COMPARING ACQUISITION, PREFERENCE, MAINTENANCE, AND SOCIAL VALIDITY OF MANUAL SIGN, PICTURE EXCHANGE, AND SPEECH-GENERATING DEVICES AS AAC OPTIONS FOR CHILDREN WITH DEVELOPMENTAL DISABILITIES

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A thesis

submitted to the Victoria University of Wellington

in fulfilment of the requirements for the degree of

Doctor of Philosophy

Victoria University of Wellington

2015

Abstract

Background: Communication deficit is a defining characteristic of children with autism spectrum disorder (ASD) and other developmental delays/disabilities (DD). In many cases the degree of communication impairment is severe. For example, approximately 25% of children diagnosed with ASD fail to develop sufficient speech to meet their everyday communication needs. In the absence of speech, these children are often taught to use augmentative and alternative communication (AAC). Three main AAC options have been taught to children with DD. These are (a) manual sign (MS), (b) picture exchange systems (PE), in which the child exchanges a picture card to communicate, and (c) speech-generating device (SGD). Debate persists in the literature as to which of these three options is best suited to address the communication intervention needs of children with DD. With the rapid developments in technology, subsequently, more high-tech devices are being introduced to the field of AAC. Studies have compared these three AAC options, but the literature has not yet compared these three options in terms of long-term maintenance of communication skills and social validity of the AAC systems.

Objective: The studies in this thesis focused on (a) comparing acquisition and maintenance of a requesting skill that was taught with each of the three AAC options (MS, PE, and SGD), (b) assessing the participant's preference of using each of the three AAC options, and (c) assessing stakeholders' perceptions of each AAC option in terms of perceived (a) intelligibility, (b) ease of acquisition, (c) effectiveness/acceptability, and d) preference.

Method: In Study 1, four children with DD were taught to use MS, PE, and SGD

to request continuation of toy play (i.e., to request *more*). This experimental study was implemented using a single-subject alternating-treatment design which was divided into four phases (i.e., baseline, intervention, post-intervention, and follow-up). The effects of intervention on acquisition of the requesting response with each option were evaluated using an alternating-treatments design across participants design. Acquisition and maintenance at 12 to 18 months was compared across the three AAC options in an alternating treatments design. The participants' preference for using each of the three AAC options was also assessed at regular intervals during the study using a choice-making paradigm. For Study 2, a non-experimental quantitative design was applied. Data were collected using an anonymous five-point Likert-scaled survey that consisted of 11 questions. 104 undergraduate students were shown a video of a person communicating with each AAC option (MS, PE, and SGD in different video clips) then asked to rate each AAC option in terms of perceived (a) intelligibility, (b) ease of acquisition, (c) effectiveness/acceptability, and (d) their preference. *Results:* Study 1. With intervention, three of the four participants learned to use each of the three AAC options, but one child only learned to use the PE option. Trials to criterion across children ranged from 22 to 28 trials for the SGD, from 12 to 60 trials for PE option, and from 21 to 64 trials for MS option. For the three participants who reached criterion with all three AAC options, maintenance results were best for PE and the SGD. Preference assessments showed that participants most often chose the SGD, suggesting a preference for using that option. For Study 2, the undergraduate students, mean ratings for perceived intelligibility and effectiveness/acceptability were significantly higher for the

SGD. The SGD and MS options were rated as being more preferred over PE. PE was rated significantly higher on perceived ease of acquisition.

Conclusion: The children's high level of proficiency in using the most frequently selected AAC system (i.e., the SGD) suggest that incorporating the child's preference for AAC system might be valuable to avoid the risk of device abandonment. Additionally, data from the social validation assessment suggests that the SGD was perceived to have greater social validity than MS and PE. The combination of these findings adds to the existing literature in supporting the use of the SGD as a promising AAC option for children with DD. Findings on acquisition rates, long-term follow-up, and preference for AAC systems extend previous research with respect to incorporating longer-term follow-up data on the child's proficiency of and preference across AAC options. Additionally, the social validation results provide a contribution to the field of AAC intervention in relation to how the wider community perceives these three AAC options. Future research might compare several AAC systems when teaching more elaborate communication skills (e.g., social interaction) and exploring factors that might impact one's perception of a certain AAC systems.

Acknowledgements

I would like to thank my primary supervisor, Professor Jeff Sigafoos, for the constant guidance and support for helping me make this thesis possible. My gratitude also goes out to my secondary supervisors, Professor Vanessa Green and Dr. Larah van der Meer, for their valuable input and encouragement on completing this thesis.

Thank you so kindly to the scholars, Dr. Sutherland, Dr. Giulio Lancioni, Dr. Mark O'Reilly, Dr. Russel Lang, Dr. Ralf Schlosser, Dr. Flaviu Hodis, Dr. Laurie McLay, and Dr. Peter B. Marschik, for providing feedback on the manuscripts of the studies in this thesis.

Support was provided from the New Zealand Government through the Marsden Fund Council, administered by the Royal Society of New Zealand; and by Victoria University, The University of Canterbury, and the New Zealand Institute of Language, Brain and Behavior.

I would like to sincerely thank the generosity of the participants of the research projects in this thesis – the children, families, teachers, and undergraduate students.

Thank you to my colleagues in my cohort group for sharing ideas, providing advice on my studies, and (most importantly) for reminding me that there is life outside of studies. Dr. Debora Kagohara, Dr. Michelle Stevens, Laura Roche, Hannah Waddington, Ruth James, Amarie Carnett, and Alicia Bravo, all of you are amazing. To my friends, Evie Geste, Sherly Sutanto, Warren Butcher, Tania Agnew, Adam Teo, Alan Faust, and Matt Wright, thank

you for being there for me. To Stephen Trevallion, thank you for keeping me focused to reach the finish line.

To my mother, a simple thank you would never be enough to express my appreciation for your never-ending love and support – thank you for believing in me. Lastly, many thanks to Navajo, the one that made me a better person – we have moved mountains, my son.

Declaration by the Author

This thesis is composed by the author's original work conducted for this PhD degree under supervision at Victoria University of Wellington. No part of it has been previously submitted for another degree or diploma. Work by other authors has been duly referenced in text, and contribution by others in jointly-authored work has been clearly stated.

The research included in this thesis was part of a broader externally funded research project entitled: *Enhancing communication intervention for children with autism*. The ethical approval for which has been included as Appendix A. This is separate to the ethical approval which I obtained for the studies presented in this thesis, which is included as Appendix B.

I have received input and feedback from my primary supervisor, Professor Jeff Sigafoos, and other members of the author's cohort team supervised by Sigafoos. However, the studies presented in this thesis were solely the independent work (i.e., designed and conducted) of the author, with conceptual input from Sigafoos. Sigafoos also provided suggestions with respect to data analyses and interpretation of results in all studies and edited drafts of the subsequent articles that were based on the studies of this thesis, as well as the chapters of this thesis. Professor Vanessa Green and Dr. Larah van der Meer edited the drafts of the thesis chapters.

The thesis consisted of two empirical studies from my original data collection activities as part of this thesis that were published during the course of my doctoral studies. As would be expected due to their conceptual input, these

papers include my supervisor and co-supervisors as co-authors. However, the papers also include additional co-authors who had conceptual input into the broader externally funded research program into which my thesis research fits.

The author reports no conflicts of interests. The author alone takes sole responsibility for the content and writing of this thesis.

Authorship Statement

In consultation with my main supervisor, Professor J. Sigafoos, I undertook to complete my PhD thesis by publication. Specifically, this means that some of the research activity that were part of this thesis have already been published as a journal article prior to the submission of the thesis. Subsequently, the studies have been subject to a process of academic peer-review, as required by the journals. These studies were conducted and completed during the period of my PhD study.

The empirical work of my thesis consists of two published papers, which are reproduced, and presented in their published formats, as Chapters 4 and 5, respectively.

Chapter 4: Achmadi, D., Sigafoos, J., Sutherland, D., Lancioni, G. E., O'Reilly, M. F., van der Meer, L., . . . Marschik, P. B. (2014). Acquisition, preference, and follow-up data on the uyse of three AAC options by four boys with developmental delay. *Journal of Developmental and Physical Disabilities*, 26:565-583. Doi: 10.1007/s10882-014-9379-z

Chapter 5: Achmadi, D., Sigafoos, J., Sutherland, D., Lancioni, G. E., O'Reilly, M. F., van der Meer, L., . . . Marschik, P. B. (2014). Undergraduates' perceptions of three augmentative and alternative communication modes. *Developmental Neurorehabilitation,* Doi: 10.3109/17518423.2014.962767

Both of the aforementioned papers are co-authored papers, due to being part of a larger grant-funded project that included co-principal investigators and several international partners. These scholars have provided conceptual contributions to a larger research project that was established prior to the commencement of my studies. My research is part of this larger research project, hence I acknowledged my colleagues' conceptual contributions by making them co-authors of these papers.

Further clarifications of the proportion of contributions in the studies are as follows:

For Study 1 (Chapter 4), the idea for this study was developed by me after consultation with Sigafoos. I designed and implemented the study, undertook the data analysis, and wrote the manuscript. My co-authors provided assistance with reliability on data collection and provided feedback on the draft manuscript. Sigafoos assisted with making revisions based on the reviewers' feedback.

For Study 2 (Chapter 5), the idea of this study was developed by me. I created the materials for the study. I also designed and implemented the study, undertook the data analysis, and wrote the manuscript. My co-authors provided suggestions on statistical analyses of the data, and feedback on the draft manuscript. Sigafoos assisted with making revisions based on the reviewers' feedback.

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CHAPTER 1

Introduction

Developmental Disabilities

Developmental disability (DD) is defined as a group of lifelong conditions that is a result of impairment in mental and/or physical functioning. Such impairments may cause delay for a child in reaching his/her developmental milestones. DD encompasses impairments in learning, mobility language, self-help, and independent living (Centers for Disease Control and Prevention, 2012). The following diagnoses are included in the group of DD: autism spectrum disorders (ASD), attention deficit/hyperactivity disorder, Asperger syndrome, cerebral palsy, Duchenne muscular dystrophy, fetal alcohol spectrum disorders, fragile X syndrome, intellectual disability (ID; previously referred to as mental retardation), hearing loss, and vision loss (Centers for Disease Control and Prevention, 2010). For young children suspected of having a DD, an initial diagnosis of developmental delay might be given to reflect the fact that the nature and extent of the child's developmental problems might not become clear until the child ages. This thesis presents studies that focused on communication interventions for children with ID and ASD. Therefore, the discussion in the following sections and chapters will be limited to such groups of DD.

This thesis will refer to the current *Diagnostic Statistical Manual of Mental Disorders*, the fifth edition (DSM-5; American Psychiatric Association, 2013) for specific terms and classifications of ID and ASD. DSM-5 was chosen as the main reference because it is one of the most common sources used by mental health practitioners worldwide as a guideline for providing diagnosis

related to mental health. The DSM-5 does not provide a distinct category of DD. However, DSM-5 puts ID and ASD under the classification of neurodevelopmental disorders, which is explained as a group of conditions that may involve impairments in personal, social, academic or occupational functioning of the individual. This diagnosis usually occurs in the early stages of life, and the onset of DD symptoms is before 18 years of age (American Psychiatric Association, 2013). Because this thesis focuses on communication interventions for children with ASD and ID, the following sections of this chapter will only provide details on the characteristics of ASD and ID.

Autism Spectrum Disorder

Historical Background

The term *autism* was first introduced in 1911 by Bleuler, a Swiss psychiatrist specializing in schizophrenia cases (Levisohn, 2007). This term was adopted from the Greek word *autos*, that means *self* (Exkorn, 2005). Bleuler explained that individuals with autism showed profound social withdrawal from social life and the tendency to be self-absorbed.

The first systematic description of autism was reported in 1943 by Kanner (1943, 1971). Kanner provided detailed case histories and symptom descriptions of 11 children, aged from 2 to 8 years old. Kanner used the term early infantile autism to define the characteristics of the participants, reporting several common traits among them: they were lacking in forming an appropriate affectionate relationship with others since the early stages of their lives, showed a fixation on a certain routine or ritual and were unable to engage in a normal conversation.

In a different study, Asperger (1944) reported similar findings to Kanner (1943) for a group of children who were reported to show limited social interactions, stereotypical and repetitive behavior patterns, and fixation on limited interests, but there were differences between the children described by Asperger and Kanner. The group in Asperger's study showed better language skills (i.e., grammar, syntax, morphology and vocabulary) compared to the group of children in Kanner's study. However, the group of children in Asperger's study showed a lack of social reciprocal communication, specifically, their social communication were heavily accompanied by peculiar vocal intonation (i.e., monotone, in a robotic tone), pedantic speech, and long monologues (Attwood, 2008). Although Asperger reported these findings in the 1940s, it was not until 1981 that Wing used the term Asperger syndrome to explain this type of developmental disorder (Wing, 1981). The development of the diagnostic criteria in the history of DSMs for individuals with these characteristics will be explained in the next section.

Diagnostic Criteria

ASD has been known under various terms in the past, for example, Atypical Development, Symbiotic Psychosis, Childhood Psychosis, and Childhood Schizophrenia (American Psychiatric Association, 1987). The changes in terms and diagnosis criteria were evident throughout the versions of DSMs, spanning from DSM-I in 1952 (American Psychiatric Association, 1952) up to the current DSM-5 in 2013 (American Psychiatric Association, 2013). There are several possible implications from these changes which will be discussed further in the Prevalence and Etiology section of this chapter. Changes

in diagnostic criteria might also mean that treatments for individuals diagnosed with ASD have changed, from being treated as a patient with schizophrenia (as per DSM-I) to being treated as an individual with ASD (as per DSM-5). Children with ASD were classified as 'childhood schizophrenic' or 'schizophrenic reaction, childhood type' under the DSM-I and 'schizophrenia, childhood type' in DSM-II (American Psychiatric Association, 1968). Both DSMs I and II describe this diagnosis as schizophrenic symptoms that occur before puberty. Symptoms might be autistic, atypical, and withdrawn behavior, failure to develop identity separate from the mother's and general developmental defects.

A specific category was eventually presented for individuals showing symptoms of ASD in DSM-III (American Psychiatric Association, 1980) which was placed under the category of Pervasive Developmental Disorder. However, it only provided a single classification: *Infantile Autism*. There were only six characteristics listed in the DSM-III for infantile autism, and all of these symptoms had to be present in order to receive such a diagnosis. The symptoms were: (1) onset before 30 months of age, (2) pervasive lack of responsiveness to other people (autism), (3) gross deficits in language development, (4) if speech is present, peculiar speech patterns are evident (e.g., immediate and delayed echolalia, metaphorical language and pronoun reversal), (5) bizarre responses to various aspects of the environment (e.g., resistance to change, peculiar interest in or attachments to animate or inanimate objects, and (6) absence of delusions, hallucinations, loosening of associations, and incoherence as in Schizophrenia.

In the revised version of DSM-III (American Psychiatric Association, 1980), the DSM III-R (American Psychiatric Association, 1987), the term

Pervasive Developmental Disorders (PDD) was introduced to refer to what is now known as ASD (Mirenda, 2008; Odom, Horner, Snell, & Blacher, 2007; Steyn & Le Couteur, 2003). The diagnositic criteria of PDD in DSM III-R were rather general compared to DSM-III. Specifically, the symptoms of PDD were qualitative impairment in the development of social interaction, verbal and nonverbal communication skills and imaginative activity, and limited activities and interests. These areas of deficits were also recognized as a "triad of impairments" (Rutter, 1978; Wing & Gould, 1979). In DSM III-R, PDD consisted of Autistic Disorder (AD) and Pervasive Developmental Disorder-Not Otherwise Specified (PDD-NOS). Autistic Disorder was previously known as Infantile Autism or Kanner's syndrome but this was amended due to controversy with the term 'infantile'. AD was explained as the most severe case of PDD that was described in 16 specific symptoms, comprised of five symptoms for impairment in social interaction (category A), six symptoms for impairment in verbal and non-verbal communication and imaginative activities (category B), and five symptoms in restricted interests (category C). Additionally, category D of the AD diagnosis was onset during infancy of childhood. To receive the diagnosis of AD, a child had to meet eight out of the 16 symptoms, and at least two from category A and one from both B and C. Cases that met the general symptoms of PDD but not AD were classified as PDD-NOS.

Further changes were made in DSM-IV (American Psychiatric Association, 1994) in relation to PDD. The general symptoms of PDD remained the same as DSM-III (American Psychiatric Association, 1980), but the sub-categories were expanded to include AD, Rett's Disorder (RD), Childhood

Disintegrative Disorder (CDD), Asperger's Disorder, and PDD-NOS (including Atypical Autism). AD had more elaborate diagnostic criteria under DSM-IV in comparison to DSM-III R (American Psychiatric Association, 1987). Specifically, there were three main categories in the diagnostic of PDD. Firstly, (1) qualitative impairment in social interaction (four symptoms); (2) qualitative impairments in communication (four symptoms); (3) restrictive and stereotyped patterns of behavior (four symptoms). Secondly, delays in at least one of the following with onset prior to 3 years of age: (1) social interaction; (2) language in social communication; and (3) imaginative play. Lastly, the disturbance had to differ from RD or CDD. To be diagnosed with AD, a child had to have at least six or more symptoms listed above, with at least four symptoms from the first category.

Not a lot of changes were reported in the DSM-IV-TR (American Psychiatric Association, 2000) compared to the earlier version (DSM-IV; American Psychiatric Association, 1994) in relation to the diagnosis of PDD, specifically for AD.

Significant changes were made in regards to the diagnostic criteria of ASD under the current version of DSM, that is the DSM-5 (American Psychiatric Association, 2013). This version of the DSM uses the term ASD instead of PDD, and puts ASD under neurodevelopmental disorders. However, the main characteristics of ASD remain the same; i.e., deficits in social interaction, social communication, and restricted, repetitive and stereotyped patterns of behavior, interests and activities. Impairments in social interaction may include (but not limited to) problems in expressing nonverbal gestures, lack of social interests,

and empathy. Communication deficits of children with ASD may include problems in language development, difficulties in establishing and maintaining conversations, and repetitive language. Abnormal functioning in behaviors might include an obsession towards a certain routine, repetition of motor behaviors, and a fixation towards details of objects.

Other impairments might also co-occur in individuals with ASD, such as impairments in sensory integration, attention deficit disorder (ADD), attention deficit hyperactivity disorder (ADHD), ID, and other learning disabilities (American Psychiatric Association, 2013; Ozonoff, Goodlin-Jones, & Solomon, 2007). Another aspect that needs to be highlighted is that there may be a significant difference between the behaviors of each child diagnosed with ASD hence making it fairly difficult to make a generalization of their traits due to their unique characteristics.

More detailed diagnostic criteria of ASD can be found in Table 1.1. Following the diagnostic criteria of ASD, more individualized characteristics can be found in the specifiers which would allow practitioners and clinicians to provide a richer diagnosis of their patients (American Psychiatric Association, 2013). Further, the severity of points A and B in Table 1.1 should be based on social communication impairments and restricted, repetitive patterns of behavior in Table 1.2.

Table 1.1.

DSM-5 Autism Spectrum Disorder Diagnostic Criteria

Criteria	Specifiers
A. Persistent deficits in social communication and social interaction across multiple contexts, as manifested by the following, currently or by history (examples are illustrative, not exhaustive; see text):	1. Deficits in social-emotional reciprocity, ranging, for example, from abnormal social approach and failure of normal back-and-forth conversation; to reduced sharing of interests, emotions, or affect; to failure to initiate or respond to social interactions. 2. Deficits in nonverbal communicative behaviors used for social interaction, ranging, for example, from poorly integrated verbal and nonverbal communication; to abnormalities in eye contact and body language or deficits in understanding and use of gestures; to a total lack of facial expressions and nonverbal communication.

Table 1.1 – *Continued*

Criteria	Specifiers
	3. Deficits in developing, maintaining, and understanding relationships, ranging, for example, from difficulties adjusting behavior to suit various social contexts; to difficulties in sharing imaginative play or in making friends; to absence of interest in peers.
B. Restricted, repetitive patterns of behavior, interests, or activities, as manifested by at least two of the following, currently or by history (examples are illustrative, not exhaustive; see text):	1. Stereotyped of repetitive motor movements, use of object, or speech (e.g., simple motor stereotypies, lining up toys or flipping objects, echolalia, idiosyncratic phrases).
	2. Insistence on sameness, inflexible adherence to routines, or ritualized patterns of verbal or nonverbal behavior (e.g., extreme distress at small changes, difficulties with transitions, rigid thinking patterns, greeting rituals, need to take some route or eat same food every day).

Table 1.1 – *Continued*

Criteria	Specifiers
	3. Highly restricted, fixated interests that are abnormal in intensity or focus (e.g., strong attachment to or preoccupation with unusual objects, excessively circumscribed or perseverative interests). 4. Hyper- or hyporeactivity to sensory input or unusual interest in sensory aspects of the environment (e.g., apparent indifference to pain/temperature, adverse response to specific sounds or textures, excessive smelling or touching of objects, visual fascination with lights or movement).
C. Symptoms must be present in the early developmental period (but may not become fully manifest until social demands exceed limited capacities, of may be masked by learned strategies in later life).	

Table 1.1. *Continued*

Criteria	Specifiers
D. Symptoms cause clinically significant impairment in social, occupational, or other important areas of current functioning.	
E. These disturbances are not better explained by intellectual disability (intellectual developmental disorder) or global developmental delay. Intellectual disability and autism spectrum disorder frequently co-occur; to make comorbid diagnosis of autism spectrum disorder and intellectual disability, social communication should be below that expected for general developmental level.	

Note. Cited from American Psychiatric Association (2013, pp. 50-51).

Table 1.2.

DSM-5 Severity Levels for Autism Spectrum Disorder

Severity level	Social communication	Restricted, repetitive behaviors
Level 3 "Requiring very substantial support"	Severe deficits in verbal and nonverbal social communication skills cause severe impairments in functioning, very limited initiation of social interactions, and minimal response to social overtures from others. For example, a person with few words of intelligible speech who rarely initiates interaction and, when he or she does, makes unusual approaches to meet needs only and responds to only very direct social approaches.	Inflexibility of behavior, extreme difficulty coping with change, or other restricted/repetitive behaviors markedly interferes with functioning in all spheres. Great distress/difficulty changing focus or attention.

Table 1.2. - *Continued*

Severity level	Social communication	Restricted, repetitive behaviors
Level 2 "Requiring substantial support"	Marked deficits in verbal and nonverbal social communication skills; social impairments apparent even with supports in place; limited initiation of social interactions; and reduced or abnormal responses to social overtures from others/ For example, a person who speaks simple sentences, whose interaction is limited to narrow special interests, and who has markedly odd nonverbal communication.	Inflexibility of behavior, difficulty coping with change, or other restricted/repetitive behaviors appears frequently enough to be obvious to the casual observer and interfere with functioning in a variety of contexts. Distress and/or difficulty changing focus or action.
Level 1 "Requiring support"	Without support in place, deficits in social communication cause noticeable impairments. Difficulty initiating social interactions, and clear examples of atypical or unsuccessful responses to social overtures of others.	Inflexibility of behavior causes significant interference with functioning in one or more contexts. Difficulty switching between activities. Problems of organization and planning hamper independence.

Table 1.2. - *Continued*

Severity level	Social communication	Restricted, repetitive behaviors
	May appear to have decreased interest in social interaction. For example, a person who is able to speak in full sentences and engages in communication but whose to-and-from conversation with other fails, and whose attempts to make friends are odd and typically unsuccessful.	

Note. Cited from American Psychiatric Association (2013, p. 53).

Prevalence and Etiology

Reports have indicated increased numbers of individuals with ASD across the world, and the rates of ASD in the past decades have risen (Newsom & Hovanitz, 2006). Evidence on the growing prevalence of children diagnosed with ASD was provided by Centers for Disease Control and Prevention (2014) in the United States. The results were calculated based on the total number of children that received the diagnosis of ASD and the total denominator of children aged 8 years old. The surveillance data showed an increase of 64% in the prevalence of ASD. Specifically, from approximately 1 in every 110 children in 2006 (Centers for Disease Control and Prevention, 2009), to 1 in every 68 in 2010 (Centers for Disease Control and Prevention, 2014), making it one of the leading causes of special educational needs.

The increased rate of individuals with ASD must be carefully interpreted. This finding does not necessarily mean that cases of ASDs have drastically amplified per se (Newsom & Hovanitz, 2006). We should also take into account that the diagnostics of ASDs have been broadened during the past decades. DSM-III-R (American Psychiatric Association, 1987) provided broader criteria of ASDs, as opposed to the earlier edition, DSM-III (American Psychiatric Association, 1980), which might allow more people to fall into this category. What was categorized with a limited diagnostic has been expanded to a list of symptoms. The increase of these rates might also be due to the widespread awareness of ASD which is not limited to parents and teachers, but also to the wider community (Centers of Disease Control and Prevention, 2010).

However, substantial changes have been made in the Neurodevelopmental category recently, specifically, sub-category ASD under DSM-5 (American Psychiatric Association, 2013) that might have several impacts on the prevalence of ASD. For example, Asperger Syndrome, which previously held a specific criterion under the ASD category in DSM-IV-TR (American Psychiatric Association, 2000) has been omitted from DSM-5 and the individuals with these symptoms from now on will receive the diagnosis of ASD without language or intellectual impairment (American Psychiatric Association, 2013). Further, DSM-5 explains that individuals that have been previously diagnosed with AD, Asperger's disorder, or PDD-NOS under the DSM-IV are still categorized under the ASD diagnosis. Additionally, DSM-5 requires more severe symptoms in order to receive the diagnosis of ASD compared to DSM-IV. These changes would most likely have an impact on the estimate number of children with ASD. The impact of raising the bar on receiving the ASD diagnosis might result in a decrease in the numbers of children diagnosed with ASD and the possibility that some children might be misdiagnosed and in turn not receive the services they need (Matson, Hattier, & Williams, 2012). Matson et al. (2012) carried out a study that focused on analyzing the effects of the modifications of the diagnostic criteria (i.e., from DSM-IV to DSM-5) on the prevalence of children diagnosed with ASD. Their findings suggest that fewer children will be diagnosed with ASD under DSM-5 criteria compared to DSM-IV, specifically, the decrease was 47.74%. The changes in the criteria of ASD in DSM-V might mean that individuals that show symptoms of ASD but do not meet the criteria of this diagnosis might be classified into the communication disorder category.

With regards to the prevalence of ASD, boys are four times more likely to be diagnosed with ASD than girls (American Psychiatric Association, 2013). Studies have suggested that there is a higher ratio of boys than girls with ASD with ratios ranging from 1.8:1 (Fombonne, Du Mazaubrun, Cans, & Grandjean, 1997) to 15.7:1 (Baird et al., 2000).

In terms of etiology, although the cause of ASD is still unknown, there have been several causes suggested, including maternal rejection, candida infections, and childhood vaccinations (Herbert, Sharp, & Gaudiano, 2002). The notion of maternal rejection as the cause of ASD was suggested by Kanner (1968) and later by Bettelheim, a professor and child developmental specialist (Millon, Krueger, & Simonsen, 2011). This theory explains that ASD was the result of the mothers' emotional coldness or lack of maternal warmth with their child, which was often referred to as the refrigerator mother theory. This hypothesis was later rejected because there was no scientific evidence to support it.

The second claim, candida infection, was developed from the hypothesis by Adams and Conn (1997) and Rimland (1988). This claim explained that candidiasis (i.e., infection due to the overgrowth of a yeastlike fungus *Candida albicans)* during labor of a child might lead to a disruption to the immune system due to the toxin that is produced by candida. This disruption may potentially lead to brain damage which can result in a child developing symptoms of ASD. This claim was later rejected due to the lack of medical evidence to support it (Siegel, 1996).

The third claim, was related to the Measles Mumps Rubella (MMR) vaccinations. In a case study of 12 children that were diagnosed with intestinal abnormalities, Wakefield et al. (1998) found that eight of the children showed symptoms of ASD. Further, it was reported that these symptoms occurred after the children received the MMR vaccination. This preliminary study suggested the connection between the MMR vaccination and ASD. The MMR claim received strong support by parents, so much so, parents chose not to vaccinate their children (Manning, 1999). Studies in the following years showed results that contradicted those of Wakefield et al.'s. Specifically, a time trend data analysis from the UK's general practice database that was conducted by Kaye, Melero-Montes, and Jick (2001), showed that although there was an increase in the prevalence of ASD reports (i.e., from 0.3 per 10,000 persons in 1988 to 2.1 per 10,000 persons in 1999) there were in fact no increases in the prevalence of MMR vaccination among children in the time period being observed. A similar study conducted by Dales, Hammer, and Smith (2001) that looked into the autism database from the California Department of Developmental Services from 1980 to 1994 supported Kaye et al.'s findings. The implication of these findings meant that the increase of prevalence of ASD was not a direct result of the vaccine, therefore rejecting the MMR vaccine claim by Wakefield et al. There are several plausible explanations as to why researchers linked MMR vaccinations to ASD. Firstly, children show distinct symptoms of ASD approximately at the age of two years old, which coincides with the time the vaccination is given. Second, the increased awareness of ASD might have also coincided with the initial widespread use of MMR vaccinations, allowing

practitioners, researchers, and parents to link these two variables, and in turn conclude that the vaccination caused the disorder. Fortunately, longitudinal data cleared this misconception and ruled out MMR vaccination as the cause of ASD.

Since aforementioned theories were all rejected, current research suggest that genetic and environmental factors largely contribute to the cause of ASD. Ratajczak (2011) conducted a review on studies that looked at the causes of ASD, concluding that ASD might be caused from genetic defects and/or inflammation of the brain, which might be a result of the aforementioned factors along with genetics (Rodier, 2000) and environmental aspects. In terms of genetics, DeFrancesco (2001) and Muhle, Trentacoste, and Rapin (2004) looked at the prevalence of ASD in twins. Their findings suggest that in the case of identical (monozygotic) twins, if one of the twins has ASD then there is a high chance of the other twin being on the autism spectrum as well. Several studies highlighted genes that were found associated with ASD, such as HOXA1 (Caglayan, 2010; Rodier, 2000), *DbetaH* (Robinson, Schutz, Macciardi, White, & Holden, 2001), *Fragile X* (Farzin et al., 2006), *FMR-1* (Vincent et al., 1996), and *SHANK2* (Berkel et al., 2010). However, DeFrancesco (2001) suggested that there is no single gene that has been found to cause autism, but rather several rare genetic mutations.

As for environmental causes, London (2000) suggested that ASD might be caused by a disease during a very early (approximately day 20-24 of gestation) fetal stage from exposures to several environmental factors. These environmental factors include the intake of medications by mothers during pregnancy, such as thalidomide (Strömland, Nordin, Miller, Akerström, &

Gillberg, 1994), misoprostol (Landrigan, 2010), and acetaminophen (Schultz et al., 2008; Schultz, 2010). Other environmental factors might include exposures to porphyrins (Geier & Geier, 2006; Nataf et al., 2006), phthalates (Kim et al., 2009), polychlorinated biphenyls (Jacobson, Jacobson, Padgett, Brumitt, & Billings, 1992), herbicides, perchlorates, mercury, coal derivates (Román, 2007), and organophosphate pesticides (Bouchard, Bellinger, Wright, & Weisskopf, 2010).

Despite extensive research on seeking the cause of autism, the end result still stands – to date there seems to be no scientific data that can provide a clear cause of this DD.

Intellectual Disability

One of the participants in Study 1 of this dissertation was initially diagnosed as having Global Developmental Delay (GDD), so therefore this section will discuss this diagnosis. DSM-5 (American Psychiatric Association, 2013) explains GDD as a sub-category of Intellectual Disability (ID), where the individual fails to meet the expected developmental milestones, mostly in the area of intellectual functioning. The diagnosis of GDD is only valid for children under the age of 5 years and requires reassessment as they grow older. Due to this reason, for the remainder of this thesis, the author will use the classification of ID to explain the characteristics of one participant in the study. The following sections of this chapter will provide more details regarding the history, diagnostic criteria, prevalence and etiology of ID.

Historical Background

Children with ID that came from a wealthy family were often looked after, as opposed to those that came from families with poor socioeconomic background (Harris, 2010). For the latter, the families tend to believe that ID was a sign of God's punishment, which resulted in the killing of the newborn or infant. Fortunately, a more supportive attitude toward individuals with ID rose with the emergence of Christianity and by the sixth century a law was established that recognized ID among the definition of disability. During the Middle Ages the community became even more supportive of people with ID, which was evident by charitable support by the community. A better understanding in science during the fourteenth to sixteenth centuries increased the awareness of ID and laws were established to protect and support individuals with ID and their families.

Observations on Cretinism which was published in 1850 (Harris, 2010) was the first medical publication that led to more insights on ID. This resulted in more attention to explore the classification of the various types of ID. Details and changes of the diagnostic criteria of ID throughout the years based on the Diagnostic Statistical Manual of Mental Disorders will be discussed in the following section.

Diagnostic Criteria

ID was listed in both DSMs I and II (American Psychiatric Association, 1952, 1974, respectively) under the term 'mental retardation' (MR). MR was explained as a subnormal general intellectual functioning that occurs during the developmental period. MR is associated with impairments in either learning and social adjustments or maturation, or both. MR was divided into several levels

based on the individual's intelligent quotient (IQ) score of the Revised Stanford-Binet Tests of Intelligence Form L and M. This test classifies the IQ range of 90-109 as average (Kaufman, 2009). Individuals with 'borderline MR' were explained to have an IQ score of 68-83; 'mild MR' ranged from 52-67; 'moderate MR' ranged from 36-51, 'severe MR' ranged from 20-35; and 'profound MR' was under 20. Another classification of MR is 'unspecified MR', which is explained as cases where the patient's intellectual functioning cannot be evaluated, but shows an indication of being subnormal. However, the diagnosis of MR was not given based solely on the IQ score but also by taking into account the patient's developmental history and present functioning (i.e., academic skills, vocational achievement, motor skills and social and emotional maturity). The IQ score should only be used as a guide.

