use	19.4 4–28	28.8 18–35	31.6 21–44
Child symbolic utterances	5.4 1–10	10.0 6–15	16.1 7–24
<b>Jade and Isabel play</b>			
Parent speech	241 198–268	270 261–283	308 245–374
Parent AAC symbol use	29.2 9–52	33.0 20–50	31.8 19–45
Child symbolic utterances	12.4 0–25	12.7 6–23	14.2 4–39

**Table 3: Mean Rates and Types of Parent AAC Symbol Use and Child Symbolic Utterances at Baseline, Intervention Phase One and Intervention Phase Two — James and Mark**

	Baseline mean, range	Phase one mean, range	Phase two mean, range
<b>James and Mark mealtime</b>			
Parent key word signs & gestures	23.6 (11–37)	17.7 11–24	17.4 7–48
Parent aided AAC	0	16.7 8–24	23.1 5–34
Total parent AAC symbol use	23.6 11–37	34.3 29–42	40.4 26–55
Child key word signs & gestures	5.4 1–8	1.3 0–2	2.5 0–11
Child aided AAC	0	2.0 0–4	6.0 0–21
Child speech	0	0.3 0–2	0.6 0–2
Total child symbolic utterances	5.4 1–8	3.7 2–5	9.1 0–23
<b>James and Mark play</b>			
Parent key word signs & gestures	8.6 2–15	10.5 10–11	12.2 2–31
Parent aided AAC	0	26 19–33	19.6 9–34
Total parent AAC symbol use	8.6 2–15	36.5 30–43	31.7 15–46
Child key word signs & gestures	0.8 0–2	0	0.3 0–2
Child aided AAC	0	0	2.1 0–8
Child speech	0	1.5 0–3	0.5 0–2
Total child symbolic utterances	0.8 0–2	1.5 0–3	2.8 0–9

**Table 4: Mean Rates and Types of Parent AAC Symbol Use and Child Symbolic Utterances at Baseline, Intervention Phase One and Intervention Phase Two — Jade and Isabel**

	<b>Baseline mean, range</b>	<b>Phase one mean, range</b>	<b>Phase two mean, range</b>
<b>Jade and Isabel mealtime</b>			
Parent key word signs & gestures	19.4 4–28	16.5 8–25	10.3 2–20
Parent aided AAC	0	12.3 4–18	21.4 9–32
Total parent AAC symbol use	19.4 4–28	28.8 18–35	31.6 21–44
Child key word signs & gestures	4.8 0–10	6.8 2–12	5.3 2–13
Child aided AAC	0	3.0 2–4	9.5 0–17
Child speech	1.6 1–2	1.3 0–3	2.8 0–8
Total child symbolic utterances*	5.4 1–10	10.0 6–15	16.1 7–24
<b>Jade and Isabel play</b>			
Parent key word signs & gestures	29.2 9–52	19 16–23	11.8 3–21
Parent aided AAC	0	14.0 4–27	20.0 8–30
Total parent AAC symbol use	29.2 9–52	33.0 20–50	31.8 19–45
Child key word signs & gestures	8.4 0–15	8.3 5–12	5.1 0–10
Child aided AAC	0	3 1–7	4.5 0–12
Child speech	6.6 0–15	3.7 2–5	6.1 0–34
Total child symbolic utterances*	12.4 0–25	12.7 6–23	14.2 4–39

\* Note: some child utterances simultaneously combined more than one communication mode (e.g., speech + sign). In these cases, both modes were counted separately but only one instance was added to total child symbolic utterances.

**Table 5: Parental Responses to the Communication Intervention Questionnaire**

Evaluation prompt*	Response*	
	Jade	James
1 The training sessions about the communication intervention were useful.	6	6
2 The home coaching sessions helped me learn to communicate with my child.	6	6
3 This communication intervention was appropriate for my child.	6	6
4 I feel confident using this communication intervention (communication boards and books).	6	6
5 This communication intervention was manageable.	6	5
6 In the future, my child's teacher will be able to communicate with my child using communication boards and books.	5†	5
7 Communication boards and books help me communicate with my child.	6	5
8 Family members can communicate with my child using communication boards and books.	5‡	4
9 I like learning to implement this communication intervention myself.	6	5
10 This intervention will allow my child to express herself/himself.	6	6
11 My family will be able to use this method of communication.	5‡	6
12 It is worth taking the time to learn aided language displays and PODD communication books.	6	6
13 It is realistic to use communication boards and books with my child.	6	5
14 I would recommend this communication intervention to other people.	6	6
15 This communication intervention is beneficial for my child.	6	6
* Parents were asked to circle the number that best described their agreement or disagreement with each statement, where 1 = strongly disagree, 2 = moderately disagree, 3 = slightly disagree, 4 = slightly agree, 5 = moderately agree, and 6 = strongly agree.		
† Jade wrote in: "if trained".		
‡ Jade wrote in: "if interested and willing to learn".		

