The effects of quantity of aided input on the accuracy of instruction following in children with Autism Spectrum Disorder

by

Sheryll Ngwira
Student Number: 18303481

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SUPERVISOR: Professor Shakila Dada

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ABSTRACT

Receptive and expressive language difficulties are some of the core challenges facing children with Autism Spectrum Disorder (ASD). Emerging research suggests that for children with ASD receptive language is more impaired than expressive language. Specifically, abstract concepts like prepositions, are challenging for them. Aided augmented input has been shown to be an effective means of facilitating understanding in some children with ASD, however the amount of aided augmented input required to ensure effective understanding has not been determined. The aim of this study was to measure and compare the participants' ability to follow instructions containing prepositions, under two conditions of aided augmented input. A with-in subject research design, involving 17 participants with ASD, was used to measure the accuracy of responses to instructions containing prepositions. Each participant was presented with 12 instructions. Half of the instructions were provided with 25% aided augmented input (prepositions only) referred to as Condition A, and the other half were presented with 75% aided augmented input (subject, preposition and location) referred to as Condition B. Their responses to the instructions were recorded and analyzed. Results suggest that there was no statistical difference between the two conditions of aided augmented input. Eight participants responded better under Condition A and five participants responded better under Condition B. Four participants responded equally under both conditions. The findings suggest that some participants may benefit from more aided augmented input and some from less aided augmented input. There is need for additional studies to determine the conditions of aided augmented input needed for the effective understanding of instructions containing prepositions and factors affecting the outcome.

Keywords: Aided Augmented Input, Augmentative and Alternative Communication, Autism Spectrum Disorder, Instruction-following, Prepositions, Receptive Language.

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2. PROBLEM STATEMENT AND LITERATURE REVIEW

2.1 Autism Spectrum Disorder

The prevalence of Autism Spectrum Disorder (ASD) has been steadily increasing since the 1960s. This increase is possibly as a result of an increased awareness, diagnosis and reporting of ASD, or as the result of a real increase in the number of people living with ASD (American Speech-Language Hearing Association, 2015; World Health Organisation, 2017). Worldwide, it is estimated that the prevalence of ASD is 1 in 160, however this estimate does not take into account the prevalence in many low- and middle-income countries that do not collect ASD-specific statistics (World Health Organisation, 2017). The ASD prevalence increased significantly in the United States of America, from 1 in 150 in 2000, to 1 in 59 reported in 2014, which amounts to a 150% increase (Centers for Disease Control and Prevention, 2018). The implications of an increase in prevalence are far reaching as there is an increased necessity for effective services and interventions, to meet the needs of the rapidly rising number of people living with ASD (Hewitt et al., 2012).

ASD is a lifelong developmental disorder, with an onset before the age of three (American Psychiatric Association, 2018). Children with ASD present with three main characteristics that vary along a continuum of severity, and are expressed uniquely in each individual (American Psychiatric Association, 2018; Centers for Disease Control and Prevention, 2018). The Diagnostic and Statistical Manual of Mental Disorders – fifth edition (DSM – 5) released in 2013 is the standard reference used in the diagnosis of ASD (Reynolds & Kamphaus, 2013). The diagnostic criteria outlined in the DSM-5 are: firstly, the child

displays, generalised deficits in social interactions and communication; secondly, restricted, inflexible and repetitive behaviour patterns; thirdly, the child's symptoms impact negatively on their functioning in most areas of their life; and lastly, the symptoms cannot be solely attributed to an intellectual disability (American Psychiatric Association, 2018; Centers for Disease Control and Prevention, 2018)

2.2 Language

Language delays and deficits are described as some of the core characteristics and challenges of children with ASD (Ganz et al., 2012; Light, Roberts, Dimarco, & Greiner, 1998; Rapin & Dunn, 2003). In general, children with ASD, have limited language skills (Kurt, 2011; Manolitsi & Botting, 2011) and they experience challenges with language development, which affects both their receptive and expressive language skills. However, the degree and profile of the difficulty are still unknown, (Hudry et al., 2010).

In typically developing children there is an underlying assumption that receptive language skills are the foundation upon which expressive language skills are built (Hudry et al., 2010; Schmitt & Justice, 2012), but this assumption does not hold true for children with ASD (Hudry et al., 2010). In these children, expressive language skills are difficult to ascertain or quantify. This is due to the atypical use of echolalia and rote learnt phrases, that may or may not be used appropriately, that distorts the perception of their true expressive language abilities (Charman, Drew, Baird, & Baird, 2003; Hudry et al., 2010). Receptive language skills are even harder to measure, due to inconsistencies in response to communication that may be due, not to a lack of understanding, but rather a generalised lack of interest in or response to communication (Charman et al., 2003). The difficulties with measuring expressive and receptive language skills as well as deviations from the typical development of language may in turn have a bearing on and influence perceptions regarding

the relationship between expressive and receptive language skills in children with ASD (Hudry et al., 2010).

On the whole, however, there appears to be consensus in research findings that receptive language may be more impaired than expressive language in many children with ASD (Charman et al., 2003; Hudry et al., 2010; Manolitsi & Botting, 2011; Rapin & Dunn, 2003). This would suggest that future research and intervention should focus on receptive language skills and general understanding in children with ASD (Hudry et al., 2010) as well as on ways of overcoming the challenges they experience with understanding.

2.3 Augmentative and Alternative Communication

One of the effective strategies that may be implemented to assist with language development and use in children with ASD, is Augmentative and Alternative Communication (AAC) (Ganz, 2015). AAC is a field of study and clinical practice that seeks to study and compensate for a temporary or permanent loss of, or failure to acquire, more traditional means of communication. It is defined as any form of non-verbal communication used to convey meaning, be it needs, desires or thoughts, so as to enhance or replace speech (ASHA, 2015).

For children who experience difficulty developing speech and language, AAC has played an important role in supplementing or substituting spoken language, and it has been shown to facilitate the development of language and generally enhance communication (Beukelman & Mirenda, 2013; Romski et al., 2010; Von Tetzchner & Grove, 2003). For children with ASD, research has shown that the use of AAC has been beneficial in facilitating communication and developing language (Ganz, 2015).

Ultimately, the purpose of AAC is to allow the child to participate and engage in activities that interest them and that may otherwise not have been accessible to them due to their lack of development of, or loss of speech (Beukelman & Mirenda, 2013). AAC helps

these children to become active participants in society (Von Tetzchner & Grove, 2003). A review of studies aimed at the use of AAC for children with ASD, has shown that AAC can be used to teach functional communication (Ganz, 2015).

The conventional use of AAC focused primarily on providing children with a means of expressive communication. However, research has shown that AAC can also be used to augment or aid input and the understanding of spoken information (Drager et al., 2006; Romski et al., 2010; Wood, Lasker, Siegel-Causey, Beukelman, & Ball, 1998). AAC therefore, has the potential to improve receptive and expressive language skills in children with complex communication needs (CCN) (Wood et al., 1998) and in children with ASD (Ganz, 2015; Light et al., 1998). Previous studies have focused on expressive language interventions but there is an emerging body of research which has focused on the use of AAC for improving understanding (Sevcik, 2006).

2.4 Augmented Input

Augmented input was first described by Beukelman and Garret (1988), cited in Allen, Schlosser, Brock, & Shane, (2017) as any form of AAC system or visual support that is used to enhance or improve the understanding of spoken input. When it was first described, augmented input referred to the use of written text and gestures, but it has since developed to include a variety of static or dynamic visual supports, as well as additional auditory input through the use of speech-generating devices (Wood et al., 1998). Augmented input advocates a multimodal approach towards providing input, so as to supplement, but not replace, speech (Schlosser et al., 2013).

There are two broad purposes for the use of augmented input. Firstly, and for the purposes of this study, it is used to increase or improve the understanding of spoken language (Dada & Alant, 2009; Drager et al., 2006; Harris & Reichle, 2004), by highlighting important

aspects of the message and the associated meaning (Wood et al., 1998). Secondly, augmented input has also been used to provide exposure to an adult model of symbol production, before the child is expected to use symbols to express themselves (Romski et al., 2010; Sennott, Light, & Mcnaughton, 2016; Smith, 2006), thus reducing the asymmetry between their input and output systems (Sennott et al., 2016; Smith, 2006).

Augmented input is broadly defined as being either unaided or aided (Beukelman & Mirenda, 2013; Drager et al., 2006; Smith, 2006). Unaided augmented input is generated, without the use of external physical supports or aids, by the communication partner, using their own body. This may take the form of manual signs or gestures used to supplement the spoken output so as to improve understanding (Beukelman & Mirenda, 2013; Holyfield, Drager, Kremkow, & Light, 2017; van der Meer et al., 2012). Aided augmented input is the use of external physical supports to supplement spoken output. This may take the form of text, graphic symbols, line drawings, photographs, low-tech communication books, electronic programmes or speech generating devices that are used in combination with speech to improve or enhance understanding (Beukelman & Mirenda, 2013; Drager et al., 2006; Smith, 2006).

There are many advantages to using aided augmented input to facilitate understanding (Schlosser et al., 2013). Visual supports: i) are permanent, whilst auditory input is transient, thus the visual support can be referred to as often as is necessary (Schlosser et al., 2013); ii) make fewer demands on memory as they require recognition and not recall (Schlosser et al., 2013; Thistle & Wilkinson, 2013); iii) allow for increased independence as they can be referred to for input and do not require the presence of the communication partner; iv) have the potential to reduce behavioural challenges resulting from misunderstandings; v) can improve motivation and engagement; and vi) are easier to make and can be used repeatedly thus ensuring consistency in information (Schlosser et al., 2013).

The disadvantages of using aided augmented input include: i) the need to plan, make, prepare and organize the visual supports; ii) the need to anticipate needs so that the correct visual support is available at the correct time (Schlosser et al., 2013); and iii) that visual supports may lead to reduced imitation or verbal output (West, 2008).

2.5 Aided augmented input and Autism Spectrum Disorder

The use of AAC and aided augmented input for children with ASD has been based on the assumption that children with ASD are visual learners (Rao & Gagie, 2006). Furthermore, research has shown the benefits of visual aids in facilitating understanding of instructions (O'Brien et al., 2016) and instructions containing prepositions, with both static and dynamic visual input (Schlosser et al., 2013). Some emerging research also suggests that children with ASD benefit from visual learning strategies or aided augmented input (Drager et al., 2006; Harris & Reichle, 2004; Holyfield et al., 2017; Rao & Gagie, 2006), due to their strong visual learning abilities (Rao & Gagie, 2006). On the other hand, some research suggests that the benefits are minimal and not statistically significant (Brady et al., 2015; Ganz, Hong, Goodwyn, Kite, & Gilliland, 2015; Rao & Gagie, 2006; Trembath, Vivanti, Iacono, & Dissanayake, 2015), that not all children with ASD benefit from visual aids and that the results vary greatly, which may suggest a lack of homogeneity in the manifestation of such visual strengths or abilities (Trembath et al., 2015). It is important to note that children with ASD are a heterogenous group of children, whose symptoms vary along a continuum (Rapin & Dunn, 2003), with different abilities, strengths and skill sets, (Trembath et al., 2015). Therefore it is not always possible to generalise findings, and making assumptions should be avoided (Rao & Gagie, 2006; Trembath et al., 2015).

Children with ASD do not only experience difficulty with the general understanding of spoken language, they also struggle to understand abstract concepts, such as prepositions

(Schlosser et al., 2013). This may well hinder their understanding and ability to follow instructions that contain prepositions. Research has shown that various aided augmented methods of input improve understanding in children with ASD (O'Brien et al., 2016; Schlosser et al., 2013), however, the amount of aided augmented input required to facilitate understanding is still unknown.

Although the importance of prepositions is not always overtly apparent, prepositions are commonly used to indicate the location of things or people, to describe where in books work should be carried out and where things or people should be located within a classroom environment (Schlosser et al., 2013). Prepositions are particularly difficult to learn due to their arbitrary and subjective nature (Bratož, 2014), which presents additional challenges for children with ASD who struggle to grasp abstract, less concrete concepts (Mechling & Hunnicutt, 2011).

Previous aided augmented input studies focused on the understanding of visual schedules during transitions (Cihak, 2011), the break-down of steps within a task (Mechling & Gustafson, 2009), or the following of instructions (as in the study by Peterson, Bondy, Vincent & Finnegen (1995) cited in Schlosser et al., (2013)). However limited research focused specifically on the general understanding of language, and specifically of instructions containing prepositions in children with ASD (Egel, Shafer, & Neef, 1984; Schlosser et al., 2013). Thus, there is need for a systematic review of the body of knowledge to determine the scope of literature available.

2.6 Systematic literature search

The main aim of the systematic search was to identify studies that use different types of augmented input to facilitate an improvement in the receptive and expressive language in children with Autism Spectrum Disorder.

The databases searched included EBSCOhost, CINAHL, ERIC, psycINFO and Medline. The search terms are outlined in Figure 1.

The inclusion and exclusion criteria are outlined in Table 1.

Table 1.

Inclusion and Exclusion Criteria used for the Systematic Literature Search

	Inclusion Criteria	**Exclusion Criteria**
Population	Children with Autism (0-18)	Neurotypical children and other disabilities
Intervention	AAC/ visual supports/ aided augmented input	
Outcome	Receptive & Expressive Language	Behavioural outcomes
Date	1970-2018	Pre-1970
Language	English	Not English
Study Design	Experimental/ Quasi-experimental	Qualitative/ Descriptive
Type of Source	Peer-reviewed Journal Articles	Dissertations/ book chapters

The results of the search outlined in Figure 1. are as follows: 95 articles were identified by means of the database search. Duplicate articles, and one French article, were removed which resulted in 78 articles. The 78 articles were screened at title level. An additional 63 articles were excluded as they were not consistent with the aims of the search. The 15 remaining articles were screened at abstract level and a further nine articles were excluded as they did not include receptive or expressive language outcomes in children with ASD. The six remaining articles were reviewed and summarised in Table 2.

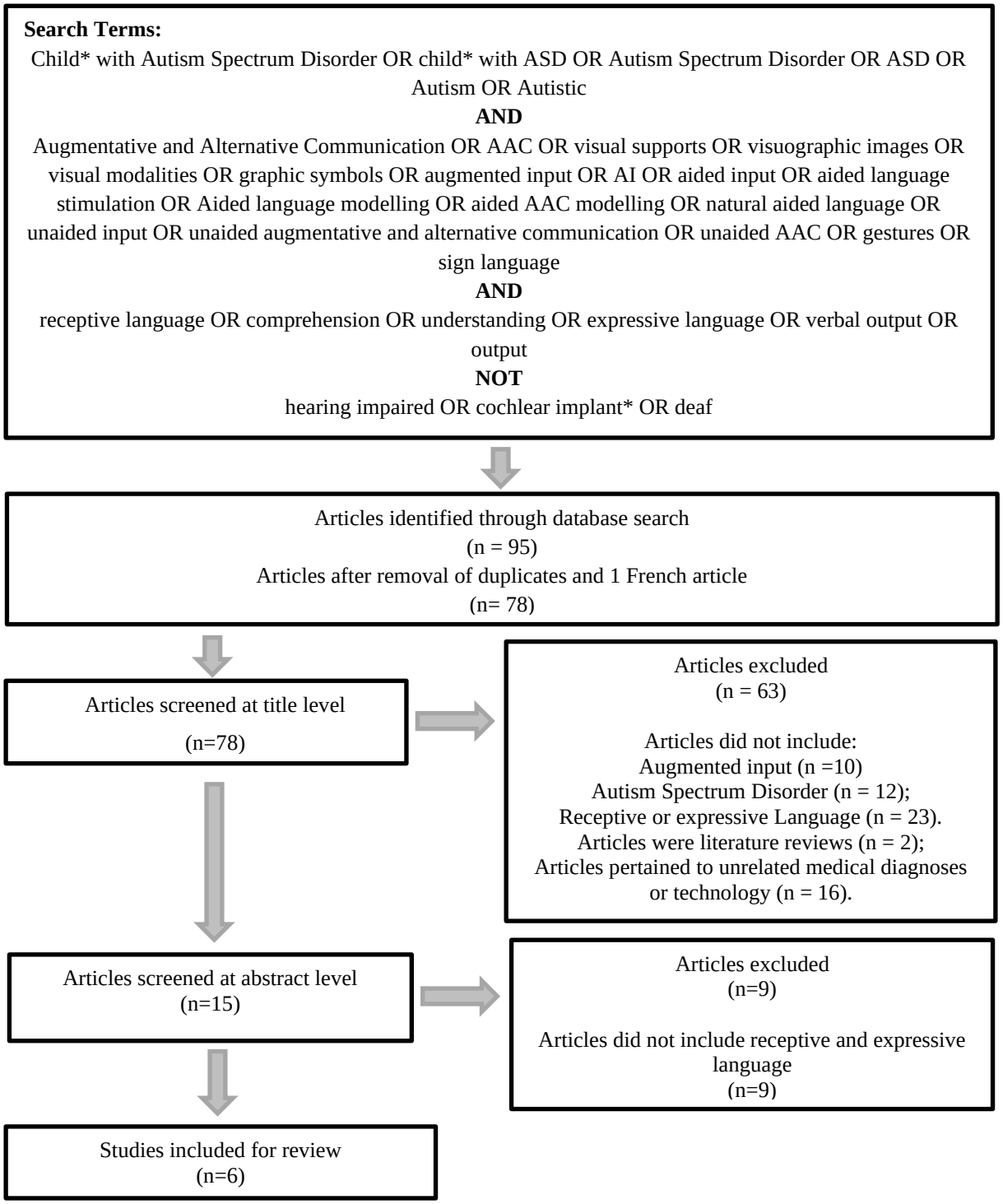

Figure 1. PRISMA flow diagram illustrating the literature search process (Moher et al., 2009)

Table 2

Systematic Search of Studies Focusing on Augmented Input in Children with ASD

No	Author(s) & Date	Article Title	Aim	Participants	Research Design	Variables: Independent; Dependent	Procedures	Results
1	Kurt, O (2011)	A comparison of discrete trial teaching with and without gestures/ signs in teaching receptive language skills to children with Autism	To determine if there is a difference between: • **1** Discrete Trial Training (DTT) with visual support (gestures & signs) along with verbal instructions versus verbal only. • **2** the two training procedures: in terms of number of sessions, number of trials, total time and percentage of errors, to criterion.	Two boys with ASD: one 5-year-old and one 12-year-old	Experimental; a single-subject research design	• **IV**: Discrete Trial Teaching procedures with and without visual supports • **DV**: learning receptive language skills	The experimental sessions consisted of the following: • **1** full probe: the subject's baseline relating to the DV was obtained • **2** training: the subjects were taught the target behaviours until they demonstrated 100% correct performance • **3 v**isual support (gestures and signs) were provided with speech in contrast to speech alone. • **4** maintenance & generalisation sessions were carried out at three & 10 weeks post 100% target achievement.	• **1** The DTT procedure used with visual support was more efficient than without visual support. • **2** There was a difference between the two training procedures: DTT with visual supports was more efficient than without visual support in terms of number of sessions, number of trials, total time and percentage of errors, to criterion.
2	Ganz, J., Hong, E., Goodwyn, F. Kite, E. & Whitney, E., (2015)	Impact of PECS tablet computer app on receptive identification of pictures given with a verbal stimulus	• To determine whether or not the PECS-based communication instruction improves receptive language identification of words in a child with autism.	One 4-year-old boy with ASD	Experimental: Multiple baseline, single case study	• **IV**: instruction (e.g. "Touch (one-word label for the object)) • **DV**: identification of the target photo	• 1 A preference test was carried out to develop a list of preferred objects. • 2 Baseline stage: the PECS app (sound muted) was placed on the table. A picture on the app was selected and two objects were presented. The subject had to select one. No error correction procedures were provided. • 3 PECS app instruction stage: five icons were presented, sound was turned on. When selected a recorded voice said one associated word, but not the label.	• Generally, the use of PECS did not significantly improve receptive language or promote expressive language. • For two of the three target words there were changes in mean levels, however this was not the case for one of the words.