DSM-III (American Psychiatric Association, 1980) placed MR under 'disorders usually evident in infancy, childhood or adolescence' – sub group 'intellectual' (categorized based on the predominant area of impairment). However, DSM III-R (American Psychiatric Association, 1987) placed MR under a sub-category of Developmental Disorders. To be diagnosed with MR, generally, an individual had to have an IQ of 70 or below (with clinical judgment made for infants) and concurrent deficits or impairments in adaptive behavior which is relative to the individual's age. Specifically, to receive the diagnosis of MR, both DSM-III and III-R required the following criteria to be met: (1) significant sub average level of general intellectual functioning (IQ or IQ equivalent), (2) significant impairments in adaptive functioning, and 3) onset before the age of 18 years old. Further, MR was divided into four degrees of

severity, as follows: (1) Mild MR (constitutes of 85% of MR cases), with characteristics including: IQ score of 50 – 70, develop social and communication skills at 0 – 5 years of age, and minimal impairments in sensorimotor areas; (2) Moderate MR (constitutes of 10% of the total MR cases), with characteristics including: IQ from 35 – 55, show social communication skills during 0 – 5 years of age but have difficulties in progressing academically beyond school grade levels; (3) Severe MR (constitutes of 3 – 4% of the total cases of MR), with characteristics including: IQ from 20 – 40, poor motor development during school years, with little or even no communicative speech; (4) Profound MR (constitutes of 1 – 2% of the total cases of MR), with characteristics including: IQ below 25 and minimal capacity for sensorimotor functioning.

Little changes were made in DSM-IV and DSM-IV-TR (American Psychiatric Association, 1994, 2000, respectively) in regards to the diagnosis of MR. The only significant change was the addition of a sub-category of MR, Severity Unspecified. This was explained as cases where the individual fell into significant sub average level of intelligence but was too heavily impaired to go through standardized IQ tests.

Major changes in the diagnostic criteria of MR were made in DSM-5 (American Psychiatric Association, 2013). The term MR was replaced by ID and more details were provided for clinicians to make a more thorough diagnosis. DSM-5 explains IDD (Intellectual Developmental Disorder) as a disorder that involves deficits in intellectual and adaptive functioning of conceptual, social and practical domains with onset during the developmental period (American Psychiatric Association, 2013). The diagnosis of ID is given to individuals with

intelligence level below average functioning, occurring prior to adulthood and impaired adaptive functioning. See Table 1.3. for detailed diagnostic criteria of ID based on DSM-5.

Further, DSM-5 (American Psychiatric Association, 2013) provided more elaborate details in terms of details of various levels of severity in individuals with ID (i.e., mild, moderate, severe, and profound) compared to the previous versions of DSM. The severity levels of ID based on DSM-5 are listed in Table 1.4. Note that these levels are based on adaptive functioning, and not IQ scores.

Prevalence and Etiology

DSM-5 (American Psychiatric Association, 2013) reported that approximately up to 1% of the general population is diagnosed with some form of ID. Further, as much as 6 out of 1,000 people are diagnosed with severe ID. Reports have shown mixed results in terms of gender ratio of people diagnosed with ID. However, it has been reported that males are most likely to have ID. Specifically, the ratio of male:female diagnosis was reported as 1.6:1 for mild ID and 1.2:1 for severe ID (American Psychiatric Association, 2013).

Table 1.3.

DSM-5 Intellectual Disability (Intellectual Developmental Disorder) Diagnostic Criteria

Criteria	Areas of deficits
A. Deficits in intellectual functions.	Reasoning, problem solving, planning, abstract thinking, judgment, academic learning, and learning from experience, confirmed by both clinical assessment and individualized, standardized intelligence testing.
B. Deficits in adaptive functioning that result in failure to meet developmental and sociocultural standards for personal independence and social responsibility.	Without ongoing support, the adaptive deficits limit functioning in one or more activities of daily life, such as communication, social participation, and independent living, across multiple environments, such as home, school, work, and community.
C. Onset of intellectual and adaptive deficits during the developmental period.	

Note. The aforementioned three criteria must be met (American Psychiatric Association, 2013, p. 33).

Table 1.4.

DSM-5 Severity levels for Intellectual Disability (Intellectual Developmental Disorder)

Severity level	Conceptual domain	Social domain	Practical domain
Mild	For preschool children, there may be no obvious conceptual differences. For school-age children and adults, there are difficulties in learning academic skills involving reading, writing, arithmetic, time, or money, with support needed in one or more areas to meet age-related expectations. In adults, abstract thinking, executive function (i.e., planning, strategizing, priority setting, and cognitive	Compared with typically developing age-mates, the individual is immature in social interactions. For example, there may be difficulty in accurately perceiving peers' social cues. Communication, conversation, and language are more concrete or immature than expected for age. There may be difficulties regulating emotion and behavior in age-appropriate fashion; these	The individual may function age-appropriately in personal care. Individuals need some support with complex daily living tasks in comparison to peers. In adulthood, supports typically involve grocery shopping, transportation, home and child-care organizing, nutritious food preparation, and banking and money management. Recreational skills resemble those of age-mates, although

Table 1.4. - *Continued*

Severity level	Conceptual domain	Social domain	Practical domain
	flexibility), and short-term memory, as well as functional use of academic skills (e.g., reading, money management), are impaired. There is a somewhat concrete approach to problems and solutions compared with age-mates.	difficulties are noticed by peers in social situations. There is limited understanding of risk in social situation; social judgment is immature for age, and the person is at risk of being manipulated by others (gullibility).	judgment related to well-being and organization around recreation requires support. In adulthood, competitive employment is often seen in jobs that do not emphasize conceptual skills. Individuals generally need support to make health care decisions and legal decisions, and to learn to perform a skilled vocation competently. Support is typically needed to raise a family.

Table 1.4. – *Continued*

Severity level	Conceptual domain	Social domain	Practical domain
Moderate	All through development, the individual's conceptual skills lag markedly behind those of peers. For preschoolers, language and pre-academic skills develop slowly. For school-age children, progress in reading, writing, mathematics, and understanding of time and money occurs slowly across the school years and is markedly limited compared with that of peers. For adults, academic skill development is typically at an elementary level, and	The individual shows marked differences from peers in social and communicative behavior across development. Spoken language is typically a primary tool for social communication but is much less complex than that of peers. Capacity for relationships is evident in ties to family and friends, and the individual may have successful friendships across life and sometimes romantic relations in adulthood. However, individuals may not perceive or interpret social cues accurately.	The individual can care for personal needs involving eating, dressing, elimination, and hygiene as an adult, although an extended period of teaching and time is needed for the individual to become independent in these areas, and reminders may be needed. Similarly, participation in all household tasks can be achieved by adulthood, although an extended period of teaching is needed, an ongoing supports will typically occur for adult-level performance.

Table 1.4. – *Continued*

Severity level	Conceptual domain	Social domain	Practical domain
	support is required for all use of academic skills in work and personal life. Ongoing assistance on a daily basis is needed to complete conceptual tasks of day-to-day life, and others may take over these responsibilities fully for the individual.	Social judgment and decision-making abilities are limited, and caretakers must assist the person with life decisions. Friendships with typically developing peers are often affected by communication or social limitations. Significant social and communicative support is needed in work settings for success.	Independent employment in jobs that require limited conceptual and communication skills can be achieved, but considerable support from co-workers, supervisors, and others is needed to manage social expectations, job complexities, and ancillary responsibilities such as scheduling, transportation, health benefits, and money management. A variety of recreational skills can be developed. These typically require additional supports and

Table 1.4. – *Continued*

Severity level	Conceptual domain	Social domain	Practical domain
			learning opportunities over an extended period of time. Maladaptive behavior is present in a significant minority and causes social problems.
Severe	Attainment of conceptual skills is limited. The individual generally has little understanding of written language or of concepts involving numbers, quantity, time, and money. Caretakers provide extensive supports for problem solving throughout life.	Spoken language is quite limited in terms of vocabulary and grammar. Speech may be single words or phrases and may be supplemented through augmentative means. Speech and communication are focused on the here and now within everyday events. Language is used for social	The individual requires support for all activities of daily living, including meals, dressing, bathing, and elimination. The individual requires supervision at all times. The individual cannot make responsible decisions regarding well-being of self or others. In adulthood, participation in tasks at home,

Table 1.4. – *Continued*

Severity level	Conceptual domain	Social domain	Practical domain
		communication more than for explication. Individuals understand simple speech and gestural communication. Relationships with family members and familiar others are a source of pleasure and help.	recreation, and work requires ongoing support and assistance. Skill acquisition in all domains involves long-term teaching and ongoing support. Maladaptive behavior, including self-injury, is present in a significant minority.
Profound	Conceptual skills generally involve the physical world rather than symbolic processes. The individual may use objects in goal-directed fashion for self-care, work, and recreation. Certain visuospatial skills, such as matching and sorting based on physical	The individual has very limited understanding of symbolic communication in speech or gesture. He or she may understand some simple instructions or gestures. The individual expresses his or her.	The individual is dependent on other s for all aspects of daily physical care, health, and safety, although he or she may be able to participate in some of these activities as well. Individuals without severe

Table 1.4. – *Continued*

Severity level	Conceptual domain	Social domain	Practical domain
	characteristics, may be acquired. However, co-occurring motor and sensory impairments may prevent functional use of objects.	own desires and emotions largely through nonverbal, nonsymbolic communication. The individual enjoys relationships with well-known family members, caretakers, and familiar others, and initiates and responds to social interactions through gestural and emotional cues. Co-occurring sensory and physical impairments may prevent many social activities	physical impairments may assist with some daily work tasks at home, like carrying dishes to the table. Simple actions with objects may be the basis of participation in some vocational activities with high levels of ongoing support. Recreational activities may involve, for example, enjoyment in listening to music, watching movies, going out for walks, or participating in water activities, all with the support of others. Co-occurring physical and

Table 1.4. – *Continued*

Severity level	Conceptual domain	Social domain	Practical domain
			sensory impairments are frequent barriers to participation (beyond watching) in home, recreational, and vocational activities. Maladaptive behavior is present in a significant minority.

Note. Cited from American Psychiatric Association (2013, p. 36).

It has been widely accepted that the primary cause of ID may be biologic, psychosocial, or a combination of both (American Psychiatric Association, 1987). Potential major causes of ID might include: (1) hereditary factors (makes up to 5% of cases), such as (but not limited to) Tay-Sachs disease, tuberous sclerosis and Down syndrome; (2) early alteration of embryonic development (in approximately 30% of ID cases), may relate to maternal alcohol consumption or infection; (3) pregnancy and perinatal problems (approximately 10% of ID cases), may include fetal malnutrition, prematurity, hypoxia and trauma; (4) physical disorders that happened during childhood (approximately 5% of ID cases), may include infections, traumas, and lead poisoning; and (5) environmental influences (makes up to approximately 15-20% of ID cases), which may include deprivation of nurturance and of social, linguistic, and other stimulation. Additionally, there is still up to 40% clinical cases where the cause of ID remains undetermined (American Psychiatric Association, 1987).

Comorbidity of ASD and ID

The literature suggests that the comorbidity of ASD and ID is not uncommon (Matson & Shoemaker, 2009). In terms of prevalence, Lai, Lombardo, and Baron-Cohen (2014) reported that approximately 45% of individuals with ASD also have ID. There is evidence to suggest that the overlap between ASD and ID is due to genetic similarities (Galasso et al., 2008; Laumonnier et al., 2006; Matson & Shoemaker, 2009; Ullmann et al., 2007). However, data is limited and more research is needed to be able to conclude that genetics are the cause of this overlap (Levine, Morrow, Berdichevsky, & Martin, 2007). The following studies highlight the patterns between the two disorders.

Firstly, a study on individuals with infantile autism who had ID by Bartak, Rutter, and Cox (1977) suggested that those with autism that have a lower IQ show significantly higher rates of stereotypies and self-injurious behavior compared to individuals who have less severe ID. Second, a study that analyzed the behavior of individuals with ASD with ID compared to ASD alone (Deb & Prasad, 1994) suggested that more individuals with ASD and ID showed impairments in communication, and frequent repetitive and restrictive behavior compared to those with ASD alone. Lastly, Vig and Jedrysek (1999) focused on the overlap between ASD and ID on preschoolers found that there was a strong and positive correlation between the severity of an individual's ID with their likelihood of receiving an ASD diagnosis. In other words, the more severe the ID is, the more likely the individual will also be on the autism spectrum.

Considering that the comorbidity of ASD and ID is common, and individuals with ASD who have ID have different characteristics compared to those with autism or ID alone, it would therefore be ideal for practitioners to obtain better understanding on these two developmental disorders in order to distinguish and explain the relationship between them (Matson & Shoemaker, 2009).

Early Intervention Programs for Children with ASD and ID

The symptoms of ASD and ID are often evident in the early stages of life (American Psychiatric Association, 2013; Mirenda, 2009a). Parents of children with ASD and ID might report evidence of delayed or lack of certain developmental milestones in their children from the age of 18 months. These children's impairments become obvious at this stage of development because a

typically developing child would usually establish basic receptive and expressive language, the interest to interact with others, and show the interest to play.

Based on these symptoms, or lack of typically developing characteristics, parents tend to seek further explanations and diagnoses for their children. This is usually the time when early intervention treatment starts (Bryson, Rogers, & Fombonne, 2003; Harris & Handleman, 2000). With the impairments in social interaction, communication skills and behavior flexibility (Folstein, 2006), it is very difficult for children with ASD to be able to live independently. Children with ID (regardless of their severity levels) need constant guidance and support in their social interaction, communication and daily living (American Psychiatric Association, 2013). In order to help achieve a constructive result, these children rely heavily on early intervention (Bryson et al., 2003; Harris & Handleman, 2000; Mirenda, 2009a), which ideally should be conducted intensively with supervision by a professional and supported by their family (Johanson & Hastings, 2002; Sallows & Graupner, 1999).

The effects of early intervention for children with disabilities were highlighted by Shonkoff and Hauser-Cram (1987). In their meta-analysis of 31 studies with the following criteria: involving children under 3 years old that were enrolled in an early intervention program, the principal cause was not the socioeconomic status, the children were raised in a home or foster home (not a residential facility), the study did not compare two different interventions, and lastly, the study provided a conclusive methodological design. Bar several comments questioning the effectiveness of the early intervention programs and methodological flaw, the general conclusion from the data suggested that early

intervention services were regarded as effective in helping enhance the developmental progress of children under three years old with disabilities. Further, it was also noted that programs with well-structured curriculum resulted in better effects on the children's performances compared to less-structured programs.

A group of scholars under The Australian Society for Autism Research (2011) provided a review that focused on effective practices in early intervention that was targeted toward children with ASD. This review included studies from 2005 to 2011, included children aged seven years and under with a diagnosis of ASD, had 10 participants or more, did not use single-subject designs, and the children had to be exposed to educational interventions – not biomedical or psychodynamic interventions. There were a total of 107 studies identified, and the interventions were classified into seven categories: (1) behavioral interventions (e.g., applied behavior analysis [ABA], early intensive behavioral interventions [EIBI/IBI], and contemporary ABA); (2) developmental interventions (e.g., developmental social-pragmatic model [DSP], floor time, relationship developmental intervention [RDI], and play therapy); (3) combined interventions (e.g., social-communication, emotional regulation and transactional support [SCERTS], treatment and education of autistic and related communication handicapped children [TEACCH], and learning experiences – an alternative program for preschoolers and parents [LEAP]); (4) family-based interventions (e.g., the Hanen program, and the early bird program); (5) therapy-based interventions that tend to focus on the development of specific skills, such as communication, cognition, social, and motor (e.g., communication-focused

interventions, visual supports/AAC, PECS, social stories, facilitated communication, functional communication training, social skills interventions, sensory/motor interventions, sensory integration, auditory integration training, and Doman-Delcato method); (6) other interventions (e.g., Higashi/daily life therapy, the option method, music intervention therapy, Spell, the Camphill movement, and Miller method); and (7) interventions for comorbid conditions associated with ASD, such as anxiety and challenging behavior (e.g., cognitive behavioral therapy [CBT], and positive behavior support [PBS]). The programs were rated based on six categories (from high to low): E – established/eligible based on evidence; EE – emerging evidence; BP – eligible based on best practice approach, evidence awaited; SE – single element, eligible based on evidence or best practice, must be used with other eligible interventions; NEI – not eligible, insufficient information regarding best practice or evidence; and lastly NEE – not eligible based on best practice guidelines or evidence that indicate the intervention is not effective.

Ratings results indicated that only ABA and EIBI received the highest ratings of E, with remaining interventions in the behavior analysis category rated as either EE or BP, except for the Miller method that was rated as NEI. Overall, family-based programs received ratings ranging from EE to BP. On the therapy-based programs, SGD, PECS, MS, and other AAC interventions were rated as EE, alert intervention was rated as BP, pragmatic language groups and aquatic occupational therapy intervention were rated as SE, while the remainder (CBT, literacy groups, sensory integration, sensory diet, etc.) were rated as NEI to NEE.

Teacher/centre support (e.g., teacher training, collaborative planning services such as IEP meetings, and transition visits) were all rated as BP.

In conclusion, it was suggested that the interventions that were rated as effective for children with ASD might potentially be applied to help the developmental progress of children with other disabilities. Further, a general summary of a successful program would ideally include the regular provision of specific curricula, specific goals that are suited to the stakeholder, highly supportive teaching resources and environments, family involvement and engagement, and readily resources to support the generalization of the skills that were acquired in the intervention program.

Another review of the literature on early intervention was provided by KPMG (2011). The review recognized the importance of early intervention and made two major points. First, effective early intervention is a crucial investment that can promote economic benefits for the child, the family of the child, and to parties beyond them. An effective early intervention program may reduce intervention costs in the later stages of life, which in turn diminishes the need for the government to spend further money needed for remediation and interventions later in the child's life. Second, the need of early intervention is in accordance with the body of literature that highlights the importance of the foundation of learning in the early years to promote ongoing learning. The review was designed to evaluate the effectiveness of early intervention on the childhood, transition to school, future social and work participation of children with DD. Additionally, the review also looked at comparing diagnostic tools to determine the eligibility of receiving early intervention programs and related assistance.

The review included longitudinal, cohort studies that involved early childhood education, home-visiting or parent education, and early intervention programs for children with a disability.

Findings of the review indicated positive results for the role of early intervention in improving the child's broad developmental and social outcomes, which in turn may have contributed to improving the child's quality of childhood. Data also suggested that early intervention in general helped improve the child's intellectual, social and behavioral skills at school entry, and these positive outcomes persisted long into the child's schooling. In terms of social and work participation in later stages of life, results of the review suggest that early intervention helped improve the child's capacity to participate in broader social and economic participation. Lastly, the review found that assessments that focuses on the child's strengths and needs with the addition of the family context are more preferred than assessments that are based on diagnoses.

Communication intervention for Children with ASD and ID

Practitioners in the special education field have established early intervention strategies to help meet the needs of young children with ASD and ID (Kaiser & Roberts, 2011). Due to their communication deficits, one of the main foci of these early interventions is enhancing communication. Communication interventions for these children has been given a great emphasis by practitioners due to the rationale that communication plays a significant role in enhancing the quality of life of individuals with DD (American Psychiatric Association, 2000), which includes children with ASD and ID. The areas that are closely affected by communication are motor, social, cognitive, and adaptive

behaviors (Education of the Handicapped Act Amendments, 1986), and because these areas are fundamental in the lives of young children, it is therefore crucial to address this issue.

Mirenda (2009b) argued that to enhance these children's quality of lives, they should be taught communication skills which would enable them to achieve these functional outcomes: (1) participate in reciprocal communication with others, (2) communicate wants and needs, (3) make choices, and (4) to initiate and to maintain social interactions. Further, Sigafoos (2006) also explained that the children's communication impairments also hinder their interactions with their caregivers, family, teachers, and friends. Previous research indicated that children with communication impairments may engage in problem behavior (i.e., aggressiveness and self-injury) to show protest or rejection (Paul, 1987; Sigafoos, Arthur-Kelly, & Butterfield, 2006). Further, there is evidence to suggest that the majority of children who receive speech-language therapy have also been reported as having behavior problems (Carson, Klee, Lee, Williams, & Perry, 1998). Horwitz et al. (2003) compared the reports from parents of young children with and without language impairments. The parents' reports suggest that externalizing behaviors are four times more likely to happen with children with language impairments compared to children with typically-developing language.

Kaiser and Roberts (2011) explained four major changes in the field of early language intervention since 1986. Firstly, there was an expansion in the population of children with disabilities receiving language intervention, from young children to include infants and toddlers. This meant that the focus of

intervention was also expanded, to include prelinguistic forms of communication. Secondly, the inclusion of infants and toddlers sparked the need to develop strategies to implement at home and in childcare settings, and not restrict it to just school settings. This implies that more people became involved in the intervention, because it would involve family members and siblings. Third, communication intervention received more attention because of its influential impact on motor, social, cognitive, and adaptive behaviors. Lastly, language interventions became more oriented towards involving parents within naturalistic settings (Romski & Sevcik, 2005).

Based on the aforementioned reasons, efforts to enhance communication for children with developmental and physical disabilities are justified and have received a great amount of emphasis because of evidence suggesting that functional communication may help reduce the negative implications for these children (Carson et al., 1998; Durand & Merges, 2001; Sigafoos et al., 2006). It is important to remember that special strategies need to be conducted in order to teach these children new skills either in the early intervention programs or for other general settings. Social validity or social acceptance is another factor that must be taken into account in communication interventions for children with DD because the communication partner's perception of an intervention may have an impact on the likelihood using or discontinuing said intervention (Kennedy, 2002; Schlosser, 1999). More details on teaching children with DD will be explained in the next section.

Specific Instructional Approaches in Communication Interventions for Children with ASD and ID

As identified in the aforementioned literature, promising outcomes for early intervention for children with ASD and ID typically involve an approach based on the principles of applied behavior analysis (ABA; Lovaas, 2003a) Specifically, discrete trial training (DTT) has been used extensively and has continued to show significant positive results in teaching various skills to children with ASD and ID. DTT adopts procedures of operant discrimination-learning, where a certain skill is simplified and taught in repeated trials, with a limited time for each trial, delivered in a one-to-one session where the stimuli is chosen by the trainer. The one-to-one teaching format using behavioral principles to teach individuals with DD has been studied extensively for more than four decades and research in this field has shown promising results (Duker, Didden, & Sigafoos, 2004; Lovaas, 2003b). Based on this evidence, therefore, most of the intervention for children with ASD and ID incorporates DTT.

Lovaas (2003b) noted that the key elements of DTT are as follows: (1) a behavioral emphasis, which involves establishing structure, providing positive reinforcement for the desired behavior, shaping behavior to become more precise, allowing shifts in stimulus control, establishing stimulus discrimination, and teaching imitation; (2) family participation, which means having family members conduct consistent procedures as the ones done by the clinicians or interventionists; (3) one-to-one instruction, which was explained as trying to keep the first 6 to 12 months of the intervention conducted under professional supervision in an individualized setting as opposed to group setting; (4) integration, which means after the individual has been taught appropriate social skills, they should be allowed to enter a group setting which, ideally, would

consist of typically-developing people. However, even in this setting the individual might still need a lot of instructions to be able to perform the social skills they have previously been taught; (5) comprehensiveness, which means children with DD will have to be taught a range of skills/behaviors; (6) intensity, which means that intervention programs may take up to approximately 40 hours per week. Further, the emphasis for the first 6 to 12 months of intervention of the program should be on teaching communication; (7) individual differences, which means intervention programs should be made to suit each individual as opposed to having one fixed program for all students; (8) duration, which means these intervention program should carry on throughout the individual's life to prevent any loss of treatment effects. Exceptions are made for young children who achieve normal adaptive behavior functioning by the age of 7; (9) quality control, which is explained as providing as detailed information of the program as possible so that it would be able to be replicated by others.

The Centers for Disease Control and Prevention (2009) delineated effective teaching procedures that can be adopted to teaching new skills to children with DD. These techniques include single-component response training (involves prompting sequence and some other additional procedures), multiple-component response training, preference assessment and choice making, addressing problem behavior during training, and maintenance and generalization (see Table 1.5 for more explanation regarding each teaching components).

Although these teaching techniques have been proven effective in teaching new skills to children with DD (Duker et al., 2004; Lovaas, 2003b), it is

important to remember that the success of the intervention also depends on other variables, such as the learner's motivational state, prior history of reinforcement, and the skills of the trainer. Therefore, it is crucial to implement strict control of the distracting variables and make sure that the trainer is experienced and knows most of these techniques well before conducting the intervention to ensure a significant high success rate during the intervention (Duker et al., 2004).

Communication interventions for children with DD are often based on the analysis of verbal behavior by Skinner (1957). Skinner defined verbal behavior as behaviors that are related to communication, specifically, behavior (of a speaker) that is reinforced through mediation of the listener or communication partner. Further, verbal behavior can take shape in two forms: vocal behavior, which involves speech (e.g., saying *I want a snack*, when one wants a snack); and non-vocal behavior, which might be defined as texts, drawing, gestures, or movements to communicate a message (e.g., pointing to a preferred item to request). There are six units, often referred to as verbal operants, in Skinner's (1957) verbal behavior framework, which is explained in Table 1.6.

Table 1.5.

Effective Teaching Procedures for Children with Developmental Disabilities

Training Component	Strategies Used	Description
Single-Component Response Training (Prompting Sequence)	Most-to-least prompting	Decreasing assistance, from the most to the least intrusive.
	Least-to-most prompting	Increasing assistance, where the trainer initially applies the least intrusive prompts and then continues to increase the intrusiveness of the prompts until the learner acquires the skill.
	Combination of most-to least and least-to-most prompting	Combination of the aforementioned prompting techniques.
	Withdrawing response prompts	Gradual reduction or fading of the prompts

Table 1.5. - *Continued*

Training Component	Strategies Used	Description
Additional Procedures in Single-Component Response Training	Progressive time delay	Increasing the duration of time before providing prompts to the learner.
	Constant time delay	Using the same amount of time before providing prompts to the learner.
	Graduated guidance	The trainer gradually reduces the amount of physical guidance as the learner's skill improves. This is a variation of most-to-least prompting.
	Response delay	Having the learner wait before responding to the task. This technique is used to reduce impulsive responding that may result in errors.
	Stimulus prompting	Gradually and systematically changing the instructional stimuli. Also known as stimulus fading.

Table 1.5. - *Continued*

Training Component	Strategies Used	Description
	Response shaping	Reinforcing responses that approximate the target response. Additionally, extinguishing responses that differ from the target response and previously reinforced approximation.
	Behavior chain interruption	Blocking access or to or removing one of the learner's required object.
	Cues-pause-point	Inserting a pause before, during and briefly after an instructional question. This is similar to response delay.
	Response restriction	Physically restricting the learner to make a response in order to increase another response.
	Imitation	Teaching the learner to do something that the trainer has modeled.

Table 1.5. - *Continued*

Training Component	Strategies Used	Description
Multiple-Component Response Training	Chaining	A sequence of interrelated responses.
	Task analysis	A list of separate responses in a proper sequence that lead to a completion of a certain task.
	Chaining Procedures: Backward chaining	Separate responses that are trained one at a time, starting from the last response in the chain. When the learner has learned the last response, he/she is taught the second to last response and is expected to perform the last and second to last response independently. And so on until the learner reaches the first response of the sequence of steps.

Table 1.5. - *Continued*

Training Component	Strategies Used	Description
	Forward chaining	Separate responses that are trained one at a time, in the correct order; from first to last. When the learner makes the first response, the trainer completes the following responses and gives the learner reinforcement. When the first step correctly, the second step is added to training session and the learner is expected to perform the first and second step independently, and so on until the last step is mastered.

Table 1.5. - *Continued*

Training Component	Strategies Used	Description
	Total task chaining	Similar to forward chaining, but training occurs in each and every step of the sequence of tasks.
	Error analysis	Determining if an error is a 1) latency/no response error, 2) topographical error, 3) duration error, or 4) sequence error; and deciding whether or not such errors are allowed to occur.
Preference Assessment and Choice-Making	Indirect preference assessment	When the learner's list of preference is sought through others; i.e., caregivers, teachers or peers.
	Direct preference assessment	Assessing the learner's preference in the items listed from indirect preference assessment by.

Table 1.5. - *Continued*

Training Component	Strategies Used	Description
		presenting them directly to the learner. The trainer will then record the learner's preference of item and analyze it based on a ranking order and use this items as reinforce r during training.
	Successive presentation	A potential preferred item is presented individually to the learner. The trainer will record the learner's response to the item until all of the potential items are presented to the learner.
	Pairwise presentation or paired-choice or forced-choice method	The item is presented together with another item and the learner is only allowed to choose one item in a number of discrete trials.

Table 1.5. - *Continued*

Training Component	Strategies Used	Description
	Choice making	The learner should be allowed to be provided with more than one preferred item.
	Simultaneous presentation	The learner is presented with more than one item at a time and is allowed to select one. The item is then replenished and the presentation is repeated 20 to 30 times to identify which item is consistently selected.

Note. Cited from Duker et al. (2004).

Most of the early intervention programs for children with DD are focused on teaching mands, which is an initial communication skill (Skinner, 1957). The rationale behind this is because manding is a basic function of communication and involves more motivation from the speaker to interact. Manding is often chosen as an initial communication skill before continuing to tacting, because children with DD tend to be less motivated by social reinforcements that are offered in teaching tacting skills.

Efforts have been made by clinicians, caregivers and interventionists in order to find the most effective intervention programs for children with DD. Since communication impairment is one of the defining characteristics of these children, the early intervention programs are usually focused on enhancing this skill. One of the ways to improve communication for these children is by utilizing augmentative and alternative communication (AAC) systems. More on AAC systems for children with DD will be explained in the following chapter.

Table 1.6.

Verbal Operants

Verbal Operant	Definition	Example
Mand	Originated from the word “command” or “demand”, or a request, which is defined as a verbal operant that is reinforced by a characteristic consequence and is under the functional control of relevant conditions of deprivation or aversive stimulation.	A speaker saying *I want a snack* is reinforced by the listener handing over a snack. The mand snack is a result of a deprivation of hunger, and is reinforced by the access to snack (positive reinforcement) by the listener.
Tact	Originated from the word “contact”. This is defined as a situation when the individual is in contact with the environment, which can reinforced by generalized reinforcement (e.g., social attention).	A speaker saying *Plane* is reinforced by a listener saying *You’re right, that is a plane.*

Table 1.6. – *Continued*

Verbal Operant	Definition	Example
Echoic	A response that is controlled by another verbal behavior, however it has the same form as the verbal stimulus, or a repeated utterance.	When teaching pronunciation of the word hat, the trainer says *Cat*, followed by the student's echoic behavior of saying *Cat*. This may be reinforced by the teacher saying *Good talking!*
Intraverbal	A verbal response which is controlled by the verbal stimulus of a different person. This verbal operant often allows for further interaction.	One person says *What is this?*, which is responded by another person with *An apple*. This is reinforced by the first person saying *You're right, it is an apple!*
Textual	This refers to a vocal response that is controlled by a verbal stimulus that does not produce a sound.	Reading a text out loud.
Autoclitic	A verbal response which modified the functions of other forms of verbal behavior.	A person saying *I think I need to go to the toilet* will be responded with another person taking or pointing him/her to the toilet.

Note. Cited from Verbal Behavior (Skinner, 1957).

CHAPTER II

AAC Interventions for Children with Developmental Disabilities

This chapter will discuss AAC interventions for children with DD. There will be three AAC modes that will be highlighted, the same modes that were used in the studies in this thesis, which were MS, PE, and SGD. Tangible Symbols (TS) will be briefly discussed because, although it is recorded in the literature as one of the AAC system that is used for children with DD, the author did not use this system in the studies. Hence more emphasis was put on MS, PE, and SGD. This chapter will firstly present a general discussion about AAC interventions for children with DD, followed by further explanations of three specific AAC modes, the arising need for providing children with DD to choose which AAC mode they prefer, and lastly a systematic literature review of studies that involved teaching children with DD to use these three types of AAC modes.

Severe communication impairment is defined as a condition in which speech is inadequate (either temporarily or permanently) to meet all of the individual's communication needs, and the condition is not a result of a hearing impairment (American Speech-Language-Hearing Association, Ad Hoc Committee on Communication Processes and Non-speaking Persons [ASHA], 1981). Even if speech occurs, it is usually marked by one or more speech impediments, such as echolalia, a monotonous tone or intonation, or idiosyncratic language (American Psychiatric Association, 2013; Kanner, 1943). Children who develop very little or no spoken language are potential candidates for AAC interventions (American Speech-Language-Hearing Association, 2005).

Augmentative and Alternative Communication

There are a wide variety of AAC systems (Mirenda, 2003), which can be used either temporarily or permanently by individuals with significant communication impairments. These systems have been categorized as unaided and aided. Unaided communication techniques do not require additional equipment external to the body. This includes MS, pantomimes and gestures (Mirenda, 2003). Aided communication involves apparatus or devices external to the body. A few examples of aided communication are pictures or photographs, TS, communication books, and SGDs (Mirenda, 2009b).

Additionally, TS have also been used in communication interventions for children with DD (Roche et al., 2013). However, the literature only showed limited empirical data on this type of system, compared to MS, PE, and SGD (Wendt, 2009). Indeed, each system (i.e., MS, PE, and SGD) have strengths and weaknesses which therefore might affect the likelihood of individuals with communication impairments adopting it as their communication system (Mirenda, 2003).The following sections will describe each of these AAC systems.

Manual Sign

There are different types of MS used worldwide, such as American Sign Language, New Zealand Sign Language, and Makaton, to name a few. Grove and Walker (1990) explained that Makaton (which they referred to as Makaton Vocabulary) was initially designed in 1972, and was targeted for deaf adults that had severe learning difficulties. Viability assessments on Makaton showed promising results which allowed further growth of this AAC system in two significant areas. Firstly, the use of Makaton expanded from using just speech

and manual signs to involving a set of graphic symbols. Secondly, the target user for this AAC system were not limited to only deaf adults with severe learning difficulties, but also children and adults with ID, ASD, specific language disorders, individuals with multiple sensory impairments, and people with neurological disorders and severe communication impairments.

