The Assessment and Intervention of Communication Repair Strategies in Primary School Children with Autism Spectrum Disorder Who Are Minimally Verbal

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THESIS HIGHLIGHTS

- Three teachers were interviewed using the Repair Strategy Assessment Scale (RSAS) to provide information on the repair strategies, if any, reportedly used by their students (12 total) in response to three different types of communication breakdowns: when the student was ignored, when the communication partner verbally requested clarification, and when the communication partner provided the wrong item/response.
- A direct assessment was then conducted with 8 of the 12 children. The children were presented with scenarios involving each of the three types of communication breakdowns. Their repair responses were recorded and classified as examples of repetition, recasting, or modification.
- Results of the direct assessment were compared to the results of the RSAS to determine potential predictive validity of the assessment and used to inform the design of an intervention program for two children. The intervention aimed at teaching the children to use a speech-generating device to repair communication breakdowns that occurred when the communication partner provided the wrong item/response.

ABSTRACT

Autism Spectrum Disorder (ASD) is characterized by marked deficits in communication and social skills in addition to restricted interests and repetitive behaviour. Children with ASD have also been reported to have significant deficits with respect to their ability to repair communication breakdowns. To date, assessments targeting communication repair strategies in children with ASD have been limited in number and lack consistency of implementation. For the current research, both an indirect and direct assessment have been developed to investigate the repair repertoires of primary school-aged children who were minimally verbal. Indirect assessments were conducted with each of the participant's teachers, and the direct assessments were conducted by creating breakdown scenarios during a requesting routine and recording if and how the children attempted to repair the communication breakdown. Results show that children tended to rely on a singular repair strategy involving the repetition of their initial request. An intervention program was then developed and evaluated with two of the children. These children were taught to use an iPad®-based speech generating device to repair communication breakdowns that occurred when the children's initial request was followed by receipt of the wrong item. The intervention was evaluated using a nonconcurrent multiple baseline experimental design. Each of the participants showed an increase in responding under specific communication breakdown conditions. While this research is quite preliminary, the data suggests that repair repertoires of children with ASD can be assessed via a structured, direct asses and improved with interventions based on the assessment results.

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RESEARCH DECLARATION

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

Ethical approval was gained through the Victoria University of Wellington Faculty of Education Ethics Committee. The ethical approval letter is included in Appendix A.

Input and feedback were received from the author's primary supervisor, Professor Jeff Sigafoos, and by other members of a cohort team, supervised by Professor Sigafoos. The studies presented in the current thesis were solely the independent work of the author, with assistance in conceptualization, data analysis, interpretation of results, and editing of chapters from Professor Sigafoos.

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

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CHAPTER 1

INTRODUCTION

Developmental Disability

Developmental disability (DD) is an umbrella term used to describe a host of disabilities that generally have a lifelong impact on the person's functioning (Developmental Disabilities Assistance and Bill of Rights Amendment, 2000). Persons with DD often require intensive and highly specialised training to participate in daily functional activities and social-communicative interactions (Center for Disease Control, 2015). The Center for Disease Control and Prevention (2015) categorises the following as DDs: (a) attention-deficit/hyperactivity disorder (ADHD), (b) autism spectrum disorder (ASD), (c) cerebral palsy, (d) foetal alcohol spectrum disorder, (e) fragile x syndrome, (f) hearing loss, (g) intellectual disability, (h) kernicuterus, (i) muscular dystrophy, (j) Tourette syndrome, and (k) vision impairment. Boyle et al. (2015) reported evidence suggesting that the prevalence of DDs appear to have increased 17.1% over the last 12 years. Much of this overall increase was due to a 289.5% increase in the diagnosis of autism spectrum disorder (ASD). Boyle et al. (2015) also reported that males had twice the prevalence for any DD when compared to females. Among males diagnosed with DD, the majority of the population was comprised of persons with ADHD and ASD.

The empirical work reported in this thesis focused on assessment and intervention of communication repair strategies of children who were diagnosed with ASD. To set the stage for this empirical work, this opening chapter will provide background on the diagnostic criteria, description, and characteristics of ASD.

AUTISM SPECTRUM DISORDER

ASD is a neurodevelopmental disorder associated with deficits in social-emotional communication and reciprocity, restrictive interests, and repetitive patterns of behaviour (American Psychiatric Association, 2013; Center for Disease Control and Prevention, 2015). As a spectrum disorder, ASD symptomology varies from individual to individual in that no two people with ASD present exactly the same observed symptoms or the severity of symptoms (Center for Disease Control, 2015; Lai, Lombardo, & Baron-Cohen, 2014). The key diagnostic characteristics of ASD have been outlined by the American Psychiatric Association (2013) and will be further described in the following section.

Diagnostic Criteria

Diagnostic guidelines for ASD have been evolving since the mid 20th century when Kanner (1943) first reported on a condition that he called *early infantile autism*. Kanner described 11 children with significant deficits in social interaction, communication abilities, and emotional responses. The children also presented with a marked and seemingly obsessive insistence on the maintenance of sameness. The following year, Asperger (1944) provided a similar account of children that seemed to present with similar, but less severe symptoms than those described by Kanner (1943). For example, the children described by Asperger had more advanced communication ability than the children described by Kanner.

In 2013, the American Psychiatric Association (2013) introduced the 5th edition of the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM–5*), in which the conditions initially described by Kanner (1943) and Asperger (1944) were categorised

as a single syndrome, referred to as autism spectrum disorder (ASD), which differed drastically from the 4th edition of the DSM. In the DSM-5, ASD is defined by two major features: (a) impairment of social communication ability and functioning and (b) restrictive interests and repetitive patterns of behaviour. Each of these features are further described in the DSM-5. The social communication feature, for example, is described in terms of deficits in social-emotional reciprocity, such as lack of social approach, inappropriate conversational exchanges (e.g., lack of conversational turn taking), and failure to respond to social overtures from others. The DSM-5 also outlines a number of deficits in nonverbal communication that are characteristic of children with ASD, such as engaging in little to no eye contact, difficulties evoking and receptively understanding body language within an appropriate context, and/or an absence of facial expressions and emotional conveyance. The ASD diagnostic criteria also reference difficulties with establishing and/or maintaining relationships. Individuals with ASD are also described as having difficulty adjusting their behaviour to fit social situations, and they may also appear to have little to no interest in others. The DSM-5 indicates that an individual must meet *all* of the aforementioned social communication deficits to be considered for diagnosis.

The second feature the DSM-5 focused on was the presence of restricted interests and repetitive patterns of behaviour. The feature consists of four sub-domains, and the DSM-5 requires that persons have deficits in at least two of the sub-domains. The first sub-domain is the presence of stereotypy or repetitive motor movements. These types of behaviours can include hand flapping, rocking, lining up objects, and echoing speech. Secondly, the DSM-5 lists the insistence on sameness as a characteristic of ASD.

Some examples of this may include insistence on eating the exact same foods for dinner on a nightly basis, showing high levels of distress when a routine is changed (such as dinner options), and having difficulties transitioning from one activity to the next. In addition, the DSM-5 includes reference to highly restricted, fixated interests as another sub-domain for ASD diagnosis. The person might become distressed if prevented from indulging in the interest. Lastly, the DSM-5 notes that individuals with ASD may have hyper-sensitivity or hypo-reactivity to certain sensory variables within the environment. A person with these types of sensitivities might have incredibly strong reactions to sounds, smells, tastes, temperatures, and certain types of lighting. In contrast, it is also possible that a person might have little to no reaction to things such as heat or pain. The DSM-5 goes on to discuss that ASD symptomology must be present in early developmental years, influence overall adaptive functioning, and not be attributable to another disability.

Severity of Diagnosis

The DSM-5 also provided a severity scale that may serve to provide insight into the needs and requirements of someone who is diagnosed on the autism spectrum. Level 1 severity is as the lowest end of the severity scale. Persons in this category might require some social supports to be able to function in the community and carry out daily tasks. These individuals might have difficulties responding to everyday social cues although they generally have language commensurate with same-age peers. Severity Level 2 is comprised of individuals that may need more intensive support. The communication abilities of these persons are more limited than at Level 1. In this group, individuals may be able to utter 2- to 3-word sentences and phrases, and they are likely to

have difficulties with appropriate nonverbal communication. Persons categorized into Level 2 are also likely to present with restricted and repetitive behaviours. The main difference between Level 1 and Level 2 severity is how "visible" the symptomology is to the average person. Level 1 persons with ASD may easily blend into the environment without notice whereas Level 2 individuals may seem to be more atypical in terms of their behaviour. Severity Level 3 is comprised of the individuals with ASD that require a high amount of supports. Specifically, persons categorized in Level 3 may require 1:1 support for the majority of their self-care needs throughout the span of their lives. These individuals may be able to utter a few intelligible words, but primarily rely on prelinguistic forms of communication (e.g., pointing, or gesturing toward objects). Prelinguistic behaviours are discussed in more detail later in this chapter. Level 3 persons with ASD may also show limited interest in peers and rarely initiate social interactions. Persons in this group also tend to engage in frequent repetitive behaviours that occur at a frequency and magnitude that may interfere with most areas of adaptive functioning. Table 1.1 outlines the severity scale of ASD from the DSM-5.

Table 1.1

DSM-5 Severity Levels for ASD (American Psychiatric Association, 2013)

Severity level	Social Communication	Restricted, Repetitive Behaviours
Level 3 "Requiring very substantial support"	Severe deficits in verbal and nonverbal social communication skills. 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 behaviour, extreme difficulty coping with change, or other restricted/ repetitive behaviours markedly interfere with functioning in all spheres. Great distress/ difficulty changing focus or action.
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, interaction is limited to narrow special interests, and who has markedly odd nonverbal communication.	Inflexibility of behaviour, difficulty coping with change, or other restricted/ repetitive behaviours appear 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"	Deficits in social communication cause noticeable impairments. Difficulty initiating social interactions, and clear examples of atypical or unsuccessful responses to social overtures of others. May appear to have decreased interest in social interactions. To-and-fro conversation with others fails, and whose attempts to make friends are odd and typically unsuccessful.	Inflexibility of behaviour causes significant interference with functioning in one or more contexts. Difficulty switching between activities. Problems of organization and planning hamper independence.

Communication Impairment

Communication impairment is a characteristic of ASD, but there is variability in terms of the degree of impairment among individuals with ASD (Grzadzinski, Huerta, & Lord, 2013; Wetherby, Woods, Allen, Cleary, Dickinson, & Lord, 2004). In the same way that ASD occurs as a spectrum disorder, communication impairments in children with ASD vary in terms of severity. The degree of communication impairment appears to be influenced by the overall severity of the person's ASD symptomology, as well as his or her level of cognitive functioning and overall level of adaptive behaviour functioning (Kjellmer, Hedvall, Fernell, Gillberg, & Norreigen, 2012).

Some individuals with ASD have severe communication impairment, meaning they have shown no appreciable amount of speech and language development. Such individuals have recently been referred to as being minimally verbal (Grzadziski, Huerta, & Lord, 2013; Tager-Flusberg & Kasari, 2013). Persons with ASD who are minimally verbal appear to comprise about 25 to 30% of the entire ASD population (Ganz, et al., 2012; Tager & Kasari, 2013; Wodka, Mathy, & Kalb, 2013). It has been argued that many of these individuals are unlikely to ever develop speech even with intensive intervention (Wodka, Mathy, & Kalb, 2013). Previously, it was reported that about 50% of children with ASD were minimally verbal (National Research Council, 2001). The more recent 25 to 30% estimate shows a marked change and this is potentially due to an expansion to the diagnostic criteria for ASD. This expansion of the ASD diagnostic criteria includes more "higher functioning" and more verbally capable children (Tager-Flusberg & Kasari, 2013). It is also possible, however, that increased access to more effective early intervention services may have resulted in sufficient speech and language

improvements for many children, and these children therefore would no longer be considered to be minimally verbal (Tager-Flusberg, Paul, & Lord, 2005).

The precise percentage of children diagnosed with ASD who remain minimally verbal by school age is unclear. One reason it is difficult to estimate this percentage is that there are varying definitions for what constitutes being minimally verbal. One factor that contributes to this is the use of various terms to describe this condition (e.g., minimally verbal, pre-verbal, non-verbal, pre-linguistic, pre-symbolic, and non-symbolic). In addition, there appears to be little agreement on the nature and scope of communicative skills that determine whether a child is considered verbal versus minimally verbal (Tager-Flusburg & Kasari, 2013). Some researchers have used standardized expressive language scales determine the person's verbal capabilities. Romski et al. (2010) considered children with Mullen Expressive Language scores below 12 months (and fewer than 10 intelligible words) to be nonverbal. Yoder and Stone (2006) classified children as nonverbal if, over the course of three separate observations, they produced fewer than 20 different, intelligible words. Essentially, groups of children deemed "nonverbal" or minimally verbal across the existing literature have been children with no intelligible words other than stereotypic speech sounds, children with few spoken words within incredibly specific contexts, or children with speech, but speech that is largely echolalic or stereotypic in nature.

In the past, the generally accepted benchmark age for speech development in children with ASD was five years of age (Tager-Flusberg, Paul, & Lord, 2005). Pickett et al. (2009), however, provided evidence that some children with ASD have begun speaking after five years of age. Indeed, after surveying the literature from 1951 to 2006,

they identified 167 cases where children began speaking after five years of age. It must be noted, however, that this group of children mostly began speaking between the ages of five and seven and the extent of speech development for the majority (67%) was limited to one-word utterances. While it is possible for children with ASD to develop speech at an older age, there appear to be few children showing extensive language development after five years of age.

For the purposes of this research, children were considered for participation if they had an expressive language age equivalency of 2 years or less on the second edition of the Vineland Adaptive Behavior Scales (Vineland-II; Sparrow, Cicchetti, & Balla, 2005). The Vineland-II was chosen for this thesis as it has been used widely over the past several decades in the research to assess adaptive behaviour in individuals with ASD and other developmental disabilities (Gillham, Carter, Volkmar, & Sparrow, 2000). The Vineland-II also has excellent internal consistency and test-retest reliability (Sparrow, Cicchetti, & Balla, 2005). Age equivalency criteria were chosen based on a standardized measure of expressive language development in attempt to reflect the target community for this thesis: children with ASD who are also minimally verbal. Kasari et al. (2013) defined children who are minimally verbal as persons who have "a very small repertoire of spoken words or fixed phrases that are used communicatively. The exact number of words may vary across children, from no spoken words or phrases to perhaps 20 or 30, depending on a range of factors including age, intervention history, and access to alternative/augmentative communication (AAC) systems. The spoken words or phrases that a child uses will often be restricted to limited contexts and may only be used to communicate one or two functions (e.g. requests with familiar adults). Moreover, the rate

of spoken language is usually very low and may include scripted phrases that have been highly trained (e.g. *I want X*). In some cases, the minimally verbal child may also use echolalic or stereotyped language that does not appear to be functionally communicative," (p. 480).

Challenging Behaviour

Children with ASD and other DDs often display challenging behaviours, such as aggression, self-injury, and extreme tantrums (Matson & Kozlowski, 2011). Challenging behaviours in individuals with ASD have significant social implications for both the individual and anyone that is related to, or involved in their care (Sigafoos, Arthur, & O'Reilly, 2003). Social implications of challenging behaviours may include difficulties integrating into daily social interactions, potential rejection from family members and caregivers, and overall exclusion from settings that may not be able to accommodate intensive levels of challenging behaviour (Matson, 2012). Health concerns may also arise for the individual and those in their immediate environment depending on the topography of the behaviour. For example, persons who self-injure by scratching their own skin may have open lacerations on their body, which may make them susceptible to infections and other medical complications. Persons with physical aggression or property destruction may put the physical health of the people caring for them at risk.

Given the overall impact on quality of life that challenging behaviour presents, it has been cited as one of the leading causes for families and caregivers seeking intervention services (Bushbacher & Fox, 2003; Hastings & Brown, 2002; Matson & Minshawi, 2006; Plant & Sanders, 2007). Current definitions of challenging behaviour focus on the personal outcomes of behaviour on the individual, rather than the physical

topography of the behaviour (Matson, 2012). Emerson and Bromley (1995) defined challenging behaviour as "culturally abnormal behaviour of such intensity, frequency, or duration that the physical safety of the person or other is placed in serious jeopardy, which is likely to seriously limit or deny access to the use of ordinary community facilities," (p. 233). Other considerations for overall definitions of challenging behaviour have made distinctions between behaviours that may be considered more or less demanding (e.g., Holden & Gitlesen, 2006). Behaviours that occur on a daily basis, prevent participation in programs and activities, that require the help of more than one care provider to physically intervene and control, and inflict significant bodily harm to the individual are considered to be more demanding. Less demanding behaviours include aberrant forms of behaviour that are generally manageable that do not meet the aforementioned criteria, such as mild forms of self-injury and physical aggression.

Challenging behaviour literature has created umbrella terms for groups of behaviours that are similar in topography for the means of providing operational definitions. Matson (2012) identified the topographies of challenging behaviour most represented in the literature to include self-injurious behaviour (SIB) and aggression, followed by stereotypy, tantrums, and property destruction. Feeding problems, pica, and rumination/vomiting have also been reported among individuals with ASD (Matson & Kozlowski, 2011). For the purposes of this thesis, SIB, stereotypy, aggression, and rumination will be further defined to provide insight into some of the behaviour challenges presented by the participants in this study.

Self-injurious Behaviour (SIB)

Matson (2012) defined SIB as "behaviour directed towards oneself that causes – or has the potential to cause- tissue damage, exclusive of acts associated with suicide, sexual arousal, or socially sanctioned practices" (p. 27). SIB encompasses several different topographies and varies widely across individuals with ASD. Topographic examples of SIB documented in persons with ASD include banging the head and/or body into hard surfaces, hair pulling, biting of the appendages, hitting and slapping the face, head, and/or body, and eye gouging (Iwata et al., 1994; Matson, Fodstad, Mahan, & Rojahn, 2010; Sigafoos, Arthur, & O'Reilly, 2003; Smith, Vollmer, & St. Peter Pipkin, 2007). Given the varied nature of SIB, it has been categorised in terms of magnitude, severity, frequency, and function (i.e., whether it is socially mediated or maintained by sensory stimulation) (Fee & Matson, 1992; Jones, 1987; Sigafoos, Reichle, & Light Shriner, 1994; Weiss, 2003). Soke et al. (2016) conducted a large-scale study investigating the most recent data from the Autism and Developmental Disabilities Monitoring (ADDM) Network (CDC, 2014) to determine the prevalence of SIB among children meeting diagnostic criteria for ASD. They looked at data from 8,065 8-year-old children from the years 2000, 2006, and 2008 and found that the average children that engaged in SIB across the 3 survey years was 27.7%. This figure is lower than previously reported, but the variation may be due in large part to sample demographics in previous studies where participants were typically enrolled in treatment or research programs and may have more severe presentations of ASD (Ando & Yoshimura, 1979; Baghdadli, Grisi, & Aussillioux, 2003; Duerden, Oakley, Mak-Fan, McGarth, & Taylor, 2012; Rattaz 2015).

Stereotypy

As mentioned previously, the DSM-5 diagnostic criteria indicate that persons with ASD display restricted, repetitive, and stereotyped patterns of behaviour. In the body of challenging behaviour literature, researchers have defined stereotypy as: involuntary, patterned, repetitive, coordinated, rhythmic, and non-reflexive behaviours that require no social mediation (Freeman, Soltanifar, & Baer, 2010; Rapp & Vollmer 2005). Stereotypy is a term used to describe a host of heterogeneous behaviours that are repetitive in nature, lack variability, and can be considered socially inappropriate (Turner, 1999). Stereotypic behaviours commonly associated with ASD have included hand flapping, body rocking, manipulating objects in a repetitive manner such as spinning or tapping, and echoic scripting (Schreibman, Heyser, & Stahmer, 1999). Stereotypy can also involve complex groups of behaviours such as rigid and restrictive patterns of interest (e.g., a child who only wants to eat white foods, or wear specific types of t-shirts because of the texture of the seams), or fixates on parts of objects for use unrelated to their intended function, such as spinning one wheel of a toy car or lining up objects by colour or shape (Cunningham & Schreibman, 2008). Some forms of stereotypic behaviour of sensory origin can be dangerous in terms of their physical effect on the body because the behaviour and the maintaining consequence are one in the same. Although stereotypic behaviour is not exclusive to ASD, it must be noted that when compared with individuals with other developmental and intellectual disabilities, persons with ASD showed a larger variety of stereotypic topographies with a higher likelihood for an increase in severity and frequency over time (Bodfish, Symons, Parker, & Lewis, 2000).

Stereotypy might be socially stigmatizing for the individual (Cunningham & Schreibman, 2008; Matson, 2012 p. 32) and might also interfere with learning activities and efforts to teach the individual. In 1972, Koegel and Covert reported evidence that children were unable to acquire and complete basic discrimination tasks while engaging in stereotypy. Using procedures that targeted the reduction of the stereotypy, they were then able to reintroduce the tasks to the children and subsequently discovered that the children showed a marked increase in correct responding and acquisition.

Goldman et al. (2009) compared a group of children with ASD and a group of children with other DDs to determine prevalence of stereotypy amongst these groups. They classified the participants as either high or low functioning based on IQ scores. For the group of children with ASD, the prevalence of stereotypy was 71% for the low functioning group, and 64% for the high functioning group. The group of children with other DDs showed a much lower prevalence in stereotypy with 31% of low functioning and 18% of high functioning participants meeting criteria. Given the impact of stereotypy on the behavioural repertoire of the individual and the high prevalence rates in children with ASD, these behaviours may need tailored assessment and intervention prior to or in conjunction with other behavioural interventions.

Aggressive Behaviour

There is no current interdisciplinary agreement on the definition of aggression (Farmer & Aman, 2011; Matson, 2012.) One of the biggest obstacles in defining aggression is the social penchant for ascribing moral judgement to the act of aggression (Gendreau & Archer, 2005). In a social sense, the act of aggression may suggest that the individual aggressing has the intent to cause physical and emotional harm, however, that

may not necessarily be the case. For the purposes of this thesis, the overarching definition of aggression will be similar to that of Matson et al. (2012) in that behaviours that result in injury or harm toward other people and/or property are considered to be aggression. As in the previously described topographies of challenging behaviour, intentionality is not considered for the purposes of defining the physical topography of the behaviour. Perhaps the most detrimental topography of aggressive behaviour is physical aggression toward others as it has some of the largest social consequences of all the variations of aggression (Broidy, Nagin, Tremblay, Bates, Brame, Dodge, & Vitaro, 2003). In some cases, the consequences of physical aggression may result in legal implications, and/or severely limit an individual's ability to participate in learning and social situations (Matson, 2012). In a parent reporting study, Farmer and Aman (2011) found that children with ASD were more likely to engage in aggressive behaviours than children diagnosed with PDD-NOS and Asperger's syndrome. For the purposes of this research, aggressive topographies of behaviour included physical aggression (hitting, biting, slapping, pinching, and/or scratching others), and property destruction (throwing and/or destroying objects) at others, or not. Research into the prevalence of aggression in children with ASD is difficult to compare due to differences in the measurement and definition of aggression. Ando and Yoshimura (1979), for example, compared 47 children with ASD to children with an ID. Teachers reported that 43% of the ASD sample engaged in physical aggression toward others, 34% engaged in property destruction, and 47% engaged in tantrums. Investigations into the aggressive topographies of children with ASD have been conducted at a rather large scale by Lecavalier (2006) where over 700 teacher and parent reports were viewed to determine what topographies of aggressive

behaviour they were engaging in and to what degree of severity. In almost every subdomain of physically aggressive behaviours, persons with ASD were reliably more likely to engage in those behaviours than other groups with other ID/DD (e.g. pinching, biting, head-butting, scratching others).

Motivation for Challenging Behaviour

In 1977, Carr reviewed evidence related to the influence of environmental variables on self-injurious behaviour (SIB) in individuals with DDs. Based on this review, Carr hypothesized that SIB could be classified as operant behaviour that served one or more functions; specifically: (a) access to social positive reinforcement (attention), (b) avoidance of an undesired stimulus (escape) and, (c) self-stimulation. Carr's seminal work in the analysis of SIB in terms of operant function lead to the development of assessment strategies for identifying the function or functions of a range of challenging behaviours of persons with ASD and other DDs (Durand & Crimmins, 1988; Iwata et al., 1994; Matson & Vollmer 1995). The resulting data from numerous such assessment studies suggest that challenging behaviour does indeed often appear to be learned/operant behaviour that is maintained by different types of reinforcing consequences; specifically: (a) social positive reinforcement in the form of attention, (b) social positive reinforcement in the form of access to tangibles, (c) social negative reinforcement in the form of escape from demands, and/or (d) automatic reinforcement, such as being maintained by the resulting sensory stimulation it produces (Cooper, Heron, Heward 2007).

In summary, while the diagnostic characteristics are a baseline for determining the presence of ASD, the severity of the disorder presents differently in each

child. The degree to which challenging topographies of behaviour affect each child fluctuates on a case-by-case basis, but does impact the vast majority of the ASD community during at least one point in each individual's life. Communication impairments also vary on a case-by-case basis; however, delays are common. The following chapter will explain some of the outcomes of having limited language, such as communication breakdowns. The chapter will then explain principles of applied behaviour analysis that are used in the treatment of ASD and the implementation of communication interventions.

CHAPTER 2

Communication Breakdowns and Repair Strategies:

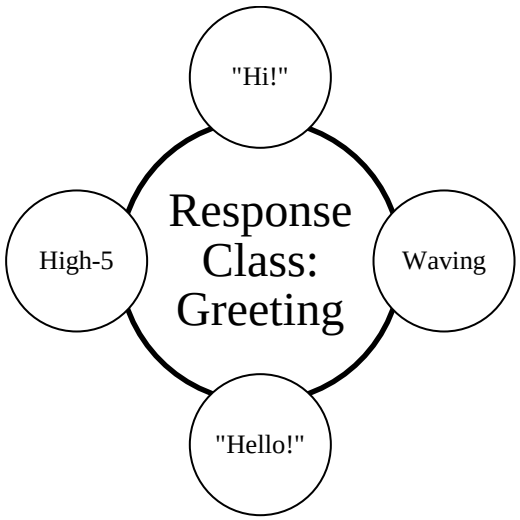
Theoretical and Empirical framework

Communication Breakdowns

Meadan and Halle (2004) analysed the concepts of communication breakdowns and repairs in terms of the response class. They did so in attempt to merge the child language literature with the principles and concepts of applied behaviour analysis. Response classes, in the behaviour analytic literature, are a group of behaviours, or responses, that produce the same outcome. An example of a response class is the group of behaviours one person might do to greet another person (Figure 2.1).

Figure 2.1.

An Example of a Response Class: Greeting Others



The hypothetical response class illustrated in Figure 2.1 consists of four different response forms that might function as effective and appropriate ways of greeting another person. Because all of these behaviours are presumed to occur for the same function (that

is the social function of greeting another individual), they can be considered functionally equivalent and thus members of the same [functional] response class. For the purposes of this research, initial communication attempts and communication repairs can be considered to exist within the same response class in that they will likely produce the same outcome given an appropriately prepared (conditioned) listener. Consider the following example:

Tom is a 4-year-old boy with ASD in a play area at school. He sees his favourite ball on a shelf, in a clear container that he cannot reach. He goes to the nearest teacher, guides her by the hand to the shelf, and moves her hand towards the container. She gets the message that Tom is attempting to gain access to a toy in the container and therefore she reaches into the container, but she does not retrieve the ball. Instead she retrieves a different toy. When she hands this toy to him, he pushes the toy away and then leads her hand towards the container again. This time, she retrieves the ball and hands it to him. Tom accepts the ball and proceeds to play with it.

In this example, guiding the teacher's hand towards the container could be viewed as an *initial communication attempt* to request the ball. However, a *communication breakdown* occurs in this scenario because the teacher initially interpreted the message incorrectly and tried to give Tom what was, from his perspective, the wrong item. Tom then attempted to repair the communication breakdown by pushing the wrong item away and once again guiding the teacher's hand to the container.

In conceptualizing communication exchanges of the type outlined in the above scenario involving Tom, Meadan and Halle (2004) noted that communication exchanges could be broken down into individual units consisting of: (a) the initial communication

act, (b) the communication breakdown, (c) the attempt to repair the communicative breakdown, and (d) the outcome arising from that attempt to repair the communication breakdown. The framework outlined by Meadan and Halle (2004) was adopted as the main conceptual foundation for the research reported in this thesis. This conceptualization is viewed as useful in that the sequence outlined above provides procedural definition that could be used for assessing (Studies 1 and 2) and then teaching (study 3) communication repair strategies. This conceptualization provides direct guidance with respect to assessment by allowing for one to systematically create distinct breakdown scenarios, by manipulating the listener's response to the child's initial communicative attempt, and then recording what, if any, strategies the child used in an attempt to repair the breakdown. This assessment information could then be used to design an intervention aimed at teaching the child an effective and socially acceptable repair strategy to use under those breakdown scenarios in which the child did not attempt to repair or attempted to repair using ineffective or less effective repair strategies. Thus, conceptualisation provided by Meadan and Halle (2004) has direct implications for designing procedures to assess and intervene on a child's communication repair strategies.

From an applied behaviour analytic perspective, communication break downs can be viewed as instances in which the speaker's communicative act goes unreinforced by the listener and thus the initial communication attempt/response is in fact placed on extinction (Brady & Halle, 2002; Halle, Brady, & Drasgow, 2004). For example, a breakdown might occur when a speaker mands (requests) for a drink, but the listener does not provide the requested item. In this case, the initial request goes unreinforced and may

cause punishment, or a decrease in communicative acts. In such situations, when a breakdown occurs, teaching a child to use an effective repair response would enable the child to gain reinforcement.

Communication breakdowns can arise for many reasons. However, three main types of breakdowns have been delineated in the literature. These three types are breakdowns that are signalled by the listener's: (a) request for clarification (e.g., "What did you say?"), (b) lack of response, or (c) giving the wrong response, such as giving the child a cracker when he or she asked for a drink (Meadan & Halle, 2004). In response to a request for clarification, the speaker might need to repeat the request, modify the original request (such as by saying it more clearly or louder), and/or by providing additional information regarding the initial communicative act because the listener did not understand the initial request. An example of this type of breakdown would occur when a child requests access to a toy and the communicative partner responds by asking, "What did you say?"

Ignoring an initial communicative attempt or being generally unresponsive to such request can lead to either an intentional, or unintentional breakdown. It must be considered that communicative partners may not have the desire to address a communicative act, so they refrain from providing a response (deliberate ignoring). This may be a reality in the home environment when a parent or caregiver is attempting to avoid an exchange for various reasons, such as purposefully ignoring a child's repeated requests for a cookie so as to extinguish that response. Conversely, a situation may arise when a child's communicative act my go unheard because the environment was simply too noisy, such as in a loud restaurant and as a result, the child's communicative attempt

is unintentionally ignored. The effect however might be the same in that the child's attempt to communication has been unsuccessful, fails to produce reinforcement for the child and has undergone an extinction trial. Lastly, a breakdown might occur when the listener's response does not match the function or purpose of the child's original communicative act. An example of this type of breakdown can occur when a child says, "I want a cookie," but the communicative partner delivers a cracker because the listener thought that was what the child had asked for. Another form of a wrong answer breakdown occurs when the listener misinterprets the function of the original message. For example, a child sees a candy bar and says, "Candy," as a request for the item, but the communicative partner responds, "Yes, that is candy," because the listener interpreted the child response "Candy," as a commenting response (or tact), rather than as a mand (or request).

Children using modalities of communication other than speech may also encounter breakdowns specific to their respective modality. For example, a child who uses manual signs with a partner who is not familiar with manual signs will likely experience a communication breakdown. This likelihood received some support in a study by Rotholz, Berkowitz, and Burberry (1988). This study provided communication intervention to two students (17 and 18 years old). The two students were described as having autism and were assessed as having language age equivalences of 2.5 to 3 years on the Peabody Picture Vocabulary Test (Dunn, 1997). The two students were taught to place orders at two fast-food outlets using either manual signs or a picture-based communication board. The results showed that when using manual signs, the students were successful in placing orders only once in 22 attempts. The lack of success was

largely due to communication breakdowns that arose because the community listeners (i.e., the staff taking orders in the fast-food outlets) did not understand sign language and could not therefore interpret the students' signed orders. Use of the communication board, in contrast, was successful on 80 to 100% of the attempts. The greater success with the communication board was attributed to the use of iconic photographs combined with printed words. That is, to order a hamburger, the students pointed to line drawings (e.g., of a hamburger) and the drawings also had the corresponding words (e.g., HAMBURGER) printed underneath. However, it could also be the case that breakdowns could occur with the use of picture/symbol-based communication systems or a speech-generating device (SGD) if the pictures/symbols were not sufficiently iconic or if the speech output from the SGD was not sufficiently intelligible (Drager, Reichle, & Pinkoski, 2010).

Communication breakdowns of the type outlined above appear to be fairly common. For example, Golinkoff (1986) reported the results of study involving observation of communication interactions between typically developing children and their mothers. Golinkoff found that only 38% of the children's communicative attempts were immediately reinforced by the parent, where the remaining 62% of the child's attempts involved a communication breakdown either because the parent missed the child's attempt or the attempt was responded to by the parent seeking some clarification or entered into some negotiation. More specifically, the observed communication interactions, when coded, appeared to fall within one of three different categories. First, there were *Successful Attempts* in which the child's initial attempt to communicate was immediately recognized and reinforced by the mother. Second, there were

Negotiations, which occurred when the child's attempted communication was met by the mother seeking clarification. Third, there were *Missed Attempts*, which arose when the mother did not recognize, or was not aware of, the child's attempt to communicate.

Because ASD is associated with significant communication impairment (American Psychiatric Association, 2013) children with ASD might be at increased risk for encountering more frequent communication breakdowns than typically developing children (Keen, 2003). This may be due to the fact that children with ASD might lack readily interpreted communication responses. Research has shown that in the classroom, teacher response rates are significantly lower when students use prelinguistic forms, which are generally more subtle, idiosyncratic or less conventional than conventional forms of communication, such as speech and symbol-based communication boards. Many children with ASD and other DDs show a reliance on prelinguistic behaviour to communicate (Kasari et al., 2013). Houghton, Bronicki, and Guess (1987), for example, conducted a study where staff responsiveness was measured across different task conditions. Specifically, they investigated the rate at which staff responded to student-initiated indication of choice and preference. A total of 48 staff members and 37 students (ages 14 months to 21 years) in public school settings, residential placement settings, and university clinical sites participated in both structured and unstructured preference activities. The authors found that staff response rates were low regardless of type of care facility or age level of the individuals. Comparatively, however, staff rates were highest in the 0 -to 5-year-old age group as opposed to older participating age groups where responding was lowest. Overall, Houghton et al. found high rates of communication breakdowns among children with DDs and significant communication impairment.

This is an important finding as it suggests that children with ASD who rely on prelinguistic communication will encounter frequent breakdowns. This is potentially detrimental because frequent communication breakdowns could reduce the child's learning and propensity to initiate and maintain their existing communication skills given that frequent breakdowns mean fewer opportunities for reinforcement and possible extinction of communicative attempts.

Communication Repair Strategies

A communication repair strategy could be defined as a persistent communicative act that follows a communication breakdown and that is used in an apparent attempt to attain the originally sought-after reinforcement in an effective, socially appropriate manner (Alexander, Wetherby & Prizant, 1997). That is, in response to a breakdown, a competent communicator will often engage in one or more additional responses in an attempt to repair that breakdown. Meadan and Halle (2004) described three main types of repair strategies. These are :(a) repetition, (b) modification, and (c) recast. Repetition is a repair strategy in which the speaker simply repeats the original means of communication in its exact same form in response to a breakdown (Alexander, 1994). Simply put, a child would repeat the exact same phrase, repeat the same manual sign, or activate the same speech output message from a SGD, for example. Modification includes changes in the original communicative act. Modification is achieved by means of augmentation of the original message by making the exact same communicative attempt, but also adding in an additional response form or additional means of communication, such as by adding in a gesture or a vocalization in an attempt to facilitate the listener's understanding of the initial message. For example, a child might repeat an approximation of the word *Cookie*,

but add in a gesture, such as also pointing to a packet of cookies on the counter. Modification can also be achieved by simplification of a communicative act where some aspect of the original message is removed (Meadan & Halle, 2004). In this situation, the speaker may verbally request a cup while gesturing in a manner that resembles drinking, but upon a breakdown the speaker may just repeat the gesture without the verbal response. Lastly, recasting is a repair strategy that includes a complete substitution of the original communicative act that includes none of the original features (Meadan & Halle, 2004). Recasting can also be referred to as substitution of communication acts. For example, if the speaker waved at a communicative partner but this waving response went unnoticed, then the speaker might use a recasting repair strategy by refraining from waving, but saying "Hello." Table 3.1 provides a brief overview the different communication breakdown types and repair strategies.

It is possible that certain prerequisite skills might be facilitative of successful communication repair. For example, a child is perhaps more likely to be effective at repairing communication breakdowns if he or she is already showing evidence of communicative intentionality (Sigafoos, Woodyatt, Keen, Tait, Tucker, Roberts-Pennell, & Pittendreigh, 2000). Intentionality has been defined as evident when children begin to make proto-imperative and proto-declarative expressions (Bates, 1976).

Table 3.1

Communication Breakdowns and Repair Types (based on Meadan and Halle, 2004)

Communication Breakdowns	Communication Repairs
Ignore – intentional or unintentional disregard for the initial communicative act	Repeat – evoking an exact replica of the initial communicative act
Request for Clarification – the listener signals the speaker that they require more information.	Recast – evoking a communicative act completely dissimilar to the initial communicative act
Wrong Response – the listener responds in a way that is incongruent with the initial communicative act.	Modification – evoking a communicative act with some topographical carryover from the initial communicative act, but modified by either adding or removing features of the initial communicative act
	Challenging Behaviour - using problematic/ socially unacceptable behaviours

Note. The use of challenging behaviour as a repair topography can fall under any of the repair definitions, however, this has been included separately as identifying problematic forms of repair is critical.

Proto-imperative expressions are those whose function is to convey the desire for objects and actions (Coggin, Olswang, & Guthrie, 1987; Iacono, Waring, & Chan, 1996). In the previously outlined example of Tom's request, his attempt to guide the teacher toward the container was most likely a proto-imperative response intended to gain access to his favourite toy. Proto-declarative responses are those that serve to deliver commentary on or about items or actions. If Tom were given his favourite toy after indicating that he wanted it and was able to tell his teacher that he loves his toy, his

comment would be considered proto-declarative (Coggins et al., 1987; Iacono et al., 1996.) Communication intentionality is viewed as playing a foundational role in the acquisition and development of language acquisition (Bloom & Trinker, 2001). To date, the literature shows that children with ASD display far fewer acts of intentional communication when compared to their neurotypical peers or individuals with other developmental delays (Chiang, Song, Lin, & Rogers, 2008; Schumway & Wetherby, 2009). By 1 year of age, neurotypical children intentionally communicate for several reasons, but the primary functions identified by Schumway and Wetherby (2009) were: (a) behavioural regulation, (b) social interaction, and (c) joint attention. For the purposes of this thesis, examples of communication for behavioural regulation include requesting items or activities. Proto-declarative functions, in contrast, are largely social rather than instrumental. That is, they are a means of initiating and maintain social interacting with others, rather than a means of getting others to meet specific wants and needs. Social interactions include, but are not limited to, commenting on objects and activities, question asking and answering, and engaging in parallel play routines, and establishing joint attention. Joint attention will be defined more specifically in the paragraphs to come. Some studies have shown that communicative repertoires in children with ASD tend to have far more limited functions than that of their neurotypical peers, and seem to be primarily used for instrumental functions/behavioural regulation than for social interaction functions (Shumway & Wetherby, 2009; Stone, Ousley, Yoder, Hogan, & Hepburn, 1997).

A second possible prerequisite is an ability to recognize when a breakdown has occurred (Meadan & Halle, 2004). Specifically, joint attention might be necessary for

enabling the child to realize that their initial communication attempt has broken down. Joint attentional problems are often presented as a major impairment for children with ASD. Joint attention can be defined as the ability to simultaneously coordinate attention between communication partners with respect to objects or events in order to share awareness (Bruner, 1975; Mundy, Sigman, & Kasari, 1990). Joint attention is often said to be a crucial aspect of a communication repair because it allows the child to naturally acknowledge and respond to cues in the environment that determine that a communication breakdown has occurred (Keen, 2003). In the absence of joint attention, the child might not have persisted in attempting to achieve the desired outcome of their communication because it is not certain that the natural cue to repair communication was clear to, or observed by, the child.