No	Author(s) & Date	Article Title	Aim	Participants	Research Design	Variables: Independent; Dependent	Procedures	Results
3	Schlosser, R., Laubscher, E., Sorce, J., Koul, R., Flynn, S., Hotz, L., Abramson, J., Fadie, H. & Shane, H. (2013)	Implementing directives that involve prepositions in children with Autism: a comparison of spoken cues with two types of aided input	To determine whether or not there was a difference in following instructions containing prepositions when presented with: • spoken input only versus spoken with aided augmented input; • static and dynamic aided augmented input.	Nine children with ASD • seven boys and two girls • Age range from 3 years 9 months to 16 years 8 months	Experimental: Within-subject research design	• **IV**: Instructions spoken, spoken with video; and spoken with photo • **DV**: accuracy with which the child carried out the instruction	The participants were exposed to three instruction conditions: • spoken only; • spoken with static aided input (photographs); & • spoken with dynamic aided input (video)	The children were better able to follow instructions with both static and dynamic aided input versus spoken input only. There was no statistically significant difference in instruction-following between the static and dynamic aided input.
4	Brady, N., Storkel, H., Bushnell, P., Barker, R., Saunders, K., Daniels, D & Fleming, K. (2015)	Investigating a multimodal intervention for children with limited expressive vocabularies associated with Autism	To provide proof of concept for a new multimodal intervention that combines speech and AAC. To determine if participants displayed an improvement in: • spoken word production; and • receptive word learning To compare children who made gains with those who did not to see what predictors of improvement may exist (if any).	10 children with ASD • nine boys and one girl • age range from 7 years 5 months to 11 years 3 months	Experimental: single-subject design using multiple probes	• **IV:** Multimodal intervention package • **DV:** word learning (expressive probes & receptive probes)	• Speech sound assessments were carried out to determine baseline for each individual child. • Word sets were identified for each child and incorporated into a created story. • A picture book was created for each of the word sets. • Expressive probes were administered. • Maintenance probes were administered for successfully learned word sets (2 – 40 sessions post learned word set).	Half of the participants showed an improvement in: • spoken word production and; • receptive word learning, Thus, the other half did not improve.
5	Drager, K., Postal, V., Carrolus, L., Castellano, M.,	The effect of aided language modelling (ALM) on	To determine whether or not aided language modelling is effective in improving:	Two children with ASD • one boy and one girl	Experimental: Single-subject, multiple baseline research design	**IV**: Aided Language Modelling intervention	• Baseline: a communication board with six pictures was used. Each picture was labelled four times during	ALM improved • symbol comprehension; and • symbol production

No	Author(s) & Date	Article Title	Aim	Participants	Research Design	Variables: Independent; Dependent	Procedures	Results
	Gagliano, C. & Glynn, J. (2006)	symbol comprehension and production in two preschoolers with Autism	• symbol comprehension (understanding); and • symbol production (expression), in children with ASD	• aged 3 years and 5 years		**DV**: the number of target words correctly identified when responding to: • graphic & verbal stimuli; • graphic stimuli • verbal stimuli and • the number of referents correctly labelled.	baseline session using a definite article (the). • Intervention: the same as baseline, but no definite article was used. • Maintenance: Probes for maintenance of graphic and verbal symbols and symbol production	The two participants were able to maintain the acquired • symbol comprehension; and • symbol production
6	Preis, J (2006)	The effect of picture communication symbols on the verbal comprehension of commands by young children with Autism	To determine whether or not • spoken and visual input result in better instruction following than only verbal input • the commands achieved would generalise to another therapist • the results achieved would be maintained over time.	Five children with ASD • two boys and three girls • age range from 5 years to 7 years	Experimental: Alternating treatments research design	**IV**: verbal and gestural inputs in the presence or absence of pictures **DV**: response to instructions	A pre-intervention assessment was carried out to determine eligibility Intervention was carried out using chronologically ordered instructions randomly assigned to one of two treatment conditions: • spoken, with visual supports • spoken, without visual supports. Positive reinforcement was provided. Generalisation stage: A new therapist was introduced. No positive reinforcement was provided. Instructions previously taught were presented. Long-term probes were presented 10- and 20-weeks after the intervention.	Results showed that there was • no difference in instruction following between the verbal input with pictures and verbal input alone • better generalisation to another therapist for the verbal input with pictures than the verbal input alone • most notably better maintenance for verbal input with pictures than verbal input alone at 10- and 20-week probes.

2.7 Augmented input studies

2.7.1 Aims and results. Table 2 indicates that a total of six studies were included from the systematic search. These studies (n=6) attempted to determine whether or not spoken input, combined with various modes of augmented input results in an improvement in understanding in children with ASD. The results indicated that understanding improved in three of the studies (n=3) (Drager et al., 2006; Kurt, 2011; Schlosser et al., 2013). However another three of the studies did not find statistically significant differences in understanding (n=3) (Brady et al., 2015; Ganz et al., 2015; Preis, 2006). The apparently contradictory or variable results may be due to several internal aspects of the research studies. Factors that may have influenced the outcomes and that are discussed in the next sections, include i) the participants included in the study, ii) the research design and iii) the choice of procedures and materials.

Overall, the study in hand highlights a paucity of literature and the need for further research. Therefore it deals broadly with the benefits of augmented input for improving understanding in children with ASD (Ganz et al., 2015) and then concentrates on the need for more focused research to determine the amount of augmented input required for specific classes of language, to improve understanding in children with ASD (Schlosser et al., 2013).

2.7.2 Participants. The number of participants in the studies varied between one (n=1) (Ganz et al., 2015), two (n=2) (Kurt, 2011; Preis, 2006) and nine or 10 children (n=3) (Brady et al., 2015; Drager et al., 2006; Schlosser et al., 2013). According to Drager et al., (2006) there may be a need for research with larger sample sizes, differences in language development and control groups to increase the strength of the studies.

The age range of participants in the studies varied from 1 year 2 months to 16 years 8 months with most of the participants younger than 10 years. It would seem that future

research studies would benefit from wider age ranges (Drager et al., 2006). Furthermore, consistent with the prevalence of ASD in society most of the participants were boys (American Speech-Language Hearing Association, 2015). Two studies had only male participants (Ganz et al., 2015; Kurt, 2011), and only one study had more female participants than male participants (Preis, 2006).

The participant selection criteria, whilst stringent for each individual study, were diverse across the research studies, as described in Table 2. The criteria varied in terms of age range, family history, receptive and expressive language skills, matching skills, exposure to visual schedules and direct selection (Brady et al., 2015; Drager et al., 2006; Ganz, Simpson, & Corbin-Newsome, 2008; Kurt, 2011; Preis, 2006; Schlosser et al., 2013) - which may well account for the varied results. The diverse participant profiles may explain or account for differences in the study outcomes (Brady et al., 2015; Drager et al., 2006; Ganz et al., 2008; Kurt, 2011; Preis, 2006; Schlosser et al., 2013).

2.7.3 Research Design. The six studies all included quasi-experimental research designs, in other words an experimental design with direct intervention. None of the studies allowed for the randomisation of subject allocation, which may have increased issues of bias in the study (McMillan & Schumacher, 2010). The lack of randomisation may have been due to the specificity of the diagnosis and the stringent participant inclusion criteria (n=6) Four of the studies carried out were single-subject studies (n=4) (Brady et al., 2015; Drager et al., 2006; Ganz et al., 2015; Kurt, 2011), one study was a within-subject study (n=1) (Schlosser et al., 2013) and the remaining one was an alternating treatment study (n=1) (Preis, 2006) which suggests some variation in the research design of the studies.

Three of the studies did not have a control group (n=3) (Drager et al., 2006; Ganz et al., 2008; Kurt, 2011; Preis, 2006), while for the other three, the participants were their own

control group (n=3) (Brady et al., 2015; Drager et al., 2006; Schlosser et al., 2013). The use of a control group improves the strength of the findings (McMillan & Schumacher, 2010).

2.7.4 Materials and Procedures. The materials used by the six studies, varied along a continuum of iconicity, which may have affected their learnability (Smith, 2006), and had an impact on the results obtained - thus accounting for the variability. Two studies explored the use of specific programmes, namely Discrete Trial Training (DTT) (n=1) (Kurt, 2011) combined with augmented input, and the Picture Exchange Communication System (PECS) (n=1), while four (n=4) (Brady et al., 2015; Drager et al., 2006; Preis, 2006; Schlosser et al., 2013) developed tests for the purposes of their studies using black-and-white line drawings (Preis, 2006) clip art (Brady et al., 2015), Picture Communication Symbols (PCS) (Mayer-Johnson, 1985) (Drager et al., 2006) and photographs (Schlosser et al., 2013).

Since the tests for the four studies were developed to target specific aims, each one was different. One study (n=1) developed different resources for each of the participants, based on their individual speech sound development (Brady et al., 2015) and these differences in materials may have affected the results.

2.7.5 Gaps identified by this study. From Table 2 it is evident that there is a paucity of literature that explores the value of using AAC to facilitate the development of receptive language skills in children with ASD (Kurt, 2011; Light et al., 1998) as only six studies could be identified (n=6). The lack of research in this field could be attributed to the perceived challenges associated with measuring receptive language outcomes (Bloom, 1974; Sevcik, 2006). On the other hand, as illustrated by the six studies, it is possible to isolate and measure receptive language, and the ability to follow instructions, as a dependent variable (n=6)

(Brady et al., 2015; Drager et al., 2006; Ganz et al., 2008; Kurt, 2011; Preis, 2006; Schlosser et al., 2013).

The current research broadly contributes to the field by determining whether or not the use of AAC is an effective means of improving understanding, and by determining which is more effective, aided augmented input (n=6) (Drager et al., 2006; Ganz et al., 2008; Kurt, 2011; Preis, 2006; Schlosser et al., 2013) or unaided augmented input (n=1) (Kurt, 2011). One study specifically looked at the difference between dynamic or static visual inputs (n=1) in an attempt to determine which would yield better outcomes. It would appear that results from three of the studies suggest that AAC is effective in facilitating the development of receptive language and specifically that aided augmented input is more beneficial than unaided augmented input (n=3) (Drager et al., 2006; Kurt, 2011; Schlosser et al., 2013). The next step would be to conduct larger research studies (Ganz et al., 2015) to assist with cautionary generalisations, as well as more focused research to determine the conditions of aided augmented input that would lead to effective understanding in children with ASD (Schlosser et al., 2013).

METHODOLOGY

3.1 Research aims

3.1.1 Main aim. The main aim of the study was to determine the effect that varied frequencies of aided input have on the accuracy of instruction following in children with ASD for instructions that contain prepositions.

3.1.2 Sub-aims. The sub aims of the study were as follows:

i. To determine the accuracy of responses to instructions that contain prepositions with aided augmented input provided for 25% of the instruction (preposition only) – referred to as Condition A.

ii. To determine the accuracy of responses to instructions that contain prepositions with aided augmented input provided for 75% of the instruction (subject, preposition and location) – referred to as Condition B.
iii. To compare the accuracy of responses to instructions containing prepositions between Condition A (25%) and Condition B (75%).
iv. To describe the preposition knowledge for the pre-experimental task in comparison to, under the aided augmented input conditions and to describe the accuracy of responses per instruction and per preposition.

3.2 Research Design

An experimental, within-subject research design was used to measure the accuracy of response to instructions that contain prepositions for two conditions of aided augmented input. The within-subject research design is a design in which the participants are exposed to all of the conditions, and their responses - under different conditions - are compared to each other (McMillan & Schumacher, 2010; Polit & Beck, 2008; Price, Jangiani, Chiang, & Leighton, 2013).

One of the advantages of within-subject designs is that internal validity is not dependent on the random allocation of participants to one condition versus another, as the participants are their own control, thus the sample size is in essence 'increased', as the participants act as the control participants (McMillan & Schumacher, 2010; Price et al., 2013).

There are three disadvantages to using the within-subject research design. Firstly, there is the potential influence of order effects. This occurs when the task is presented in the same order each time, and the order of presentation affects the results - either positively or negatively - due to potential exposure or learning in a previous task or item (Charness et al., 2012; Price et al., 2013). Secondly, there is the carry-over effect, which occurs, when performance in one condition affects performance in subsequent conditions. Lastly, there is the experimenter demand effect which occurs when (with repeated exposure) participants begin to act in accordance with what they perceive to be the researcher's expectation. (Charness et al., 2012; McMillan & Schumacher, 2010).

The disadvantages of the within-subject research design can be minimized to reduce their influence on the results. Order effects and carry-over effects can be counterbalanced by exposing the participants, to all of the conditions in a different order sequence (Charness et al., 2012; McMillan & Schumacher, 2010; Price et al., 2013). In addition, experimental

control can be increased, if the participants are randomly assigned to at least two conditions and the tasks are then presented to half of the participants in one order and to the other half in a different order (Charness et al., 2012; McMillan & Schumacher, 2010).

In order to control for order effects, a cross-over design was implemented. Two sets of six instructions containing prepositions - which were matched in terms of age of acquisition of the prepositions - were randomly assigned to each condition of aided augmented input. Half of the participants, group 1, were presented with Condition A - 25% of aided augmented input followed by Condition B - 75% of aided augmented input and the other half, group 2, were presented with the reverse order. A comparison was made in terms of the accuracy of instruction-following across the two conditions of aided augmented input.

3.3 Research Phases

The research study involved three phases as outlined in Table 3. Phase 1 - Resource Development, Phase 2 - Pilot Study and Phase 3 - Main Study.

The aims of Phase 1 were to develop the materials and resources to be used in the pilot study and main study.

The aims of Phase 2 were firstly to test the materials and resources, and secondly to determine the recruitment strategy feasibility, the participant selection criteria, the informal pre-experimental tasks, and the data collection procedure. Thirdly, Phase 2 aimed to measure the time taken to administer the pre-experimental tasks, and the experimental task.

The aims of Phase 3 were to identify participants for the study, collect the data, analyse the data, and report on the data.

Table 3

Research Phases of the Study

Phase 1: Resource Development	**Phase 2: Pilot Study**	**Phase 3: Main Study**
The resources required for the study were developed including all the information letters, consent letters, reply slips, assent letters, and non-disclosure forms. This phase also included the development of the pre-experimental screening tasks, the aided instructions and sourcing all of the required resources and materials.	The pilot study aimed to determine the feasibility of the study with regards to the recruitment strategy, participant selection criteria, informal pre-experimental tasks, data collection procedures, data capturing procedures and the timing of the pre-experimental and the experimental tasks.	The informal pre-experimental tasks were completed, and participants were identified for the study. Once data collection had been concluded the data was analysed using descriptive statistics and inferential statistics, specifically the Mann-Whitney U-Test and the Wilcoxon Signed Ranks Test.

3.4 Materials

3.4.1 Letters. The different permission, informed consent and assent letters that were used in this study are described in more detail below.

3.4.1.1 School Principal Permission Letter. A letter was drafted containing information about the purpose of the study, the criteria for the selection of participants, confidentiality arrangements and assistance required from the school. It also contained a permission slip for the school principal to sign, thereby giving the researcher permission to access the school, to ask speech therapists and teachers for assistance with the identification of potential participants and to work with the participants (Appendix C).

3.4.1.2 Therapist Consent Letter. An information letter consent form, was given to the speech therapists, requesting their assistance with the initial identification of potential participants. The letter contained information regarding the purpose of the study, the criteria for selecting participants, the speech therapist's right to withdraw from the study and their

role regarding the identification of participants. The signed consent form indicated that the speech therapist was willing to participate in the study (Appendix D).

3.4.1.3 Teacher Consent Letter. An information letter consent form, was given to each teacher, requesting their assistance with the identification of potential participant and the sending and collecting of consent letters to and from the caregivers. The letter contained information regarding the purpose of the study, the criteria for the selection of participants, the teacher's right to withdraw from the study and their role regarding the identification of participants. The signed consent form indicated that the teacher was willing to participate in the study (Appendix E).

3.4.1.3 Caregiver Consent Letter. An information letter consent form, was given to the parents or legal guardians, requesting their consent to participate in the study, and permission for their child to participate in the study. The letter contained information regarding the purpose of the study, the criteria for the selection of participants, the caregiver's right to withdraw from the study at any time, the rights of the participant, the fact that a video recording of sessions would be made (for research purposes only) and the storage of data collected (Appendix F).

In order to ensure that the biological or adoptive parent of the potential participants completed the Caregiver Consent Letter and Caregiver Questionnaire, the parent completing the Caregiver Questionnaire was required to sign a statement, confirming that they were indeed the legal guardian of the potential participant.

3.4.1.4 Participant Assent Letter. A letter, in which pictures were used to help with understanding, was read and explained to the participant. The letter contained information

regarding the researcher, what would happen during the sessions, the participant's right to withdraw at any time and the video recording of sessions (Appendix G).

3.4.1.5 Non-disclosure Agreement – Independent Observer. An information letter non-disclosure form, was given to the Independent Observer, to arrange for their assistance with observing and rating the video recordings of the tasks and the checking of the data transfer to the Excel document. The letter contained information about the researcher, the purpose of the study, the role of the Independent Observer in the study and their agreement not to disclose any information regarding what they observed (Appendix H).

3.4.2 Questionnaires. The following two questionnaires were used:

3.4.2.1 Teacher Questionnaire. The teacher questionnaire had to be completed by the teacher to provide information that would assist in the description of participants for the study. It requested information regarding home language, language abilities, schooling history, ability to attend to tasks for at least 15 minutes, ability to follow instructions in class, behaviour in the class, previous exposure to visual schedules and the potential participant's matching skills. (Appendix I).