A recent review on studies that included MS for individuals with DD was conducted by Wendt (2009). Wendt (2009) conducted an updated literature review of a previous meta-analysis (Wendt, 2007) and literature reviews (Schlosser & Wendt, 2008a, 2008b). The studies in the review by Wendt (2009) were evaluated based on the certainty of evidence related to the quality of the study and by calculating their effect sizes.

Wendt (2009) identified 21 experimental studies (18 single-subject experimental designs and 3 group designs) in his review. The target skills in the studies were mostly (n = 14) to teach MS or gesture, two of the studies compared the effects of simultaneous communication versus sign alone and/or speech, and one study focused on the effects of different instructions in teaching MS. The overall result of this review suggested that MS and gestures are considered as highly effective alternative communication systems for individuals with limited speech.

Blischak et al. (1997) suggested several potential advantages of MS. For example, it is readily used because the individual is not dependent on external resources to use this system, which means the individuals adopting this AAC mode can use their arms and hands to communicate. Further, it is inexpensive, portable, and quick to use. Other advantages of MS were proposed in other

studies (Sundberg, 1993; Sundberg & Partington, 1998). Firstly, MS may be easier to learn compared to learning speech. Individuals with limited speech may have significant difficulties in speaking verbally, but would more likely to be able to copy gestures or movements. Secondly, prompts (mostly physical prompts) are easier to be applied (and faded) in the case of teaching an individual to learn motor behaviors. In contrast, providing prompts for vocalization might be difficult especially if an individual does not have a strong vocal imitative repertoire. Thirdly, MS was considered to be less demanding on abstract understanding abilities because it uses concrete gestures, as opposed to speech that heavily relies on verbal memory (Sundberg & Partington, 1998). Lastly, individuals with limited speech might have negative experiences that they cannot overcome as the result of prolonged failed attempts to learn speech (Sundberg & Partington, 1998). In this case, MS can act as an alternative mode of communication, and its stark difference from speech (i.e., using motor movements instead of vocalization) might encourage these individuals to learn it.

However, there are potential limitations of MS that have been suggested in previous research (Blischak et al., 1997; Tincani, 2004; Weitz, Dexter, & Moore, 1997). For example, Blischak et al. (1997) and Tincani (2004) suggested that individuals with limited control of their motor skills might find difficulties in producing intelligible manual signs that mostly require movements in the upper body, arms and hands. Further, Blischak et al. (1997) and Weitz et al. (1997) suggested that the communication partner should be trained to understand MS. Children with severe learning difficulties have problems in processing, retaining, and recalling information and since MS requires these skills, the acquisition and

level of proficiency of children with such characteristics could be limited (Grove & Walker, 1990; Iacono & Duncum, 1995; lacono, Mirenda, & Beukelman, 1993).

Picture Exchange

PE can be described as handing over a picture/symbol to a communication partner in exchange for the item associated with the picture/symbol (Frost & Bondy, 2002). One of the most used type of PE was proposed by Frost and Bondy, which is referred to as Picture Exchange Communication System ([PECS] Bondy & Frost, 1994). This communication system follows several systematic protocols in teaching communication skills (see Table 2.1). The criterion for each phase is 80% correct (i.e., independent responses that were not prompted).

It has been suggested (Bondy & Frost, 1994) that more people might be able to comprehend this type of communication system even without prior training because the pictures/symbols are usually similar to the actual item. Further, Frost and Bondy have provided evidence that children with ASD can be taught to use this system. In the same study, data has shown a rapid rate of acquisition and self-initiated response using this system. However, other research has suggested potential limitations of PE interventions, such as expandability, portability (Sigafoos & Iacono, 1993), and readiness (Wilkinson & McIlvane, 2002), because this system requires preparation of the pictures (making and searching) prior to the individual using it.

Preston and Carter (2009) presented a systematic review which was specifically targeted on the efficacy of PECS (Bondy & Frost, 1994; Frost &

Bondy, 2002). This review involved 27 studies, spanning from 1992 to 2007, with a total of 456 participants (aged 20 months to 40 years old, and 83% were reported to have the diagnosis of ASD). The majority (n = 14) of the studies employed single-subject designs, pre-experimental designs were adopted by eight studies, quasi-experimental group studies were conducted in two studies, and three studies used randomized controlled trials. Most of the targeted skills were mands (i.e., requesting). Generalization of PECS skills (e.g., to different settings, people, or stimuli) were conducted in 15 studies. Maintenance was only assessed in five studies, two of which employed long-term follow-up. Social validity was reported in four studies. Results suggest positive findings supporting the efficacy of PECS (i.e., target skills were acquired) for children and adults with ASD and other related DD that have limited speech. However, the results of this review must be interpreted carefully. There were limitations in the methodology of the studies (i.e., limited descriptive and experimental control, and lack of procedural reliability). Other limitations include the low number of studies that conducted maintenance and generalization assessments, and the low number of studies that compared PECS with other AAC systems to examine the relative level of effectiveness.

Table 2.1.

Protocols of PECS

Protocol Phase	Goal
I. Physical exchange	This phase is aimed towards teaching an individual to exchange a picture of a preferred item (i.e., food items, leisure activities, or a break) with the trainer in a close proximity. This phase includes full-physical prompting (i.e., hand-over-hand prompting), fading of physical prompts, and fade of the open hand cue by the trainer.
II. Expanding spontaneity	The goal of this phase involves increasing the distance between the user and the trainer, and between the user and the picture book.
III. Picture discrimination	This phase aims to teach the user to select the preferred item from a range of other pictures (i.e., distractor) and to give said picture to the trainer for an exchange of the preferred item. This phase involves correspondence training and reducing the size of the pictures and/or label of picture.

Table 2.1. – *Continued*

Protocol Phase	Goal
IV. Sentence structure	The target skill for this phase involves making a request by building a short sentence. In this particular case, the sentence would be selecting the picture of I WANT, putting it on a sentence strip, followed by selecting the picture of a preferred item and putting it on the same sentence strip, then handing over the sentence strip to the trainer.
V. Responding to the question *What do you want?*	This phase involves implementing zero second delay, gradually increasing the delay, and reducing gesture prompts.
VI. Commenting	Commenting can involve responding to a question or spontaneous commenting and requesting.

Note. Cited from Frost and Bondy (1994).

Speech-generating Devices

The potential limitations of both MS and PE address the need to find a system that is compact, easily understood by the communication partner, has a large repertoire of vocabulary and can be easily tailor-made to suit the children's needs (Sennot & Bowker, 2009; Shane et al., 2011). SGDs, or sometimes also known as Voice Output Communication Aids (VOCA), are considered to be a promising system to answer the limitations of the previous AAC modes (Schlosser & Blischak, 2001). An SGD is defined as an electronic device with a display that contains various symbols. Selecting the symbol results in synthesized or digitized speech output. Synthesized voice output means that the voice output is a text-to-speech sound produced by software. Digitized voice output means that pre-recordings of messages are produced. Digitized voice output might sound more like natural speech, whereas synthesized voice output might come across as sounding monotone. However, an SGD with synthesized voice output may allow the user to change the tone of voice, instantly create different sentences or words by typing them, which provides flexibility and freedom to be used in different settings. This flexibility is not offered by an SGD with digitized speech output. There are also different types of SGD displays, such as fixed, and dynamic. Fixed display is usually a type of low-tech SGD, in which the display is restricted into a particular format. An example of this type of SGD is GoTalk20+. Dynamic display is usually involves a touch screen display. When the user presses an icon the device can then show a different screen, or the user can scroll up or down the screen to locate a certain icon. Examples of this type of SGD are iPod Touch® and iPad® with communication software.

Besides the voice output and display, SGD is also differentiated in terms of dedicated and non-dedicated. Dedicated SGD is described as devices that are designed solely for the use as a communication aid. Examples of dedicated SGDs are Tech/Talk 6X8, BigMack, GoTalk, DynaMate, and Dynavox. Non-dedicated SGDs are generally computers that are installed with AAC software. Hence they might serve different functions, such as a media player, navigation device, or learning device, that are often found in iPod Touch®- and iPad®-based SGD.

Although the idea of using electronic speech output as a communication aid for children with DD was first introduced in the 1970s by Colby and colleagues at Stanford University (Mirenda & Iacono, 2009), a review by Schlosser and Blischak (2001) suggests that this AAC system only started to receive more attention in the 1990s. In the current technology era, more efforts are made towards providing an electronic and portable AAC mode for children with ASD (Sennot & Bowker, 2009).

van der Meer and Rispoli (2010) identified 23 studies with a total of 51 children with ASD and 14 different SGDs that were used across the studies (i.e., Tech/Talk 6X8, BigMack, GoTalk, Clicker 3, Cheap Talk 4 Inline Direct, LightWRITER SL35, SpeakEasy, Introtalker, Four Button Touch Talk Direct, Black Hawk, The Vantage, Mini-message MATE Words+, DynaMyte and Talara-32). The targeted skills in the studies included requesting, commenting, answering questions with yes or no, spelling, reducing perserverative requesting and irrelevant speech, and other communicative behavior (e.g., gestures, engaging in conversation, turn-taking, etc.). Post-intervention follow-up was conducted in seven studies, varying from 1 week up to 1 year after the

intervention finished. Findings of the review suggested that: (1) most of the studies were focused on teaching the participants to make a request, (2) maintenance is considered as an important factor of the intervention, and (3) increasing numbers of studies focusing on assessing the child's preference for using one AAC system over another. This review provided evidence that supports the use of speech-generating devices in intervention programs for children with ASD.

The use of portable electronic devices is becoming more popular in the community (McNaughton & Light, 2013), and there is evidence to suggest that this phenomenon also applies to the field of AAC. A recent review that specifically focused on studies that involved iPod®- and iPad® as a communication aid (Alzrayer, Banda, & Koul, 2014) suggested positive results in using these devices to teach individuals with DD communication skills. This review also looked at the participants' ability to maintain and generalize the acquired skills. There were 15 studies that were included in this review, consisted of 52 participants (age three to 23 years). The majority of the studies (*n* = 12, or 80%) focused on manding as their target skill, while the remaining studies targeted tacting. Results suggested that iPads® or iPods® were highly effective in increasing communication skills and decreasing challenging behavior in individuals with DD. There were only three studies that reported generalization probes in this review, and all reported positive results in using these devices for different stimuli and settings.

Positive findings from the body of literature might suggest that SGDs can be an effective communication aid for individuals with DD.

Tangible Symbols

Tangible symbols (TS) comprises of three-dimensional permanent object(s) that can be manipulated and touched to communicate a message (Rowland & Schweigert, 1989). This system may involve: (a) real (whole) objects, (b) miniature objects, and/or (c) parts of the real object (Beukelman & Mirenda, 2013). TS is similar to PE in its utilization, in terms of exchanging the object to communicate. However, there does not seem to be a systematic protocol for teaching TS, such as in PECS (Bondy & Frost, 1994).

A systematic review of studies using TS in AAC interventions for children with DD was conducted by Roche et al. (2014). This review focused on the use of TS as a communication aid for individuals with DD. There were nine studies, spanning from 1989 to 2013, with a total of 129 participants (aged 3 to 20 years old) that were included in this review. The participants had a mixture of DD, ID, and/or visual impairments. All of the studies focused on teaching requesting skills using experimental designs. Results of the review summarized that with intervention, a little over half of the total participants (n = 70, or 54%) in the studies acquired the target skill, which was functionally using TS as a mode of alternative communication, to make a request. However, it must be noted that several of the studies in the review had some methodology limitations, specifically in controlling the effects of the intervention (or lack thereof), hence the results have to be interpreted with caution.

Overall, all of these systems have their strength and weaknesses (see Table 2.2), and therefore it is an important task to be able to find a system that is best-suited for the individual that will use it, specifically, in this case, children

with DD. It has been argued that extrinsic factors (i.e., modalities, devices and instructional systems) might have an impact on the ability to develop communication skills for non-verbal children (Romski, Sevcik, & Adamson, 1997). With the broad range of AAC options available for children with DD we are led to an important question that has both theoretical and applied implications; which system is best suited to the needs of, most effective for and preferred by children with DD and their communicative partners? In order to answer this question, previous research has been designed to compare these AAC systems as explained below.

Studies Evaluating the Comparative Efficacy of AAC Systems

One way to provide evidence on which AAC system is most effective is through comparative studies (Kennedy, 2005). However, finding the most effective and efficient intervention is not as simple and easy as it may sound (Ogletree & Harn, 2001; Sevcik, Romski, & Adamson, 1999). Studies have shown mixed results, which continue to spark debate in the literature.

Table 2.2.

Features of MS, PE, SGD, and TS.

Variable	MS	PE	SGD	TS
Definition	A language that consists of a structured system of hand(s) and finger(s) shapes, along with arm(s), hand(s), and finger(s) movements.	Handing over a picture/symbol to a communication partner in exchange for the item associated with the picture/symbol.	An electronic device that translates symbols into synthesized or digitized speech output.	Three-dimensional permanent object(s) that can be manipulated and touched as an alternative communication.
Administration	Communication is established by making gestures using fingers, hands, and arms movement as a representation	Communication is established by exchanging a picture/symbol that represents an item/activity with a	Communication is established by the speaker pushing an icon on the SGD monitor that is programmed to	Similar to PE.

Table 2.2. – *Continued*

Variable	MS	PE	SGD	TS
	of a letter or word.	communication partner to obtain said item/activity.	produce a speech output.	
Aided (needs an apparatus external to the body) or Unaided (does not need an apparatus external to the body)	Unaided	Aided	Aided	Aided
Learning demands	Requires relatively high learning demands, because the speaker would have to memorize the gestures for each	Relatively low, the speaker only needs to learn to exchange the picture/symbol. The speaker can use pictures/symbols that	Relatively low, the speaker only needs to learn to press an icon on the device. Similar to PE, less memory recall is	Relatively low, similar to PE, the speaker only needs to learn to exchange the symbols/objects with the listener.

Table 2.2. – *Continued*

Variable	MS	PE	SGD	TS
	letter or word.	are already available, hence does not need a lot of recall effort. Additional skills that are required are: correspondence (between the picture/symbol with the actual object, discrimination of picture/symbols, and locating the picture book.	needed (compared to MS) because the pictures/symbols are already available on the device. Similar to PE, additional skills that are required are: correspondence, discrimination, and navigating through the device.	Requires less memory recall (compared to MS) because the speaker uses symbols/objects that are already available. Additional skills that might be required are: correspondence, discrimination, and locating the symbols/objects.

Table 2.2. – *Continued*

Variable	MS	PE	SGD	TS
Physical size and portability	None required	A picture book might be somewhat bulky and heavy to carry around, which would cause negative impact portability. Flicking through a picture book to find the correct picture might be time consuming.	The latest SGD devices (i.e., iPod Touch and iPad) are relatively compact and light, because they were designed to be portable devices. The speech output allows for the speaker to communicate in large areas and/or which the listener might be located at a distance or not attending to the speaker.	Symbols/objects might take up space and can be heavy to carry around, which would not be as portable as MS or SGD. Additionally, carrying around a lot of different symbols/objects would be less efficient.

Table 2.2. – *Continued*

Variable	MS	PE	SGD	TS
			Does not cause a stigma to the speaker because of its popular and high-tech features.	
Readiness of system	Dependant on memory recall.	The pictures/symbols will need to be made prior to using them, which can be time consuming. Dependant on availability of picture/symbol, which might cause potential	The pictures/symbols might already be in the SGD repertoire. In cases where the picture/symbol is not available, it will have to be programmed. Programming the SGD can be time	The symbols/objects will need to be made prior to using them, which can be time consuming. Dependant on availability of symbols/objects, which might cause

Table 2.2. – *Continued*

Variable	MS	PE	SGD	TS
		communication breakdown if the picture/symbol is not available.	consuming. Dependent on battery, which might cause communication breakdown should the battery run out of power. Dependent on device, which might cause potential communication breakdown if the device is broken.	potential communication breakdown if the symbol/object is not available.

Table 2.2. – *Continued*

Variable	MS	PE	SGD	TS
Customization	The gestures cannot be changed.	The picture/symbol can use stick drawings, or a picture of the actual item. The picture/symbol can be in color or monochrome.	The device can be programmed to suit the speaker's needs. For example, sentences can be built prior to the use of the device, hence when the speaker presses an icon it can produce a sentence instead of just one word. For advanced users, they can type a sentence and the SGD will produce the	The symbol can be real objects, miniature objects, or parts of the real object.

Table 2.2. – *Continued*

Variable	MS	PE	SGD	TS
			speech output of the sentence. In case of language barrier, the device can be adjusted to match the listener's language. May serve multiple functions, such as for leisure, visual tasks, academic aid, etc.	

Table 2.2. – *Continued*

Variable	MS	PE	SGD	TS
Required skills	The ability to move fingers, hands, and arms in such a way so that the speaker would be able to produce intelligible gestures. In other words, individuals with limited arms, hands, and fingers movements might find difficulties in producing intelligible gestures.	A little fine motor skill to be able to select/pull the picture/symbol from the picture book, and mostly gross motor skills to hand the picture/symbol over to the listener.	A little fine motor skill to be able to push the icon on the SGD screen.	Similar to PE, depending on the size and shape of the object.

Table 2.2. – *Continued*

Variable	MS	PE	SGD	TS
Skills required by communication partner	Previously trained to be able to understand MS.	Does not need previous training.	Does not need previous training.	Does not need previous training.
Distance between speaker and listener	The speaker and listener will have to be in close proximity and within line of sight with each other to so that they would be able to see the gestures made by the speaker.	The speaker and listener will have to be in close proximity to each other so that the speaker can make the exchange of picture /symbol with the listener.	The speaker and listener do not necessarily need to be in close proximity or within line of sight with each other.	The speaker and listener will have to be in close proximity to each other so that the speaker can make the exchange of symbol with the listener.

The debate in the literature as to which AAC system is most effective continues, as positive results were found both in studies using PECS and SGDs. Therefore, other means have been carried out to determine which of these systems is more efficient. Specifically, assessing acquisition rates can also be an effort to find which AAC mode is more efficient (Kennedy, 2005). Efficient intervention may be measured by the time required to teach a targeted skill (or for the child, to learn a targeted skill) which can be measured by comparing acquisition rates between intervention programs. Lancioni et al. (2007) reviewed four studies (11 participants in total) that focused on comparing the acquisition rates between PE and SGD in teaching the participants to make a request for preferred items. The participants had one or some of the following characteristics: severe to profound ID, spina bifida, cleft palate, hydrocephalus, unspecified developmental delay, autism or PDD. Findings suggested that all of the participants acquired the targeted skills at similar rates for both systems. These findings suggest that based on the acquisition rate, interventions involving PE and SGD are equivalently efficient to teach children with ASD to request preferred items.

Other studies that involved assessing preference for AAC systems in their experimental designs (van der Meer et al., 2012a, 2012b) have provided evidence that the participant's preference for a specific AAC mode may decrease the amount of time to learn the targeted skills, therefore making the intervention program more effective and efficient.

AAC System Preference

Parmenter (1988) argued that one's quality of life can be enhanced by providing the power to make a choice from several available options. A child's preference might therefore be an important aspect to take into account when choosing an intervention for children with DD (Mirenda, 2009a; Stancliffe, 2001). This could be viewed as a type of self-determination, which is described as the individual's ability to self-sufficiently make a choice (Field, Sarver, & Shaw, 2003; Stancliffe, 2001). This idea is also aligned with one of the goals in educating individuals with DD which addresses the need to provide such individuals greater autonomy, independence, and self-determination (American Association of Mental Retardation, 1992). It has been suggested that a high level of self-determination will allow an individual to gain more control of their lives (Field, Martin, Miller, Ward, & Wehmeyer, 1998), which in turn could result in a better quality of life. In regards to choosing an AAC system for a young non-verbal child with DD, therefore, practitioners, caregivers and teachers might seek to assess the child's preference as to which system he or she wants to use.

van der Meer, Sigafoos, O'Reilly, and Lancioni (2011) reviewed 7 studies that included 12 participants who had a DD diagnosis and involved individual preference probes between two AAC systems. The AAC interventions used in these studies were MS, PE, and SGDs. Results suggested that 67% (n = 8) of the participants showed some degree (AAC system selected ≥ 55% of choice opportunities) of preference for using SGDs, compared to 33% (n = 4) of participants who showed some degree (≥ 55%) of preference for using PE to communicate. The participants in the studies reviewed by van der Meer et al. (2011) did not show a preference for MS. Therefore, it can be suggested that

individuals with DD might show a preference for using a certain AAC system, highlighting the importance of giving children with DD the opportunity to exert some self-determination in the AAC intervention.

Whilst the review by van der Meer et al. (2011) suggested that children with DD seem to show a preference for one device over the other(s), there are still gaps that need to be explored in future research. For example, there were no reports of directly comparing MS, PE, and SGD in the same study. Also, only one of the studies in the review (i.e., Soto, Belfiore, Schlosser, & Haynes, 1993) involved assessing maintenance of the acquired skills and findings of this study shows a decrease in performing the target behavior. Therefore further research with more control is needed to explore maintenance of the acquired skills to use manual sign, picture exchange and speech-generating device.

A recent study (van der Meer et al., 2012b) has provided empirical evidence on how the participant's preference impacts the proficiency of a communication intervention. Four children with DD (5 to 10 years of age) were involved in learning the skills to request preferred items using an SGD (i.e., iPod Touch®) and with MS. The experimental design employed multiple-probes across participants and alternating treatments. The aim of the study was to compare the acquisition rates and preference of the two AAC modes. All participants acquired the skills to use the SGD whilst one failed to learn MS. Preference assessments suggested that three out of four participants chose to use the SGD over MS. Findings of this study support previous studies that have highlighted the importance of the child's preference of an AAC system, arguing

that their choice of system will have a positive impact on their proficiency and maintenance of the acquired skills.

In another study, van der Meer et al. (2012a) focused on directly comparing MS, PE, and an iPod®-based SGD. They used the same teaching strategies for all the AAC modes and assessed the acquisition rates, maintenance and preference of AAC systems. The study involved four children (6 to 13 years of age) with DD and focused on teaching a general request for a preferred item (i.e., requesting snacks or play time). A multiple baseline and alternating treatments design was used. This study also employed multiple probes to assess device preference during intervention. Results of acquisition training indicated that all four participants learned to use PE and SGD, but two failed to learn MS. Preference assessments showed that three participants more frequently chose to use the SGD, whilst one of the participants showed more preference in the PE system.

The study by van der Meer et al. (2012a) suggested that by adopting systematic teaching strategies some children with DD can be taught to use three different AAC systems (i.e., MS, PE, and SGD) to make a general request for a preferred item. Secondly, similar to previous findings, participants showed a preference for using one mode and were more proficient in using the system the preferred.

Although van der Meer et al. (2012a) suggested some critical points in the field of AAC systems and DD, there are some limitations in their study. First, they did not apply a long-term follow-up to assess the maintenance of the acquired skills and explore the stability of the participants' preference for a

certain AAC option. Second, they did not assess social validity of the AAC systems. These limitations should be addressed in future research. The preference probes that were conducted in the early stages of the intervention might raise some concerns, because it may not be suffice to suggest that a participant showed preference in a system that they have not yet mastered the use of. Further, the literature of choice assessment suggests that preference does change over time (Stafford, Alberto, Fredrick, Heflin, & Heller, 2002). Hence, it would be of value to assess the individual's preference for AAC system over the long term.

There appears to be two trends that are emerging in the field of AAC research (Sigafoos, O'Reilly, Lancioni, & Sutherland, 2014), which are: (1) use of new technology; and (2) comparison studies of different AAC systems. The use of new technology involves the use of portable and high-tech SGD, such as iPads®, smartphones, and other tablet devices. Comparison studies have also become more common, which might be due to the need of finding an AAC system that is most effective and preferred by the user. Variables that have been compared are acquisition rates to learn the target skill(s), maintenance of performance in using the system, and preference for system. These trends warrant a systematic review of this literature which focuses on comparison of AAC system for children with DD.

Systematic Literature Review of Studies Comparing AAC Systems for Children with Developmental Disabilities

This systematic review was focused on assessing the purpose, methodology that was used, and findings in studies that involved comparing the

use of two or more AAC systems (i.e., MS, PE and/or SGD) to teach children with DD new communication skills. Specifically the review will also evaluate child preference for using one AAC system over another (if any), long term follow-up (if any), and social validation of the AAC systems (if any). It was expected that the findings from this literature review would illustrate evidence of effectiveness of these three AAC modes and trends in this field of communication intervention. Findings of this review will also address gaps in the literature and identify areas that need to be addressed in future research.

Method

Search procedures. A systematic search was conducted by the author in four electronic databases, namely: PsycINFO, ERIC, Linguistics and Language Behavior Abstracts and ProQuest. The search was limited to English-language journal articles that were peer-reviewed and published in scholarly journals. The age of the participants were limited to children; i.e., from 0 – 12 years of age. The search did not put a restriction on the publication year and therefore covered all the dates in the aforementioned databases up to October 2013 (when the search was conducted). The "Advanced Search" option was selected and the keywords "AAC", "Developmental Disabilities" and "Children" were entered in the "Anywhere" field for all of the databases. The abstracts of the records that were returned from the electronic database search were then reviewed by the author against the inclusion criteria to determine which studies would be included in the review (more details on the inclusion criteria can be found in the following section of this chapter).

Three further search strategies were implemented to find other relevant studies that may have been missed from the electronic database search. First, the author browsed the reference list of the studies that were included in the review to find other possible relevant articles (i.e., reference search). The second additional search was done by hand searching the journals that published the articles that were included in the review (i.e., journal search). Lastly, another electronic database search was conducted by typing in the names of authors included studies in the search field, covering all four electronic databases that were used in the previous search (i.e., author search).

Screening and inclusion criteria. To be included in this review, the article had to be: (1) a published peer-reviewed research study; (2) included children (0-12 years of age) with diagnoses with DD (specifically, ASD and/or ID); (3) involved comparing two or more AAC systems (i.e., SGD, MS, and/or PE); (4) examined the effects of an intervention involving such AAC systems. Specifically, intervention is defined as implementing one or more therapeutic/teaching procedures for the purpose of trying to increase or improve the child's communication skills or abilities through the use of MS, PE, and/or SGD. For examples, teaching a child to use the AAC mode(s) to: (a) make requests, (b) spell words, or (c) repair a communicative breakdown; and (5) included reports of empirical data on the effectiveness of the intervention. In total there were 18 articles for inclusion in this review.

The initial search of the four electronic databases resulted in 114 articles in total. After the abstracts of the articles were checked against the inclusion/exclusion criteria, five articles met the inclusion criteria for this review.

Four additional articles were identified in the reference list search. One additional article was identified in author search. No additional articles met the inclusion criteria from the journal search. From this combination of search procedures, the author found 10 articles that were potential to be included in the systematic literature review. There were eight additional articles that were added to the review as the result of personal communications between the author with J. Sigafoos (November 28, 2013) and L. Roche (February 17, 2014). Therefore a total of 18 studies were included in the present review.

Data extraction. Records that were returned from the electronic database and manual search were evaluated by the author against the inclusion and exclusion criteria. The articles that were included in the review were then coded based on: (1) participants' descriptions (e.g., age, gender, number and diagnosis); (2) settings of study; (3) AAC mode used (e.g., MS, PE, or SGD); (4) research design; (5) skills taught in the study, (6) intervention procedures, including follow-up sessions (if any), preference assessment (if any), (8) social validation (if any), (8) quantitative outcomes of the intervention; and (9) reliability and treatment integrity.

The outcome of the studies were ranked in three categories (Lang et al., 2012): (a) positive outcome, which meant the target skill(s) were reached due to the intervention; (b) negative outcome, which meant the intervention did not help the participant(s) to reach the target skill(s); and (c) mixed outcome, which meant that with intervention only some of the participants learned the target skills.

Inter-rater agreement. The author made a summary of the articles (see Table 2.3) that were reviewed by an independent observer to check against the inclusion/exclusion criteria to assess inter-rater agreement on this literature review. The independent reviewer also assessed the clarity of the descriptions of the (1) purpose, (2) characteristics of participants, (3) research design, and (4) certainty of evidence and outcomes of each study. Upon review, there was 100% agreement between the author and independent reviewer on the inclusion of the 18 articles. Minor adjustments (i.e., grammatical changes) were made on the description of the studies.

Results

Table 2.3 provides a summary of the purpose, characteristics of participants, experimental design, and outcomes for each of the 18 studies that were included in the literature review. The studies were sorted based on the dates they were published so that it would help illustrate the trend in the literature of AAC interventions for children with DD.

Table 2.3.

Summary of the Studies on AAC Interventions for Children with DD

Study	Purpose	Participants	Research Design and Certainty of Evidence	Outcomes
Iacono, Mirenda & Beukelman (1993)	To compare the effectiveness of unimodal (speech+sign) vs multimodal (speech+sign+VOCA) AAC techniques.	Two boys with ID (3 years 6 months and 4 years 6 months).	Single-subject, multiple baseline, alternating treatment designs. Conclusive.	Positive; Intervention resulted in increased spontaneous production of targeted 2-word combinations. Acquisition rate: 1 participant acquired multimodal faster, the other did not show difference in acquiring the skills between uni- and multimodal AAC techniques.
Taylor & Iacono (2003)	To compare the effects of speech+sign vs speech+sign+VOCA in	One boy with diagnoses of mild ID and severe	Single-subject, multiple baseline, alternating treatment	Mixed; Positive improvements in communication was evident when

Table 2.3. – *Continued*

Study	Purpose	Participants	Research Design and Certainty of Evidence	Outcomes
	A naturalistic intervention approach to play.	communication impairment (3 years 6 months).	design. Conclusive.	speech+sign+VOCA was used compared to speech+sign alone.
Tincani (2004)	To compare the effects of PECS and MS on the acquisition of making requests for preferred items and examine the students' acquisition of vocal behavior using each systems. To assess social validity of the intervention.	One boy with diagnoses of ASD and ID (5 years 10 months) and one girl diagnosed with PDD-NOS (6 years 8 months).	Single-subject, non-concurrent baseline, alternating treatment design. Conclusive.	Mixed results; Both participants initially acquired PECS more rapidly than MS but after 1 participant received modified MS training, performance in MS increased, performance in PECS decreased. Vocalization rate was higher for 1 participant on MS and higher for the other participant on PECS.

Table 2.3. – *Continued*

Study	Purpose	Participants	Research Design and Certainty of Evidence	Outcomes
Bock et al. (2005)	To compare the effectiveness (i.e., acquisition rates & generalization) and preference between PECS and VOCA.	Six boys, all non-verbal with diagnoses of DD (all 4 years-old).	Single-subject, non-concurrent baseline, alternating treatment design. Preference was assessed. Conclusive.	Positive; Three children (50%) acquired PECS faster than VOCA; Five participants (83%) generalized PECS and VOCA in different environment. Preference: Two children (33%) showed preference in VOCA, three (50%) preferred PECS.
Son et al. (2006)	To compare acquisition and preference for two types of AAC systems (i.e., PE and VOCA)	Children with diagnoses of ASD or a related DD with limited	Single-subject, non-concurrent baseline, alternating treatment design.	Positive; Acquisition rate: little difference between PE and VOCA. Preference: Two children

Table 2.3. – *Continued*

Study	Purpose	Participants	Research Design and Certainty of Evidence	Outcomes
		speech and no physical disabilities; 2 girls (aged 5 years 5 months and 3 years 8 months, respectively) and 1 boy (aged 3 years old.	Preference for AAC system was assessed using s systematic a choice-making paradigm. Conclusive.	consistently preferred PE and the third showed preference for the VOCA.
Beck et al. (2008)	To compare Picture Exchange Communication System (PECS) and a Voice Output Communication Aide (VOCA) to make a	Three preschool boys (age not specified; two diagnosed with ASD and 1 with PDD-NOS). The	Single-subject, non-concurrent baseline, alternating treatment design. Preference for AAC was assessed.	Positive; Acquisition rate: participants learned PECS in a relatively short time period Preference: mixed; 1 boy preferred VOCA.

Table 2.3. – *Continued*

Study	Purpose	Participants	Research Design and Certainty of Evidence	Outcomes
	request of a preferred item.	children had limited speech and did not use an AAC system as a communication device.	Conclusive.	
Cannella-Malone et al. (2009)	To assess the preference of AAC system (PE vs SGD).	One boy diagnosed with significant ID (11 years old).	Single-subject, multiple-probe (across AAC systems) design. Preference for AAC system was assessed using a free-operant	Positive; The participant was successful in acquiring basic use of all three devices to make a request and make a correspondence between the picture icon and item requested. The second phase involved functional

Table 2.3. – *Continued*

Study	Purpose	Participants	Research Design and Certainty of Evidence	Outcomes
			paradigm. Conclusive.	uses of the device (i.e., retrieve, turn on, and use the device). Preference: a clear preference for the Cyrano Communicator.
Winborn-Kemmerer et al. (2009)	To assess the preference for mand topography between microswitch vs picture card.	One boy with PDD (aged 7 years old).	Single-subject, non-concurrent baseline, alternating treatment design. Preference for mand topography was assessed within a concurrent-	Positive; The two novel mand topographies proved to be effective in reducing problem behavior. Preference: The participant showed clear preference for picture card.