A third possible prerequisite to successful repair is the extent to which the child has acquired an effective repertoire of relevant communication skills (Keen, 2003). Essentially, Keen suggested that the ability to repair communication might depend on the level of sophistication with which each individual child is able to communicate. Communications breakdowns that happen to children who have limited communication repertoires, or primarily utilize prelinguistic behaviours to make requests, may look and be perceived in a different manner than a child with a more complex communication repertoire. This will also be highlighted in the following chapter in further discussions of the response class, but the general hypothesis could be made that the more communicative responses a person has, the more tools they may have to address a communication breakdown.

In the next section, communication repairs and breakdowns will be related to the principles of Applied Behaviour Analysis (ABA). This next section will aim to provide an analysis of the issues related to the assessment and intervention of communication repair strategies from a behaviour analytic theoretical framework. The aim of this theoretical framing is to highlight some of the operational issues that need to be considered in the assessment of communication repair strategies and in the design of behavioural/educational interventions aimed at teaching children to use effective communication repair strategies.

Applied Behaviour Analysis

Applied Behaviour Analysis (ABA) is the systematic application of the principles of operant conditioning to create socially significant behaviour change (Cooper, Heron, & Heward, 2007). In application, ABA has a long history of demonstrated success in teaching new skills and increasing adaptive behaviours of children and adults with DDs thus helping possibly create a significantly improved quality of life for such individuals. ABA also has a long history of demonstrated success in reducing problematic behaviours of children and adults with DDs. In the following explanations of the principles of ABA, the previously mentioned example of Tom, the 4-year-old boy diagnosed with ASD attempting to access a preferred ball, will be used to illustrate the relevance of ABA to this thesis research.

Three-Term Contingency

The basic unit of analysis in ABA is the three-term contingency, which is comprised of an antecedent, a target behaviour, and a consequence (Cooper et al., 2007). An antecedent is a variable that is present at the time when the targeted behaviour should

occur. The target behaviour refers to a response or cluster/sequence of responses that could/should have occurred — or have in fact occurred in the past— in the presence of the antecedent. Target behaviours have effects on the environment. They alter or change the environment and some of these effects or consequences may function to increase the future probability that that response will recur in the presence of that antecedent. These types of consequences are called reinforcers and the relation is termed reinforcement. Other consequences function to decrease the future probability that a response will recur in the presence of that antecedent. These types of consequences are called punishers and the relation is termed punishment (Alberto & Troutman, 2013). Some antecedent conditions come to evoke specific target behaviours because in the past the target behaviour produced reinforcing consequences when that specific set of antecedent conditions were present and only when that specific set of antecedent conditions were present. When this relation develops, the antecedent can be referred to as a discriminative stimulus. That is, the antecedent condition is now discriminative for reinforcement. Another way of saying this is that antecedent sets the occasion for the response by virtue of the fact that it has become a signal for the availability of reinforcement should the response occur (Schlinger, Blackley, Fillhard, & Poling, 1991). In Tom's example, it could be interpreted that the antecedent or discriminative stimulus that set the occasion for the response of requesting the ball was the fact that the ball was visible, but out of his reach. The presence of the ball set the occasion for any behaviour that had in the past been effective in enabling Tom to access the reinforcer (i.e., the ball). Presumably, in the absence of this discriminative stimulus, it would have been less likely that Tom would have produced a response to obtain the ball and less likely that any such response would

have been reinforced, given that there might not have been a ball present to deliver to Tom if he had made the response.

With regard to the assessment of communication repair strategies, one approach might be to wait for an initial communicative response and then contrive scenarios that set the occasion for use of a communication repair strategy. This could be accomplished by creating specific types of antecedent [communication breakdown] conditions and recording whether or not each antecedent condition evoked a repair response and, if so, what type of repair responses were evoked. Keen (2003) argued that some children with ASD might not respond to different types of communication breakdown because the breakdown has not been established (or conditioned) as a discriminative stimulus. That is the child might have repair responses that could be emitted, but those responses are not under the stimulus control of the antecedent conditions that signal that a breakdown has occurred. When a discriminative stimulus reliably evokes a specific response, it is said to be under stimulus control.

When discussing the three-term contingency, it is important to note that consequences of behaviour do not necessarily imply a negative connotation. Consequences of behaviour can be defined as any alteration to the environment directly related to the action of the target behaviour (Alberto & Troutman, 2013). Consequences can function to either increase or decrease the future likelihood of that behaviour recurring in the presence of the discriminative stimulus (Cooper et al., 2007). Reinforcement and punishment are two classes of consequences that influence behaviour.

Reinforcement

Reinforcement refers to a relation between a target behaviour and the resulting consequence in which the occurrence of the consequence following the target behaviour functions to increase the future likelihood of that behaviour will recur (Cooper et al., 2007). Consequences that function to increase the future likelihood of behaviour are called reinforcers. Schlinger et al. (1991) noted that characteristics of a reinforcer are that reinforcers must: (a) follow a behaviour, and (b) increase the future likelihood of that behaviour. Additionally, the increased likelihood of the behaviour should occur as a direct result of the consequence. In the example of Tom, the consequence (or reinforcer) that increased the likelihood that he would request the ball in the future is presumed to be the resulting access to the ball itself. If Tom is given access to the ball consistently when he guides an adult's hand to the ball, and if he is then more likely to repeat those behaviours under similar antecedent conditions in the future, then access to the ball could be said to have functioned as an effective type of reinforcement for the response of guiding the adult's hand to the container in which the ball was to be found.

Reinforcement contingencies can be further defined in terms of positive or negative reinforcement. Positive reinforcement refers to adding a consequence or stimulus to the environment following a response; whereas negative reinforcement refers to the removal of a stimulus. The term positive alludes to the introduction, or addition, of a stimulus to the environment. This is not to be confused with connotations of the word positive that may imply "good" consequences. The term positive is variable specific while reinforcement implies that the variable has increased the future likelihood of the behaviour. In the example of Tom, it must be noted that although Tom can see the ball,

the ball is not in his direct environment in that it is not accessible. In terms of positive reinforcement, Tom gaining access to the ball constitutes the introduction of a variable (the ball) into his direct environment. If access to this ball increases the likelihood that he will guide an adult's hand to the ball and/or point to it, his request is considered to be positively reinforced. Negative reinforcement also increases behaviour. The term negative is consequence-specific, and alludes to the removal of a stimulus. This is not to be confused with possible connotations for the word negative meaning "bad." In the example of Tom, he was negatively reinforced for pushing the wrong item away when the communication partner did not understand him. The wrong item that was handed to him instead of the ball could be considered aversive or non-preferred, and his pushing the item away resulted in the removal in the non-preferred item. Thus, the response of pushing the item away was negatively reinforced by removal of the item. As a result of experiencing this negative reinforcement, it would be predicted that, in the future, if Tom does not want something that is handed to him, he may be more likely to push it away. In line with the effects of reinforcement, it could be argued that reinforcement, both positive and negative, are important learning mechanisms that might shape and maintain communication behaviour, including communication repair strategies.

Punishment

In contrast to reinforcement, punishment involves the addition or removal of stimuli contingent on the occurrence of a targeted behaviour that functions to decrease the future likelihood of that behaviour (Cooper et al., 2007). It must be noted that the term punishment may be associated with negative connotations; however, the defining feature of punishment is that it results in decreasing the future probability of a target

behaviour. More specifically, positive punishment involves the introduction of a stimulus after the occurrence of a targeted behaviour and a resulting decrease in the future probability of that behaviour. As in previous discussions of reinforcement, the term positive in this sense implies the introduction of a variable, not the connotative properties of the word "positive." In the example of Tom, positive punishment could be considered if the teacher gave him the wrong item, and did not allow him an opportunity to repair the communication breakdown. The addition of the undesired toy may serve to reduce the likelihood that he will make such requests in the future. Negative punishment involves the removal of a stimulus contingent upon a response, which functions to decrease the future probability of that response. In the example of Tom, if the teacher removes the highly-preferred ball after doing a socially inappropriate behaviour, and if that reduces the likelihood that the inappropriate behaviour happens again, then Tom's inappropriate behaviour is said to have been punished.

With regard to communication and breakdowns that might arise during a communication interaction, it is possible that communicative partners inadvertently punish the child's communicative behaviour and therefore reduce the future probability of the child engaging in communication (Keen, 2003; Sigafoos, 2004). For example, consider a child who mands (that is, makes a request) for a cracker, but the communication partner does not provide a cracker, but instead reprimands the child (e.g., "No, you cannot have a cracker. Stop asking me."). If, because of the reprimand, the child is now less likely to make requests of that partner, then we can say that the reprimand functioned as punishment for the child's requesting behaviour.

Schedules of Reinforcement

The rate and timing with which behaviours are reinforced is an important variable that influences the frequency of behaviour and the pattern of behaviour over time. The pattern, timing, and rate of reinforcement, also known as the schedule of reinforcement, can be viewed as being either continuous or intermittent. Continuous schedules of reinforcement involve the consistent delivery of reinforcement contingent for each and every response, that is reinforcement occurs on a 1:1, fixed-ratio 1, or continuous schedule. Intermittent schedules of reinforcement provide reinforcement on some time-based or response-based schedule (Cooper, Heron, & Heward, 2007). For example, a parent might reinforce a child's requests for cookies that occur only after a certain period of time has lapsed since the child last had a cookie. In educational work aimed at teaching new skills, continuous schedules of reinforcement are often considered to be important for establishing new skills to mastery (Alberto & Troutman, 2013). Intermittent schedules of reinforcement, in contrast, are usually introduced after the behaviour has been acquired or mastered, so as to promote maintenance of responding and to ensure responding occurs at an acceptable rate (Cooper, Heron, & Heward 2007). In the example of Tom, if we assume that he had already mastered the skill of requesting items in his environment, it can be hypothesized that this behaviour might persist even if it is not reinforced every single time. This concept may support Keen's (2003) finding in which children with ASD were most likely to repeat the initial communicative act in a seemingly natural attempt to repair communication. If requests are intermittently reinforced, it would be implied that the children would continue to use the same response repeatedly as they would have had a history of the response not always working, but

working often enough so as to ensure that the child persists in using it, which would then pay off often enough to ensure that repeating requests will occur when the initial request fails to produce reinforcement. Intermittent schedules of reinforcement can facilitate the maintenance of behaviours and make behaviour more resistant to extinction (Cooper, Heron, & Heward, 2007).

Extinction

When a previously reinforced response no longer produces reinforcement, the operation is known as extinction. Extinction results in an initial increase in responding (an extinction burst) followed by a gradual reduction in the occurrence of the response Cooper, Heron, & Heward, 2007). In the example of Tom, extinction would have occurred if every time he guided the teacher toward the ball she did not provide him access to the ball. However, it is also possible that due to an extinction burst, Tom's decrease in behaviour would occur only after his guiding and/or pointing had first increased in magnitude (e.g., tugging at his teacher harder, forcefully pointing rather than casually pointing). For some children with ASD, an increase in magnitude does not necessarily imply an increased magnitude of the same topography of behaviour. Another behavioural by-product of extinction involves scrolling through the response class hierarchy and shifting to other response forms within that class (Alberto & Troutman, 2013; Cooper, Heward, Heron, 2007). If the response class hierarchy related to Tom's requesting involved socially unacceptable forms of behaviour, it is possible that unreinforced (or ignored) responses may result in those aberrant forms of behaviour being evoked. Anecdotally, it has been observed that given the nature of these behaviours, listeners could possibly be inclined to reinforce these topographies of

behaviour in attempt to stop them therefore moving them up the response class hierarchy. As will be further explained later in this thesis, extinction could be seen as a necessary component in building a repertoire of communication repairs in that certain topographies of prelinguistic behaviours must be extinguished and replaced with more effective repair strategies or functional behaviours (Carr & Durand, 1985).

Differential Reinforcement and Functional Communication Training

The procedure known as differential reinforcement involves the use of reinforcement contingencies in tandem with extinction procedures. In education, differential reinforcement procedures are often used for the purpose of replacing challenging behaviour with a more appropriate, yet functionally-equivalent, behaviour (Cooper, Heron, & Heward, 2007). This is relevant for children with ASD when considering that challenging behaviours, in terms of function, are often communicative (Carr & Durand, 1985). When replacing challenging topographies of behaviour with other socially acceptable forms of communication, a specific type of differential reinforcement procedure, referred to as Functional Communication Training (FCT), is indicated (Durand & Carr, 1987; Durand, 1993; Durand & Carr, 1991). FCT is consistent with the behavioural concept of functional equivalence (Carr, 1988). Functional equivalence will be discussed in the following section. Essentially, the theoretical framework behind FCT is that if a challenging behaviour evokes a certain response, it is possible that one can replace that challenging behaviour by teaching the child an alternative response that results in the same consequence that the challenging behaviour achieved for the child (Durand & Moskowitz, 2015; Mirenda, 1997). For this replacement to occur, the alternative must be more efficient than the original challenging

behaviour. Efficiency in this context means the response must require less effort to complete than the effort required to engage in challenging behaviour in terms of physical magnitude and the amount of time the behaviour takes from start to finish in order to receive reinforcement (Durand & Carr, 1987; Durand, 1993; Durand & Carr, 1991). Efficiency also refers to how consistently the response is reinforced (Durand & Carr, 1987; Durand, 1993; Durand & Carr, 1991). Reinforcement for the new, alternative replacement behaviours should occur more consistently than reinforcement of challenging behaviour. Ideally, challenging behaviour should be placed under extinction, in that it should no longer be reinforced.

With regard to communication breakdowns, a child might engage in challenging behaviour when a communicative attempt is not effective in gaining reinforcement, (i.e., when a breakdown occurs). The occurrence of challenging behaviour in response to a breakdown might be seen as a type of extinction burst evoked by the extinction trial, or is evoked by the breakdown and the resulting lack of reinforcement. In this scenario, it may be useful to teach the child to engage in an alternative, and more socially acceptable form of behaviour that would effectively repair the communication breakdown, which would be easy for the child to produce, and which could be reinforced quickly and consistently. As the new repair form is taught and consistently reinforced, it is of course important to make sure that any challenging behaviour is no longer reinforced, that is that challenging behaviour continues on an extinction schedule.

Response Classes and Response Class Hierarchies

Some individuals may have acquired effective responses that could be used to repair communication breakdowns, however, those responses may take low precedence

within the response class hierarchy. Response classes refer to categories of topographically varied responses that produce similar outcomes (Catania, 1998), and the hierarchy is the order in which responses within the class are likely to occur (Baer, 1982). Verbally requesting, pointing, and signing are all forms of behaviour that could potentially function as of means of requesting or gaining access to preferred items and thus these three different forms nonetheless constitute a single response class of "requesting" responses. For the example of Tom, the response class hierarchy related to requesting items may include a host of behaviours such as, guiding an adult by the hand to relevant areas, pointing, grunting, head banging, and physical aggression. The order in which the individual utilizes each response might sometimes follow a predictable pattern (Richman, Wacker, Asmus, Casey, & Andelman, 1999). For example, Tom might always first try requesting using a prelinguistic response (guiding and/or pointing) and only move on to a challenging form of behaviour if the initial responses did not work.

Several variables appear to influence the order in which an individual emits specific behaviours (Cooper, Heron, & Heward, 2007). One variable may that may play a role in the ordering of these behaviours is the rate or consistency with which each behaviour has been reinforced in the past (Richman et al., 1999). Essentially, it can be hypothesized that behaviours that result in desired outcomes most consistently may take priority within the hierarchy. In the example of Tom, guiding adults to desired items may be one of the first responses in his requesting hierarchy because it may have worked more effectively than making unintelligible vocalisations. Secondly, the latency to which the behaviour results in desired consequences, or the immediacy of reinforcement, may also play a role in the ordering of a response class hierarchy. It can be hypothesized that

behaviours that consistently result in desired consequences may be further prioritized by how quickly and readily desired consequences are delivered (Lalli & Mace, 1995). In the example of Tom, he may have learned historically that pointing from afar to alert adults that he wanted a ball was not efficient in providing him quick access to the item, whereas when he guided people to the items, he would gain access more quickly. When discussing communication repairs, it is possible that although the child may have functional repairs within their repertoire, other repair topographies may take temporal priority based on how quickly and efficiently they have been reinforced in the past. A third variable that may affect the ordering of behaviours within a response class hierarchy is the amount of effort required to achieve the desired outcome, also knowns as response effort (Lalli & Mace, 1995). Essentially, efficient behaviours may be ones that yield the most desirable outcome for the least amount of effort. In the example of Tom, guiding a teacher to a desired item may have been considered less effortful to him than screaming from across the room to gain attention from the teacher to then indicate that he wanted an item. In addition to utilizing adaptive, socially acceptable forms of behaviours within a response-class to achieve a desired outcome, children with ASD might also utilize challenging behaviour to communicate wants and needs within those same classes (Richman et al., 1999). With regard to Tom's example, consider what may have happened if after the communication breakdown occurred, additional breakdowns continued to occur because the teacher continued to offer the wrong item. In this scenario, Tom might resort to scrolling through several behaviours within his requesting response class to try to repair the breakdown and continue trying out new responses until one of these is successful in him gaining the desired outcome. Depending of the number of responses available to

him, at some point he might escalate to problematic forms of behaviour, such as screaming and head banging. If he was eventually successful in getting the ball by screaming, for example, then Tom might learn to use such forms of challenging behaviour more immediately as his preferred means of repairing breakdowns. This situation might be corrected by being more responsive to Tom's initial and less problematic repair attempts.

Mands As Explained by B.F. Skinner

Skinner's analysis of verbal behaviour disaggregates communicative behaviour into verbal operants. For the purposes of this thesis, the *mand* will be further reviewed. Skinner (1957) defines the mand as a verbal operant "in which the response is reinforced by a characteristic consequence and is therefore under the functional control of relevant conditions of deprivation of aversive stimulation," (p. 36-36). Plainly, the mand is a request that serves to attain desired items or activities, or to terminate undesirable, or aversive stimulation. In Tom's example, the mand occurred when Tom indicated that he wanted the item. Skinner also determined that mands are the only verbal operant directly controlled by relevant motivating operations (e.g., deprivation, aversive stimulation, satiation), which suggests that training target mands should consider the degree of motivation the learner has for the items used in training. Essentially, training should be built around items that the learner is highly motivated to accrue.

Augmentative and Alternative Communication

It is estimated that 25 to 30% of individuals diagnosed with ASD never develop any appreciable amount of speech (Tager-Flusberg & Kasari, 2013; Wodka, Mathy, & Kalb, 2013). In such cases, augmentative and alternative communication (AAC) is often

recommended as a way of providing the child with an alternative method of communication. (Beukelman & Mirenda, 2013; Millar, Light, & Schlosser, 2006; Mirenda, 2001, 2003; Ogletree & Harn, 2001). AAC may function to either supplement existing, yet limited speech, or as the person's primary means of communication (Lorah Parnell, Whitby & Hantula, 2015). Mirenda (2003) argued that a primary mission of AAC intervention is to establish a means of communication for the individual that is effective and efficient within the natural environment and which can be maintained over the individual's lifespan.

Two classes of AAC (aided and unaided) have been recommended for children with ASD (Beukelman & Mirenda, 2013). Unaided communication is accomplished with the use of the individual's own body as the primary resource. This includes the use of manual signing or natural gestures (Beukelman & Mirenda, 2013). Some benefits of unaided AAC include that physically prompting signs may be more readily available than prompting speech, and no additional resources are needed to ensure that the AAC system is in working order as with electronic devices. However, Lorah et al. (2015) noted that unaided AAC has significant limitations, the most notable of which, being that the speaker relies entirely on the listener's familiarity with the respective AAC. If a person that uses manual sign, for instance, goes into a public restaurant where no other person present knows how to do or understand manual sign, the person's communication repertoire is no longer functional. Essentially, regardless of how well the child is able to do manual sign, communication attempts would likely be unsuccessful. Secondly, persons with autism and/or other developmental and intellectual disabilities may show gross and fine motor impairments in addition to difficulties with imitative skills (Bondy

& Frost 1994; Mirenda 2003). Lastly, Bondy et al. (2004) argued that unaided forms of AAC are limited in that they often require the individual to learn multiple topographies of behaviours. Manual signs are individually comprised of different combinations of gross and fine motor behaviours that are visibly different from one another, which could be quite a large task when compared to aided forms that require that the child learn one response topography, such as pointing to activate a button on a screen.

Aided AAC, in contrast to unaided AAC, involves the use of an external device (Ganz, Rispoli, Mason, & Hong, 2014; Lancioni, O'Reilly, Cuvo, Singh, Sigafoos, & Didden, 2007; Mirenda, 2001). Devices vary in both topography and sophistication. The Picture Exchange Communication System (PECS), for example, is considered a relatively low-tech aided AAC option. It involves the use of picture cards and symbols to replace verbal speech, where the pictures are exchanged with a communicative partner (Bondy & Frost, 2001). In this process, the speaker interacts with a listener utilising the exchange of a picture or word card that symbolizes a tangible item (e.g. toy), an activity (e.g. jumping on a trampoline), an intraverbal response (e.g. yes, or thank you), or a statement (e.g., "My name is…"). There are also higher-tech options, such as use of iPad®, iPod®, and other screen activated devices for the purpose of speech generation for children and adults with limited communicative repertoires (Sigafoos & Drasgow, 2001). Communication exchanges with electronic AAC devices require that the speaker activate the screen by, for example, touching or pressing a word or symbol (e.g. a picture, or illustrated icon) of an item, activity, response, or statement that results in synthetic speech output (Lorah et al., 2015). Several variables influence the selection of communication technology including (a) ease of use, (b) cost, and (c) preference (van der Meer &

Rispoli, 2010; van der Meer, Sigafoos, O'Reilly, & Lancioni, 2011). One benefit of the use of synthesized speech output associated with electronic/aided AAC is that the speaker is not required to actively recruit the attention of the listener prior to attempting communication (Lancioni et al., 2007). When considering manual signing, the speaker must first engage the listener to establish grounds for communication; however, electronic AAC has the potential to simultaneously recruit attention by means of an audible request.

Additional advantages of AAC must be noted with regard to the clarity of communication. As previously mentioned, children who are minimally verbal tend to rely on prelinguistic means of communication, which can be quite arbitrary in nature, and require a degree of familiarity with the child to understand the context of some prelinguistic requests. If prelinguistic behaviours can be replaced, or accompanied by the use of AAC, students may be more successful in repairing communication than utilising communication forms that lead to a communication breakdown in the first place.

Communication interventions for children with autism who are minimally verbal have historically focused on teaching one or more modalities of communication, specifically the use of manual signs, gestures, picture-based communication boards or picture- exchange systems, and/or the use of electronic speech-generating devices (Ganz, 2015). Manual signs and gestures are classified as unaided AAC, whereas picture-based systems and SGDs are referred to as aided AAC (Beukelman & Mirenda, 2005). With unaided AAC, no external devices or materials are needed to communicate, whereas aided AAC involves the use of external materials (e.g., pictures that are exchanged or an electronic device that produces synthesized speech). While manual signing has been

successfully taught to children with autism who are minimally verbal (Carr, Binkoff, Kologinsky, & Eddy, 1978; Carr, Kologinsky, & Leff-Simon, 1987; Falcomata, Wacker, Ringdahl, Vinquist, & Dutt, 2013; Hinerman et al., 1982; Kee, Casey, Cea, Bicard, & Bicard, 2012; Remington & Clarke, 1983; Valentino & Shillingsburg, 2011), the overall AAC literature points to better outcomes for interventions involving aided AAC (Schlosser & Wendt, 2008). Comparison studies also point to the possibility that aided AAC, specifically SGDs, might be the preferred mode of AAC for some children with autism. For example, McLay, van der Meer, Schäfer, et al. (2015) compared the acquisition, generalization, maintenance, and preference across manual sign, picture exchange, and SGDs with four children. The children's acquisition of communicative requests for preferred objects was slower when they were being taught to use manual signs compared to when they were being taught to use picture exchange and SGDs. In addition the participants appeared to demonstrate a preference for using SGDs. These data, suggesting more rapid acquisition and a preference for SGDs, influenced the decision in the present intervention work to make use of SGDs. Another factor taken into consideration for the present intervention was the degree of familiarity the participants had with existing modalities of communication. Both of the children in the present intervention had some familiarity with using variations of speech-generating applications in their classroom environment. They also had ready access to iPad® technology in the classroom. For these reasons, the iPad-based SGD used in the present intervention study seemed to be a reasonable option for the children involved in the current study.

Summary and Conclusion

It is argued that communication breakdowns happen more frequently for children with ASD who are minimally verbal than that of their neurotypical peers. The arbitrary nature of prelinguistic communication, while intermittently allowing the child to access their environment, still leaves the child vulnerable to misunderstandings, or communication breakdowns in their natural environments. With the principles of applied behaviour analysis outlined in this chapter, it can be hypothesized that these principles can be put to use with the aim of creating interventions to target an increase in more digestible communication forms, such as speech-generating devices within the context of a communication breakdown. While the aim is not to entirely extinguish prelinguistic communication forms, it can be argued that combined use of speech-generating devices in tandem with prelinguistic behaviours may increase the success rate of communication repairs for children who are minimally verbal.

The following chapter will outline existing repair assessment research that has put the principles of behaviour to use in describing possible mechanisms that both help and hinder communication repair in children with ASD. A small number of intervention studies were also reviewed that were based entirely on behaviour analytic principles, with some promising evidence for effective procedures for teaching communication repairs.

CHAPTER 3

OVERVIEW OF EXISTING LITERATURE

Previous research has been conducted into the nature and assessment of communication breakdowns and repairs among children with mild to moderate disabilities (Alexander, Wetherby, & Prizant, 1997; Calculator & Delaney, 1986; Paul & Cohen, 1984) and among children with more severe communicative deficits and/or persons utilizing AAC (Ohtake et al, 2005; Sigafoos et al, 2004). Assessment and intervention studies related to communication breakdowns and repairs and involving persons with ASD and limited verbal repertoires have also been reported (Meaden, Halle, Watkins, & Chasey, 2006; Ohtake, Yanagihara, Nakaya, Takashi, Sato, & Tanaka, 2005). The aim of this chapter is to review assessment studies into communication breakdowns and repairs and studies evaluating interventions for teaching communication repair strategies to individuals with ASD and other DDs.

Communication Repairs in Neurotypical Development

Neurotypical children demonstrate attempts at communication repair within the first year of their lives (Bacso & Nilsen, 2017). Researchers have reported that children as young as 12 months of age often point to objects or make vocal approximations of words in a seeming attempt to repair communication if a misunderstanding occurs (Golinkof, 1986; Liszkowski, Albrecht, Carpenter, & Tomasello, 2008). The degree to which young neurotypical children are effective in repairing communication breakdowns remains uncertain. In a study conducted by O'Neill and Topolovec (2001), neurotypical, 2-year-old children were observed to determine if they would modify or recast their communication attempts in response to a communication breakdown. This was done in a

situation where a pointing gesture would be considered insufficient. Additionally, these investigations also sought to determine if the participants could independently determine instances in which pointing would be insufficient. In the first of three studies, 16 participants, with a mean age of 2 years and 8 months, observed a sticker being placed in one of two boxes that each had different symbolic labels on them. Pre-assessment procedures determined that each of the participants could reliably expressively identify each of the symbols. The communication partner, usually a parent, did not see which box contained the sticker. For half of the trails for each child, the boxes were physically placed so that the child could unambiguously point to the box containing the sticker. For the other half of trials, the boxes were placed adjacent and touching, or stacked atop one another to facilitate the need for the child to use a more specific communication repair strategy. Each of the children were found to be three times more likely to use a combination of their original gesture plus a descriptor word or phrase when the boxes were adjacent to one another when compared to non-adjacent trials. In non-adjacent trials, the children were likely to rely on the gesture alone, with some intermittent use of words or descriptors. This finding suggested that typically developing children were able to make an on-the-spot assessment of the situation and use that information to select the communication repair strategy that was most likely to be effective.

The second study utilized the same set of procedures, except the stickers were hidden inside two actual toys. The participant pool included 16 children of similar age to the group in Study 1. The toys were plastic farm animals that each of the children could expressively identify prior to the onset of the study. A plastic fixture was used to stack the toys atop one another to remain consistent with the object formations used in Study 1.

The results showed that the children were more likely to repair communication by verbally expressing the names of the animal toys in addition to their gestures to gain access to the sticker; there were few differences in responding across adjacent versus non-adjacent trials. Another interesting finding was that the children were more likely to abandon the prelinguistic gesture in favour of using the name of the toy.

A third study was conducted and was procedurally identical to Study 2 except that the participants were younger, with a mean age 2 years 4 months. This study sought to determine if there was a notable difference in responding between younger versus older children. This younger group of children was most likely to use gestures alone without adding or modifying their request with the addition of speech to repair communication when compared to responses of the older children in the previous two studies. Rates of responding using gestures while saying the item name or some non-specific directive (e.g., “that one,” or “over there,”) was relatively comparable with higher rates of verbal responses alone in adjacent trials when compared to non-adjacent trials. One marked difference in responding in this younger group than the participants in the last study was that they were far less likely to use the name of the item in isolation to repair communication. Rates of repair responding were slightly higher than those observed in Study 1, but fewer instances of isolated vocal responding were observed when compared Study 2.

Collectively, these studies provide evidence to suggest that 2-year-old children demonstrate variations in responding to repair communication. This might stem from combining elements of the initial request, which for most participants was pointing, with vocal utterances, both specific to the item they were attempting to access. Depending on

the specificity of the item (e.g. a labeled box versus an actual toy), repairs seem to vary. More complex responses, such as using the specific name of the item, were more likely to be observed when the object in question was a familiar toy or trinket than when the item was an arbitrary box.

These are important findings for mapping developmental expectations and repair milestones for children with autism who are minimally verbal. These studies could be taken as providing a developmental baseline of communication repairs and the effects that the environment has on repair responding. It is also important to note that repair responding is observed to change and evolve over a neurotypical child's third year of life. With regard to intervention work for children with autism who are minimally verbal, this type of developmental data related to the emergence and use of repair responses might serve as a basis for informing intervention targets when aiming to teach or improve a child's communicative repair skills. As previously noted, communication deficits are to be expected for children with autism who are minimally verbal, which can also impact the individual's potential of experiencing a communication breakdown. Having a developmental understanding of repair responding might provide teachers with information that could assist them in developing scaffolded programmes of teaching. These programmes can serve to increase repair responding in a way that takes the individuals age, and current level of performance into consideration. The ultimate goal is to develop responses that are as congruent with developmental expectations as possible.

Repair Assessment Literature

Martin, Barstein, Hornickel, Matherly, Durante, and Losh (2017) conducted a study investigating non-comprehension signalling across groups of children with fragile

X syndrome, ASD, and Down syndrome. A group of neurotypically developing children also participated as a control. Non-comprehension signalling, was defined by the authors as a group of behaviours that are used to indicate that the listener has acknowledged that communication breakdown as occurred. The authors sought to determine whether any syndrome specific differences existed that might influence implementation of communication interventions and training. This study had a participant pool of 121 males and 81 females total ranging from an average age of 6 to 12 years of age. The 202 participants were from five sub-groups pertinent to diagnosis; fragile X syndrome (FXS) with and without ASD (FXS-ASD; FXS-Only), sole diagnosis of ASD (ASD-O), Down syndrome (DS), and typically developing (TD). The Leiter-Revised and Peabody Picture Vocabulary Test-III (Dunn & Dunn, 1997) were used to determine cognition and receptive vocabulary skills in addition to the Autism Diagnostic Observation Schedule (ADOS; Lord, Luyster, Gothan, & Guthrie, 2012) to verify the diagnoses for subgroup allocation.

The non-comprehension signalling task included two researchers that served as the Examiner and the Speaker. The Speaker had a picture card that was not disclosed to the participant. The participant was then instructed to match one picture from the array of four pictures in their possession to the Speaker's picture. Participants were told they were allowed to engage with the Speaker by asking questions, or making statements with the goal of matching their picture to the Speaker's. The Speaker provided information to the participant across four different conditions: (a) *Informative*, where no communication breakdown was presented; (b) *Incompatible*, where the directions and the images in front of the child had no relation (e.g., instructing the participant to select a pink star when no

such thing was present); (c) *Unfamiliar*, where the Speaker uses a descriptor that would be likely unknown by the child (e.g., instructing the participant to find the equine animal in the array.), and (d) *Ambiguous*, where the Speaker failed to provide the appropriate descriptor word to determine the correct image (e.g., instructing the participant to put a heart on the board when there are four different coloured hearts). Eighteen trials across the four conditions (six Informative, four Incompatible, four unfamiliar, and four ambiguous) were presented to each child.

Non-comprehension signals were classified into nine different categories of responses. *Nonspecific requests for repetition* were recorded when a child informally asked the Speaker to repeat themselves by saying "What?" oh "Huh?" *Requests for Confirmation* were recorded when the participant asked questions related to the Speaker's request (e.g., "You mean the red circle?"). *Requests for Definition* were recorded when the child asked the Speaker to define words in their request (e.g., "What does equine mean?"). *Requests for Specific Information* were recorded when the participant asked for more details about the Speaker's request (e.g., "Which shape?"). Statements of non-existence were recorded when the participant told the Speaker that the item requested of them is not present (e.g., "I don't see that colour pencil."). Statements of existence were recorded when the participant disclosed to the Speaker what items they had in their array (e.g., "I have four stars," or "The colours I have are blue, green, red, and purple.*"*). *Statements of Uncertainty* were recorded when the participant told the Speaker that they were unsure of how to respond to what was asked of them (e.g., "I don't know."). *Facial Expressions/Gestures* were recorded if the child contorted their face in such a way that indicated confusion or shrugged in response to a question. Lastly, *Other* was recorded

when the child made statements that did not meet the criteria of the previous 8 response definitions (e.g., “That’s tricky,” or “That’s a tough one.”).

There were no clear indicators that sex or interactions between sex and diagnosis existed that led any group to perform higher or lower in non-comprehension signalling, however, boys with FXS-ASD appeared to make significantly fewer signals overall when compared to other experimental groups. Increased ASD severity also seemed to correlate with boys who utilized fewer non-comprehension signals in participants with FXS-ASD when compared with boys with the FSX-O diagnosis. Although the presence of ASD symptomology seemed to adversely influence the FSX-ASD group, those with ASD-O seemed to have fewer deficits in non-comprehension signalling given that they performed relatively similar to the TD controls. ASD-O boys performed significantly better than those with FSX-ASD and DS.

Limitations to the Martin et al. (2017) research must be noted. The authors discussed that although statistical control for both mental age equivalency and receptive communication existed, groups with non-comprehension signalling similar to the TD group had higher receptive scores than those who seemed to have bigger deficits. The authors also noted that the absence of an expressive language measure is a limitation. Previous research has determined that expressive language is not necessarily a predictor of the ability to signal non-comprehension specific to FXS or DS groups. Another limitation to note is that the authors did not investigate more passive communication breakdowns where the listener ignores (deliberately or not) the initial request of the child. Lastly, communication breakdowns in the Martin et al. study were limited to

conversational exchange and thus were perhaps not relevant for use with minimally verbal children.

In addition, with regard to the Martin et al. (2017) study, some discussion points must be noted. Primarily, the nomenclature used to describe communication breakdowns and repairs varied significantly. Definitions of communication breakdowns and repairs vary widely across studies investigating this topic across and within disciplines. Response definitions across the current literature seem to fall within the parameters of the definitions outlined by Meadan and Halle, (2004) in the previous chapter, but may have contextual information relative to the nature of the assessment. Another discussion point to address is the fact that the children had relatively high communication ability and so these findings may not generalize to children with ASD who are minimally verbal. The communication breakdowns and repairs utilized in this study were sophisticated in that the child was not only expected to repair the communication breakdown, but to also signal to the speaker that communication had, in fact, broken down. The requirement for children to indicate when a breakdown occurred might not be a reasonable expectation for children with impaired communication abilities as they may not have the requisite skills to signal this to their communication partner while also making a repair attempt.

In another relevant study, Ohtake (2005) assessed repairs in primary school children diagnosed with ASD. They investigated what kinds of repair strategies the children used, what kinds of modifications, if any, each child made and their relative effectiveness, and whether there was a relation between types of breakdowns and types of repairs. Three students diagnosed with autism and severe language delays (each had an expressive language age equivalency of less than 1 year) participated in this study.

Takeshi was 7.9 years old and primarily used prelinguistic behaviour to communicate his wants and needs although he did have a limited number of one-word requests. He did have some tacts (object labels), however, they did not seem to generalize to functional mands (requesting responses). Minoru was a 10.10-year-old female that used prelinguistic behaviour as a primary means of requesting, but had a limited amount of generalized mands (e.g., "more" "want"). The assessment was conducted throughout the entire school day across several school environments and across a variety of activities.

The authors determined which activities occurred most frequently during the school day and among those, which seemed to be most reinforcing to each of the children. The authors sought to utilize naturally occurring motivating operations to evoke spontaneous requesting within activities. Once high-frequency, highly-preferred activities were identified, researchers established routines within the activities to more effectively sabotage the situation to promote spontaneous requesting and repairs. Once routines within activities were established, the researcher would then purposefully pause the activity for 7 s and wait to see if the child would make a requesting response to reinstate/continue the activity. If the child did not request continuation after 7 s, the trial was terminated. If the child did request continuation, a communication breakdown was presented. The researchers exposed the children to five different breakdown scenarios: (a) *attending with no responding*, where the researcher attended to the child but did not meet their request, (b) *not attending and not responding*, where the researcher did not acknowledge the child's request and did not meet their request, (c) *spoken request*, where the researcher verbally asked for clarification of the original request, (d) *gestural request*, where the researcher gestured to ask for clarification of the original request (e.g., looking

confused with folded arms), and (e) *wrong response*, where the researcher responded incorrectly to the original request (e.g., giving the child a glove when they ask for tickles). A 7-s time delay occurred after the breakdown was presented and at the end of this 7 s, regardless of the response made, the original mand was reinforced. Data were collected on the different repairs that the children made and these were classified as follows: (a) *repetition*, where the child repeats the original form of the mand (e.g., reaching is followed with more reaching after the breakdown), (b) *modification by means of reduction*, where the student omitted some elements of the original mand, (c) *modification by means of addition*, where the student added new elements to the original mand form, (d) *modification by means of substitution*, where the original mand was completely replaced with a new mand topography, and (e) *termination*, where manding did not persist in the face of a breakdown.

Each of the students displayed varied repair behaviours. Takeshi was most likely to repair using modifications by means of addition, however he showed repair capabilities across all breakdown scenarios. Minoru was most likely to repeat in attempt to repair breakdowns, and showed no termination of mands once breakdowns were presented. It could be suggested that, in terms of communicative persistence, that Minoru had the highest threshold for extinction. Chiharu was most likely repair communication using modifications by means of substitution, but only by a small margin over repetition. Chiharu was also the participant most likely to terminate, or refrain from communicative persistence in the face of a breakdown. It must be noted for discussion that modification criteria included the addition, subtraction, or substitution of prelinguistic behaviours. If the child used a reach to request an item, using another prelinguistic behaviour such as

touching the researcher's hand in addition to reaching would be considered a modification by means of addition. Modifications occurred at the highest rate in conditions where the researcher did not attend or respond to the child's initial request. Takeshi and Chiharu were most likely to make modifications that involved physical touch in these conditions, which, given that the researcher was not attending to them at all, may be seen as an effective repair strategy for children with limited communication repertoires and less sophisticated mand topographies. Lastly, the researchers determined that, in terms of repair strategies, the children were most likely to use non-conventional communication topographies. Given discussions of response class hierarchies, it can be argued that the once a mand that has historically been successful (the first behaviour in that response-class hierarchy) is placed under extinction, or is not reinforced, that the student will move on to the next behaviour in the hierarchy. One implication of these results is that there may be value in teaching new forms of repairs to minimally verbal students with ASD as the availability of new repair forms may serve to enable students to repair breakdowns more successfully.