3.4.2.2 Caregiver Questionnaire. This questionnaire was completed by the caregiver to provide information that would assist in the selection and description of participants for the study. It requested information regarding the potential participant's age, diagnosis, home language, language abilities, general understanding of prepositions in the home environment, as well as hearing and visual abilities (Appendix J).

3.4.3 Informal pre-experimental tasks

The following pre-experimental tasks were carried out:

3.4.3.1 Noun Knowledge Task. Eight miniature objects were used to determine receptive noun knowledge. These included: a doll, bowl, spoon, car, cap, box, truck and teddy bear. Three items were selected each time and placed on the table in front of the potential participant. The potential participant was asked to identify one of the three objects using an auditory-only instruction, for example "Give me the doll," with an expectant gesture (i.e. holding out a hand to receive the object).

The participant had 10 seconds to respond. A code was used to mark the correct (+) and incorrect (-) responses so that the participant was not aware of the result of their performance. If the participant failed to respond within the 10-second time-limit, the instruction was repeated after a 5-second inter-task interval and another 10 seconds were allowed. When the participant responded correctly, it was marked as correct (+). When the participant responded incorrectly or did not respond the response was marked as incorrect (-). The participant's response was recorded on the Noun Knowledge Task form (Appendix K). Each of the eight nouns was tested for noun knowledge once. In order to qualify for inclusion, the child had to identify five or more objects correctly.

3.4.3.2 Preposition Knowledge Task. A miniature teddy bear and a miniature truck were used to screen for preposition knowledge. The miniature teddy bear and miniature truck were placed on the table in front of the potential participant. The potential participant was asked to place the teddy bear *in front of* or *behind* or *under* or *next to* or *on* the truck (e.g. "Put the teddy bear *on* the truck").

The participant had 10 seconds to respond. A code was used to mark the correct (+) and incorrect (-) responses so that the participant was not made aware of the result of their

performance. The participant's response was recorded as correct (+) or incorrect (-) on the Preposition Knowledge Task form (Appendix L). Each of the five prepositions was tested once. In order to qualify for inclusion and to ensure a deficit in preposition knowledge, the potential participant had to get two or fewer of the instructions correct.

3.4.3.3 Matching Task. Six miniature objects, including a doll, bowl, spoon, car, cap and box, and six PCS graphic pictures of the aforementioned objects were used to determine matching skills. Three of the miniature objects were placed on the table in front of the potential participant. The potential participant was presented with a PCS graphic picture (approximately 10cm by 10cm) of one of the objects on the iPad Air2^{TM1} and was asked to hand the corresponding object to the researcher. For example, the researcher said "Give me this one.", whilst pointing at the PCS graphic picture on the iPad Air2^{TM1}.

The participant had 10 seconds to respond. A code was used to mark the correct (+) and incorrect (-) responses so that the participant was not made aware of the result of their performance. When the participant responded correctly, the item was marked as correct (+). When the participant responded incorrectly or did not respond the item was marked as incorrect (-). The participant's response was recorded as correct (+) or incorrect (-) on the Matching Task form (Appendix M). In order to qualify for inclusion, the child had to match four or more of the pictures with the objects.

3.4.4 Standardised Measures. The following standardised measures were used:

3.4.4.1 The Peabody Picture Vocabulary Test, Fourth Edition (PPVT-4). The PPVT-4 (Dunn & Dunn, 2007) (see Appendix N) is a receptive language test. It is a norm-referenced, comprehensive instrument that measures the receptive language of children from the age of 2.6 years to that of adults aged 90 years. The PPVT-4 was administered as a measure of vocabulary comprehension, at the single-word level. The PPVT-4 covers a range

of receptive language vocabulary including content words (e.g. animals, vegetables) and parts of language (e.g. nouns, adjectives). The PPVT-4 is administered by presenting one test page at a time. Each test page has four pictures displayed in a grid, and the participant is asked to identify, by pointing, the picture named by the researcher (e.g. “Show me shoe”).

3.4.4.2 Childhood Autism Rating Scale (CARS). The CARS (Schopler, Reichler, & Rochen-Renner, 1988) (see Appendix O) is a 15 item clinical rating scale which is used to identify and diagnose children with ASD, and it has been shown to have good agreement with diagnoses made using DSM – IV criteria (Rellini, Tortolani, Trillo, Carbone, & Montecchi, 2004). It is used to derive a severity level of ASD based on observations made regarding different categories (e.g. relating to people, imitation, emotional response). The total CARS score ranges from a low score of 15 to a high of 60. The score represents a continuum of behaviours exhibited. The CARS was completed using information gathered from i) a short period of observation in the classroom or on the playground, ii) the interaction during the pre-experimental screening tasks, iii) the caregiver questionnaire, iv) the teacher questionnaire, and v) where necessary, discussions with the teacher.

3.4.5 Experimental task. Four trial instructions were used to ensure that the participants understood what was required of them. Twelve instructions, matched for age of acquisition, and randomly assigned to two sets of six instructions each, were used. These were taken from Schlosser et al., (2013), with some modifications to the objects. The set of instructions were matched according to the number of subjects and prepositions. Each set was randomly assigned to one of two conditions of aided augmented input, condition A and condition B. For both conditions a carrier phrase, “Put the (subject) (preposition) the (location)” e.g. “Put the doll behind the bowl”, was used.

Condition A was defined as consisting of the PCS aiding only the preposition (25%) in the instruction e.g. Put the spoon UNDER[a] the car ([a] text in CAPS was represented with PCS). Condition B was defined as consisting of the PCS aiding the subject, preposition and location (75%) in the instruction e.g. Put the CAP ON the BOX.

Table 4 shows the trial items, the instructions and the aided augmented input used for this study.

Table 4

Aided Augmented Input for Trial Items and Instructions Containing Prepositions

Trial	Aided Augmented Input		Condition
	Part of language	Percentage (%)	
1. Put the doll IN[a] the box	Pr[b]	25	A
2. Put the spoon IN FRONT OF the car	Pr	25	A
3. Put the DOLL IN FRONT OF the BOX	S+Pr+L[c]	75	B
4. Put the CAP IN the BOWL	S+Pr+L	75	B

Instruction	Aided Augmented Input		Condition
	Part of language	Percentage (%)	
1. Put the spoon ON the bowl	Pr	25	A
2. Put the cap UNDER the bowl	Pr	25	A
3. Put the doll BEHIND the bowl	Pr	25	A
4. Put the spoon NEXT TO the bowl	Pr	25	A
5. Put the doll ON the car	Pr	25	A
6. Put the cap NEXT TO the box	Pr	25	A
7. Put the CAP ON the BOX	S+Pr+L	75	B
8. Put the DOLL UNDER the BOX	S+Pr+L	75	B
9. Put the SPOON BEHIND the BOWL	S+Pr+L	75	B
10. Put the DOLL NEXT TO the CAR	S+Pr+L	75	B
11. Put the SPOON UNDER the CAR	S+Pr+L	75	B
12. Put the CAP BEHIND the CAR	S+Pr+L	75	B

Note:
[a] Text in CAPS is represented with Picture Communication Symbols
[b] Preposition
[c] Subject + Preposition + Location

3.4.5.1 Picture Communication Symbols. The Picture Communication Symbols (PCS) (Mayer-Johnson, 1985) were used in the current study to provide aided augmented input for the trial items and instructions containing prepositions. Previous research by Light and Locke (1989) cited in Drager et al., (2006) has shown that PCS graphic pictures are generally better understood than most other graphic symbols and their use improves understanding in children with ASD (Preis, 2006). The size of each symbol was approximately 10cm by 10cm. The pictures were shown in grammatically correct order for each instruction, and they were presented using the GoTalk Now [TM2] App on the iPad Air2 [TM1] (Appendix P).

3.4.6 Checklists. The following checklists were used to ensure procedural integrity and data reliability.

3.4.6.1 Procedural Integrity Protocol. The protocol (Appendix Q) was developed to ensure that the procedures for each day and specifically for the aided augmented input conditions were carried out consistently and in the specified manner across all participants, in order to eliminate any discrepancies. This was important to ensure that the changes noted in the dependent variable could confidently be attributed to the independent variable and not to other unrelated variables (Schlosser, 2002). The procedural integrity protocol provided documented evidence that confirmed that all the activities for the day had been carried out as required.

3.4.6.1.1 Procedural Integrity Protocol for the pre-experimental tasks. The procedural script for the pre-experimental screening of potential participants contained the following elements: i) greeting the potential participant, ii) introducing the researcher iii) explaining the activities of the day using the assent form iv) obtaining assent v) explaining and administering

the noun knowledge task vi) explaining and administering the preposition knowledge task, and vii) explaining and administering the matching task. If the potential participant met the initial screening criteria, then viii) the PPVT-4 (Appendix N) was explained and administered and ix) CARS (Appendix O) was completed.

3.4.6.1.2 Procedural Integrity Protocol for the trial items. The procedural script for the trial items (Appendix Q) covered the following information: i) providing information about the trial items and ii) providing the materials to be placed on the table for each of the trials items referring to the aided augmented input on the iPad Air2^{TM1} and the relevant trial item, for each of the trial items used.

3.4.6.1.3 Procedural Integrity Protocol for the experimental task. The procedural script for the experimental task (Appendix Q) covered the following information: i) greeting the potential participant, ii) introducing the researcher, iii) explaining the activities of the day using the assent form, iv) explaining the recording of the experimental tasks (as per the assent form); v) obtaining assent, vi) providing the materials to be placed on the table for each of the 12 instructions, referring to the aided augmented input on the iPad Air2^{TM1} and the relevant instruction, for each of the 12 instructions; vii) neutral motivation after every three instructions and viii) providing a token of appreciation at the end of the tasks (e.g. a sticker or star).

3.4.6.2 Record Form. The Record Form (Appendix R) was developed to provide written evidence of the participants responses. It includes five columns, the first column contains the instruction number, the second column contains the 12 instructions and the third column contains the condition of aided augmented input. In the fourth column the researcher

recorded the correct responses given by the participants and the incorrect responses were recorded in the fifth column. A code was used to mark the correct (+) and incorrect (-) responses so that participants were not aware of their performance being rated.

The Record Form was also utilised to ensure that data was transferred correctly from the Record Form to the Excel Data Collection Form (Appendix S). The Record Form makes provision for an inter-rater to check and sign that the data was indeed transferred correctly.

3.4.6.3 Excel Data Collection Form. The Excel Data Collection Form (Appendix S) was developed to capture data recorded on the Record From, for purposes of statistical analysis. It includes a column for all of the participant numbers and 12 additional columns – one for each instruction - where the corresponding data was captured and indicated a (1) for a correct response and (0) for an incorrect response per participant. The Spreadsheet also includes columns for participant age, PPVT-4 age-equivalent score, CARS rating, totals for each condition and the overall total per participant.

3.4.7 Brochures. The following brochure was developed:

3.4.7.1 Research Feedback Brochure. A brochure outlining the aims, methodology, participants, results and the clinical implications (Appendix T) was given to the participating school principals, therapists, teachers and parents of participants in order to share information gained from the study.

3.5 Equipment

3.5.1 Presentation equipment. An Apple iPad Air2^{TM1} Model MP2F2HC/A, (9.7-inch screen) and iAdaptor^{TM3} 5 was used to present the aided augmented input. The aided

augmented input - in the form of the PCS- were presented in the correct grammatical order by using the GoTalk Now[TM2] App.

3.5.2 Video-recording equipment. Video recording of the sessions was done using an Apple iPad Wifi [TM1], Model MP2G2HC/A (9.7-inch screen). The recordings were stored and used by the independent observer to ensure the reliability of data collection and procedural integrity.

3.6 Pilot study

A pilot study that involved one participant with ASD was carried out. The procedures outlined in section 3.8 were adhered to and refined following the pilot study.

A pilot study is a smaller, exploratory version of the larger or full-scale study. It is carried out to determine whether or not a proposed study is practicable and achievable, and what aspects need to be changed or modified prior to the full-scale study implementation (Abu Hassan, Schattner, & Mazza, 2006; Thabane et al., 2010; van Teijlingen, 2002). A pilot study improves the chances of success of the main study, but does not guarantee success (Thabane et al., 2010; van Teijlingen, 2002).

3.6.1 Objectives. The main aim of this pilot study was to determine whether or not the proposed research methodology was feasible and appropriate. It specifically tested the recruitment strategy, participant selection criteria, pre-experimental screening task procedures, materials and equipment, data collection procedures, data capturing and data analysis that were to be used in the main study.

3.6.2 Participants. The principal of one of the schools was contacted and consent was obtained to carry out the pilot study at their school. One participant was recruited who fulfilled the selection criteria described in Table 6.

3.6.3 Aims, materials, procedures, results and recommendations. Table 5 gives an overview of the aims of the pilot study, the materials used and procedures followed, the results obtained and the recommendations made after the completion of the study.

Table 5

Aims, Materials, Procedures, Results and Recommendations of the Pilot Study

Aims	Materials	Procedures	Results	Recommendations
1. To determine if the recruitment strategy was feasible.	The following informed consent letters and their reply slips were used: i. School Principal Permission Letter ii. Therapist Consent Letter iii. Teacher Consent Letter iv. Caregiver Consent Letter	The researcher met with the school principal to explain the research study. The School Principal Permission Letter was discussed and left with the school principal to read at their own leisure. The School Principal Reply Slip was collected after two days. The school principal arranged for the deputy principal to hand out the Therapist Consent Letter, the Teacher Consent Letter and the Caregiver Consent Letter to the relevant individuals within the school. All the consent letters were collected two days later.	All of the reply slips were completed and returned, signed. There were no queries that arose as a result of misunderstandings regarding the information sought.	No changes recommended.
2. To evaluate the participation selection criteria, specifically: i. ASD diagnosis ii. Age (4-10.11 years), iii. English Home Language iv. Normal or corrected vision and hearing v. Preposition and noun knowledge and matching skills.	The following questionnaires were used: i. Teacher Questionnaire ii. Caregiver Questionnaire	The questionnaires that were given to relevant teachers and caregivers for completion requested the following information about the participant: i. General biographical information e.g. name, age ii. ASD diagnosis iii. Home language iv. Vision and hearing v. Exposure to visual aids/ schedules vi. Preposition and noun knowledge, and matching skills The letters were collected two days after they had been dropped off.	The questionnaires were comprehensively completed and the requested information was obtained in addition to other relevant and useful information. No queries arose regarding the information sought or the wording of questions. The participant met all the selection criteria.	No changes recommended.
3. To determine:	The following letter was used: i. Assent Letter	The Assent letter was read to the potential participant on the day of the pre-experimental	The pilot study participant was able to:	No changes recommended.

Aims	Materials	Procedures	Results	Recommendations
i. the appropriateness of the wording of the Assent Letter ii. the participant's perceived understanding of the Assent letter		screening tasks and on the day of the experimental tasks. The yes and no response tokens were explained as per the Assent letter on both occasions. The stop sign was explained as per the Assent letter on both days. Three boxes with pictures were utilised to obtain assent to: i. Work with the researcher; ii. Record the session; iii. Acknowledge understanding of their right to stop at any time.	i. respond and verbalise his understanding of what was said to him and what was required of him ii. use the yes and no response tokens well iii. understand the use of the Stop sign	
4. To determine: i. the feasibility of the pre-experimental screening tasks; ii. the time required for the administration of the pre-experimental screening tasks.	i. Noun Knowledge task, ii. Preposition Knowledge task, iii. Matching task.	The pre-experimental screening tasks were administered. The pre-experimental screening tasks were timed, and challenges were noted.	The pilot study participant carried out all of the tasks. He was distractible, but remained engaged in all of the tasks. The time taken to administer the pre-experimental screening tasks was less than 10 minutes.	No changes recommended.
5. To determine: i. the feasibility of the standardized tests; and ii. the time taken to complete the administration of these tests.	i. PPVT-4 ii. CARS	The PPVT-4 was administered, and times and challenges were noted. The CARS was completed, and challenges were noted.	The following was noted regarding the PPVT-4: i. The participant remained engaged throughout the administration of the PPVT-4; ii. The PPVT-4 was administered within 10 minutes. The following was noted regarding the CARS: i. There were aspects of the CARS that the researcher could not answer due to the short interaction during the pre-experimental screening tasks	No changes recommended to the administration of the PPVT-4. The CARS should be completed, where necessary, with the assistance of the class teacher who has a better understanding of the participant.

Aims	Materials	Procedures	Results	Recommendations
			ii. The CARS was completed in less than 5 minutes	
6. To determine i. the feasibility of administering the instructions with aided augmented input; ii. the time taken to complete the experimental tasks	The following were used: i. Procedural Integrity Protocol with the instructions containing prepositions; ii. Miniature objects; and iii iPad™1 Model MD369SO/A (9.7-inch screen) with the PCS providing the aided augmented Input.	The researcher carried out the experimental task according to the procedural integrity protocol. The PCS providing the aided augmented input was presented by means of the iPad™1. The experimental task execution was recorded using the iPad Wifi™1, Model MP2G2HC/A timed and challenges were noted.	The participant was engaged throughout. The participant attempted to move the aided augmented input PCS graphic pictures on the iPad™1 during the presentation of the instructions with the aided augmented input. The participant was able to see the full 'sentence' of the aided augmented input prior to the presentation of the individual PCS due to the way in which the aided augmented input is saved on the iPad™1. The task was completed in 9 minutes 15 seconds.	The possibility of the participant manipulating the PCS graphic pictures should be eliminated by placing the iPad™1 further away from the participant. The PCS should be presented using the iPad Air2™1 Model MP2F2HC/A and the GoTalk Now™2 App (for iPad™1) Thus, the participant will not be exposed to the PCS prior to the instruction being given.
iii. To determine the appropriateness of data collection and procedural integrity tools	The following were used: i. Procedural Integrity Protocol; ii. Record form; iii. Excel spreadsheet.	The researcher used the script to complete the tasks and the forms and she noted any challenges with recording the results.	The procedural integrity protocol was adhered to and the following was noted: i. The researcher provided neutral reinforcement after each item as opposed to after every 3 items. ii. The record form was completed iii. The Excel spreadsheet was completed.	The Procedural Integrity Protocol should be modified to allow for more frequent neutral reinforcement.
iv. To test the recording equipment and the logistics of recording	i. iPad Wifi™1	The recording equipment was set up and the experimental tasks were carried out. After the assessment, the quality of the audio and visuals was assessed.	The participant moved the iPad™1 during the recording of the tasks. The recording did not capture the PCS graphic pictures to ensure that the responses could be validated against the PCS stimulus	The recording equipment should be place further away from the participant. It should also be angled to ensure that all of the relevant information is recorded.

3.6.4 Summary of pilot study. The pilot study highlighted the following areas that required modification prior to the main study: i) the CARS would need to be completed with the assistance of the teacher who would be able to provide additional information about the participant; ii) the equipment used to present the PCS and record the experiment would need to be placed further away from the participant; iii) the programme used to present the PCS would need to be changed from the photo gallery to the GoTalk Now^{TM2} app; and iv) the procedural integrity protocol would need to be modified to include additional neutral reinforcement.