Table 2.3. – *Continued*

Study	Purpose	Participants	Research Design and Certainty of Evidence	Outcomes
			schedules design. Conclusive.	
Flores et al. (2012)	To compare communication behaviors between and preference for iPad® vs PE. To assess social validation.	Five boys diagnosed with ASD (aged 3.8, 4.1, 4.3, 5.4, and 5.9 years old).	Single-subject, non-concurrent, alternating-treatment design. Preference was assessed. Conclusive.	Mixed; Communication behaviors either increased when using the iPad® or remained the same as when using PE. Preference: no clear preference.
van der Meer, Didden , et al. (2012)	To compare acquisition, maintenance and preference between SGD, PE and MS to make a general request for preferred items.	Two boys (age 12 years old, diagnosed with ASD; another aged 6 years old, diagnosed with	Single-subject, multiple-probe (across participants), alternating treatment design.	Mixed; Acquisition: All three children mastered SGD and PE but only two mastered MS. Preference: Three participants chose SGD more frequently,

Table 2.3. – *Continued*

Study	Purpose	Participants	Research Design and Certainty of Evidence	Outcomes
		ID), and 1 girl (aged 10 years old, diagnosed with DD).	Preference for AAC system was assessed using a systematic choice-making paradigm. Conclusive.	one chose PE more frequently.
van der Meer, Kagohara , et al. (2012b)	To compare acquisition rates and preference for using an SGD vs MS as AAC options.	Four boys that had diagnoses of ASD or relevant DD (age 10, 7 and two age 5.5 years old).	Single-subject, multiple-probe (across participants), alternating treatments design. Preference for AAC system was assessed using a	Mixed; Acquisition: All participants mastered SGD but only three mastered MS. Preference: Three participants preferred SGD while the remaining participant preferred MS.

Table 2.3. – *Continued*

Study	Purpose	Participants	Research Design and Certainty of Evidence	Outcomes
			systematic a choice-making paradigm. Conclusive.	
van der Meer, Sutherland, et al. (2012)	Comparing acquisition and preference of three AAC systems (SGD, PE, and MS) in making specific requests.	Three boys with ASD and ID (4, 10, and 11 years), and 1 boy with ASD (4 years).	Single-subject, non-concurrent multiple-baseline, alternating treatments design. Preference for AAC system was assessed using a systematic a choice-making paradigm. Conclusive.	Mixed; Three participants learned to make specific requests using MS, PE, and SGD. One participant only learned PE. Preference: two preferred PE, two preferred SGD.

Table 2.3. – *Continued*

Study	Purpose	Participants	Research Design and Certainty of Evidence	Outcomes
Boesch et al. (2013a)	To compare the effectiveness of PECS vs SGD in teaching requesting skills. To assess social validation.	Two boys (6 and 10 year old), and 1 girl (7 year) with diagnoses of severe autism with little to no functional speech.	Single-subject design, multiple baseline (across participants), alternating treatments design. Conclusive.	Positive; Increase in requesting behavior for all participants across intervention phases with both AAC modes with no significant differences between PECS and the SGD for any participant.
Boesch et al. (2013b)	To compare the effectiveness of PECS vs SGD on social-communicative skills	Two boys (6 and 10 year old), and 1 girl (7 year) with diagnoses of	Single subject, multiple baseline, alternating treatment design.	Mixed results, no clinically-significant differences between PECS and SGD.

Table 2.3. – *Continued*

Study	Purpose	Participants	Research Design and Certainty of Evidence	Outcomes
	and speech development.	severe autism with little to no functional speech.	Conclusive.	
Lorah et al. (2013)	To compare and assess preference between iPad® as an SGD and PE in teaching mands.	Five boys with ASD (3.8, 4.1, 4.3, 5.4, 5.9 years).	Single-subject, non-concurrent, alternating treatment design. Preference for AAC system was assessed using a systematic choice-making paradigm. Conclusive.	Positive; Acquisition: three participants acquired SGD more quickly, and the rest learned PE faster. Performance was higher for four participants using the SGD. Preference: Four participants demonstrated a clear preference for the SGD device and one for PE.

Table 2.3. – *Continued*

Study	Purpose	Participants	Research Design and Certainty of Evidence	Outcomes
Roche et al. (2013)	To compare the acquisition rate in mastering and the preference of tangible symbols, picture exchange, and a direct selection response to access cartoon videos.	Two boys with ASD (11.8 and 9.3 years).	Multiple-baseline (across participants) and alternating treatments design. Preference for AAC system was assessed using a systematic a choice-making paradigm. . Conclusive.	Positive; Acquisition: Both participants learned to access six cartoon videos using the three options at comparable rates. Preference: Both boys most often chose to use tangible symbols.
van der Meer et al. (2013)	To compare acquisition of and preference for SGD, PE and MS in multi-step requesting and social	Two boys with ASD that have previously been taught to use the AAC systems to	Single-subject, multiple baseline, alternating treatments design. Preference for AAC	Positive: Both participants mastered the target responses (two- and three-step requesting responses, greetings, answering

Table 2.3. – *Continued*

Study	Purpose	Participants	Research Design and Certainty of Evidence	Outcomes
	communication.	request for preferred items (10 and 11 years).	system was assessed using a systematic a choice-making paradigm. Conclusive.	questions, and social etiquette responses) to varying levels of proficiency with each communication option. Preference: One participant preferred the SGD and the other preferred PE.
Couper et al. (2014)	To compare acquisition of and preference for MS, PE and SGD to make a request.	Nine children with ASD and limited communication skills.	Single-subject, non-concurrent baseline (across participants), alternating treatments design. Preference for AAC	Mixed: Five children mastered all three systems. Acquisition rate: Four children learned SGD faster compared to MS and PE. Preference: Eight children demonstrated a preference

Table 2.3. – *Continued*

Study	Purpose	Participants	Research Design and Certainty of Evidence	Outcomes
			system was assessed using a systematic a choice-making paradigm. Conclusive.	for the SGD.

Participants. The literature review was focused on AAC interventions for children with ASD and ID, hence some participants had to be excluded from four studies (i.e., Beck, Stoner, Bock, & Parton, 2008; Cannella-Malone, Debar, & Sigafoos, 2009; Winborn-Kemmerer, Ringdahl, Wacker, & Kitsukawa, 2008; van der Meer et al., 2012a) because they did not meet the criteria (i.e., age or diagnosis) of this literature review.

This left a total of 59 participants, with a large proportion of males (*n* = 51 or 86%) compared to females (*n* = 8 or 14%) were involved in the 18 studies in this review. The age of the participants ranged from 3.0 to 12.3 years old (M = 6.8). Specifically, nearly half of the total participants (*n* = 26, or 44%) were aged from 3 to 5 years old. The second highest population were children aged 6 to 8 years old (*n* = 14, or 24%), followed by children aged 9 to 10 years old (*n* = 9, or 15%), and lastly children aged 11 to 12 years old (*n* = 7, or 12%). Beck et al. (2008) did not specify the ages of their three participants, and only stated that they were all in preschool. In terms of diagnoses, more than half of the participants were reported to have a diagnosis of, or related to, ASD (*n* = 33 or 56%), followed by DD (*n* = 8 or 14%), 12% (*n* = 7) had a diagnosis of ASD and ID, 12% (*n* = 7) were diagnosed with ID, and the remaining four participants were diagnosed with PDD-NOS (*n* = 4 or 7%).

In terms of sample size, five studies (27%) had two participants, four other studies (22%) had four participants, three studies (17%) had three participants, two studies (11%) had one participant, another two studies (11%) had five participants, one study (6%) had six participants, and the remaining study (6%) had nine participants.

Settings of study. More than half of the studies (*n* = 10, or 56%) were conducted in school settings, while 28% (*n* = 5) were conducted in a range of settings (i.e., between school, home, and clinical settings), two studies (11%) were conducted in a clinical setting, and the remaining study (5%) was conducted in a home setting.

AAC system used. All of the studies in this review involved a combination of at least two out of four AAC systems, namely SGD, PE, MS, and TS. In terms of the number of AAC systems involved, a large portion of the studies (*n* = 13 or 72%) compared two AAC systems and the other five studies (28%) compared three. Specifically, nine studies (50%) involved comparing SGD and PE, four studies (22%) compared SGD, MS, and PE, three studies (17%) compared SGD and MS, one study (5.5%) focused on comparing MS and PE and the remaining study (5.5%) compared SGD, PE, and TS.

There were six types of devices used in the 17 studies that utilized SGDs. The Apple iPod® Touch with the Proloquo2Go™ application was used most frequently (*n* = 5 or 29%). This was followed by the Apple iPad® that was used in three (18%) studies (one with Pick a Word application and photographs of American Sign Language symbols, another study used the Proloquo2Go™ application, and the remaining study used movies that were downloaded to the device). One study used a Super-wolf[2] device with overlays from Mayer-Johnson Boardmaker (Mayer-Johnson & Company, 1994), one study used a Dynovox™ with Picsyms and Dec Talk voice, one study used a TechTalk 6x8, one study used a Mini-MessageMate and Cyrano Communicator, one study used a micro-switch, two studies used a Go Talk (one study used it with symbols from

Boardmaker, and the other used colored pictures and printed words of the picture above it), two studies used a Logan ProxTalker (one study used the pictures from Picture Communication Symbols, and the other used pictures from Pyramid Educational Consultants™).

There were a total of five types of MS systems that were used in the eight studies that involved MS. Makaton Sign Language (Makaton New Zealand/Aotearoa, 1998) was used most frequently (*n* = 4 or 44%). One study used Signing Exact English (Gustason, Pfetzing, Zawalkow, & Norris, 1980), one study used American Sign Language, one study used manual signs taken from the Dictionary of Australasian Signs, and one study used Dutch Sign Language.

There were 15 studies that used PE with four different PE systems. The most frequent PE system that was used was the Boardmaker (Mayer -Johnson and Co., (1994); *n* = 5, or 28%. This was closely followed by four studies (22%) that used photos or pictures of the stimuli. There were three studies (17%) which used symbols from the PECS Communication Book (Pyramid Educational Products, 2009). Symbolstix from the Proloquo2Go™ application was used by two studies (11%), and the remaining study used symbols from a Picture Communication Board.

There was only one study in this review that involved TS. This study used hand-made TS from colored clay that were shaped to resemble the main cartoon characters of videos that the participant liked to watch (i.e., characters in animated movies).

Research design. All of the 18 studies adopted single-case experimental designs (Kennedy, 2005). The studies generally involved a sequence of phases (i.e., baseline, teaching, and follow-up). Ten (56%) studies used a non-concurrent multiple baseline and eight studies (44%) used multiple baselines across participants or AAC systems.

Skills taught in the study. The majority of the studies (n = 16, or 89%) were focused on teaching the participants to request preferred items or play activity. The remaining three studies involved teaching the production of words, such as cut orange, or sick bear (lacono et al., 1993), symbolic play, teaching new words such as hungry, elephant, and lion in a naturalistic play situation (Taylor & Iacono, 2003), and social communication, such as eye contact with, physical orientation toward, and smiling to the trainer (Boesch, Wendt, Subramanian, & Hsu, 2013b).

Intervention procedures. All of the studies implemented baseline and teaching phases. Four studies (22%) involved generalization, and three studies (17%) involved a follow-up phase. Preference for using the compared AAC modes was assessed in 13 studies (72%). Eight of these studies (Couper et al., 2014; Lorah et al., 2013; Roche et al., 2013; Son, Sigafoos, O'Reilly, & Lancioni, 2006; van der Meer et al., 2012a, 2012b, 2013; van der Meer, Sutherland, O'Reilly, Lancioni, & Sigafoos, 2012c) assessed preference using a systematic a choice-making paradigm, one study assessed preference within a concurrent-schedule design (Winborn-Kemmerer, Ringdahl, Wacker, & Kitsukawa, 2009), one study assessed preference using a free-operant paradigm (Cannella-Malone et al., 2009), and the remaining studies (Beck et al., 2008;

Bock et al., 2008; Flores et al., 2012) did not specify which paradigm they used to assess participants' preference for the compared AAC systems.

There were eight studies (Boesch, Wendt, Subramanian, & Hsu, 2013a; Boesch et al., 2013b; Couper et al., 2014; Taylor & Iacono, 2003; van der Meer et al., 2012a, 2012b, 2012c, 2013) that included post-teaching phases (i.e., post-intervention, maintenance, and/or follow-up sessions). Maintenance and post-intervention sessions occurred after the participant has mastered one or more AAC systems, hence the timing of these sessions varied, depending on the participant's acquisition rates. The studies also reported different times for the follow-up sessions, from two weeks to 11 months. The methods used in collecting post-teaching also varied. Specifically, all studies collected data in these phases using the AAC system that was preferred or yielded better results by the participant, with the exception of one study (Taylor & Iacono, 2003), where the data were collected on all AAC systems. Additionally, one study (Taylor & Iacono, 2003) collected post-intervention data using the Westby Play Scales (Westby, 1980) and Nicolich (1977) levels of play development. The other studies assessed the results based on levels of success or independent responses. The overall post-intervention results showed more positive results for the participants' use of SGD and PE compared to MS.

Preference for AAC system. There were seven studies (Beck et al., 2008; Bock et al., 2008; Cannella-Malone et al., 2009; Flores et al., 2012; Lorah et al., 2013; Son et al., 2006; Winborn-Kemmerer et al., 2009) that assessed preference between PE and SGD. Out of the total of 24 participants that were involved in these studies, nine (37.5%) showed a clear preference for SGD, seven (29%) for

PE, and the rest were unclear. There was one study (van der Meer et al., 2012b) that assessed the preference between MS and SGD. With a total of four participants, three (75%) preferred SGD, and one (25%) preferred MS. The two participants that were involved in the PE, TS, and SGD comparison study by Roche et al. (2013) both showed a preference for TS. The remaining four studies (Couper et al., 2014; van der Meer et al., 2012a, 2012c, 2013), which involved a total of 19 participants and compared MS, PE, and SGD, showed that the majority of participants (n = 14, or 74%) had a preference for SGD, four (21%) for PE, and the rest did not show a clear preference for an AAC system.

Social validation. Assessments on social validity were conducted by a small proportion (n = 3, or 17%) of the studies in this review (Boesch et al., 2013a; Flores et al., 2012; Tincani, 2004). Please refer to Chapter 3 for more information on social validation of these studies.

Quantitative outcomes of the studies and certainty of evidence. In terms acquisition of the target skill(s) of the intervention, half of studies (n = 9, or 50%) reported positive outcomes, while the remaining studies showed mixed results. Within the studies that showed mixed outcomes which compared MS and SGD (i.e., Taylor et al., 1993; van der Meer et al., 2012b), all five participants learned to use SGD, and three learned to use MS. Tincani's study (2004) showed mixed results in comparing PE and MS, in which all of the participants learned to use PE faster, yet one of them showed a decrease in the use of PE after exposed to a modified training intervention for MS. Comparison results between PE and SGD were mixed in studies by Boesch et al. (2012) and Flores et al. (2012). Specifically, three out of the total of eight participants learned to use either

systems, one only learned to use SGD, and the rest did not acquire the skills to use both systems. The remaining three studies (Couper et al., 2014; van der Meer et al., 2012a, 2012c, 2013) involved 19 participants in total, and were aimed at comparing MS, PE, and SGD. More than half of the total participants (n = 10, or 53%) learned to use all three systems. One participant (5%) only learned to use PE, two participants (11%) failed to learn MS, and remaining two participants (11%) failed to acquire the skills to use any of the offered AAC systems.

Certainty of evidence was ranked in three categories (Davis et al., 2013): (a) conclusive, which included studies that showed: (1) demonstrated experimental control (in single case designs) or control group (in group designs), (2) an adequate level of inter-observer agreement (i.e., collected from 20% or more sessions with 80% or more level of agreement), (3) a clear definition of dependent variables, (4) sufficient methodological details for the study to be replicated, and (5) attempts to control alternative explanations of the intervention results (e.g., randomized control trial, double-blind, and treatment fidelity); (b) preponderant, which is the same as conclusive except that the study did not control for alternative explanations of the results; and lastly (c) suggestive or insufficient, which applies to studies that did not involve an experimental design (i.e., case studies, an AB designs). All of the studies in this review reported conclusive evidence.

Reliability and treatment integrity. All of the studies conducted inter-observer reliability checks with results exceeding the generally accepted standard of 80% inter-rater agreement. Procedural integrity was also above the standard of 80% correct implementation of procedural steps in the 16 studies that assessed

this. There were two studies (Bock, Stoner, Beck, Hanley, & Prochnow, 2005; Son et al., 2006) that did not apply procedural integrity checks.

Discussion

The purpose of this systematic literature review was to gain a better understanding of the literature on studies comparing acquisition of two or more AAC systems in children with DD. The general trend of the 18 studies that were identified in this review indicate that more studies from 1993 to 2014 have been focused on comparing low tech AAC systems (MS, PE and/or TS) to high tech ones (SGD). This might be due to the increasing number of electronic devices available that can be used as communication aids and the growing number of software or applications that cater for various needs of children with DD. The compact size, user-friendly software and hardware, and the flexibility (i.e., programs using different languages) to use SGDs for different functions (i.e., requesting or social communication) might have also influenced the increased use of this type of AAC system in homes and schools (McNaughton et al., 2008).

The age limitation criteria of this literature was set to 0-12 years old, hence all of the participants in the studies were children. The majority of the participants that were involved in the 18 studies were children with an average age of 6.8 years. This might suggest that there is an emphasis on the need for communication interventions for young children. However, the findings also suggest that there is a lack in early communication interventions (i.e., on preschool and school entry age children). Since developmental disabilities can be detected from as early as 18 months (American Psychiatric Association, 2013;

Mirenda, 2009a), it would seem beneficial to focus research on toddlers, preschool, and school entry age children.

The gender composition of these studies is consistent with the prevalence data of ASD, in terms that most of the participants were boys compared to girls. In terms of sample size, most of the studies had relatively small sample sizes (i.e., between one to four), with the largest sample size of nine participants. Small sample sizes are common in studies that adopt single-case research designs. Although this is a common experimental design for analyzing intervention effects in educational settings, the implication of small sample sizes could mean that results from the studies might not be generalizable to the wider population. Still, such designs are useful for assessing effects of interventions for individual children. Also, by systematic replication, a series of separate single-case designs can yield greater external validity.

A large portion of the studies was conducted in school settings or a combination of school, home, and clinical settings. This might be due to the age of the participants, where they were more likely to be in school during the day. Further, the majority of studies that were conducted in schools took place during break time. This might suggest that the parents of the participants or the researchers decided to conduct the studies at times that would have minimum effect on the participants' school time. There are several possible benefits in conducting the research in school settings. Firstly, the participants might have already associated the setting as a learning environment, which might increase the positive outcome of the study. Secondly, by conducting the study in schools, it is possible to have a staff present during the sessions so that they would be able

to apply the teaching principles into classroom, which might have enhanced outcomes.

There were various types of MS, PE, and SGD systems used in the studies. Indeed, there are various options available for each MS, PE, SGD, and TS. However, one would question the extent of level of effectiveness of each type of system. For example, would Makaton be more or less effective than American Sign Language? Or, which would be the more effective type of SGD; the iPod Touch or iPad? The overall results of such comparison research may depend upon the specific types of MS, PE, and SGD systems/devices that area compared.

In terms of target skills, the emphasis on teaching manding (requesting) skills to the participants, which was evident in this review is consistent with the literature of verbal behaviour (Skinner, 1957). Specifically, manding skills are usually the initial communication skill that is taught to children with DD as a basis for further communication skills. Hence, this is one of the targeted skills that receive priority in early intervention.

Because all of the studies implemented multiple baseline and alternating treatment design, it is not surprising to see that the certainty evidence for the studies was categorized as conclusive. In addition, all of the studies showed positive results in achieving the target skills, which provide evidence that the intervention methods that were used in these studies were effective in teaching the participants the new communication skills (Duker et al., 2004). An assessment of preference for using one AAC system over the others was incorporated into several studies, based on the notion that the participants would

more often choose the system that they most preferred to use. This would be an important aspect to consider upon choosing an AAC system that is best-suited for the user.

In terms of post-intervention or follow-up, there was a significant difference in the method used in these studies. Most of the studies bar one (Taylor & Iacono, 2003), collected data on the AAC system that the participant preferred to use or was better at using during follow-up. If the effectiveness of an AAC system was determined by how long one can maintain the skills to use said system, then ideally the studies should assess maintenance on all of the AAC systems that were involved, instead of assessing just the most preferred system.

In terms of preference, the studies suggest that MS was the least preferred AAC system. This might be due to the higher learning demand, and the less intrinsice appeal, compared to PE, and SGD. The latter was preferred by most participants. Previous research (lacono et al., 1993; Iacono & Duncum, 1995; McNaughton et al., 2008; Sigafoos & Drasgow, 2001) has suggested that high learning demands might have a negative effect on the preference of AAC system, which might be the case for MS. Since it was evident that the acquisition rates between PE and SGD were comparably equal, this might help explain why PE and SGD were both regarded as acceptable. Further, the mixed results for social validity assessments might mean that people have rather indifferent perceptions regarding the acceptance of PE and SGD as a communication aid. Interestingly, the social validity results differ from the results of the children's preference for AAC system, which indicated more preference for the SGD. Could there be other

variables in assessing the social acceptance of an AAC system other than ease of acquisition?

In some of these studies, it was hypothesized that the participant's preference for an AAC system would impact the effectiveness of the AAC intervention. The results of these studies suggest that the participants tend to show better performance when using the AAC system they most preferred. However, long-term follow-up is lacking from the 18 studies in the literature review. To date, it appears that the longest period was about 12 months. If one measure of effectiveness is how long the skills are maintained, and considering that preference of system changes through time, then it would be of value to conduct more long-term follow-up studies, specifically over 12 month period. Ideally, these follow-up checks would involve maintenance checks on, and the child's preference for, different AAC systems. The latter would enable one to assess the stability of preferences.

Additionally, it is also important to consider the communication partner's perception of the AAC system (i.e., social validity). By assessing social validity, it might be possible to explore the level of acceptability of the AAC systems. Further, it was evident that there was a lack of social validation assessment in the 18 studies that were reviewed particularly, and in the field of AAC generally. Future research will need to address these topics. It would be ideal to incorporate not only the user's ability to maintain the skills after a long period of time and assess changes in their preference for AAC systems (if any), but also take into account the communication partner's perceptions of AAC systems for children with DD.

CHAPTER III

Social Validation of AAC Systems for Children with ASD and ID

Kazdin (1977) and Wolf (1978) noticed that social validity is assessed by exploring how the intervention is perceived or accepted by others (i.e., practitioners, teachers, and/or caregivers). The level of social acceptance plays an important role because although the intervention may be objectively effective, if the consumer perceives that intervention does not bring a significant positive change then the intervention would perhaps be less likely to be implemented (Kennedy, 2002; Schlosser, 1999). In other words, if the communication partners do not perceive the intervention as effective, the intervention would less likely be accepted and used by the stakeholders. However, to date there is a relative lack of social validation research in AAC (Callahan, Henson, & Cowan, 2008; Schlosser, 1999; Snell, et al., 2010). If the level of social acceptance of these AAC systems is an important factor to ensure the continuation of using the system as a communication aid, it would therefore be sensible and timely to give an emphasis on this particular topic.

Further, Philips and Zhao (1993) suggested that approximately one third of assistive technology (which includes AAC devices), are abandoned by their users due to several factors: (1) a failure of the device to enhance independent functioning; (2) difficulty in device maintenance; and (3) high levels of assistance required by family members to implement the device successfully. Additionally, Parette and Brotherson (2004) suggested that a family's decision on using an AAC system for their child might be influenced by several factors: (1) whether the use of the AAC system in public settings will be unduly

stigmatizing and/or draw negative attention to the child; (2) the portability of the AAC system; and (3) if the AAC system can be functionally used to communicate with others. For more details on social validity factors in AAC interventions, please see Table 3.1. Therefore evaluating social validity of the different AAC systems (SGD, PE, MS) might support successful implementation and sustained use of AAC.

A review on social validation of interventions in AAC by Schlosser (1999) identified 13 studies that involved single-subject experiments, but only four (Hamilton & Snell, 1993; Heller et al., 1997; McNaughton & Tawney, 1993; O'Keefe & Dattilo, 1992) assessed social validation. Ganz et al. (2012) identified 24 studies in their meta-analysis of single case research studies on aided AAC systems. Only seven of those studies included social validity assessments (Buckley & Newchok, 2005; Johnston, Nelson, Evans, & Palazolo, 2003; Kravits, Kamps, Kemmerer, & Potucek, 2002; Marckel, Neef, & Ferreri, 2006; Olive, Lang, & Davis, 2008; Schlosser & Blischak, 2004; Tincani, 2004). These findings suggest that evidence on social validation is relatively lacking and assessments of this component are warranted in research in the AAC field.

Table 3.1.

Categories, Components, and Definitions of the Social Validity Matrix for AAC Interventions

Categories	Components	Definitions
Stakeholders	Direct	Primary recipients of an intervention.
	Indirect	Persons who are strongly affected by the targeted change.
	Immediate community	Persons who interact with the direct and/or indirect stakeholders on a regular basis either professionally or socially.
	Extended community	Persons who live in the same community but who probably do not know or interact with the direct and indirect stakeholders, or expert in the study.
Intervention goals	Topography	Broad social goals: value base that underlies AAC. Behavioral categories: hypothesized subcategories of broad social goals. Discrete responses: specific behaviors make up the behavioral categories.
	Level	Anticipated performance that indicates a goal has been achieved.
Intervention methods	Materials	Articles used for the preparation and/or implementation of intervention.
	Procedures	Type: the specific intervention strategy used during intervention. Form: the "how" of intervention implementation.

Table 3.1. *Continued*

Categories	Components	Definitions
Intervention outcomes	Proximal	Perceived changes that are directly related to intervention.
	Instrumental	Perceived changes presumed to lead to other outcomes without further intervention.
	Intermediate	Perceived changes in total "quality of life" as a result of intervention.
	Distal	Perceived changes for stakeholders as a group.
Validation methods	Subjective evaluation	Soliciting of opinions of persons who have a special position due to their expertise or their relationship to the client.
	Social comparison	Comparability of performance with a group of individuals whose behavior is considered to be "typical", "desirable", or "normal".

Note. Cited from Schlosser (1999, p. 236).

In assessing social validity, Schwartz and Baer (1991) emphasized three key aspects to evaluate: what to ask the audience, who is a suitable audience, and how to assess the audience. There are several instruments that have been used to measure social validity (Finn & Sladeczek, 2001; Miltenberger, 1990). One instrument is the Treatment Evaluation Inventory (TEI) that was developed by Kazdin (1980a, 1980b). This instrument consists of 15 questions that are rated on a 7-point Likert scale. The aspects that are assessed in TEI are acceptability of intervention, appropriateness of the procedures, the level of fairness of the intervention on the subject, and how much the respondents liked the intervention. A second instrument is the Intervention Rating Profile (IRP), which was developed by Witt and Martens (1983). This instrument consists of 20 questions rated on a six-point Likert scale. The IRP was designed to assess the acceptability of school-based interventions that focused on problem behaviors. A third instrument is the Treatment Acceptability Rating Profile (TARF) developed by Reimers and Wacker (1988). This instrument is a modified version of the TEI. The TARF was designed to identify other factors that may affect the acceptability of a certain intervention. Lastly, the Behavior Intervention Rating Scale (BIRS) was developed by Von Brock and Elliott (1987). This instrument is the modified version of the IRP and consists of 29 items, which assesses the relation between effectiveness and acceptability of the intervention.

There seems to be evidence of the importance of social acceptance or social validation of AAC systems to prevent device abandonment, and to help shed a light on finding AAC systems that are acceptable by communication partners (Kennedy, 2002; Schlosser, 1999). However, to date there is a relative

lack in social validation reports for AAC systems for individuals with DD as a mentioned before (Callahan et al., 2008 Schlosser, 1999; Snell, et al., 2010). Further, a current review of social validation seems to be lacking in the literature of AAC interventions. This warrants a systematic review of literature focused on evaluating the social validity of AAC system for children with DD.

Systematic Literature Review of Social Validity Assessments on AAC Systems for Children with Developmental Disabilities

This systematic review is focused on assessing the purpose, methodology, and findings of studies that involved the assessment of social validity for AAC intervention for individuals with DD. It was expected that the findings from this literature review would reveal trends in acceptance levels of various AAC systems. Findings of this review might also find areas that need to be addressed in the literature and suggestions for future research.

Method

Search procedures. A systematic search was conducted by the author in four electronic databases, namely: PsycINFO, ERIC, Linguistics and Language Behavior Abstracts, and ProQuest. The search was limited to English-language journal articles. The search did not put a restriction on the publication year and therefore covered all the dates in the aforementioned databases up to October 2014 (when the search was conducted). The "Advanced Search" option was selected and the keywords "Social valid*" (the asterisk sign allows an open-search in the database on words such as "validity", or "validation"), "AAC", and "Developmental Disab*" were entered in the "Anywhere" field for all of the databases. The abstracts of the records that were returned from the electronic

database search were then reviewed by the author against the inclusion criteria to determine which studies would be included in the review (more details on the inclusion criteria can be found in the following section of this chapter).

Three further search strategies were implemented to find other relevant studies that may have been missed from the electronic database search. First, the author browsed the reference list of the studies that were included in the review to find other possible relevant articles (i.e., reference search). The second additional search was a journal search, which was done by hand searching the journals that published the articles that were included in the review. Lastly, author search was conducted, in which another electronic database search was conducted by typing in the authors' name in the search field. This covered all four electronic databases that were used in the initial search (i.e., PscyINFO, ERIC, Linguistics and Language Behavior Abstracts, and ProQuest). Studies that were selected from the combined search procedures were checked against the inclusion and exclusion criteria to be included in the review.

Screening and inclusion criteria. To be included in this review, the article had to be: (1) a published peer-reviewed research study; (2) included social validation assessments on AAC interventions that were used by individuals (no age restrictions) with DD (with the diagnosis of ASD, ID, related diagnoses); (3) the assessment could be a stand-alone study or part of a study, and (4) included reports of empirical data on social validity assessments of AAC systems. Specifically, social validation assessment was defined as exploring the perceptions of AAC interventions. This could be, but not limited to, parents, teachers, peers of children with DD, and the wider community. For example,

exploring the perceptions of parents of children and/or teachers of students with ASD on the use of PE and SGD, or exploring the perceptions of peers of individuals that use MS. The initial search retrieved 226 studies, which were screened against the inclusion criteria. This screening resulted in 13 articles. After the author conducted the additional searches, there were 8 articles that were added, resulting in a total of 21 articles that were included in the review.

Data extraction. The articles that were included in the review were then coded based on: (1) participants' descriptions (e.g., age, gender, and number); (2) AAC system that were involved; (3) tools that were used to assess social validity; and (4) quantitative outcomes of the assessments.

The author made a summary of the articles based on the following categories: (1) purpose of the social validation assessment, (2) characteristics of participants, (3) methods used for data collection, and (4) outcomes of each study. The outcome of the studies was ranked in three categories: (a) positive outcome, which meant the respondents showed high level of acceptability; (b) negative outcome, which meant the respondents showed low level of acceptability; and (c) moderate outcome, which meant that the participants did not rate acceptability as being positive or negative.

Results

Table 3.1 provides a summary of the purpose, characteristics of participants, research design, and certainty of evidence and outcomes for each of the 21 studies that were included in the present review These studies were sorted based on the dates they were published so that it would help illustrate trends in the

literature on social validity assessments of AAC interventions for individuals with DD.

Participants. The studies in this review involved at least 221 participants, ranging from caregivers, siblings, peers, and teachers of children with DD to speech-language therapists, experimenter of the study, and member of the wider community. Some of the studies (Buckley & Newchok, 2005; Flores et al., 2012; Hamilton & Snell, 1993; Kravits et al., 2002; Marckel et al., 2006; Mirenda, Wilk, & Carson, 2000; Schlosser & Blischak, 2004; Yoder & Stone, 2006) did not provide details on the exact numbers of the respondents that completed the social validation assessments, hence the total number of the participants is only an approximation.

In terms of stakeholders, Light, Binger, Agate, and Ramsay (1999) was the only study that involved direct AAC users, who completed the social validation assessment. Indirect stakeholders (i.e., caregivers and siblings of the AAC users) were involved in seven studies (Boesch et al., 2013a; Marckel et al., 2006; McNaughton & Tawney, 1992; O'Keefe & Dattilo, 1992; Olive et al., 2008; Tincani, 2004; Yoder & Stone, 2006). Only one study (Carlile, Reeve, Reeve, & DeBar, 2013) involved assessing the AAC users' peers, which also are indirect stakeholders. Moreover, with respect to assessing indirect stakeholders, there

Table 3.2.

Summary of studies on AAC Systems for Children with DD that Assessed Social Validation

Study	Purpose of Social Validation	Participants	Data Collection Methods	Outcomes
O'Keefe & Datillo (1992)	To explore the qualitative information regarding differences in conversational control during Response-Recode form in the conversation of an AAC system user.	Three caregivers (one female, others unidentified), one female sibling.	Data was collected through interview sessions approximately 6 weeks after intervention has ceased.	Positive; Observable and lasting changes in the AAC user's conversational control skills. The intervention was rated as valuable.
McNaughton & Tawney (1992)	To explore the preference for spelling instruction techniques (copy-write-compare vs student-	Two caregivers (one male, one female) of two AAC users.	Data was collected through interview sessions post-intervention.	Positive; Both respondents reported positive results of the intervention on the AAC user are spelling performance.

Table 3.2. *Continued*

Study	Purpose of Social Validation	Participants	Methods for Data Collection	Outcomes
	directed cueing) and the impact they had on the AAC user's vocabulary.			Anecdotal reports suggest that the AAC user generalized the skills to different settings.
Hamilton & Snell (1993)	To assess the satisfaction levels on the mileu methods (i.e., procedures and outcomes) of the intervention on increasing spontaneous communication book use across environments.	Two caregivers and two teaching assistants (descriptive were not provided) of a male teenager using a picture-based communication book.	Data was collected during the second follow-up probe, using a six question questionnaire with a 4-point Likert scale.	Mixed; Most respondents were satisfied with how the pictures in the picture book meet the user's wants and needs, how the procedures were easy to understand and to be implemented on a daily basis. They also showed positive reports on how the teenager spontaneously uses the picture book.