Several limitations must be noted with regard to the study by Ohtake (2005). Due to the naturalistic, non-invasive breadth of the assessment, data collection took three weeks. For a classroom setting, three weeks is a significant amount of time to endure without any information on potential intervention. While the aim of the current study was merely to investigate repertoires, there is very little practical value to teachers and paraprofessionals for an assessment where responding depends solely on the child and their current level of motivation. Contriving breakdown scenarios around highly preferred activities in a naturalistic way might serve to move the assessment along faster

and in a more systematic way. Secondly, response and repair definitions could serve to be more clearly and succinctly defined. More specifically, the researchers looked at prelinguistic behaviours in isolation and considered the addition or subtraction of these behaviours to determine what kinds of modifications the children were making, however, if the argument is to be made that prelinguistic acts alone are insufficient at allowing minimally verbal students access their environment to the highest degree, then assessing modifications across mand modalities might be more beneficial to the student. Essentially, if prelinguistic behaviours are not reliably functioning as mands, then looking at more sophisticated mand forms may serve to establish a stronger mand repair repertoire. Furthermore, it can be argued that modifications are the most sophisticated means of repairing communication as they combine previously successful mand forms, however, if the mand forms that are being combined are functionally equivalent and highly dependent on the familiarity of the communication partner, it can be argued that a modification was not indeed achieved.

In another relevant study, Dincer and Erbas (2010) investigated repair strategies within a group of 23 students ranging from 1 to 9 years old. More specifically, they investigated how often each of the students initiated a communicative act, how often those initiations required a repair, which repair strategies were used, and how often repairs were successful. Of the 23 students, 7 were diagnosed with pervasive developmental disabilities, 3 with autism, and 16 with Down syndrome. Each of the participants had either fewer than 5 words in their vocabulary, or the primary use of non-symbolic communication forms, such as gestures (e.g., reaching, pointing) and leading adults to desired items. Data collection occurred within the student's classrooms during

free play. Each student was video recorded for a total of 60 min, however, randomly selected, 30-min segments were chosen for data collection. Initial communication behaviour was defined as a gesture or vocalization that was directed at another person that served a communicative function. Coded communication breakdowns included requests for clarification, non-acknowledgements, and topic shifts. Requests for clarification were breakdowns where the teacher indicated verbally, or nonverbally, that they did not understand the original message. Non-acknowledgements were instances where the communicative attempt was ignored. Lastly, topic shifts were verbal redirections given to the students during an activity when a request was made for items not related to the activity. Repair strategies were coded as a repetition, recast, or additions. Repetitions occurred when the child repeated the exact same words or gestures as the original communication attempt. Recasting occurred when the child used a modality of communication that was completely different from the original message. Lastly, additions occurred when the student added a word or gesture to the original statement while repeating the original statement.

An average of 10 communication initiations was made by each student, of which, an average of 65% of communication breakdowns resulted in a repair attempt. Of the total repair strategies used, repetition was most utilized among the students representing 60% of all repairs. Addition was used for 30% of repairs, followed by recast, which was used 8% of the time. These results corroborated previous research indicating that nonverbal children with DDs were observed to make several attempts to repair communication breakdowns, but appear to be most likely to use repetition as a primary repair strategy. One explanation for this trend may in fact be that the participant cannot

engage in variability of response due to limitations within the existing repertoire. For example, if a child has only nonspecific mands for food, (e.g. “more”, “please”), it is likely the child will repeat the mand rather than augment it by means of addition due to a limited repertoire and a strong reinforcement history across several eating contexts with a known communication partner. Another explanation for the wide use of repetition across participants may be attributed to difficulties persons with developmental disabilities face in determining that a communication breakdown has occurred, or that further clarity is needed.

While the results of the Dincer and Erbas (2010) study provide much insight and direction in this area of research, some limitations must be noted. Primarily, observations were conducted across free-play activities, some of which might have inhibited communication opportunities. Some activities provided many opportunities for communicative exchanges and breakdowns (e.g., reading a story in a picture book), while others were self-maintained (e.g., drawing, colouring) resulting in fewer communication opportunities. Secondly, standardized communication and cognition assessments were not readily available in the country where the study was conducted. The researchers were required to acquire knowledge of the student’s repertoires via anecdotal information provided by teachers, specialized therapists, and paraprofessionals.

In another relevant study, Meadan, Halle, Watkins, and Chadsey (2006) implemented a structured protocol to assess repair behaviour in two children with ASD who were minimally verbal. The two boys, Ray and Ethan, were 2 years 8 months old, and 3 years 3 months old, respectively. Both boys communicated primarily with gestures. Sessions were conducted on a 1 adult to 1 child ratio in the children’s homes

and lasted an average of 20 min. The researcher and the child engaged in leisure and snack routines during each session, such as doing a puzzle, or reading a book, or stacking blocks. Two types of sessions were conducted with respect to breakdown types presented. Type 1 sessions only contained one type of breakdown scenario where a request for clarification was made. Type 2 sessions exposed the child to three types of breakdowns: (a) ignore, (b) wrong response, and (c) requests for clarification. The procedures for the assessment included engaging with one of the child's highly-preferred items to draw attention to it and providing the verbal cue, "I have an (item)!" If the child indicated that they didn't want the item by pushing it away, another item was offered. If the child indicated that they did in fact want the item, they were allowed access to the item. If no response was made within 15 s, the item was removed and replaced. Non-preferred items were also presented for rejection trials. If the child did not initiate a rejection immediately the item was handed to the child or put within reach of the child. If challenging behaviour occurred, alternative, socially appropriate means of rejection were prompted. In Type 1 sessions, a communication breakdown in the form of a request for clarification was made on an average of every 3 indications that the child wanted the target item. In Type 2 trials, breakdowns were still presented on an average of every 3 request indications, however, 3 types of breakdowns were presented. The breakdowns included: (a) ignore, where the implementer would engage in a feigned work activity not looking at the child, (b) requests for clarification where the implementer made eye contact with the child and said, "What?", and (c) wrong response breakdowns included the implementer pointing to the desired item and saying "Yes, this is an (item)," while nodding their head.

Both children repaired communication breakdowns for a majority of trials. Ray repaired 66% of total communication breakdowns and Ethan repaired 73%. When repairs were evaluated across activity types, Ray was shown to be most likely to repair during food and book activities when compared to other play routines. Ethan showed relatively equal percentages of repair responding across all conditions. With regard to breakdown types, both boys were most likely to repair in response to a request for clarification, followed by the wrong response breakdown scenario. They were least likely to repair during the ignore scenario. Data were also analysed to show the types of repair topographies used for each breakdown type. Ray was most likely to repair requests for clarification by using vocalisations as opposed to other prelinguistic gestures, however, he was most likely to repair using reaching and pointing for wrong response and ignore breakdowns. For all three conditions, Ethan primarily reached for items when he experienced a communication breakdown, however, he showed a markedly higher rate of vocalisation repairs in the ignore breakdowns when compared to wrong response and requests for clarification.

Limitations of this study are of note. First, the study is limited as it involved only two participants and thus it is not clear if similar findings would be found among other children with ASD who are minimally verbal. Another limitation to note, that the authors did not cite, is that implementation of this type of assessment requires that the implementer stay on track with the types of breakdowns that need to be presented, all while engaging in a naturalistic play routine with a child. It does not seem realistic for a single person to mitigate all of those variables while trying to maintain the child's attention and ensure that the routine flows naturally and expect to maintain procedural

integrity across sessions. It would be incredibly difficult for an assessment of this type to be carried out by a teacher in a classroom setting, even with high levels of training.

This study was a contribution to the existing literature in that it determined the environment does, in fact, play a role in how children with ASD repair communication breakdowns. More specifically, this study showed that children repair differently across different breakdown scenarios. This study also provided a framework for how to conduct structured assessments directed at communication repair strategies within the natural environment. Some of the strengths of this study are that naturalistic routines allowed the child to be assessed within the context of a familiar, highly-preferred situation, which may have motivated repair responses. Additionally, engagement in these routines seem to be positive in terms of influencing a good rapport between the child and the implementer, and could also contribute to the high rates of repair responses.

Repair Intervention Literature

In terms of intervention, Sigafoos et al. (2004) appear to have published the first study to explore the teaching of communication repair strategies to individuals with DD who were minimally verbal. In this study, the participants were taught to use a speech-generating device (SGD) to repair a communication breakdown. The study involved two participants named Jason and Megan. Jason was a 16-year-old boy with intellectual disabilities and pervasive developmental delay not otherwise specified (PDD-NOS). With the exception of limited manual signs, he was considered minimally verbal. Megan was a 20-year old female diagnosed with ASD, intellectual disability, and bilateral hearing loss. She was also considered minimally verbal, and also had a history of self-injury. Both of

the participants relied on prelinguistic behaviours to make requests (reaching for items and guiding caregivers' hands to desired items).

Sessions for both participants were conducted in a one-to-one fashion during a morning snack routine. Jason's sessions were conducted in a classroom setting, where Megan's sessions were conducted at a vocational training facility. Preference assessments were conducted to determine potential reinforcers for each participant and gross motor assessments were conducted to investigate whether the participants were physically able to activate the SGD. Sessions were conducted 3 to 5 times per week for about 5 min per session. Target responses were defined as follows: (a) *Behavioural Indication*, any attempt to access the tray of edibles, (b) SGD *use*, activation of the SGD in isolation, and (c) *Combined Use*, the use of both prelinguistic behaviours and SGD activation. Data was collected on *First Responses*, which was defined as the topography of the first response that the participant made in attempt to request, and *Repairs*, in which the participant used the SGD to make a request after a breakdown had occurred, that is when the first request was ignored by pretending not to notice the participant's first response.

Baseline procedures were conducted at a table top. Researchers presented a tray of highly preferred edibles in sight, but just out of reach. An empty bowl was placed in front of the participant where highly preferred edibles will be placed after each trial. The SGD was set within easy reach of each participant. Each session began with limited, noncontingent access to highly preferred edibles to evoke requests followed by the researcher saying, "Let me know if you want any more." In *Standard Opportunity* trials, any first request topography was immediately reinforced whereas in *Repair Probe trials* the first response was ignored for 10 s to see if a repair with the SGD would occur.

Procedures for Standard Opportunities were identical during intervention to those in baseline. Repair Probes also looked similar, except if a SGD-based repair did not occur within 10 s, then the communication partner prompted a correct SGD response suing the least amount of physical assistance. When the SGD repair response occurred, the participant was immediately reinforced with the delivery of the preferred item. Using this procedure, both participants learned to use the SGD to repair communication breakdowns. Interestingly, Megan began to use the SGD to make the first request rather that solely using it for communication repair.

Ohtake (2010) systematically replicated Sigafoos et al. (2004) study but they taught participants to use a picture exchange response, rather than SGD, as the repair strategy. In addition, instead of creating breakdowns by ignoring the first response, Ohtake (2010) created breakdowns by using the wrong response breakdown scenario. The study involved only one participant, a 12-year-old boy with ASD who relied on prelinguistic behaviours (e.g., reaching, pointing, holding his hand open) to request. Sessions of 15 min occurred in a self-contained classroom at a table top in a 1:1 configuration. Two sessions were conducted per week. The researchers ran Standard Opportunity and Repair Probes similar to the Sigafoos et al. (2004) study except, Repair Probes involved giving the participant the wrong item when he made a request. To repair, the child was taught to select a picture card corresponding to the item he wanted and hand it to the communication partner. He was taught to perform this response using modelling and physical prompting.

The positive results from Sigafoos et al. (2004) and Ohtake (2010) suggest that individuals who are minimally verbal can be taught to repair communication with AAC.

Some limitations to these studies are that participants were exposed to only on type of communication breakdown in each study. No investigations were made to determine that the child would generalise use of their AAC to other breakdown scenarios. Another limitation must be noted with respect to the study conducted by Ohtake (2010) in that the participant was taught to repair under the very specific context of requesting writing utensils, where Sigafoos, Drasgow, Halle, O'Reilly, Seely-York, Erdrisinha & Andrews, (2004) taught the repair response in a commonly occurring, daily routine. In terms of practicality, teaching repairs under the context of a daily living routine may be beneficial as those routines are quite frequent on a daily basis.

Summary and Conclusion

The studies reviewed in this chapter suggest that children with ASD and other DDs will often engage in a variety of responses that appear to function as attempts to repair various types of communication breakdowns. In addition, systematic instructional procedures have been effectively applied to teach AAC-based communication repair strategies. While the existing body of research on the assessment and intervention of communication repair strategies for minimally verbal children with ASD is quite limited in number, some insight has been provided on possible approaches to assess, and potentially intervene on communication repair strategies. At present, the few assessment studies that have investigated repair skills among children with ASD who are minimally verbal indicate that children are likely to respond differently to different types of breakdown scenarios. Thus, assessment should cover a range of breakdown scenarios. The intervention literature utilising AAC, more specifically, speech-generating devices is even more limited in size than assessment literature, and requires further investigation,

perhaps with the influence of direct assessment outcomes (See Chapters 5 and 6). The next chapter will describe Study 1, the indirect assessment of communication repair strategies, where teachers report on the ways in which their respective students have been observed to repair communication breakdowns on a day-to-day basis. Results of Study 1 will be compared to the results of the direct assessment that will be outlined in Study 2 to determine the predictive validity of the indirect assessment.

CHAPTER 4

Study 1: Indirect Assessment of Communication Repair Strategies

Data suggest that children with ASD are likely to encounter a higher rate of communication breakdowns than children with other types of developmental disabilities (Keen, 2003). As discussed in previous chapters, certain traits associated with ASD might play a role in the higher rates of communication breakdowns among children with ASD. Specifically, deficits in communicative intentionality have been cited as one factor that could adversely impact the ability to repair communication breakdowns in children with ASD. This possibility might be due to the fact that children with ASD appear more likely to show fewer markers for intentional communication than do children with other types of developmental disabilities or neurotypical peers (Chiang, Song, Lin, & Rogers, 2008; Shumway & Wetherby, 2009). Deficits in joint attention have also been suggested as possibly influencing the extent to which children with ASD are able to repair communication breakdowns (Osterling & Dawson, 1994). Specifically, challenges in establishing joint attention could potentially make it more difficult for children with ASD to recognize when a communication breakdown has occurred (Keen, 2003). If a child is not aware of the cues that signal the need for a communication repair, he or she would seem less likely to produce repairs when breakdowns occur.

Considering that children with ASD are likely to experience frequent communication breakdowns, and may also be less able to effectively repair such breakdowns, assessment in relation to communication breakdowns and repairs in children with ASD is warranted. Such information may be useful for informing interventions aimed at teaching children with ASD to effectively repair communication breakdowns. To date, the assessment

literature in relation to communication repair strategies is quite limited and there is no current agreement as to how best to conduct assessments of communication repair strategies in children with ASD. Possible assessment approaches include the use of indirect (informant reports) and the use of more direct (observational) approaches. In light of the limited research on the assessment of communication repair strategies in children with ASD, the purpose of the current study was to investigate the outcomes from an indirect (informant-based) assessment (this chapter, Chapter 4) and then undertake a direct (observation-based) assessment (Chapter 5) of the communication repair forms used by children with ASD under different types of communication breakdown scenarios. The specific research questions addressed in this chapter and the next are:

1. What response forms, if any, do the teachers of children with ASD report that these children use in an attempt to repair different types of communication breakdowns? (Chapter 4)
2. What response forms, if any, are children with ASD observed to use in response to different types of communication breakdowns? (Chapter 5)
3. To what extent do the results of an indirect (informant-based) assessment (Chapter 4) correspond to the results of a direct (observation-based) assessment? (Chapter 5)

To address these three research questions, this chapter (Chapter 4) and the next chapter (Chapter 5) will describe and present the results from an indirect assessment (Chapter 4) where teachers were asked to report on the communication strategies used by a sample of children with ASD under their care. Teacher reports were collected using a questionnaire that was developed for the purpose of this study. These teacher reports

were then compared to a direct structured assessment (Study 2, Chapter 5) in which I created specific breakdown scenarios and directly observed the child's responses to the contrived scenarios.

Method

Ethical Approval and Participant Recruitment

Ethical approval for this study was granted from the Victoria University of Wellington Ethics Committee and approved on the 2nd November 2015. Informed consent was gained from the principal of the primary school where the all of the studies reported in this thesis were conducted. In addition, the lead teachers in the classroom, the teaching staff, and the parents/guardians of the children involved provided consent. The children were not of legal consenting age to provide consent. Each child was assigned a pseudonym to protect his or her confidentiality.

Participants were recruited from a local Wellington primary school with a self-contained, special-education unit on campus. The principal and head-teacher of the special education unit were contacted to enquire about their willingness to participate in research involving communication interventions. They were provided with Information Sheets that explained and outlined the goals and basic procedures of the research. Information Sheets also explained the extent to which the school, staff, and each child was expected to participate and emphasized their right to terminate research at any given point if they so choose. I made a short presentation to the parents of the children in the special-education unit outlining the information on the sheets provided and answered any questions regarding the research that the parents might have regarding their child's potential participation in the event their child met participation criteria.

Participants

Teacher participants. A total of three teachers participated in the current study. Table 4.1 gives a brief summary of each participating teacher. Sasha was the lead teacher of the group, she was 46 years of age and had 21 years teaching experience. She was the informant for Kaiser, Gabriel, Kurt, and Scarlett. Kelly was a senior teacher in the classroom and was 59 years of age and had 23 years of teaching experience. She was the informant for Jeff, Donald, Ford and Annie. Dorene was the third teacher in the classroom. She was 55 years of age and had 18 years teaching experience. She was the informant for Damian, Mariah, Ed, and Ricky. All three teachers had full practising certificates issued by the Education Council of New Zealand.

Table 4.1

Teacher participant information

Teacher	*Age*	*Years of Experience*	*Students Reported on Using the RSAS*
Sasha	46	21	Kaiser, Gabriel, Kurt, and Scarlett
Kelly	59	23	Jeff, Donald, Ford and Annie
Dorene	55	18	Damian, Mariah, Ed, and Ricky

Student participants. A total of 12 students were recruited for the study and all 12 completed the study. Table 4.2 gives a brief summary of each of the participating

students. The table gives each child's pseudonym, age (in years) diagnoses, gender, scores on the expressive and receptive communication subscales of the second edition of the Vineland Adaptive Behaviour Scales (Vineland-II; Sparrow, Cicchetti, & Balla, 2005), and a brief description of their primary communication forms. The Vineland was administered by interviewing the classroom teacher after the child had been recruited and consent obtained, but before the administration of the indirect assessment of communication repairs that is reported in this chapter. The Vineland-II provides a measure of adaptive behaviour functioning across four major domains (a) communication, (b) daily living, (c) socialization, and (d) motor skills. It also has a maladaptive behaviour scale. For the purposes of this study, scores pertaining to expressive and receptive language were examined to determine eligibility for participation. The main inclusion criteria for the current study required that students had an age equivalency of 2 years or less on the expressive communication domain of the Vineland-II.

Table 4.2

Demographic Information for the Student Participants and Results of the Vineland-II

Participant	*Age*	*Sex*	*Diagnosis*	*Vineland Expressive Age (Year:Months)*	*Vineland Receptive Age (Year:Months)*	*Primary Communication Forms*
Mariah	11	Female	ASD/ID	2:0	2:5	Gestures (reaching, pointing, head nodding), some words (rarely spontaneous), eye contact
Damian	6	Male	ASD	0:9	0:10	Gestures (reaching, pointing, pulling someone's hand, physical contact with conversation partner) vocalisations (unintelligible)
Jeff	5	Male	ASD	0:7	0:8	Gestures (reaching, pointing, pulling someone's hand, getting closer to conversational partner) vocalisations (unintelligible), eye contact
Kaiser	10	Male	ASD	1:0	1:7	Gestures (reaching, pointing, guiding someone's hand), iPod®-based SGD (when prompted by adult, not spontaneous), eye contact

Kurt	11	Male	ASD	0:9	1:9	iPod®-based SGD, gestures (reaching, guiding someone's hand, physical contact with communication partner) eye contact
Annie	12	Female	ASD/ID	1:0	3:11	Gestures (guiding someone’s hand, reaching) vocalisations and word approximations
Donald	9	Male	ASD	0:6	1:5	Gestures (reaching, pointing, pulling someone's hand, getting closer to conversational partner) vocalisations (unintelligible), eye contact
Scarlett	6	Female	ASD	1:6	2:6	Gestures (guiding someone's hand, reaching, pointing, getting closer to conversational partner)
Ford	11	Male	ASD	1:10	2:5	2-3-word requests, gestures (reaching, pointing, physical contact with conversational partner)
Ed	5	Male	ASD	1:9	2:11	1-word requests, gestures (reaching, pointing)
Ricky	6	Male	ASD	1:11	2:10	1-2 requests, gestures (reaching, pointing, guiding someone's hand)

Gabriel	6	Male	ASD	1:8	1:4	1-2-word requests, gestures (reaching, pointing, guiding someone's hand, physical contact with conversational partner)

Notes: ASD = Autism Spectrum Disorder; ID = Intellectual Disability. Age equivalencies are shown as Year: Months.

Mariah was an 11-year-old girl. She had a diagnosis of autism and intellectual disability given by her paediatrician. On the second edition of the Vineland-II, she obtained an expressive language age equivalency of 2 years and a receptive language age equivalency of 2 years 5 months. According to teacher reports, Mariah primarily communicated by repeating what seemed to be scripted phrases about things that happened in her past (i.e. evoking going to the dentist, or her mum having a baby a few years prior). She appeared to emit various such scripts to initiate conversations with adults, regardless of the context. She showed very little spontaneous, functional communication, in that she rarely initiated requests or conversational exchanges in ways that neurotypical peers might. If her needs were not met she would wait until someone familiar enough with her activity preferences anticipated her need and provided it for her. Alternatively, she had a history of challenging behaviour (e.g., pushing adults away, screaming, crying, attempting to hit other children) that appeared to be related to accessing preferred objects or escaping from aversive stimuli (e.g., other children crying or screaming loudly, or work tasks that she was not interested in completing). She was in the process of learning how to toilet herself on a regular schedule. Mariah was reported by the teacher to have normal hearing and vision. She was not currently taking medication.

Damian was a 6-year-old boy with a diagnosis of autism as determined by his paediatrician. On the Vineland-II, he obtained an expressive language age equivalency of 9 months and a receptive language age equivalency of 10 months. Damian did not speak words but he could make speech-like sounds that appeared to be his way of trying to recruit the attention of an adult. Damian was not toilet trained, but he was capable of

feeding himself and could partially participate in a number of daily tasks, such as changing his clothes and hand washing. His vision and hearing were not impaired according to teacher reports. Damian's teachers also reported that he had a history of challenging behaviours that were hypothesized to be related to escape from demands. The topographies of challenging behaviours that he displayed included flopping to the floor, crying loudly, screaming, and occasional attempts at hitting or kicking. He was also reported to use several prelinguistic forms of communication to access preferred objects and activities within his environment (e.g., pointing, or guiding an adult by the hand to preferred items or activities).

Jeff was a 5-year-old boy diagnosed with autism and global developmental delay as determined by his paediatrician. On the second edition of the Vineland, he obtained an expressive language age equivalency of 7 months and a receptive language age equivalency of 8 months. According to teacher reports, Jeff primarily used prelinguistic behaviours such as reaching and/or guiding adults to desired items or activities to communicate. He showed no evidence of a verbally imitative repertoire and made no observed attempts at approximating words or speech sounds related to desired items or attention recruitment. Jeff was observed to engage in a host of stereotypic behaviours such as eye gouging, rectal digging, and reported rumination and vomiting. These behaviours were observed to occur in a restrictive, repetitive manner and seemed to occur across any environmental condition (i.e. during work tasks, during leisure activities, while fully engaged with an adult, etc.). In terms of adaptive living skills, Jeff required adult assistance with most daily living tasks such as toileting and dressing himself. He was capable of feeding himself; however, that seemed to require direct adult monitoring.

Lastly, Jeff's teacher reported him to have vision and hearing within the normal range and was not taking medications at the time of the research.

Kaiser was a 10-year-old boy diagnosed with autism as determined by his paediatrician. On the second edition of the Vineland, he obtained an expressive language age equivalency of 1 year and a receptive language age equivalency of 1 year 7 months. He was one of two students who had previous communication training using iPad®-based AAC devices. According to teacher reports, the majority of his SGD repertoire required verbal prompting such as, "What do you want?" with no spontaneous communication. If his iPod® that was loaded with Proloquo2go® was not within direct reach of him, he did not seem to seek it out to initiate a request. When he was within reach of his device, and was prompted by an adult, he was observed to discriminate between several buttons to determine his wants and needs; however, his teacher reported that he required training for novel buttons programmed onto his device. With careful adult supervision, Kaiser was able to participate in some functional, daily living tasks such as clothing himself, and feeding himself; however his history of significant challenging behaviours toward peers and staff required he have high levels of supervision while executing daily livings activities in the classroom. Kaiser's teacher reported observing high-magnitude challenging behaviours such as physical aggression, property destruction, and chronic masturbation. Functional behaviour assessments conducted by school staff suggested that Kaiser's behaviour was multi-functional, in that it seemed to be maintained by multiple environmental and sensory variables.

Kurt was an 11-year-old boy diagnosed with autism as determined by his paediatrician. On the second edition of the Vineland, he obtained an expressive language

age equivalency of 9 months and a receptive language age equivalency of 1 year 9 months. He was another student with previous communication training using an iPod®-based AAC device. Kurt was capable of making spontaneous requests using his SGD; however, many of his requests were overgeneralised requests (e.g. activating the button for "Outside" on his iPod to recruit attention, to terminate an activity, or to initiate a request for an object out of reach). Adult prompts typically involved a teacher or other adult reminding Kurt, "Use your words," which would then result in him attempting to employ his device. He was able to discriminate between several buttons programmed onto his SGD, and required minimal training for new buttons, which implied that Kurt was able to discriminate new stimuli on his SGD. He was not required to seek out his SGD because he wore a small vest that was attached to his SGD, so it rarely left his reach. Kurt required adult prompting to toilet himself, however, was able to complete the majority of tasks related to toileting (e.g., pulling pants up and down, hand washing, etc.) without adult intervention and was also able to feed himself without adult intervention. Kurt was also reported as having normal vision and hearing. The only reported medication that Kurt took regularly was a small dose of melatonin at nights to aid in sleeping.

Annie was a 12-year-old girl with autism. On the second edition of the Vineland, she obtained an expressive language age equivalency of 1 year and a receptive language age equivalency of 3 years 11 months. According to teacher reports, Annie relied primarily on prelinguistic behaviours to communicate her wants and needs. Prelinguistic topographies of Annie's communication involved gestures (e.g., point to, or motion toward objects), guiding adults to items/activities, and/or making unintelligible

vocalisations to indicate that she wanted or needed something. She had a history of self-injury in the form of banging her head on hard surfaces or oh her own knee. Teachers reported that self-injury was most likely to occur when she was unable to access desired items or activities. She required verbal prompting to engage in most daily living skills, but required minimal assistance in completing the tasks. For example, if she was instructed to go to the toilet, she was able to take herself, without any further adult assistance. She was also reported to independently feed and dress herself. Annie's teacher reported that she was within normal range of hearing and vision, and required no visual or auditory aides for learning. Teachers were not sure of what, if any, medications were administered to Annie as she took no medications while in the classroom.

Donald was a 9-year-old boy with autism. On the second edition of the Vineland, he obtained an expressive language age equivalency of 6 months and a receptive language age equivalency of 1 year 5 months. Donald had previous, informal experience with using a picture exchange communication system; however, the skill was reported to not generalise over time and was not utilized at the time of the study. He required adult assistance for completing daily living tasks such as toileting and feeding himself. Adult assistance was reported as a requirement to mitigate deficits in functional living skills and as a preventative measure for physical aggression toward peers and adults. Donald's teacher reported a history of several challenging behaviours including physical aggression toward adults and peers, property destruction in the form of throwing work materials and leisure items, and self-injury in the form of rubbing his feet together until the flesh was left raw. He was reported to have normal hearing and vision and there were no reports of medication use.

Scarlett was a 6-year-old girl diagnosed with autism as determined by her paediatrician. On the second edition of the Vineland, she obtained an expressive language age equivalency of 1 year 6 months and a receptive language age equivalency of 2 years 6 months. According to teacher reports, she showed no evidence of an imitative repertoire and made no attempts to approximate words or sounds to determine her wants or needs. Scarlett was also reported to primarily rely on prelinguistic behaviours to communicate with adults. Topographies of prelinguistic behaviours included guiding adults to items or activities she could not access on her own, or made motions toward things she desired. She had informal, previous training with picture exchange; however, it was not being utilized as her primary means of communication. If picture exchange materials were not directly within her reach, she would not seek them out to initiate communicative exchanges, and would require adult prompting even when the materials were within reach. At the time of the study she was not able to independently toilet herself or independently complete daily living skills without the assistance of an adult. She was reported to present with mild to moderate challenging behaviours in the form of crying and lying on the floor, but not at a significantly high rate, and was reported to most likely to occur when she was denied access to a preferred item or activity. Scarlett's teacher reported that she had normal vision and hearing and was not aware of any prescription medications.

Ford was an 11-year-old boy with autism. On the second edition of the Vineland, he obtained an expressive language age equivalency of 1 year 10 months and a receptive language age equivalency of 2 years 5 months. Ford was described as highly echolalic by his teachers. He would repeatedly script phrases of television shows in various languages

and dialects; however, was reported to present with few occurrences of spontaneous, functional language. If he were asked a simple question, such as “Hi, how are you?” he would quickly respond, “How are you? Say ‘Hi!’” He had no reported challenging behaviours and was able to independently toilet and feed himself. He was also able to independently navigate himself through the school grounds to go to other classroom for activities he was scheduled to participate in. Ford’s teacher reported that he had normal hearing and vision and was not known to be on any medications.

Ed was a 5-year-old boy with autism. On the second edition of the Vineland, he obtained an expressive language age equivalency of 1 year 9 months and a receptive language age equivalency of 2 years 11 months. Ed was reported as having moderate to severe echolalia in that he repeated the last few words of phrases uttered to him (e.g., if a teacher asked “How are you, Ed?” he would respond “How are you, Ed”). He was also observed to have very limited spontaneous requests for highly desired items; however, there were reports of significant challenging behaviours if Ed was denied access to desired items or activities. For example, if he wanted access to his favourite puzzle, he would approach a teacher, grab her hand, and say “Puzzle?” repeatedly. If the teacher responded saying it was not time to play with the puzzle, he would engage in some challenging behaviours. Challenging behaviour topographies included screaming, crying, and verbal protests at volumes significantly louder than what might be considered socially acceptable. He was able to complete daily living skills with some adult assistance and prompting. If an adult prompted him, he was able to take himself to the toilet, and required some assistance cleaning himself. In terms of feeding himself, he was fully independent and only required adult assistance opening some food packages. He was

reported as performing within normal range of hearing and vision when compared to neurotypical peers, and required no additional visual or auditory supports to engage in learning tasks.

Ricky was a 6-year-old boy with autism. On the second edition of the Vineland, he obtained an expressive language age equivalency of 1 year 11 months and a receptive language age equivalency of 2 years 10 months. Ricky had very limited, spontaneous requests and spoke at volumes far below expected conversation level. If an adult approached and greeted him, he would put his head down and say "Hi," at an inaudible volume. Ricky sometimes, but infrequently, initiated verbal requests but would typically only use 1-word phrases to communicate his wants and needs. For example, if he wanted access to the courtyard attached to the classroom, he would approach a teacher and say, "outside?" repeatedly until his needs were met. Ricky's teacher reported that he was able to eat, dress and toilet himself independently. He had no reported challenging behaviours in the classroom. In fact, if he made a request that could not be met, he would quietly move on to another activity that he could access without adult assistance. Ricky's teacher reported that he had normal hearing and vision and was taking no known medications.

Gabriel was a 5-year-old boy with autism. On the second edition of the Vineland, he obtained an expressive language age equivalency of 1 year 8 months, and a receptive language age equivalency of 1 year 4 months. At the time of initial assessment, Gabriel showed intermittent verbal requests when prompted by an adult to "Use your words," or by asking, "What do you want?" Gabriel also presented as mildly echolalic, and would typically only repeat the last one or two words of a phrase, for example, if a teacher approached him and said, "That lunch looks yummy!" he would repeat "looks yummy!"

or “yummy!” Over the course of the current study, and the study reported in the following chapter, Gabriel showed signs of emerging language. His teachers reported that he was becoming more likely to evoke spontaneous requests for a small host of items and activities. Gabriel also had a history of challenging behaviours in the classroom with regard to peers. He was reported to engage in socially inappropriate behaviours with peers, such as attempting to put his hands down other children’s pants, and would also engage in property destruction in the form of throwing objects and sweeping objects off of surfaces. A functional assessment conducted by school personnel indicated that challenging behaviours may have been socially maintained by access to adult attention. Gabriel was reported to have normal hearing and vision, and was not on any known medications.

Setting

Teachers were interviewed in their classrooms by myself. The interviews were conducted on a one-to-one basis at a quiet time. There were no other adults or students present during the interview.

The Repair Strategy Assessment Scale and its Development

The interview protocol was specifically developed by myself for the purpose of the present study. The interview protocol, referred to as the Repair Strategy Assessment Scale (RSAS), is shown in Figure 4.1. The interview required from 20 to 30 min to complete. Approximately, the first 10 min of each interview was spent explaining the response definitions for different types of repair strategies and communication breakdowns. The teacher was also given a copy of the names of the repair strategies and their definitions if they felt like they needed additional reference to answer the questions.

Five types of communication repair strategies were defined. First, *Repeat* was recorded if the teacher thought their student would continue to utilise the original request/mand form in the face of a communication breakdown. Second, *Modify* was recorded if the teacher thought their student would try to alter their original message by either adding or subtracting request/mand topographies from the initial request/mand form. Third, *Recast* was recorded when the teacher thought their student would completely replace their original request with a different request/mand form. Fourth, *No Response* was recorded if the teacher thought the student would not continue the original request form in the face of a breakdown. Lastly, *Challenging Behaviour* was recorded if the teacher thought the child would engage in challenging behaviour in response to a communication breakdown. If the child did have a history of challenging behaviours, teachers were asked to describe these behaviours. Definitions of challenging behaviours were individualized for each student based on these teacher descriptions.

Figure 4.1.

A copy of the RSAS questionnaire

Student:_____ Date:_____
Teacher:_____ Interviewer:_____

Response Definitions:

1. Repeat – Say or do the exact same thing as the first request.
2. Modify – Say or do the exact same thing as the first request, but with taking away or adding something to the first request.
3. Recast – Say or do something completely different from the first request.
4. No response – The child would say or do nothing.
5. Challenging Behavior – Problematic forms of behavior, such as hitting, screaming, crying, slapping, punching, self-injury, etc.

Repair Strategy Assessment Scale					
	Repeat	Modify	Recast	No Response	Challenging Behavior
What would the child do if…					
1. …they indicated they wanted [favorite snack], but you didn't acknowledge them the first time?					
2. …they indicated to you that they wanted [favorite snack], but you gave them the wrong thing as a result of misunderstanding?					
3. …they indicated to you they wanted [favorite snack], but you were not sure of the request, so you said "huh?" to clarify?					
4. …they indicated they wanted [favorite toy], but you didn't acknowledge them the first time?					
5. …they indicated to you that they wanted [favorite toy], but you gave them the wrong thing as a result of misunderstanding?					
6. …they indicated to you they wanted [favorite toy], but you were not sure of the request, so you said "huh?" to clarify?					
7. …they indicated they wanted [favorite activity], but you didn't acknowledge them the first time?					
8. …they indicated to you that they wanted [favorite activity], but you gave them the wrong thing as a result of misunderstanding?					
9. …they indicated to you they wanted [favorite activity], but you were not sure of the request, so you said "huh?" to clarify?					
10. …they indicated they wanted attention, but you didn't acknowledge them the first time?					
11. …they indicated to you that they wanted attention [tickles, hugs, etc.), but you gave them the wrong kind of attention [e.g., greeting) as a result of misunderstanding?					
12. …they indicated to you they wanted attention, but you were not sure of the request, so you said "huh?" to clarify?					

The RSAS is comprised of 12 questions that describe various situations in which a communication breakdown has occurred. The 12 items were intended to investigate three breakdown conditions: (a) *Ignore*, where a request is ignored (deliberately, or not), (b) *Wrong Response*, where the original communication attempt was followed by a non-

matching response from the teacher (e.g., a child mands for a cookie, but is wrongly given an apple.) and lastly (c) *Request for Clarification*, where the listener signals that they received the message but need further information to meet the need, such as by saying "What was that?" Each of the breakdowns was described within the context of requesting access to preferred toys, snacks, and activities, and in the recruitment of attention. Figure 4.1 above shows the full list of questions included in the RSAS that were asked of each teacher regarding their respective students. It is identical to the assessment sheet that each teacher received.

The structure RSAS was based on an existing protocol for assessing the function of problem behaviour. Specifically, the RSAS structure was based on the Questions About Behavioural Function scale (QABF) described by Matson and Vollmer, (1995). The QABF is an interview-based assessment tool that is used to seek information about the possible function or purpose of challenging behaviour. Functional assessments are charged with establishing existing relationships between target behaviours and the respective environment (Iwata, Vollmer, & Zarcone, 1990; Neef & Iwata, 1994; Vollmer & Smith, 1996). When a functional assessment is conducted, hypotheses around the functions of target behaviours are used to develop interventions to reduce the occurrence of target behaviours (Sprague & Horner; 1995). With regard to the RSAS, it was thought that a similar interface could be used to determine the relation, if any, between the type of communication breakdown that occurred and the repair strategy, if any, that a child was reported to use. Another feature of the RSAS that was adapted from the QABF was the quickness with which the assessment could be implemented and scored. The QABF can be implemented and scored by a person with a background and/or training in applied

behaviour analysis within an average of about 20 minutes (Matson, Tureck, Reiske, 2011). When considering the potential for use in the classroom, it was noted that the assessment not only needed to be quick and easy to understand to the interviewee, but also readily available for scoring and analysis from a clinical perspective. A certain degree of urgency must be considered with regard to communication interventions as communication deficits can coincide with challenging, or aberrant behaviours. Essentially, the RSAS was comprised to operate in a similar fashion with the purpose of capturing an informant's reports about the child's repair repertoire across different breakdown scenarios. Clinically speaking, the trajectory of this research, in total, is a direct reflection of the hierarchal approach used to identify functional properties of challenging behaviour as described by Paclawskyj et al. (2001). This hierarchal approach begins with questionnaires and interviews conducted with parents, teachers, or persons familiar with the individual who is engaging in the behaviour, followed by direct observation of the individual that typically takes place in the natural environment. When sufficient data are analysed, an intervention is created and implemented to reduce unwanted behaviours, with and aim to increase desired behaviours. For the purposes of this research, data collected from this questionnaire assessment will be used to inform the nature of direct assessments with each student.

Procedure

Teachers were interviewed during their breaks in the school day away from the classroom where no students or other staff members were present. Teachers were given a copy of the RSAS to follow along with as I explained each response definition, along with an example of each. Response definitions were also labelled on the RSAS forms for

teachers to refer back to if they needed reminding of the definitions. The questions were asked one at a time, and the teachers usually provided an example of an instance they observed the specific breakdown scenarios with their respective students to answer the question. On occasion, teachers would ask me to clarify if the examples they provided would fall under any of the response definitions, however; no additional information or clarification was given to teachers in these instances. They were simply referred back to the list of response definitions and prompted to take assistance from the form.