**Appendix 1: Pre-Intervention Questionnaire**

Department of Educational Studies  
Faculty of Human Sciences  
MACQUARIE UNIVERSITY NSW 2109  
Phone: +61 (0)2 9850-7880  
Fax: +61 (0) 2 9850-8254  
Email: mark.carter@mq.edu.au



Chief Investigator's / Supervisor's Name & Title: Associate Professor Mark Carter, PhD.

**AAC Research Project****Project Name:**

**Coaching parents to use augmentative and alternative communication (AAC) language systems with young children with complex communication needs.**

**Questionnaire**

1. What would you like to learn during this training session on using an aided language approach to language learning?
2. What is your understanding of aided language stimulation?
3. What do you like about augmentative and alternative communication (AAC)?
4. Do you have any concerns about using AAC?
5. Do you have any questions you would like answered during this session?  
Please write these on the back of this page.

**Appendix 2: Training Evaluation Form**

Department of Educational Studies  
Faculty of Human Sciences  
MACQUARIE UNIVERSITY NSW 2109  
P one: +61 (0)2 9850-7880h  
Fax: +61 (0) 2 9850-8254  
Email: mark.carter@mq.edu.au



Chief Investigator's / Supervisor's Name & Title: Associate Professor Mark Carter, PhD.

**Evaluation: Aided Language Training Session****Date and Location:**

1. The Information was relevant. Not at all Some Most All

Comments: \_\_\_\_\_  
\_\_\_\_\_

2. I feel that I will be able to implement this approach. Not at all Some Most All

Comments: \_\_\_\_\_  
\_\_\_\_\_

3. What were the most helpful parts of this training session?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

4. What were the least useful parts of this training session?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

5. What do you need to learn more about?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

6. Any other comments

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

*Thank you for taking the time to provide us with your valuable feedback.*



### Appendix 3: Communication Intervention Questionnaire

The communication intervention is called aided language stimulation. This involves using aided language displays and a PODD communication book.

**Please circle the number that best describes your agreement or disagreement with each statement.**

Statements	Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree
1. The training sessions about the communication intervention were useful.	1	2	3	4	5	6
2. The coaching sessions at home helped me learn to communicate with my child.	1	2	3	4	5	6
3. This communication intervention was appropriate for my child.	1	2	3	4	5	6
4. I feel confident using this communication intervention.	1	2	3	4	5	6
5. This communication intervention was manageable.	1	2	3	4	5	6
6. In the future, my child's teacher will be able to communicate with my child using this communication intervention.	1	2	3	4	5	6
7. This intervention helps me to communicate with my child	1	2	3	4	5	6
8. Family members can communicate with my child using this communication intervention (communication boards and books)	1	2	3	4	5	6
9. I like learning to implement this communication intervention myself.	1	2	3	4	5	6
10. This intervention will allow my child to learn to express her / himself.	1	2	3	4	5	6
11. My family will be able to use this method of communication.	1	2	3	4	5	6
12. It is worth taking the time to learn this communication intervention (aided language displays and PODD communication books).	1	2	3	4	5	6
13. It is realistic to use this communication intervention with my child	1	2	3	4	5	6
14. I would recommend this communication intervention to other people.	1	2	3	4	5	6
15. Overall, this communication intervention is beneficial for my child.	1	2	3	4	5	6

2. Any other comments?

*Thank you for your feedback!*

## Chapter Four: Conclusion

### Chapter Overview

In Chapter Four, the findings from the systematic review and the pilot intervention study are integrated to form an overall conclusion in response to the research questions. The chapter concludes by highlighting the contribution this research makes to the literature relating to effective aided language stimulation interventions for young children with complex communication needs.