Table 3.2. *Continued*

Study	Purpose of Social Validation	Participants	Methods for Data Collection	Outcomes
				Results were mixed on the teenager's ability to use the picture book spontaneously and the recording of the procedures on a daily basis.
Light et al. (1999)	To socially validate the functionality and value of partner-focused questions to enhance communication competence of AAC users.	Two participants of the study (AAC users with diagnosis of ID). Facilitators of the AAC users (teachers, parents, and/or residential counselors). 20 members of the	An interview and survey in writing (for the participants of the intervention and their facilitators, respectively) conducted post-intervention asked about the AAC user's communication	Mixed; All of the participants reported to be more effective communicators as a result of the intervention. All of the facilitator reported enhancements in the AAC user's communication competence. Members of the public showed mixed results on the

Table 3.2. *Continued*

Study	Purpose of Social Validation	Participants	Methods for Data Collection	Outcomes
		general public (i.e., adults who had no previous experience in AAC).	competence (i.e., more effective, less effective, or no change in effectiveness) after undergoing the intervention. Members of the public were asked to judge the AAC user's communicative competence (i.e., more competent, less competent, or no difference) after	communication competence of the individuals with ID; one was reported to be more competent, the other was reported to show no clear difference in his communication competence.

Table 3.2. *Continued*

Study	Purpose of Social Validation	Participants	Methods for Data Collection	Outcomes
			viewing a video of the individual using the AAC pre- and post intervention. Data was analyzed using chi-square analysis.	
Mirenda et al. (2000)	To assess how successful 170 students with autism used technology (i.e., VOCA and computers) in their education over a five-year period.	School staff (details not identified).	Anecdotal retrospective reports from school staff which were categorized in a six-level Likert scoring system.	Positive; Of 63 students using VOCAs, 19% (*n* = 12) showed little success, 31.7% (*n* = 20) showed moderate success, and 49.2% (*n* = 31) showed high level of success. Of 131 students that used computers, 7.6% (*n* = 10)

Table 3.2. *Continued*

Study	Purpose of Social Validation	Participants	Methods for Data Collection	Outcomes
				showed little success, 26% (*n* = 34) showed moderate level of success, and 66.4% (*n* = 87) showed high level of success.
Kravits et al. (2002)	To assess a student's social skill behavior using PECS.	Experimenter.	Assessing the student's frequency of spontaneous peer interaction using PECS across different settings.	Positive; The student's peer interactions increased in journal time, and the frequency increased from 2 in baseline to 7 in centers and 13 in journal time.
Johnston et al. (2003)	Assessing teacher's perception of teaching a student with ASD to initiate interactions using visual supports.	Nine preschool teachers.	Utilized 7-point Likert survey to assess the teacher's perception of the importance,	Mixed; Results on intervention components: 1) creating communicative opportunities: all of the teachers reported

Table 3.2. *Continued*

Study	Purpose of Social Validation	Participants	Methods for Data Collection	Outcomes
			difficulty, and appropriateness of the intervention components (creating communicative opportunities, modeling desired skill, and providing specific guidance) and environmental variables of the intervention (disruption to classrooms routines,	that creating communicative opportunities was very important and appropriate. 66.7% (n = 6) reported that this component was not difficult to implement, 33.3% (n = 3) reported that it was moderately difficult. 2) modeling desired skill was rated as very important by all teachers. 89%(n = 8) reported that this was very appropriate yet difficult to implement. 3) providing specific guidance. 78% (n= 7) reported this as

Table 3.2. *Continued*

Study	Purpose of Social Validation	Participants	Methods for Data Collection	Outcomes
			time to implement the intervention, continuation of using the intervention by the child, difficulties to implement the intervention).	very important, while the remaining respondents reported this as moderately important. Most of the respondents (89% or n = 8) reported this strategy as being not difficult to implement, while the remaining participant reported this as being moderately difficulty. All of the respondents reported this strategy as being very appropriate.
Magiati & Howlin	To assess teachers' overall views on the use	23 school staff of eight special	Survey at the end of the project.	Positive; All teachers gave highly positive ratings (good or

Table 3.2. *Continued*

Study	Purpose of Social Validation	Participants	Methods for Data Collection	Outcomes
(2003)	of PECS in the classroom. To find if the teachers have any difficulties in implementing PECS after training. To find the extent of usage of PECS during school days.	needs schools from the South of England.		very good rating) about the value of using PECS in the classroom. The advantages of using PECS in the classroom: an effective form of communication for the children, children became more confident and independent, and reduce in tantrums and frustrations for the children. Three teachers reported that their teaching has generally improved after using PECS. Difficulties in implementing

Table 3.2. *Continued*

Study	Purpose of Social Validation	Participants	Methods for Data Collection	Outcomes
				PECS were related to the preparation of this system; one teacher reported that PECS was very difficult, and three reported few difficulties.
Schlosser & Blischak, (2004)	To evaluate certain experimental procedures of speech and print feedback on spelling in terms of: The required latency (in seconds) for a participant to spell a word. The extent to which a	Teachers of the children in the study.	Not reported.	Positive; Latency was agreed at 20 seconds. Teachers concurred with the researchers' proposed instruction for spelling and for differentiating experimental conditions.

Table 3.2. *Continued*

Study	Purpose of Social Validation	Participants	Methods for Data Collection	Outcomes
	participant would comprehend instructions to help them differentiate feedback conditions. The extent to which a participant would understand proposed spelling instructions.			
Tincani (2004)	To evaluate the acceptability or viability of the intervention, specifically assessing the importance of the intervention to	One teacher (female), parents (father, mother, and one not identified) of two children in the	Written questionnaire.	Mixed; Teacher's response: Procedures and results of the study were important for understanding AAC for children with DD. The usefulness of the modality of

Table 3.2. *Continued*

Study	Purpose of Social Validation	Participants	Methods for Data Collection	Outcomes
	understanding communication training for children with DD, which modality was more effective for children in the study (PECS versus MS), which modality of training would be more feasible to implement and which one would the respondent be more likely to implement, and finally how did the	study.		either MS or PECS varied depending on the characteristics of each student. The respondent reported that it would be feasible to incorporate either PECS or MS with the students, and both AAC systems were equally likely to be used. The respondents reported that the alternating treatment design of the study was not preferable, adding that the students would have learned more if just exposed

Table 3.2. *Continued*

Study	Purpose of Social Validation	Participants	Methods for Data Collection	Outcomes
	participation affect the study's participants.			to one AAC system. Parents gave mixed responses. A father of one student reported positive feedback of the intervention on his son's communication skills and that he and his partner liked MS better. A mother of another student reported that the study did have a significant impact on her daughter's communication skills and that she like PECS better compared to MS.

Table 3.2. *Continued*

Study	Purpose of Social Validation	Participants	Methods for Data Collection	Outcomes
Buckley & Newchok (2005)	To gain information on the teachers' acceptability of intervention procedures.	Teaching staff.	Interview.	Positive; The teaching staff in the classroom accepted functional communication training.
Marckel et al. (2006)	To assess the social validity of goals and outcomes of teaching improvisation with PECS to children with autism.	Teachers and parents of two young boys with autism.	Survey with 10-point Likert scale (1-low, 10-high).	Positive; Goals were reported as *M* = 7.0, outcomes were reported as *M* = 9.5.
Yoder & Stone (2006)	To evaluate the importance and use of different treatment strategies (PECS vs RPMT) to determine	Parents of 36 preschoolers with ASD.	Survey, four-point Likert scale (4-most positive).	Positive; PECS: Adequately covered *M* = 3.7 (SD = 0.34). Importance *M* = 3.8 (SD = 0.38).

Table 3.2. *Continued*

Study	Purpose of Social Validation	Participants	Methods for Data Collection	Outcomes
	whether they were: adequately covered, perceived as important to the child's development, or used by the parent at the end of the treatment phase.			Frequency of use *M* = 3.6 (SD = 0.6). RPMT: Adequately covered *M* = 3.7 (SD = 0.28). Importance *M* = 3.8 (SD = 0.36). Frequency of use *M* = 3.6 (SD = 0.41).
Olive et al. (2007)	To evaluate the use of VOCA for a student with autism.	One teacher.	Anecdotal report.	Positive; The child requested his VOCA during a play session when the VOCA was not made available suggested that the child was comfortable with the VOCA system.

Table 3.2. *Continued*

Study	Purpose of Social Validation	Participants	Methods for Data Collection	Outcomes
Olive et al. (2008)	To ascertain the mother's attitudes towards functional communication training. To determine if the mother's attitudes toward functional communication training changed following intervention mastery.	A mother of a child with ASD.	Using the pre- and post-Behavioral Intervention Rating Scale (BIRS; Elliott & Treuting, 1997). Assessed acceptability and effectiveness in a six-point rating scales (1-lowest; 6-highest).	Positive; Acceptable rating before and after intervention were same = 5.3. Effectiveness pre-intervention = 4.7. Effectiveness post-intervention = 5.1.
Fatima et al. (2012)	To explore the perceptions of speech therapists about integration of technology in speech and language.	20 speech therapists (16 females, four males). Nine worked at seven	Self-developed questionnaire with a forced-choice option (yes/no).	Positive; A positive response toward involving technology in the practice of speech-language therapy.

Table 3.2. *Continued*

Study	Purpose of Social Validation	Participants	Methods for Data Collection	Outcomes
	development of children with ID.	schools, 11 worked at five hospitals, and three worked at speech therapy centers. 11 had six to10 years of experience.		
Flores et al. (2012)	Pre-intervention: to assess the need for a communication system (PE versus SGD), and to assess the interest in using an alternate form of a communication system.	Program staff.	Close- and open-ended questionnaire with four-point Likert system.	Positive; Positive perception and recognized need of SGD for the students.

Table 3.2. *Continued*

Study	Purpose of Social Validation	Participants	Methods for Data Collection	Outcomes
	Post-intervention: to assess which system (PE versus SGD) did the respondent think was more liked by the user, which system resulted in faster communication by the user, and which system was easier to manipulate by the user. Additionally, to assess which system was easier for the respondent to use and			

Table 3.2. *Continued*

Study	Purpose of Social Validation	Participants	Methods for Data Collection	Outcomes
	to implement. Lastly, to assess which system the respondents preferred.			
Boesch et al. (2013a)	To compare the effectiveness of PECS vs SGD in teaching requesting skills.	Three parents of children with DD.	The survey was a modified version of Treatment Acceptability Rating Form – Revised (TARF-R; Reimers & Wacker, 1988)	Positive; Parents indicate positive perceptions of the intervention. Two respondents believed their child preferred the SGD and one believed the child preferred PECS.
Carlile et al. (2013)	Undergraduate students were asked to evaluate the value of participant engagement and	13 undergraduate psychology major students. 12 peers of typically-	Participants were shown randomly selected video clips of each student that	Positive; Undergraduate students showed an increase on their ratings of the AAC user's appropriateness of

Table 3.2. *Continued*

Study	Purpose of Social Validation	Participants	Methods for Data Collection	Outcomes
	completion of activities, the appropriateness of the activities, and whether participants were appropriately structuring their leisure time as compared to their typically-developing peers. Peers of the students in the study were asked to assess the peers' acceptability of the intervention. Instructors, supervisors,	developing children from an age-equivalent general education classroom. Seven instructors, supervisors, and other staff who taught the children outside of the study. 91 members of the wider community.	received intervention in the study. The videos were presented in the order of two pre- then post-intervention (using the iPod touch to teach leisure skills to children with autism), and the other two were presented in the opposite order. Questionnaire with seven-point Likert	structuring their leisure time pre- versus post-intervention, from *M* = 2.6 to 5.2. Grade-equivalent peers rated that procedures were acceptable and that they would not become upset if the AAC user was using the iPod Touch. The participants reported that they might want to play with and help the AAC user use the iPod Touch. The participants also showed interest in learning to use the iPod Touch.

Table 3.2. *Continued*

Study	Purpose of Social Validation	Participants	Methods for Data Collection	Outcomes
	and other staff were asked to assess the outcomes of the treatment. Members of the general public were asked to assess which treatment looked more typical of an age-equivalent peer, and which would be more accepted in the community (iPod Touch versus three-ring binder).		scale.	Instructors and other staff personnel rated the procedures as acceptable, reasonable, and affordable. They also reported that they liked the procedures, would likely to implement the procedures, and incorporate the procedures in their classroom. Raters also reported that the strategies would cause disruption to the classroom routines and the procedures would not cause discomfort to the AAC users.

Table 3.2. *Continued*

Study	Purpose of Social Validation	Participants	Methods for Data Collection	Outcomes
				78% respondents from members of the community selected the iPod touch as the format that looked more typical in relation to age-equivalent peers. 80% of the respondents selected the iPod touch as more accepted in the community.
Pennington et al. (2014)	To assess: the perceived level of difficulty in learning the procedure, the perceived level of difficulty in applying the procedure, the	Two instructors of the study.	Five questions in a four-point Likert scale format.	Positive; Both instructors indicated that the procedures were easy to learn and implement. Both instructors indicated that the intervention was effective and that they

Table 3.2. *Continued*

Study	Purpose of Social Validation	Participants	Methods for Data Collection	Outcomes
	perceived effectiveness of the procedure, the perceived likelihood that the instructor will continue using the procedure, and the perceived likelihood that the procedures will be used in other contexts. To capture the instructors' responses during reliability observations to explore their opinions that were less constricted by the Likert- scale questionnaire.			would use the intervention in other educational contexts. The instructors' comments during intervention were generally favorable. Specifically, positive comments were noted on the students' performance. Expressions of concerns were recorded during slow acquisition rates of two students but were then diminished once the students showed progress in acquisition.

Table 3.2. *Continued*

Study	Purpose of Social Validation	Participants	Methods for Data Collection	Outcomes
Smith et al. (2014)	To assess the acceptability of the intervention and outcomes in using video feedforward for rapid learning of a picture-based communication system.	Two teacher aides and one speech-language therapist.	Questionnaire and anecdotal reports.	Positive; Results from the questionnaire showed that all respondents reported positive attitudes towards all aspects and phases of the study, unanimously indicating that they would recommend and use the intervention again in the future. Anecdotal reports were very positive.

were 13 studies (Buckley & Newchok, 2005; Carlile et al., 2013; Flores et al., 2012; Hamilton & Snell, 1993; Johnston et al., 2003; Light et al., 1999; Magiati & Howlin, 2003; Marckel et al., 2006; Mirenda et al., 2000; Olive et al., 2007; Schlosser & Blischak, 2004; Smith, Hand, & Dowrick, 2014; Tincani, 2004) that involved school staff (i.e., program facilitator, teacher, teacher aid, and/or other school staff) in their social validity assessments.

There were two studies (Fatima et al., 2012; Smith et al., 2014) that involved the immediate community (i.e., speech-language therapists) in their social validity assessments. There were three studies that assessed social validity from extended members of the community. Specifically, one study (Carlile et al., 2013) involved undergraduate students, two studies (Carlile et al., 2013; Light et al., 1999) involved members of the wider community, and one study (Pennington, Collins, Stenhoff, Turner, & Gunselman, 2014) involved the research experimenter in the social validation assessments.

Intervention component being assessed. All of the studies except one (Schlosser & Blischak, 2004) involved assessing the respondents' perception and/or attitudes towards the results of the intervention. There were 11 studies (Buckley & Newchok, 2005; Carlile et al., 2013; Flores et al., 2012; Hamilton & Snell, 1993; Johnston et al., 2003; Magiati & Howlin, 2003; Pennington et al., 2014; Schlosser & Blischak, 2004; Smith et al., 2014; Tincani, 2004; Yoder & Stone, 2006) that involved assessing the acceptability and/or appropriateness of the procedures of the intervention. Eight studies (Boesch et al., 2013a; Fatima et al., 2012; Flores et al., 2012; Magiati & Howlin, 2003; Mirenda et al., 2000; Olive et al., 2007; Tincani, 2004; Yoder & Stone, 2006) involved assessing the

respondents' perception and/or attitude toward the materials (i.e., AAC system) that were used in the intervention.

Method of assessment. There were 15 studies in this review (Boesch et al., 2013a; Carlile et al., 2013; Fatima et al., 2012; Flores et al., 2012; Hamilton & Snell, 1993; Johnston et al., 2003; Light et al., 1999; Magiati & Howlin, 2003; Marckel et al., 2006; Olive et al., 2008; Pennington et al., 2014; Schlosser & Blischak, 2004; Smith et al., 2014; Tincani, 2004; Yoder & Stone, 2006) that involved data collection using a survey or questionnaire. These studies used written surveys or questionnaires (or online surveys for Carlile et al., 2013) that were developed by the authors, except for two studies which used revised versions of the TARF-Revised (Reimers & Wacker, 1988) used in Boesch et al. (2013a), and the BIRS (Von Brock & Elliott, 1987) used in Olive et al., (2008). Additionally, Light et al. (1999), and Carlile et al. (2013) used video clips that were shown to members of the wider community prior to asking the respondents to complete a survey. There were four studies (Buckley & Newchok, 2005; Light et al., 1999; McNaughton & Tawney, 1992; O'Keefe & Dattilo, 1992) that collected social validation data through interviews with the respondents. Kravits et al. (2002) collected social validation data through observation of the AAC user's behavior. Four studies (McNaughton & Tawney, 1992; Mirenda et al., 2000; Olive et al., 2007; Smith et al., 2014) collected social validation data from anecdotal reports from the respondents.

Outcomes of assessment. Positive outcomes of social validation assessments were reported by 17 studies. Mixed outcomes were reported by

Hamilton and Snell (1993); Johnston et al. (2003); Light et al. (1999), and Tincani (2004).

Discussion

This systematic review of the literature yielded 21 studies that involved social validation assessments of AAC interventions for individuals with DD. This review is important in the field of AAC because it provides current evidence on the use of social validation assessments in the AAC literature for people with DD.

There are several factors that are highlighted from this review based on the trend in the literature and analyses of social validation components by Schlosser (1999). Firstly, with respect to the trend of the prevalence of social validation assessments in the AAC literature, it appears that there has been an increase in attention to this aspect of outcomes during the last three years, reflected by six studies that were published from 2012 onward. Secondly, consistent with previous findings (Rispoli et al, 2010; van der Meer & Rispoli, 2010) there seems to be an increase in assessments involving SGDs in the literature since 2007. This might be due to increased availability and the fact that more educational professionals seem to be using this technology in their practices (Newman, 2004; Parette, 1997), the appeal factor, relatively low learning demands, and multifunction features of SGDs (Beukelman & Mirenda, 2005; McNaughton et al., 2008). Thirdly, in terms of assessments of the proportion of stakeholders, most of the studies collected social validation data from indirect stakeholders (caregivers, siblings, and peers), members of the immediate community (clinicians), and extended community (undergraduate

students and members of the wider community). The lack of social validation assessments from the direct stakeholder is most likely because of the young age of the individuals and their limited comprehension that hinders their ability to express thoughts and feelings. Fourth, most of the studies in this review focused on the procedures and results of the intervention. Only one involved the AAC system. It would be sensible to direct our attention to social validation of the AAC systems that are used in the interventions. By investigating this aspect, we might be able to shed a light on which AAC system that might be suited to the consumers and for his or her communication partners. Lastly, most of the studies reported positive outcomes on the procedures, materials used, and results of the AAC interventions. However, this finding must be interpreted with caution, because a large number of studies used instruments that were not standardized, and several studies based their social validation reports on anecdotal comments.

In general, the variables that were assessed in the studies involved several key components of social validity proposed by Schlosser (1999). Firstly, in terms of stakeholders, the studies involved direct and indirect stakeholders, as well as immediate and extended members of the community. Studies that involved more than one stakeholder can be regarded as very useful, because it provided more than one point of view on social validity (Schwartz & Baer, 1991). This is important because it can be potentially used as a holistic approach in better understanding how different type of stakeholders perceive these types of communication interventions and systems for individuals with DD. Further, gaining information on how different populations perceive AAC systems might help practitioners and clinicians in selecting an AAC system that is best-suited

for its user and accepted by others. Secondly, the majority of the studies focused on the social validity of the methods (i.e., materials and procedures) and outcomes of the intervention. This is also consistent with some key points of social validity that were suggested by Schlosser (1999). The focus on the intervention methods and outcomes might act as feedback from stakeholders in viewing the acceptability of these components, and in turn might help show which materials and procedures that are regarded as acceptable or outcomes of interventions that are regarded as effective. Assessment of these factors would be valuable when one has to choose between two or more options of AAC systems or teaching procedures. Additionally, it would also help in cases where new AAC options are emerging, for example the iPad-based SGD. This relatively new communication aid has shown promising results in the research literature (Alzrayer et al., 2014). However, the body of literature has also shown promising results for MS and PE (Preston & Carter, 2009; Wendt, 2009; also see Chapter 2 for a review on AAC systems), hence it is important to assess the social validity of all of these AAC systems in an attempt to identify which system is perceived as most acceptable. By taking these factors into account and selecting interventions that are regarded as highly acceptable by others, the risk of system abandonment might be reduced (Kennedy, 2002; Schlosser, 1999).

The methods that were used by the studies to assess social validity varied, with the majority using survey or questionnaires. This is consistent with the findings from previous research on conducting social validity assessments (Finn et al., 2001; Schwartz & Baer, 1991). Video clips were also used by some studies to illustrate the use or the changes in behaviors of the direct stakeholders. This

method of data collection might be useful to show an example of the AAC that was used in the study to the respondents of the survey. By doing so, it might be likely to establish a controlled stimulus across the participants of the survey. The downside of survey or questionnaire methods is the restriction on gaining more information of the underlying reasons for the participant's responses. Interviews were also used as a method to collect data on social validity. Although this type of data collection requires more time to complete, it would allow for a deeper investigation of how the participants perceive the acceptability of AAC systems. Data collection of social validity through observation of the AAC user's behavior was also present in some studies in this review. The potential advantage of this method is the experimenters can directly witness the user's behavior in using the AAC systems provided. Anecdotal reports, no matter how promising, should be interpreted carefully because they might not be objective evidence of social validation (Smith et al., 2014). The results of the various methods used in collecting social validity data suggest that it seems to be difficult to determine which method is most comprehensive to achieve this result, which is consistent with findings from Finn et al. (2001). Ideally, it would be beneficial to involve two or more methods of collecting data on social validity of AAC systems to gain a deeper knowledge of the participant's responses.

The majority of studies reported that participants perceived AAC systems for individuals with DD as acceptable. It appears that the characteristics of the participant and how the data was collected or the data collection methods (i.e., survey or questionnaire, interviews, and/or direct observations) did not have a significant impact on the participants' acceptability ratings. Rather, the

acceptability of the AAC systems seems to be mainly affected by the participants' perceptions of the outcomes of the intervention and ease of use or implementation of the AAC system. The high acceptability of AAC systems based on its ease of use is consistent with findings from previous studies (lacono et al., 1993; Iacono & Duncum, 1995; McNaughton et al., 2008; Sigafoos & Drasgow, 2001). Moreover, if these findings were to be analyzed based on the three main aspects of assessing social validity this is the what, who, and how of assessing social validity (Schwartz & Baer, 1991), it might reveal that different stakeholders and methods in collecting data (the who and how aspect of social validity assessments, respectively) generally yield similar results. Another plausible explanation for this finding is that these studies used similar target audiences and methods, hence the general results were similar across studies.

On the topic of acceptability of specific AAC systems, there were two studies that assessed social validation of SGD, one study assessed PE, and the remaining study assessed a computer system. All of these studies showed positive ratings for the AAC system that was assessed. On the other hand, four comparative studies that involved two different AAC systems (SGD vs computer, PE vs SGD) all showed mixed results. The findings suggest that the participants in the multiple-AAC system studies rated both systems as equally positive, without showing a significant difference in their ratings for one AAC option over the other.

Findings of this review have several implications for practice and research. Firstly, the growing trend on the use of tablet-based SGDs might suggest that this system is becoming more popular in this field and there might

be value in involving this AAC system in comparative research and social validity assessments. That is, a future direction for research might be to focus on directly comparing MS, PE, and SGD to determine which system is rated as most acceptable. It would also be beneficial to assess the social validity of MS, PE, and SGD to ascertain which option is most socially valid.

CHAPTER IV

OVERVIEW OF THE PRESENT RESEARCH

Purpose of the Research Projects

The research projects presented in this thesis were designed to extend and gain new knowledge on AAC interventions for children with DD. The two studies in this thesis were aimed at two different stakeholders, firstly direct (i.e., children with DD, Study 1), and secondly indirect stakeholders (i.e., members of wider community, Study 2). The general aim of the studies was firstly to directly compare different AAC systems in terms of the participants' acquisition rates for mastering the target skills, maintenance of, and preference for each AAC systems (MS, PE, and SGD). Secondly, to receive feedback from the wider community on the perceived acceptability (social validity) of each of these AAC systems.

The literature (see Chapter 2) supports the use of AAC in enhancing communication skills for children with DD. With the wide range of AAC systems already available and in particular the literature suggesting new high-tech AAC systems (e.g., iPad-based SGD) are showing promising results, it was considered important to directly compare these AAC systems in order to assess which AAC system might be most effective and preferred. The factors that were compared included the acquisition rates in learning the skills to use the three AAC systems, maintenance of the skills from immediately after the teaching stage up to 18 months after the teaching had ceased, and the children's preference for using each AAC system. Further, requesting, or what is also referred to as manding, is a basic or initial skill that is taught in communication interventions for children with DD, hence this was selected as the target skill.

Previous research (van der Meer et al., 2011) suggests that acquisition rates, maintenance of, and preference for AAC system might have a positive impact on the effectiveness of an intervention (i.e., speed of acquisition). There is also some evidence to suggest that the child's preference for an AAC system might change over time (Stafford et al., 2002; van der Meer et al., 2012c). Considering that to date no studies have conducted follow-up checks beyond 12 months, carrying out a study that involved a longer follow-up phase was deemed timely.

The second study in this thesis focused on exploring the perceptions of members from the wider community (i.e., university undergraduate students) on the acceptability (social validity) of MS, PE, and SGD. Particularly analyzing how the undergraduates perceive the acceptability of these three AAC systems, in terms of the intelligibility of the system, ease of acquisition, effectiveness, and their preference for each AAC system. The literature (see Chapter 3) suggests that an AAC system that is highly acceptable by the wider community would more likely result in the continued use of that particular AAC system. From the literature review it appears that to date there seems to be a lack of evidence in the literature in assessing social validity for these three different AAC systems, and therefore a study on this topic would be beneficial for determining whether each AAC system is perceived differently.

Research Questions

This thesis examined the comparison of MS, PE, and SGD as communication aids for children with DD that have severe communication impairment. The studies presented in this thesis were based on the following research questions:

- Study 1:
    1. By using systematic instructional procedures, can young children with DD learn the skills to make a request for continuation of toy play using MS, PE, and SGD?
    2. Is there a difference in acquisition rates for MS versus PE versus SGD amongst these children?
    3. Do children with DD show a preference for MS, PE, or SGD?
    4. Is there a change in preference for MS, PE, and SGD over time?
    5. Are these children able to maintain the skills they acquired for a long period of time?
    6. Does preference for AAC system influence maintenance?
- Study 2:
    1. Which AAC system do undergraduate students perceive as most intelligible?
    2. Which AAC system do undergraduate students perceive as easiest to learn?
    3. Which AAC system do undergraduate students perceive as most acceptable for use in the community?
    4. Which AAC system do undergraduate students report that they would prefer to use?

Hypotheses

In line with the research questions for Study 1 and based on previous research on comparative studies of AAC systems (see Chapter 2), it was hypothesized that by using systematic teaching procedures, children with DD would learn to make requests using MS, PE, and SGD. These systematic

teaching procedures have been found effective (Duker, Didden, & Sigafoos, 2004) hence similar results will be expected in this study. It was also hypothesized that faster acquisition would occur using the AAC system that they preferred, and their preference for the AAC system will also positively influence their performance during the long-term follow-up phases. This hypothesis was drawn based on the notion that less learning demands and appeal factor might have an impact on preference and proficiency (Iacono et al., 1993; Iacono & Duncum, 1995; Light & Drager, 2007; Mirenda, 2003; van der Meer et al., 2012c). Lastly, it was hypothesized that their preference for AAC system would not change throughout the phases of the study, that is, would be stable. This hypothesis was based on the findings from van der Meer et al. (2012c).

In terms of social validation (Study 2), it was hypothesized that the participants would show a difference in their perceptions of each of the AAC options. The different characteristics of each AAC options might elicit different perceptions in terms of intelligibility, ease of acquisition, effectiveness, and that the communication partners might have different preferences in this respect.

Methods

Research Design

The experimental design of Study 1 involved alternating-treatment design that was conducted in a naturalistic setting (Ninci et al., 2013). The design involved baseline, intervention, post-intervention, and long-term follow-up phases.

Research design of Study 2 adopted non-experimental quantitative design, which was aimed to assess the participant's perception of MS, PE, and

SGD in terms of intelligibility, ease of acquisition, effectiveness, and their preference. Data were collected using a five-point Likert scale questionnaire that was designed by the author and Sigafoos. The questions in the questionnaire were developed from ideas that arose from conducting Study 1.

Procedures

Study 1.

Instructional strategies. Study 1 utilized systematic instructional teaching procedures including time delay before prompting (Halle et al., 1979) and graduated guidance, which involves providing the least amount of physical guidance necessary to support the child to make the target response, that is to use the AAC system to make a request (Duker et al., 2004). These strategies were used because previous research (see Chapter 2) suggested that these strategies are effective in teaching new skills to individuals with DD (Duker et al., 2004).

Preference assessments. Preference for using each AAC option was assessed throughout the phases of the study using a structured choice-making paradigm (Sigafoos, 1998). This process involved presenting all AAC systems in front of the participant and allowing him/her to select one AAC system to perform the target behavior (i.e., make a request). Additionally, preference for AAC system was determined based on the requirements presented in previous studies. Specifically, a preferred item was defined as an item that was consistently selected by the participant at least 70% of the time (Son et al., 2006).

Study 2.

Social validity measures. Strategies implemented in Study 2 resemble previous studies on social validity in the AAC field (see Chapter 3) to assess the

participants' perceptions of MS, PE, and SGD. Specifically, this study used three video clips to show the participants an individual using MS, PE, and SGD (respectively) to request a preferred item. After each video clip had finished, the participants were asked to rate each AAC option on a questionnaire that consisted of 11 questions in a five-point Likert scale format.

Ethics

Ethics approval for this study was sought from the author's university ethics committee (approval letter in Appendix A). Consent from the parents, school principals, and teachers for the four boys to participate (for Study 1). Head of School of the University and lecturers of the selected classes (for Study 2) were obtained prior to the commencement of the studies. Additionally, consent for publication of the results of the studies was also obtained. For Study 1, the participants' assent was inferred by the fact that they seemed to enjoy in engaging with the researcher during sessions. Since the data in Study 2 was collected through anonymous survey, the participant's consent to participate in the study was inferred by their completion of the survey.

CHAPTER V

STUDY 1

Acquisition, Preference, and Maintenance of AAC Systems in Children with Developmental Disability

Ethical clearance and informed consent

Ethics approval for this study was sought from the relevant university ethics committee (reference SEPI/2012/66 RM19560). Consent from the parents, principal of schools, and teachers for the four boys to participate and for the publication of results were also obtained. The participants' assent was inferred by the fact that they seemed to enjoy engaging with the researcher during sessions.

Publication

An article based on this study has been published in the *Journal of Developmental and Physical Disabilities*: Achmadi, D., Sigafoos, J., Sutherland, D., Lancioni, G. E., O'Reilly, M. F., van der Meer, L., . . . Marschik, P. B. (2014). Acquisition, preference, and follow-up data on the use of three AAC options by four boys with developmental delay. *Journal of Developmental and Physical Disabilities*, 26:565-583. Doi: 10.1007/s10882-014-9379-z

J Dev Phys Disabil
DOI 10.1007/s10882-014-9379-z

ORIGINAL ARTICLE

Acquisition, Preference, and Follow-up Data on the Use of Three AAC Options by Four Boys with Developmental Disability/Delay

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Abstract We compared how quickly four boys with developmental disability/delay learned to use manual signing (MS), picture exchange (PE), and a speech-generating device (SGD) to request the continuation of toy play. Opportunities to choose to use MS, PE, and SGD were included to determine if the boys showed a preference for using one of these options. Follow-up sessions occurred at 12, 15, and 18 months post-intervention. With intervention, three of the four participants learned to use each option, but one child only learned to use PE. Trials to criterion across children ranged from 22 to 28 for the SGD, from 12 to 60 for PE, and from 21 to 64 trials for MS. For the three participants who reached criterion with each AAC system, maintenance results were best for PE and SGD. Preference assessments during follow-up showed that participants most often chose the SGD, indicating a preference for that option. The findings suggest there may be value in assessing a child's preference for different AAC options as part of the post-intervention follow-up process.

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Published online: 01 May 2014

Keywords Augmentative and alternative communication · Developmental delay · Acquisition · Preference · Maintenance · Manual signing · Picture exchange · Speech-generating device

Introduction

When a child shows significantly delayed speech and language development, clinicians often aim to teach him or her to use one or more augmentative and alternative communication (AAC) options (Johnston and Cosby 2012). A commonly targeted initial intervention objective is to teach the child to use one or more AAC systems to request preferred stimuli (Reichle et al. 1991). Requesting is an important initial communication skill to teach because it enables the child to (a) express wants and needs, (b) gain reinforcement, (c) exert some degree of control over the environment, including the behavior of listeners, and (d) self-determine the amount and type of environmental stimulation (Sigafoos and Mirenda 2002). When beginning such an intervention, an important issue is to decide which AAC option, or which of several AAC options, should be taught to the child.