3.7 Main Study

3.7.1 Recruitment and sampling participants. Once approval was obtained from the University of Pretoria's Ethics Committee (Appendix A) and the Gauteng Department of Education (Appendix B), the participants were selected using non-probability, purposive sampling (Etikan, Musa, & Alkassim, 2016; McMillan & Schumacher, 2010). The participants were selected from schools for children with special needs. Four schools were contacted and permission was obtained from three of the schools. The school therapists that consented to participate in the study identified potential participants. Table 6 provides a summary of the participant recruitment administrative process at the three schools.

Table 6

Summary of the Participant Recruitment Administrative Process

School	Forms sent out	Forms Returned	Forms not returned	Consent given	Consent not given	Assent given	Assent not given	Criteria met	Criteria not met
1	30	16	14	16	0	15	1	8	7
2	36	19	17	19	0	19	0	4	15
3	32	16	16	14	2	13	1	6	8
Total	**98**	**51**	**47**	**49**	**2**	**48**	**2**	**18**	**30**

In total 98 Caregiver Consent Letters were sent out and 49 potential participants with completed consent forms were screened to determine candidacy. Eighteen participants were identified for the study, however only 17 participants who met the selection criteria were included in the study. One participant did not return to school for the duration of the data collection period due to ill health. The recruitment of the participants is described in the general procedures.

3.7.2 Participant selection criteria. The participant selection criteria are presented in Table 7.

Table 7

Participant selection criteria

Criterion	Justification	Measure used
Diagnosis of Autism Spectrum Disorder (ASD) reportedly diagnosed by a medical professional	In order to determine whether or not aided augmented input would assist with the comprehension of prepositions in children with ASD, it was important to ensure that the participants are diagnosed with ASD (Rellini et al., 2004; Schlosser et al., 2013).	Caregiver Questionnaire
Children between the ages of 4 and 10.11 years	Since previous studies focused on children with a broader age-range, there was a need for more focused information (Schlosser et al., 2013).	Caregiver Questionnaire
English Home Language or at least one year's exposure to English at school	The tasks had been developed in and were carried out in English. Thus, proficiency in English was required.	Caregiver Questionnaire
No uncorrected visual or hearing difficulties	In order to ensure result validity, hearing and visual difficulties were eliminated as factors that may adversely affect the child's ability to interact with the aided augmented input (Higginbotham, Shane, Russell, & Caves, 2007).	Caregiver Questionnaire

Criterion	Justification	Measure used
Noun knowledge (at least 5/8 correct)	It was necessary to determine whether or not the participants were able to identify, by label ("point to the ____ (name of object)), the objects that were to be used in the tasks, as well as to determine the skills they had already developed (Schlosser et al., 2013).	Noun Knowledge Task (Schlosser et al., 2013)
Preposition knowledge (at most 2/5 correct)	It was necessary determine the presence of a deficit to ensure that there was potential for improvement in understanding with the use of aided augmented input (Schlosser et al., 2013).	Preposition Knowledge Task, modelled on the prepositions subtest of the Reynell Developmental Language Scales (Reynell & Curwen, 1977).
Matching skills (at least 4/6 correct)	It was necessary to determine whether or not the participants were able to match visual aids to the objects that were used in the tasks as well as to determine the skills they had already developed (Schlosser et al., 2013)	Matching Task (Schlosser et al., 2013)

3.7.3 Participant description. The participants are described next and Table 8 provides a summary of the participants' information.

The 17 participants in the study were male, diagnosed with ASD by a medical professional, and had no visual or hearing challenges. Their ages ranged from 6.6 years to 10.8 years with a mean age of 8.2 years and median age of 8.1 years. They used English as their home language or had been exposed to English for at least one year at school. Three of the participants' home language was English with no exposure to other languages in the home. Three participants were exposed to English and isiZulu, two were exposed to English and isiXhosa, and two others were exposed to English and Ndebele. Each of the other participants (n=7) was exposed to English and one other language, namely, Afrikaans, French, Ibo, Sepedi, Sesotho, Setswana or Shona.

The participants were able to identify five (n=2), six (n=4), seven (n=6) or eight (n=5) out of a possible eight of the miniature objects used for the Noun Knowledge Task. Seven of

the participants could not show any knowledge of prepositions on the Preposition Knowledge Task, and they obtained a score of 0/5. Eight of them showed a deficit in preposition knowledge, thus obtaining scores of 1/5 while two of the participants scored 2/5. All the participants (n=17) were able to match all of the miniature objects with the PCS (6/6). Participant 2 did not complete the PPVT-4 (Dunn & Dunn, 2007) testing, thus he did not obtain an age-equivalent score. The other participants (n=16) achieved age-equivalent scores of between 2.0 years to 4.0 years on the PPVT-4 (Dunn & Dunn, 2007), with a mean and median age of 3.1 years. Most of the participants (n=14) obtained mild to moderate ratings on the CARS (Schopler et al., 1988) with the other three participants obtaining a severe rating.

All of the participants were attending schools for children with special needs and have been exposed to visual schedules in the classroom. Their schooling history (time) ranged from four months to five years. Eight participants had previously been exposed to AAC, seven participants had not been exposed to AAC and there was no reporting for two of the participants. Most of the participants (n=15) had previously received or were currently receiving speech therapy and only two participants had never received speech therapy. The participants varied along a continuum in terms of their verbal abilities to communicate needs or tell stories. Some participants were not able to verbally communicate their needs at all (n=3), one participant could occasionally communicate his needs verbally while the remaining 13 participants were able to communicate their needs verbally. Most of the participants could not tell stories (n=15) and only two participants were able to do so.

Table 8

Description of Participants

No. [a]	Age (years)	Gender	Diagnosis	Home Language	Normal Visions & Hearing	PPVT-4[b] (years)	CARS Score[c]	Noun Knowledge	Preposition Knowledge	Matching Skills	Verbal Skills [d]	School History (years)	Speech Therapy	Visual Schedules	AAC Exposure
1	6.8	Male	ASD	English Ibo	Yes	3.6	32	7/8	0/5	6/6	Needs: Yes Stories: No	4	Yes 2 years	Yes	No
2	8.1	Male	ASD	English French	Yes	-	33.5	6/8	0/5	6/6	Needs: No Stories: No	4	Yes 5 years	Yes	Yes
3	10.8	Male	ASD	English isiZulu	Yes	3.2	32.5	7/8	0/5	6/6	Needs: Yes Stories: Yes	2	Yes 3 years	Yes	-
4	7.10	Male	ASD	English Setswana	Yes	2.6	32	6/8	1/5	6/6	Needs: Yes+No Stories: No	4	No	Yes	Yes
5	9.5	Male	ASD	English Xhosa	Yes	4.0	30	7/8	0/5	6/6	Needs: Yes Stories: No	2 ½	Yes	Yes	No
6	8.9	Male	ASD	English	Yes	3.5	36.5	7/8	1/5	6/6	Needs: No Stories: No	5	Yes 5 years	Yes	Yes
7	8.5	Male	ASD	English Sesotho	Yes	2.11	30.5	7/8	1/5	6/6	Needs: Yes Stories: No	3	Yes 3½ years	Yes	Yes
8	7.5	Male	ASD	English Afrikaans	Yes	3.1	31.5	7/8	1/5	6/6	Needs: Yes Stories: No	2	Yes 2 years	Yes	No
9	7.10	Male	ASD	English isiZulu	Yes	2.8	37	6/8	0/5	6/6	Needs: Yes Stories: No	4 months	No	Yes	No
10	9.9	Male	ASD	English Ndebele	Yes	2.5	37	5/8	1/5	6/6	Needs: Yes Stories: No	5	Yes 6 years	Yes	No
11	10.2	Male	ASD	English Sepedi	Yes	3.5	32.5	8/8	2/5	6/6	Needs: Yes Stories: No	3	Yes	Yes	No
12	8.7	Male	ASD	English Shona	Yes	3.8	31.5	8/8	1/5	6/6	Needs: Yes Stories: No	4 ½	Yes 3 years	Yes	Yes
13	7.0	Male	ASD	English Ndebele	Yes	3.9	31.5	8/8	1/5	6/6	Needs: Yes Stories: No	1 ½	Yes 4 years	Yes	No
14	7.1	Male	ASD	English	Yes	2.0	33.5	5/8	0/5	6/6	Needs: Yes Stories: Yes	3	Yes 2 years	Yes	Yes
15	6.6	Male	ASD	English	Yes	3.7	32.5	8/8	1/5	6/6	Needs: Yes Stories: No	5 months	Yes 4 years	Yes	Yes
16	7.1	Male	ASD	English isiZulu	Yes	2.4	35	6/8	0/5	6/6	Needs: No Stories: No	1 ½	Yes	Yes	-
17	8.1	Male	ASD	English Xhosa	Yes	3.8	34.5	8/8	2/5	6/6	Needs: Yes Stories: No	2 ½	Yes 6 years	Yes	No

Note: [a] Participant Number
[b] Age-equivalent score
[c] CARS Scores: 15-30 Non-Autistic
30-36 Mildly – Moderately Autistic
36-60 Severely Autistic
[d] Verbal skills in terms of the ability to 1) communicate their needs and 2) tell short stories

3.8 Procedures

3.8.1 Ethical considerations. Ethical considerations are essential when planning and implementing research, especially when the research involves human participants (McMillan & Schumacher, 2010; Polgar & Thomas, 2008; Polit & Beck, 2008). Data collection for this study only began once the University of Pretoria's Ethics Committee had granted ethics approval.

It was important to consider the three main ethical principles outlined in the Belmont report as they are important when conducting research involving human participants (Polit & Beck, 2008). The three principles are beneficence, respect for human dignity and justice. These principles encompass other principles that were also adhered to as discussed below.

The principle of respect for human dignity encompasses, for instance, the right to self-determination and full disclosure, which relates directly to informed consent (McMillan & Schumacher, 2010; Polit & Beck, 2008). The participant and/or the legal guardian were fully informed of the procedures and were free to participate in or withdraw from the study at any time. Continued assent was obtained from the participants each time that they engaged with the researcher. In addition, participants were informed of the need to store the collected data for a period of 15 years at the Centre for Augmentative and Alternative Communication, at the University of Pretoria, and their informed consent was obtained for the storage of the data. Participants were also reassured that this information would be kept safely to ensure their privacy.

In order to ensure privacy, the researcher assigned each participant a participant number to keep their information private and confidential. The video recording also did not record the participants' faces, but only their hands responding and the researcher. These videos were used only to ensure the reliability of the research results and for no other purposes.

3.8.2 General procedures. Approval to conduct the study was obtained from the University of Pretoria's Ethics Committee (Appendix A). Permission to carry out research at Gauteng Department of Education (GDE) schools was obtained from the GDE (Appendix B). Permission was also obtained from specific school principals to conduct the study at their respective schools (Appendix C).

The school principal introduced the researcher to the school-based speech therapist who assisted with the initial identification of potential participants based on the participant criteria provided in Table 7. Informed consent was therefore obtained from the speech therapist (Appendix D). Once the potential participants had been identified, informed consent was also obtained from the different teachers (Appendix E), who assisted with the identification and confirmation of potential participants (also based on the participant criteria provided in Table 7). The teachers furthermore assisted with the identification of English-speaking parents, and they distributed and collected not only the Caregiver Consent Letters (Appendix F), but also a Caregiver Questionnaire (Appendix J), that provided biographical information. Finally, informed consent was obtained from the caregivers of the potential participants.

Once a potential participant was identified, data collection commenced.

3.8.3 Data collection procedures.

3.8.3.1 Pre-experimental task screening. On a prearranged day, the researcher went to the school and set up the Noun-Knowledge Task (Appendix K) in the allocated room. The researcher then went to the potential participant's classroom where the teacher introduced the researcher to the potential participant. The researcher and potential participant next went to

the allocated room. Assent was obtained from the potential participant before the task was started (Appendix G).

The potential participant carried out the Noun Knowledge Task. If the potential participant met the selection criteria for the first task, the preposition knowledge task was carried out. If the potential participant met the selection criteria for the second task, the matching task was carried out. In the event that the participant did not meet the criteria for one of the tests, testing was stopped and no further tasks were carried out. The potential participant was given a token of appreciation (e.g. a star or sticker) and returned to their classroom. However, if the potential participant satisfied the selection criteria outlined in Table 7, further testing was carried out using the PPVT-4 (Appendix N).

After the PPVT-4 (Dunn & Dunn, 2007) had been completed, the potential participant was given a token of appreciation (e.g. a star or sticker) and taken back to their classroom. The researcher returned to the allocated room and immediately administered the Childhood Autism Rating Scale (Schopler et al., 1988) (Appendix O).

The information obtained from the pre-experimental task screening, testing and rating was used to determine candidacy and to obtain descriptive information about the participants. This information was also used to allocate the participants into two groups that were matched for age.

3.8.3.2 Experimental task administration. At a different time, the researcher set up the materials for the assessment in the allocated room on the school premises. Once all the materials were set up, the researcher went to the selected participant's classroom and re-introduced herself to the participant. The researcher and participant went to the allocated room and the participant was made aware of all video-recording equipment in the room. Assent was obtained from the participant before the task was started (Appendix G).

The researcher sat opposite the participant and explained to the participant what he needed to do. The target object and location for the first trial item were placed on the table in front of the participant. The iPad Air2^{TM1} with the PCS of the aided augmented input for the relevant trial item was placed to the left of the participant, and it was elevated using the iAdapter case, in front of the researcher, facing the participant. The researcher verbalised the trial instruction ("Put the doll in the box") whilst pointing at the iPad Air2^{TM1} to draw the participant's attention to the aided augmented input.

If the participant responded correctly, the task item was marked as correct (+) and the researcher proceeded to the instructions. If the participant did not respond correctly the participant had 10 seconds to carry out the trial instruction. When the participant failed to respond within the 10-second time-limit, the instruction was repeated after a 5-second inter-task interval and another 10-seconds were allowed. When the participant responded incorrectly or did not respond it was marked as incorrect (-). A code was used to mark the correct (+) and incorrect (-) responses to ensure that the participant was not aware of his performance being rated. If the participant responded incorrectly the next trial instruction was presented. When the participant responded correctly to one trial item the researcher proceeded to the instructions.

For each instruction the target object and location were placed on the table in front of the participant. The iPad Air2^{TM1} with the PCS of the aided augmented input for the relevant instruction was elevated to the left of the participant, using the iAdapter case, in front of the researcher, facing the participant.

The researcher verbalised each instruction (e.g. "Put the doll behind the bowl") whilst pointing at the iPad Air2^{TM1} to draw the participant's attention to the aided augmented input. The participant had 10 seconds to carry out the instruction. A code was used to mark the correct (+) and incorrect responses (-) to ensure that the participant was not aware of his

performance being rated. When the participant failed to respond within the 10-second time-limit, the instruction was repeated after a 5-second inter-task interval and another 10-seconds were allowed. When the participant responded correctly, the task item was marked as correct (+). When the participant responded incorrectly or did not respond it was marked as incorrect (-). Intermittent reassurance was provided to maintain the participant's motivation (e.g. You are on track!).

Once the tasks had been completed the participant was given a token of appreciation (e.g. a star) and taken back to his classroom.

3.8.4 Reliability.

3.8.4.1 Procedural Integrity. A rater, a post-graduate Physiotherapist, observed 40% of the video recordings that had been made of the tasks and completed the procedural integrity protocol checklist (Appendix Q) to determine procedural integrity (expressed as a percentage) (McMillan & Schumacher, 2010). According to Schlosser (2002) between 20% and 40% of the recordings should be rated by an independent rater. A score above 75% is rated as excellent (McMillan & Schumacher, 2010). Seven of the 17 (41%) procedural integrity protocol checklists were randomly selected and rated. Procedural integrity was calculated using the following formula:

$$\frac{\text{Steps correctly completed}}{\text{Total Number of Steps}} \times 100$$

$$\frac{258}{273} \times 100 = \mathbf{94.5\%}$$

3.8.4.2 Data Collection Reliability. Data obtained from the pre-experimental screening tasks, PPVT-4, CARS and the experimental tasks was captured on the Excel Data

Collection Form (Appendix S). A rater, a Speech Therapist enrolled in a post-graduate degree programme, checked 41% of the Microsoft Excel scoresheets to ensure that the responses were captured correctly and to determine the percentage agreement and a score above 75% was rated as excellent (McMillan & Schumacher, 2010). It was calculated to ensure that the data was recorded accurately, by using the following formula:

$$\frac{\text{Number of Agreements}}{\text{Number of Agreements + Number of Disagreements}} \quad X \quad 100$$

$$\frac{204}{204 + 0} \quad X \quad 100 = \mathbf{100\%}$$

3.8.5 Validity. Internal design validity was maintained by attempting to reduce potential threats to the validity (McMillan & Schumacher, 2010; Polgar & Thomas, 2008; Polit & Beck, 2008). The first challenge of instrumentation threats to validity, refers to the way in which changes to the instrument or the person collecting the data, may affect the result (McMillan & Schumacher, 2010). This threat was reduced by using a script to ensure consistent procedures and a standard means of interacting with the participants. The researcher collected all the data to ensure that there were no changes due to different data collectors. In addition, an inter-rater was enlisted to ensure that the procedure was consistent and that the data collected was accurate.

Validity threats associated with the selection of participants for the sample group and the control group (McMillan & Schumacher, 2010) were reduced by the within-subject research design, as the group participants were also the control group.

3.8.6 Data Analysis. The biographical information and scores from the CARS, PPVT-4, preposition knowledge tasks, noun knowledge tasks and matching tasks were captured on

an Excel scoresheet and descriptive statistics were used to describe the data. Data collected from the tasks (involving the instructions that contain prepositions) was also captured on an Excel spreadsheet and comparisons were made between the instructions in terms of the correct and incorrect responses for each item, across participants and for each condition. The descriptive data using percentages was subsequently presented in tables and bar charts.

A QQ plot and the Shapiro-Wilk test were used to test the assumption of normality (McMillan & Schumacher, 2010). As a result of the results of aforementioned tests non-parametric statistical tests were used to analyse the data. Nonparametric tests allow for data analysis when data points do not appear to come from normally distributed data points (McMillan & Schumacher, 2010). Non-parametric tests are slightly less sensitive than parametric tests at detecting differences between groups, however they reduce the probability of unreliable or incorrect results obtained from the use of parametric tests when the assumptions for parametric tests were not met (McMillan & Schumacher, 2010; Price et al., 2013). The Mann-Whitney test was used to determine whether there was a statistically significant difference between Condition A and Condition B results for Group 1 and Group 2. This was done so as to determine whether or not there was an order effect which would suggest that learning in the one condition influenced the results in the subsequent condition (Charness et al., 2012; Price et al., 2013). Table 9 outlines the aims of the non-parametric tests used for data analysis.