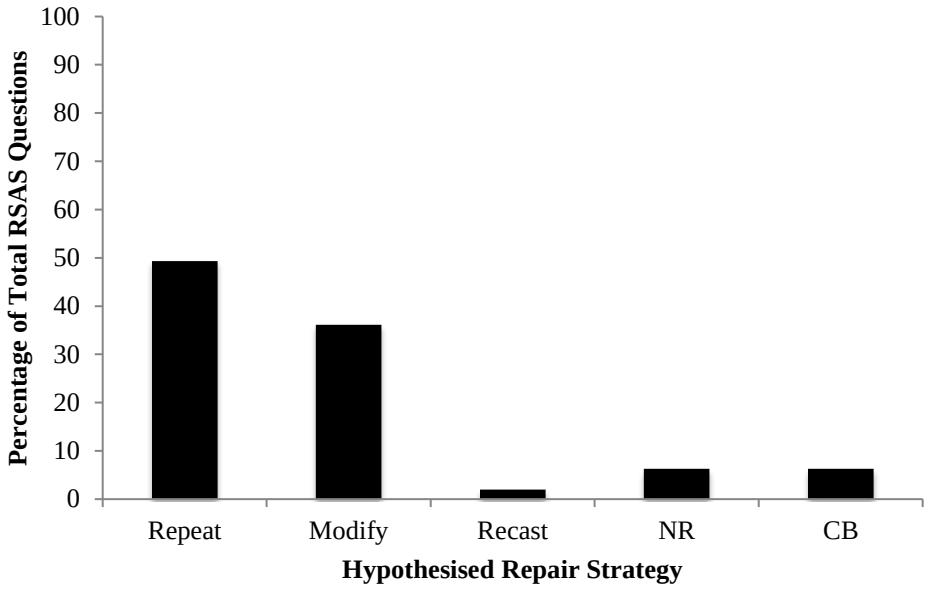
Results

Figures 4.4 to 4.15 show each individual child's RSAS results. Individual results show how often the teacher chose each individual repair strategy to create a hypothesized repair hierarchy. Essentially, hypotheses around the order in which children are most likely to repair can be made from the results in this assessment. For instance, the most frequently reported repair might be reflective of the most likely used repair within the child's response class, and so on. Figure 4.2 shows a group analysis of all teacher reports, and Figure 4.3 shows the group analysis by specific breakdown types

As shown in Figure 4.2 below, for 49.3% of the RSAS questions, teachers reported that the child would utilize *Repeat* as a primary means of communication repair, followed by *Modify*, at 36.1%, *Challenging Behaviour* for 6.3%, *No Repair* for 6.3%, and finally *Recast* at 2%.

Figure 4.2.

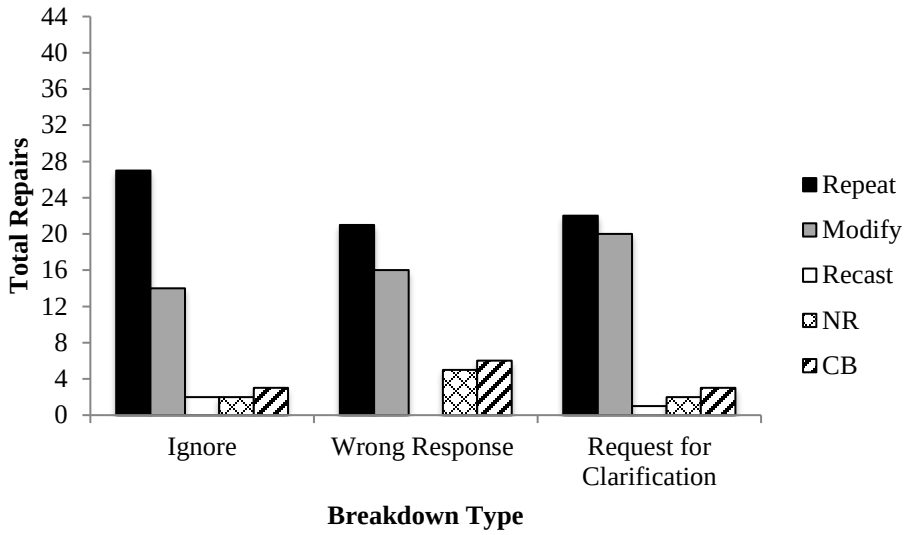
Overall results for all of the teachers who completed the RSAS.



Data are also shown across breakdown types in Figure 4.3. In the *Ignore* condition, 56.3% of responses indicated that children might use *Repeat* to repair communication, followed by *Modify* at 29.1%, followed by *Recast* and *No Repair at 4.2%*, and *Challenging Behaviour* at 6.3%. In the *Wrong Response* condition, 43.8% of responses indicated that students would use *Repeat* to repair communication, followed by *Modify* at 33.3%, *Challenging Behaviour* at 12.5%, *No Repair* at 10.4%, and none of the teachers chose *Recast*. In the *Request for Clarification* condition 45.8% of teacher responses suggested that their children would *Repeat* to repair communication, followed by *Modification* at 41.7%, *Challenging Behaviour* at 6.2%, *No Repair* at 4.2% and recast at 2.1%.

Figure 4.3.

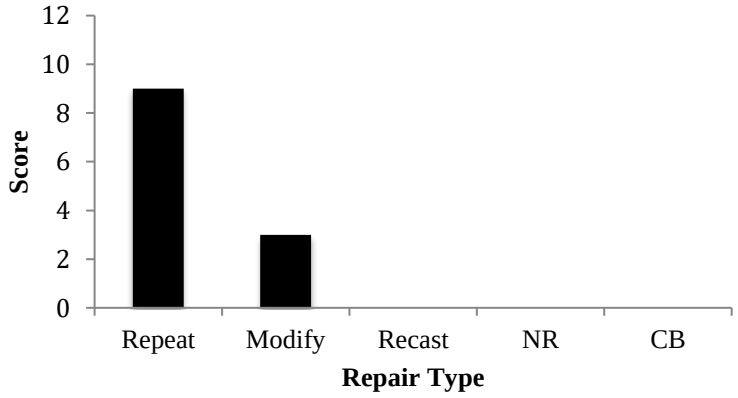
Collective Repair Strategies by Breakdown Type



As shown in Figure 4.4, Damian was reported to most likely to repair communication by *repeating* his original request. His second most commonly reported repair strategy involved *modifying* his original request. Damian's teacher reported no other repair strategies.

Figure 4.4.

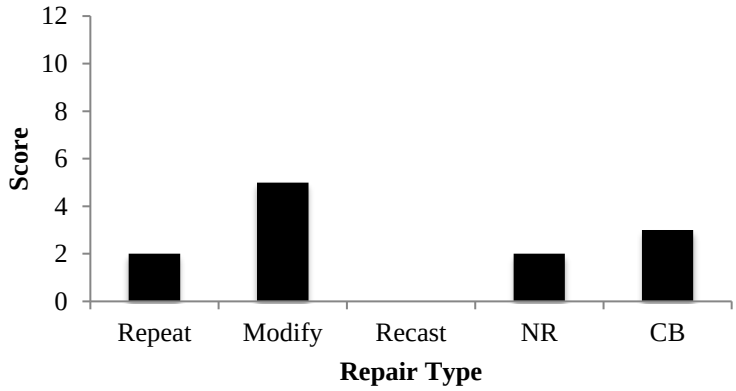
RSAS Results for Damian



As shown in Figure 4.5, Kaiser reported to most likely repair communication by *modifying* his original request. His second most commonly reported repair strategy involved topographies of *challenging behaviour* in lieu of his original request. Kaiser's teacher reported that his third most commonly used repair strategy was to *repeat* his original request, while it was reported that he was equally likely not to attempt a repair. *Recasts* were not reported as being part of Kaiser's repair class.

Figure 4.5.

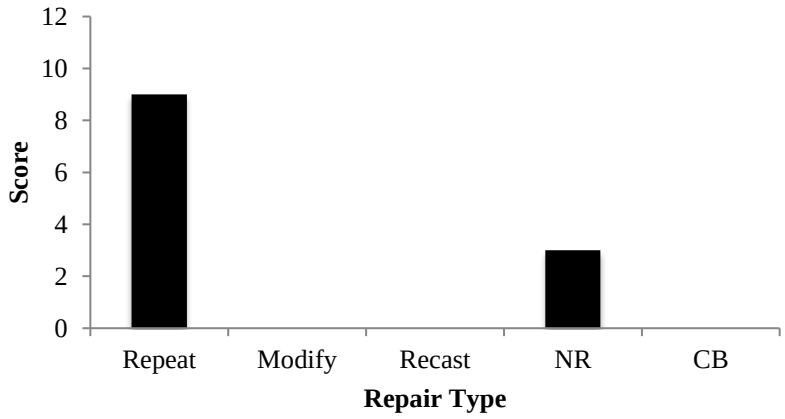
RSAS Results for Kaiser



As shown in Figure 4.6, Donald was reported as most likely to repair communication by *repeating* his original request. No other repair strategies were reported as his teacher reported that if he were not to use repetition, he would not attempt a repair at all.

Figure 4.6.

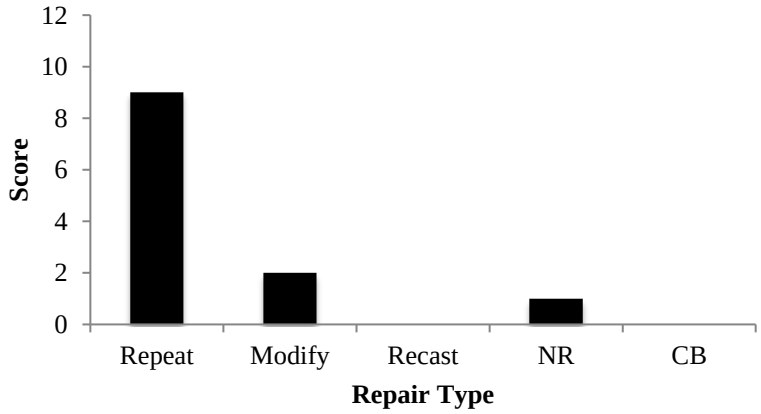
RSAS Results for Donald



As shown in Figure 4.7, Ricky was reported as most likely to repair communication by *repeating* his original request. Ricky's second most reported repair strategy was a *modification* of his original request. No other repair strategies were reported as his teacher reported that if he were not to use repetition or modification, he would not attempt to repair a communication breakdown.

Figure 4.7.

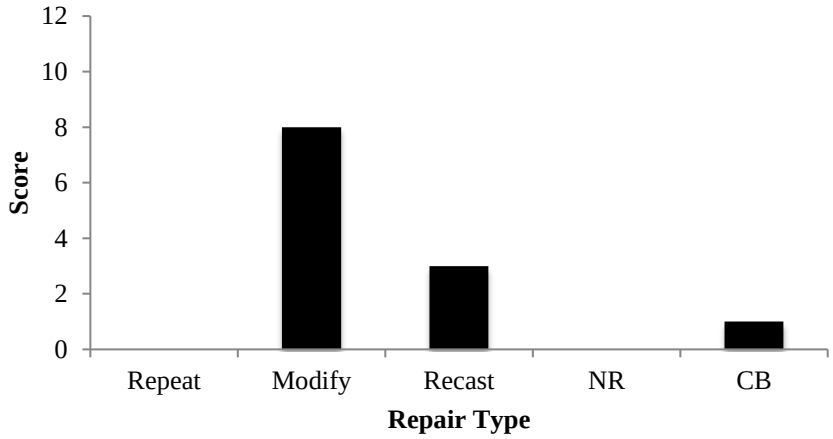
RSAS Results for Ricky



As shown in Fig. 4.8, Annie was reported to use a *modification* of her original request as her primary means of repairing communication breakdowns. Her second most commonly reported repair strategy was to completely replace, or *recast* her original request by asking using a different response topography. The third most commonly reported repair strategy was to engage in *challenging behaviour*. Annie's teacher reported no other repair strategies during the assessment

Figure 4.8.

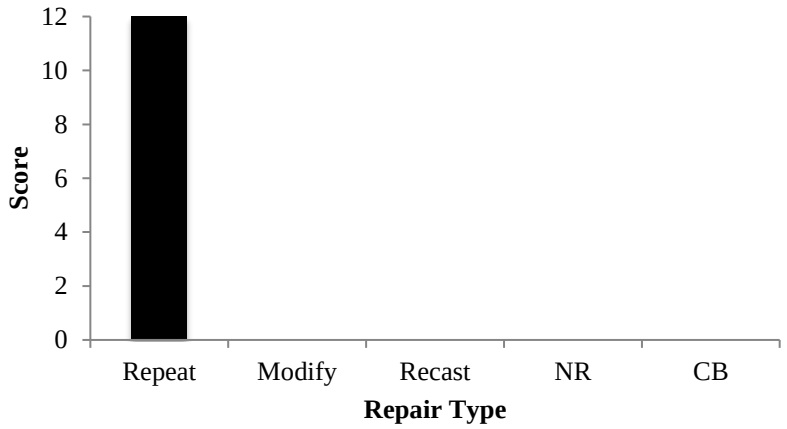
RSAS Results for Annie



As shown in Figure 4.9, Ed was reported to use *repetition* as his only means of communication repair. No other repair topographies were reported.

Figure 4.9.

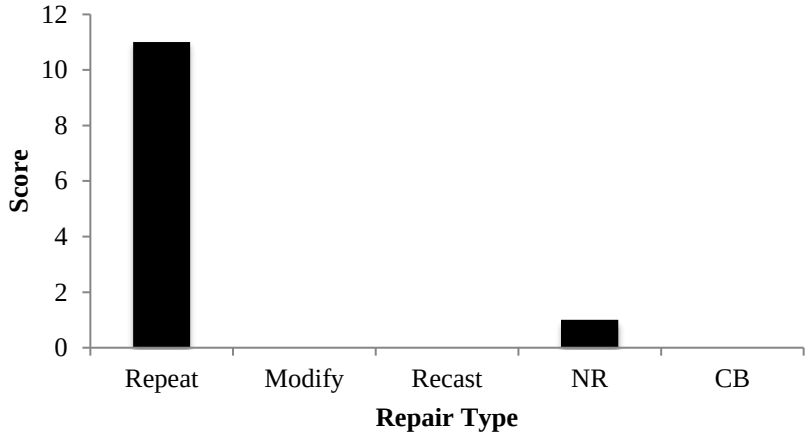
RSAS Results for Ed



As shown in Figure 4.10, Jeff was reported as most likely to repair communication by *repeating* his original request. Jeff's teacher reported that if he were not to use repetition to repair communication, he would not try to repair at all.

Figure 4.10.

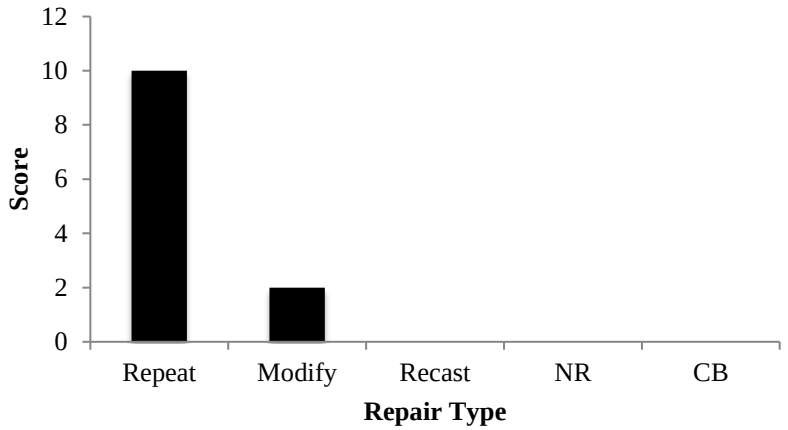
RSAS Results for Jeff



As shown in Figure 4.11, Mariah was most likely to repair communication by *repeating* her original request. Her second, and only other reported repair strategy, was to *modify* her original request.

Figure 4.11.

RSAS Results for Mariah



As shown in Figures 4.12 and 4.13, Kurt and Ford had identical results and were reported as most likely to *modify* their original requests to repair communication breakdowns. Their second, and only other reported repair strategy was *repeating* the original request topography. No other repair topographies were reported

Figure 4.12.

RSAS Results for Kurt

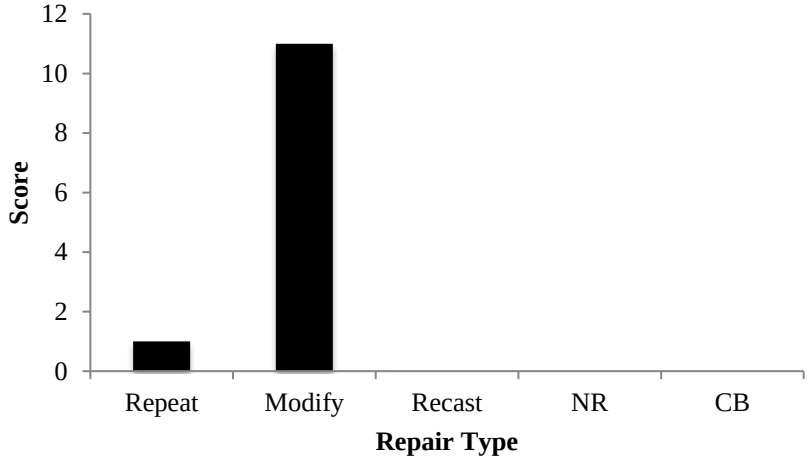
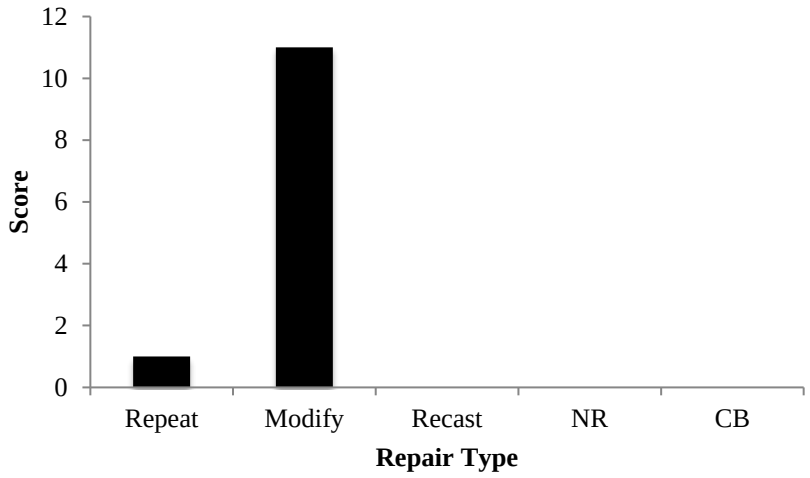


Figure 4.13.

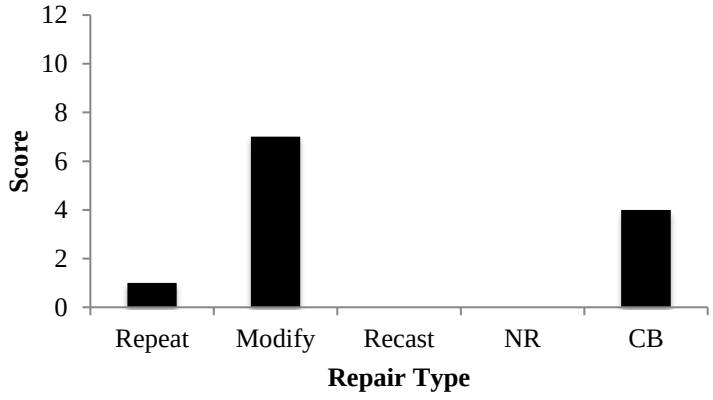
RSAS Results for Ford



As shown in Figure 4.14, Scarlett's was reported to be most likely to repair communication by *modifying* her original request. Her second most reported repair strategy was to engage in *challenging behaviour*. Scarlet's third most reported repair strategy was to *repeat* her original request. No other repair topographies were reported for Scarlett.

Figure 4.14.

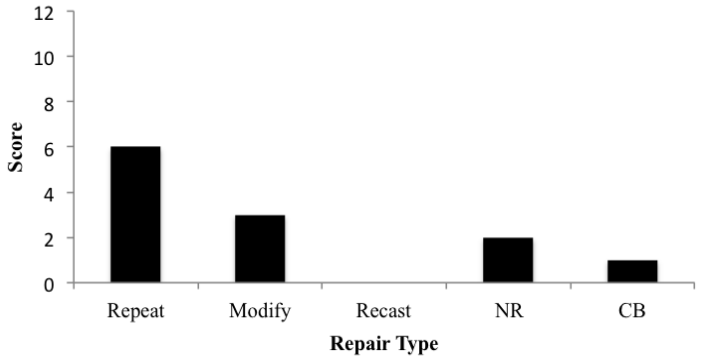
Scarlett RSAS Outcome



As shown in Figure 4.15, Gabriel was reported to be most likely to repair communication by *repeating* his original request. His second most reported repair strategy was to make *modifications* to his original request. It was reported that his third most likely response would be no attempt to repair broken down communication, followed by his last most reported repair response, which was challenging behaviour.

Figure 4.15.

RSAS Results for Gabriel



Discussion

Teacher reports in this study suggest that their students with ASD engaged in at least some forms of communication repair despite having limited language performance. More specifically, teachers reported that the participating students are most likely to repair communication breakdowns using repetition and modification. The data suggest that teachers perceived that the children would most likely use repetition as a repair tactic. The existing literature shows support for this finding in that similar results have been reported when individuals with ASD have been assessed to identify their most frequently used repair strategies (Dincer & Erbas, 2010; Halle & Meadan 2007; Keen, 2005; Meadan et al. 2008).

These findings suggest that these teachers perceived that the children did in fact attempt to repair communication breakdowns. For the majority of students, teachers identified a dominant repair response, or a response that was included in more than half of assessment questions. 9 of 12 assessment results showed teachers responses favoured a single communication repair strategy per student throughout the assessment. For example, Mariah's teacher reported that she would be likely to repeat for 83% of total assessment questions. The results of Dincer and Erbas (2010) showed similar results in a natural environment observation of 16 children with developmental disabilities, where the child either almost exclusively used repetition or modification for their primary communication repair strategies. These results could suggest that minimally verbal children with ASD do not vary their repair responses often, if at all. These data could also simply suggest that teachers do not note variability in repair responding, even if present, which begs a need for further, direct assessment.

Modification was the second most reported repair strategy. It must be noted that these modifications pertained to modifications using more than one prelinguistic behaviour. For instance, when Annie's teacher reported her use of modification during the assessment, she described modifications as clusters of prelinguistic behaviours. These could be described as making unintelligible vocalisations to initially indicate she wanted a highly preferred item, then repairing communication using the same unintelligible vocalisation while also increasing proximity to the communication partner and making physical contact. While this is considered a modification by definition, the use of modifications that are entirely prelinguistic in nature may not necessarily make the child more successful in repairing communication breakdowns.

This study appears to be the first study that has used an interview format with teachers to assess repair behaviours of children with ASD who are minimally verbal. Various assessment approaches have been made in attempt to investigate repair responding in minimally verbal children with ASD; however, examinations of time-efficient, classroom-friendly means of investigating repairs have yet to be explored. This study makes a contribution to the existing body of literature in that it takes into account the need of assessment approaches that may be best suited for the classroom, or the practical setting. A further contribution will be made when results of the RSAS are compared with results of a direct assessment, which is the focus of Study 2 (Chapter 5), to evaluate the level of the RSAS's predictive validity.

While the results of this indirect assessment show some agreement with existing literature, these results should be considered preliminary. Further testing is required to determine the predictive validity, if any, of this assessment, and will be thoroughly examined in the following chapter. In terms of the utility of the assessment in the classroom, teachers reported that they were pleased with the short amount of time the assessment took from start to finish. They also reported that they found it to be beneficial to think about and discuss their students' communication with regard to assessment questions as it prompted them to consider the many variables included in a communication exchange and how reliably they are able to respond to communication initiations.

Each of the teachers seemed quite confident in their responding during interviews. It must be noted that each of the teachers interviewed for this assessment had a minimum of a year's worth of experience with each of their students, so they had a plethora of daily

interactions with each child and were able to recall many instances in which their students have attempted communication repair. This may not be the case with teachers who have limited experience with the target student; however, this could be an area of future research investigating familiarity thresholds that affect the predictive validity of the indirect assessment.

Some limitations about this study must be noted. Primarily, interobserver agreement was not secured during teacher interviews. Teacher interviews were conducted in one day, and scheduling conflicts prevented the presence of a second, independent observer to attain agreement on teacher responses. Secondly, interrater reliability was not attained for each of the participants to show comparisons in responding across staff familiar with each of the students. While this is a noted limitation to the current study, the primary focus of this indirect assessment was to determine the predictive validity of the assessment, rather than the degree with which assessment results agree across individuals. Lastly, a retest of the RSAS was not conducted for the students that underwent interventions that will be described in Chapter 6. This information would have proven useful for determining repertoire changes post-intervention and should be considered in future research.

In light of limitations of indirect reports, there is a need for validation by direct assessment. This is the aim of Study 2, which is reported in Chapter 5. Based on the teachers' responses to the interview protocol, each child was reported to attempt to repair communication breakdowns. Specifically, 7 out of the 12 students were reported to utilize repeating as a means for repairing requests; this finding corroborates results by Keen (2003) that suggest that children with autism primarily utilize repeating as a primary

means of communication repair. For example, Scarlett's assessment showed that she was most likely to have challenging behaviour when communication broke down within the context of access to highly preferred toys as opposed to making requests for food, activities, or attention. The information that can be gathered from the structure of this assessment may also be able to lay a foundation for communication interventions around situations that trigger the most maladaptive responses.

Overall, teachers reported that their students were most likely to repair communication using repetition, followed by modification. These data suggest that minimally verbal children with ASD can, and do, repair communication breakdowns within the classroom setting. The following chapter will describe direct assessment methodologies created to validate the current indirect assessment. The following chapter will provide insight on the predictive validity of this indirect assessment, and some possible explanations for the trends in repair responding in minimally verbal children with ASD.

CHAPTER 5

Study 2: Direct Assessment of Repair Strategies

Introduction

The purpose of the empirical study reported in this chapter was to investigate the repair repertoires of minimally verbal children with ASD in the classroom setting using direct assessment methods. Another aim of this study was to compare the results of the direct assessment with the teacher reports collected in the previous chapter (Chapter 4, Study 1). The results of this comparison could provide useful information for designing the subsequent interventions reported in Chapter 6 (Study 3). Those interventions aimed to teach effective communication strategies to two of the children from Studies 1 and 2.

Method

Participants and Setting

All but four of the participants from the previous, indirect assessment (Study 1) were included in this study. Kaiser and Annie were not included in the present study because their teachers were concerned about their safety owing to increased challenging behaviour. Ricky was not included because he and his family had moved to another country. And Scarlett was not included due to her having increased medical issues/complications.

The assessment tasks associated with this study (Study 2) were administered in one-to-one sessions that lasted from approximately 5 to 20 min (see **Procedures**). Sessions were conducted in a music room within the classroom. The classroom was approximately 3.5 by 3.5 m and it contained a table, two chairs, and a closed and locked cabinet of teaching materials. Some sessions were also conducted in the larger classroom

while other students were present when the music room was not available. These settings were chosen because they had few visual distractions and were therefore considered better for maintaining the children's attention during the sessions. Sessions were conducted at a rectangular table where I sat directly across from the participant. Materials present during assessment sessions included a small tripod and recording device to capture sessions on video tape for in depth coding, in addition to a plastic bin that contained the child's highly preferred items, and a paper and pencil for data collection.

Preference Assessment

Teachers were interviewed to determine highly preferred items for each of the children. The purpose of this interview was to identify three to five highly preferred items that the children did not have ready access to in the classroom for use in the repair assessment trials. For this assessment, teachers were approached during classroom snack and play times to list highly preferred items. The items requested were items that the children are well known to love, but have little access to during the school day. Neutral, or non-preferred items were also investigated during teacher interviews. Neutral items were described as items that the child would not necessarily be fond of, but also would not be something that would upset the child when they see it. Neutral items were typically flash cards, pieces of paper, or lids to the containers that held highly preferred items. The results of these preference assessment interviews are provided in Table 5.1.

Table 5.1

Results of Preference Assessment Interviews with Teachers

Damian	*Ford*	*Mariah*	*Kurt*	*Donald*	*Jeff*	*Ed*	*Gabriel*
M&M's	Hokey pokey	Fruit jellies	Chocolate fingers	M&M's	M & M's	Pez Dispensers	Helicopter Toy
Chocolate fingers	Chocolate fingers	Peanut slab	Chocolate frogs	Pretzels	Marshmallows	Fire Truck Puzzle	Marble Run
Tickles	Squiggles	Chocolate fingers	Fruit jellies	Sparkly pillow	Fruit Jellies	Little People Farm	Space Coaster
Fruit juice	Peanut slab	Hokey pokey	Chocolate bars				Air Ball Toy
Popcorn	M&M's	Chocolate buttons	Squiggles				

Response Definitions

Initial Mand was defined as the first response that a child made in response to a requesting opportunity. Several different forms or topographies of the initial mand were recorded: The use of speech or a SGD was recorded when the child said complete words, made word approximations, or made an initial mand with a SGD. Only one of the participants in this study, Kurt, used a SGD. His SGD consisted of an iPad® with the Proloquo2go® application. None of the other students used any type of AAC device. Instead, the remaining children relied on prelinguistic responses. Therefore, prelinguistic responses were recorded as an initial mand when the child engaged in one or more of the following behaviours: (a) reached for object, (b) reached for my hand and guided it to the desired object, (c) used a vocalization other than verbal approximations of sounds, (d) stood to reach for the item, and/or (e) pointed to, or gestured toward an object. Challenging behaviour was recorded as the initial mand if the child engaged in problem behaviour such as self-injury, crying screaming loudly, and/or physical aggression.

Mand Repairs referred to the type of response that the child used in response to a communication breakdown (i.e., when the child's initial mand was not successful in

gaining reinforcement). Mand repairs were defined in terms of whether or not the attempt to repair involved repetition, modification, or recasting. A repetition was recorded if the initial mand and the repair forms were identical. For example, repetition was recorded if the child reached for an item to indicate that he/she wanted it, and either continued to reach for the item, or initiated another reach for the item in response to a breakdown. Modifications were defined as a repair attempt if the response involved the addition or removal of some element of the initial mand. For example, if the initial mand involved the child reaching for the desired item, and the breakdown resulted in the child reaching for the item while also making vocalisations, it was recorded as a modification. Another example would be if the child's initial mand involved reaching for an item while making vocalizations, and the breakdown resulted in the child only reaching for the item without the vocalisations. A recast was defined as a mand repair that shared no common elements with the initial mand. For example, a recast was recorded if the initial mand involved the child reaching for the item, and after the breakdown occurred, the child produced vocalisations instead of persisting in reaching. Some of the children were also observed to engage in challenging behaviour in response to communication breakdowns. Challenging behaviour was recorded as a mand repair if the child engaged in a problematic behaviour, such as physical aggression (e.g., attempting to hit, kick, slap, punch, or bite me), engaging in self-injury (e.g., hitting, slapping, or pinching oneself or engaging in head banging), or property destruction (e.g., throwing items, knocking items over, sweeping items off of the table).

Procedures

During each session the child was presented with an opportunity to request for a highly preferred item, followed by one of several different types of breakdown scenarios. An opportunity to request was initiated by my offering two preferred items and asking the child to choose which one they wanted. The child was allowed between 10 and 20 s to choose the desired item. This range of time allotted for choice making was determined with respect to potential distractions present depending on the environment in which the session was conducted. Depending on availability, some sessions were conducted in a room within the classroom, and other sessions were conducted in the classroom itself, away from the other students, but they could still be seen and heard. The flexibility with respect to the amount of time allotted for choice making, which was determined by myself at the time of the session, depending on the level of distraction present. For example, if there were minimal (low-volume) disruptions/activities in the classroom, then the time allowed for choice making time was set at 10 s. However; if there was a high level of noise/disruption in the classroom (e.g., children and teachers singing songs, or playing games that generated notable auditory and visual distractions), the time allowed for the child to make a choice could be increased to up to 20 s. I mentally counted the number of seconds before the child made a choice. If the child did not make a choice within the 10 to 20 s time period that was allowed, I would engage with the item with large gestures and look at the child expectantly. If the child still did not make a choice within 10 to 20 s, the items were replaced with other, highly-preferred items until the child made a choice. When the child makes a choice, I then put the chosen item within sight, but out of reach of the participant, or held the item within sight, but out of reach of

the participant. I then gestured toward the item and said “I have (item) here, if you’d like it, let me know.” The child was then given between 5 and 10 s to produce an initial mand. The 5 s initial mand time was chosen due to concerns that too long a latency would appear similar to ignore trials where I withdrew attention from the child. The breakdown was presented within 5 s to attempt to ensure communication breakdowns looked topographically different. If the child did not produce an initial mand within the 5 s timeframe, I would then interact with and comment on the item. If the item was toy, for example, I would engage in play with the toy and say “What a cool toy!” or “How fun is this?!” If the item was a snack, I would shake the container and hold it up within eyesight of the child and say, “Yum snacks!” If an initial mand still had not occurred within X s, then a new item was presented. The intention was to present items in this way until the child made an initial mand. Once the child had produced an initial mand, I then created a communication breakdown in one of the following ways (a) ignoring the child’s initial mand (ignore), where I looked or turned away from the child for 10 s; (b) requesting clarification (request for clarification) after the initial mand, where I would respond to the initial mand by saying, “Huh?” or “What was that?”, or (c) giving a wrong response (wrong response), where I handed the participant an item different to the one that the child had initially requested. The wrong item was an item that was considered to be neutral, (i.e., a non-preferred item). After the communication breakdown was initiated, I waited 10 s before delivering the originally requested item, while saying, “Oh! You wanted (item)!” Behaviours that occurred in the 10 s after each communication breakdown scenario had begun were considered to be an attempt to repair the communication breakdown, and were thus recorded and coded as a repetition,

modification, or request for clarification. Each of the communication breakdown scenarios were presented three times per session in random order and children received a total of five sessions. Each session lasted from 5 to 20 min depending on the child's speed in making initial choices and initial mands.

All children completed each assessment session with the exception of Ed and Jeff. For both of these participants, the last two trials of the last session were not completed as sessions were paused for challenging behaviour.

Interobserver Agreement

Data were collected on the child's responses during the 5 s time period immediately following the cue for an initial mand and during the 10 s period immediately after a communication breakdown scenario occurred. Data were collected in vivo during all sessions by myself (AB) who served as the primary observer. To assess the reliability of the primary observer's data collection, an independent observer also recorded data on the child's responses from video recordings of the assessment sessions. The independent observer was a post-graduate student with experience observing children with DDs. The independent observer was trained to collect data by reviewing a sample of videos while being provided with guidance and feedback on data collection using the procedural integrity checklist that will be outlined in the following section. Training was conducted with sample videotapes, but these videotapes were not used in the final calculations for inter-observer agreement. To calculate inter-observer agreement, an agreement was scored if the primary and the independent observer had each recorded the same data for each trial of the assessment session, whereas any discrepancy was counted as a disagreement. Inter-observer agreement (IOA) was calculated using the formula:

Agreements/(Agreements + Disagreements) x 100%. Across all students, IOA was collected on 50% of the sessions. The overall mean percentage of agreement was 94%, with a range of 78% to 100% across children. For Damian, IOA was conducted for 60% of total sessions. Mean IOA was 100%. For Ford, IOA was collected for 60% of sessions. Mean IOA was 92.7% with a range of 89% to 100%. For Mariah, IOA was collected for 60% of sessions. Mean IOA was 89% with a range of 78% to 100%. For Kurt, IOA was collected for 40% of his sessions. Mean IOA was 87.5% and had no range as both sessions were scored identically. For Donald, IOA was collected for 60% of sessions. Mean IOA was 100%. For Jeff, IOA was collected on 40% of sessions. Mean IOA was 100%. For Ed, IOA was taken for 40% of sessions. Mean IOA was 88.5% with a range of 77% to 100%. For Gabriel, IOA was collected for 40% of sessions and mean IOA was 92.7% with a range of 89 to 100.

Procedural Integrity

During the same sessions when IOA was assessed, the independent observer also recorded whether I had correctly implemented the assessment procedures. For this, the independent observer had a checklist that described each step of the assessment procedures (see Appendix A). The percentage of steps implemented correctly was calculated for each session. The mean percentage of correct implementation across sessions was 98% with a range of 92 to 100%.

Data Collection Timeframe

Data collection began in February 2016, but had to be halted in late April of 2016 due to a serious injury sustained by myself. Data collection recommenced in October of 2016 with final data points collected in April of 2017.

Results

Figures 5.1 and 5.2 show Damian's assessment results. As Figure 5.1 indicates, Damian repeated his initial mand to repair communication for 62.2% of total trials, followed by modification at 8.9%. Damian did not attempt to repair communication for 28.9% of trials. Figure 5.2 shows how Damian repaired with respect to the communication breakdown. In the ignore condition, Damian repaired 77.7% of all communication breakdown trials. Damian used repetition to repair communication for 53.3% of trials, followed by modification at 13.3%. For 33.3% of the ignore trials, Damian made no attempt to repair the communication breakdown. In the wrong response condition, Damian made no attempt to repair communication for 53.3% of trials, and used repetition for the remaining 46.7%. In the request for clarification condition Damian repaired communication in all assessment trials. Damian used repetition to repair communication for 86.7% of trials, followed by modification at 13.3% of trials.

Figure 5.1

Overall Direct Assessment Results for Damian

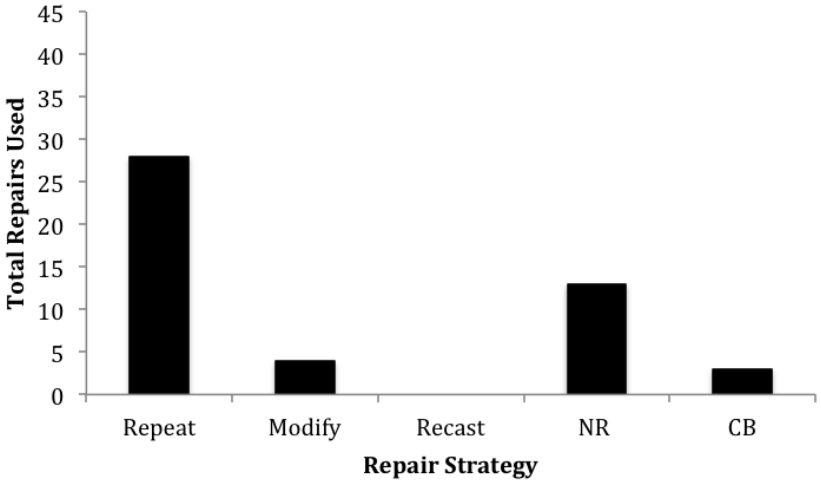
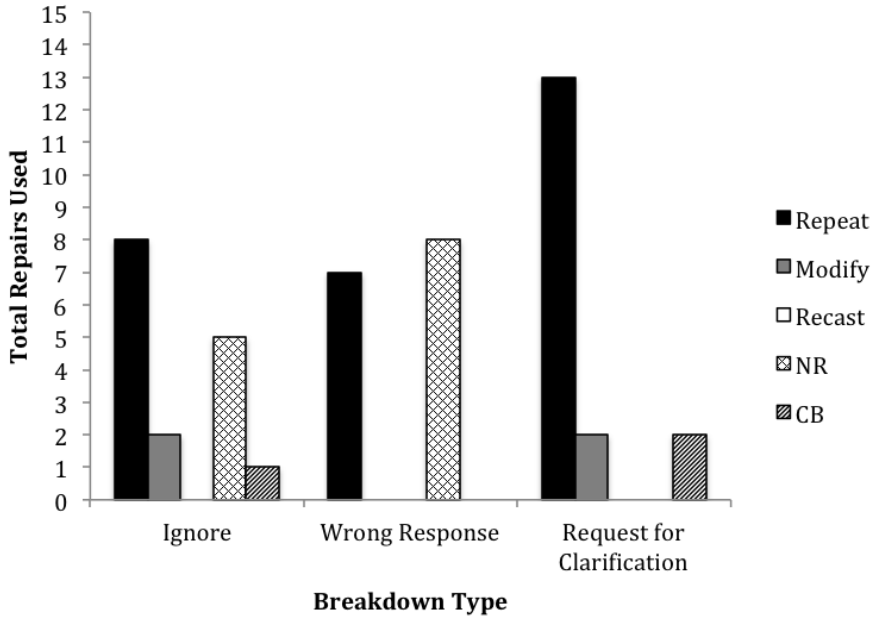


Figure 5.2

Repairs by Breakdown Type for Damian



Figures 5.3 and 5.4 show Ford's assessment results. As Figure 5.3 shows, Ford used repetition to repair communication for 44.4% of trials, followed by modification at 22.2%, request for clarification for 4.4%, and Ford made no attempt to repair communication for 28.9% of total trials. Of total repairs, 6.7% of trials involved topographies of challenging behaviour. Figure 5.4 shows how Ford repair communication with respect to the communication breakdown. In the Ignore condition Ford attempted communication repair for 80% of total trials. In this condition, Ford used repetition to repair communication for 40% of trials, modification for 33.3%, and request for clarification and CB each for 6.7% of trials. For 20% of Ignore trials, Ford made no attempt to repair communication. For wrong response trials, Ford attempted communication repair for only 33.3% of trials. When repairs were attempted, Ford used

repetition for 20% of trials, modification for 13.3%, and CB for 6.7%. In the wrong response condition Ford did not try to repair communication for 66.7% of trials.