Significant delay with respect to speech and language development is common among children with developmental delay/disabilities, including individuals with autism spectrum disorder (ASD) and intellectual disability (Lang et al. 2010; Schlosser et al. 2007). Mirenda (2003) noted that three main AAC systems have been recommended for individuals with developmental disability: (a) manual sign (MS), (b) picture exchange (PE), and (c) use of an electronic speech-generating device (SGD). When starting an intervention to teach the use of MS, for example, the child might be taught to make the sign for MORE as a way of gaining continued access to play/preferred toys. With PE, the child might be taught to select a line drawing representing *MORE TOYS* and hand it to a listener in exchange for the corresponding reinforcement (i.e., access to toys, continuation of playing; Bondy and Frost 2009). A third option involves the use of a SGD (van der Meer and Rispoli 2010). With this option, the child might be taught to touch a *MORE* symbol from the device's screen display. Such devices can be programmed so that touching an icon leads to corresponding digitized or synthesized speech output (e.g., "*I want more.*"). Upon hearing the speech output, the listener would then provide access to the requested object or activity so as to reinforce the person's prior requesting response.

There is considerable debate on which of these three AAC options (i.e., MS, PE, or SGD) is best suited to the communication needs of children with developmental delay/disabilities (Mirenda 2003; Sigafoos et al. 2003; Sundberg 1993). At a conceptual level, van der Meer et al. (2011) reviewed a number of potentially relevant variables that might impact on this question, including (a) acquisition, (b) maintenance, and (c) preference. Acquisition, in this context, refers to the ease and speed with which an individual can be taught to (or learn to) use different AAC systems. Comparing acquisition rates (e.g., the number of training trials required to reach a criterion of 80 % correct or better over three successive sessions) across different AAC systems might yield important differences that could inform the decision regarding which option is likely to be best suited to the person's learning characteristics. Maintenance in this context refers to the level of performance that occurs during sessions conducted

some weeks or months after acquisition. Maintenance is assessed after the training criterion has been reached. During maintenance, the targeted communication skills continue to be reinforced, but other treatment procedures (e.g., verbal or physical prompting) are absent (Schlosser 2003). Preference, in the present context, refers to the consistent selection of one option when given numerous opportunities to choose among different options. For example, if an individual selected the SGD 70 % of the time when given numerous (e.g., n=50) opportunities to choose between using MS, PE, and a SGD, this could indicate a preference for using the SGD (van der Meer et al. 2011). Wehmeyer (2002) argued that rehabilitation efforts for individuals with developmental disabilities should aim to promote greater self-determination. One potential way to promote self-determination is to give individuals some degree of choice and control over aspects of their own treatment or intervention (Sigafoos 2006). Thus, providing opportunities for choice among MS, PE, and SGD options could be seen as one way to incorporate aspects of the self-determination principle into AAC intervention.

At the empirical level of this debate, several studies have compared different AAC options with respect to one or more of the above mentioned variables, that is acquisition, maintenance, and/or preference (Boesch et al. 2013a, b; Couper et al. 2014; Flores et al. 2012; Lorah et al. 2013; Son et al. 2006; Tincani 2004; van der Meer et al. 2012a, b, 2013a, b). Couper et al. (2014), for example, compared how quickly nine children with ASD learned to use MS, PE, and an Apple iPod® Touch-/iPad®-based SGD to request the continuation of toy play. The researchers compared trials to criterion, preference for using the MS, PE, and SGD option, and maintenance. In terms of trials to criterion, the results were mixed in that only five children reached the criterion of 80 % correct or better over three successive sessions with all three options. Among these five children, the mean trials to criterion were 29, 33, and 44 for the SGD, PE, and MS options, respectively. Of the remaining four children, two learned to use both PE and the SGD, but did not reach criterion with the MS option, whereas the other two children made progress during intervention, but did not reach criterion with any of the three AAC systems. Results from the preference assessments suggested that eight of the nine children preferred the SGD as evidenced by selecting it from 56 to 86 % of the time. Data from the maintenance probes indicated comparable performance to that of intervention.

The findings reported by Couper et al. (2014) are generally consistent with the main findings of other comparative studies (Boesch et al. 2013a, b; Flores et al. 2012; Lorah et al. 2013; Son et al. 2006; Tincani 2004; van der Meer et al. 2012a, b, c, 2013a). Specifically, the results of these studies suggest that MS, PE, and SGD options can be successfully taught to individuals with developmental disabilities for (mainly) requesting and social communication purposes using well-established instructional procedures, such as (a) creating discrete opportunities, (b) prompting correct responses, (c) fading prompts, and (d) providing reinforcement (Duker et al. 2004). Similar acquisition rates have been found in studies that have compared PE to SGD (e.g., Boesch et al. 2013a, b; Couper et al. 2014). However, some studies have reported individual differences in acquisition rates, with some children learning SGD faster than PE and vice versa (Lorah et al. 2013). Other studies, comparing MS to PE and/or to SGDs for example, have reported data suggesting that the MS option may be more difficult to teach or slower for individuals to learn (Couper et al. 2014; van der Meer et al. 2012a, b, c).

In studies that included choice opportunities to assess preference for different AAC systems, most individuals have shown a preference for using the SGD (Couper et al. 2014; van der Meer et al. 2012a, b, c), although it is also important to note that there have been individual differences with some children preferring to use PE, for example (Lorah et al. 2013; van der Meer et al. 2013a).

There is some evidence to suggest, from some of these comparative studies, that individuals tend to reach acquisition faster and show better maintenance with their preferred AAC option (Couper et al. 2014; van der Meer et al. 2012a, b, c). However, van der Meer and colleagues also noted that preference changed over time for some individuals. The amount of time elapsing from intervention to the maintenance phases of these studies have ranged from 2 weeks to 8 months, post-acquisition (van der Meer et al. 2012a, b, c). Given the possibility that preference for using different AAC systems might change over time and influence acquisition and maintenance, it would therefore seem important to assess maintenance in relation to preference over a longer period of time. It is possible that preference for different AAC options might be more likely to change over a longer period of time (e.g., 18 months) and that the influence, if any, of preference on maintenance with different options might also change over this period of time. Investigating this possibility would require teaching children to use each of three options and then conducting follow-up sessions over a longer time span (i.e., up to 18 months post-intervention).

The present study was designed to assess the influence, if any, of preference on maintenance across three AAC options by collecting data on children's preference for three AAC systems and performance (percent correct) with each option during maintenance assessments conducted at 12, 15, and 18 months post-intervention. The intent was to determine if the degree of preference for the different options changed or remained stable over time and if children performed better during maintenance sessions with the more preferred option. The study replicates Couper et al. (2014) in terms of experimental design and procedures, but extends Couper et al. by providing intervention to four new children and by including longer-term maintenance checks. Information of this type could be useful to clinicians in deciding when and how often to assess children's preference for different AAC options and, ultimately, for avoiding treatment failure (Ganz et al. 2010).

Method

Ethical Clearance and Informed Consent

Ethical approval for this study was sought from the relevant university ethics committee. Consent from the parents, school principal, and teachers for the four boys to participate and for the publication of results was also obtained. The participants' assent was inferred by the fact that they seemed to enjoy in engaging with the researcher during sessions.

Participants

The four participating children had been diagnosed with developmental disability or developmental delay and limited expressive communication skills, but sufficient vision,

hearing, or motor skills to be able to use the AAC systems being compared in the present study.

Kane Kane was a 5 year-old boy diagnosed with autism. His receptive, expressive, and written communication skills on the second edition of the Vineland Adaptive Behavior Scales (Vineland-II; Sparrow et al. 2005) were equivalent to 0:6, 0:9, and 1:10 respectively. He did not have any vision or hearing impairments, and his fine motor skills on the Vineland-II were equivalent to 2:3. Kane's parents reported that Kane had not received any intensive communication intervention involving AAC systems. He communicated by pointing or leading someone to the object he needed. He grunted, shouted, pushed away, or threw a tantrum to indicate disagreement or rejection.

George George was a 5 year-old boy with a diagnosis of global developmental delay. On the Vineland-II (Sparrow et al. 2005) he received an age equivalence of 0:10 for receptive, 0:6 for expressive, and 1:10 for written communication. He did not have any vision or hearing impairments, and his fine motor skills were equivalent to 1:11 on the Vineland-II. George did not have a history of using AAC to enhance his communication. George rarely initiated any communicative interactions. If he wanted something he would retrieve it himself or approach the area of his preferred item and stand near it if it was not accessible to him. He demonstrated rejection by pushing away, walking away, making loud noises, or tantrums.

Harvey Harvey was a 4 year-old boy with a diagnosis of high-functioning autism. His receptive, expressive, and written communication skills were equivalent to 1:6, 0:9, and 4:3 respectively on the Vineland-II (Sparrow et al. 2005). He did not have any vision or hearing impairments, and his fine motor skills were equivalent to 2:10 on the Vineland-II. His parents reported that Harvey did not have experience using AAC systems prior to the study. He mostly communicated by pointing toward an object or making loud noises to seek attention. He indicated rejection by throwing a tantrum, looking away, or walking away.

Theo Theo was a 5 year-old boy with a diagnosis of autism and global developmental delay. His receptive, expressive, and written scores on the Vineland-II (Sparrow et al. 2005) were equivalent to 1:11, 2:6, and 5:6 respectively. He did not have any vision or hearing impairments, and his fine motor skills were equivalent to 4:6 on the Vineland-II scale. Theo's parents reported that he had not used any AAC systems before the study commenced. He communicated primarily by pointing or leading someone's hand toward an object that he wanted. He indicated rejection by walking away, pushing away, or throwing a tantrum.

Setting, Intervention Context, and Personnel

The initial sessions for Kane, George, and Harvey took place in their homes. The sessions usually occurred in a quiet room in their house during the morning or afternoon. When the participants reached school age (i.e., 5 years of age), the sessions

took place in the school environment in a quiet room or empty classroom. Theo's sessions were conducted in a school classroom.

The procedures were implemented in a one-to-one context, with the instructor (first author) and one participant at a time. Sessions were conducted with the instructor and participant sitting next to each other on the floor. Additionally, video recording was also used to gather reliability and procedural integrity data. Parental consent was sought prior to the video recordings. An independent observer viewed up to 76 % of the recorded sessions to collect inter-observer agreement (IOA) data and procedural integrity checks. Additionally, a third observer viewed up to 29 % of the recorded sessions to collect IOA data on the procedural integrity checks (see section on reliability and procedural integrity).

Preferred Stimuli

The preferred stimuli used in this study were various toys placed in a box, which were selected to create a natural play situation. In addition, individual toys that belonged to each participant were used. To ensure that the participant was interested in playing with the toys in the box, the participant and researcher sat on the floor with the lid of the box open exposing the toys, and the participant was given 5 min to play with the toys. Toy play was defined as touching, holding, or playing with an object from the box in an appropriate manner using one or both hands (e.g., opening pages of a book, bouncing a ball, or knocking a wooden nail with a hammer). To confirm that the children enjoyed playing with the toys, they each had to reach at least 3.5 min (70 %) of toy play across three, 5 min free-play sessions. Based on this we assumed that the participants were interested in playing with the toys in the box and would therefore be motivated to request the continuation of toy play when their toy play was interrupted.

AAC Systems

Speech-generating device The SGD used in this study was an iPod Touch® second generation with 16GB memory that was placed inside an iMainGo2™ speaker. This speaker was used to amplify the sound of the SGD. The Proloquo2Go™ application (Sennot and Bowker 2009) was installed on the device, showing a screen with a 2×2 grid with an icon illustrating *MORE* in one space of the grid (the others were left blank). The symbol was retrieved from the Proloquo2Go™ symbol set. The symbol was illustrated with black lines and colored in with red. When the symbol was selected, the device produced synthesized voice-output *"I want more"*.

Picture exchange The PE board was a laminated sheet of white paper sized 15×15 cm with a 2×2 grid, with all spaces on the grid left blank. The *MORE* symbol for the PE system was retrieved from the Boardmaker software (Mayer-Johnson Co 1994) for the picture card. The symbol was similar to the one used in the SGD except it was black and white. This symbol was printed and laminated on a white sheet of paper sized 4.5× 4.5 cm. The picture card was attached to the PE board using Velcro™ dots. The symbol was placed on one space of the grid, leaving the others empty, without picture cards.

Manual sign A laminated sheet of white paper sized 15×15 cm with a 2×2 grid was used to represent the MS system. A drawing illustrating the hand formations for the

sign MORE, adopted from the Makaton Sign Language system (Makaton New Zealand/Aotearoa 1998), was printed on one space of the grid on the MS board. The other three spaces on the grid were left blank.

Response Definitions, Observation, and Measurement

The operational definition of a successful independent request was any independent behavior (without any prompts) to make a request for more toy play using a certain AAC system. The target behavior for MS was making hand gestures that demonstrated the Makaton sign MORE. Approximation of the sign (e.g., using just the index finger instead of index finger and thumb to sign MORE) was accepted as correct. The target behavior for PE was handing over/tapping the *MORE* picture card from/on the PE board. Finally, the target behavior for SGD was touching the appropriate *MORE* symbol to produce voice-output *"I want more."* For the AAC preference assessments, an AAC system was defined as selected when the participant independently activated, reached for, pointed to, or approached a specific AAC system.

Experimental Design, Study Phases, and Session Schedule

The teaching of AAC systems was conducted using an alternating-treatment design with four participants (Kennedy 2005). The study included the following phases: baseline, intervention, post-intervention, and follow-up. AAC preference assessments occurred during all phases except intervention. Maintenance assessments were conducted during the last four sessions of post-intervention and throughout all sessions of follow-up. Each block of sessions consisted of 20–60 min of presentations of discrete trials. These sessions were conducted once a week throughout baseline and intervention and for the first month of post-intervention. Sessions were conducted once a month for the remainder of post-intervention and once every 3 months throughout follow-up. The AAC systems were not available outside of the sessions of the study.

Procedures

Sessions were conducted within the context of a natural play routine (Ninci et al. 2013). Sessions started with the participant sitting on the floor and being given one min of toy play using the toys from the box and/or their own toy. After 1 min of toy play, the instructor put all of the toys inside the box and moved it away from the participant's reach. The steps following this procedure varied depending on the phase, as explained below.

AAC preference assessments During these assessments, the SGD, PE, and MS systems were placed on the floor. Participants were allowed approximately 10 s to select one of the systems. After a system was chosen participants were given a requesting opportunity with it, as outlined in the following study phases. If a participant did not select an AAC system within approximately 10 s, it was recorded as a non-selection and the next trial was commenced. Additionally, the placement of the systems was alternated during each trial to control for the possibility of choice being dependent on the location of the AAC system.

Baseline Each session of the baseline phase consisted of five AAC preference assessment trials. After one min of toy play the instructor inserted an interruption by putting the toys in the box, closing the lid of the box and moving the box away from the participant's reach. The instructor then presented all three AAC options (i.e., MS, PE, and SGD) in front of the participant and the instructor said to the participant *Let me know if you want more*. The participant was given 10 s to make a response. The participant was given access to the box of toys after the 10 s interval had passed regardless of his response. No prompts occurred during this phase. After approximately 1 min of toy play, the next trial was undertaken in the same manner.

Intervention The teaching procedures in each intervention session were conducted following a discrete trial format with 12 trials, in which each AAC system (i.e., MS, PE, and SGD) was presented four times. The presentation of the systems was counterbalanced across trials to prevent order effects (Kennedy 2005). However, if the participant reached criterion (8 correct responses in a block of 10 trials) with one system, that system was put on hold from the training schedule and teaching continued with the other AAC systems, until criterion was met with all systems.

Trials started with 1 min of toy play before an interruption in which the instructor removed access to the toys from the participant. The instructor then presented only one AAC system to the participant and said *Let me know if you want more*? Graduated guidance (using the least amount of physical guidance necessary) was used to teach the participants to request more toy play with the specified AAC system (Duker et al. 2004). Prompting occurred under a time delay schedule (0, 3, 5, and 10 s delay) or if the participant performed an incorrect response. The intervention phase started with one session of 0 s delay, followed with one session of 3 s delay, then one session of 5 s delay and the remainder of the intervention sessions were conducted with a 10 s delay before any prompting was given. The participants were given access to the toys contingent upon performing the target behavior (independently using the specified AAC system to request more toy play) or if they performed the target behavior after being prompted. Verbal social reinforcement (e.g., *Great, you want more.*) was provided and the participant was allowed to play with the toys for 1 min until the next trial was initiated.

Post-Intervention This phase occurred after a participant had reached criterion with each AAC system. The procedures were similar to the ones in baseline, (i.e., no prompting involved), except access to the toys was given contingent on the participant's independent correct request. Post-intervention sessions were conducted once a week for 1 month (4–5 sessions) then once a month for 11 months, resulting in a total of 15–16 sessions. Each session consisted of five trials of AAC preference assessments. The last 4 sessions of post-intervention consisted of 3 maintenance assessment trials (see below) and 5 AAC preference assessment trials.

Maintenance assessments These sessions were undertaken to assess each participant's maintenance of correct use of all three AAC systems, not just their preference. The procedures were similar to those of baseline (i.e., no prompting involved), except the instructor presented only one AAC system at a time until the participant had an opportunity to request more toy play with each AAC system (i.e., MS, PE, and

SGD). If the participant made a correct response he was given access to the box of toys. If a correct response did not occur within 10 s, the instructor waited at least another 30 s before giving the participant access to the box of toys.

Follow-Up Procedures for this phase were identical to the last four sessions of post-intervention (3 maintenance assessment trials and 5 preference assessment trials), except the sessions in follow-up were conducted once every 3 months. Thus one follow-up session was conducted at 12, 15, and 18 months (i.e., three follow-up sessions during this phase).

Procedural Modifications Due to procedural oversight, Kane only received one session (consisting of three trials) during baseline. George received two baseline sessions consisting of five and two trials, respectively. During intervention George showed slow progress in reaching criterion for MS and SGD and therefore a modified teaching procedure was implemented. After session 13 the procedures went back to one session each of 0, 3, and 5 s delay, followed by a 10 s delay before prompting for the remaining intervention sessions for MS and SGD.

George only used PE during maintenance assessments because that was the only AAC system he learned to use. Mass trial training was introduced to George 1 week prior to the 15 and 18 month follow-up sessions because he did not show any signs of correct PE use in the first (12 month) follow-up session. During these trials George was given 15 opportunities to request more toy play using just PE where the instructor used 0 s delay before prompting. All three systems were still presented to George during the preference assessment trials.

Theo was absent from school for several months during the post-intervention phase for reasons unrelated to this study. Hence he only received three sessions of the combined maintenance assessment and preference assessment trials for this phase.

During post-intervention, one preference assessment trial was not implemented because Kane engaged in severe problem behavior. Three preference assessment trials in post-intervention were cancelled with George because he was very lethargic due to illness. There were two additional preference assessment trials for Harvey during post-intervention because he did not show a clear selection in the previous trials (he picked up two AAC systems, but used only one).

Inter-Observer Agreement (IOA) and Procedural Integrity

During each session the instructor collected data on the AAC system selected (preference assessments) and the presence or absence of a correct request using the AAC system on a trial-by-trial basis. The reliability of the instructor's data collection and implementation of procedural steps was collected by a second and third observer through reviewing video-recordings of the sessions. IOA between data collected by the instructor and observer was calculated using the following formula: Agreements/(Agreements + Disagreements)× 100 %. IOA data was collected on 29–76 % (M=52.5 %) of all sessions across participants with 100 % agreement. The independent observer evaluated procedural integrity by checking if the instructor correctly implemented the list of procedures that were set for each phase of the study. Data on procedural integrity was collected on 29–76 % (M= 52.5 %) of all sessions with 100 % agreement. A second independent observer collected

IOA data on the procedural integrity checks during 9–29 % (M=19 %) of all sessions across participants with 100 % agreement.

Results

Figures 1, 2, 3, and 4 illustrate each participant's performance in making a request using the three AAC systems (i.e., MS, PE, and SGD) for each session across phases of the study. Figure 5 shows results of AAC preference assessments across phases and participants. Table 1 displays results of acquisition, which shows the trials it took to meet the criterion for each AAC system across participants. Analyses of performance, maintenance, and preference data involved visual inspection of the graphed data (Kennedy 2005). Acquisition of skills was analyzed by evaluating the number of trials it took to meet the set criterion.

During Baseline, all of the participants demonstrated 0 % correct use of each AAC system (i.e., MS, PE, and SGD). Similarly, all of the participants did not select an AAC system on each AAC preference assessment. These data were consistent with the reports of the participants' parents noting that they had not received any intensive communication intervention using these AAC systems.

Kane Kane acquired mastery of the SGD and PE to make a request independently at almost the same rate. It took him nearly 3 times longer to master MS (see Table 1). Kane received 17 sessions (84 trials) to make a request for more toy play during post-intervention (see Fig. 1). His performance on the AAC systems he selected was consistently high (100 %) during post-intervention and follow-up.

During maintenance assessments throughout post-intervention and follow-up, Kane demonstrated 100 % correct requesting with the SGD and PE. However, while Kane achieved 100 % correct requesting with MS on one maintenance assessment session during post-intervention, his performance was 0 % for the other six maintenance assessments throughout post-intervention and follow-up. During preference

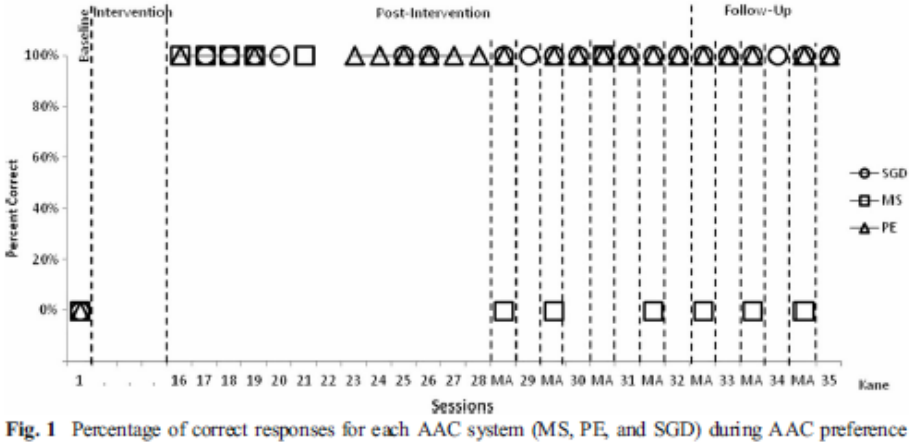

Fig. 1 Percentage of correct responses for each AAC system (MS, PE, and SGD) during AAC preference assessment and maintenance assessment (MA) trials in each session for baseline, post-intervention, and follow-up for Kane

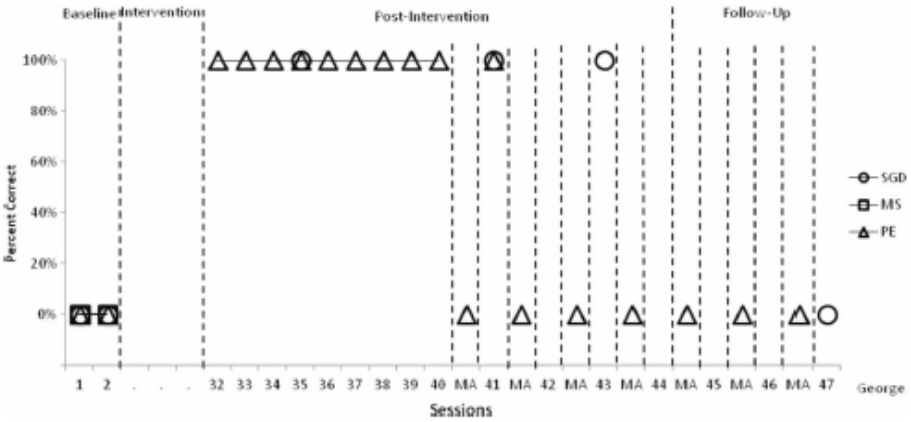

Fig. 2 Percentage of correct responses for each AAC system (MS, PE, and SGD) during AAC preference assessment and maintenance assessment (MA) trials in each session for baseline, post-intervention, and follow-up for George

assessments in post-intervention Kane's selection of AAC options was variable. However, in follow-up he consistently (i.e., 84 % of the time) chose the SGD (see Fig. 5). He received a total of 102 AAC preference assessment trials and chose SGD on 35 %, PE on 32 %, and MS on 11 % of occasions. He did not select an AAC system 22 % of the time.

George George showed difficulties in acquiring mastery for each AAC system. He reached criterion for PE only, after 60 trials. Intervention for SGD and MS was discontinued after 133 trials of teaching these two systems with no significant improvement in performance. George received 13 sessions (62 trials) to make a request for more toy play during post-intervention. He showed high performance (100 %) on PE during the first 9 sessions of this phase. However, his results on PE dropped to 0 % correct on the 10th session of this phase and throughout the remainder of this phase and the sessions in follow-up. He showed high performance (100 %) on SGD in the 4th,

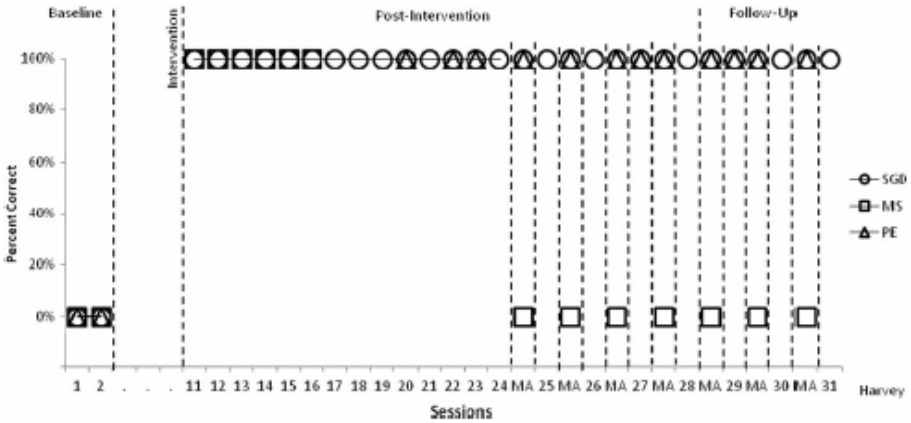

Fig. 3 Percentage of correct responses for each AAC system (MS, PE, and SGD) during AAC preference assessment and maintenance assessment (MA) trials in each session for baseline, post-intervention, and follow-up for Harvey

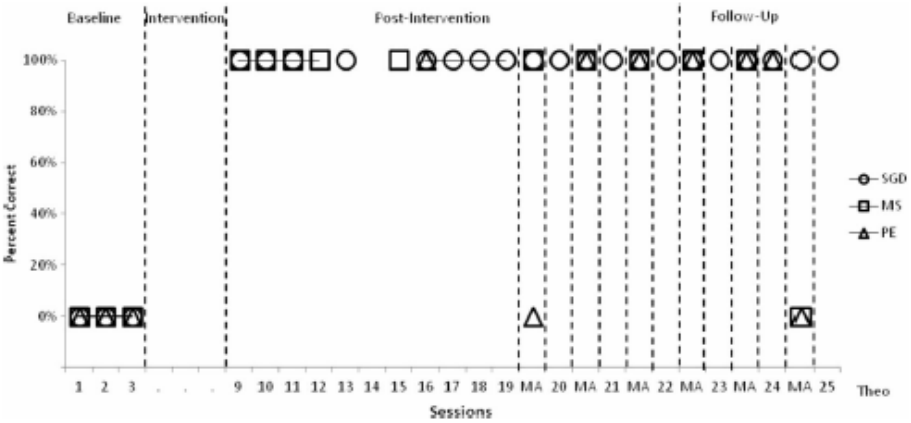

Fig. 4 Percentage of correct responses for each AAC system (MS, PE, and SGD) during AAC preference assessment and maintenance assessment (MA) trials in each session for baseline, post-intervention, and follow-up for Theo

11th, and 15th sessions of post-intervention. George's results were 0 % on all maintenance assessments.

George's AAC preference assessment data (see Fig. 5) during post-intervention and follow-up demonstrated a high number of non-selections, followed by PE. Overall George received 84 AAC preference assessment trials, in which he selected MS 0 %, SGD 7 %, and PE 31 % of the time. He did not make a selection on 62 % of occasions.

Harvey Harvey required fewer trials to master PE compared to SGD. He required more trials to learn the MS option compared to the other two options (see Table 1). Harvey received 18 sessions (92 trials) to make a request for more toy play during post-intervention. His performance was consistently high (100 %) in the system that he chose to use throughout post-intervention and follow-up (see Fig. 3). He showed consistently high performance on SGD and PE (100 %), but 0 % for MS in all of the maintenance assessment sessions.

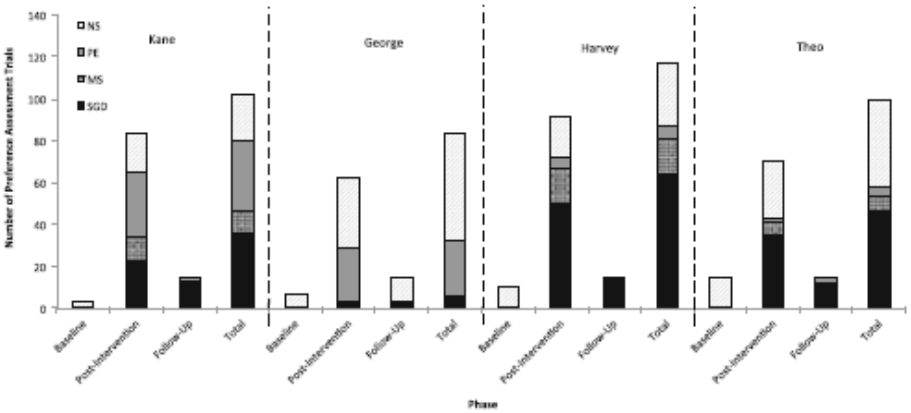

Fig. 5 Results from assessment to assess preference for the three AAC systems. The data show the frequency with which each AAC system (MS, PE, and SGD) was chosen and frequency of no selections (NS) across participants and phases

Table 1 Trials to criterion during the intervention phase for each participant and for each AAC option

Child	Trials to criterion[a]		
	SGD	MS	PE
Kane	22	64	23
George	N/A	N/A	60
Harvey	28	42	20
Theo	24	21	12

[a]Criterion was set as 8 independent requests within a block of 10 consecutive trials

The results of AAC preference assessments during post-intervention varied (see Fig. 5). However, Harvey's preference results were more consistent on follow-up. He received 15 trials of preference assessment in follow-up in which he consistently chose to use the SGD (100 %). The overall results of preference assessments showed that Harvey selected to use the SGD 55 %, MS 15 %, and PE 5 % out of the total 117 trials. The percentage of non-selections was 26 %.

Theo Theo learned MS and SGD at a comparable rate, but this was at a slower pace than PE (see Table 1). Theo received 14 sessions (70 trials) to make a request for more toy play during post-intervention. His performance was consistently high (100 %) in the system that he chose to use throughout post-intervention sessions and follow-up (see Fig. 4). He showed consistently high performance (100 % correct) using SGD during all of the maintenance assessment sessions. His performance on MS was also consistently high (100 % correct) during post-intervention. He showed a lower rate of success in maintaining PE (i.e., 100 % correct on 66 % of post-intervention sessions). Although he showed 100 % correct use of MS and PE in the first two sessions of maintenance assessment in follow-up, he failed to maintain them on the last session (18 months post-intervention).

AAC preference assessment data during post-intervention demonstrated that Theo selected SGD and did not make a selection for an AAC system comparably often. He consistently chose the SGD (80 %) during follow-up. Theo received a total of 100 AAC preference assessments in which he selected SGD on 47 %, MS on 6 %, and PE on 5 % of the trials. He did not make a selection 42 % of the time.

Discussion

Our results suggest that the systematic instructional procedures that were implemented in this study (Duker et al. 2004) were largely effective in teaching the participants to request the continuation of toy play using three different AAC systems (i.e., MS, PE, and SGD). Further, the findings support previous research which showed that children with developmental disabilities can be taught to use multiple AAC systems for functional communication (Couper et al. 2014; Boesch et al. 2013a, b; Flores et al. 2012; Lorah et al. 2013; Son et al. 2006; Tincani 2004; van der Meer et al. 2012a, b, c). Importantly, this study compared acquisition rates of, preference for, and maintenance of AAC systems on basic requesting skills. The study was unique in terms of its

inclusion of long-term follow-up for 18 months post intervention. The three participants that reached acquisition criteria for each AAC system only demonstrated a distinct preference for one of the systems (i.e., SGD) during this long-term follow-up. Maintenance of this AAC system was also high. These findings are consistent with previous research suggesting some children only exhibit a stable preference for an AAC system after they have developed proficiency in using each AAC system (van der Meer et al. 2012c). However, across the combined phases of the study none of the participants indicated a clear preference for using one AAC system over the others. This was in contrast with previous research where children with developmental disabilities have consistently indicated a clear preference for using a certain AAC system and that acquisition impacted their preference for that AAC system (Couper et al. 2014; van der Meer et al. 2012a, b, c, 2013a).

Specifically, all of the participants learned to use PE and three participants learned to use the SGD and MS. The analysis of acquisition rates showed that three participants learned to use PE faster than the other systems. However, for two of these participants, the difference in acquisition rates between PE and SGD were not clinically significant. A possible explanation for the slightly longer acquisition rate for SGD compared to PE is the finesse in motor skills required to operate the SGD (Kagohara et al. 2010). In order to activate the speech output, participants must be able to press the symbol on the screen of the SGD with a light touch or tap, which is not as straightforward as using PE (i.e., tapping or pulling a picture card off a Velcro™ dot). Results of maintenance assessments indicated that SGD and PE were also maintained at a high rate by three of the participants.