### Summary of the Research

The primary purpose of this research was to study the role of parents in implementing augmentative and alternative communication (AAC) interventions for their children with complex communication needs. The research focused on early intervention because of the opportunity early intervention presents to address the disadvantage experienced by young children with complex communication needs, and because the need for further research in this area had been emphasised recently (Behnami & Clendon, 2015; Ronski, Sevcik, Barton-Hulsey, & Whitmore, 2015).). As the primary communication partners of their young children, parents play a key role in the early language development of their children. There are important questions relating to the education and support that parents need if they are to provide AAC interventions. After conducting a systematic review of the relevant literature, the researchers designed and conducted a pilot study into the efficacy of coaching parents to implement an AAC intervention with young children who have complex communication needs, using an aided language stimulation approach and a pragmatic organisation dynamic display (PODD) communication system.

The systematic literature review carried out in the first stage of this research has contributed a new analysis and synthesis of information about: a) the efficacy of parent coaching as a practice in AAC interventions; b) the efficacy of parent-implemented symbolic AAC interventions in early intervention; c) support for aided language interventions and functional communication training; and d) the lack of published research into early interventions using

PODD communication systems. The small number of studies rated as “strong” in the review highlighted the need for more high-quality research into early AAC symbolic interventions.

The highest quality studies found in the review used parent coaching, defined as a combination of verbal explanation, written information, demonstration or modelling, practice, feedback and review. Coaching was associated with effective parent-implemented AAC interventions, although it appeared that the specific coaching methods were highly variable across studies.

Based on the review, aided language interventions are a best practice early intervention to support language learning in young children with complex communication needs. Functional communication training was also supported as an evidence-based practice in studies such as Gerow, (2016) and Simacek et al. (2017). Three functional communication training studies were of high quality and demonstrated positive outcomes, but those interventions had a narrower focus compared to aided language interventions. Aided language interventions, such as the shared book-reading interventions developed by Binger, et al. (2008) and Kent-Walsh, et al. (2010) offered more scope for language development. The randomised controlled trial by Ronski et al. (2010) provided the most compelling evidence in support of aided language interventions. In that randomised controlled trial, aided language interventions produced better language outcomes and suggested better qualitative speech gains than speech-alone interventions.

The pilot study involved an aided language stimulation intervention (Goossens, 1989; Porter & Cafiero, 2009) across two natural contexts (mealtime and play) and in the natural home setting. It is the first experimental study using PODD communication systems (Porter, 2007, 2017). PODD is a communication system distinguished by its relative complexity, providing an extended vocabulary of symbols to users. Equipping parents to implement PODD was therefore a challenging example of coaching natural communication partners in a real-world intervention (Light & McNaughton, 2015).

The study had a primary focus on parent learning of the PODD communication system as it was felt that this was feasible within the time-frames available for a single case design study; at the outset of the study, the researcher did not know if it would be possible to expect changes to the children's communication in addition to the parent's communication. Although an AB design was a weak experimental design, it was a practical approach to the complexities of PODD and the time-frames required for implementation. The pilot study was used to trial dependent variables and models of implementation. In future research, inter-rater reliability could be enhanced with refined definitions of communication events. The usefulness of video as a data collection tool and aid to parent coaching was confirmed.

Results of the systematic review and the pilot study supported the efficacy of coaching parents to implement an aided language stimulation intervention with children who have complex communication needs. Parent feedback about the training and coaching used in the pilot study was positive. The pilot study had positive results for both the parents and the children for the dependent measures in the study. An experimental effect was found for parents' frequency of AAC symbol use in the mealtime activity and for play for one of the parents, with an increase in AAC symbol use in the intervention. Both children increased their symbolic utterances, which included a combination of graphic symbols introduced with the aided language displays, and signs, conventional gestures and speech approximations. The aided language displays and the PODD communication books enriched the children's environments, increasing their opportunities for language learning.

There is need to advocate for increased recognition that training is required for communication partners, such as parents, caregivers and teachers, as a vital component of AAC interventions. Many forms of AAC are not intuitive, rather, they involve learning new skills to be implemented competently. Communication access is a basic human right; it should not be considered discretionary, but rather an essential skill for all. AAC may require time and effort, but it is vital for inclusion of people with complex communication needs (Solarsh & Johnson, 2017).

Future research that extends the work from this pilot study should: a) use a more rigorous multiple-baseline design, now that we have more information about the feasibility and time-frames required for this research; b) include fidelity of coaching and fidelity of implementation measures for the coach and the parents, to enhance the rigour of the study; c) further develop the measurement tools used in this study, to analyse changes that occur with the introduction of aided language displays and the PODD communication system in more depth (for instance, in relation to pragmatic, semantic and syntactic functions and to analyse changes in the frequency of parent and child turns more accurately); d) include measures of generalisation and maintenance. Parents identified the need for support to train people in the children's other daily environments, such as preschool, day care and school. This is an important aspect of operationalising communication access for young children in their everyday environments and should be a priority for future research.