Figure 5.3

Overall Direct Assessment Results for Ford

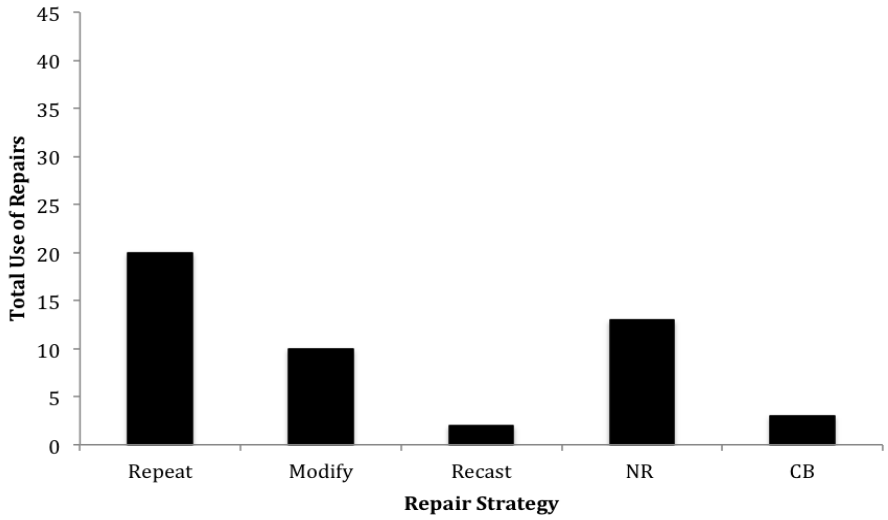
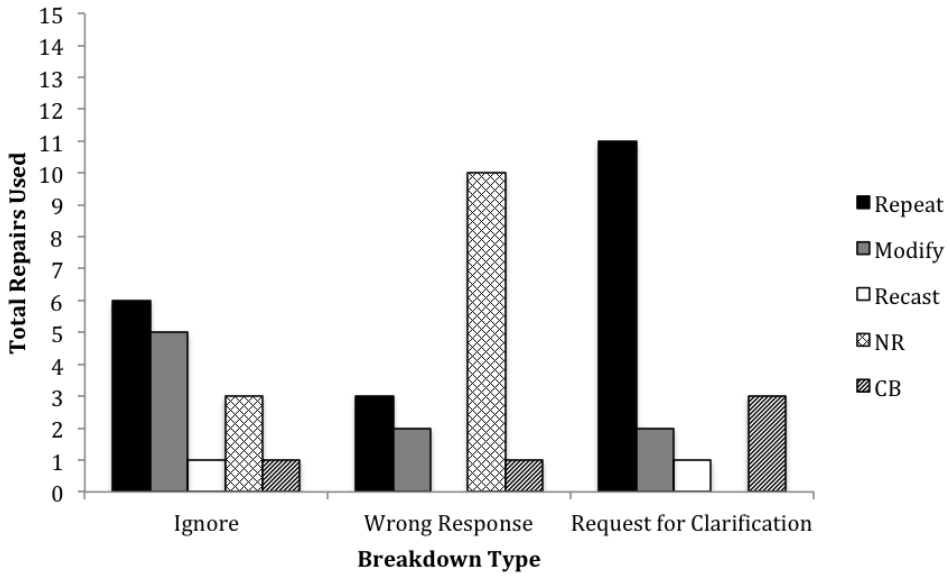


Figure 5.4

Repairs by Breakdown Type for Ford



Figures 5.5 and 5.6 show Mariah's assessment results. As Figure 5.5 shows, Mariah was observed to use repetition for 75.5% of total assessment trials, followed by modification for 22.3%, and for 2.2% of trials Mariah was not observed to attempt repair. Figure 5.6 shows how Mariah repaired with respect to the communication breakdown. In the Ignore condition Mariah attempted communication repair in all trials. Mariah used repetition to repair communication for 66.7% of trials and modification for the remaining 33.3%. In the wrong response condition, Mariah attempted communication repair in most trials. She used repetition to repair for 66.7% of trials and modification for the 26.6%. No repair attempts were observed for 6.7% of trials. In the request for clarification condition, Mariah attempted communication repair in all trials. She used repetition to repair for 86.6% of trials and modification for the remaining 13.3%.

Figure 5.5

Overall Repair Results for Mariah

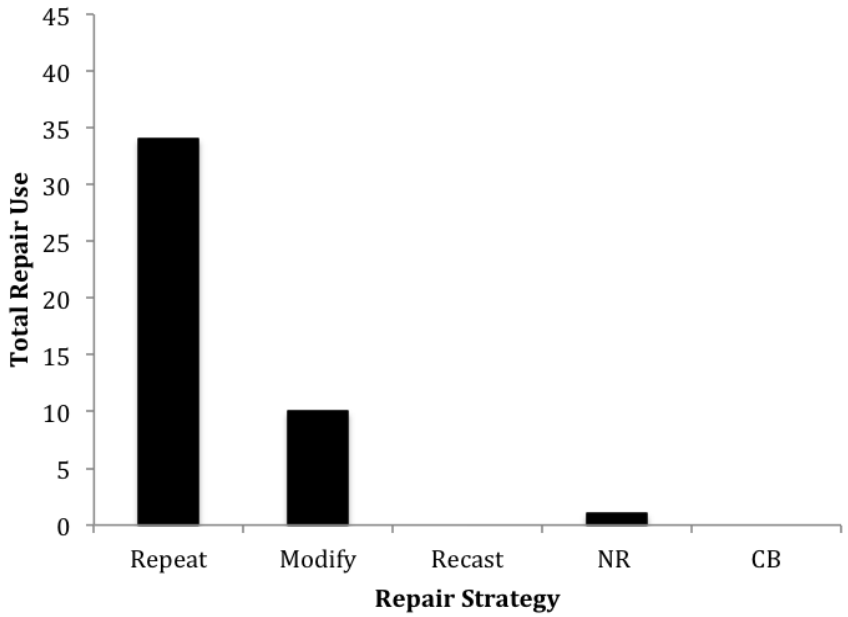
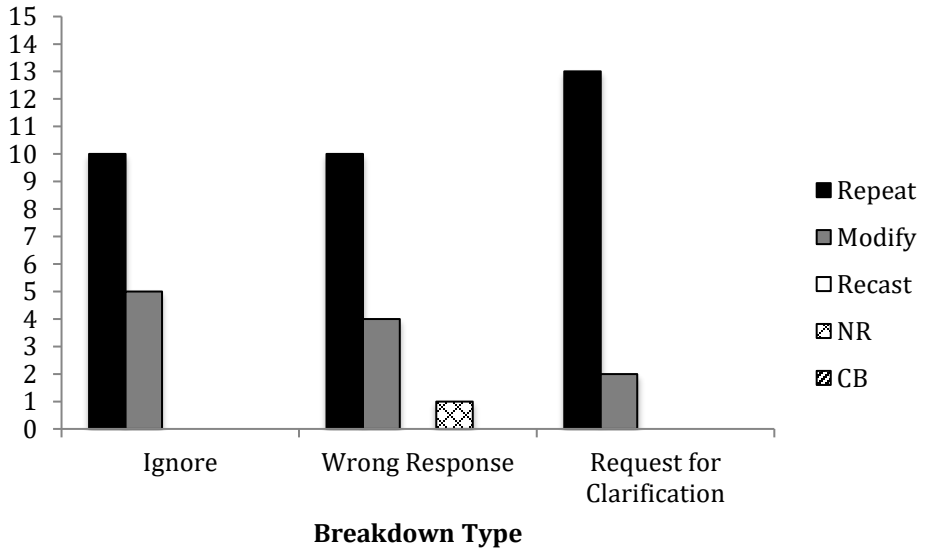


Figure 5.6

Repairs by Breakdown Type for Mariah



Figures 5.7 and 5.8 show Kurt's assessment results. As Figure 5.7 shows, Kurt used repetition to repair communication for 55.6% of total assessment trials, followed by modification for 17.7% of trials, and request for clarification for 11.1% of trials. 15.6% of trials involved no attempt to repair. Figure 5.8 shows how Kurt repaired with respect to the communication breakdown. For the Ignore condition Kurt attempted repair for 93.3% of trials. He used repetition to repair communication for 60% of trials followed by modification and request for clarification for 13.3% each. 6.7% of trials involved no attempts to repair communication. In the wrong response condition, Kurt attempted communication repair in 73.3% of trials. He used repetition to repair communication for 40% of trials, followed by modification at 20%, and request for clarification at 13.3% of trials. The remaining 26.7% of trials involved no repair attempts. In the request for clarification condition, Kurt attempted communication repair in 86.7% of trials. He used repetition to repair communication for 60% of trials, followed modification at 20%, and

request for clarification for 6.7%. The remaining 13.3% of trials involved no repair attempts. Figure 5.9 shows the results of a single probe where Kurt's speech-generating device was not made available. For 55.6% of probe trials, Kurt made no attempts at initiating a mand and 33.3% of trials involved no attempt at repairs. The remaining 11.1% of trials involved repetition to repair communication.

Figure 5.7

Overall Repair Results for Kurt

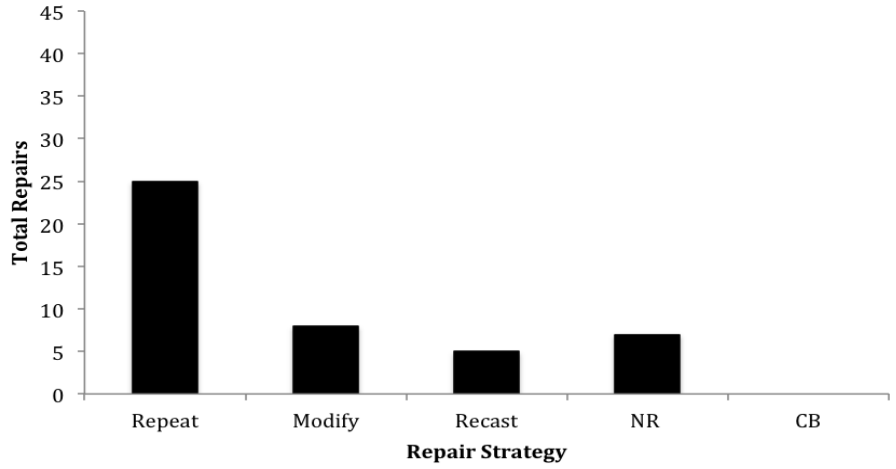


Figure 5.8

Repairs by Breakdown Type for Kurt

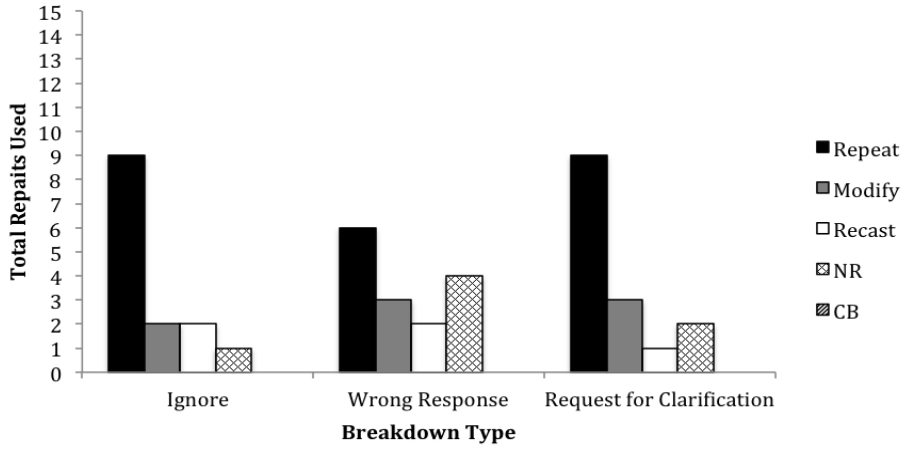
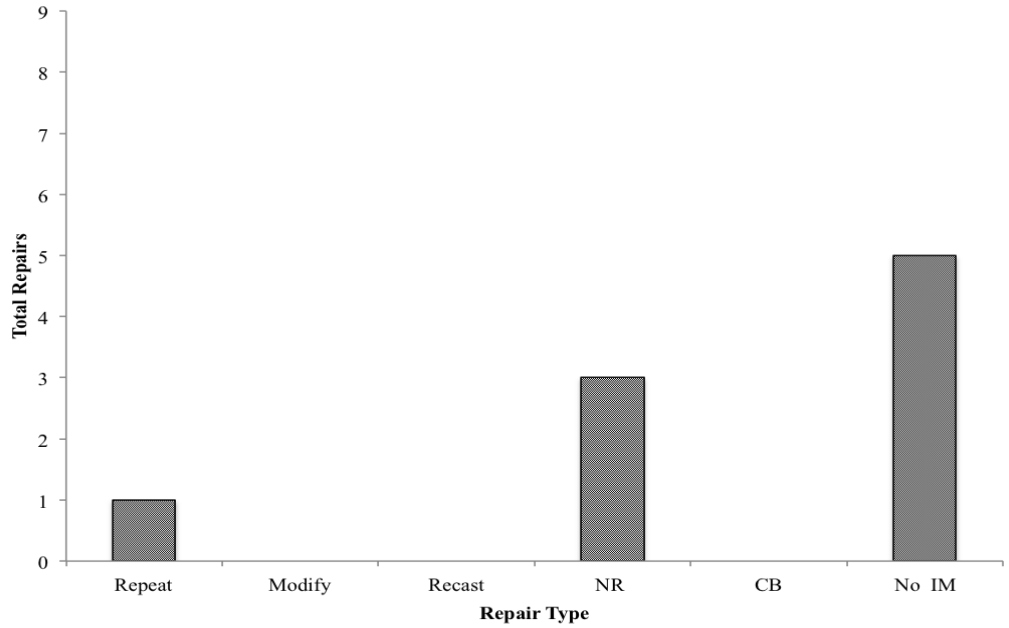


Figure 5.9

Assessment Probes Without the SGD Present for Kurt



Figures 5.10 and 5.11 show Donald's assessment results. As Figure 5.10 shows, Donald used repetition to repair communication for 66.7% of total trials. The remaining 33.3% of trials involved no attempts to repair communication. Figure 5.11 shows Donald's repair strategies with respect to the communication breakdown. In the ignore condition Donald attempted communication repair for 60% of trials. He used repetition for 60% of trials with the remaining 40% representing no repair attempts. In the wrong response condition, Donald attempted communication repair for 53% of trials. He used repetition to repair communication for 53 % of trials, and the remainder of the 47% of trials involved no repair attempt. In the request for clarification condition, Donald attempted communication repair for 80% of trials. He used repetition to repair communication for 80% of trials, and did not try to repair communication for the remaining 20%.

Fig 5.10

Overall Repair Results for Donald

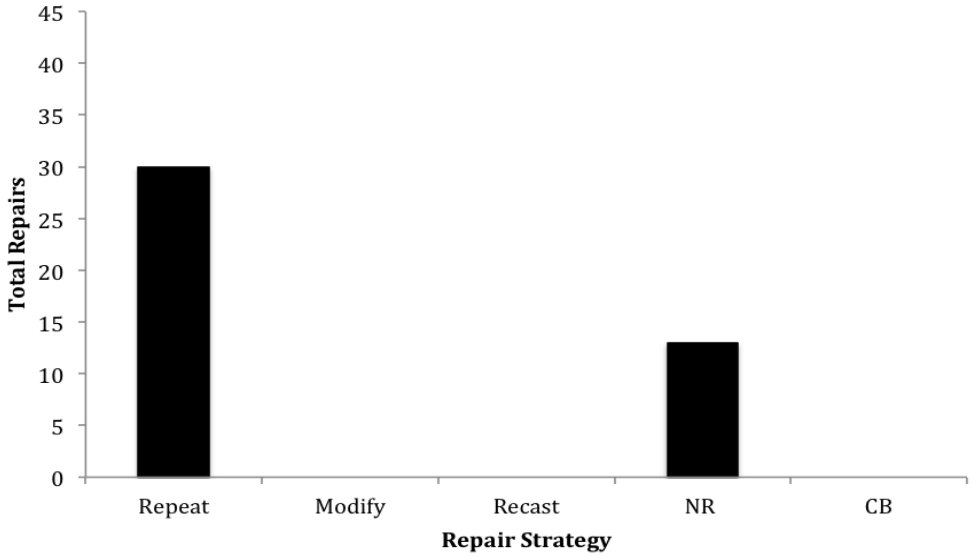
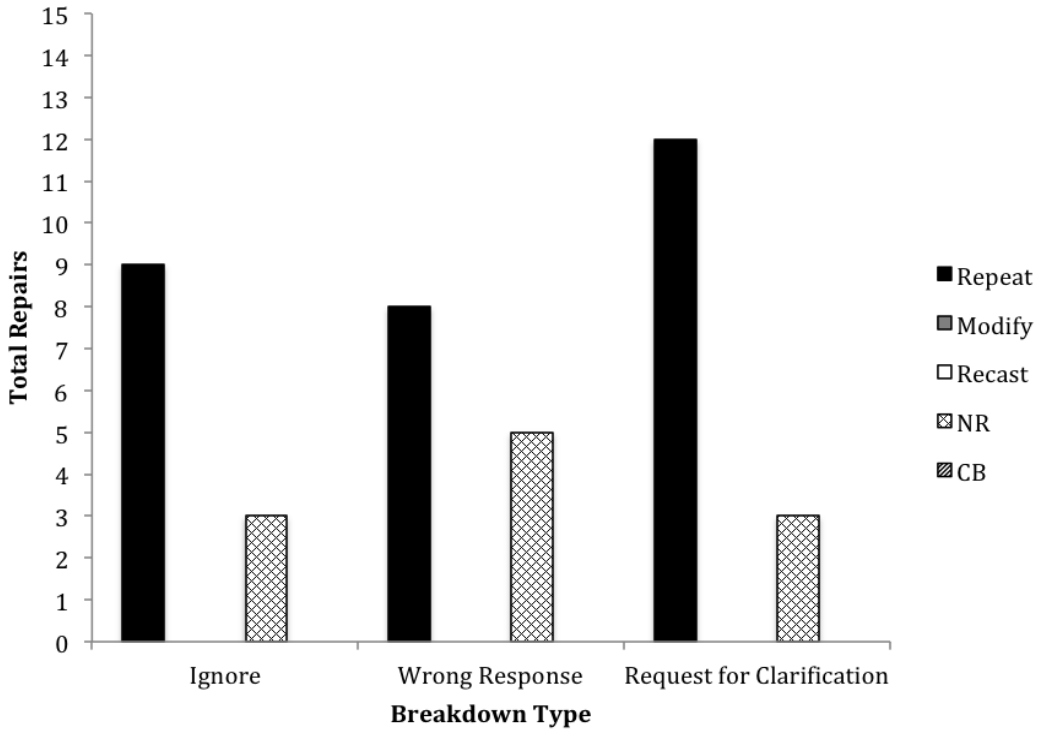


Figure 5.11

Repairs by Breakdown Type for Donald



Figures 5.12 and 5.13 show Jeff's assessment results. As Figure 5.12 shows, Jeff used repetition to repair communication for 66.7%. All remaining trials involved no attempts at repairing communication. Figure 5.13 shows Jeff's repair topographies with respect to the communication breakdown. In the ignore condition, Jeff used repetition to repair communication for 100% of trials. In the wrong response condition, Jeff attempted to repair communication for 20% of trials. Jeff used repetition to repair communication for 20% of trials, while the remainder of trials involved no repair attempts. In the request for clarification condition, Jeff used repetition to repair for 100% of trials.

Figure 5.12

Overall Repair Results for Jeff

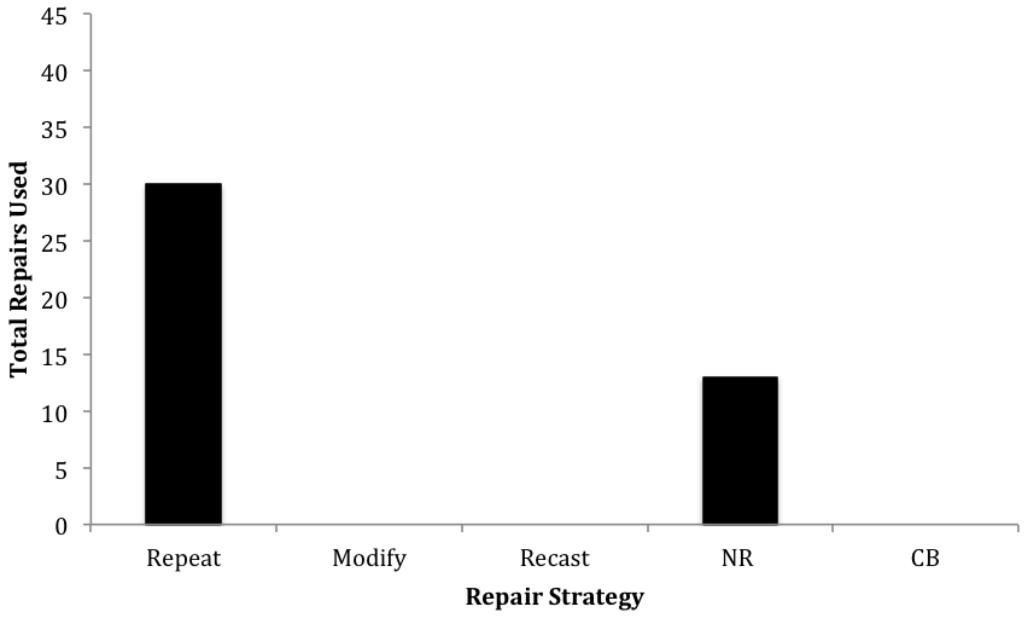
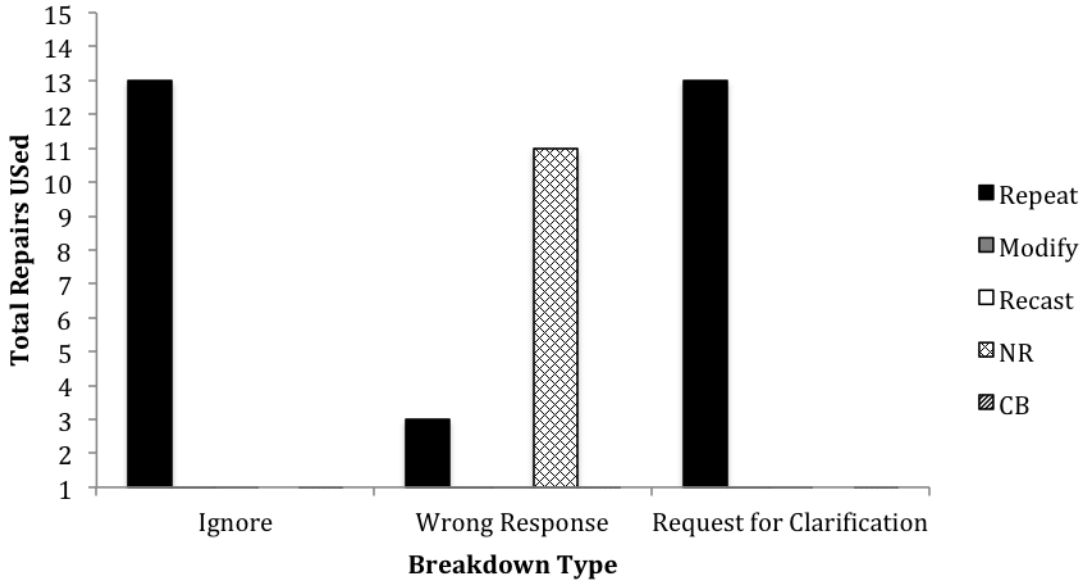


Figure 5.13

Repairs by Breakdown Type for Jeff



Figures 5.14 and 5.15 show Ed's assessment results. As Figure 5.14 shows, Ed used repetition to repair communication for 42.8% of total assessment trials followed by modification at 33.3%, recast at 9.7%, and 13.3% of trials had no repair attempts. Of total repairs, 11.9% included topographies of challenging behaviour. Figure 5.15 shows Ed's repair strategies with respect to the communication breakdown. In the ignore condition, Ed used repetition to repair for 46.7% of trials, modification for 40% of trials, and CB for 20% of trials. In the wrong response condition, Ed used repetition to repair communication for 20% of trials, and CB, modification, and request for clarification each for 13.3% of trials while 26.7% of trials had no repair attempts. In the request for clarification condition, Ed used repetition to repair communication for 46.7% of trials, followed by modification for 26.7%, followed by recast at 13.3% while 6.7% of trials involved no repair attempt.

Figure 5.14

Overall Repair Results for Ed

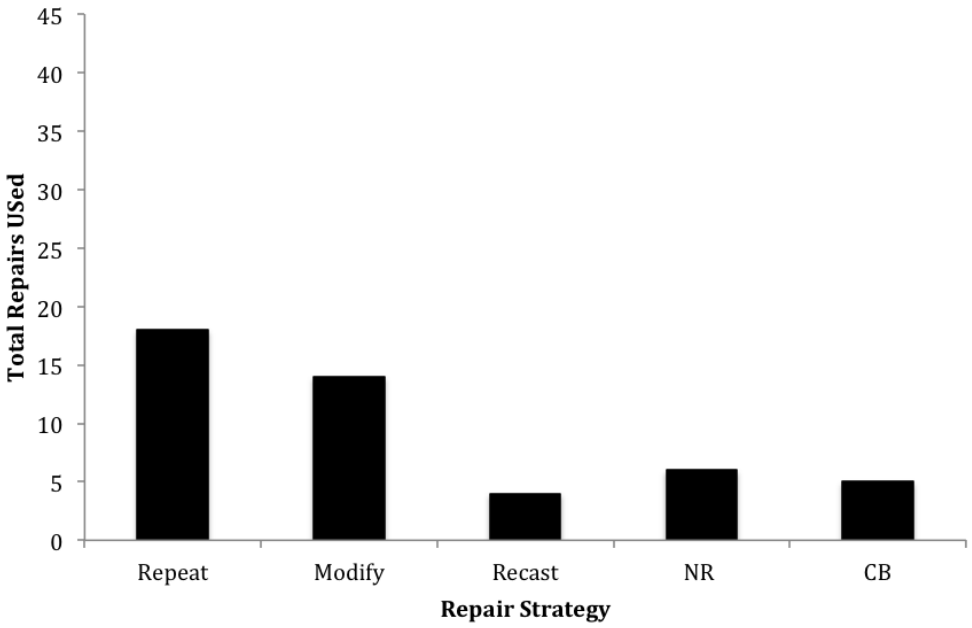
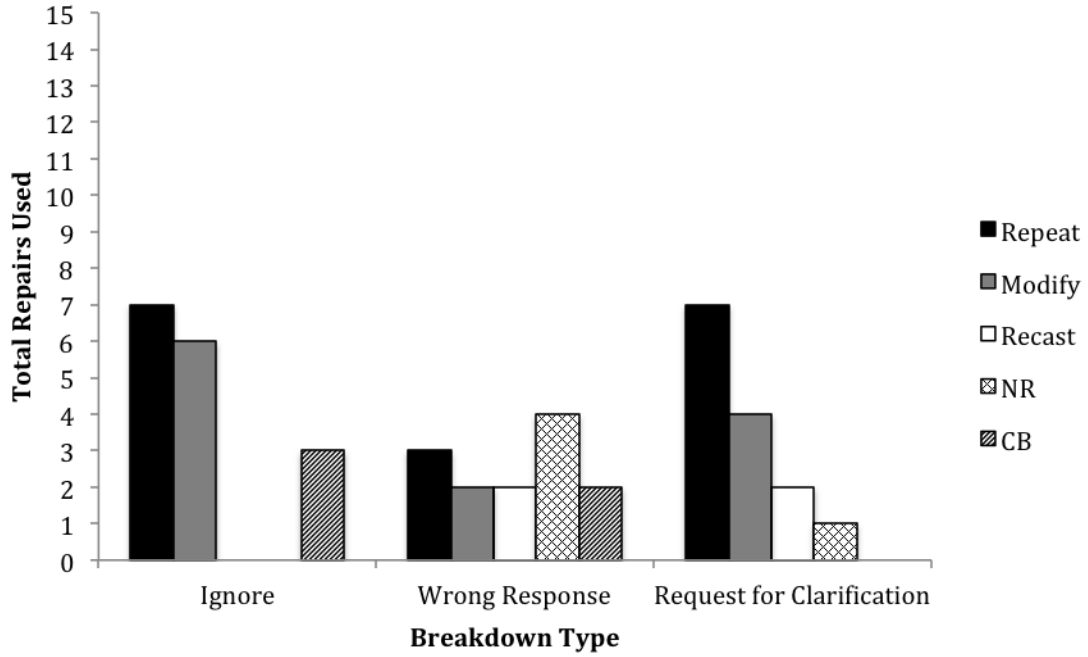


Figure 5.15

Repairs by Breakdown Type for Ed



Figures 5.16 and 5.17 depict Gabriel's assessment results. As shown in Figure 5.16, Gabriel attempted repair for 82.2% of trials. He used repetition for 37.8% of total trials, modifications for 42.2%, recast for 2.2%, and did not make a repair attempt for 17.8% of sessions. Figure 5.17 shows Gabriel's repair strategies with respect to the communication breakdown. In the ignore condition, Gabriel used repetition for 53.3% of trials, modification for 33.3% of trials, and no repair attempt was made for the following 13.3% of trials. In the wrong response condition, Gabriel used repetition for 6.7% of trials, modification for 46.7% of trials, recast for 6.7% of trials, and did not try at communication repair for the remaining 40% of trials. In the request for clarification condition, Gabriel used repetition to repair communication for 53.3% of trials and the remaining 47.6% of trials involved a modification.

Figure 5.16

Overall Repair Results for Gabriel

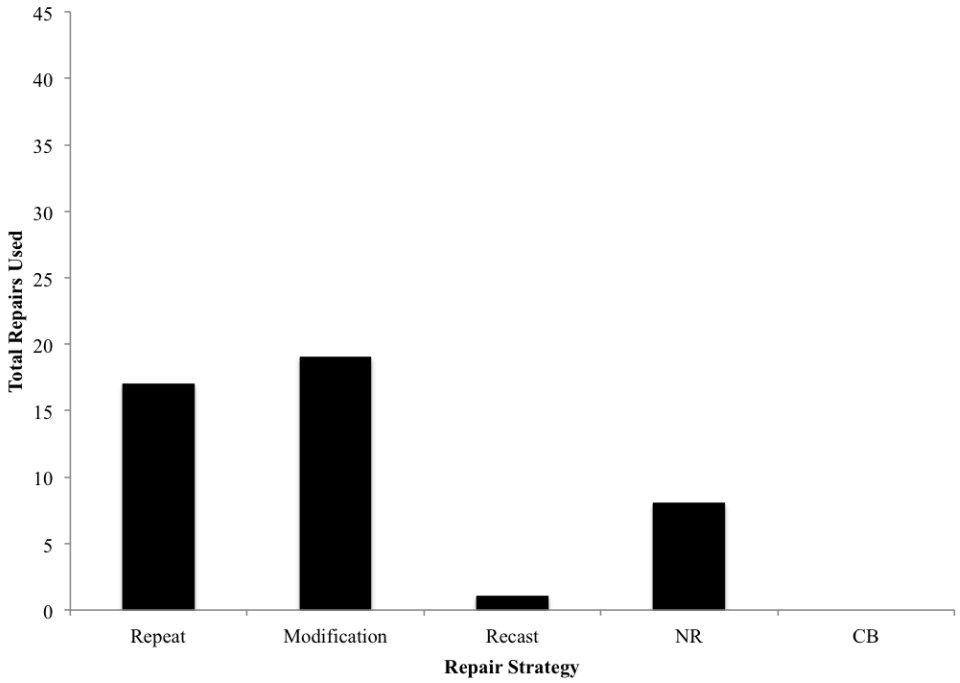
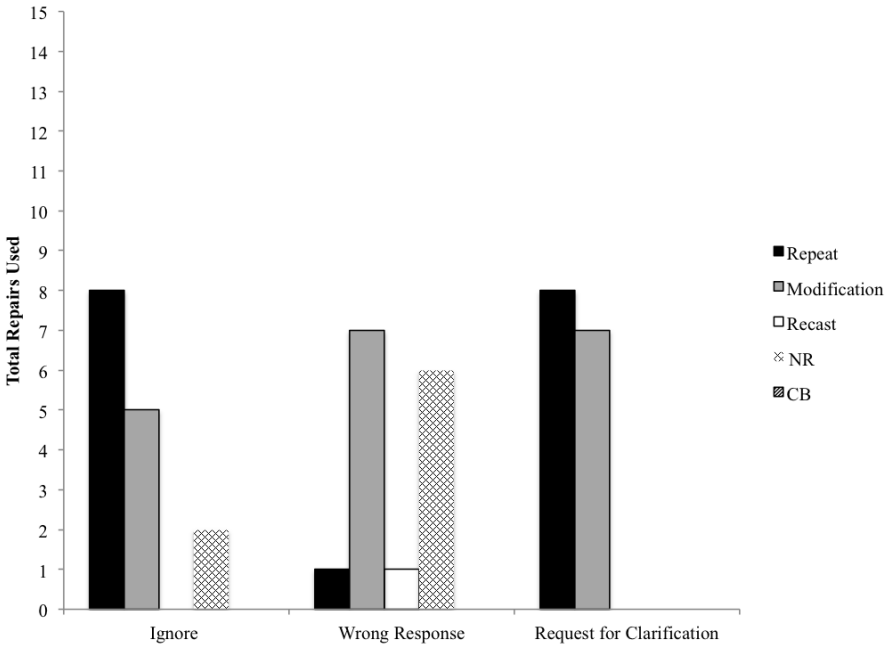


Figure 5.17

Repairs by Breakdown Type for Gabriel



Figures 5.18 and 5.19 depict group results of the direct assessment by repair type and breakdown type, respectively. As shown in Figure 5.18, repetition was the most highly observed communication repair strategy across all participants. 56.4% of total assessment trials involved repetition as the utilized communication repair strategy, 18.2% of trials involved a modification, 3.7% of trials involved a recast, challenging behavior occurred in 1.8% of trials, and no repairs were observed for 19.9% of trials.

Figure 5.18.

Collective direct assessment results by repair type

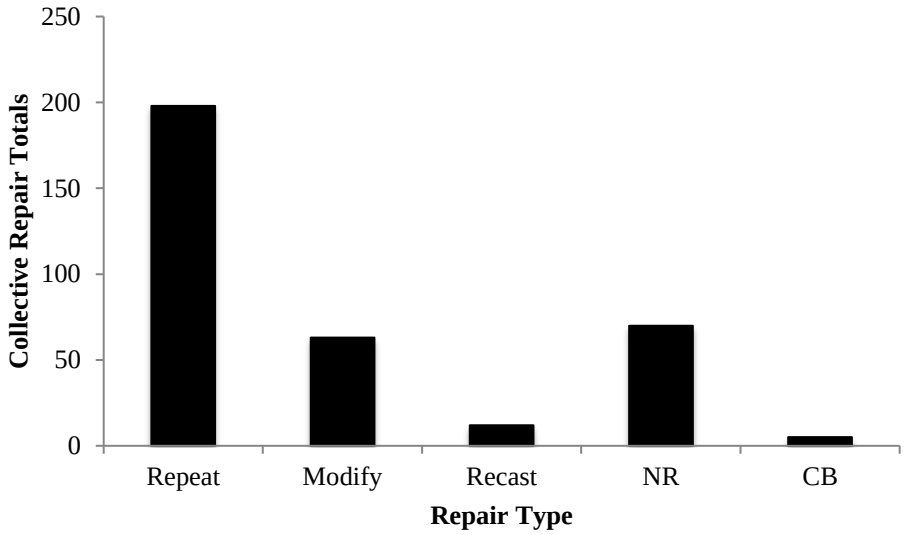
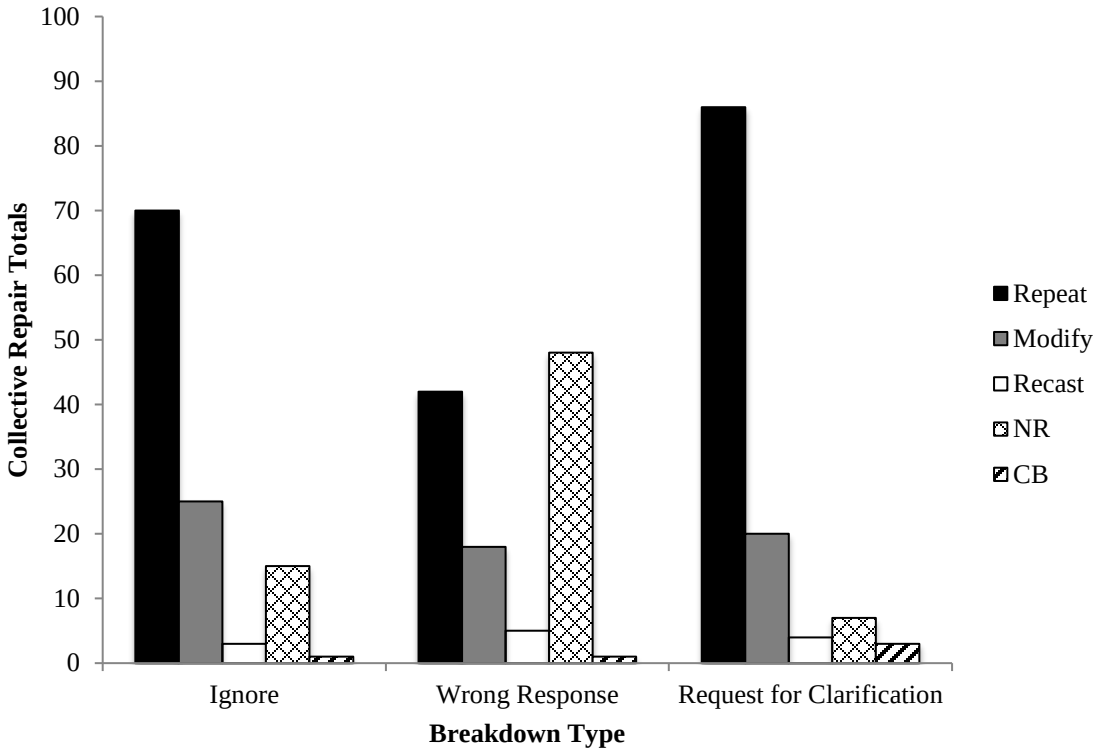


Figure 5.19 shows the groups repair responses broken down by breakdown types. The group was observed to attempt communication repair for 80.1% of trials. In the ignore condition, the group repaired communication using repetition for 59.8% of trials, modification for 21.4% of trials, recast for 3.6% of trials, and challenging behavior for 1.4% of trials, while the remaining 13.8% of trials involved no observed repair responses. In the wrong response condition, the group repaired communication with repetition of the initial mand for 36% of trials, modifications for 17%, recasts for 5.6%, and challenging behaviour for 1.4% of trials while no repairs were observed for 40% of trials. In the request for clarification condition, the group used repetition to repair communication for 70% of trials, modification at 18.4%, recasts at 3.3%, challenging behaviour at 2.5%, and no repair responses were observed for 5.8% of trials.

Figure 5.19

Collective repairs by breakdown type



Discussion

The results of the current assessment suggest that the children attempted to repair communication breakdowns to varying extents across the three different breakdown scenarios. The findings in this study are consistent with previous research in that students with ASD who are minimally verbal appeared to make attempts to repair communication in response to different types of communication breakdowns (Brady, Mclean, Mclean, & Johnson, 1995; Dincer & Erbas, 2010; Keen, 2005). These main findings suggest that this group with ASD and limited verbal performance appeared to possibly detect when a communication breakdown occurred and also appeared to attempt to repair that breakdown. Also, these findings suggest that the environment, or the type of breakdown

presented, had an effect on the rate and type of repair strategy each child used to repair communication.