Table 9

Non-parametric Test Aims

Aim	**Statistical test**	**Justification**
To determine whether or not there was a statistically significant difference between the two conditions of aided augmented input	Wilcoxon Signed Ranks	This test is used to compare two sets of data from the same participants where the data points cannot be shown to come from a population within which the parameter is normally distributed (McMillan & Schumacher, 2010).

4. RESULTS

The results of the study are discussed in line with the sub-aims of the study, which were twofold, namely i) to determine the accuracy of responses to instructions containing prepositions with aided augmented input provided for 25% (preposition only) of the instruction, referred to as Condition A and 75% (subject, preposition and location) of the instruction, referred to as Condition B; and ii) to compare the accuracy of responses between Condition A and Condition B. In addition, the participant's results are described and discussed as they relate to i) their performance in the pre-experimental task and the experimental task, for the prepositions targeted, as well as ii) for the individual performances per instruction and per preposition.

4.1 Accuracy of responses to instructions with aided augmented input provided for Condition A and Condition B.

Table 10 provides an overview of the participant results for Condition A and Condition B, and the scores obtained on the PPVT-4 and CARS.

Table 10

Participants' Response Accuracy for Condition A, Condition B, PPVT-4 score and CARS

Participant Number	Number of accurate responses - Condition A	Number of accurate responses - Condition B	PPVT-4 Age-equivalent score (years)	CARS Score Mild/ Moderate/ Severe	
1	1	0	3.6	32	Mild
2	0	0	-	33.5	Mild
3	1	0	3.2	32.5	Mild
4	0	0	2.6	32	Mild
5	2	3	4.0	30	Mild
6	2	1	3.5	36.5	Severe
7	3	1	2.11	30.5	Mild
8	3	4	3.1	31.5	Mild
9	2	1	2.8	37	Severe
10	0	0	2.5	37	Severe
11	3	2	3.5	32.5	Mild
12	2	3	3.8	31.5	Mild
13	2	1	3.9	31.5	Mild

14	0	1	2.0	33.5	Mild
15	2	2	3.7	32.5	Mild
16	0	1	2.4	35	Mild
17	5	2	3.8	34.5	Mild

The participants' results outlined in Table 10 above show great variation in their individual response accuracies for the two aided augmented input conditions. The participants obtained age-equivalent scores of between 2.0 years (24 months) and 4.0 years (48 months) on the PPVT-4. Most of the participants (n=14) obtained scores of between 30 and 36 (mild to moderate ASD rating) on the CARS (Schopler et al., 1988) with the other three participants obtaining a score above 36 (severe ASD rating). Table 10 illustrates that some participants performed better with 25% aided augmented input, others performed better with 75% aided augmented input and some performed equally across the two conditions.

Figure 2 provides a summary of the participants' accurate responses for each condition.

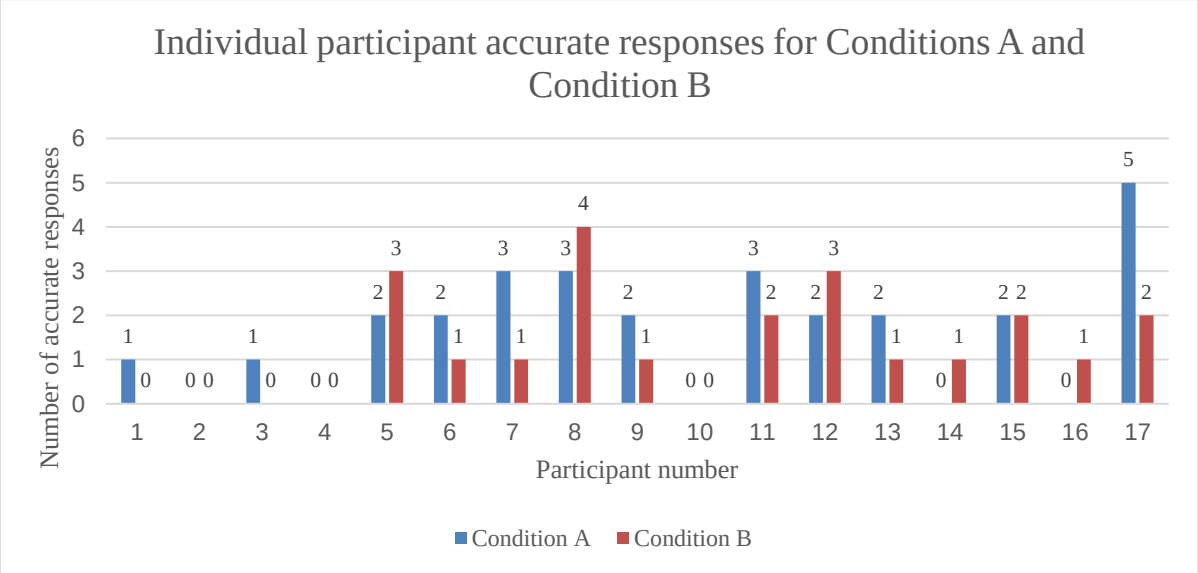

Figure 2. Individual participant accurate responses for Condition A and Condition B

Figure 2 illustrates that for Condition A, participants 2, 4, 10, 14 and 16 (n=5) obtained a score of zero and participant 17 (n=1) obtained a score of five, representing the

lowest and highest scores, respectively (*M*=1.65, *SD*=1.41). Participants 1, 2, 3, 4, 10, 14 and 16 obtained scores below the mean (n=7) while participants 5, 6, 7, 8, 9, 11, 12, 13, 15 and 17 (n=10) achieved scores above the mean. For Condition B, participants 1, 2, 3, 4 and 10 (n=5) obtained a score of zero and participant 8 (n=1) obtained a score of four, representing the lowest and highest scores, respectively (*M*=1.29, *SD*=1.21). Participants 1, 2, 3, 4, 6, 7, 9, 10, 13, 14 and 16 obtained scores below the mean (n= 11) while participants 5, 8, 11, 12, 15 and 17 (n=6) achieved scores above the mean. The median scores were 2 and 1 for Condition A and Condition B, respectively.

4.2 Comparison of the accuracy of responses between Condition A and Condition B

Participants 2, 4 and 10 (n=3) obtained a total score of zero and participants 8 and 17 (n=2) obtained a total score of seven, representing the lowest and highest total scores respectively (*M*=2.94, *SD*=2.36). Participants 1, 2, 3, 4, 10, 14 and 16 obtained scores below the mean (n=7) while participants 5, 6, 7, 8, 9, 11, 12, 13, 15 and 17 (n=10) achieved scores above the mean. The median score for all the instructions was 3.

Participants 1, 3, 6, 7, 9, 11, 13 and 17 (n=8) obtained a higher total for response accuracy for Condition A than for Condition B. Participants 5, 8, 12, 14 and 16 (n=5) did the opposite and obtained a higher total for response accuracy for Condition B. Participants 2, 4, 10 and 15 (n=4) obtained the same accuracy total for both conditions. Three of these participants (2, 4 and 10) obtained zero for both conditions and participant 15 obtained two for both conditions.

Figure 3 illustrates the percentage of accurate responses for Conditions A, Condition B and the total (Condition A and B).

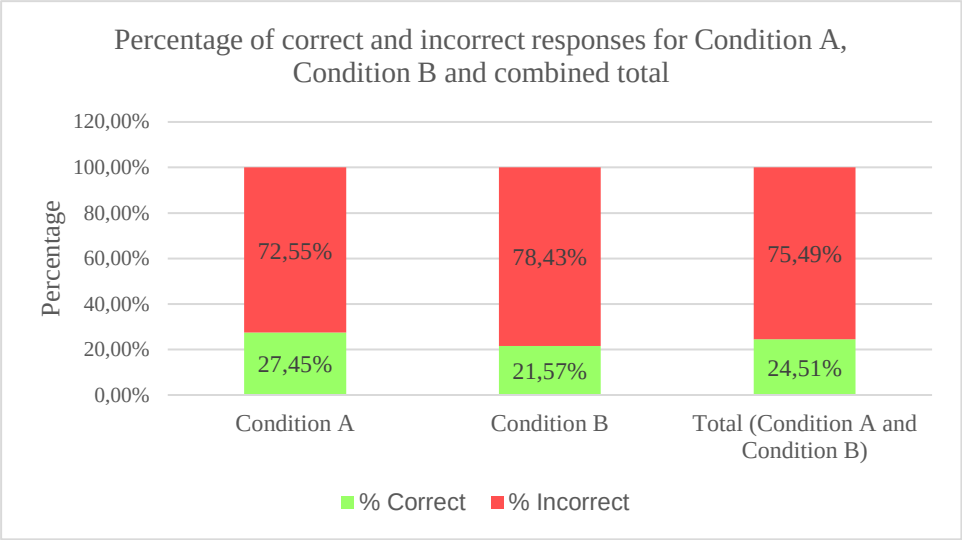

Figure 3. Percentage of correct and incorrect responses for Condition A, Condition B, and the combined total (Condition A and Condition B)

Figure 3 illustrates that the participants achieved an average response accuracy for instructions under Condition A of 27.45%, under Condition B of 21.57%. and 24.5% for all of the instructions.

The Shapiro-Wilk test was used to test the assumption of normality and to determine whether the data points are from a normally distributed set of data points. The data points are not from a normally distributed set of data points for either Condition A ($p=0.038$) or for Condition B ($p=0.029$), where normal distribution is $p>0.05$. Thus, nonparametric tests, namely the Wilcoxon Sign-Rank test was used to determine whether or not there was a statistically significant difference between the two conditions of aided augmented input. Testing revealed that this was not the case. No statistically significant difference could be found between the two conditions of aided augmented input ($Z = -1.164$, $p = 0.244$).

In addition, the Mann-Whitney test was used to determine whether there was a statistically significant difference between Group 1 and Group 2, so as to determine whether there were order effects. Group 1 were presented with Condition A and then Condition B, whilst Group 2 were presented with Condition B and then Condition A. Testing revealed no statistically significant difference between the two groups for Condition A ($Z=-1.550$,

p=0.121) and for Condition B (*Z*=-1.100, *p*=0.271). These results indicate that there were no order effects and that there was no significant difference in results for participants who were presented with Condition A first when compared to participants who were presented with Condition B first.

4.3 Comparison of preposition knowledge between the pre-experimental task and under the aided augmented input conditions

Table 11 illustrates participants preposition knowledge during the pre-experimental screening task and under the two conditions with the aided augmented input.

Table 11

Preposition Knowledge for the Pre-experimental Task and in the Aided Augmented Input Conditions

Preposition Knowledge	Participant number →	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Pre-task	On	-[a]	-	-	+	-	+	+	-	-	-	-	-	-	-	-	-	+
	Under	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-
	next to	-	-	-	-	-	-	-	-	-	+	+	+	+	-	+	-	-
	Behind	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	+
Condition A	On	-	-	+	-	+	+	+	+	+	-	+	-	+	-	+	-	+
	Under	+[b]	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	+
	next to	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-	+
	Behind	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-
Condition B	On	-	-	-	-	+	+	+	+	+	-	+	+	-	-	+	-	+
	Under	-	-	-	-	+	-	-	+	-	-	-	+	+	-	+	-	-
	next to	-	-	-	-	+	-	-	+	-	-	+	+	-	+	-	+	+
	Behind	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Overall performance		**1**[c]	**2**[d]	**1**	**3**[e]	**1**	**2**	**1**	**1**	**1**	**3**	**1+3**	**1**	**1+3**	**1**	**1+3**	**1**	**1+3**

Note: [a] incorrect or no response
[b] correct response
[c] better responses to the instructions for the aided augmented input than the pre-experimental task screening
[d] same response for aided augmented input than the pre-experimental task screening
[e] worse instruction responses for aided augmented input than in the pre-experimental task screening

The accuracy of responses in the aided augmented input conditions was low however, several participants (n=9) were able to carry out instructions containing prepositions under condition A or B, which they had not been able to carry out during the pre-experimental task screening task, as shown in Table 11. Two participants showed a decrease in the accuracy of their responses compared to the pre-experimental screening task, and two participants showed no change in the accuracy of their responses when compared to the pre-experimental screening task. Four participants presented with variable results, they presented with an increase in response accuracy for some of the prepositions and a decrease in response accuracy for other prepositions.

4.4 Accuracy of instruction-following under Condition A and Condition B per instruction

The accuracy of individual instruction following is described to outline the differences in the accuracy of responses per instruction. The information for individual instructions is represented in Figure 4.

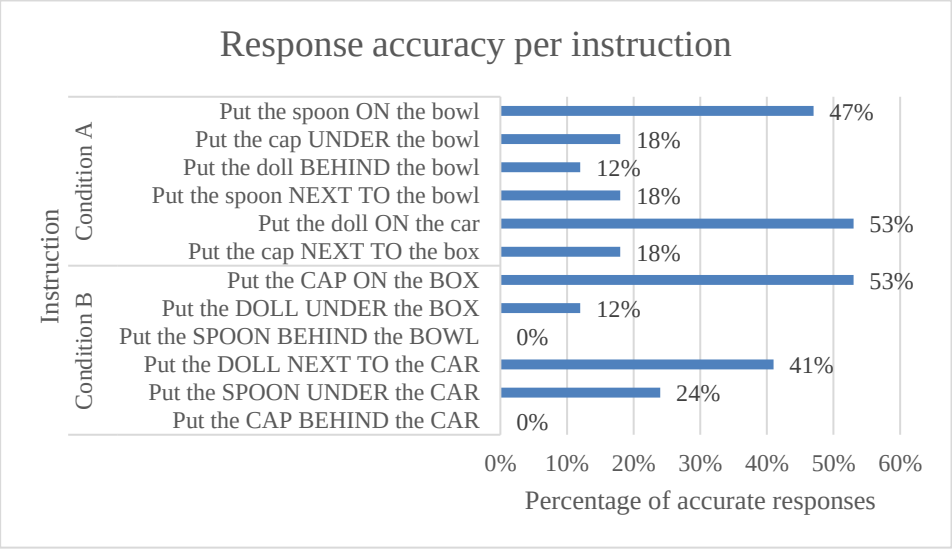

Figure 4. Accuracy of responses per instruction

Figure 4 illustrates that participants achieved 47% response accuracy for instructions 1 (Put the spoon on the bowl) and 53% response accuracy for instruction 5 (Put the doll on the

car) under Condition A, and a total of 53% accurate responses for instruction 1 (Put the cap on the box) under Condition B. These three instructions all targeted the preposition ‘on’, which is acquired at the age of about 24 months (Schlosser et al., 2013).

The participants achieved 18% accurate responses for instruction 2 (Put the cap under the bowl) under Condition A, and a response accuracy of 12% for instruction 2 (Put the doll under the box) and 24% for instruction 5 (Put the spoon under the car) under Condition B (see Figure 4). These instructions contain the preposition ‘under’, which is acquired at the age of about 36 months (Schlosser et al., 2013).

For the instructions that targeted the preposition ‘next to’, which is acquired at the age of about 40 months (Schlosser et al., 2013), the participants achieved 18% response accuracy for instructions 4 (Put the spoon next to the bowl) and 6 (Put the cap next to the box) under Condition A and 41% response accuracy for instruction 4 (Put the doll next to the car) under Condition B (see Figure 4).

The participants achieved 12% response accuracy for instruction 3 (Put the doll behind the bowl) under Condition A and 0% for instructions 3 (Put the spoon behind the bowl) and 6 (Put the cap behind the car) under Condition B (see Figure 4).

4.5 Accuracy of instruction-following under Condition A and Condition B per preposition

Figure 5 below provides a description of the response accuracy for the individual prepositions.

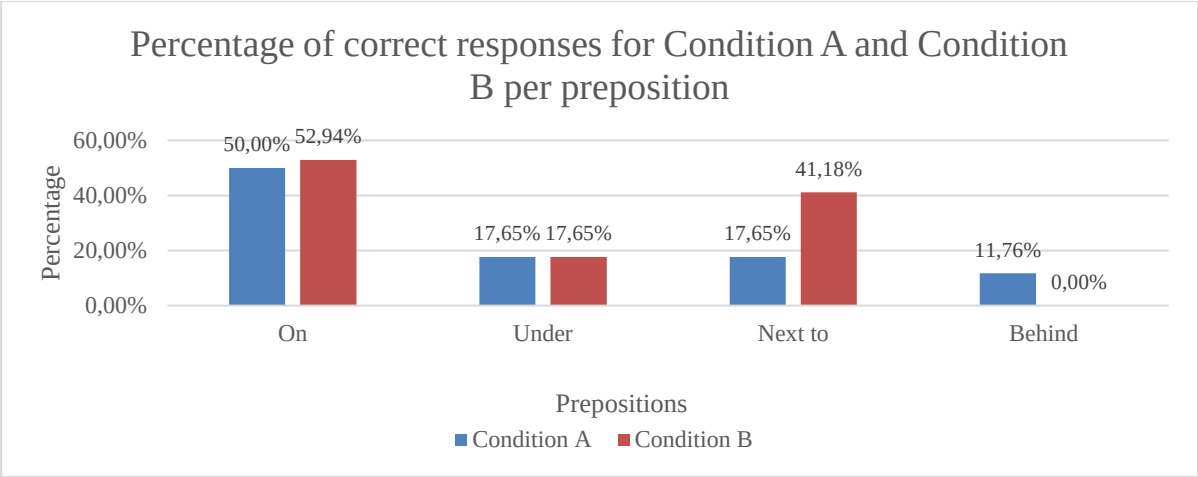

Figure 5. Accuracy of responses per preposition

Figure 5 illustrates that the participants achieved a similar response accuracy for the preposition ‘on’ under Condition A (50%) and Condition B (53%) and the same response accuracy under both conditions (18%) for the preposition ‘under’ (see Figure 5). The response accuracy for the prepositions ‘on’ represents the highest total for all of the prepositions targeted, which may be due to the earlier age of acquisition (24 months). All of the participants attained an age-equivalent score of at least 24 months (2.0 years) on the PPVT-4, as illustrated in Table 10.

The response accuracy for the preposition ‘next to’ showed a difference under the two conditions with 18% under Condition A and 41% under Condition B. The percentage of accurate responses for the preposition ‘behind’ was 12% under Condition A, with no accurate responses recorded under Condition B (0%) for any of the participants. The instructions that contained the preposition ‘behind’ showed the lowest response accuracy for all of the prepositions targeted. This may be due to the age of acquisition of the preposition which is at the age of about 48 months (Schlosser et al., 2013) and only one participant attained an age-equivalent score of 48 months (4.0 years) on the PPVT-4.

4.6 Discussion

The purpose of this study was to measure and compare the ability of children with ASD to follow instructions containing prepositions under two conditions of aided augmented input – Condition A with aided augmented input provided for 25% of the instruction (preposition only) and Condition B with aided augmented input provided for 75% of the instruction (subject, preposition and location).