Kane and Harvey required more trials to learn the MS option, whereas George did not reach acquisition with the MS option (see Table 1). Even though Kane and Harvey eventually reached the acquisition criterion with the MS option, they did not maintain this skill during follow-up. The slower rate of mastery and lack of maintenance with the MS option is consistent with results for some of the participants in previous studies that have compared acquisition of MS with either the use of PE and/or SGD (Couper et al. 2014; Iacono and Duncum 1995; Iacono et al. 1993; Sigafoos and Drasgow 2001; van der Meer et al. 2012a, b, c). There are several possible explanations for these results. Firstly, as opposed to SGD and PE which use symbols that are readily recognizable, MS requires the recall of memory which might be an area of difficulty for some children with developmental disabilities (Iacono and Duncum 1995; Iacono et al. 1993; Light and Drager 2007). Secondly, MS requires more sophisticated motor skills compared to SGD and PE. Specifically, to be able to perform an intelligible MS an individual would have to make an exact arm, hand, and finger movement to communicate (Blischak et al. 1997; Tincani 2004) whilst for SGD they would only touch a symbol on the screen and for PE pull off and hand over the picture card. Thirdly, children with developmental disabilities tend to show fairly poor performance on the system they least prefer. Several studies that focused on comparing the use of different AAC systems with children with developmental disabilities (Couper et al. 2014; van der Meer et al. 2012c) suggested that acquisition and performance were better using the AAC system that they most preferred. Finally, from the instructor's point of view, MS might be more difficult to teach compared to SGD and PE (van der Meer et al. 2012a, b, c). Findings from the present study might suggest that even though the procedures were largely successful in teaching SGD and PE, there are possibly better instructional systems suited to teaching the use of MS. For example, strategies involving priming (instead of physical prompting) and the continued use of

prompts throughout post-intervention might have increased the participants' performance in MS, as evidenced by positive results in using these strategies to teach key word signing to children with autism in a study by Tan and colleagues (2014). Furthermore, focusing on teaching one system per session as per the procedures in van der Meer et al. (2012a, b, c), and van der Meer et al. (2013a), might have led to better results in the acquisition and maintenance of MS. It must also be noted that the only participant who failed to learn MS was the only boy in this study who was diagnosed with global developmental delay (compared to ASD) and received the lowest scores on the expressive sub domain of the Vineland-II (Sparrow et al. 2005). Therefore the teaching procedures and/or targeted skills (i.e., learning to use three different AAC systems) used in this study might not be suited to individuals with lower functioning in communication skills as indicated by the Vineland-II (Sparrow et al. 2005). Likewise Theo's diagnosis of ASD and higher scores on the expressive sub domain of the Vineland-II might explain his rapid acquisition.

In light of preference, the participants only showed consistent selection for an AAC system, the SGD, during follow-up and indicated mixed results during other phases of the study. Hence the overall results do not indicate a clear preference for using one AAC system over the others. Specifically, the overall findings indicate that from the three AAC options available, SGD was chosen the most (ranging from 7 to 55 % with an average of 36 %), followed by PE (ranging from 5 to 32 %, with an average 18 %), and lastly MS (ranging from 0 to 15 % with an average of 8 %). The number of non-selections was highest (ranging from 22 to 62 % with an average of 38 %). Based on the requirements as described in previous studies where items have to be selected at least 70 % (Son et al. 2006) or 80 % (Green et al. 2008) of the time to determine preference, it was therefore concluded that overall there was no clear preference for an AAC system in this study.

There are several possible explanations for the high number of non-selections throughout most phases, with a distinct preference only evidenced during follow-up. One might suggest that the reason why a certain AAC system was not chosen consistently might be due to the fact that individuals with developmental disabilities show changes in preference over time (Stafford et al. 2002; van der Meer et al. 2012c). However, consistent with previous studies (van der Meer et al. 2012a, b), stable preferences might be dependent on acquisition and proficiency in using the AAC systems. This would explain the non-selections during baseline. In addition to this, it is possible that the participants had not yet developed their choice-making skills prior to follow-up (Sigafoos 1998; Wehmeyer 1992; Wehmeyer et al. 2010) and would therefore not be able to make a consistent selection and show a clear preference for one AAC system over the others. Finally, the procedures used in the intervention phase might have had an impact on the high number of non-selections. Specifically, all of the AAC systems were available rather than making only one option available for the session (van der Meer et al. 2012b, c). As explained above, this might have not only affected acquisition rates, but in turn also affected choice-making. Weaker intervention effects and therefore proficiency might also explain continued non-selections and variation in selections of AAC systems throughout post-intervention. However, the inclusion of maintenance sessions might have allowed for proficiency and the eventual consistent selection of an AAC system (the SGD) during follow-up.

It appeared that the three participants who learned to use all three AAC systems most consistently chose to use the SGD during follow-up sessions even though their acquisition and proficiency with the SGD was comparable to their performance with the PE option. Previous research suggests that young children tend to choose AAC systems that are more appealing to them (Light and Drager 2007). It was therefore hypothesized that they might have thought the SGD was more appealing (Couper et al. 2014; van der Meer et al. 2012c). It could also be possible that these children selected the SGD due to its immediate response (i.e., speech output), as opposed to PE where they had to pull off the symbol from the board and hand it to the instructor (Ganz et al. 2013; Schlosser and Blischak 2004).

The assessment of acquisition rates and preference for AAC options might help parents and clinicians select AAC systems that are effective and suitable for children with developmental disabilities. Our results support and extend the evidence base for preference-enhanced communication interventions (Couper et al. 2014; van der Meer et al. 2012a, b, c, 2013a, b) in several ways. Firstly, it is evident that these children are capable of learning to use more than one AAC system. This can help ensure that the child is still able to communicate using other systems should their preferred AAC system be broken or unavailable (Sigafoos and Drasgow 2001). Secondly, participants were more proficient in using the AAC system they chose and were more likely to continue using this system in the long-term. Variation in the selection of AAC systems until participants had developed proficiency and long-term maintenance of communication skills suggests the need for regular AAC preference assessments. It would appear most beneficial to assess preferences once participants have had some experience with each AAC system. While teaching the use of, and assessing preferences for, several AAC systems is intensive initially, we suggest that long-term maintenance of communication skills with the participants' preferred AAC option might reduce the continued time and cost associated with implementing communication interventions.

These recommendations need to be considered with caution given that the study is limited in its focus on teaching a single and initial requesting skill. Directions for future research could involve assessing the impact of preference for different AAC options when teaching other communication functions/skills, on generalization across settings, and on overall language and social functioning.

Acknowledgements and Declaration of Interests Support for this research was provided from the New Zealand Government through the Marsden Fund Council, administered by the Royal Society of New Zealand; and by Victoria University of Wellington, The University of Canterbury, and The New Zealand Institute of Language, Brain & Behaviour. The authors report no conflicts of interests. The authors alone are solely responsible for the content and writing of this paper.

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CHAPTER VI

Study 2

Social Validation of Three AAC Systems

Ethical clearance and informed consent

Ethics approval for this study was sought from the author's university ethics committee (reference SEPI/2012/66 RM19560). Consent from the Head of School of Education at Victoria University and lecturers of the selected classes were obtained prior to the commencement of the study. The survey was anonymous, hence completing the survey indicated consent to participate.

Publication

An article based on this study has been published in *Developmeant Neurorehabilitation*: Achmadi, D., Sigafoos, J., Sutherland, D., Lancioni, G. E., O'Reilly, M. F., van der Meer, L., . . . Marschik, P. B. (2014). Undergraduates' perceptions of three augmentative and alternative communication modes. *Developmental Neurorehabilitation,* Doi: 10.3109/17518423.2014.962767

DEVELOPMENTAL NEUROREHABILITATION

http://informahealthcare.com/pdr
ISSN: 1751-8423 (print), 1751-8431 (electronic)

Dev Neurorehabil, Early Online: 1–4
 DOI: 10.3109/17518423.2014.962767

informa healthcare

BRIEF REPORT

Undergraduates' perceptions of three augmentative and alternative communication modes

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Abstract

Objective: To assess undergraduates' perceptions of three augmentative and alternative communication (AAC) modes. *Method*: We showed 104 undergraduates a video clip of a person using each of the three AAC modes and asked them to rate each option in terms of perceived (a) intelligibility, (b) ease of acquisition, (c) effectiveness/acceptability, and (d) preference. The three AAC modes shown were (a) manual signing, (b) picture exchange, and (c) speech-generating device. *Results*: Mean ratings for perceived intelligibility and effectiveness/acceptability were significantly higher for the speech-generating device. The speech-generating device and manual signing options were rated as being more preferred over picture exchange. Picture exchange was rated significantly higher on perceived ease of acquisition. *Conclusion*: Speech-generating devices were perceived to have greater social validity than manual signing and picture exchange.

Keywords

Augmentative and alternative communication, developmental disability, manual signing, picture exchange, social validation, speech-generating device, undergraduates' perceptions

History

Received 27 August 2014
Revised 31 August 2014
Accepted 3 September 2014
Published online 30 September 2014

Introduction

Augmentative and alternative communication (AAC) is indicated for many people with neurodevelopmental disorders [1]. Three commonly used AAC options are: (a) manual signing (MS), (b) picture exchange (PE), and (c) use of a speech-generating device (SGD). An important rehabilitation decision relates to the selection of an AAC option [2].

The extent to which MS, PE, and SGDs are socially valid could be an important consideration with respect to the selection of an AAC option. Schlosser [3] noted that social validity relates, in part, to the social acceptability of the person's method of AAC communication. Further, Schlosser [3] argued that AAC intervention should be evaluated in terms of social validity. One potentially useful type of social validation would be to ask people in the community to rate the extent to which various AAC options are perceived by them to be (a) intelligible/understandable, (b) easy to learn to use, and (c) effective and acceptable for use in the community. Raters could also indicate which option they would prefer to use if they were unable to speak.

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The present study was designed to solicit this type of social validation data from university undergraduate students. Undergraduates were selected because their perceptions could be construed as reflecting the views of an educated, but non-specialist, community sample of lay persons. It has been said that such lay people are the ultimate judges of what constitutes communicative competence [3]. Therefore, data of this type could be useful when planning AAC interventions for individuals who would be using AAC in the commuity with unfamiliar listeners.

Methods

Setting and participants

The study was conducted at a public university located in a major New Zealand city. The university had a total (2013) enrolment of approximately 23 461 students (55% female and 45% male). In terms of ethnicity, most (64%) were European/Pākehā, followed by Asian (18%), Māori (8%), Pasifika (5%), and other ethnicities (5%).

Participants were 104 undergraduate students enrolled in one of four Education courses. The courses focused on educational policy, early childhood education, classroom teaching, and educational psychology. Age and gender data were not collected. In each of these courses the students

received approximately 2–3 hours of lecture content related to developmental disability (e.g., autism spectrum disorder and/or intellectual disability and physical disabilities).

Video clip

We created a 90-s video clip showing a female non-disabled adult (i.e., the speaker) using an SGD, then using MS, and then using PE. In each case, the speaker used the AAC system to request a preferred item from a second female and non-disabled adult (i.e., the listener). The speaker and listener were not actors; they were PhD students in Education undertaking studies on teaching communication skills to children with developmental disabilities.

The video clip began with the following audio statement: *In the following video you will see someone making a request using a speech-generating device, then using a manual sign, and then using a picture exchange communication system.* The printed words speech-generating device, manual sign, and picture exchange were embedded into the video prior to each respective segment. During the video clip, the speaker did not utter any speech/words, but instead used only the SGD, MS, and PE options to communicate a request.

The video clip then showed the speaker and listener sitting at a table. The listener offered the speaker a plate of snacks and said *Here, you can have a snack.* The speaker was then shown taking a snack from the plate. The listener then removed the plate and said: *Let me know if you want more.* At this point, the speaker made a request using one of the AAC systems. In the SGD segment, the speaker was shown tapping a *MORE* icon from the screen of an iPod Touch® (Apple Corporation, Cupertino, CA, www.apple.com), which produced synthesized speech output (i.e., ''I want more''). The listener responded to the speech output by offering the speaker the plate of snacks from which the speaker selected and ate one of the snacks. In the clip for the MS option, the speaker was shown producing the manual sign for MORE based on the Online Dictionary of New Zealand Sign Language (http://nzsl.vuw.ac.nz) and the listener then offered the plate of snacks from which the speaker selected and ate one of the snacks. For the PE segment of the video clip, the speaker handed a picture card to the listener and the listener then offered the plate of snacks from which the speaker selected and ate one of the snacks. The picture card had a graphic symbol representing *MORE* with the printed word *more* on it. After the PE segment, students were requested to complete the survey (see below), which had been distributed prior to watching the video.

Survey

The survey consisted of 11 questions rated on a 1 (Strongly disagree) to 5 (Strongly agree) scale. The 11 questions comprised four groups covering: (a) intelligibility, (b) ease of acquisition, (c) effectiveness and acceptability, and (d) preference. Four questions assessed the perceived intelligibility of the options (i.e., I think this AAC system is like natural speech. I think this AAC system would be understandable to parents and teachers of children with autism spectrum disorder/intellectual disability. I think this AAC system would be understandable to familiar adults of children with autism spectrum disorder/intellectual disability. I think this AAC system would be understandable to unfamiliar adults). Two questions assessed the perceived ease of using and learning to use the option (i.e., I think this AAC system would be easy to learn to use. I think the AAC system would be easy for children with autism spectrum disorder/intellectual disability to use.). Three questions assessed the perceived effectiveness and acceptability (i.e., I think this AAC system would be effective in the community. I think this AAC system is the best method of nonverbal communication. This AAC system would not draw undue negative attention to the user.). The remaining two questions assessed preference (i.e., I would choose to use this AAC mode if I were unable to speak. I would prefer my child to use this AAC system.). The survey ended by asking participants to indicate their experience (in years and months) with MS, PE, and SGDs.

Procedures

Eleven Education graduate students were asked to read the draft survey and view the video clip to establish face validity. In light of their feedback, wording changes were made to the survey, and the video clip was edited to include the initial explanation.

Data were collected from undergraduates at the end of one of their lectures. Before completing the survey, students were given an Information Sheet that included background information about the study and instructions. Specifically, the students were told that they would be participating in a study that aimed to explore their perceptions of three communication methods that are often used by individuals with significant communication impairments. Students were informed that some children are unable to speak due to a developmental disability, such as intellectual disability or autism spectrum disorder. It was noted that in these cases the child might be taught to use an alternative mode of communication, such as manual signs, a picture exchange system, or to use an electronic speech-generating device. The term children was used to relate the survey to lecture content and because one of the survey questions asked the undergraduates to rate how easy they thought it would be for children with autism spectrum disorder/intellectual disability to learn to use the SGD, MS, and PE options.

The undergraduates were also told that they would see a video illustrating each of these three options and would then be asked to give their opinion about each option by filling out a survey. Students were given 5 min to read the Information Sheet. After this, the survey was distributed and the students were shown the video clip as a group. After viewing the video clip, the students completed the survey.

Data were analysed by calculating means and standard deviations for the intelligibility, ease of acquisition, effectiveness/acceptability, and preference items. Participants' answers to the four intelligibility items were averaged to create an intelligibility component score. Similar component scores were created for the ease of acquisition, effectiveness/acceptability, and preference items. Paired *t*-tests [4] were conducted to determine significance between each mean component score across the MS, PE, and SGD options.

DOI: 10.3109/17518423.2014.962767

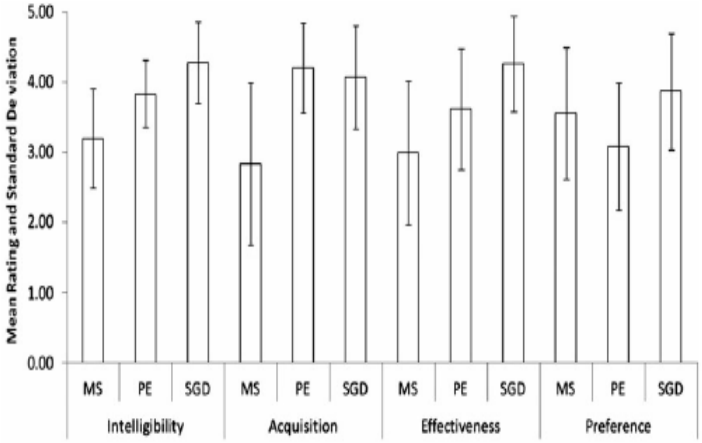

Figure 1. Mean ratings and standard deviations of perceived intelligibility, ease of acquisition, effectiveness, and preference for MS (manual sign), PE (picture exchange) and SGD (speech-generating device).

Significance was set at $p < 0.01$ level of significance to protect against the inflation of family-wise Type I Error rates associated with conducting multiple comparisons.

Results

The 104 undergraduates' self-reported experience with MS, PE and SGDs ranged from 0 to 4 years ($M = 0.20$ years). Figure 1 shows the mean ratings for intelligibility, ease of acquisition, effectiveness/acceptability, and preference for each of the three AAC options. The SGD was rated as more intelligible ($M = 4.27$, SD = 0.58) than PE ($M = 3.83$, SD = 0.48) and MS ($M = 3.19$, SD = 0.72). In terms of ease of acquisition, PE was rated higher ($M = 4.21$, SD = 0.64) than SGD ($M = 4.07$, SD = 0.73) and MS ($M = 2.80$, SD = 1.14). Perceptions of effectiveness/acceptability were highest for the SGD ($M = 4.27$, SD = 0.69), followed by PE ($M = 3.61$; SD = 0.86), and MS ($M = 2.99$, SD = 1.02). For the preference items, the SGD was rated higher than MS and PE was rated as least preferred. The respective means were: SGD ($M = 3.86$, SD = 0.83); MS ($M = 3.56$, SD = 0.94); and PE ($M = 3.08$, SD = 0.91). Significant differences were found for all comparisons with the exception of that between PE and SGD on ease of acquisition, and for preference ratings between SGD and MS. Cohen *d* effect size calculations (Table I) ranged from small to large.

Table I. Results of paired *t*-tests.

Items	Comparison	*t*	df	*p*	Cohen's *d*
Intelligibility	PE – MS	8.03	102	0.00*	0.79
	PE – SGD	−8.03	102	0.00*	−0.79
	MS – SGD	−11.3	102	0.00*	−1.11
Ease of Acquisition	PE – MS	9.65	102	0.00*	0.95
	PE – SGD	2.07	101	0.04	0.2
	MS – SGD	−7.84	101	0.00*	−0.78
Effectiveness	PE – MS	4.59	94	0.00*	0.47
	PE – SGD	−6.36	94	0.00*	−0.65
	MS – SGD	−8.90	96	0.00*	−0.90
Preference	PE – MS	−4.21	95	0.00*	−0.43
	PE – SGD	−5.88	95	0.00*	−0.60
	MS – SGD	−2.11	95	0.04	−0.22

PE = Picture Exchange; MS = manual sign; SGD = speech-generating device. Cohen $d = 0.20$ (small); $d = 0.50$ (medium); $d = 0.80$ (large).
*Significant at $p < 0.01$.

Discussion

The results suggest that (a) the SGD option was perceived to be more intelligible and more effective/acceptable than both the PE and MS options, (b) the SGD and MS options were preferred over PE, and (c) the SGD and PE options were perceived to be easier to learn and use than MS.

One explanation for higher intelligibility and effectiveness ratings for the SGD option could be its associated synthetic speech output. The speech output could be seen as providing a stimulus for listeners that is more akin to natural speech – which is of course the most prevalent mode of communication in mainstream society – than the output from either manual signing or the exchange of a picture card. The associated speech output might also explain why the SGD was preferred over PE, although this result might also stem from the higher perceived intelligibility and effectiveness ratings for the SGD. MS was also rated as more preferred than the PE option, perhaps because manual signing is a familiar mode of communication due to its use by the Deaf community [5]. With respect to ease of acquisition, the PE and SGD options might have been rated as easier to use and easier to learn to use because both of these options were configured with the same graphic symbol (i.e., a line drawing that included the printed word *more*).

These results and the associated inferences need to be regarded as tentative and interpreted with caution. The results are based on perceptions from a convenience sample of undergraduates who were mainly unfamiliar with AAC and had only a brief (video-based) exposure to the three options. In addition, only one video clip was used showing use of the AAC options in the same order. This was necessary because it was not practical to create multiple video clips covering each possible sequence of SGD, MS, and PE use. However, the use of a single video clip showing SGD use first, then MS, and then the PE option could have introduced a confounding sequence effect. This is perhaps unlikely due to the fact that

the overall video clip was relatively brief (90 s) and thus unlikely to have created any major sequence (i.e., primacy or recency) effects with these respondents. Still, the study would have been improved by controlling for order effects. Different patterns of results might arise from respondents having more experience with AAC. Future research is thus needed to assess the generality of these findings. Future research could also include follow-up interviews to shed light on the reasoning behind participants' ratings. This type of information might help to advance our knowledge as to why the SGD was rated as more intelligible, effective, and as highly preferred.

The results of this study are consistent from preliminary ratings we have from five parents and four teachers of children with developmentally disabilities. The children had been taught to use MS, PE, and a SGD and then their parent and teachers completed a similar survey. Like the undergraduates, these parents and teachers also rated the SGD as the most intelligible, and effective. Unlike the present sample of undergraduates, however, these parents/teachers also rated the SGD as the easiest to learn to use, and as more preferred than the MS and PE options. However, these unpublished data were not tested for significance due to the small sample size.

The results of this study are also consistent with several studies that have directly compared acquisition of, and preference for, MS, PE, and SGD among children with developmental disabilities [6–8]. These studies have generally found that PE and SGD are acquired faster than MS. Interestingly, most of the participating children in these studies showed a preference for the SGD. Thus, children requiring AAC seem to prefer using a SGD; whereas undergraduates' preference ratings were not significantly different for the SGD and MS options.

Overall, these results suggest that, compared to MS and PE, SGDs might be the more socially valid AAC option. Information of this type could be useful to rehabilitation professionals. While such data might be of some clinical value, decisions regarding the selection of AAC options should be made on a case-by-case basis. Social validity might be an important variable to consider in this decision-making process.

Declaration of interest

The authors report no conflicts of interests. The authors alone are solely responsible for the content and writing of this paper. Support for this research was provided from the New Zealand Government through the Marsden Fund Council, administered by the Royal Society of New Zealand; and by Victoria University of Wellington, The University of Canterbury, and The New Zealand Institute of Language, Brain & Behaviour.

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CHAPTER VII

General Discussion

Main Findings

It has been suggested (Sigafoos, O'Reilly, Lancioni, & Sutherland, 2014) that there are two trends emerging in the field of AAC, namely (1) the use of new technology (such as portable electronic devices as AAC systems), and (2) comparison studies of different AAC systems. These trends warranted a systematic review of the literature (see Chapter 2) that focused on assessing the purpose, methodology, and findings of studies that involved comparing the use of two or more AAC systems (i.e., MS, PE and/or SGD) to teach children with ASD and related DD new communication skills.

There are several main findings from the literature review. Firstly the literature suggested that there appears to be a trend in comparing SGDs with low tech AAC systems (MS, PE, and/or TS) in comparison studies. Many of the studies used high-tech portable devices, with voice-output software that served as SGD. Secondly, there was evidence to suggest that there was little focus on early intervention studies, especially on preschool and school entry age children. Thirdly, all of the studies used single-subject, alternating-treatment designs, which are commonly found in the field of educational research. As a result the majority of studies had a small number of participants and most of the participants were boys. Fourth, while the studies focused on comparing different types of AAC options (i.e., MS, PE, and/or SGD), comparisons of different versions of the same AAC option seemed to be lacking. For example, to assess the effectiveness of MS, it might be beneficial to compare the effectiveness of

Makaton (Makaton New Zealand/Aotearoa, 1998) versus New Zealand Sign Language (Kennedy et al., 1997). Fifth, most of the studies collected data using the AAC system that was most preferred by the participant, as opposed to assessing the participant's performance in using all of the AAC systems, both preferred and less preferred. Sixth, in terms of preference for AAC systems, it was evident that MS was generally the least preferred compared to PE and SGD. Lastly, there seemed to be a lack of long-term follow-up. The longest follow-up stage was one year post-intervention.

There is evidence to suggest that if the communication partners do not perceive the AAC system as effective, the intervention is perhaps less likely be used by the AAC user (Kennedy, 2002; Schlosser, 1999). The important role of acceptance of AAC system and the lack of emphasis on social validation in the field of AAC (Callahan, Henson, & Cowan, 2008; Schlosser, 1999; Snell, et al., 2010) warranted a systematic literature review on social validation (see Chapter 3) to summarize current knowledge on the social validation of AAC systems.

There were several main findings arising from the systematic literature review on social validation of AAC systems. Firstly, social validity assessments of AAC systems seem to have received more attention in recent years compared to the 1990s. Secondly, there was an increase in the use of SGDs in the literature starting from about 2007. Thirdly, social validity assessments were mostly conducted on indirect stakeholders (caregivers, siblings, and peers), members of the immediate community (clinicians), and extended community (undergraduate students and members of the wider community). Fourth, most of the studies in the literature focused on assessing the stakeholders' perceptions of the results

and procedures of the intervention of one AAC system, as opposed to assessing their perceptions of different AAC systems.

The findings of the systematic literature reviews on AAC comparison studies (Chapter 2) and social validity of AAC systems (Chapter 3) pointed to several key aspects to address in future research. Firstly, comparison of acquisition, preference, and long-term follow-up of MS, PE, and SGD as AAC options (Study 1) and secondly, social validation of these AAC options (Study 2).

The main findings of Study 1 are as follow. Firstly, the results suggested that systematic instructional procedures (Duker et al., 2004), based on the principles of ABA (Lovaas, 2003a) were largely effective. The findings add new evidence to the literature on effective methods for teaching AAC to children with DD. Further, by using these procedures, the data suggest that most of the participants learned to use more than one AAC system for functional communication (i.e., to request). These findings are similar to previous research (Boesch et al., 2013a, 2013b; Couper et al., 2014; Flores et al., 2012; Lorah et al., 2013; Son et al., 2006; Tincani, 2004; van der Meer et al., 2012a, 2012b, 2012c). Learning more than one AAC system could be valuable in case of system breakdown, unavailability of one AAC system, or if listeners do not understand one system.

There was one participant in Study 1, George, who only reached acquisition with PE. The author implemented several procedural modifications in order to help George acquire MS and SGD skills, but without much success. As mentioned in Chapter 5, George's inability to acquire the skills might have been

due to his diagnosis and low expressive language age. For a comparison, Theo was diagnosed with ASD and had a higher expressive language age compared to George and he mastered MS, PE, and SGD. The difference might suggest that the teaching procedures that were used in this study were more effective for children with better expressive language skills.

The second main finding was focused on investigating the difference (if any) in acquisition rates between MS versus PE versus SGD. Based on findings from previous research that compared MS with other AAC options (eg., PE or SGD (Couper et al., 2014; lacono et al., 1993; Iacono & Duncum, 1995; Sigafoos & Drasgow, 2001; van der Meer et al., 2012a, 2012b, 2012c), it was hypothesized that the participants would show slower acquisition rates for MS compared to PE and SGD. The findings suggest that the hypothesis was supported and the findings are in line with those of previous research (Couper et al., 2014; lacono et al., 1993; Iacono & Duncum, 1995; Sigafoos & Drasgow, 2001; van der Meer et al., 2012a, 2012b, 2012c). Further, the acquisition rates of PE and SGD were comparable. It must be noted that the participants were not given access to the intervention materials outside of the study. This is to control for carry-over effect that might jeopardize the results of the study. The teachers and parents of the participants could, and did, use PE in their homes and school, but did not use the MS, PE, or SGD symbols used in Study 1.

Slower acquisition rates on MS (compared to PE and SGD) might stem from several factors. Firstly, perhaps there are higher learning demands for MS (lacono et al., 1993; Iacono & Duncum, 1995; Light & Drager, 2007). Specifically, as opposed to PE and SGD which use graphic symbols and require

recognition memory, MS requires recall memory that might be an area of difficulty for children with DD (Mirenda, 2003). Secondly, one would have to make a precise finger, hand, and arm formation and movement to be able to perform an intelligible MS gesture (Blischak et al., 1997; Tincani, 2004) which might be more difficult to learn. Thirdly, from the instructor's point of view, teaching MS might be more difficult than teaching PE and SGD (van der Meer et al., 2012a, 2012b, 2012c).

It must be noted that the teaching sessions comprised of 12 trials, which included four trials each for MS, PE, and SGD. The results might have been better if the teaching procedures only focused on one AAC system per session, so that the participants would have plenty of opportunities with one AAC system before moving on to another. This approach might have made it easier for the children to learn each system. Further, the acquisition rates of MS might have been better using different teaching procedures, such as priming instead of using physical prompting (Tan et al., 2014).

The third main finding of Study 1 focused on whether or not the participants showed a clear preference for using one of the AAC systems. The participants showed a consistent preference the SGD during follow-up. During baseline, however, all participants consistently showed no selection of AAC systems. Preference was not checked during training, hence it cannot be determined if preference during that phase influenced the acquisition rates. This was because I wanted to concentrate on acquisition during the training phase. Preference assessments during post-interventions showed mixed results. The overall results on preference assessments showed that no selection was the

highest (*M* = 38%), followed by SGD (*M* = 36%), PE (*M* = 18%), and lastly MS (*M* = 8%). Based on requirements of clear preference (Son et al., 2006), an item has to be selected at least 70%. Therefore, overall there was no clear preference for an AAC system in this study.

However, during the follow-up phase it appeared that the three participants who acquired the skills to use MS, PE, and SGD, did show a preference for SGD, even though their acquisition rates and proficiency in using the SGD were comparable to the PE option. The more frequent selection of the SGD option in the follow-up phase is consistent with previous studies (Couper et al., 2014; van der Meer et al., 2012c). There might be several reasons to explain why these children selected the SGD more than MS or PE during the follow-up phase. Firstly, Light and Drager (2007) suggested that young children tend to choose an AAC system that is more appealing to them. Thus, for the participants, the appeal factor for the SGD might have been greater than MS and PE. Secondly, the participants might have chosen SGD due to its speech output (Ganz et al., 2013; Schlosser & Blischak, 2004), as opposed to PE, which has no speech output. The implication of these findings is that most children could prefer speech output, as it might be a type of reinforcing feedback.

Further, the teaching procedures might have had an impact in the change of preference for AAC system. Specifically, by teaching the participants all three AAC systems within one session (as opposed to one AAC system per session), the intervention effect might have been weaker due to carry-over effects. If preference affected proficiency (van der Meer et al., 2012c), it could be that a low rate of proficiency equates to a lower preference differentiation. Hence the

lower preference for MS might be explained by the lower proficiency with MS overall. Secondly, it has been suggested in previous research (Stafford et al., 2002; van der Meer et al., 2012c) that some individuals with DD will show changes in preference over time. The implications of these findings might mean that it would be beneficial to conduct preference assessments at regular intervals to capture any changes in preference. If change in preference can be detected, it might be more useful to change the intervention to match the user's new preference.

The fourth main finding of Study 1 relates to the influence of preference for an AAC system on maintenance/proficiency. Based on previous research, it was hypothesized that the participant's preference for an AAC system would have a positive impact on their level of maintenance in using said system (van der Meer et al., 2012c). In the current study, the proficiency levels during post-intervention checks were largely high for PE and SGD. However, as mentioned above, preference assessment data during post-intervention showed mixed results with a high number of non-selections. Hence there did not appear to be a clear association between preference and proficiency during the post-intervention sessions, unlike findings from van der Meer et al. (2012c).

On the other hand, results from the long-term follow-up phase suggested a clearer preference for the SGD in most participants, compared to the post-intervention phase. Proficiency levels were also higher with both SGD and PE, but lower for MS. Clearer preference during long-term follow-up support findings from previous research, and suggest that children with DD might not have developed a strong and consistent preference until the long-term follow-up

phase. For the current study, the generally higher preference for SGD and PE could have been a result of the possibly lower learning demands of these AAC systems as opposed to MS (lacono et al., 1993; Iacono & Duncum, 1995; Light & Drager, 2007). While preference and/or proficiency are important factors to consider in selecting an AAC system, it might also be of value to explore other factors (i.e., acquisition rates, learning demands) that might contribute towards both preference for, and proficiency of, using different AAC systems. For example, if the participant were to choose between using an SGD that required turning on the SGD and navigating the SGD to reach the desired page, compared to a single MS to make a request for a preferred item, which one would he/she choose? Likewise, learning demands and teaching procedures might influence preference and proficiency.

The fifth main finding of Study 1 comes from the long-term follow-up checks that occurred up to 18 months post-intervention. This length of follow-up has never been performed in previous comparison studies in the AAC field (see Chapter 2 for a review). It was hypothesized that the participants would maintain proficiency in using the AAC systems during long-term follow up. Results suggest that the hypothesis was partially supported. Specifically, as mentioned earlier, data from the long-term follow-up sessions indicated that most of the participants showed a high level of proficiency in PE and SGD compared to MS. It might be that, for some children with ASD and ID, AAC systems that involve recognition skills are maintained better than ones that involve recall skills.

The main findings of Study 2 are as follow. Firstly, the findings on the undergraduates' perception of the intelligibility of MS, PE, and SGD suggest that

SGD was perceived as more intelligible compared to MS and PE. Indeed, it is reasonable to assume that SGD was rated as more intelligible due to its speech output, compared to PE that involves a picture card and MS that relies on the communication partner's level of understanding of MS. Secondly, in terms of ease of acquisition, SGD and PE was rated as easier to learn than MS. This finding is consistent with previous research (lacono et al., 1993; Iacono & Duncum, 1995; Light & Drager, 2007), which have suggested that perhaps MS imposes higher learning demands (i.e., requires recall memory) compared to PE and SGD, which use graphic symbols and thus seem to require recognition memory. Thirdly, undergraduate students rated SGD as the most acceptable AAC system to use in the community. This might be due to the fact that using an SGD might not draw undue negative attention to the user compared to MS and PE. The fourth main finding of Study 2 relates to the undergraduate students' preference for each AAC system. Overall, SGD and MS were the AAC systems that were preferred by undergraduate students. This might be due to the intelligibility and acceptability of the SGD, and the fact that MS (sign language) is a familiar AAC system (see Chapter 2 for a review on MS).

Main Contributions

The present thesis provides several main contributions to the literature and AAC field. Firstly, the systematic literature reviews of comparison studies on AAC systems (Chapter 2) and social validation of AAC systems (Chapter 3) provided a summary of the purpose, methodology, and findings on these topics thus facilitating evidence-based practices (Schlosser, 1999).