Another finding that is consistent with previous research (e.g., Alexander, Wetherby, & Prizant, 1997) is that the children had a propensity to use repetition as the primary means of attempting to repair communication breakdown. When considering the discussion in Chapter 3 about response classes, it may be hypothesized that children who are minimally verbal may rely on this type of communication repair (repetition) perhaps because they have a relatively limited repertoire of communicative behaviours to choose from in general. Along these lines, Jeff and Donald were observed to use the fewest topographies of prelinguistic behaviour overall. Jeff primarily got closer to me and guided my hand to the desired object, whereas Donald typically tried to hastily grab the item that was out of reach. Their teacher reported that this was the case for the majority of their communication attempts. For these two participants, it can be hypothesized that a limited initial mand repertoire suggests that there will also be a limited repair repertoire. And when the mand repertoire is limited, attempts to repair will perhaps most likely involve the use of repetition.

With regard to age equivalency scores from the Vinland-II assessment, as presented in Chapter 4, Jeff and Donald were rated as having the lowest age equivalency scores in the expressive communication domain. It is possible that these low scores have been reflected in the assessment results, further supporting the argument that the fewer communication skills that a child has developed, the fewer different types of repair topographies they will show when confronted by a communication breakdown.

All students attempted repair in the vast majority of breakdowns that occurred in the request for clarification scenario. This is congruent with previous research that has suggested that children with ASD and DDs are most likely to respond to requests for clarification when compared to other types of breakdown scenarios (Brady, 2003). While these findings have not been reported with consistency within the ASD/DD body of research, data have been more consistent in research involving linguistically advanced children (Gallagher & Darnton, 1978; Tomasello, Conti-Ramsden, & Ewert, 1990; Wilcox & Webster, 1980). This may be due to the characteristic of the breakdown itself in that the communication partner explicitly signals that the breakdown has occurred by asking for clarification (Brady & Halle, 2002; Brady, McLean, McLean, & Johnston, 1995; Brinton, Fujiki, Loeb, & Winkler, 1986). When a request for clarification occurs, it might therefore be interpreted as providing a more obvious signal to the child that a breakdown has occurred compared to the ignore scenario, for example. In the ignore condition, there would seem to be a less obvious signal that a breakdown has occurred and this may be one reason why children tend to be more likely to attempt to repair when a request for clarification occurs compared to when their initial request is simply ignored. Halle, Brady, and Drasgow (2004) have suggested this possibility in arguing that children may be less likely to repair communication in the ignore condition because this scenario does not necessarily provide a clear signal that a breakdown as occurred. Halle et al. (2004) also suggested that a child's propensity to repair in the ignore breakdown scenario may depend on the child's level of motivation to request the item or activity related to the initial mand, but of course this could apply to any type of breakdown scenario. To help ensure motivation was constant and high across all of the present assessment sessions,

items that were reported to be highly preferred were identified and used for each child. Thus, differences in the percentage of repairs made under the different breakdown conditions most likely stem from differences in the stimulus properties of three different breakdown scenarios rather than differing and changing levels of motivation to repair.

Another possibility is that performance in the ignore condition stemmed from a learning history in which others have often ignored the child's request perhaps because of the child's reliance on subtle prelinguistic behaviour. Thus, the child's propensity to repair when ignored may have been extinguished due to the child learning that an un-attending adult indicates that reinforcement is not available. That is, an adult's inattentiveness signals that the response will not be reinforced and therefore the child learns not to respond/repair when the adult is not attending.

Another finding that is consistent with previous research is that children with ASD/DD showed relatively fewer repair responses to the wrong response breakdown scenarios (Brady, 2003; Brady et al., 1995; Tomaselloe, Conti-Ramsden, & Ewert, 1990). Wilcox and Webster (1980), for example, reported significantly less attempts to repair when typically developing children were exposed to the wrong response breakdown scenario. Similarly, seven of the eight participants in the current study often failed to attempt to repair in the wrong response breakdown scenario. Indeed, only 1 participant attempted to repair in all of the assessment trials under the wrong response condition. This finding might be explained in terms of the relatively reinforcing value of the requested item versus the [wrong] item that was given with the intent to create a breakdown (Halle, Brady, & Drasgow, 2004). Specifically, if the wrong item is still a reinforcer, the child might simply accept it, rather than attempt to repair communication.

In the current research, the wrong response breakdown scenario involved giving the child an item that was different from what they had originally asked for, and was an item that teachers reported as being "neutral" or not being preferred, but not being aversive in nature either. Some examples were a piece of paper, a blank piece of cardstock, or the lid of the container holding highly preferred items.

Repair attempts in the wrong response scenarios might have been low if the child has had a history of receiving lesser-preferred or non-preferred items. Such a child might consider the delivery of *any* item to have fulfilled the request, rather than only accepting the specific item that corresponds to the referent of their initial request (initial mand). If it is assumed that children with ASD experience more communication breakdowns than their neurotypical peers, then it can also be assumed that children with ASD might, over time, learn to tolerate and accept wrong items. That is, for some children getting something, even if not highly preferred, is better than getting nothing at all.

With regard to the individual variation among the children participating in the present study, a few points can be made. First, Ed, Ford, and Mariah all presented with some speech, but their speech was highly echolalic (Ed and Ford) or showed little variety and lack of initiation (Mariah). Throughout the entirety of the assessment, Mariah did not use speech at all in her initial mands. With regard to her mand repairs, the only time she used speech was to say, "Hey, that's not funny!" in one of the ignore trials. Mariah also showed a lot of motor imitation during the assessment. When I spoke to her, for example, she would often imitate my facial expressions and body movements. This was also observed in session when some breakdowns would occur. In ignore conditions, for example, I would clearly turn my gaze and head away from Mariah, and in many

instances, Mariah would do the same while slowly reaching for the desired item. This tendency to engage in such imitation may have made her less likely to respond to the ignore breakdown scenario.

Keen (2003) argued that in some cases problem behaviours could develop as a means of attempting to repair a communication breakdown. This is consistent with evidence suggesting that problem behaviour often serves a communication function for children with ASD/DD (Durand & Moskowitz, 2015). However, of the total sample, only Ford and Ed showed problematic forms of repairs. These always occurred in tandem with other socially acceptable behaviours, such as making light physical contact with me, or making direct eye contact. Results regarding challenging behaviours for these two participants were similar to findings made by Keen (2003) where children repeated requests, but with escalation. For example, instances where Ford exhibited challenging behaviour occurred when he would vocally request by pointing to the item and saying, "Hokey Pokey," and after the communication breakdown occurred, he would continue pointing and yell "Hokey Pokey!" far above conversation level while laughing very loudly.

With regard to the indirect assessment outlined in Chapter 4, teacher reports of their respective students' primary repair strategies tended to be relatively consistent with the results of direct assessment described in this chapter, at least for five out of the eight participants. While teacher reports for Ed's primary means of repair matched the results of his direct assessment, the assessment results did not account for the observed repair variability during direct assessment. Essentially, Ed's RSAS results suggested that he would have fewer repair strategies than he was actually observed to have used in the

direct assessment. For Ford and Kurt, their teachers reported that they would be most likely attempt to repair by using modification. However, the direct assessment results showed that they both most often use repetition to repair communication breakdowns. Gabriel's teacher reported that he would be most likely to repair using repetition, however the direct assessment showed that he used modifications most often. Despite these discrepancies, the RSAS appeared to provide a promising indication of how the children actually responded during the direct assessment during which they were exposed to three specific types of breakdown scenarios. The RSAS would thus seem to have some predictive validity. In light of this correspondence, there would seem to be value in future research to investigate the reliability and further explore predictive validity of the RSAS with larger samples of children.

Some limitations of the current study must be noted. For Donald, it seemed that he lost interest in one of the items that was identified as preferred. For one of the items, a pillow covered in sequins, Donald had a notably high latency to response. Toward the last sessions of the assessment, I had to create a toss game for him to engage with the item as receiving the item alone seemed to be met with little interaction. For him, an additional, tightly structured preference assessment might have been useful with the aim to identify additional preferred items. Additionally, the lack of systematic preference assessment for all participants should be noted as a limitation. Preference assessments were not conducted for this study because the teachers were considered capable to provide accurate information about the students' preferences based on their long-term observations and interactions with these students. Another limitation of note is that modifications were recorded when the initial mand and the mand repair shared at least

one common response element, however, this does not provide much insight as to whether children were using a wider variety of behaviours before or after the breakdown. That is, it is unclear whether they were modifying by adding or subtracting forms from the repair attempt. Another limitation of the current study is that it was constructed using a structured assessment format, which might not correspond to how the children would attempt to repair in the natural environment. An additional limitation of note is that in final sessions with Ed and Jeff, the session required termination because the children escalated to termination criteria. A school holiday was to occur shortly after data were collected, so the final trials of the final sessions were not completed. Another possible limitation of the current study is that the time allotted for producing a mand repair was longer than the time allowed for the children to produce the initial mand. When considering the structure of this assessment, the response time allotted for the initial mand was set to be shorter than that of the mand repair so as to allow the child to attend to the breakdown and build motivation to repair, however, it may have been insufficient in allowing the full breadth of request forms the child would use to imitate the mand. Lastly, data were not collected on specific prelinguistic topographies presented in initial mands or repair mands. Rather broad response definitions were used, which therefore did not capture the range of specific repair topographies that the children used in their initial mand or mand repair, rather, the class that repair topographies belonged to (i.e., repeat, recast, modifications, challenging behaviours). As previously discussed in Chapter 1, one of the downfalls of prelinguistic forms of communication is that they may be subtle and difficult to interpret or recognize as an attempt to communicate, so an emphasis was placed on the classification of the repair response as opposed to the frequency with which

each topography was presented. Further research could investigate the relationships between physical topographies of repair responses and the breakdown scenarios with which they occur to create a topographical response class hierarchy across breakdown scenarios.

Summary and Conclusion

The existing body of literature concerning the assessment of repair strategies is quite limited and is predominantly comprised of naturalistic observation. The current study, therefore, makes an important new contribution to the assessment literature in that it involved a structured-experimental assessment of repair strategies in response to three different types of breakdown scenarios. Given that the RSAS results predicted the results of this structured assessment, there is also the contribution of providing a promising indirect assessment that would seem easier and quicker to complete than a structured-experimental assessment (Tarbox, 2009). However, because there were some discrepancies between the RSAS and the results of the structured-experimental assessment used in this study, there would seem to be value in undertaking such assessments to verify the results of any indirect or naturalistic assessment of repair strategies. Indeed, the results of Study 2 highlight some possible limitations of indirect assessment of the type reported in Study 1. Specifically, the RSAS did seem to capture the child's primary means of communication repair, but not the range of repair strategies observed in the direct assessment. The variables that contributed to the inconsistencies across the two assessments are unknown, but the presentation and topographical structure of the questionnaire may be altered for future research. For each of the assessment items, the first potential repair response listed was "Repeat." It would be beneficial to determine

if this was a factor that affected how teachers responded by changing the order of potential repair responses on the document. A total of 5 responses could have been made on the RSAS: (a) repeat, (b) recast, (c) modify, (d) no repair, or (c) challenging behaviour, so investigations into response biases based on the physical structure and presentation of the RSAS may be useful in promoting fair responding.

Considering the aforementioned limitations to the literature, considerations should be made for the length of time allotted for children to repair communication in future direct assessments. Providing structured trials that more closely resemble the natural environment may provide more insight on the variability of repair responses in children with ASD/DD. Additional considerations may be made for the degree to which prelinguistic forms are observed with regard to topography. The current research considered prelinguistic forms as a single class, but it is possible that different types of prelinguistic forms may serve different communication functions for the child. Future research should consider recording the different topographies of prelinguistic behaviours used by children to repair communication breakdowns. Future research should also make comparisons between groups of children utilizing different modalities of communication. Most of the children in the present study relied on prelinguistic behavior, while only one child had full independence and use of a speech-generating device.

In conclusion, the results of this study suggest that this group of children with ASD who are also considered to be minimally verbal did demonstrate behaviours that could be interpreted as attempts to repair communication breakdowns and that they did so across several different types of breakdown scenarios. This study also shows, via direct assessment, that the indirect assessment conducted previously appeared to have provide

some valid information about the children's communication abilities with respect to repairing communication breakdowns.

With consideration of trends in the data, interventions were developed to help increase repair responding under wrong response breakdowns, where repairs were least likely to be observed. The following chapter will fully describe procedures aimed at teaching communication repairs with a speech-generating device for two children who showed a low likelihood of repairs in the wrong response condition.

CHAPTER 6

Study 3: Repair Strategy Intervention and Breakdown Detection Probes

Introduction

This chapter reports on the intervention study resulting from direct assessment findings in the previous chapter. The aim of the intervention was to teach participants to use a speech-generating device to repair communication breakdowns that occurred in response to the "Wrong Response" scenario. A second purpose of this study was to determine if the participants would discriminate between scenarios where requests were honoured immediately, and hence there was no need to repair, versus scenarios when a breakdown occurred and thus there was a need for the participant to use the targeted repair response.

Method

Participants and Setting

The two participants in the current study were also involved in both of the previous studies. Damian and Gabriel were chosen for intervention because they both had high rates of failure to repair in the Wrong Response scenarios of the previous direct assessment study. Sessions were conducted in a music room within the classroom. The classroom was approximately 3.5 by 3.5 m and it contained a table, two chairs, and a closed, locked cabinet that contained teaching materials. These sessions were conducted at a rectangular table where I sat directly across from, or next to the participant. Some sessions were also conducted on the teaching floor of the classroom while other students were present, depending on the availability of space. Materials present during assessment sessions included a small tripod and recording device to capture sessions on digital video

for in depth coding, in addition to a box that contained participants' highly preferred items.

Response Definitions

Myself and a trained observer recorded the participants' responses. For each trial, these two individuals recorded whether or not the participant activated the correct series of symbols on the speech-generating device to repair the communication breakdown.

Figures 6.1 and 6.2 depict flow charts for both the standard mand trial, and the repair mand trials respectively. As shown in Figure 6.1, the standard mand trial is presented by target responses. The first target response of the standard mand trial was activation of the "I want," button. The second target response was activation of the folder containing buttons representing highly preferred items (e.g. "Toys" for Gabriel and "Snacks" for Damian). The third target response was activation of the button corresponding to the highly preferred item chosen at the start of the session. Lastly, the fourth target response was activation of the "Thank You" button as the communication partner delivered the item. As shown in figure 6.2, the first 3 target responses in the repair mand trials were identical to standard mand trials. The fourth target response of this sequence was activating the "Oops! Wrong one!" button when the wrong item was delivered to the child. The fifth target response was to activate the "Thank You" button as the communication partner was removing the wrong item and delivering the item corresponding to the request.

Figure 6.1

Standard Mand Flow Chart

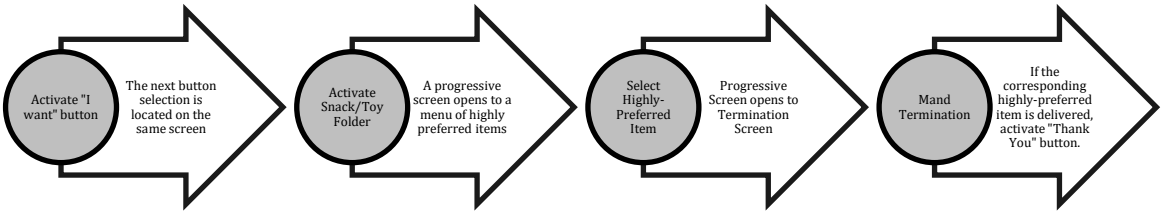
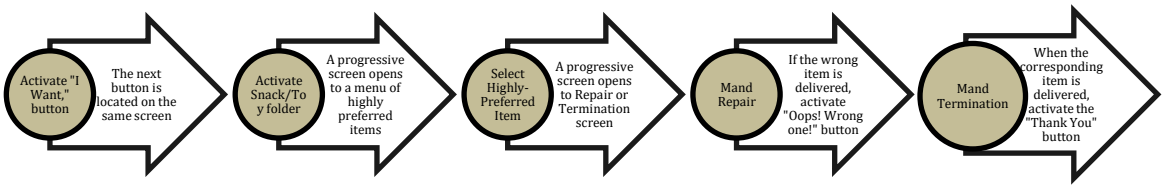


Figure 6.2

Mand repair flow chart



Figures 6.3 to 6.6 show visual representations of the speech-generating device screen that the participants saw during session trials. Figure 6.3 shows the first step of both sequences where the target response was activation of the "I want," button. Synthetic speech output was generated when this button was activated.

Figure 6.3.

Step 1 of mand sequence: Activating "I Want"

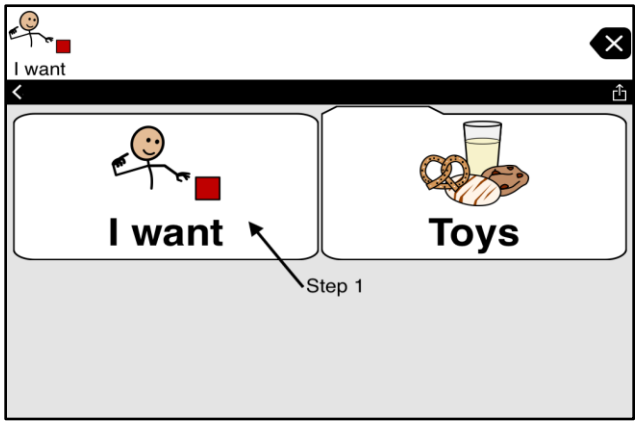
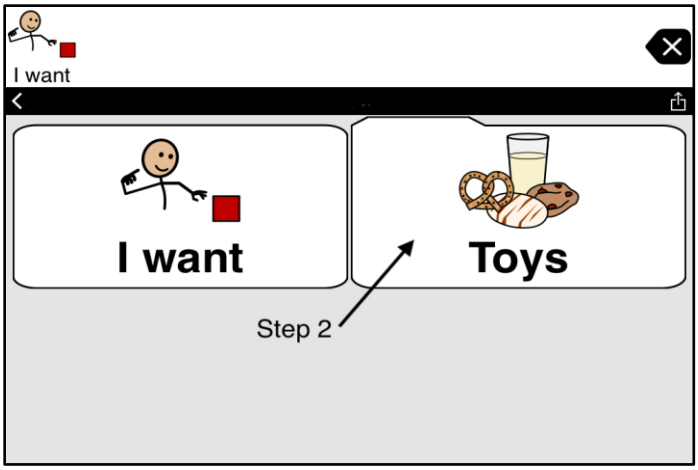


Figure 6.4 shows the second step of both sequences where the target response was to activate the folder containing the menu of highly preferred items. This folder was located adjacent to the "I want," button.

Figure 6.4.

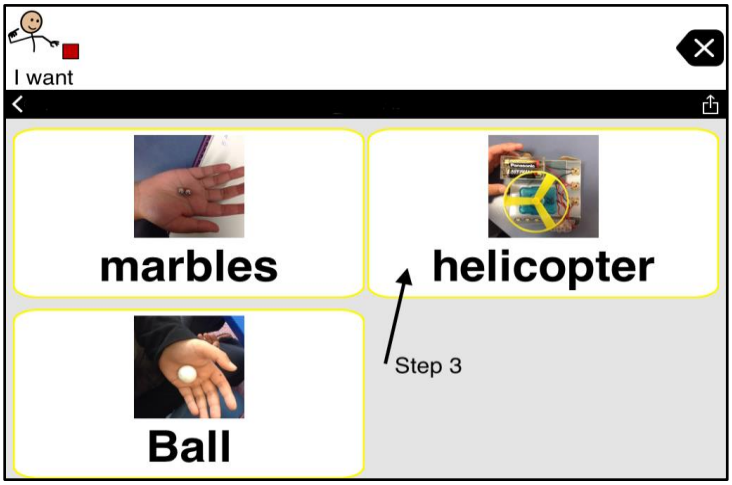
Step 2 of mand sequence: Activating the folder button



When the folder button was activated, no synthetic speech output was generated, however, a progressive screen was activated that automatically opened up to the menu of highly-preferred items, which is depicted in Figure 6.5.

Figure 6.5

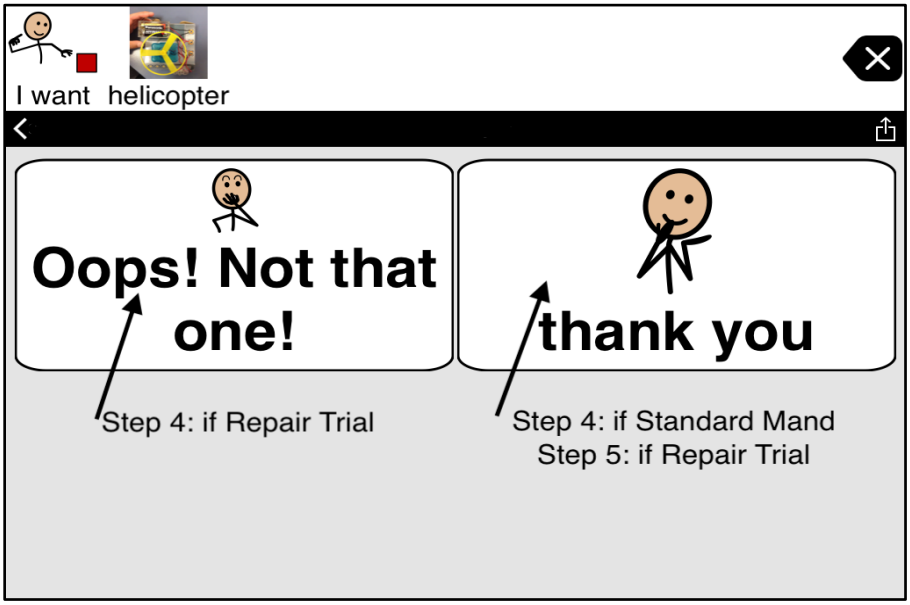
Step 3 of the mand sequence: choosing the desired item



When the highly preferred item was activated, synthetic speech output was generated and another progressive screen opened up to the repair or termination screen as depicted in Figure 6.6. If the item being delivered corresponded to the original request, which was considered a standard mand trial, the target response was then to activate the "Thank You," button as the communication partner delivered the highly-preferred item. If the item being delivered was the wrong item, which was considered a repair trial, the target response was then to activate the "Oops! Wrong one!" button. As the communication partner withdrew the wrong item and delivered the correct item corresponding to the original request, the target response was then to activate the "Thank You," button.

Figure 6.6.

Steps 4 and 5 of the mand sequence: Choose to repair, or finish the sequence



Procedures

Baseline. At the start of each standard mand training baseline session, the child was offered a choice between two highly preferred items and was asked, "Which one do

you want?" If the child did not immediately make an indication that they wanted an item, I would manipulate the items and comment on them by saying "Oh how yum!" or "This looks like fun!" while looking expectantly at the child. When the child made a clear indication of which item they desired I placed the item within view of the child, but out of reach. The iPad® mini loaded with Proloquo2go® was placed in front of the child while I said, "I have (item) here, if you'd like it, let me know!" If the child did not activate all of the appropriate buttons for each of the pre-determined steps of the multi-step request, the trial was considered incorrect and the child did not access the desired item. No prompting for incorrect responses was done during this phase of the current study.

Standard Mand Training Intervention. These sessions began exactly the same as baseline sessions, however, prompting hierarchies were introduced after the child was given the directive, "I have (item) here, if you'd like it, let me know!" Most-to-least prompting procedures were used to help teach correct manding using the SGD. Most-to-least prompting procedures involve high levels of (physical) prompting at the start of training. Over the course of time, prompting is reduced both in invasiveness and frequency and is typically accompanied by a time delay where the participant is allowed time to respond before the implementer utilizes the prompting hierarchy (Cooper, Heron, & Heward, 2007; Libby, Weiss, Bancroft, & Ahearn, 2008). These prompting methodologies were chosen because they have been associated with fewer errors during training when compared to other prompting methodologies (Demchak, 1990). For both participants, the most invasive prompt at the start of the training was using a pen or

marker to point to and model tapping the correct buttons. No hands-on physical prompts were used during this training for either participant.

In standard mand sessions, the child was given between 5 and 10 s to initiate the request. Similar to the conditions of the previous study, sessions were conducted within the classroom setting, away from but within hearing and/or seeing distance of the classroom. Depending on the time of day, the classroom environment could be noisy and potentially distracting (e.g., due to teachers and children singing songs, or playing different games, or interacting with materials that may have produced sounds). Thus, the amount of time allowed for a response varied; less time was allowed when the classroom was not highly distracting; more time was allowed when the classroom was nosier and, thus, potentially more distracting. I mentally counted the number of seconds that passed before a response occurred. It was always the case, however, that I gauged the child's level of attention to ensure the child was always given adequate time to initiate the request. If the request was not initiated immediately, I would move into the child's line of sight and look expectantly at the iPad®. When the child motioned toward the SGD, I would block incorrect attempts and point to the correct button to begin the multi-step request. Incorrect attempts were blocked throughout each trial, until the child successfully activated the button corresponding to the desired item. At this point I would immediately say, "OH! You wanted (item)!" and reach for the desired item in anticipation for the child to activate the final button, "Thank you." Once the final button was activated, I said, "You're welcome! Thanks for telling me!" while delivering the desired item. More emphatic social praise was offered for successful trials with faded prompting, for example, if the child responded in a trial that had markedly less invasive

prompting than the trial before, they received high levels of vocal praise by saying “Oh! You wanted (item)!” while being hugged or tickled by me.

Repair Trials. Once the child performed the multi-step, Standard Mand at mastery (80% or higher for 3 consecutive sessions), they moved into the next phase of research, which were Repair Trials. These trials were identical to Standard Mand trials; except that the child was not immediately delivered the desired item once they made the appropriate request. In Repair Trials, when the child activated the button corresponding to the desired item, the child was immediately exposed to a communication breakdown where they were given an unrelated, neutral item rather than the desired item. Most-to-least prompting was used to help teach the child to repair the mand by activating the button that says “Oops! Wrong one!” When the child activated the button, I would say “OH! You wanted (item)!” while removing the incorrect item, and placing a hand on the desired item. Once I reached for the correct, desired item, the child was then required to activate the “thank you” button to terminate the trial and receive the desired item.

Mixed Probes. Once the child was able to show mastery with the standard mand and communication repairs (80% or higher for 3 consecutive sessions), the child was presented a mix of Standard Mand trials and Repair Trials in random order. These trials were presented identical to those in the Standard Mand and Repair Trial sessions; however, probe trials did not involve any prompting, and incorrect responses were not met with reinforcement. Mixed probe sessions contained 5 trials total that were comprised of either 2 Repair Trials, and 3 Standard Mand Trials, or 3 Repair Trials and 2 Standard Mand Trials. For both participants, Mixed Probes were presented beginning

with 3 Repair Trials and 2 Standard Trials, and alternated throughout the entire phase of research.

Inter-observer Agreement

I collected data on all responses for both participants, in vivo, or during the time of the session. For Damian, an independent observer was present during all phases of training and probes. The observer present was the same observer that collected inter-rater reliability and procedural integrity data in the previous study, so she was familiar with the participants of the current study. Brief training was done during and after the first session of each phase of research for Damian. The observer would watch the first session and would collect data that were not factored into inter-rater reliability figures. Directly after the first session took place, I provided immediate feedback on data collection, and the observer was given the opportunity to ask questions and to gain clarification on anything not addressed in feedback.

During Damian's sessions, the independent observer sat in a chair that was placed approximately 1 m from the table where sessions were conducted. The independent observer did not directly interact with Damian, even if he sought out her attention. If he did make bids for attention, she was instructed to refrain from making eye contact with him and not attend to him so as to not interfere with the procedures. In between sessions, however, she had small interactions with him (e.g., giving him a high five or waving and saying "Hi.")

It must be noted that during the time of Damian's sessions, the independent observer was able to foster a relationship with the classroom staff, and was eventually hired to be a teacher's aide in the classroom. After Damian's final sessions, she was able

to develop a meaningful relationship with him, and also provided support to him in the classroom. No perceived conflicts of interest were noted as her interactions with his education occurred after the termination of this research.

Interobserver agreement for Damian's sessions was achieved via video recording with the same observer when scheduling did not allow the observer to be physically present. An agreement was scored if the experimenter and independent observer had recorded the same data for each session, whereas any discrepancy was counted as a disagreement. Inter-observer agreement (IOA) was calculated by using the formula: Agreements/(Agreements + Disagreements) x 100% to determine the percentage of agreement for each session. IOA was collected on 50.1% of all sessions and had an average of 98.1% agreement with a range of 80% to 100%. Procedural integrity had an average of 97.9% with a range of 81.3% to 100%.

The same observer collected IOA and procedural integrity data for Gabriel's sessions. Procedures for data collection and training and calculation of IOA and procedural integrity were identical to measures taken for Damian's sessions. The exception in this case is that all IOA and procedural integrity data were taken via video recording, as scheduling did not permit the observer to be physically present. A total of 38% of sessions were analyzed by the independent observer. IOA was scored at an average of 98.8% with a range of 90%-100%.

Procedural Integrity

During the same sessions when IOA was assessed, the independent observer also recorded whether I correctly implemented the intervention and probe trials using a checklist that described each step of the trial procedures. (See Appendix A) The

percentage of steps implemented correctly was calculated for each session. The mean percentage of correct implementation across sessions for Damian was 97.9% with a range of 81.3%-100%. For Gabriel, mean percentage of correct implementation across sessions was 98.4% with a range of 87.5-100%.

Data Collection Timeframe

Data collection for Damian began in October of 2017 and ended in December 2018. Data collection for Gabriel began in February 2018 and ended in May 2018.

Results

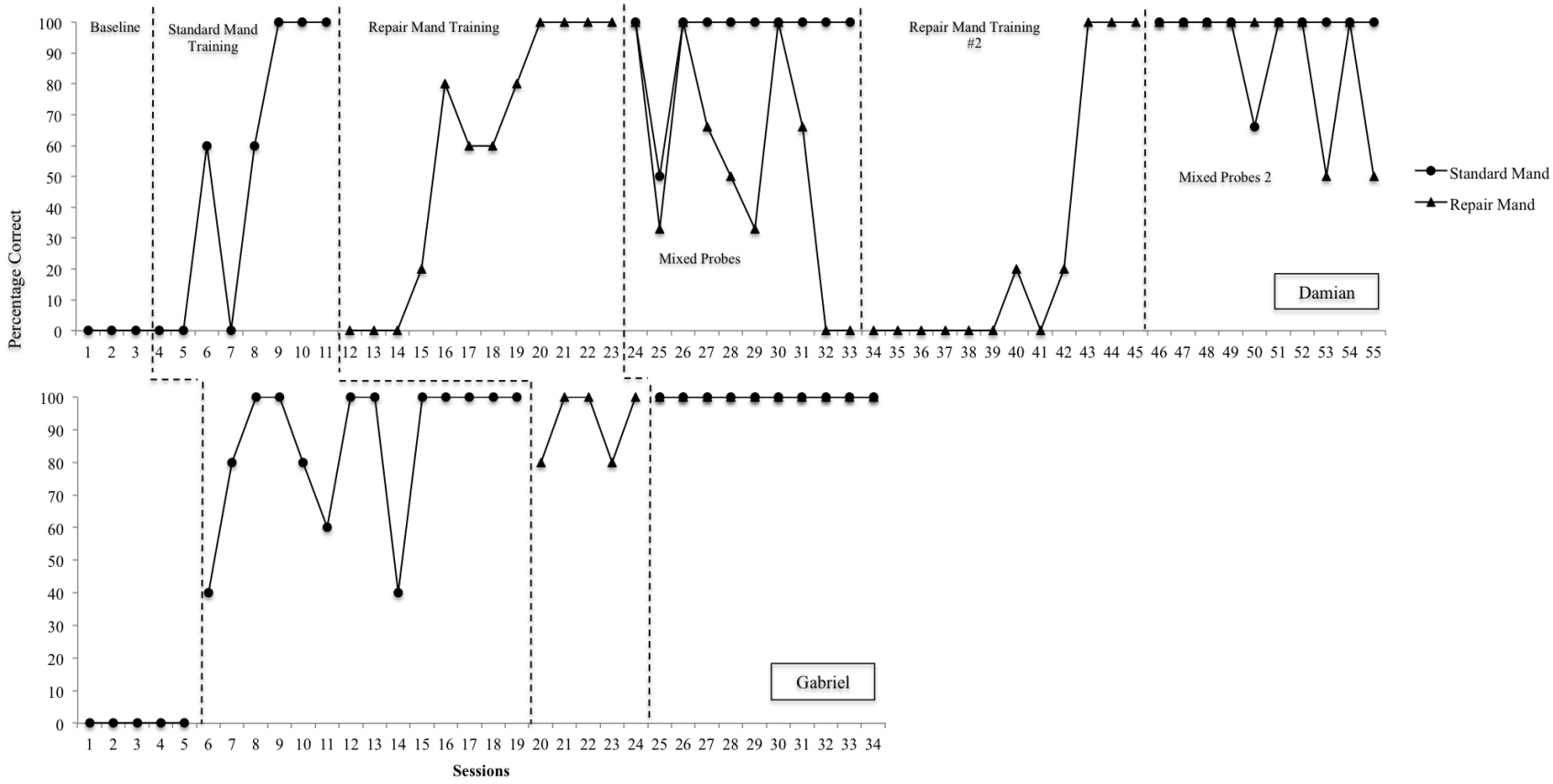
As shown in Fig. 6.7 (top panel), during baseline, Damian did not complete the entire multi-step request using the SGD. In the standard mand training phase, it took eight total sessions before Damian was able to complete the entire requesting sequence with no adult assistance. In the Repair Training phase, it took four total sessions before Damian showed improvements in repairing with the multiple-step mand, and 11 sessions to reach mastery criteria. In the first phase of the Mixed Probe trials, Damian repaired an average of 49.8% of communication breakdowns with a range of 0 to 100%. A second phase of Repair training was introduced to ensure that the skill was still intact, and after 11 additional sessions, repairs reached mastery criteria once again. The last phase, depicted in Fig 6.1, shows a second and last reintroduction of the Mixed Probe trials. Damian correctly repaired communication breakdowns in 90% of all of these Repair probes.

Fig 6.7 (bottom panel) shows the results of Gabriel's mand and repair training. In baseline, Gabriel did not complete the entire requesting sequence for any trials. In the mand training phase, Gabriel reached mastery criteria for the Standard Mand sequence within 12 sessions. In the Repair Training sessions, Gabriel entered the phase already at

mastery criteria and maintained mastery levels across 5 sessions. In the Mixed probes, Gabriel consistently discriminated a standard mand from a communication breakdown for 100% of all trials.

Figure 6.7.

Results of Standard & Repair Mand training and discrimination probe



Discussion

The aim of the current study was to determine whether communication repairs could be taught to two children with ASD and to determine whether those children would discriminate between instances in which their needs were met immediately when compared to instances where communication breakdowns occurred and a communication repair was needed. The results of this study suggest that children with autism can be taught to repair communication breakdowns in a structured teaching format that made use of systematic instructional procedures. These procedures were formed with consideration of previous research by Genc-Tosun and Kurt (2017) aimed at teaching children with ASD who are nonverbal how to complete multi-step requesting sequences on an iPad® based speech generating device. The aforementioned authors utilized time delay and graduated guidance to help participants achieve the requesting sequence. While procedures for the current study do not involve pre-determined time delay phases, the amount of time delay increased as the level of prompting decreased over the course of intervention sessions for both participants. For example, at the start of intervention sessions for Damian, a 0 s time delay was allowed before I used light physical prompting (touching Damian's hand, then pointing to the correct buttons on the device) to aid the response. As Damian showed proficiency in activating the correct buttons, the time delay was increased to allow independent responding. Prompting was also faded from making physical contact with Damian to gesturing toward the correct button as needed.

These findings are consistent with previous research that suggests that individuals can be taught to repair communication in response to structured communication breakdowns (Ohtake et al., 2010; Sigafoos et al., 2004). The present study builds upon

previous research by virtue of the fact that it appears to be the first study to isolate and teach initial requesting and communication repairs within the same scenario while also probing whether the child showed discrimination of successful requests versus requests met with a communication breakdown. Previous intervention studies solely looked at whether the participants were able to acquire repair behaviours, under breakdown conditions.

With regard to the previous study (Study 2; direct assessment), both participants were noted to be least likely to attempt repairs in the Wrong Response condition, which was a finding that is congruent with those of previous studies (Brady, 2003; Brady et al. 1995; Tomaselloe et al 1990). The current study could be considered a contribution to the existing body of research in that both of the boys showed significant deficiencies in repair responding in the direct assessment (Study 2), and showed marked improvements in responding in the exact same breakdown scenario throughout intervention. Although Damian did not show promising evidence of generalization of the repair over time, acquisition of the skill occurred rather quickly and marked improvements were made during intervention sessions. This may provide a practical framework to increase repair responses for children who are least likely to repair communication when exposed to a Wrong Response breakdown in communication. Procedures utilized in the current study contain systematic teaching procedures that can be readily adapted to the clinical setting, or in a classroom setting on a 1:1 ratio. Practical implications of this study are that children can be taught to execute basic mands and repair mands within the same teaching procedures which eliminate the need to teach the two communication responses in isolation with different teaching procedures for each. Additional practical implications of

these results indicate that it may be useful to embed communication repair trials within standard mand teaching procedures to ensure that the child has a means of repair other than existing prelinguistic behaviors.

Based on the results of Study 2, observations revealed that each of the participants used prelinguistic behaviours to initiate requests. However, it must be noted that these behaviours could be considered potentially difficult for unfamiliar communication partners to interpret and this could in turn lead to communication breakdowns. Although these prelinguistic attempts at communication were recognized and understood by the teaching staff, they were all familiar with the students. It was therefore viewed as important for the participants to learn to use a modality of communication that was more likely to be easily understood with future communication partners, with unfamiliar communication partners, and across a range of inclusive environments. Given the need for a more readily understood mode of communication, and considering the fact that the SGD was already available to the children, the decision was made to pursue intervention with an SGD rather than teaching the children to use manual signs or a picture-based AAC system.

In terms of the iPad®-based SGD itself, each child was familiar with the device. That is, in both the home and school environments, both participants had access to iPads for both learning and leisure; the children appeared to enjoy using the device. In terms of maintenance of the device and the speech-generating application, the application had back-up capabilities to ensure all the customization done for each child could be stored. The teaching staff also seemed comfortable with using the SGD and the communication application. In terms of the customization of the application, the interface allowed for

new communication symbols and corresponding speech-outputs to be added to adapt to the child's changing needs.

For Damian, it must be noted that he had some limited, informal training using an SGD loaded with Proloquo2go® by recommendation of a speech therapist in his classroom. This training may have influenced the rapid acquisition of both the Standard Mand and the Repair behaviours, as he was familiar with the SGD and the application. Secondly, the variability in responding in the first phase of Mixed Probes must be addressed. One hypothesis for inconsistencies in repairing communication in this condition may involve response effort. Standard Mand trials required fewer responses, or steps, to acquire the desired item, so this may have had an abative effect on repair behaviour. Essentially, in a Standard Mand, four responses were required to gain access to the desired item, whereas Repair Trials required five responses. In the second phase of the Mixed Probe, although Damian performed considerably better than in the first Mixed Probe phase, it can be seen that there was a decline in responding toward the end of the phase, so it is possible that additional probing could have established further whether response effort was, in fact, a cause for the deterioration of the behaviour over time. Another explanation may be considered with respect to Damian's use of a speech-generating device in the classroom. Damian's use of the speech-generating device in the classroom environment seemed to be sparse at best and relied entirely upon whether the teacher remembered to incorporate the device into teaching sessions. This intermittent use may have impacted Damian's ability to generalize the repair skill over time, as it may be that he is still quite dependent on adult intervention in the use and maintenance of skills with the speech-generating device. Another hypothesis could be made that this

level of responding may reflect the way children with ASD repair in the natural environment. When considering discussions of the response class and Damian's previous results in the direct assessment, the decline in accurate responding in this case may be explained by the position in which this new type of communication repair falls within Damian's response class. It is not necessarily safe to assume that if a child is taught a new means of repairing, that this new means will automatically take priority within the response class and will be utilized primarily in the absence of the specific reinforcement conditions of the training scenario.