For all the participants, it was clear that there was a deficit in receptive language skills, which is consistent with previous research findings (Charman et al., 2003; Hudry et al., 2010; Manolitsi & Botting, 2011; Rapin & Dunn, 2003). In addition, also consistent with previous research findings, the participants experienced a significant challenge in understanding instructions containing prepositions (Schlosser et al., 2013) – a finding that extended the current knowledge base and emphasised the need for additional research in this area. Previous studies focused on the effectiveness of aided augmented input, which has since been established (Schlosser et al., 2013) and was evident in this study, as several participants were able to carry out instructions containing prepositions which they had not been able to do during the pre-experimental task screening (which made no use of aided augmented input). The use of prepositions in the classroom setting is inescapable, and therefore important, and this study highlights the need for spoken input to be supplemented with aided augmented input to improve the understanding of instructions containing prepositions (Schlosser et al., 2013). Thus, even though the accuracy of responses was low, the aided augmented input assisted some participants in following the instructions that contained prepositions.

The data collected for these participants showed that there was no statistically significant difference between the two conditions of aided augmented input. Some of the participants performed better with less aided augmented input, some performed better with more aided augmented input and others showed no improvement or difference between the

two conditions. This supports previous research which indicated that children with ASD are a heterogenous group of children, with unique strengths and abilities, and that it is not always possible to generalise findings or find one solution that will be generalisable to all children with ASD (Rao & Gagie, 2006; Trembath et al., 2015).

Although many of the participants had not previously had exposure to AAC, all of them (including the participants who obtained zero for both conditions of aided augmented input) have had exposure to visual schedules, using PCS, in the classroom, which would suggest an awareness of pictures providing information or support for understanding (Cihak, 2011). Previous studies made use of photos taken from video scenes, which may have allowed the matching skills of the children with ASD to by-pass the need to understand the spoken instructions (Schlosser et al., 2013). The current study made use of PCS which did not allow for matching skills to compensate for a lack of understanding and this may have resulted in poorer than anticipated results.

The variability in performance across the two conditions may add to the body of available knowledge which suggests that not all children with ASD are strong visual learners (Brady et al., 2015; Ganz et al., 2015; Rao & Gagie, 2006) and that there is a need for in-depth assessment to determine the strengths of individual children with ASD before implementing AAC or aided augmented input (Ganz, 2015).

Overall, this study has shown that although aided augmented input improved the accuracy of responses to instructions containing prepositions for some of the children with ASD, there is no conclusive evidence to determine which condition of aided augmented input is most effective in improving the understanding of instructions that contain prepositions. There may well be need for intervention or training to maximise the benefits of the aided augmented input in children with ASD (Ganz, 2015; Schlosser et al., 2013).

5. CONCLUSION

The aim of the study was to investigate the effects of quantity of aided augmented input on the accuracy of instruction following in children with ASD. The children with ASD were given instructions under two conditions of aided augmented input, and their accurate responses were recorded and compared. Following is a summary of the most important aspects of the study.

5.1 Summary of the main findings

The results of this study varied across participants with some participants performing better under Condition A and others better under Condition B. No statistically significant difference was found between the two conditions of aided augmented input. The study found that some participants performed better with instructions that contained prepositions which were acquired at a younger age, and worse with instructions that contained prepositions acquired at a later age regardless of the quantity of aided augmented input. The current study adds to the body of knowledge that suggests that aided augmented input helps children with ASD to understand instructions that contain prepositions

5.2 Critical evaluation of the study

5.2.1 Strengths. The current study aimed to determine which condition of aided augmented input was require to facilitated the improvement in the participants' understanding of instructions that contain prepositions. The participants were screened prior to testing to determine their knowledge of the objects and prepositions as well as their matching skills. This was important to ensure that they did not have a pre-task knowledge of the prepositions targeted which previous studies had not measured (Schlosser et al., 2013). Establishing noun knowledge was important so as to ensure that the lack of knowledge of the objects or inability

to match pictures to objects, did not affect the outcome or have an impact on the results.

Previous studies used photos of the target position or end result (Schlosser et al., 2013) and these could have by-passed the need for understanding and participants may have relied on matching skills. This study made use of PCS which decreased iconicity and reduced the possibility of matching therefore it improved the isolation of the dependent variable, namely the participants' execution of the instruction due to understanding.

The research design allowed for the control of order and carry-over effects as well as experimenter demand effects, thus improving the validity of the results. (Charness et al., 2012; McMillan & Schumacher, 2010; Price et al., 2013). In addition, scripts were used to ensure consistency across participants and improve the procedural integrity of the study.

5.2.1 Limitations. The study included 17 participants, who complied with specific selection criteria and were recruited from schools for children with special needs. This resulted in a purposeful and small sample, which unfortunately limits the potential generalisability of findings to the broader population of children with ASD.

The study participants were provided with the target items, thus the objects included in the instruction were pre-determined without any foils. This strategy reduced the demands placed on the participants and the possibility for incorrect subject or location choice. However, it also reduced the generalisability to real-life situations where many foils could impact on the participant's ability to understand or execute an instruction.

The study made use of 12 instructions and targeted four prepositions. Although every attempt was made to match the two conditions of six instructions each with age of preposition acquisition, this was not achieved. Both conditions contained instructions with the four targeted prepositions and an additional two duplicate prepositions which were different for the two conditions. Condition A contained 'on' and 'next to' and Condition B contained 'under'

and ‘behind’, as duplication prepositions in the instructions. These variations in prepositions across the two conditions may have had an effect on the results.

The study presented the aided augmented input as individual pictures which were pointed to as the instructions was verbalised, resulting in the PCS being as transient as the auditory input, thus reducing the potential benefits of a more permanent visual aid. This may have placed higher demands on the working memory of the participants and reduced the potential to benefit from the aided augmented input.

Although the study tested the noun and preposition knowledge as well as matching skills of the participants, the participants’ ability to process information in a sentence was not assessed. The PPVT-4 also assessed the participants’ language skills at a single word level, thus no formal assessment of language at the sentence level was carried out and that may have had an influence on the results.

This was an experimental study which tested the participants’ ability to follow instructions without any prior intervention and outside of a natural context. The study did not allow for teaching of the objects or the PCS prior to the testing so as to ensure that all of the objects and PCS were known.

5.3 Clinical implications

The study found that the individual participants responded differently to the two conditions of aided augmented with varied results across the two conditions, suggesting that there is need for individualised assessments and interventions when using aided augmented input for children with ASD. As previously stated, children with ASD are not an homogenous group (Ganz, 2015) and this emphasises the need for individualised clinical interventions.

The study found that the use of aided augmented input can improve children with ASD’s understanding of instructions that contain prepositions in everyday situations,

especially in the classroom where prepositions are frequently used. Although the actual amount of aided augmented input required may differ among children with ASD, there appears to be general consensus (confirmed by this study) that aided augmented input is effective in improving the understanding of instructions that contain prepositions by children with ASD (Schlosser et al., 2013), therefore caregivers and professionals working with these children can use them to facilitate understanding.

5.4 Recommendations for further studies

The following recommendations are made regarding future studies. Firstly, there is a need for studies with a larger number of participants. Studies with a larger number of participants would help to identify any differences in understanding that may exist between the different conditions of aided augmented input and may help with highlighting factors that influence the benefits of each condition of aided augmented input.

Secondly there is need for an increase in the number of instructions presented, that would test each preposition at least twice. A larger number of instructions with the same prepositions tested equally in each condition would decrease variables across the conditions which may influence the outcome.

In addition, there is need to increase the duration of the aided augmented input and to present the input as a picture sentence which is non-transient, rather than as individual words which are transient.

There is need for additional language testing of potential participants, so that the language skills of the participants are known at the sentence level, specifically relating to their ability to process information provided in sentences.

Lastly, there may be need for a treatment study, with repeated exposure over a period of time to determine whether teaching with aided augmented input improves the

understanding of instructions that contain prepositions and if there is carry-over to other prepositions once the concept is learned.

5.5 Conclusion

The findings of this study suggest that there was no statistically significant difference between the two conditions of aided augmented input that were provided. The study has added to the body of knowledge that suggests that aided augmented input helps children with ASD to understand instructions that contain prepositions. However, there is need for further research to determine what condition of aided augmented input is required to optimally facilitate the understanding of instructions that contain prepositions.

Notes:

1. TM1: iPad, iPad Air2 and iPad Wifi are registered trademarks of Apple Inc., Cupertino, CA 95014, USA.
2. TM2: GoTalk Now App is a registered trademark of Attainment Company, Verona, Wisconsin, USA.
3. TM3: iAdaptor is a registered trademark of Advanced Multimedia Devices, Inc., Farmingdale, NY 11735, USA

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7. APPENDICES

Appendix A: University of Pretoria Ethics Committee Approval Letter

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities
Research Ethics Committee

19 February 2019

Dear Ms Ngwira

Project:	**The effects of quantity of aided input on the accuracy of instruction following in children with Autism Spectrum Disorder**
Researcher:	**S Ngwira**
Supervisor:	**Prof S Dada**
Department:	**Centre for Augmentative and Alternative Communication**
Reference number:	**18303481 (GW20181020HS)**

Thank you for your response to the Committee's correspondence.

I have pleasure in informing you that the Research Ethics Committee formally **approved** the above study at an *ad hoc* meeting held on 18 February 2019. Data collection may therefore commence.

Please note that this approval is based on the assumption that the research will be carried out along the lines laid out in the proposal. Should your actual research depart significantly from the proposed research, it will be necessary to apply for a new research approval and ethical clearance.

We wish you success with the project.

Sincerely

Prof Maxi Schoeman
Deputy Dean: Postgraduate and Research Ethics
Faculty of Humanities
UNIVERSITY OF PRETORIA
e-mail: PGHumanities@up.ac.za

cc: Prof S Dada (Supervisor) Prof J Bornman (HoD)

Fakulteit Geesteswetenskappe
Lefapha la Bomotho

Research Ethics Committee Members: **Prof MME Schoeman (Deputy Dean);** Prof KL Harris; Mr A Bizos; Dr L Blokland; Dr K Booyens; Dr A-M de Beer; Ms A dos Santos; Dr R Fasselt; Ms KT Govinder Andrew; Dr E Johnson; Dr W Kelleher; Mr A Mohamed; Dr C Puttergill; Dr D Reyburn; Dr M Soer; Prof E Taljard; Prof V Thebe; Ms B Tsebe; Ms D Mokalapa

Appendix B: Gauteng Department of Education Approval Letter

GAUTENG PROVINCE
Department: Education
REPUBLIC OF SOUTH AFRICA

8/4/4/1/2

GDE RESEARCH APPROVAL LETTER

Date:	10 December 2018
Validity of Research Approval:	05 February 2019 – 30 September 2019 2018/367
Name of Researcher:	[redacted]
Address of Researcher:	
Telephone Number:	
Email address:	
Research Topic:	The effects of the quantity of aided input on the accuracy of instruction-following in children with Autism Spectrum Disorder
Type of qualification	Masters
Number and type of schools:	Four LSEN Schools
District/s/HO	Gauteng West, Johannesburg East, Johannesburg West and Tshwane West

Re: Approval in Respect of Request to Conduct Research

This letter serves to indicate that approval is hereby granted to the above-mentioned researcher to proceed with research in respect of the study indicated above. The onus rests with the researcher to negotiate appropriate and relevant time schedules with the school/s and/or offices involved to conduct the research. A separate copy of this letter must be presented to both the School (both Principal and SGB) and the District/Head Office Senior Manager confirming that permission has been granted for the research to be conducted.

The following conditions apply to GDE research. The researcher may proceed with the above study subject to the conditions listed below being met. Approval may be withdrawn should any of the conditions listed below be flouted:

10/12/2018

Office of the Director: Education Research and Knowledge Management
7th Floor, 17 Simmonds Street, Johannesburg, 2001
Tel: (011) 355 0488
Email: Faith.Tshabalala@gauteng.gov.za
Website: www.education.gpg.gov.za

1. *The District/Head Office Senior Manager/s concerned must be presented with a copy of this letter that would indicate that the said researcher/s has/have been granted permission from the Gauteng Department of Education to conduct the research study.*
2. *The District/Head Office Senior Manager/s must be approached separately, and in writing, for permission to involve District/Head Office Officials in the project.*
3. *A copy of this letter must be forwarded to the school principal and the chairperson of the School Governing Body (SGB) that would indicate that the researcher/s have been granted permission from the Gauteng Department of Education to conduct the research study.*
4. *A letter / document that outline the purpose of the research and the anticipated outcomes of such research must be made available to the principals, SGBs and District/Head Office Senior Managers of the schools and districts/offices concerned, respectively.*
5. *The Researcher will make every effort obtain the goodwill and co-operation of all the GDE officials, principals, and chairpersons of the SGBs, teachers and learners involved. Persons who offer their co-operation will not receive additional remuneration from the Department while those that opt not to participate will not be penalised in any way.*
6. *Research may only be conducted after school hours so that the normal school programme is not interrupted. The Principal (if at a school) and/or Director (if at a district/head office) must be consulted about an appropriate time when the researcher/s may carry out their research at the sites that they manage.*
7. *Research may only commence from the second week of February and must be concluded before the beginning of the last quarter of the academic year. If incomplete, an amended Research Approval letter may be requested to conduct research in the following year.*
8. *Items 6 and 7 will not apply to any research effort being undertaken on behalf of the GDE. Such research will have been commissioned and be paid for by the Gauteng Department of Education.*
9. *It is the researcher's responsibility to obtain written parental consent of all learners that are expected to participate in the study.*
10. *The researcher is responsible for supplying and utilising his/her own research resources, such as stationery, photocopies, transport, faxes and telephones and should not depend on the goodwill of the institutions and/or the offices visited for supplying such resources.*
11. *The names of the GDE officials, schools, principals, parents, teachers and learners that participate in the study may not appear in the research report without the written consent of each of these individuals and/or organisations.*
12. *On completion of the study the researcher/s must supply the Director: Knowledge Management & Research with one Hard Cover bound and an electronic copy of the research.*
13. *The researcher may be expected to provide short presentations on the purpose, findings and recommendations of his/her research to both GDE officials and the schools concerned.*
14. *Should the researcher have been involved with research at a school and/or a district/head office level, the Director concerned must also be supplied with a brief summary of the purpose, findings and recommendations of the research study.*

The Gauteng Department of Education wishes you well in this important undertaking and looks forward to examining the findings of your research study.

Kind regards

.....

Ms Faith Tshabalala
Acting Director: Education Research and Knowledge Management

DATE: 10/12/2018

Office of the Director: Education Research and Knowledge Management
7th Floor, 17 Simmonds Street, Johannesburg, 2001
Tel: (011) 355 0488
Email: Faith.Tshabalala@gauteng.gov.za
Website: www.education.gpg.gov.za

GAUTENG PROVINCE
Department: Education
REPUBLIC OF SOUTH AFRICA

8/4/4/1/2

GDE AMENDED RESEARCH APPROVAL LETTER

Date:	**26 August 2019**
Validity of Research Approval:	**04 February 2019 – 30 September 2020** **2018/367A**
Name of Researcher:	**Ngwira S.P.T**
Address of Researcher:	[redacted]
Telephone Number:	
Email address:	
Research Topic:	**The effects of the quantity of aided input on the accuracy of instruction-following in the children with Autism Spectrum Disorder.**
Type of qualification	**Masters (MA AAC)**
Number and type of schools:	**Four LSEN Schools**
District/s/HO	**Gauteng West, Johannesburg East, Johannesburg West and Tshwane South**

Re: Approval in Respect of Request to Conduct Research

This letter serves to indicate that approval is hereby granted to the above-mentioned researcher to proceed with research in respect of the study indicated above. The onus rests with the researcher to negotiate appropriate and relevant time schedules with the school/s and/or offices involved to conduct the research. A separate copy of this letter must be presented to both the School (both Principal and SGB) and the District/Head Office Senior Manager confirming that permission has been granted for the research to be conducted.

26/08/2019

The following conditions apply to GDE research. The researcher may proceed with the above study subject to the conditions listed below being met. Approval may be withdrawn should any of the conditions listed below be flouted:

Office of the Director: Education Research and Knowledge Management
7th Floor, 17 Simmonds Street, Johannesburg, 2001
Tel: (011) 355 0488
Email: Faith.Tshabalala@gauteng.gov.za
Website: www.education.gpg.gov.za

1. *Letter that would indicate that the said researcher/s has/have been granted permission from the Gauteng Department of Education to conduct the research study.*
2. *The District/Head Office Senior Manager/s must be approached separately, and in writing, for permission to involve District/Head Office Officials in the project.*
3. *A copy of this letter must be forwarded to the school principal and the chairperson of the School Governing Body (SGB) that would indicate that the researcher/s have been granted permission from the Gauteng Department of Education to conduct the research study.*
4. *A letter / document that outline the purpose of the research and the anticipated outcomes of such research must be made available to the principals, SGBs and District/Head Office Senior Managers of the schools and districts/offices concerned, respectively.*
5. *The Researcher will make every effort obtain the goodwill and co-operation of all the GDE officials, principals, and chairpersons of the SGBs, teachers and learners involved. Persons who offer their co-operation will not receive additional remuneration from the Department while those that opt not to participate will not be penalised in any way.*
6. *Research may only be conducted after school hours so that the normal school programme is not interrupted. The Principal (if at a school) and/or Director (if at a district/head office) must be consulted about an appropriate time when the researcher/s may carry out their research at the sites that they manage.*
7. *Research may only commence from the second week of February and must be concluded before the beginning of the last quarter of the academic year. If incomplete, an amended Research Approval letter may be requested to conduct research in the following year.*
8. *Items 6 and 7 will not apply to any research effort being undertaken on behalf of the GDE. Such research will have been commissioned and be paid for by the Gauteng Department of Education.*
9. *It is the researcher's responsibility to obtain written parental consent of all learners that are expected to participate in the study.*
10. *The researcher is responsible for supplying and utilising his/her own research resources, such as stationery, photocopies, transport, faxes and telephones and should not depend on the goodwill of the institutions and/or the offices visited for supplying such resources.*
11. *The names of the GDE officials, schools, principals, parents, teachers and learners that participate in the study may not appear in the research report without the written consent of each of these individuals and/or organisations.*
12. *On completion of the study the researcher/s must supply the Director: Knowledge Management & Research with one Hard Cover bound and an electronic copy of the research.*
13. *The researcher may be expected to provide short presentations on the purpose, findings and recommendations of his/her research to both GDE officials and the schools concerned.*
14. *Should the researcher have been involved with research at a school and/or a district/head office level, the Director concerned must also be supplied with a brief summary of the purpose, findings and recommendations of the research study.*

The Gauteng Department of Education wishes you well in this important undertaking and looks forward to examining the findings of your research study.