There are several additional contributions of the findings that might be beneficial to the field of AAC and for clinicians involved in selecting an AAC system that is best-suited for an AAC user. Firstly, findings from Study 1 extend the current literature on AAC specifically by including long-term follow-up to 18 months post-intervention with three different AAC systems (i.e., MS, PE, and SGD). Secondly, new data on four new children with DD from Study 1 further support previous studies in demonstrating effective systematic teaching procedures, involving preference and maintenance assessments, which might in turn be beneficial in selecting an AAC system for the user. Thirdly, data from Study 1 suggest that AAC systems that were based on symbols and possibly recognition memory (i.e., PE and SGD) were learned faster than MS, which seems to require recall memory. Fourth, the participants in Study 1 come from a younger age group compared to previous studies (see Chapter 2). Fifth, the data of Study 1 were collected in two different settings (i.e., home and school), as opposed to previous studies that mainly collected data from one setting (see Chapter 2). These latter two contributions thus help to extend the generalizability of research comparing AAC systems. Sixth, the literature (see Chapter 3) suggested that an AAC system would more likely be used if the wider community perceived it as acceptable. Lastly, Study 2 used an innovative data collection method; that is by showing short clips of someone using MS, PE, and SGD to communicate. This method may allow for social validation of different options in a range of fields, such as comparing two methods of toilet training.

The abovementioned factors show how the studies in this present thesis extend the literature on AAC and also offer important new data to help clinicians

select an effective AAC system for children with DD. This could help reduce the time and cost associated with selecting an AAC system that is best-suited to the user, prevent device abandonment, and avoid negative experiences that might occur from an ineffective teaching or selection process.

Implications for practice

There are several additional implications of these findings for practice. Firstly, although the teaching procedures in the intervention phase of Study 1 might have contributed to the mixed results on preference during post-intervention, it seems that the maintenance levels were relatively high and consistent for PE and SGD. This might indicate that the teaching procedures were largely effective and can be applied to other children with DD. However, there might have to be some modification in the procedures for some children. Secondly, data from Study 1 provided findings on the participant's performance, preference, and long-term follow up. Such data enables AAC selection to be based on the empirical evidence, instead of making the selection based only on the user's characteristic. Third, it can be concluded that there is no ultimate best AAC system that would fit everyone's needs. This means that the best-suited AAC system would most likely depend on the learner's ability and characteristic as well as performance and preference. Lastly, it was suggested that the wider community have their own perceptions on different AAC systems. Thus it would be of value to assess these factors and take them into account in the process of selecting an AAC system for a candidate.

Directions for Future Research

Future research could aim to involve younger children as the target population to assess the effectiveness of earlier intervention. It would be also be of value to include generalization probes, to focus on teaching one AAC system per session, instead of the mixture of all systems in one session. It might be useful to look into comparing different types of SGDs, PE systems, or MS versions to see which one is most preferred or easiest to learn. Specifically for SGD, future research might compare different types of speech outputs and whether it has an impact on the AAC user's acquisition rates, and both the AAC user's and communication partner's preference for AAC system. Involving assessments of whether participants had access to any of the AAC systems outside of the research sessions would also be beneficial in controlling for potential practice effect that might compromise the results of the study. In the area of social validation, it would be useful to include other stakeholders, such as parents, teachers, siblings, and peers. Lastly, different data collection methods, such as interviews or combining surveys and interviews might allow for a better understanding of the acceptability factors of certain AAC systems.

Conclusion

From the results of these two studies, it might be concluded that assessing the AAC user's preference for an AAC system could be beneficial. Additionally, long-term follow-up is important in order to assess the stability of preferences, and to isolate any decrease in maintenance that needs to be addressed. Additionally, it would also be of value to assess perceptions of the AAC user's communication partner and wider community. The general association between Study 1 and Study 2 lies on the notion that the consumers' perceptions are

important in the implementation of an intervention (Kennedy, 2002; Schlosser, 1999). In other words, if the stakeholders perceive an intervention as not acceptable, then the intervention would less likely be implemented. In turn, this would potentially support the continuity of device use or in other words, prevent device abandonment. It may be suggested that in general, the AAC users and undergraduate students show a positive response towards SGD compared to MS and PE. These general results reflect the advantage of conducting direct comparisons to find the AAC system that is best-suited for the user and accepted by the community.

The results of these findings must be interpreted with caution. Firstly, results of Study 1 only focused on teaching a single requesting skill. Secondly, still on Study 1, positive results of the findings might only be applicable to a certain population, specifically these four young children with DD. Thirdly, the methodology of Study 2 (i.e., the use of video clips) might have an impact on the results of the study. There is a chance that results might vary if a different data collection method were used, for example interviews. Lastly, the results of social validation assessments in Study 2 might vary in different populations. For example, caregivers and teachers of children with severe communication impairments might have different perceptions of different AAC systems compared to those of undergraduate students.

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APPENDIX A

Ethics approval letter: *Enhancing communication intervention for children with autism*

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI
VICTORIA
UNIVERSITY OF WELLINGTON

FACULTY OF EDUCATION PO Box 17-310 Wellington 6012, New Zealand
Website www.victoria.ac.nz

4 December 2012

Donna Achmadi
PhD student
Victoria University of Wellington Faculty of Education
C/- School of Educational Psychology and Pedagogy
Donald Street
Wellington

Dear Donna

RE: Ethics application SEPP/2012/66 RM 19560

I am pleased to advise you that your ethics application **'Long-term Follow-up and Social Validation of Augmentative and Alternative Communication Use Among Children with Autism Spectrum Disorders'**, with the required changes, has been approved by the Victoria University of Wellington Faculty of Education Ethics Committee. Please note that the approval for your research to commence is from the date of this letter.

Best wishes for your research.

Yours Sincerely

Dr Sue Cornforth

Co-Convener
Victoria University of Wellington Faculty of Education Ethics Committee

APPENDIX B

Information Sheet for Parents of Children in Study 1

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI
VICTORIA
UNIVERSITY OF WELLINGTON

FACULTY OF EDUCATION

Project Title: Enhancing Communication Intervention for Children with Autism

Dear Parent,

We would like to invite you to consider allowing your child to participate in a research study that involves follow-up assessments of the skills that they have previously acquired. The purpose of this study is to see if children with autism, or children who have other related types of developmental disabilities, can maintain the skills they have learned (i.e., to make a request with manual signs, picture-exchange systems, or by using speech-generating devices) and see which system they prefer. This study also aims to explore your perception of the three communication systems that your child has been taught to use.

If you agree to allow your child to participate, we will conduct these follow-up sessions 12 and 18 months after their teaching sessions have finished. Each session would approximately take 10 minutes to complete. I am hoping to begin the 12 month follow-up in December 2012 and the 18 month follow-up in June 2013. During each follow-up session, we will be looking to see how many times and how accurately your child uses each of the three communication systems and if they show a preference in using one system over the others.

Upon completion of your child's participation in the study, we will also request that you fill out a survey that will allow us to gain insight into your perspectives on the different modes of communication used in the research.

The survey consists of questions related to your preferences and opinions relative to the three different modes of communication we taught your child to use. That is, (a) manual sign, (b) picture exchange, and (c) speech-generating device.

The survey would be given to you as your child nears the end of the follow-up programme. It should take approximately 5 minutes to complete the survey.

There is no obligation for you to agree to allow your child to participate or to complete the survey. Your responses to the survey will remain confidential. That is, we will not report your name or identify you in any way when reporting the results of the survey. If you decide to participate, you have the right to withdraw your consent at any time and discontinue your child's participation. Your decision to discontinue participation will not affect your present or future relationship with Victoria University of Wellington.

Confidentiality

Any information that is obtained in connection with this study and that can be identified with you or your child will remain confidential and will be disclosed only with your permission, except where disclosure is required by law.

The results of this project will be presented in written and verbal reports, but we will not use your name or your child's real name in any oral or written reports and we will not provide any personal information that would enable anyone to identify you or your child in any reports.

Ethics
This research has been assessed and approved by Victoria University Faculty of Education Ethics Committee (Reference Number SEPP/2012/66 RM 19560). If at any time you have any questions or concerns about your treatment as a research participant in this study, contact Dr. Allison Kirkman, Chair of the Victoria University of Wellington Human Ethics Committee (telephone: +64 4 463 5676; E-mail: allison.kirkman@vuw.ac.nz).

Data Storage and Deletion
All data will be stored in a locked filing cabinet in a locked office at Victoria University of Wellington. As required by copyright, the data will be stored for 5 years after publication and then shredded and thrown away after the 5-year storage period.

Reporting/Dissemination
The results of this study will be submitted for publication in research and or professional journals and may be presented at a conference. Any such reports will be given to you. However, if at any time you would like more detailed feedback, we would be more than happy to provide this either in person, or via the telephone, letter, or email.

If you have any questions about the study now or at any time in the future, please feel free to contact us using the following contact information:

Sincerely,

Donna Achmadi
School of Educational Psychology and Pedagogy
Faculty of Education
Victoria University of Wellington
PO Box 17-310, Karori
Wellington, NZ
Tel: (04) 463 5233 ext. 4597
Email: donna.achmadi@vuw.ac.nz

My supervisor is:
Professor Jeff Sigafoos
School of Educational Psychology and Pedagogy

Faculty of Education
Victoria University of Wellington
PO Box 17-310, Karori
Wellington, NZ
Tel: (04) 463 9772
Email: jeff.sigafoos@vuw.ac.nz

APPENDIX C

Consent Forms for Parents of Children in Study 1

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI VICTORIA UNIVERSITY OF WELLINGTON

FACULTY OF EDUCATION

CONSENT FORM FOR PARENT

Project Title: Enhancing Communication Intervention for Children with Autism

This research has been assessed and approved by Victoria University Faculty of Education Ethics Committee (SEPP/2012/66 RM 19560).

Please tick each of the boxes and sign the form to indicate your agreement with the statements below and your consent for your child and yourself to participate in this research.

1	I have read and understood the Information Sheet for this study.	○
2	I understand the nature of my involvement and the nature of my child's involvement in this project.	○
3	I understand that the investigators do not foresee any potential physical, psychological, social, legal, or other risks to me or my child as a result of participating in this study.	○
4	I understand that all research data will be securely stored at Victoria University of Wellington premises for at least five years, and will be destroyed when no longer required.	○
5	Any questions that I have asked have been answered to my satisfaction.	○
6	I agree that research data gathered for the study may be published provided that my own and my child's identity is not disclosed.	○
7	I understand that my identity, and my child's identity, will not be disclosed in any publications stemming from this research.	○
8	I understand that I will receive feedback on my child's progress and that I can request additional feedback at any time.	○
9	I agree to allow my child to participate in this investigation and understand that I may withdraw my permission at any time without any negative effect. I can also withdraw any data that has been collected about my child at any time prior to the publication of that data.	○
10	I agree to participate in the questionnaire at the end of the study, which consists of questions related to my preferences and opinions relative to the three different modes of communication that were taught to my child.	○
11	It is possible that you might not want to participate in the questionnaire at the end of the study, but that you would still like your child to participate in the research. If this is the case, you can tick this circle:	○

12 It is possible that you might not want to your child to participate in the research, but that you would still like to complete the questionnaire. If this is the case, you can tick this circle: ○

Parent Name/Contact Details

Name of Child

_____

_____

_____

Parent Signature

Date

_____

_____

_____

Please return this Consent Form in the envelope provided.
Thank you.

APPENDIX D

Information Sheet for Principals of Children in Study 1

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI
VICTORIA
UNIVERSITY OF WELLINGTON

FACULTY OF EDUCATION

Project Title: Enhancing Communication Intervention for Children with Autism

Dear Principal,

We would like to invite you to consider allowing your student and staff to participate in a research study that involves follow-up assessments of the skills that they have previously acquired. The purpose of this study is to see if children with autism, or children who have other related types of developmental disabilities, can maintain the skills they have learned (i.e., to make a request with manual signs, picture-exchange systems, or by using speech-generating devices) and see which system they prefer. This study also aims to explore the teacher's perception of the three communication systems that the student has been taught to use.

If you agree to allow your student to participate, we will conduct these follow-up sessions 12 and 18 months after their teaching sessions have finished. Each session would approximately take 10 minutes to complete. I am hoping to begin the 12 month follow-up in December 2012 and the 18 month follow-up in June 2013. During each follow-up session, we will be looking to see how many times and how accurately the student uses each of the three communication systems and if they show a preference in using one system over the others.

Upon completion of the student's participation in the study, we will also request your staff (i.e., the student's teacher) to fill out a survey that will allow us to gain insight into their perspectives on the different modes of communication used in the research.

The survey consists of questions related to preferences and opinions relative to the three different modes of communication we have taught the student to use. That is, (a) manual sign, (b) picture exchange, and (c) speech-generating device.

The survey would be given to the teachers as the student nears the end of the follow-up programme. It should take approximately 5 minutes to complete the survey.

There is no obligation for you to agree to allow your student to participate or staff to complete the survey. Your staff's responses to the survey will remain confidential. That is, we will not report your name, your school's name or the teacher's name, or identify you in any way when reporting the results of the survey. If you decide to allow your student and staff to participate, you have the right to withdraw your consent at any time and discontinue the student's and/or staff's participation. Your decision to discontinue participation will not affect your present or future relationship with Victoria University of Wellington.

Confidentiality
Any information that is obtained in connection with this study and that can be identified with you, your school, your teacher or your student will remain confidential and will be disclosed only with your permission, except where disclosure is required by law.

The results of this project will be presented in written and verbal reports, but we will not use your name, your school's name, your staff's name or your student's real name in any oral or written reports and we will not provide any personal information that would enable anyone to identify you or your child in any reports.

Ethics
This research has been assessed and approved by Victoria University Faculty of Education Ethics Committee (Reference Number SEPP/2012/66 RM 19560). If at any time you have any questions or concerns about your treatment as a research participant in this study, contact Dr. Allison Kirkman, Chair of the Victoria University of Wellington Human Ethics Committee (telephone: +64 4 463 5676; E-mail: allison.kirkman@vuw.ac.nz).

Data Storage and Deletion
All data will be stored in a locked filing cabinet in a locked office at Victoria University of Wellington. As required by copyright, the data will be stored for 5 years after publication and then shredded and thrown away after the 5-year storage period.

Reporting/Dissemination
The results of this study will be submitted for publication in research and or professional journals and may be presented at a conference. Any such reports will be given to you. However, if at any time you would like more detailed feedback, we would be more than happy to provide this either in person, or via the telephone, letter, or email.

If you have any questions about the study now or at any time in the future, please feel free to contact us using the following contact information:

Sincerely,

Donna Achmadi
School of Educational Psychology and Pedagogy
Faculty of Education
Victoria University of Wellington
PO Box 17-310, Karori
Wellington, NZ
Tel: (04) 463 5233 ext. 4597
Email: donna.achmadi@vuw.ac.nz

My supervisor is:
Professor Jeff Sigafoos
School of Educational Psychology and Pedagogy
Faculty of Education
Victoria University of Wellington
PO Box 17-310, Karori
Wellington, NZ
Tel: (04) 463 9772
Email: jeff.sigafoos@vuw.ac.nz

APPENDIX E

Consent Forms for Principals of Children in Study 1

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI VICTORIA UNIVERSITY OF WELLINGTON

FACULTY OF EDUCATION

CONSENT FORM FOR PRINCIPAL

Project Title: Enhancing Communication Intervention for Children with Autism

This research has been assessed and approved by Victoria University Faculty of Education Ethics Committee (SEPP/2012/66 RM 19560).

Please tick each of the boxes and sign the form to indicate your agreement with the statements below and your consent for your student and the student's teacher to participate in this research.

1	I have read and understood the Information Sheet for this study.	○
2	I understand the nature of my involvement and the nature of my student's involvement in this project.	○
3	I understand that the investigators do not foresee any potential physical, psychological, social, legal, or other risks to me or my student as a result of participating in this study.	○
4	I understand that all research data will be securely stored at Victoria University of Wellington premises for at least five years, and will be destroyed when no longer required.	○
5	Any questions that I have asked have been answered to my satisfaction.	○
6	I agree that research data gathered for the study may be published provided that my own, my school, my staff and my student's identity is not disclosed.	○
7	I understand that my identity, my student's identity and my staff's identity will not be disclosed in any publications stemming from this research.	○
8	I understand that I will receive feedback on my student's and staff's progress and that I can request additional feedback at any time.	○
9	I agree to allow my student and staff to participate in this investigation and understand that I may withdraw my permission at any time without any negative effect. I can also withdraw any data that has been collected about my student and staff at any time prior to the publication of that data.	○
10	I agree for my staff to participate in the questionnaire at the end of the study, which consists of questions related to his/her preferences and opinions relative to the three different modes of communication that were taught to the student.	○
11	It is possible that you might not want your staff to participate in the questionnaire at the end of the study, but that you would still like	○

your student to participate in the research. If this is the case, you can tick this circle:

12 It is possible that you might not want to your student to participate in the research, but that you would still like your staff to complete the questionnaire. If this is the case, you can tick this circle: ○

Name/Contact Details

_____

Principal Signature Date

_____ _____

_____

Please return this Consent Form in the envelope provided.
Thank you.

APPENDIX F

Information Sheet for Teachers of Children in Study 1

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI VICTORIA UNIVERSITY OF WELLINGTON

FACULTY OF EDUCATION

Project Title: Enhancing Communication Intervention for Children with Autism

Dear Teacher,

We would like to invite you to consider allowing your student to participate in a research study that involves follow-up assessments of the skills that they have previously acquired. The purpose of this study is to see if children with autism, or children who have other related types of developmental disabilities, can maintain the skills they have learned (i.e., to make a request with manual signs, picture-exchange systems, or by using speech-generating devices) and see which system they prefer. This study also aims to explore your perception of the three communication systems that your student has been taught to use.

If you agree to allow your student to participate, we will conduct these follow-up sessions 12 and 18 months after their teaching sessions have finished. Each session would approximately take 10 minutes to complete. I am hoping to begin the 12 month follow-up in December 2012 and the 18 month follow-up in June 2013. During each follow-up session, we will be looking to see how many times and how accurately your student uses each of the three communication systems and if they show a preference in using one system over the others.

Upon completion of your student's participation in the study, we will also request that you fill out a survey that will allow us to gain insight into your perspectives on the different modes of communication used in the research.

The survey consists of questions related to your preferences and opinions relative to the three different modes of communication we taught your student to use. That is, (a) manual sign, (b) picture exchange, and (c) speech-generating device.

The survey would be given to you as your student nears the end of the follow-up programme. It should take approximately 5 minutes to complete the survey.

There is no obligation for you to agree to allow your student to participate or to complete the survey. Your responses to the survey will remain confidential. That is, we will not report your name or identify you in any way when reporting the results of the survey. If you decide to participate, you have the right to withdraw your consent at any time and discontinue your student's participation. Your decision to discontinue participation will not affect your present or future relationship with Victoria University of Wellington.

Confidentiality
Any information that is obtained in connection with this study and that can be identified with you, your school or your student will remain confidential and will

be disclosed only with your permission, except where disclosure is required by law.

The results of this project will be presented in written and verbal reports, but we will not use your name, your school's name, or your student's real name in any oral or written reports and we will not provide any personal information that would enable anyone to identify you or your student in any reports.

Ethics
This research has been assessed and approved by Victoria University Faculty of Education Ethics Committee (Reference Number SEPP/2012/66 RM 19560). If at any time you have any questions or concerns about your treatment as a research participant in this study, contact Dr. Allison Kirkman, Chair of the Victoria University of Wellington Human Ethics Committee (telephone: +64 4 463 5676; E-mail: allison.kirkman@vuw.ac.nz).

Data Storage and Deletion
All data will be stored in a locked filing cabinet in a locked office at Victoria University of Wellington. As required by copyright, the data will be stored for 5 years after publication and then shredded and thrown away after the 5-year storage period.

Reporting/Dissemination
The results of this study will be submitted for publication in research and or professional journals and may be presented at a conference. Any such reports will be given to you. However, if at any time you would like more detailed feedback, we would be more than happy to provide this either in person, or via the telephone, letter, or email.

If you have any questions about the study now or at any time in the future, please feel free to contact us using the following contact information:

Sincerely,
Donna Achmadi
School of Educational Psychology and Pedagogy
Faculty of Education
Victoria University of Wellington
PO Box 17-310, Karori
Wellington, NZ
Tel: (04) 463 5233 ext. 4597
Email: donna.achmadi@vuw.ac.nz

My supervisor is:
Professor Jeff Sigafoos
School of Educational Psychology and Pedagogy
Faculty of Education
Victoria University of Wellington

PO Box 17-310, Karori
Wellington, NZ
Tel: (04) 463 9772
Email: jeff.sigafoos@vuw.ac.nz

APPENDIX G

Consent Forms for Teachers of Children in Study 1

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI VICTORIA UNIVERSITY OF WELLINGTON

FACULTY OF EDUCATION

CONSENT FORM FOR TEACHER

Project Title: Enhancing Communication Intervention for Children with Autism

This research has been assessed and approved by Victoria University Faculty of Education Ethics Committee (SEPP/2012/66 RM 19560).

Please tick each of the boxes and sign the form to indicate your agreement with the statements below and your consent for your student and yourself to participate in this research.

1	I have read and understood the Information Sheet for this study.	○
2	I understand the nature of my involvement and the nature of my student's involvement in this project.	○
3	I understand that the investigators do not foresee any potential physical, psychological, social, legal, or other risks to me or my student as a result of participating in this study.	○
4	I understand that all research data will be securely stored at Victoria University of Wellington premises for at least five years, and will be destroyed when no longer required.	○
5	Any questions that I have asked have been answered to my satisfaction.	○
6	I agree that research data gathered for the study may be published provided that my own and my student's identity is not disclosed.	○
7	I understand that my identity, and my child's identity, will not be disclosed in any publications stemming from this research.	○
8	I understand that I will receive feedback on my student's progress and that I can request additional feedback at any time.	○
9	I agree to allow my student to participate in this investigation and understand that I may withdraw my permission at any time without any negative effect. I can also withdraw any data that has been collected about my student at any time prior to the publication of that data.	○
10	I agree to participate in the questionnaire at the end of the study, which consists of questions related to my preferences and opinions relative to the three different modes of communication that were taught to my student.	○
11	It is possible that you might not want to participate in the questionnaire at the end of the study, but that you would still like your student to participate in the research. If this is the case, you can tick this circle:	○

12 It is possible that you might not want to your student to participate in the research, but that you would still like to complete the questionnaire. If this is the case, you can tick this circle: ○

Teacher's Name/Contact Details

Name of Child

_____

_____

_____

Signature

Date

_____

_____

_____

Please return this Consent Form in the envelope provided.
Thank you.

APPENDIX H

Information Sheet for Head of School of Undergraduate Students in

Study 2

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI VICTORIA UNIVERSITY OF WELLINGTON

FACULTY OF EDUCATION

Project Title: Enhancing Communication Intervention for Children with Autism

Dear Head of School,

We would like to invite you to consider allowing your students from EPSY 342 to participate in a research study that involves exploring their perceptions of three communication intervention systems for individuals with significant communication impairments.

If you agree to allow your students to participate in this study, we will show them a short video clip of an individual using three different communication aids to make a request. At the end of the video clip, the students will be asked to complete a short survey that will allow us to gain insight into their perspectives on the different modes of communication used in the research. The session will take approximately 10 minutes to complete.

The survey consists of questions related to their preferences and opinions relative to the three different modes of communication shown in the video clip. That is, (a) manual sign, (b) picture exchange, and (c) speech-generating device.

There is no obligation for you to agree to allow the students to participate in this study. Their responses to the survey will remain confidential. That is, we will not report the name or identify the school or the students' in any way when reporting the results of the survey. If you decide to participate, you have the right to withdraw your consent at any time and discontinue the students' participation.

Confidentiality
Any information that is obtained in connection with this study and that can be identified with the school or the students will remain confidential and will be disclosed only with your permission, except where disclosure is required by law.

The results of this project will be presented in written and verbal reports, but we will not use the school's name or the students' real name in any oral or written reports and we will not provide any personal information that would enable anyone to identify the school or the students in any reports.

Ethics
This research has been assessed and approved by Victoria University Faculty of Education Ethics Committee (Reference Number SEPP/2012/66 RM 19560). If at any time you have any questions or concerns about your treatment as a research participant in this study, contact Dr. Allison Kirkman, Chair of the Victoria University of Wellington Human Ethics Committee (telephone: +64 4 463 5676; E-mail: allison.kirkman@vuw.ac.nz).

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If you have any questions about the study now or at any time in the future, please feel free to contact us using the following contact information:

Sincerely,

Donna Achmadi
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Faculty of Education
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Faculty of Education
Victoria University of Wellington
PO Box 17-310, Karori
Wellington, NZ
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Email: jeff.sigafoos@vuw.ac.nz

APPENDIX I

Consent Form for Head of School of Undergraduate Students in Study 2

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI VICTORIA UNIVERSITY OF WELLINGTON

FACULTY OF EDUCATION

CONSENT FORM FOR HEAD OF SCHOOL

Project Title: Enhancing Communication Intervention for Children with Autism

This research has been assessed and approved by Victoria University Faculty of Education Ethics Committee (SEPP/2012/66 RM 19560).

Please tick each of the boxes and sign the form to indicate your agreement with the statements below and your consent for the students of EPSY 342 to participate in this research.

1	I have read and understood the Information Sheet for this study.	○
2	I agree to allow the students to participate in a questionnaire which consists of questions related to his/her preferences and opinions relative to the three different modes of communication systems for children with autism.	○
3	I understand that I may withdraw my permission at any time without any negative effect. I can also withdraw any data that has been collected about the students at any time prior to the publication of that data.	○
4	I understand that the investigators do not foresee any potential physical, psychological, social, legal, or other risks to me or the students as a result of participating in this study.	○
5	I understand that all research data will be securely stored at Victoria University of Wellington premises for at least five years, and will be destroyed when no longer required.	○
6	I agree that research data gathered for the study may be published provided that my own, my school, my staff and the student's identity is not disclosed.	○
7	I understand that my identity, the student's identity and my staff's identity will not be disclosed in any publications stemming from this research.	○
8	I understand that I can request additional feedback regarding the progress of the study at any time.	○
9	Any questions that I have asked have been answered to my satisfaction.	○

Name/Contact Details

_____

Signature Date

_____

_____ _____

Please return this Consent Form in the envelope provided.

Thank you.

APPENDIX J

Information Sheet for Course Coordinator of Undergraduate Students in Study 2

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI VICTORIA UNIVERSITY OF WELLINGTON

FACULTY OF EDUCATION

Project Title: Enhancing Communication Intervention for Children with Autism

Dear Course Coordinator,

We would like to invite you to consider allowing your students from EPSY 342 to participate in a research study that involves exploring their perceptions of three communication intervention systems for individuals with significant communication impairments.

If you agree to allow your students to participate in this study, we will show them a short video clip of an individual using three different communication aids to make a request. At the end of the video clip, the students will be asked to complete a short survey that will allow us to gain insight into their perspectives on the different modes of communication used in the research. The session will take approximately 10 minutes to complete.

The survey consists of questions related to their preferences and opinions relative to the three different modes of communication showed in the video clip. That is, (a) manual sign, (b) picture exchange, and (c) speech-generating device.

There is no obligation for you to agree to allow the students to participate in this study. Their responses to the survey will remain confidential. That is, we will not report the name or identify you, the school or the students in any way when reporting the results of the survey. If you decide to participate, you have the right to withdraw your consent at any time and discontinue the students' participation.

Confidentiality
Any information that is obtained in connection with this study and that can be identified with the school or the students will remain confidential and will be disclosed only with your permission, except where disclosure is required by law.

The results of this project will be presented in written and verbal reports, but we will not use the school's name or the students' real name in any oral or written reports and we will not provide any personal information that would enable anyone to identify the school or the students in any reports.

Ethics
This research has been assessed and approved by Victoria University Faculty of Education Ethics Committee (Reference Number SEPP/2012/66 RM 19560). If at any time you have any questions or concerns about your treatment as a research participant in this study, contact Dr. Allison Kirkman, Chair of the Victoria University of Wellington Human Ethics Committee (telephone: +64 4 463 5676; E-mail: allison.kirkman@vuw.ac.nz).

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If you have any questions about the study now or at any time in the future, please feel free to contact us using the following contact information:

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Faculty of Education
Victoria University of Wellington
PO Box 17-310, Karori
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APPENDIX K

Consent Forms for Course Coordinator of Undergraduate Students in Study 2

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI VICTORIA UNIVERSITY OF WELLINGTON

FACULTY OF EDUCATION

CONSENT FORM FOR COURSE COORDINATOR

Project Title: Enhancing Communication Intervention for Children with Autism

This research has been assessed and approved by Victoria University Faculty of Education Ethics Committee (SEPP/2012/66 RM 19560).

Please tick each of the boxes and sign the form to indicate your agreement with the statements below and your consent for the students of EPSY 342 to participate in this research.

1	I have read and understood the Information Sheet for this study.	○
2	I agree to allow the students to participate in a questionnaire which consists of questions related to his/her preferences and opinions relative to the three different modes of communication systems for children with autism.	○
3	I understand that I may withdraw my permission at any time without any negative effect. I can also withdraw any data that has been collected about the students at any time prior to the publication of that data.	○
4	I understand that the investigators do not foresee any potential physical, psychological, social, legal, or other risks to me or the students as a result of participating in this study.	○
5	I understand that all research data will be securely stored at Victoria University of Wellington premises for at least five years, and will be destroyed when no longer required.	○
6	I agree that research data gathered for the study may be published provided that my own, my school, my staff and the student's identity is not disclosed.	○
7	I understand that my identity, the student's identity and my staff's identity will not be disclosed in any publications stemming from this research.	○
8	I understand that I can request additional feedback regarding the progress of the study at any time.	○
9	Any questions that I have asked have been answered to my satisfaction.	○

Name/Contact Details

_____

Signature Date

_____ _____

_____

Please return this Consent Form in the envelope provided.

Thank you.

APPENDIX L

Information Sheet for Undergraduate Students in Study 2

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI
VICTORIA
UNIVERSITY OF WELLINGTON

FACULTY OF EDUCATION

Dear Student,

We would like to invite you to participate in a research study that involves exploring your perceptions of three communication intervention systems for individuals with significant communication impairments.

If you agree to participate in this study, we will show you a short video clip of an individual using three different communication aids to make a request. At the end of the video clip, you will be asked to complete a short survey that will allow us to gain insight into your perspectives on the different modes of communication used in the research. This study will approximately take 10 minutes to complete.

The survey consists of questions related to your preferences and opinions relative to the three different modes of communication showed in the video clips. That is, (a) manual sign, (b) picture exchange, and (c) speech-generating device.

There is no obligation for you to agree to complete the survey. Your responses to the survey will remain confidential. That is, we will not report your name or identify you in any way when reporting the results of the survey. If you decide to participate, you have the right to withdraw your consent at any time and discontinue your participation. Your decision about whether or not you want to participate will not affect your present or future relationship with Victoria University of Wellington.

Confidentiality
Any information that is obtained in connection with this study and that can be identified with the school or the students will remain confidential and will be disclosed only with your permission, except where disclosure is required by law.

The results of this project will be presented in written and verbal reports, but we will not use the school's name or your real name in any oral or written reports and we will not provide any personal information that would enable anyone to identify the school or the students in any reports.

Ethics
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Victoria University of Wellington
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My supervisor is:
Professor Jeff Sigafoos
School of Educational Psychology and Pedagogy
Faculty of Education
Victoria University of Wellington
PO Box 17-310, Karori
Wellington, NZ
Tel: (04) 463 9772
Email: jeff.sigafoos@vuw.ac.nz

APPENDIX M

Social Validation Survey for Undergraduate Students

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI VICTORIA UNIVERSITY OF WELLINGTON

FACULTY OF EDUCATION

Social Validation Survey

Please answer the following questions based on your perception of the three AAC modes shown in the video clips (i.e., Picture-exchange, Makaton Manual Sign and iPod®-based Speech-Generating Device). Please mark an 'X' in the column that best matches your perceptions.

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1.	I think the following AAC system is like natural speech:					
	Picture-exchange					
	Manual sign					
	Speech-generating Device					
2.	I think the following AAC system would be easy to learn to use:					
	Picture-exchange					
	Manual sign					
	Speech-generating Device					
3.	I think the following AAC system would be easy for children with developmental disability [Autism Spectrum Disorders (ASD) or Intellectual Disability (ID)] to use:					
	Picture-exchange					
	Manual sign					
	Speech-generating Device					
4.	I think the following AAC system would be understandable by parents and teachers of children with ASD or ID:					
	Picture-exchange					
	Manual sign					
	Speech-generating Device					

(Continued on next page. Please turn over)

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
5.	I think the following AAC system would be understandable to familiar adults of children with ASD or ID:					
	Picture-exchange					
	Manual sign					
	Speech-generating Device					
6.	I think the following AAC system would be understandable to unfamiliar adults of children with ASD or ID:					
	Picture-exchange					
	Manual sign					
	Speech-generating Device					
7.	The following AAC system would be effective in the community:					
	Picture-exchange					
	Manual sign					
	Speech-generating Device					
8.	I think the following AAC system would NOT draw undue negative attention to the user:					
	Picture-exchange					
	Manual sign					
	Speech-generating Device					
9.	I would choose to use the following AAC mode if I were unable to speak:					
	Picture-exchange					
	Manual sign					
	Speech-generating Device					
10.	I would prefer my child to use the following AAC system:					
	Picture-exchange					
	Manual sign					
	Speech-generating Device					

(Continued on next page. Please turn over)

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
11. Overall, I think the following AAC system is the best method of nonverbal communication:					
Picture-exchange					
Manual sign					
Speech-generating Device					

I have had experience using the following systems:

- Picture exchange : _____ years _____ months _____ Less than 1 month _____ no experience
- Manual sign: : _____ years _____ months _____ Less than 1 month _____ no experience
- Speech-generating device: : _____ years _____ months _____ Less than 1 month _____ no experience

Please feel free to add any additional comments in the space provided below:

_____

_____

_____

_____

Thank you for completing this survey.