Another note to make about Damian's progress is that Standard Mand responding maintained at 100% for all but 2 of the 20 Mixed Probe sessions. In each of the repair trials that contained errors, the errors were specific to Damian attempting to terminate the trail by saying "Thank You," so it cannot be certain that the communication breakdown was salient for Damian. When considering how wrong response breakdowns happen in the natural environment, the argument can be made, again, that children with ASD have been "trained" to accept a replacement for items that are not available. If a child indicates that they want a cookie, but is given a piece of fruit instead, the child is expected to accept it because that is what is available. This may explain why Damian's likelihood to repair diminished in the first phase of the discrimination probes and required subsequent booster repair training. In the second phase of discrimination probes, I made much larger gestures when delivering the wrong item. Instead of handing over the item in a casual fashion, I would pick the item up and lift it in the air in an exaggerated way in attempt to draw attention to the item. It is possible that by exaggerating movements during the communication breakdown, I may have made the breakdown a more salient cue to repair

communication. Toward the end of the second discrimination probe phase, a decrease in repair responding was apparent, however, follow up data was not taken to determine if that level of responding would have continued to decrease over time.

For Gabriel, it must be reiterated that he had some previous training and experience with a speech-generating device prior to the current study. He was able to make some single-step requests for highly preferred items prior to participation in the current research. According to teacher reports, Gabriel was also showing an increase in the use of vocal speech after initial assessments of his participation in this study so his verbal repertoire was growing; however, during the course of the research his use of language was inconsistent and he was observed to use a maximum of one to three words per utterance when he did evoke speech. It should be noted that at the time of initial assessment, he met the inclusion criteria (e.g. Vineland-II Expressive and Receptive age equivalence of 2 years or younger).

In the baseline condition, Gabriel completed some, but not all steps of the manding sequences. Reliably, he was able to select the toy folder and activate the button that corresponded with the desired item; however, he did not complete the first or last steps of the manding sequence, which is reflected in the low rates of correct responding in the baseline condition. Very little prompting was required before Gabriel showed improvements in the Standard Mand phase. Low magnitude challenging behaviours occurred and may have created some variability in responding during this phase. Sessions were conducted during a morning snack and playtime routine, and if Gabriel saw children playing with other, highly-preferred toys, he would make attempts to escape the session, or would attempt to throw objects to delay or pause the session. The standard mand trials

shared some similarities to the repair trials, so this may be an explanation as to why Gabriel showed such immediate proficiency in the repair phase. Essentially, this phase was almost identical to the Standard Mand trials with the exception of repair button activation. On the final Termination/Repair screen, participants were left with two choices: (a) to select "Oops! Not that one!" to repair, or (b) to select "Thank you," to end the trial. Since Standard Mand trials involved activating the "Thank you," button, it can be hypothesized that, by process of elimination, Gabriel was able to more readily access the repairs with little intervention from myself. Gabriel did not incur repair booster training, or a second phase of mixed probes because no decrease in repair responding was observed in the first phase of mix probes.

Both participants learned both the standard manding sequence and the communication repair sequence; however, it is not clear that both of them were able to conditionally discriminate the two when presented in random order. While Gabriel showed evidence of discriminating across all Mixed Probe trials, Damian's ability to discriminate the two conditions was not certain. While the boys both met inclusion criteria for participation in the current research, Gabriel presented with a more sophisticated verbal repertoire than Damian, which may have contributed to the differences in their respective data. In terms of social interactions, Gabriel seemed to be more socially aware than Damian and showed more strength in joint attention than Damian. For example, during Mixed Probe trials, Gabriel would watch my hands to see what item I reached for after the button after he initiated the request to determine, or anticipate, how to respond. For Damian, the communication had to be exaggerated beyond socially acceptable means before he began to show discrimination more

regularly. This information supports hypothesized prerequisite skills noted by Keen (2003) in that differences in communication repertoire with regard to joint attention can have significant effects on a child's ability to repair communication.

One important limitation to note is that communication repairs were not probed during baseline. Given the increased complexity of the mand repair over the standard mand, it could be hypothesized that if the child was not able to complete the entire standard mand sequence (i.e. the same sequence as the mand repair, but with fewer steps), that it would be highly unlikely that the communication repair was an existing part of the communicative repertoire. Additionally, assessment results showed that in conditions similar to baseline, both participants were least likely to attempt communication repair during the Wrong Response condition when compared to the other two conditions, so the argument can be made further that the skill was absent. Another limitation to note is the lack of follow up data to determine if the skills generalized over time. This would determine the lasting effects of the training that each of the participants underwent; however, school scheduling did not allow further generalization probes.

Further research should include conducting a supplementary RSAS with teachers after intervention to note if the teachers perceive improvements in the child's ability to repair after acquisition of the new skill. Another area of interest that future research should investigate is whether the child would generalize the use of the communication repair to the natural environment. Structured breakdown scenarios serve to provide many learning opportunities; however, the current study does not account for whether the children were able to use the repairs in their normal classroom routines. Additionally, the current study focused on intervention with regard to only one communication breakdown

scenario; however, deficits in repair responding were represented for all participants across all conditions in the previous studies. Future research should involve investigations in intervention packages that may be able to address each of the communication breakdown scenarios.

The aim of the current research was to determine if the information gathered from the previous two studies could serve to inform interventions for communication repair strategies to increase the use of communication repairs within a specific breakdown context while also probing to determine if participants would conditionally discriminate across two different training conditions. The results of the current study should be considered preliminary in terms of the effectiveness of these repair intervention methodologies, but do imply that it may be possible to target specific repair deficits and create an increase in repair responding for children with ASD that are minimally verbal.

CHAPTER 7

General Discussion

Summary of Thesis Aims

The specific research questions addressed in this thesis were as follows:

1. What response forms do teachers report being used by students with ASD to repair different types of communication breakdowns? (Chapter 4)
2. What response forms, if any, are observed to be used by the students in response to different types of structured communication breakdowns? (Chapter 5)
3. To what extent do the results of the indirect teacher reports correspond to the results of a structured observations?
4. Can children with ASD who are minimally verbal be taught to use a SGD to repair communication breakdowns? (Chapter 6)
5. Do children with ASD who are minimally verbal and who have been taught to use a SGD to repair communication breakdowns discriminate between a successful communication attempt and one that warrants the use of a communication repair response? (Chapter 6)

To address the first research question, an indirect assessment questionnaire was developed and used to solicit teachers' perceptions regarding their students' communication repair abilities. To address the second question, a direct assessment protocol was developed and implemented to identify what, if any, repair strategies the children would display when presented with a number of different breakdown scenarios. Upon completion of the two assessment approaches, and to address the third research question, the results of the indirect and direct assessment were compared to explore the

predictive validity, if any, of the indirect teacher questionnaire. For this, the direct assessment protocol was considered the standard against which to ascertain how well the questionnaire yielded information about the children's communication repairs. To address the final two research questions, the results from the direct assessment were then used to design interventions that aimed to teach discriminated use of a communication repair strategy under conditions were repair responding was least likely to occur.

Intervention occurred under a structured communication breakdown scenario where the child was given the wrong item after having first made a request for a highly preferred item. Once the child showed mastery in repairing the breakdown using the SGD, probes were conducted to determine if the child could discriminate between situations where a communication breakdown was present — and thus required the use of a communication repair— versus situations where the request was honoured, thus, not requiring repair.

Rationale for the Thesis Research

There is an expansive body of literature on teaching communication skills to children with ASD, who are also minimally verbal. This research includes studies on teaching the use of SGDs and other AAC modalities. However, it appears that this intervention research has rarely been based on a prior assessment of the children's existing communication repair responses and the conditions under which any existing communication forms are or are not likely to occur (Sigafoos et al., 2011). More specifically, studies into assessing existing communication repair strategies and teaching repair strategies in this population is limited (Dincer & Erbas, 2010; Meadan, Halle, Watkins, & Chadsey, 2006; Ohtake et al., 2005; van der Meer & Rispoli, 2010). As

mentioned in Chapter 2, estimates suggest that neurotypical children experience communication breakdowns during approximately one third of all of their communication attempts. Based on this, it would seem reasonable to argue children with ASD are perhaps even more likely to experience communication breakdowns given that communication impairment is a defining characteristic of ASD (Golinkoff, 1986; Keen 2003). In light of the risk of frequent communication breakdowns affecting children with ASD who are minimally verbal and the limited amount of literature in this area, there was an continues to remain, a critical need for further study into the assessment and intervention of communication repair strategies among children with ASD. Additionally, investigations by O'Neill and Topolovec (2001) have informed a range of expectations around the topographic makeup of repair repertoires of neurotypical 2-year-old children. These children comparatively show similar communication characteristics to children with autism who are minimally verbal. The findings of their investigations have influenced what could be viewed as developmentally appropriate intervention targets. These influences are evidenced within the overarching goal of expanding the repair repertoire to include topographies of repair strategies that are perhaps more readily interpreted by future and unfamiliar communication partners, similar to that of neurotypical peers. The present study aimed to extend existing research by exploring the predictive validity of an indirect assessment (compared to a direct assessment) and to evaluate the effects of a teaching programme aimed to teaching SGD use as a communication repair strategy.

Methodological Considerations

Study 1 involved an indirect, informant-based assessment of repair strategies in which teachers reported on the communication repair skills of a sample of children with ASD who were also minimally verbal. The strengths and potential advantages of this approach are time efficiency, ease of administration, and the amount of information yielded without direct observation of the target behaviors (Tarbox, 2009; Iwata et al., 2000). The limitations of indirect assessment approaches include the potential for bias leading to limited reliability across informants (Iwata et al., 2000). In the present Study 1, additional limitations included the lack of interobserver agreement and test-retest. IOA was not conducted for Study 1 due to scheduling conflicts that prevented an independent observer from being present during interviews in conjunction with limited scheduling availability of teachers. Additionally, test-retest reliability of the indirect assessment was not conducted with teachers to determine the reliability of responding over time. This oversight occurred due to time constraints resulting from quarterly school holidays and the time intensive nature of the direct assessment.

Study 2 involved the direct assessment of communication repair strategies by exposing the sample group to structured breakdown scenarios. The strengths and potential advantages of this approach include the ability to systematically manipulate variables to observe their effects on: a) children's ability to repair, and b) types of repair strategies actually used. Some potential limitations of the direct assessment approaches used in Study 2 include the assessment's time consuming and the potential for reinforcement of maladaptive forms of repairs, if present (Keen 2003; Keen 2005). The procedures of the direct assessment required that the child received the item 10 s after the

breakdown occurred, regardless of the topography of the repair. For children that used challenging topographies of behaviour in their communication repair, this may have served as reinforcement for the challenging forms of communication repair, in that access to highly preferred items were made available even if the repair response in use was challenging in nature. In Study 2, an additional limitation was the short amount of time provided to engage in repair responses. For children who did not repair within the time frame provided, it should not be assumed that they merely failed to repair communication, as it may be that the amount of time allotted was insufficient in allowing the child to produce a repair response. The amount of time given for the repair response in breakdown trials was similar to that of procedures described by Sigafoos et al. (2004) where repair probes involved a 10 s time delay to allow the participant to repair broken down communication.

Study 3 involved the evaluation of an intervention aimed at teaching two children to repair a communication breakdown using a SGD. Teaching occurred in the context of a breakdown in which the child made a request and was then given a mismatching (wrong) item. This context was selected as the teaching context because the results of the direct assessment indicated that these two participants were least likely to attempt to evoke communication repair in this condition. The strengths and potential advantages of this are that the systematic teaching procedures that were used to teach repair responding are nearly identical to procedures for teaching requesting sequences to children with ASD that have empirical support (Genc-Tosun & Kurt, 2017; van der Meer et al., 2013). Essentially, the procedures described in Study 3 already had empirical support regarding their effectiveness in teaching children with ASD how to make multiple-step requests.

The advantage of the empirical base is that these same procedures can be replicated for use in the classroom for trained staff. Additionally, the interventions in Study 3 were directly informed by the direct assessment conducted in Study 2, which suggests that the direct assessment results may be promising in informing communication repair interventions in future research. Limitations in Study 3 included a lack of repair probes in baseline conditions. Repair probes were not conducted because repair responses were considered to be more complex than the standard mand, so if standard mand responding was not achieved in baseline, it would be unlikely that correct repair responding would be part of the child's existing repertoire.

Additional limitations included a lack of data on the specific repair topographies for each child's initial mand and repair strategies; however, the focus of this study was not to determine the topography of repair that related to the communication breakdown, but to examine ways in which repair types, or classes, related to communication breakdowns.

One limitation of the existing repair literature is that previous assessments of repairs have typically happened within the context of the natural environment, which did not allow for systematic manipulations of variables. Essentially, natural environment observations do not provide adequate experimental control and may not be reflective of the repertoire as a whole. Using a naturalistic assessment approach could lead to a situation in which the strength of the repair skills is underestimated due to lack of opportunity, for example. The direct assessment methods used in Study 2 were created with the aim of providing structured communication breakdowns of varying types to determine if: (a) the child showed repair behaviours across three different breakdown

scenarios and (b) if the child showed variability in responding across the different breakdown scenarios. This type of information was seen as useful for informing interventions aimed at teaching repair strategies.

With regard to the actual structure of the direct assessment, the intent of the assessment was to create discrete trials that could be presented in rapid succession so the child was able to readily and regularly access their highly preferred items. This approach was intended to maintain the participants' buy-in and to ensure that the shortest duration of class time was taken from the student to maximize access to other daily learning opportunities. Lastly, the direct assessment was created to correspond to the indirect assessment. The indirect assessment posited questions that required teachers to consider the ways in which their students would respond under specific conditions, such as, what the child would do if he or she indicated they wanted a toy, but they were ignored, or given the wrong item, or asked for clarification by saying, "Huh? What was that?" In the direct assessment, trials were delivered in a very similar fashion to the way they were described in the indirect assessment. These methodological approaches allowed me to address one of the main purposes of this thesis, which was to compare the results of the indirect (RSAS) with the results of the direct assessment as a way of exploring the potential utility/predictive validity of the RSAS.

The indirect assessment tool (RSAS) was created to reflect other types of indirect assessment protocols that have been used to assess the function of problem behaviour of persons with developmental disabilities (Durand & Crimmins, 1992; Matson & Vollmer, 1995; Paclawskyj, Matson, Rush, Smalls, & Vollmer, 2000). These functional assessment tools were considered a useful model for the indirect assessment of repair strategies

because they have been reported to be highly favoured in the classroom setting when compared to direct methods because of their ease of use, and quickness of implementation (Floyd, Phaneuf, & Wilczynski, 2005; Tarbox, Wilke, Najdowski, Findel-Pyles, Balasanyan, Caveney, & Tia, 2009). The direct assessment procedures outlined in Study 2 were then developed to reflect the RSAS, in part, in conjunction with procedures used to assess repair strategies in prior research (e.g., Meadan et al., 2006). Meadan and colleagues, for example, exposed children to the same three breakdown conditions used in Study 2, however the aforementioned authors embedded the breakdowns into a naturalistic routine, and breakdowns were presented on an average of every third request made by the child. Study 2 sought to create the same pre-programmed breakdowns in a structured, discrete-trial format to ensure each participant had the same number and type of experiences with the different breakdown scenarios.

The teaching procedures involved in Study 3 of this thesis were based on procedures reported in previous studies as being successful in teaching SGD use to children with ASD who were also minimally verbal (Genc-Tosun & Kurt, 2017; van der Meer et al. 2013; Waddington, Sigafoos, Lancioni, O'Reilly, van der Meer, Carnett, & Marschik, 2014). More specifically, the intervention procedures described in Study 3 involved the following steps: (a) creating a need for a repair, (b) time delay, (c) graduated guidance, and (d) differential reinforcement. Creating the need for the repair was achieved by sabotaging the requesting sequence, or purposefully interjecting a predetermined communication breakdown after the child indicated their desire for the target item. Time delay is a response prompting procedure that calls for prompting directly after the discriminative stimulus, or cue is delivered, and is provided until the

child emits the targeted response (Morse & Schuster, 2004). It must be noted that discrete-trial formatting typically calls for highly structured procedures (Eikeseth, Smith, & Klintwall 2014), thus my use of a flexible time-delay deviates from the generally prescribed discrete-trial training formats. Flexibility was introduced to account for the varying levels of noise/distractions that are inevitable within the children's classroom environment. It was reasoned that such flexibility was required to ensure children always had ample opportunity to respond. Allowing flexibility within a natural classroom setting was viewed as preferable and more ecologically valid than creating a highly structured, distraction-free teaching environment. As the child showed independent responding, the prompts were faded or removed in presentations following independent target responses (Walker, 2007). The prompts used in conjunction with time delay procedures were identical to those of Genc-Tosun & Kurt, (2017) and involved graduated guidance, where prompting levels were intrusive (e.g., partial physical prompts) at the start of each teaching phase and prompting levels were faded and adjusted based on the child's responses over the course of each session. Lastly differential reinforcement was achieved by only reinforcing correct, independent responses rather than trials involving prompting and/or incorrect responses (Cooper, Heron, & Heward, 2007). More specifically, the child only got access to the desired item if, and only if, they independently completed the requesting sequence.

While Study 3 was limited to two participants, strength of the study was that it evaluated these procedures using a rigorous experimental design, that is the nonconcurrent multiple baseline design (Watson & Workman, 1981). This experimental design controls for a range of extraneous variables by ruling out historical exposure to

variables that may contribute an increase in target behaviour and can provide evidence as to whether or not introduction of the intervention was solely responsible for changes in the dependent variable (Campbell & Stanley, 1963; Cooper, Heron, Heward, 2007). As part of the design, discrimination was also tested. Specifically, after each child showed mastery of both the standard mand and the mand repair, the child was then exposed to probes where both types of trials were presented in random order to determine whether they would discriminate between situations where requests were met immediately versus requests that yielded a communication repair. This appears to be the first study to test for such a conditional discrimination. This is an advance because conditional responses may provide insights into how, or if, children with ASD who are minimally verbal are able to detect a communication breakdown. Keen (2003) raised this issue with respect to joint attention deficits, and argued that because these deficits are commonly associated with children with ASD that they may inherently have difficulties detecting communication breakdowns, which may inhibit their repair repertoires overall.

Main Findings

With regard to Study 1, teachers reported that the students would primarily rely on repetition to repair communication breakdowns. This finding is in general agreement with repair assessment literature that has shown a high rate of repetition for children who are minimally verbal (Brady et al., 1995; Dincer & Erbas, 2010; Keen, 2005). The results of Study 1 — when compared with Study 2 — suggest that RSAS generated useful information from teachers about the children's actual repair strategies. The results of Study 1 suggest that the teachers did seem to be able to accurately report on the primary repair strategy that their students were most likely to use as evidenced by the results of

Study 2. However, teachers did not to provide as accurate of reports on the range/variability of repair strategies that children were observed to use in Study 2. Indeed, it appears that the larger the child's repair repertoire, the less likely the teacher would be to identify the precise repair responses that a child was observed to use in the direct assessment. So, while the comparison of Study 1 and Study 2 results suggest that teachers can accurately report on their students' repair strategies, the present sample of teachers seemed to be less precise in reporting the range of the child's repair strategies.

The main findings of Study 2 suggested that the participating children appeared to attempt to repair communication breakdowns across a range of breakdown scenarios. This finding agrees with data from Meaden and Halle (2004). While the majority of repair responses were considered to be repetition, in line with the teacher reports from Study 1, it was also found that there was a range of strategies used and also some variation in the children's responding across different breakdown scenarios. Most repair responses were recorded for the request for clarification scenario when compared to the other two breakdown scenarios. This finding is consistent with previous research, which suggests that children with ASD are most likely to repair when they are asked for clarification. The fewest repair responses were noted in the wrong response scenario. That is, in Study 2, when a child was given an item not related to the item he or she had initially requested, then the child was less likely to attempt to make a repair when compared to the other two breakdown scenarios. Because the fewest repair responses occurred in the wrong response scenario, it was selected as the context for the intervention study (Study 3).

The main findings of Study 3 suggested that the two participating children learned to use a multi-step manding sequence on an SGD to repair communication breakdowns under the wrong response scenario. The results of this intervention study were, however, mixed with respect to the question of whether the intervention had also resulted in the children learning to discriminate instances in which a communication repair was required. Of the two participants, only one showed clear and consistent discrimination between opportunities where there had been a breakdown (and hence when a repair was necessary) and opportunities where there had not been a breakdown (and hence when a repair response was unnecessary). One explanation for these mixed findings may be that the participants had different levels of communicative skills. Keen et al., (2005) hypothesized that the ability to detect and repair a communication breakdown may be directly related to the degree to which the individual has sufficient communication skills related to the repair. While both boys met inclusion criteria for these studies, Gabriel's expressive language age equivalency was scored at 1 year 8 moths, while Damian's was scored at 9 months. These differences in expressive communication may explain the vast differences in results during repair probes, or why Damian required re-teaching of the skill and a second phase of repair probes as opposed to Gabriel who showed discrimination across all trials.

When considering the collective results of the three studies, there are several points to be made. Firstly, these children were often observed to repair communication breakdowns in ways that were also reported by teachers. While some ability to repair breakdowns could be said to have been present in the children's repertoires (based in the results of Study 2), it remains difficult to determine the degree with which each child was

able to detect the different types of communication breakdowns, and hence, their ability to discirminate that a repair was required. This might account for why the percentage of opportunities with an attempt to repair was relatively lower in the wrong response scenario of Study 2 compared to the other two scenarios. It was also found, in Study 2, that most children were observed to use the repetition strategy when they did attempt to repair a breakdown. While the repetition of the initial mand could be considered a form of communication repair, it is also possible that a breakdown had not actually been detected and instead the child was just repeating the initial mand due to the delay in reinforcement.

Secondly, from Study 1, it appeared that these teachers had, in the past, observed the children attempt to repair communication breakdowns often enough that they could accurately report on what the children would be most likely to do when confronted by different breakdown scenarios. Some explanations for this outcome can be made with consideration of the teacher's experience with each of their students. Teachers had been working with their respective students from one to nine years. This extensive experience with their students may have put them in a position of having observed the child under several breakdown conditions over time, and influenced confident, accurate responding of their repair responses. Considering the high rates of communication breakdowns that children with ASD encounter, it can be argued that teachers and their respective students had been exposed to countless communication breakdowns over the course of their time together. These variables may have contributed to the accuracy of responding in the RSAS.

Third, the direct assessment provided data on situations in which the children were least likely to repair. These data suggest that the child either did not detect the communication breakdown, or did not have the tools to repair communication in conditions where they were least likely to respond. This information was then used to influence intervention for both participants. The ways in which assessment data was used to inform intervention targets, along with the use of time delay, graduated guidance, and differential reinforcement procedures seem to have contributed to the success of the intervention, in that, both children achieved the communication repair at masterly levels.

Expansion of Existing Research

The three studies conducted in this thesis make new and important contributions to the existing literature in several ways. First, the thesis development work has resulted in what appears to be a promising new questionnaire (the RSAS) for undertaking an indirect, informant-based assessment of repair behaviour children with ASD who are minimally verbal. This is important as it may have positive practical implications for the classroom setting where practical and efficient assessment methodologies are required. Secondly, the direct assessment is the first structured assessment created that directly exposes children with ASD to different types of structured breakdown scenarios using discrete trials. This is an important advance in that it provides a more streamlined approach to assessing communication repairs that allows for control of variables that, otherwise, may be confounding to comparisons across children and sample groups. For example, the direct assessment in Study 2 had a specific number of breakdowns per session, with each of the three communication breakdowns presented equally. For each session, the total number of trials remained consistent; as did the amount of times each

communication breakdown occurred. From a practical standpoint, the prescriptive nature of this assessment structure may be easier to implement and track than attempting to embed communication breakdowns into a naturalistic routine as prescribed in procedures described by Meadan et al. (2008). The procedures in Meadan et al. (2008) also required that the implementer ensure that communication breakdowns were presented on an average of every 3 requests, which may be difficult to monitor in a naturalistic routine without the help of an additional observer, whereas the assessment outlined in this thesis allows the implementer to determine the order and types of trials presented prior to engaging with the child. Third, the information yielded from the comparison of the direct and indirect assessment methods appears to provide evidence that the RSAS may have some potential predictive validity for assessing communication repair strategies. Fourth, the interventions targeted at increasing communication repair strategies were the first derived from a structured, direct assessment of communication repair strategies. This is important as it allowed for empirical support in determining deficits in repair responding. Fifth, the mixed probes conducted within the intervention study appear to be the first investigation aimed at determining the degree to which children with ASD would come to discriminate when a communication repair was signaled versus not. This is an important advance in that discrimination probes like this can be used to inform if the child responds accordingly to discriminative stimuli associated with, or detects, the communication breakdown.

The main findings from this thesis are generally consistent with existing research in the assessment and teaching of communication repair strategies to children with DDs, including children with ASD who are minimally verbal (Alexander, 1997; Keen, 2005;

Martin et al., 2017; Meadan, Halle, Watkins and Chadsey, 2006; Dincer & Erbas, 2010; Ohtake et al., 2010, Sigafoos et al., 2004). One of the questions that this research was unsuccessful in determining is if children with ASD who are minimally verbal actually detected whether or not a communication breakdown has occurred. This was unclear primarily due to sample size. Only two participants went into intervention after the direct assessment was conducted, which is an inadequate sample size to determine trends in responding across participants. Future research into breakdown detection via conditional discrimination probes should be conducted with larger groups of children.

Explanation of Findings

Some hypotheses can be posited in attempt to explain some of the findings of this thesis. With regard to children being least likely to respond in the wrong response scenario of Study 2, it could be that the high rate of communication breakdowns in daily living has taught children with ASD to accept whatever is handed to them when they indicate a desire for an item. One of the considerations for this phenomenon is one of the key characteristics of ASD, which is an insistence on sameness. If a child has a penchant for asking for the same items repeatedly — like favourite snacks, toys, and activities — then it is likely that parents, teachers and caregivers will have to respond to those requests based on the availability of those snacks, toys, and activities in addition to preserving the child's health and safety. For example, if the child is indicating the desire for access to the school playground when it is raining, the teacher may be left with little choice but to attempt to encourage the child to play indoors. If the child indicates that they want to go to the playground repeatedly throughout the day, the teacher may be charged with continuing to provide the child with distractions. Implications for these types of natural

contingencies may serve to train children with ASD who are minimally verbal to accept whatever is given to them when requesting an item, rather than expecting correspondence with the original request.

Another consideration for these breakdown scenarios must be made with respect to the degree with which the child is able to communicate. If children communicate using primarily prelinguistic behaviours, communication partners will generally have to rely more on context clues to determine what the child is actually requesting. If a child approaches a pantry to indicate that they want a snack, for example, the communication partner might have to guess exactly what type of snack the child wants. In these instances, it may be that the communication partner often ends up giving the child the wrong item, and simultaneously extinguishes the request. It is possible that this unintentional withholding of reinforcement may decrease the child's likelihood to repair, or persist, in the acquisition of the desired item in the future. From this type of interaction the child may, over time, be conditioned to refrain from repairing communication and simply accept whatever response is given to their request.

With regard to the high use of repetition across most participants, which has previously been documented in previous research, (Alexander, 1997; Dincer & Erbas, 2010; Keen, 2005), a possible explanation could be that this strategy is the only viable option for the child due to having a limited response class, or range of communicative responses from which to draw upon. It can be argued that if a child has very few communicative behaviours to indicate their wants and needs, then their capacity to repair communication is likely to be equally limited. With regard to treatment, it should not be assumed that children with larger communication repertoires are more adept at

communication repairs than children with limited repertoires. Children who showed some vocal communication behaviors in Study 2 still relied quite heavily on repetition for their primary communication repair strategies. These children could be considered to have larger communicative repertoires than those who evoked no vocal speech, yet the results were still quite similar. It should also not be assumed that teaching children with limited communication a wide range of requests, or increasing the manding repertoire, will inherently have a positive effect on communication repairs as the detection of breakdowns is still uncertain. Standard mands, and mand repairs might be seen as functionally equivalent in the sense that they both would appear to function as a means to obtain a desired item/activity. On the other hand, it is also the case that standard or initial mands and repair mands could be seen as functionally independent or separate, distinct responses to some extent because they are occasioned (or triggered) by different contexts or discriminative stimuli. That is the initial mand in Study 3 was probably occasioned by the presence of a listener and preferred objects, whereas the repair mand might have been occasioned by the presence of a listener and preferred objects in addition to communication partner's wrong response.

While each of the children showed limited communicative performance, some differences in responding were noted across the children with respect to their individual communicative repertoires. Children who scored the lowest in pre-assessment showed the least variability in repair responding. Children who either had previous training in SGD use, or had some vocal verbal behaviour showed the highest degree of repair variability across participants. It seems as though there might be a relation between the size of the communication repertoire and the variability with which children repair communication.

With regard to the detection of the communication breakdown, the variables that contribute to successful detection are still uncertain, however, some variables of note should be considered. The two participants in the intervention study showed entirely different communication repertoires. Damian was a child that had previous, informal exposure to training with AAC, but showed no signs of an emerging verbal repertoire. Gabriel was a child that had the same limited AAC exposure, however, he showed signs of a budding vocal communication repertoire, as reported by his teacher. He was beginning to engage in more spontaneous speech, and was beginning to show an increase in his average utterances to up to 2 words at the end of the study. He was observed to echo phrases emitted from the speech-generating device during intervention sessions. These noted differences in the topography and development of each child's communicative repertoires may have influenced the child's ability to detect the communication breakdown. Gabriel seemed to anticipate the reciprocal nature of the communication exchange, in that he seemed to acknowledge the communication partner's role in the exchange. He was observed to be attentive to my hands after the communication breakdown was presented to determine the appropriate button to activate, and as the requesting sequence was being completed, he regularly made eye contact with me when, or after, activating the "Thank You" button in anticipation of the highly preferred item. In contrast, Damian seemed not to attend to me as a communication partner as much as he did the item(s) in question. He required large, animated movements in the presentation communication breakdown to draw is attention to me and seemed to respond in a seemingly rote fashion during each training phase, which may have impacted his ability to detect the communication breakdown. Damian's responses may

have been considered rote because he was not observed to attend to me or the items that were being handed to him during intervention trials while activating the buttons. It almost seemed like he was attending to the expected pattern of responding, rather than the role that the communication partner played in whether or not his request was met immediately. When considering these accounts of each of the participants, it can be argued that joint attention in addition to the sophistication of the communication repertoire can affect the degree to which a child is able to detect communication breakdowns.

Limitations

The indirect assessment was limited in that only one interviewee was available for each child, which did not allow for comparisons across different teachers. Thus inter-informant agreement on the indirect questionnaire could not be checked. While this is a limitation with regard to the reliability of the teacher's reports, it must be noted that the primary goal of the indirect assessment was to determine the predictive validity of the assessment, rather than the degree to which several different individuals agree on the child's skill set. It was stated in Chapter 6 that one of the main limitations of indirect assessment is that results do not always show agreement across interviewees, so the focus on predictive validity to the direct assessment was considered of utmost importance, which is why Study 1 was followed by direct assessment in Study 2. A second limitation to note is that there were no re-test reliability checks for the RSAS or the direct assessment. Conducting such checks would have provided data on the stability of the children's repair strategies over time. Future research would be improved by including checks of inter-informant and test-retest reliability. A third limitation to cite with regard

to the indirect assessment was that the teachers were informants for multiple children. This may influence or introduced a response set bias, in that teachers may have overgeneralized responses used for one child's assessment to the rest of their respective sample, which may have contributed to the notably consistent reports of repetitions as a likely communication repair form. Lastly, no statistical analysis was made to determine how significant the differences were between RSAS results and the direct assessment. One of the reasons these analyses were not made was that the RSAS probed for repairs across 4 static items: (a) food/snacks, (b), toys, (c) activities, and (d) attention. The direct assessment did not allow for a direct reflection of the RSAS because not all of the children were reported to find all of those scenarios highly reinforcing. For example, one of the targets in the RSAS was to identify potential repairs while requesting a snack. Damian was a child that was reported to enjoy snacks, like chocolate biscuits, and was reported to have little food selectivity, however Ed was reported to be highly selective about the foods he ate, so the use of snacks in the assessment for Ed may have been abative to repair responding.

With regard to Study 2, some limitations are of note. Firstly, the response time allowed for each of the students was only 10 s. This limitation is of note because in scenarios where children did not produce an observable repair, it is possible that lack of responding was due to a possibly inadequate amount of time to respond. While this is a possibility, it also must be considered that in both the ignore and request for clarification conditions that trials involving no repairs were far lower than that of the wrong response condition, so it could also be argued that if this amount of time was entirely inadequate, then there may be a higher rate of failure to respond across all conditions. A second

limitation must be noted with the discrete trial structure of the direct assessment. While this structure provided control in terms of the distribution of breakdown exposures for each child per session, this approach is not necessarily reflective of responding in the natural environment. Future research would benefit for comparisons of results from natural environment assessments to structured assessments as described in this thesis.

A glaring limitation of note for Study 3 is the very small participant pool. Only two participants were involved, so the results of this study should not be considered reflective of the community of children with ASD who are minimally verbal. Additionally, no follow up data were collected to determine if the children maintained the skills over time, and no generalization sessions were conducted to determine if the skills would be utilized to acquire other, highly preferred items. Another limitation of this study is that it sought to teach communication repairs within the context of a single breakdown scenario. Teaching repair responses in the wrong response scenario did not prompt generalization of the skill to other breakdown scenarios, as the target response was specific to receiving the wrong item. Lastly, there was an absence of repair probes during baseline. The skill was not probed due to the assumption that if the child did not produce the standard mand response, that it would be unlikely that they would produce the repair response. Repair responses could be considered to be more complex than the standard mand in that it had more steps and required detection of the relevant discriminative stimulus, or communication breakdown.

Implications

While the promising results of the comparison of the indirect and direct assessment should be seen as preliminary, further research into predictive validity has the

potential to determine the extent to which the RSAS might be a useful tool for assessing communication repairs in children with DDs, including children with ASD who are also described as minimally verbal. Still, based on the present results, it seems that one possible approach would be to use both an indirect and direct assessment approach as predictive validity of the indirect assessment is not finite, and variables affecting outcomes of the indirect assessment have yet to be addressed.

The results of Study 3 suggest that the intervention procedures were successful in teaching two children with ASD to repair communication breakdowns when those breakdowns involved receiving the wrong item. The approach in teaching a standard mand before teaching the repair sequence seemed to be a logical sequence for the intervention. Indeed, the SGD-based repair response was acquired with fewer trials than standard mands for each participant in intervention (Study 3), so sit appears that the initial mand training may have facilitated responding the later repair training. This can be attributed to the stark similarity in the sequences for both types of responses, where both response sequences were identical, except for the repair response. Both children initiated the mand with the iPad in all repair trials and in all mixed probes, and subsequently repaired communication using the iPad as well, so it can be assumed that repair responses were not under control of the presence of the SGD. These responses were also considered to be modifications, as they had some topographical similarities, with aspects of the repair being different to the initial mand. Similar findings were reported in a study conducted by Sigafoos et al., (2004) where participants were observed to use prelinguistic behaviours in addition to activation of the SGD as their initial mand. This suggests that

one possible approach for developing effective repair skills in such children would be to follow a similar training sequence.

Some methodological improvements must also be noted and recommended for future research. First, it is recommended that the first step in any such assessment and intervention work should be a detailed assessment of the child's preferences to identify reinforcing items that they can later request. This would also allow the implementer to build rapport with the child as well as assist in identifying items that the child found highly motivating enough to cause communicative persistence in the face of a breakdown. Using a more direct, systematic preference assessment is more time consuming than the interviews used to determine highly preferred items used in the present thesis, however, the systematic approach may have been more effective in ensuring the identification of reinforcing stimuli for the children to request. With regard to the intervention conducted (Study 3), repair probes should be conducted in the baseline phase to determine the absence of the skill, rather than assuming that the skill is not present based on the absence of the standard mand.

Future Research

Future research should investigate differences in assessment scores before and after intervention has been conducted. These results could be used to determine if teachers see improvements in responding after intervention has been completed and to determine the stability of the assessment over time. This information could be useful in determining observable differences in responding while also establishing that assessment results can, or should, remain stable over time. Additionally, inter-rater agreement should

be investigated with regard to questionnaire to provide information on the assessment's reliability.

The intervention component of this thesis examined the improvement of repair responding within a single communication breakdown context. Future research should consider investigating the improvement of repair skills across different breakdown contexts, and also examine variables that might influence performance across breakdowns. More specifically, investigations should be conducted with the focus of targeting multiple breakdowns rather than isolated breakdowns. Existing research has already indicated that several factors may influence repair deficits in children with ASD such as, deficits in joint attention, low communicative intent, and/or the size of the communication repertoire prior to intervention (Keen, 2003; Wetherby, Alexander, & Prizant, 1998), so further research should investigate groups of children with common deficits and compare assessment results. For instance, children with varying degrees of joint attention should undergo direct assessment to determine ways in which they repair. The same can be suggested for children with varying degrees of communicative intent and communicative repertoires to determine if any of those variables might influence the probability with which children are likely to respond to different breakdown scenarios. Another area for future research should include investigations into the degree with which repair strategies generalise across communication breakdown scenarios, or if detection of communication breakdowns generalises across different types of breakdowns.

Gabriel began to echo the synthetic speech output during the requesting sequences in the intervention (Study 3) and intermittently began to say the phrases even before he

activated the buttons. Future research should investigate increases in vocal speech for children who show signs of an increasing vocal repertoire.

Another consideration for future research pertains to the assessment of repair repertoires. Comparative studies exploring repair responding in the natural environment versus contrived assessment scenarios might offer useful information about how realistic and representative repair responding is when assessed in a more structured, discrete-trial format. While Study 2 did seem to yield reliable data on the types of repair responses used by each child, the context was comprised of relatively contrived scenarios conducted in a discrete-trial format. It might therefore be useful to determine if the same responses observed would occur under more real-world breakdown scenarios. For this, procedures would need to be developed to undertake assessments of repairs in response to more naturally occurring communication breakdowns. Essentially, the issue is one of the relative outcomes from contrived versus more natural assessment contexts.

In addition, future research could investigate the effectiveness of using more naturalistic approaches for teaching communication repair strategies in comparison to the clinically structured session approach adopted in the present intervention work. Naturalistic approaches might offer the advantage of being more easily incorporated into the typical classroom environment. While the 20 min training sessions used in the present thesis were not logistically difficult in these special education classrooms, in some cases it may be difficult to implement 20 min, one-to-one training sessions in general education/inclusive classroom environments. Adopting a more naturalistic teaching approach for repair responding may allow teachers to conduct assessment and

intervention in more accessible small group format during typical classroom-based learning opportunities.

Lastly, future research should investigate repair responding in children with high rates of challenging behaviour as existing research has suggested that children with ASD who are minimally verbal often use challenging behaviour in an attempt to repair communication breakdowns (Keen, 2005; Meadan, Halle, Watkins, and Chadsey, 2006). Only two of the participants in Study 2 showed repairs with problematic topographies. As noted in the limitations of that study, termination criteria were developed that prevented children with high rates of challenging behaviour to participate in the direct assessment so these results may be an underrepresentation of how often problematic repairs occur in children who are minimally verbal. These investigations should aim to determine whether it is the case that when challenging behaviours exist, the child uses challenging topographies over other, more socially acceptable forms of prelinguistic behaviour to repair communication breakdowns.

Conclusion

This thesis aimed to investigate the repair strategies in children with ASD who were minimally verbal via an indirect questionnaire-style assessment conducted with teachers, in addition to a direct assessment conducted with each child, individually. This thesis also aimed to use assessment results to determine the need for intervention targeted at improving repair strategies within a specific breakdown context while also probing to determine whether the children came to discriminate when it was necessary to attempt a repair versus when it was not. Overall, the methodologies applied to investigating the research questions presented in this thesis have been largely successful in answering

these questions. The questions that were addressed in part, with some uncertainty, have at least provided a structure for future research and more in-depth investigations.

The findings in this thesis have significant importance as they have empirically and systematically investigated the ways in which a convenience sample of children with ASD responded to communication breakdowns, which are a commonly occurring situation in daily communication interactions, and can affect the ways in which children persist, or not, in repairing communication. Factors, like communication breakdowns, that play such a significant role in how communication is shaped in children with ASD, should take precedence in communication interventions as they simply beg the question: What happens when communication does not work? Given that communication breakdowns happen so frequently, the extent to which a child can repair can impact the overall effectiveness of the child's communication attempts.

References

Alberto, P. A., & Troutman, A. C. (2013). *Applied behavior analysis for teachers. 6th*. Prentice Hall.

Alexander, D. (1994). *The emergence of repair strategies in chronologically and developmentally young children*. Unpublished dissertation, Florida State University, Tallahassee.