Kind regards

.....

Mr Gumani Mukatuni
Acting CES: Education Research and Knowledge Management

DATE: 26/08/2019

Making education a societal priority

Office of the Director: Education Research and Knowledge Management
7th Floor, 17 Simmonds Street, Johannesburg, 2001
Tel: (011) 355 0488
Email: Faith.Tshabalala@gauteng.gov.za
Website: www.education.gpg.gov.za

Appendix C: School Principal Permission Letter

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities

March 2019

PERMISSION LETTER TO SCHOOL PRINCIPAL

Dear Principal

REQUEST TO CONDUCT RESEARCH AT YOUR INSTITUTION

I am a student, currently reading towards a Master's degree at the University of Pretoria, Center for Augmentative and Alternative Communication. In partial fulfilment of the requirements of the aforementioned degree, I am conducting a study entitled "The effects of quantity of aided input on the accuracy of instruction-following in children with Autism Spectrum Disorder". The research study is being conducted under the supervision of Professor Shakila Dada.

Rationale for the study

Children with Autism Spectrum Disorder (ASD) often have difficulty understanding spoken language. The use of visual aids or pictures, has been shown to improve their ability to understand spoken language. However, there is a need for further research to see how the combination of pictures and spoken language helps with the understanding of instructions in children with ASD.

This study will present two levels of aided input, 20% and 60 % and compare how children with ASD understand the instructions containing prepositions.

Objectives of the study

The main aim of the study is to determine the effect of varied frequencies of aided input on the accuracy of instruction-following, for instructions containing prepositions, in children with ASD. The following sub-aims will be carried out to achieve the main aim:

i. to determine the accuracy of responses to instructions containing prepositions with 20% aided input.
ii. to determine the accuracy of responses to instructions containing prepositions with 60% aided input.

Fakulteit Geesteswetenskappe
Lefapha la Bomotho

Centre for Augmentative and Alternative Communication, Room 2-36, Com path Building, Lynnwood Road
University of Pretoria, Private Bag X20
Hatfield 0028, South Africa
Tel +27 (0)12 420 2001
Fax +27 (0) 86 5100841
Email saak@up.ac.za
www.caac.up.ac.za

Expectations of the school

Participation in this study is voluntary and one may withdraw from the study at any time. Approval of this request will give the researcher permission to conduct the study at your school.

This will involve assisting the researcher with identifying learners between the ages of 4 and 10.11 years who have ASD. These learners will be assessed and the learners who meet the selection criteria will be included in the study.

Resources Needed

For the duration of the study the researcher will need access to and the use of a classroom/ therapy room, chairs and a table. Permission to conduct the study would mean that the researcher will have access to the learners at agreed upon times to ensure no disruption of academic work.

The study will require the learner to participate in activities on 2 separate days. On the first day, the pre-assessment will take approximately 1 hour per learner. A formal language assessment and 3 pre-task assessments, that have been designed for the purposes of this study will be conducted e.g. the learner will be asked to move a few objects around and to match pictures with objects. Learners who do not meet the selection criteria will not be required to participate on the second day.

Learners who meet the selection criteria will need to complete tasks on a second day. These learners will carry out tasks individually, however for data collection purposes, they will be allocated to 2 groups matched for age. The task completion will take approximately 45 minutes per participant. The tasks will include following instructions with 20% and 60% percent aided input.

Video recordings are part of the data collection process and will be treated as confidential. The video recording will only be used for data collection purposes and will not be used for training or conference presentations.

Who can participate in this study

There are specific selection criteria for learners to meet in order to participate in this study which relate to their diagnosis, age and language skills. The potential participant's parents or guardians will need to give their informed consent for their children's participation in the study. The potential participants and participants will need to give their assent to be a part of the study.

Electronic and hard copies of the research data will be stored at the University of Pretoria for 15 years in a locked cupboard. All of the data will be treated with confidentiality.

Access to the results of the study

I trust that the information provided is sufficient to enable you to provide the researcher permission to conduct the proposed study at your school. Please do not hesitate to contact us at the contact details below if you require any additional information. It would be much appreciated if you would complete the attached reply slip. Thank you for your time.

Yours sincerely

[redacted] [redacted]

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities

REPLY SLIP

PERMISSION TO CONDUCT THE STUDY

TOPIC
The effects of quantity of aided input on the accuracy of instruction following in children with Autism Spectrum Disorder

[redacted] [redacted]

I, _____, Principal of _____ (*School name*) hereby stipulate that:

Please tick the appropriate box:

☐ I consent to the study being conducted at _____ (*School name*) and that:

1. I have received and read the request to conduct research at this institution from Sheryll Ngwira.
2. I understand the requirements for the completion of the study.
3. I agree to allow Sheryll Ngwira to conduct the study at _____ (*School name*) in accordance with the requirements stipulated in the request.

☐ I do **not** consent to the study being conducted at _____(*School name*).

I would like a copy of the minithesis to be emailed to me. ☐Yes ☐No

Email address:_____

Signed at _____ on the _____ of _____ 201_.

Signature of Principal _____

Signature of researcher [redacted]

Centre for Augmentative and Alternative Communication, Room 2-36, Com path Building, Lynnwood Road
University of Pretoria, Private Bag X20
Hatfield 0028, South Africa
Tel +27 (0)12 420 2001
Fax +27 (0) 86 5100841
Email saak@up.ac.za
www.caac.up.ac.za

School Stamp

Fakulteit Geesteswetenskappe
Lefapha la Bomotho

Appendix D: Therapist Consent Letter

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Humanities 100.
1919 - 2019
Centre for Augmentative & Alternative Communication

March 2019

Dear Therapist

REQUEST TO CONDUCT RESEARCH AT YOUR INSTITUTION

I am a student, currently reading towards a Master's degree at the University of Pretoria, Center for Augmentative and Alternative Communication. In partial fulfilment of the requirements of the aforementioned degree, I am conducting a study entitled *"The effects of quantity of aided input on the accuracy of instruction following in children with Autism Spectrum Disorder"*. The research study is being conducted under the supervision of Professor Shakila Dada.

Research topic

To compare the effect of two levels of aided input on the understanding of instructions containing prepositions, in children with Autism Spectrum Disorder (ASD)

Rationale for the study

Children with ASD often have difficulty understanding spoken language. The use of visual aids e.g. pictures, has been shown to improve their ability to understand spoken instructions. However, there is a need for further research to see how the combination of pictures and spoken language helps with the understanding of instructions in children with Autism Spectrum Disorder (ASD) because this has implications for resource preparation.

This study will present two levels of aided input and compare how children with ASD respond to the instructions.

Fakulteit Geesteswetenskappe
Lefapha la Bomotho

Centre for Augmentative and Alternative Communication, Room 2-36, Com path Building, Lynnwood Road
University of Pretoria, Private Bag X20
Hatfield 0028, South Africa
Tel +27 (0)12 420 2001
Fax +27 (0) 86 5100841
Email saak@up.ac.za
www.caac.up.ac.za

Objectives of the study

The main aim of the study is to determine the effect of varied frequencies of aided input on the accuracy of instruction-following, for instructions containing prepositions, in children with ASD. The following sub-aims will be carried out to achieve the main aim:

i. to determine the accuracy of responses to instructions containing prepositions with aided input provided for the preposition only.
ii. to determine the accuracy of responses to instructions containing prepositions with aided input provided for the subject, preposition and location.

Your Role

Approval for this study to be conducted has been granted by the Gauteng Department of Basic Education. You are requested to assist with the identification of learners with the following characteristics:

1. ASD, with a diagnosis from a medical professional (doctor or specialist);
2. Aged between 4 and 10.11 years;
3. English home language; and
4. No uncorrected hearing or visual difficulties.
   All information obtained regarding the learners will be treated as strictly confidential.

Access to the results of the study

When the study is completed the researcher will present the results to the principal, therapists, teachers and parents/ guardians at an agreed upon time. Electronic and hard copies of the research data will be stored at the University of Pretoria for 15 years. All of the data will be treated with confidentiality. The results may be shared in article formats with other professionals and at conference presentations, without revealing the identity of the school or the participants. The minithesis will be available electronically and can be emailed to the you, if requested.

Participation in this study is voluntary and you may withdraw from the study at any time. Should you require any additional information, you are welcome to contact us at the contact details below. Please complete the attached reply slip.

Yours sincerely

[redacted] [redacted]

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Humanities 100.
1919 - 2019
Centre for Augmentative & Alternative Communication

REPLY SLIP
Consent to participate in the research study

TOPIC
"The effects of quantity of aided input on the accuracy of instruction following in children with Autism Spectrum Disorder"

[redacted] [redacted]

I, _____, a therapist at _____ (*School name*) hereby stipulate that (*please tick the appropriate box*):

☐ I consent to participate in the study and that:

i. I have received and read the request to conduct research at this institution from Sheryll Ngwira.
ii. I understand the requirements for the completion of the study.
iii. I agree to assist Sheryll Ngwira with the identification of potential participants and complete the teacher questionnaire pertaining to participants in the study at _____ (*School name*), in accordance with the requirements stipulated in the request.

OR

☐ I do not consent to participate in the study.

☐ I would like a copy of the mini-thesis to be emailed to me.
Email address:_____

Signed at _____ on the _____ of _____ 20__.

Signature of Therapist: _____

Fakulteit Geesteswetenskappe
Lefapha la Bomotho

Centre for Augmentative and Alternative Communication, Room 2-36, Com path Building, Lynnwood Road
University of Pretoria, Private Bag X20
Hatfield 0028, South Africa
Tel +27 (0)12 420 2001
Fax +27 (0) 86 5100841
Email saak@up.ac.za
www.caac.up.ac.za

Appendix E: Teacher Consent Letter

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities

March 2019

Dear Teacher

REQUEST TO CONDUCT RESEARCH AT YOUR INSTITUTION

I am a student, currently reading towards a Master's degree at the University of Pretoria, Center for Augmentative and Alternative Communication. In partial fulfilment of the requirements of the aforementioned degree, I am conducting a study entitled "The effects of quantity of aided input on the accuracy of instruction following in children with Autism Spectrum Disorder". The research study is being conducted under the supervision of Professor Shakila Dada.

Research topic

To compare the effect of two levels of aided input on the understanding of instructions containing prepositions, in children with Autism Spectrum Disorder (ASD)

Rationale for the study

Children with ASD often have difficulty understanding spoken language. The use of visual aids e.g. pictures, has been shown to improve their ability to understand spoken instructions. However, there is a need for further research to see how the combination of pictures and spoken language helps with the understanding of instructions in children with Autism Spectrum Disorder (ASD) because this has implications for resource preparation.

This study will present two levels of aided input (20% and 60%) and compare how children with ASD respond to the instructions.

Approval for this study to be conducted has been granted by the Gauteng Department of Basic Education. You are requested to assist in the following way:

1. with the identification of English-speaking parents or legal guardians of children between the ages of 4 and 10.11 years, who do not have any hearing or visual difficulties.
2. complete a teacher questionnaire regarding the learner's biographical information and functioning in various classroom-based activities. Only relevant information about the learner's age, gender, therapy history, and home language will be accessed by the researcher.
   All information obtained will be treated as strictly confidential.
3. once consent has been obtained from parents or legal guardians, you would allow learners who meet the selection criteria to leave the classroom on two specified days, once for pre-assessment, for approximately 1 hour and once for the task completion, for approximately 45 minutes. Video recordings will form part of the data collection process and will be treated as confidential.

Access to the results of the study

When the study is completed the researcher will present the results to the principal, teachers, parents/ guardians and participants at an agreed upon time. Electronic and hard copies of the research data will be stored at the University of Pretoria for 15 years. All of the data will be treated with confidentiality. The results may be shared in article formats with other professionals and at conference presentations, without revealing the identity of the school or the participants. The minithesis will be available electronically and can be emailed to the you, if requested.

Participation in this study is voluntary and you may withdraw from the study at any time. Should you require any additional information, you are welcome to contact us at the contact details below. Please complete the attached reply slip.

Yours sincerely

[redacted] [redacted]

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities

REPLY SLIP
Consent to participate in the research study

TOPIC
"The effects of quantity of aided input on the accuracy of instruction following in children with Autism Spectrum Disorder"

[redacted] [redacted]

I, _____, a teacher at _____ (*School name*) hereby stipulate that (*please tick the appropriate box*):

☐ I consent to participate in the study and that:

1. I have received and read the request to conduct research at this institution from Sheryll Ngwira.
2. I understand the requirements for the completion of the study.
3. I agree to assist Sheryll Ngwira with the identification of potential participants and complete the teacher questionnaire pertaining to participants in the study at _____ _____ (*School name*), in accordance with the requirements stipulated in the request.

OR

☐ I do not consent to participate in the study.

☐ I would like a copy of the minithesis to be emailed to me.
Email address:_____

Signed at _____ on the _____ of _____ 201_.

Signature of Teacher _____

Fakulteit Geesteswetenskappe
Lefapha la Bomotho

Centre for Augmentative and Alternative Communication, Room 2-36, Com path Building, Lynnwood Road
University of Pretoria, Private Bag X20
Hatfield 0028, South Africa
Tel +27 (0)12 420 2001
Fax +27 (0) 86 5100841
Email saak@up.ac.za
www.caac.up.ac.za

Appendix F: Caregiver Consent Letter

Faculty of Humanities

March 2019

Dear Parent/ Guardian

I am a student, currently reading towards a Master's degree at the University of Pretoria, Center for Augmentative and Alternative Communication. In partial fulfilment of the requirements of the aforementioned degree, I am conducting a study at the school your child attends to look at the effect of different amounts of aided input, on the understanding of instructions containing prepositions, in children with Autism Spectrum Disorder (ASD). The research study is being conducted under the supervision of Professor Shakila Dada.

Research topic

To compare the effect of two levels of aided input, on the understanding of instructions containing prepositions, in children with Autism Spectrum Disorder (ASD).

Rationale for the study

Children with ASD often have difficulty understanding spoken language. The use of visual aids e.g. pictures, has been shown to improve their ability to understand spoken instructions. There is a need for further research to determine how much aided input, which combines spoken language with visual aids, is needed to improve understanding of prepositions.

This study will present two levels of aided input, at 20% and 60 %, and compare how children with ASD respond to the instructions.

ii. to determine the accuracy of responses to instructions containing prepositions with 60% aided input.

What will be expected from my child if I allow him/ her to participate?

Upon consent from you, your child will be asked if they would like to participate. Your child will possibly be expected to participate in activities on 2 separate days. On the first day, the pre-assessment will take approximately 1 hour per learner to determine whether or not they meet the selection criteria. The selection criteria for this study are:
i) children with ASD between the ages of 4 and 10.11 years;
ii) English home language;
iii) no uncorrected visual or hearing difficulties;
iv) a standard score of more than 75 on a formal language assessment;
v) 2, or less than 2 out of 5 for a preposition assessment and
vi) 4, or more than 4 out of 6 for noun and matching assessments. The three assessments mentioned in v) and vi) have been designed for the purposes of this study. The assessments involve identifying a picture from a group of 4 pictures in response to a spoken label, as well as manipulating a few objects, as depicted in the pictures.

If your child does not meet the selection criteria after the assessments s/he will not need to complete the tasks on a second day. If your child meets all of the selection criteria after the assessments s/he will be asked to complete tasks on a second day. The reason for the selection criteria is to ensure that all the children included in the study have comparable language abilities.

On the second day your child will complete tasks that will take approximately 45 minutes. The tasks will include following instructions with 20% and 60% percent aided input (pictures). Video recordings are part of the data collection process and will be treated as confidential.

Risks and benefits of participation

The participant will not be at risk for harm during the study process.

What will be expected of you if you participate?

If you agree for your child to participate in the study, you need to complete a short questionnaire about your child's language development.

What are your rights and the rights of your child?

You and your child have the choice of whether or not you want to participate in the study. Please see the letter which will be read to your child to obtain their assent, should you consent to their participation. There will not be any negative consequences if you do not participate in the study. You and your child can withdraw from the study at any point in time if you no longer want to participate in the study. Your child can withdraw from the study at any point in time if s/he no longer wants to participate in the study. When the study results are presented, we will make sure that your name and your child's name are never mentioned so that your privacy is protected.

What happens after the data is collected?

The results and video recordings will be handled by myself, a research assistant and my supervisor. All of the information obtained will be kept safely in a locked cupboard at the Center for Augmentative and Alternative Communication for 15 years.

The information obtained from the parents and children that participate in the study will be put together to write a minithesis and an article in a scientific journal, and to make a presentation at conferences, without revealing the identity of the school or the children. I will provide feedback following the study and if you would like to find out more about the results, I will email an electronic copy of the minithesis to you. If you have any questions about the study, you are welcome to contact me at any time.

Please complete the attached reply slip. Should you require any additional information, please do not hesitate to contact me. Thank you for your time.

Yours sincerely

REPLY SLIP
PARENTAL INFORMED CONSENT

TOPIC
To compare the effect of two levels of aided input, on the understanding of instructions containing prepositions, in children with Autism Spectrum Disorder

[redacted] [redacted]

Name of Participant (Child): _____

Name of Parent/ Guardian: _____

Date: _____

I hereby stipulate that:

1. I understand my rights as a participant in the study.
2. I understand the scope of this study and the way in which it will be conducted.

I hereby (*please tick the appropriate box*):

☐ Voluntarily declare my consent to participate in this study as stipulated in the letter.

OR

☐ Declare that I will not participate in this study.

Signed at _____ on the _____ of _____ 201_.

Signature of Parent/ guardian_____

REPLY SLIP
PARENTAL INFORMED CONSENT – PARTICIPANT

TOPIC
To compare the effect of two levels of aided input, on the understanding of instructions containing prepositions, in children with Autism Spectrum Disorder

[redacted] [redacted]

Name of Participant (Child): _____

Name of Parent/ Guardian: _____

Date: _____

I hereby stipulate that:

3. I understand my child's rights as a participant.
4. I understand the scope of this study and the way in which it will be conducted.

I hereby (*please tick the appropriate box*):

☐ Voluntarily declare my consent for my child to participate in this study as stipulated in the letter.

OR

☐ Declare that my child may **not** participate in this study.

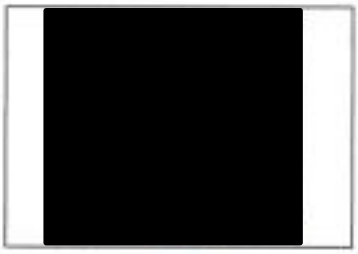
I would like a copy of the minithesis to be emailed to me. ☐ Yes ☐ No
Email address:_____

Signed at _____ on the _____ of _____ 201_.

Signature of Parent/ guardian_____

Appendix G: Participant Assent Letter

Participant Assent
Script 1



Hello, my name is Sheryll. I want to work with you to see how children understand some words and pictures. I want to ask you if you will work with me today. If you say yes, this is what we will do:

First, I will show you toys and ask you to point to some of the toys.