### **Conclusion**

The research in this thesis supported parent coaching as an effective process to assist parents to learn new skills required to implement AAC interventions at home with their young children. Parents found the aided language stimulation intervention using aided language displays and a PODD communication system manageable and beneficial for their children's language learning. The structured review synthesised the current evidence for the efficacy of parent coaching as a practice in AAC interventions and confirmed that, with appropriate support and education, parents can implement symbolic AAC in early intervention. Aided AAC in early intervention appears to be more effective than speech-alone, and use of AAC enhances rather than delays the development of speech. The pilot study addressed a gap in the literature as no previous experimental research had been carried out using PODD communication systems. Parents and children both increased their AAC symbol use. Further research into the use of PODD communication systems is required. It is hoped that the outcomes from this thesis will provide a basis for the development of more rigorous experimental studies in the future.

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**Appendix A: Ethics Approval**

See next page.



Office of the Deputy Vice-Chancellor  
(Research)

Research Services  
Research Hub, Building C5C East  
Macquarie University  
NSW 2109 Australia  
T: +61 (2) 9850 4459  
<http://www.research.mq.edu.au/>  
ABN 90 952 801 237



**MACQUARIE**  
University  
SYDNEY • AUSTRALIA

18 January 2018

Dear Associate Professor Carter,

**Reference No:** 5201701051

**Title:** *Coaching parents to use an augmentative and alternative communication (AAC) language system with young children with complex communication needs.*

Thank you for submitting the above application for ethical and scientific review. Macquarie University Human Research Ethics Committee (HREC (Human Sciences & Humanities)) considered your application.

I am pleased to advise that ethical and scientific approval has been granted for this project.

This research meets the requirements set out in the *National Statement on Ethical Conduct in Human Research* (2007 – Updated May 2015) (the *National Statement*).

**Standard Conditions of Approval:**

1. Continuing compliance with the requirements of the *National Statement*, which is available at the following website:

<http://www.nhmrc.gov.au/book/national-statement-ethical-conduct-human-research>

2. This approval is valid for five (5) years, subject to the submission of annual reports. Please submit your reports on the anniversary of the approval for this protocol.

3. All adverse events, including events which might affect the continued ethical and scientific acceptability of the project, must be reported to the HREC within 72 hours.

4. Proposed changes to the protocol and associated documents must be submitted to the Committee for approval before implementation.

It is the responsibility of the Chief investigator to retain a copy of all documentation related to this project and to forward a copy of this approval letter to all personnel listed on the project.

Should you have any queries regarding your project, please contact the Ethics Secretariat on 9850 4194 or by email [ethics.secretariat@mq.edu.au](mailto:ethics.secretariat@mq.edu.au)

The HREC (Human Sciences and Humanities) Terms of Reference and Standard Operating Procedures are available from the Research Office website at:

[http://www.research.mq.edu.au/for/researchers/how\\_to\\_obtain\\_ethics\\_approval/human\\_research\\_ethics](http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_research_ethics)

The HREC (Human Sciences and Humanities) wishes you every success in your research.

Yours sincerely



**Dr Karolyn White**

Director, Research Ethics & Integrity,

Chair, Human Research Ethics Committee (Human Sciences and Humanities)

This HREC is constituted and operates in accordance with the National Health and Medical Research Council's (NHMRC) *National Statement on Ethical Conduct in Human Research* (2007) and the *CPMP/ICH Note for Guidance on Good Clinical Practice*.

**Details of this approval are as follows:**

**Approval Date:** 16 January 2018

The following documentation has been reviewed and approved by the HREC (Human Sciences & Humanities):

Documents reviewed	Version no.	Date
Macquarie University Ethics Application Form		Revised Application Received 12/12/2017
Response addressing the issues raised by the HREC		Received 12/12/2017
Participant Consent form	1	12/12/2017
Service Consent Form	1	12/12/2017
Participant Information: Parent & Child	1	27/10/2017
AAC Research Project Information	1	12/12/2017
Social Validity Questionnaire	1	27/10/2017

**\*If the document has no version date listed one will be created for you. Please ensure the footer of these documents are updated to include this version date to ensure ongoing version control.**