Alexander, D., Wetherby, A., & Prizant, B. (1997). The Emergence of Repair Strategies in Infants and Toddlers. *Seminars in Speech and Language, 18*(03), 197-212. doi:10.1055/s-2008-1064073

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed., text revision). Washington DC: Author.

Ando, H., & Yoshimura, I. (1979*).* Comprehension skill levels and prevalence of maladaptive behaviors in autistic and mentally retarded children. *Child Psychiatry and Human Development, 9*, 131–136. doi: 10.1007/bf01433475

Asperger, H. (1944). Die autistischen psychopathen im kindesalter. *Archiv fur Psychiatrie und Nervenkrankheiten, 117*, 76-136. doi: 10.1007/bf01837709

Baer, D. M. (1982). The imposition of structure on behavior and the demolition of Behaviour structures. In H. E. Howe (Ed.), *Nebraska Symposium on Motivation* (pp. 217-254). Lincoln, NE: University of Nebraska Press.

Baghdadli, A., Grisi, C., & Aussillloux, C. (2003). Risk factors for self-injurious behaviors among 222 young children with autistic disorders. *Journal of Intellectual Disability Research, 47*, 622–627. doi: 10.1046/j.1365-2788.2003.00507.x

Bacso, S., & Nilsen, E. (2017). What's that you're saying? Children with better executive functioning produce and repair communication more effectively. *Journal of Cognition and Development, 18*(4), 441-464.

Bates, E. (1976). *Language and context: the acquisition of pragmatics*. New York: Academic Press.

Beukelman, D., & Mirenda, P. (2005). *Augmentative and alternative communication: Supporting children and adults with complex communication needs* (3rd ed.). Baltimore: Paul H. Brookes Publishing Co.

Bodfish, J. W., Symons, F. J., Parker, D. E., & Lewis, M. H. (2000). Varieties of repetitive behavior in autism: Comparisons to mental retardation. *Journal of autism and developmental disorders*, *30*(3), 237-243. doi: 0162-3257/00/0600-0237$18.00/0

Bondy, A. S., & Frost, L. A. (1994). The picture exchange communication system. *Focus on Autistic Behavior*, *9*, 1-19. doi:10.1177/108835769400900301

Bondy, A., & Frost, L. (2001). The picture exchange communication system. *Behavior Modification, 25*(5), 725-744. doi:10.1177/0145445501255004

Bondy, A., Tincani, M., & Frost, L. (2004). Multiply controlled verbal operants: An analysis and extension to the Picture Exchange Communication System. *The Behavior Analyst*, *27*, 247-261. doi: 10.1007/bf03393184

Boyle, C., Boulet, S., Schieve, L., Cohen, R., Blumberg, S., Yeargin-Allsopp, M., Kogan, M. (2011). Trends in the prevalence of developmental disabilities in US children, 1997-2008. *Pediatrics, 127*, 1034-1042. doi:10.1016/j.yped.2012.03.006

Bloom, L., & Tinker, E. (2001). *The Internationality Model and Language Acquisition: Engagement, Effort, and the Essential Tension in Development*. Blackwell.

Brady, N. C., & Halle, J. W. (2002). Breakdowns and repairs in conversations between beginning AAC users and their partners. *Exemplary practices for beginning communicators: Implications for AAC*, 323-351.

Brady, N. C., Steeples, T., & Fleming, K. (2005). Effects of prelinguistic communication levels on initiation and repair of communication in children with disabilities. *Journal of Speech, Language, and Hearing Research*, *48*(5), 1098-1113.

Brady, N. C., Mclean, J. E., Mclean, L. K., & Johnston, S. (1995). Initiation and repair of intentional communication acts by adults with severe to profound cognitive disabilities. *Journal of Speech Language and Hearing Research, 38*(6), 1334. doi:10.1044/jshr.3806.1334

Brinton, B., Fujiki, M., Loeb, D. F., & Winkler, E. (1986). Development of conversational repair strategies in response to requests for clarification. *Journal of Speech Language and Hearing Research, 29*(1), 75. doi:10.1044/jshr.2901.75

Broidy, L. M., Nagin, D. S., Tremblay, R. E., Bates, J. E., Brame, B., Dodge, K. A., Vitaro, F. (2003). Developmental trajectories of childhood disruptive behaviours and adolescent delinquency: A six-site, cross-national study. *Developmental Psychology, 39*(2), 222-245. doi:10.1037//0012-1649.39.2.222

Bruner, J. S. (1975). The ontogenesis of speech acts. *Journal of Child Language*, *2*(1), 1-19. doi:10.1017/s0305000900000866

Bushbacher, P. W., & Fox, L. (2003). Understanding and intervening with challenging behavior of young children with autism spectrum disorder. *Language, Speech, and Hearing Services in Schools*, *34*, 217–227. doi:10.1044/0161-1461(2003/018)

Calculator, S. N., & Delaney, D. (1986). Comparison of nonspeaking and speaking mentally retarded adults' clarification strategies. *Journal of Speech and Hearing Disorders*, *51*(3), 252-259.

Campbell D. and Stanley J. (1963) Experimental and quasi-experimental designs for research. Rand McNally & Co., Chicago.

Carr, E. G. (1977). The motivation of self-injurious behavior: a review of some hypotheses. *Psychological bulletin*, *84*(4), 800.

Carr, E. G. (1988). Functional equivalence as a mechanism of response generalization. In R. Horner, R. Koegel, & G. Dunlap (Eds.), Generalization and maintenance: Life-style changes in applied settings (p. 221-241). Baltimore: Paul H. Brookes.

Carr, E. G., Binkoff, J. A., Kologinsky, E., & Eddy, M. (1978). Acquisition of sign language by autistic children. I: Expressive labelling. *Journal of Applied Behavior Analysis*, *11*, 489–501.

Carr, E. G., & Durand, V. M. (1985). Reducing behavior problems through functional communication training. *Journal of applied behavior analysis*, *18*(2), 111-126.

Carr, E. G., Kologinsky, E., & Leff-Simon, S. (1987). Acquisition of sign language by autistic children. III: Generalized descriptive phrases. *Journal of Autism & Developmental Disorders, 17*, 217–229. doi:10.1007/BF01495057

Catania, A. C. (1998). The taxonomy of verbal behavior. In *Handbook of research methods in human operant behavior*(pp. 405-433). Springer, Boston, MA.

Centers for Disease Control and Prevention. (2015). Autism Spectrum Disorder (ASD) 2015. Retrieved from http://www.cdc.gov/ncbddd/autism/index.html

Chiang, C. H., Soong, W. T., Lin, T. L., & Rogers, S. J. (2008). Nonverbal communication skills in young children with autism. *Journal of autism and developmental disorders*, *38*(10), 1898.

Coggins, T. E., Olswang, L. B., & Guthrie, J. (1987). Assessing communicative intents in young children. *Journal of Speech and Hearing Disorders*, *52*(1), 44. doi:10.1044/jshd.5201.44

Cooper, J. O., Heron, T. E., & Heward, W. L. (2007) *Applied behavior Analysis.* Upper Saddle River, N.J: Pearson/Merrill-Prentice Hall,

Cunningham, A. B., & Schreibman, L. (2008). Stereotypy in autism: The importance of function. *Research in Autism Spectrum Disorders*, 2(3), 469–479. http://doi.org/10.1016/j.rasd.2007.09.006Developmental Disabilities Assistance and Bill of Rights Act of 2000, Pub. L. No. 106-402, C.F.R. (2000).

Dincer, B., & Erbas, D. (2010). Description of communication breakdown repair strategies produced by nonverbal students with developmental disabilities. *Education and Training in Autism and Developmental Disabilities*, 45(3), 400-409. Retrieved from http://www.jstor.org/stable/23880113

Durand, V. M. (1993). Problem behaviour as communication. *Behaviour Change*, *10*(4), 197-207. doi:10.1017/S0813483900005301

Durand, V. M. (1999). Functional communication training using assistive devices: recruiting natural communities of reinforcement. Journal of Applied Behavior Analysis, 32(3), 247–267. http://doi.org/10.1901/jaba.1999.32-247

Durand, V. M., & Carr, E. G. (1987). Social influences on "self-stimulatory" behavior: analysis and treatment application. Journal of Applied Behavior Analysis, 20(2), 119–132. http://doi.org/10.1901/jaba.1987.20-119

Durand, V. M., & Carr, E. G. (1991). Functional communication training to reduce challenging behavior: Maintenance and application in new settings. *Journal of Applied Behavior Analysis, 24*(2), 251-264

Durand, V. M., & Moskowitz, L. (2015). Functional communication training: Thirty years of treating challenging behavior. *Topics in Early Childhood Special Education, 35*(2), 116-126

Duerden, E., Oakley, H., Mak-Fan, K., McGrath, P., Taylor, M., et al. (2012). Risk factors associated with self-injurious behaviors in children and adolescents with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 42*, 2460–2470.

Dunn, L. M., & Dunn, L. M. (1997). *PPVT-III: Peabody picture vocabulary test*. American Guidance Service. doi:10.1007/springerreference_184274

Durand, V. M., & Crimmins, D. B. (1988). Identifying the variables maintaining self-injurious behavior. *Journal of Autism and Developmental Disorders, 18*(1), 99-117.

Durand, V. M., & Crimmins, D. B. (1988). The motivation assessment scale. *Dictionary of Behavioral Assessment Techniques*, 309-310.

Durand, V. M., & Moskowitz, L. (2015). Functional communication training: Thirty years of treating challenging behavior. *Topics in Early Childhood Special Education, 35*(2), 116-126. https://doi.org/10.1177/0271121415569509

Eikeseth, S., Smith, D. P., Klintwall, L. (2014). Discrete trial teaching and discrimination training. In J. Tarbox, D. Dixon, P. Sturmey, & J. Matson (Eds). *Handbook of Early Intervention for Autism Spectrum Disorders Research, Policy, and Practice* (pp.229-254). New York, NY: Springer.

Emerson, E., & Bromley, J. (1995). The form and function of challenging behaviors. *Journal Of Intellectual Disability Research, 39*, 388-398. http://dx.doi.org/10.1111/j.1365-2788.1995.tb00543.x

Falcomata, T. S., Wacker, D. P., Ringdahl, J. E., Vinquist, K., & Dutt, A. (2013). An evaluation of generalization of mands during functional communication training. *Journal of Applied Behavior Analysis, 46*, 444–454. doi:10.1002/jaba.37

Farmer, C. A., & Aman, M. G. (2011). Aggressive behavior in a sample of children with autism spectrum disorders. *Research in Autism Spectrum Disorders*, *5*(1), 317-323. doi:10.1177/1362361313518995

Fee, V. E., & Matson, J. L. (1992). Definition, classification, and taxonomy. In J. K. Luiselli, J. L. Matson, & N. N. Singh (Eds.), *Self-injurious behavior: Analysis, assessment, and treatment* (pp. 3-20). New York: Springer.

Floyd, R. G., Phaneuf, R. L., & Wilczynski, S. M. (2005). Measurement properties of indirect assessment methods for functional behavioral assessment: A review of research. *School Psychology Review*, *34*(1), 58-73.

Freeman, R. D., Soltanifar, A., & Baer, S. (2010). Stereotypic movement disorder: Easily missed. *Developmental Medicine & Child Neurology, 52*(8), 733-738. doi:10.1111/j.1469-8749.2010.03627.x

Gallagher, T. M., & Darnton, B. A. (1978). Conversational Aspects of the Speech of Language-Disordered Children: Revision Behaviors. *Journal of Speech Language and Hearing Research, 21*(1), 118. doi:10.1044/jshr.2101.118

Ganz, J. B., Earles-Vollrath, T. L., Heath, A. K., Parker, R. I., Rispoli, M. J., & Duran, J. B. (2012). A meta-analysis of single case research studies on aided augmentative and alternative communication systems with individuals with autism spectrum disorders. *Journal Of Autism And Developmental Disorders, 42*(1), 60-74. doi:10.1016/j.ridd.2011.09.023

Ganz, J. B., Rispoli, M. J., Mason, R. A., & Hong, E. R. (2014). Moderation of effects of AAC based on setting and types of aided AAC on outcome variables: An aggregate study of single-case research with individuals with ASD. *Developmental Neurorehabilitation, 17*(3), 184-192. doi:10.3109/17518423.2012.748097

Ganz, J. (2015). AAC Interventions for Individuals with Autism Spectrum Disorders: State of the Science and Future Research Directions. *Augmentative and Alternative Communication, 31*(3), 203-214.

Genc-Tosun, D., & Kurt, O. (2017). Teaching multi-step requesting to children with autism spectrum disorder using systematic instruction and a speech-generating device. *Augmentative and Alternative Communication, 33*(4), 213-223. doi:10.1080/07434618.2017.1378717

Gendreau, P. L., & Archer, J., (2005). Subtypes of aggression in humans and animals. *Developmental origins of aggression*, 25-46.

Gillham JE, Carter AS, Volkmar FR, Sparrow SS. Toward a developmental operational definition of autism. *Journal of Autism and Developmental Disorders.* 2000;30:269–278.

Goldman, S., Wang, C., Salgado, M. W., Greene, P. E., Kim, M., & Rapin, I. (2009). Motor stereotypies in children with autism and other developmental disorders. *Developmental Medicine & Child Neurology*, *51*(1), 30-38. doi: 10.1111/j.1469-8749.2008.03178.x.

Golinkoff, R. M. (1986). 'I beg your pardon?': the preverbal negotiation of failed messages. *Journal of Child Language*, *13*(3), 455-476.

Grzadzinski, R., Huerta, M., & Lord, C. (2013). DSM-5 and autism spectrum disorders (ASDs): An opportunity for identifying ASD subtypes. *Molecular Autism*, *4*(1), 12. doi:10.1186/2040-2392-4-12

Halle, J., Brady, N. C., & Drasgow, E. (2004). Enhancing socially adaptive communicative repairs of beginning communicators with disabilities. *American Journal of Speech-Language Pathology*, *13*(1), 43-54. DOI: 10.1044/1058-0360(2004/006)

Hastings, R. P., & Brown, T. (2002). Behavior problems of children with autism, parental self-efficacy, and mental health. *American Journal on Mental Retardation*, *107*, 222–232. http://dx.doi.org/10.1352/08958017(2002)107<0222:BPOCWA>2.0.CO;2

Hinerman, P. S., Jenson,W. R.,Walker, G. R., & Petersen, P. B. (1982). Positive practice overcorrection combined with additional procedures to teach signed words to an autistic child. *Journal of Autism and Developmental Disorders, 12*, 253–263.

Holden, Borge, & Gitlesen, Jens Petter. (2006). A total population study of challenging behaviour in the county of Hedmark, Norway: Prevalence, and risk markers. *Research in Developmental Disabilities, 27*(4), 456-465. Doi:10.1016/j.ridd.2005.06.001.

Houghton, J., Bronicki, G. B., & Guess, D. (1987). Opportunities to express preferences and make choices among students with severe disabilities in classroom settings. *Journal of the Association for Persons with Severe Handicaps, 12*(1), 18-27.

Iacono, T. A., Waring, R. E., & Chan, J. B. (1996). Sampling communicative behaviours in children with intellectual disability in structured and unstructured situations. *International Journal of Language & Communication Disorders, 31*(2), 106-120. doi:10.3109/13682829609042215

Iwata, B. A., Dorsey, M. F., Slifer, K. J., Bauman, K. E., & Richman, G. S. (1994). Toward a functional analysis of self-injury. *Journal of Applied Behavior Analysis, 27*(2), 197-209. doi:10.1901/jaba.1994.27-197

Iwata, B. A., Vollmer, T. R., & Zarcone, J. R. (1990). The experimental (functional) analysis of behavior disorders: Methodology, applications, and limitations. In A. C. Repp & N. N. Singh (Eds.), *Perspectives on the use of nonaversive and aversive interventions for persons with developmental disabilities* (pp. 301-330). Sycamore, IL, US: Sycamore Publishing Company.

Iwata, B. A., Wallace, M. D., Kahng, S. W., Lindberg, J. S., Roscoe, E. M., Conners, J., Worsdell, A. S. (2000). Skill acquisition in the implementation of functional analysis methodology. *Journal of Applied Behavior Analysis, 33*(2), 181-194. doi:10.1901/jaba.2000.33-181

Jones, R. S. (1987). The relationship between stereotyped and self-injurious behaviour. *British Journal of Medical Psychology*, *60*(3), 287-289. https://doi.org/10.1111/j.2044-8341.1987.tb02744.x

Kanner, L. (1943). Autistic disturbances of affective contact. *Nervous Child, 2*, 217- 250. doi:10.1017/s003329170001727x

Kasari, C., Brady, N., Lord, C., & Tager-Flusberg, H. (2013). Assessing the minimally verbal school aged child with autism spectrum disorder. *Autism Research, 6*(6), 479-493. doi:10.1002/aur.1334

Kee, S. B., Casey, L. B., Cea, C. R., Bicard, D. F., & Bicard, S. E. (2012). Increasing communication skills: A case study of a man with autism spectrum disorder and vision loss. *Journal ofVisual Impairment & Blindness, 106*, 120–125.

Keen, D. (2003). Communicative repair strategies and problem behaviours of children with autism. *International Journal of Disability, Development and Education*, *50*(1), 53-64. http://dx.doi.org/10.1080/1034912032000053331

Kjellmer, L., Hedvall, Å., Fernell, E., Gillberg, C., & Norrelgen, F. (2012). Language and communication skills in preschool children with autism spectrum disorders: Contribution of cognition, severity of autism symptoms, and adaptive functioning to the variability. *Research in Developmental Disabilities*, *33*(1), 172-180. doi:10.1016/j.ridd.2011.09.003

Koegel, R. L., & Covert, A. (1972). The relationship of self-stimulation to learning in autistic children. *Journal of Applied Behavior Analysis, 5*(4), 381-387. doi: 10.1901/jaba.1972.5-381

Lai, M.C., Lombardo, M.V., Baron-Cohen, S. (2014). Autism. *Lancet, 383,* 896-910. doi:10.1016/s0140-6736(13)61539-1

Lalli, J. S., Mace, F. C., Wohn, T., & Livezey, K. (1995). Identification and modification of a response- class hierarchy. *Journal of Applied Behavior Analysis, 28*(4), 551-559. doi:10.1901/jaba.1995.28-551

Lancioni, G., O'Reilly, M., Cuvo, A., Singh, N., Sigafoos, J., & Didden, R. (2007). PECS and VOCAs to enable students with developmental disabilities to make requests: An overview of the literature. *Research in Developmental Disabilities, 28*(5), 468-488. doi:10.1016/j.ridd.2006.06.003

Lecavalier, L. (2006). Behavioral and emotional problems in young people with pervasive developmental disorders: Relative prevalence, effects of subject characteristics, and empirical classification. *Journal of Autism and Developmental disorders, 36*(8), 1101-1114. doi:10.1007/s10803-006-0147-5

Libby, M. E., Weiss, J. S., Bancroft, S., & Ahearn, W. H. (2008). A Comparison of Most-to-Least and Least-to-Most Prompting on the Acquisition of Solitary Play Skills. *Behavior Analysis in Practice, 1*(1), 37–43. http://doi.org/10.1007/BF03391719

Liszkowski, U., Albrecht, K., Carpenter, M., & Tomasello, M. (2008). Infants' visual and auditory communication when a partner is or is not visually attending. *Infant*

Behavior & Development, 31(2), 157-167.

Lorah, E. R., Parnell, A., Whitby, P. S., & Hantula, D. (2015). A systematic review of tablet computers and portable media players as speech generating devices for individuals with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *45*(12), 3792-3804. doi:10.1007/s10803-014-2314-4

Lord, C., Luyster, R., Gotham, K., & Guthrie, W. (2012). Autism Diagnostic Observation Schedule–Toddler Module. *Los Angeles: Western Psychological Services*.

Martin, G. E., Barstein, J., Hornickel, J., Matherly, S., Durante, G., & Losh, M. (2017). Signaling of noncomprehension in communication breakdowns in fragile X syndrome, Down syndrome, and autism spectrum disorder. *Journal of communication disorders*, *65*, 22-34. doi:10.1016/j.jcomdis.2017.01.003

Matson, Johnny L. (2012). *Functional Assessment for Challenging Behaviors*(Autism and Child Psychopathology Series). New York: Springer.

Matson, J., Fodstad, J., Mahan, S., & Rojahn, J. (2010). Cut-offs, norms and patterns of problem behaviours in children with developmental disabilities on the baby and infant screen for children with autism traits (BISCUIT-Part 3). *Developmental Neurorehabilitation, 2010, 13(1),* 3-9. doi: 10.3109/17518420903074887

Matson, J. L., & Kozlowski, A. M. (2011). The increasing prevalence of autism spectrum disorders. *Research in Autism Spectrum Disorders*, *5*(1), 418-425. doi:10.1016/j.rasd.2010.06.004

Matson, Johnny L., Sipes, Megan, Horovitz, Max, Worley, Julie A., Shoemaker, Mary E., & Kozlowski, Alison M. (2011). Behaviors and corresponding functions addressed via functional assessment. *Research in Developmental Disabilities: A Multidisciplinary Journal, 32*(2), 625-629. doi:10.1016/j.ridd.2010.12.011

Matson, J. L., & Minshawi, N. F. (2006). *Early intervention for autism spectrum disorders: A critical analysis*. Oxford, UK: Elsevier.

Matson, J. L., & Vollmer, T. R. (1995). User's guide: Questions about behavioral function (QABF). *Baton Rouge, LA: Scientific Publishers*.

McLay, L., Meer, L., Schäfer, M., Couper, C., McKenzie, M., O'Reilly, L., . . . Sutherland, E. (2015). Comparing Acquisition, Generalization, Maintenance, and Preference Across Three AAC Options in Four Children with Autism Spectrum Disorder. *Journal of Developmental and Physical Disabilities, 27*(3), 323-339.

Meadan, H., & Halle, J. W. (2004). Communication repair and response classes. *The Behavior Analyst Today, 5*(3), 291-303. doi:10.1037/h0100034

Meadan, H., Halle, J. W., Watkins, R. V., & Chadsey, J. G. (2006). Examining communication repairs of 2 young children with autism spectrum disorder: The influence of the environment. *American Journal of Speech-Language Pathology, 15*(1), 57-71. doi:10.1044/1058-0360(2006/007)

Millar, D. C., Light, J. C., & Schlosser, R. W. (2006). The impact of augmentative and alternative communication intervention on the speech production of individuals with developmental disabilities: A research review. *Journal of Speech, Language, and Hearing Research, 49*(2), 248-264. doi: 10.1044/1092-4388(2006/021)

Mirenda, P. (1997). Supporting individuals with challenging behavior through functional communication training and AAC: Research review. *Augmentative and Alternative Communication, 13*(4), 207-225. doi: 10.1080/07434619712331278048

Mirenda, P. (2001). Autism, augmentative communication, and assistive technology: What do we really know? *Focus on Autism and Other Developmental Disabilities, 16*, 141-151. doi:10.1177/108835760101600302

Mirenda, P. (2003). Toward functional augmentative and alternative communication for students with autism: Manual signs, graphic symbols, and voice output communication aids. *Language, Speech, & Hearing Services in Schools, 34*, 203-216. doi:10.1044/0161-1461(2003/017)

Morse, T. E., & Schuster, J. W. (2004). Simultaneous prompting: A review of the literature. *Education and Training in Developmental Disabilities*, 39(2), 153–168. doi:10.1016/s0891-4222(02)00122-1

Mundy, P., Sigman, M., & Kasari, C. (1990). A longitudinal study of joint attention and language development in autistic children. *Journal of Autism and developmental Disorders, 20*(1), 115-128. doi:10.1007/bf02206861

National Research Council. (2001). *Educating children with autism*. National Academies Press.

Neef, N. A., & Iwata, B. A. (1994). Current research on functional analysis methodologies: An introduction. *Journal of Applied Behavior Analysis, 27*(2), 211-214. doi:10.1901/jaba.1994.27-211

Ogletree, B. T., & Harn, W. E. (2001). Augmentative and alternative communication for persons with autism: History, issues, and unanswered questions. *Focus on Autism and Other Developmental Disabilities*, *16*(3), 138-140. doi: 10.1177/108835760101600301

Ohtake, Y., Wehmeyer, M., Uchida, N., Nakaya, A., & Yanagihara, M. (2010). Enabling a prelinguistic communicator with autism to use picture card as a strategy for repairing listener misunderstandings: A case study. *Education and Training in Autism and Developmental Disabilities, 45(3)*. doi: https://www-jstor-org.helicon.vuw.ac.nz/stable/23880114

Ohtake, Y., Yanagihara, M., Nakaya, A., Takahashi, S., Sato, E., & Tanaka, M. (2005). Repair strategies used by elementary-age beginning communicators with autism: A preliminary descriptive study. *Focus on Autism and Other Developmental Disabilities*, *20*(3), 158-168. doi:10.1177/10883576050200030401

O'Neill, D.,K., & Topolovec, J. C. (2001). Two-year-old children's sensitivity to the referential (in)efficacy of their own pointing gestures. *Journal of Child Language, 28*(1), 1-28. Retrieved from https://search-proquest-com.helicon.vuw.ac.nz/docview/85546072?accountid=14782

Osterling, J., & Dawson, G. (1994). Early recognition of children with autism: A study of first birthday home videotapes. *Journal of Autism and Developmental Disorders*, *24*(3), 247-257. doi:10.1007/bf02172225

Paclawskyj, T. R., Matson, J. L., Rush, K. S., Smalls, Y., & Vollmer, T. R. (2000). Questions about behavioral function (QABF):: A behavioral checklist for functional assessment of aberrant behavior. *Research in developmental*

disabilities, *21*(3), 223-229

Paul, R., & Cohen, D. J. (1984). Outcomes of severe disorders of language acquisition. *Journal of Autism and Developmental Disorders, 14*(4), 405-421. doi:10.1007/bf02409831

Pickett, E., Pullara, O., O'Grady, J., & Gordon, B. (2009). Speech acquisition in older nonverbal individuals with autism: a review of features, methods, and prognosis. *Cognitive and Behavioral Neurology*, *22*(1), 1-21. doi:10.1097/wnn.0b013e318190d185

Plant, K. M., & Sanders, M. R. (2007). Reducing problem behavior during caregiving in families of preschool-aged children with developmental disabilities. *Research in Developmental Disabilities, 28,* 362–385. doi:10.1016/j.ridd.2006.02.009

Rapp, J. T., & Vollmer, T. R. (2005). Stereotypy I: A review of behavioral assessment and treatment. *Research in Developmental Disabilities, 26*(6), 527-547. doi:10.1016/j.ridd.2004.11.005

Rattaz, C., Michelon, C., & Baghdadli, A. (2015). Symptom severity as a risk factor for self-injurious behaviours in adolescents with autism spectrum disorders. *Journal of Intellectual Disability Research, 59*, 730–740. doi: 10.1111/jir.12177

Remington, B., & Clarke, S. (1983). Acquisition of expressive signing by autistic children: An evaluation of the relative effects of simultaneous communication and sign-alone training. *Journal of Applied Behavior Analysis, 16*, 315–328.

Richman, D., Wacker, D., Asmus, J., Casey, S., & Andelman, M. (1999). Further analysis of problem behavior in response class hierarchies. *Journal of Applied Behavior Analysis, 32*(3), 269-283. doi:10.1901/jaba.1999.32-269

Romski, M., Sevcik, R. A., Adamson, L. B., Cheslock, M., Smith, A., Barker, R. M., & Bakeman, R. (2010). Randomized comparison of augmented and nonaugmented language interventions for toddlers with developmental delays and their parents. *Journal of Speech Language and Hearing Research, 53*(2), 350. doi:10.1044/1092-4388(2009/08-0156)

Rotholz, D. A., Berkowitz, S. F., & Burberry, J. (1989). Functionality of two modes of communication in the community by students with developmental disabilities: A comparison of signing and communication books. *Journal of the Association for Persons with Severe Handicaps, 14*(3), 227-233. doi:10.1177/154079698901400308

Schlinger, H. D., Blakely, E., Fillhard, J., & Poling, A. (1991). Defining terms in behavior analysis: Reinforcer and discriminative stimulus. *The Analysis of Verbal Behavior, 9*(1), 153-161. doi:10.1007/bf03392869

Schlosser, R.W., & Lee, D. L. (2000). Promoting generalization and maintenance in augmentative and alternative communication: A meta-analysis of 20 years of effectiveness research. *Augmentative and Alternative Communication, 16*, 208–226.

Schreibman, L., Heyser, L., & Stahmer, A. (1999). Autistic disorder: Characteristics and behavioral treatment. *Challenging behavior of persons with mental health disorders and severe disabilities*, 39-63.

Shumway, S., & Wetherby, A. M. (2009). Communicative acts of children with autism spectrum disorders in the second year of life. *Journal of Speech, Language, and Hearing Research, 52*(5), 1139-1156. doi:10.1044/1092-4388(2009/07-0280)

Sigafoos, J., Arthur, M., & O'Reilly, M. F. (2003). *Challenging behavior and developmental disability*. London: Whurr.

Sigafoos, J., & Drasgow, E. (2001). Conditional use of aided and unaided AAC: A review and clinical case demonstration. *Focus on Autism and Other Developmental Disabilities, 16,* 152-161. doi:10.1177/108835760101600303

Sigafoos, J., Drasgow, E., Halle, J. W., Oreilly, M., Seely-York, S., Edrisinha, C., & Andrews, A. (2004). Teaching VOCA use as a communicative repair strategy. *Journal of Autism and Developmental Disorders, 34*(4), 411-422. doi:10.1023/b:jadd.0000037417.04356.9c

Sigafoos, J., Reichle, J., & Light Shriner, C. (1994). Distinguishing between social and nonsocial motivated challenging behavior: Implications for the selection of intervention strategies. In M. F. Hayden & B. H. Abery (Eds.) *Challenges for a service system in transition: Ensuring quality community experiences for persons with developmental disabilities* (pp. 147-169). Baltimore: Paul H. Brookes.

Sigafoos, J., Woodyatt, G., Keen, D., Tait, K., Tucker, M., Roberts-Pennell, D., & Pittendreigh, N. (2000). Identifying potential communicative acts in children with developmental and physical disabilities. *Communication Disorders Quarterly, 21*(2), 77-86. doi: 10.1177/152574010002100202

Smith, R. G., Vollmer, T. R., & St. Peter Pipkin, C. (2007). Functional approaches to assessment and treatment of problem behavior in persons with autism and related disabilities. In P. Sturmey & A. Fitzer (Eds.), *Autism spectrum disorders: Applied behavior analysis, evidence, and practice* (pp. 187-234). Austin, TX: Pro-Ed

Soke, G. N., Rosenberg, S. A., Hamman, R. F., Fingerlin, T., Rosenberg, C. R., Carpenter, L., DiGuiseppi, C. (2017). Factors associated with self-injurious behaviors in children with autism spectrum disorder: Findings from two large national samples. *Journal of Autism and Developmental Disorders*,*47*(2), 285-296. doi:10.1007/s10803-016-2951-x

Sparrow, S., Cicchetti, D., & Balla, D. (2005). *Vineland-II Adaptive Behavior Scale* (2nd ed.). Minneapolis: Pearson.

Sprague, J. R., & Horner, R. H. (1995). Functional assessment and intervention in community settings. *Mental Retardation and Developmental Disabilities Research Reviews, 1*(2), 89-93. doi:10.1002/mrdd.1410010203

Stone, W. L., Ousley, O. Y., Yoder, P. J., Hogan, K. L., & Hepburn, S. L. (1997). Nonverbal communication in two-and three-year-old children with autism. *Journal of Autism and Developmental Disorders*, *27*(6), 677-696. doi: 0162-3257/97/1200-0677$12.50/0

Tager-Flusberg, H., & Kasari, C. (2013). Minimally verbal school aged children with autism spectrum disorder: The Neglected End of the Spectrum. *Autism Research, 6*(6), 468-478. doi:10.1002/aur.1329

Tager-Flusberg, H., Paul, R., & Lord, C. (2005). Language and communication in autism. In Volkmar, F. R., Paul, R., Klin, A., & Cohen, D. J. (Eds.), *Handbook of autism and pervasive developmental disorders, 1*, 335-364. Hoboken, NJ: John Wiley and Sons.

Tarbox, J., Wilke, A. E., Najdowski, A. C., Findel-Pyles, R. S., Balasanyan, S., Caveney, A, Tia, B. (2009). Comparing indirect, descriptive, and experimental functional

assessments of challenging behavior in children with autism. *Journal of Developmental and Physical Disabilities, 21*(6), 493-514. doi:10.1007/s10882-009-9154-8

Tomasello, M., Conti-Ramsden, G., & Ewert, B. (1990). Young children's conversations with their mothers and fathers: Differences in breakdown and repair. *Journal of Child Language, 17*(01), 115. doi:10.1017/s0305000900013131

Turner, M. (1999). Annotation: Repetitive behaviour in autism: A review of psychological research. *Journal of Child Psychology and Psychiatry, 40*(6), 839-849. doi:10.1017/s0021963099004278

Valentino, A. L., & Shillingsburg, M. A. (2011). Acquisition of mands, tacts, and intraverbals through sign exposure in an individual with autism. *Analysis of Verbal Behavior, 27,* 95–101.

van der Meer, L., & Rispoli, M. (2010). Communication interventions involving speech-generating devices for children with autism: A review of the literature. *Developmental Neurorehabilitation, 13,* 294-306. doi:10.3109/17518421003671494

van der Meer, L., Sigafoos, J., O'Reilly, M. F., & Lancioni, G. E. (2011). Assessing preferences for AAC options in communication interventions for individuals with developmental disabilities: A review of the literature. *Research in Developmental Disabilities, 32*(5), 1422-1431. doi:10.1016/j.ridd.2011.02.003

Vollmer, T. R., & Smith, R. G. (1996). Some current themes in functional analysis research. *Research in Developmental Disabilities, 17*(3), 229-249. doi:10.1016/0891-4222(96)00006-6

Waddington, H., Sigafoos, J., Lancioni, G. E., O'Reilly, M. F., Meer, L. V., Carnett, A., . . . Marschik, P. B. (2014). Three children with autism spectrum disorder learn to perform a three-step communication sequence using an iPad®-based speech-generating device. *International Journal of Developmental Neuroscience, 39,* 59-67. doi:10.1016/j.ijdevneu.2014.05.001

Walker, G. (2007). Constant and progressive time delay procedures for teaching children with autism: A literature review. *Journal of Autism and Developmental Disorders, 38*(2), 261-275. doi:10.1007/s10803-007-0390-4

Watson, P. J., & Workman, E. A. (1981). The non-concurrent multiple baseline across-individuals design: An extension of the traditional multiple baseline design. *Journal of Behavior Therapy and Experimental Psychiatry, 12*(3), 257-259. http://dx.doi.org/10.1016/0005-7916(81)90055-0

Weiss, J. (2003). Self-injurious behaviours in autism: A literature review. *Journal on Developmental Disabilities, 9,* 129-143. doi: 10.1097/01.yco.0000179484.62391.dc

Wetherby, A. M., Woods, J., Allen, L., Cleary, J., Dickinson, H., & Lord, C. (2004). Early indicators of autism spectrum disorders in the second year of life. *Journal of Autism and Developmental Disorders, 34*(5), 473–493. doi:10.1007/s10803-004-2544-y

Wilcox, M. J., & Webster, E. J. (1980). Early discourse behavior: An analysis of children's responses to listener feedback. *Child Development, 51*(4), 1120. doi:10.2307/1129552

Wodka, E., Mathy, P., & Kalb, L. (2013). Predictors of phrase and fluent speech in

children with autism and severe language delay. *Pediatrics*, *131*(4), e1128-e1134. doi:10.1542/peds.2012-2221

Yoder, P., & Stone, W. L. (2006). A randomized comparison of the effect of two prelinguistic communication interventions on the acquisition of spoken communication in preschoolers with ASD. *Journal of Speech, Language, and Hearing Research, 49*(4), 698-711. doi:10.1111/j.1365-2214.2007.00757_2.x

Appendix A

Ethical Approval Notices

researchmaster-help@vuw.ac.nz Inbox - Official November 2, 2015 at 5:41 PM

Human ethics application approval. Automated Email, Do Not Reply Details

To: Alicia Bravo, Cc: louise.grenside@vuw.ac.nz, jeff.sigafoos@vuw.ac.nz

Dear Alicia,

Thank you for your application for ethical approval (Assessing and teaching communication repair strategies to children with developmental disabilities, reference 0000022361), which has now been considered by the Standing Committee of the Human Ethics Committee.

Your application is approved as of today. You will receive an approval memo in the near future.

Best wishes with the research.

Susan Corbett
Human Ethics Committee

*****This is an automated email. Do not reply to this email address*******

Queries for the central Human Ethics Committee can be sent to ethicsadmin@vuw.ac.nz

Human Ethics amendment/extension request approved 0000022361 Automated Email Inbox ×

researchmaster-help@vuw.ac.nz Thu, Apr 5, 11:08 AM

to me, harrison.mazengarb, isobel.cairns, ethicsadmin, jeff.sigafoos

Dear Alicia,

Your application for amendment/extension of Human Ethics application number 0000022361 (Assessing and teaching communication repair strategies to children with developmental disabilities) is approved as of today.

In the case of an amendment, this approval is valid until the end date of your original ethics approval; in the case of an extension, this approval applies until the new end date that you have nominated.

If you would like to receive a formal letter please contact the HEC Administrator (ethicsadmin@vuw.ac.nz).

Thank you

ResearchMaster

*****This is an automated email. Do not reply to this email address*******

Queries for the central Human Ethics Committee can be sent to ethicsadmin@vuw.ac.nz
Pipitea Ethics subcommittee queries can be sent to: pipitea-hec@vuw.ac.nz
Psychology Ethics subcommittee queries can be sent to: louise.hamblin@vuw.ac.nz
Information Management subcommittee queries: vanessa.venter@vuw.ac.nz

Appendix B

Treatment Fidelity Checklists

Repair Assessment Treatment Fidelity

Treatment Fidelity Items

1. Breakdowns will be presented in random order.
2. Each trial will begin with the Sd, "If you want (item/activity) let me know."
3. After the child indicates they want the item the implementer will then create a breakdown by either:
    a. Ignornig the request
    b. Providing the wrong response with a lesser preferred item
    c. Requesting clarification by saying, "What was that?"
4. Immediately after the breakdown, a 10s delay will be given to observe repairs.
5. After 10s the child will be given access to the item/activity for 30s, or until consumed.

Mand Training Baseline

1. Present the child two highly preferred snacks and say, "Which do you want?"
2. The child will indicate which one he/she prefers.
3. With the preferred item in sight, the researcher will then present the child with the iPad® and say, "If you want something, let me know."
4. After 5s, if the child has not activated the correct button, then the trial is terminated and all potential answers would be considered incorrect and the child will not be reinforced.
5. If the correct icon is activated, the researcher will allow the child to complete the request until the child either correctly completes the entire request, or until the child is no longer able to complete the request (correctly activating, the following buttons: "I Want", "Snack (folder)", Corresponding Snack Icon, and finally, "Thank You.")

Repair Trials

1. Before the start of the session, present the child two highly preferred snacks and say, "Which do you want?"
2. The child will indicate which one he/she prefers.
3. With the preferred item in sight, the researcher will then present the child with the iPad® and say, "I have [item] here. If you'd like some, let me know."
4. When the child selects the desired item the researcher will deliver the wrong item (not related to the desired item) to the child.
5. After 5s, if the child has not activated the "Oops! Wrong one!" button, or is clearly going to make an error, the researcher will use most-to-least prompting to promote correct responding.
6. After the child activates the repair button, the researcher will say, "Oh! You wanted [item]!" and will deliver the item after the child then activates the "Thank you" button.

Mixed Standard & Repair Trials

1. Before the start of the session, present the child two highly preferred snacks and say, "Which do you want?"
2. The child will indicate which one he/she prefers.
3. With the preferred item in sight, the researcher will then present the child with the iPad® and say, "I have [item] here. If you'd like some, let me know."
4. When the child selects the desired item the researcher will:
    a. Give the child access to the desired item until consumed (if edible) or for a maximum of 30s (if activity) (3/5 Trials).
    b. OR deliver the wrong item (not related to the desired item) to the child and wait 5s for a repair (2/5 Trials).
5. If after 5s the child has not made an attempt to request for the item, the researcher will call attention to the item (e.g., Ooh, look at these yummy lollies...)
6. Regardless of the response, no prompting will be provided, and only correct responses will be reinforced.