Second, I will show you some toys and ask you to move the toys around.

Third, I will show you a picture of a toy and ask you to point to the toy.

Fourth, I will show you four pictures at a time. I will say some words and you must tell me which picture I am talking about

I will record us when we are working.

If you want to stop at any time, you can tell me or point to this picture of the stop sign and I will take you back to class.

Participant Number:	

Day 1

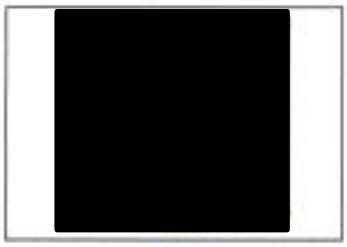
I have two pictures here. This picture is for yes. This picture is for no. I am going to ask you a question. You have to answer yes (point to yes picture) or no (point to no picture).

I have some boxes with me today with pictures on them. I am going to ask you a question for each box. You have to answer yes (point at yes picture) or no (point at no picture) by posting the yes or no picture into the box.

Let's look at some of the boxes:

Symbol on Post Box	Question asked	Tick participants response	
		Participant posted yes response	Participant posted no response
	Would you like to work with me today?		
	Can I please video tape what we are going to do?		
	Do you understand that we can stop whenever you want to?		

Participant Assent
Script 2



Hello, my name is Sheryll. I want to work with you to see how children understand some words and pictures. I want to ask you if you will work with me today. If you say yes, this is what we will do:

I will show you some toys and ask you to move the toys around.

I will record us when we are working.

If you want to stop at any time, you can tell me or point to this picture of the stop sign and I will take you back to class.

Participant Number:	

Day 2

I have two pictures here. This picture is for yes. This picture is for no. I am going to ask you a question. You have to answer yes (point to yes picture) or no (point to no picture).

I have some boxes with me today with pictures on them. I am going to ask you a question for each box. You have to answer yes (point at yes picture) or no (point at no picture) by posting the yes or no picture into the box.

Let's look at some of the boxes:

Symbol on Post Box	Question asked	Tick participants response	
		Participant posted yes response	Participant posted no response
	Would you like to work with me today?		
	Can I please video tape what we are going to do?		
	Do you understand that we can stop whenever you want to?		

Appendix H: Non-disclosure Agreement – Independent Observer

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities

March 2019

Dear Independent Observer

I am a student, currently reading towards a Master's degree at the University of Pretoria, Center for Augmentative and Alternative Communication. In partial fulfilment of the requirements of the aforementioned degree, I am conducting a study at the school your child attends to look at the effect of different amounts of aided input, on the understanding of instructions containing prepositions, in children with Autism Spectrum Disorder (ASD). The research study is being conducted under the supervision of Professor Shakila Dada.

Research topic

To compare the effect of two levels of aided input, on the understanding of instructions containing prepositions, in children with Autism Spectrum Disorder (ASD).

Rationale for the study

Children with ASD often have difficulty understanding spoken language. The use of visual aids e.g. pictures, has been shown to improve their ability to understand spoken instructions. There is a need for further research to determine how much aided input, which combines spoken language with visual aids, is needed to improve understanding of prepositions.

This study will present two levels of aided input, at 20% and 60 %, and compare how children with ASD respond to the instructions.

Objectives of the study

The main aim of the study is to determine the effect of varied frequencies of aided input on the accuracy of instruction-following, for instructions containing prepositions, in children with ASD. The following sub-aims will be carried out to achieve the main aim:

i. to determine the accuracy of responses to instructions containing prepositions with 20% aided input.
ii. to determine the accuracy of responses to instructions containing prepositions with 60% aided input.

Fakulteit Geesteswetenskappe
Lefapha la Bomotho

Centre for Augmentative and Alternative Communication, Room 2-36, Com path Building, Lynnwood Road
University of Pretoria, Private Bag X20
Hatfield 0028, South Africa
Tel +27 (0)12 420 2001
Fax +27 (0) 86 5100841
Email saak@up.ac.za
www.caac.up.ac.za

What will be expected of you?

You will be asked to observe video recordings of the tasks and to complete a checklist to determine that all of the tasks are completed, and in the correct order. You will also be asked to observe video recordings to ensure that the responses were captured correctly. All of the data that you observe is confidential and as such may not be shared with any other person.

Please complete the attached reply slip. Should you require any additional information, please do not hesitate to contact me. Thank you for your time.

Yours sincerely

[redacted] [redacted]

REPLY SLIP
NON-DISCLOSURE AGREEMENT – INDEPENDENT OBSERVER

TOPIC
To compare the effect of two levels of aided input, on the understanding of instructions containing prepositions, in children with Autism Spectrum Disorder

[redacted] [redacted]

Name of Independent Observer: _____

Occupation: _____

Date: _____

I hereby stipulate that:

☐ I understand the scope of this study and the way in which it will be conducted.

☐ I understand my role in the study.

☐ I understand that I may not disclose, in writing or verbally, any of the information regarding the study or the participants that I am made aware of during the study.

I hereby declare that I will not disclose any information regarding the study or the participants and will maintain confidentiality at all times.

Signed at _____ on the _____ of _____ 201_.

Signature of Independent Observer: _____

Appendix I: Teacher Questionnaire

Official use: Participant No.

TEACHER QUESTIONNAIRE

Dear Teacher

Thank you for your assistance with this research study. Could you please answer the questions below regarding (*learner's name*) _____ so that I am able to better understand him/her.

Thank you in advance.

BIOGRAPHICAL INFORMATION

Learner's Name: _____ Date of Birth: _____

Home language: _____ Gender: _____

How long has the learner been at this school? _____

How long has the learner been in your class? _____

Please tick (✓) the relevant column

FOLLOWING INSTRUCTIONS

	YES	NO
10. Can the learner listen to an instruction without interrupting?		
11. Can the learner follow a one-part instruction?		
12. Can the learner follow a two-part instruction?		
13. Is the learner able to follow basic instructions in the classroom?		
14. Is the learner able to follow instructions to perform simple actions?		
15. Is the learner able to follow instructions including locations (e.g. in/ behind)?		
16. Do you use visual schedules in your classroom?		

LANGUAGE

	YES	NO
17. Can the learner name objects in the class?		
18. Can the learner communicate his/ her needs verbally?		
19. Does the learner understand short stories?		
20. Does the learner tell short stories?		

GENERAL

	YES	NO
21. Does the learner have any special/ particular likes or dislikes?		

Please explain:

_____

_____

Please mention any additional information which you think is important:

_____

_____

_____

_____

_____

_____

_____

_____

Teacher Name: _____ Class: _____

School:_____

Appendix J: Caregiver Questionnaire

Official use: Participant No.

CAREGIVER QUESTIONNAIRE

Dear Parent/ Guardian

Thank you for your assistance with this research study. Could you please answer the questions below regarding (*child's name*) _____ so that I am able to better understand him/her.

Thank you in advance.

BIOGRAPHICAL INFORMATION

Learner's Name: _____ Date of Birth: _____

Home language: _____ Gender: **M F**

Diagnosis: _____

When was your child diagnosed? _____

Which professional diagnosed your child? _____

Please tick (✓) the relevant column

CURRENT THERAPY

	YES	NO
1. Does your child currently receive speech & language therapy?		
2. If yes, how long has your child been receiving speech & language therapy?		
3. Has your child been exposed to Augmentative and Alternative Communication?		

VISION

	YES	NO
4. Has your child's eyesight ever been tested?		

5. Does your child have any visual problems?		
6. Does your child wear glasses?		

HEARING

7. Has your child's hearing ever been tested?		
8. Does your child have any hearing difficulties?		
9. Does your child use a hearing aid/ cochlear implant?		
10. Does your child respond when being called by a person not facing him/her?		
11. Does your child have any difficulty hearing you at home?		

LANGUAGE

	YES	NO
12. What is your home language		
13. What language do you speak to your child?		
14. Does your child understand English?		
15. Does your child use English to communicate at home?		
16. Does your child use English to communicate socially?		

GENERAL

	YES	NO
17. Does your child have any special/ particular likes or dislikes?		

Please mention any additional information which you think is important:

_____

_____

_____

_____

I, (parent's name), _____ am the legal guardian/ parent of (child's name), _____. The information above is correct and accurate to the best of my knowledge.

Signed: _____ Date: _____

Appendix K: Noun Knowledge Task

Noun Knowledge Task

Participant Number: _____

Instruction	**Presented with:**		**Correct (+)**	**Incorrect (-)**
Give me the doll	spoon	car		
Give me the bowl	teddy bear	truck		
Give me the spoon	cap	box		
Give me the car	box	truck		
Give me the cap	doll	bowl		
Give me the box	bowl	teddy bear		
Give me the truck	doll	cap		
Give me the teddy bear	car	spoon		

Completed by: _____

Checked by: _____

Photographs of Miniature Objects

Doll

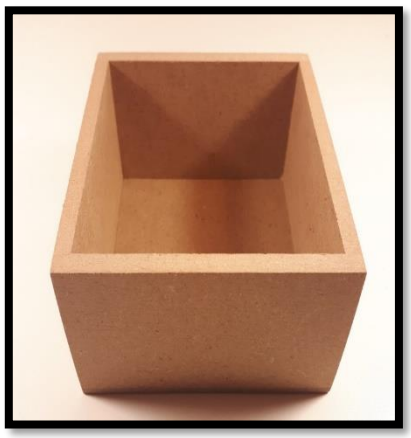
Spoon

Bowl

Cap

Car

Box



Truck

Teddy Bear

Appendix L: Preposition Knowledge Task

Preposition Knowledge Task

Participant Number: _____

Instruction	Correct (+)	Incorrect (-)
Put the teddy in front of the truck		
Put the teddy on the truck		
Put the teddy next the truck		
Put the teddy behind the truck		
Put the teddy under the truck		

Completed by: _____

Checked by: _____

Appendix M: Matching Task

Matching Task

Participant Number: _____

Instruction: **"Give me this one"**

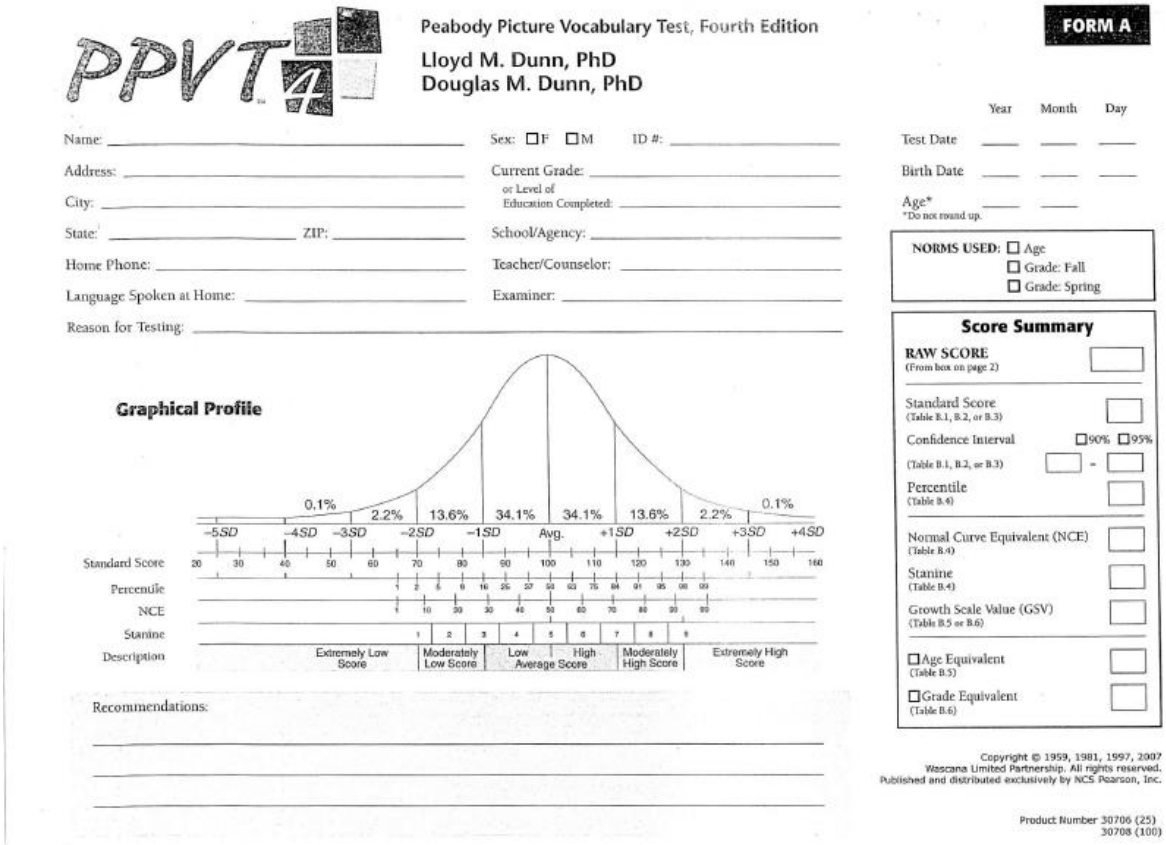
Point at the image on the iPad

Picture Communication Symbol (PCS)	**Presented with:**		**Correct (+)**	**Incorrect (-)**
Spoon	cap	car		
Cap	bowl	doll		
Doll	cap	box		
Car	box	spoon		
Box	doll	bowl		
Bowl	car	spoon		

Completed by: _____

Checked by: _____

Appendix N: Peabody Picture Vocabulary Test – Fourth Edition



PPVT 4

Peabody Picture Vocabulary Test, Fourth Edition

Lloyd M. Dunn, PhD
Douglas M. Dunn, PhD

FORM A

Name: _____ Sex: ☐F ☐M ID #: _____

Address: _____ Current Grade: _____

City: _____ or Level of Education Completed: _____

State: _____ ZIP: _____ School/Agency: _____

Home Phone: _____ Teacher/Counselor: _____

Language Spoken at Home: _____ Examiner: _____

Reason for Testing: _____

	Year	Month	Day
Test Date			
Birth Date			
Age* *Do not round up.			

NORMS USED: ☐ Age ☐ Grade: Fall ☐ Grade: Spring

Graphical Profile

0.1% 2.2% 13.6% 34.1% 34.1% 13.6% 2.2% 0.1%

−5SD −4SD −3SD −2SD −1SD Avg. +1SD +2SD +3SD +4SD

Standard Score 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160

Percentile 1 2 5 9 16 25 37 50 63 75 84 91 95 98 99

NCE 1 10 20 30 40 50 60 70 80 90 99

Stanine 1 2 3 4 5 6 7 8 9

Description: Extremely Low Score | Moderately Low Score | Low Average Score | High Average Score | Moderately High Score | Extremely High Score

Score Summary

RAW SCORE (From box on page 2)	
Standard Score (Table B.1, B.2, or B.3)	
Confidence Interval (Table B.1, B.2, or B.3)	☐90% ☐95%
Percentile (Table B.4)	
Normal Curve Equivalent (NCE) (Table B.4)	
Stanine (Table B.4)	
Growth Scale Value (GSV) (Table B.5 or B.6)	
☐Age Equivalent (Table B.5)	
☐Grade Equivalent (Table B.6)	

Recommendations:

Product Number 30706 (25)
30708 (100)

Administering Items

The **Training Items** must be administered first. Directions are listed on the training easel pages.

The **Start Item** is the first item in the age-appropriate item set. Start Items are listed in the right-hand column on this page, and on the tabbed easel pages.

The **Complete Set Rule** requires the administration of all 12 items in the set in order, beginning with the first item in the set.

The **Basal Set Rule** is one (1) or zero (0) errors in a set. Establish the Basal Set first. If necessary, administer earlier sets until the rule is met or until Set 1 is completed. Then test forward by sets until a Ceiling Set is obtained.

The **Ceiling Set Rule** is eight (8) or more errors in a set. Stop testing after giving ***all*** items in the Ceiling Set.

Recording Responses and Errors

- Record the examinee's response (1, 2, 3, or 4) on the record form by circling the corresponding number after the stimulus word for each item. The correct response is in red. See the example below.
- Indicate an error (incorrect or no response) by drawing an oblique line through the E, as shown below.

Example:

Start Ages 2:6–3:11					SET 1
1. ball	1	2	(3)	4	E
2. dog	(1)	2	3	4	E
3. spoon	1	2	3	(4)	E
4. foot	1	2	(3)	4	E

- For each set, record the number of errors in the box labeled "Number of Errors."

Calculating the Total Number of Errors

Transfer the number of errors per set to the boxes below, and add up the total errors. Be sure to use the *lowest* Basal Set and the *highest* Ceiling Set. See Chapter 2 of the manual for further details.

Set 1 ____	Set 2 ____	Set 3 ____
Set 4 ____	Set 5 ____	Set 6 ____
Set 7 ____	Set 8 ____	Set 9 ____
Set 10 ____	Set 11 ____	Set 12 ____
Set 13 ____	Set 14 ____	Set 15 ____
Set 16 ____		
Set 17 ____	Set 18 ____	Set 19 ____

Total Errors (between Basal Set and Ceiling Set) ____

Calculating the Raw Score

Record the number of the Ceiling Item, which is the last item in the Ceiling Set. For example, if the examinee's *highest* Ceiling Set was Set 6, the Ceiling Item would be 72. Subtract from the Ceiling Item the total number of errors made by the examinee (from the Basal Set through the Ceiling Set). The result is the Raw Score. See Chapter 2 of the manual for further details.

Ceiling Item ____

Total Errors − ____

Raw Score ____

Transfer this Raw Score to the record form cover.

Start Your Administration Here

Training Items

All instructions for introducing the test and administering the Training Items are located in the easel.

Ages 2:6 Through 3:11

Training Page A

A1. boy	1	2	3	4	E
A2. chair	1	2	3	4	E
A3. puppy	1	2	3	4	E
A4. bike	1	2	3	4	E

After the examinee responds correctly and without help to two Training Items, go to Item 1, and begin testing.

Age	2:6–3:11
Start Item	1

Ages 4 Through Adult

Training Page B

B1. laughing	1	2	3	4	E
B2. sleeping	1	2	3	4	E
B3. hugging	1	2	3	4	E
B4. walking	1	2	3	4	E

After the examinee responds correctly and without help to two Training Items, go to the appropriate Start Item, and begin testing.

Age	4	5	6	7	8	9	10
Start Item	13	37	49	61	73	85	97

Age	11–12	13	14–16	17–18	19+
Start Item	109	121	133	145	157

- **Complete Set Rule:** Administer all 12 items in the set in order, starting with the first item in the set.
- **Basal Set Rule:** One (1) or zero (0) errors in a set.
- **Ceiling Set Rule:** Eight (8) or more errors in a set.

Start Ages 2-6–3-11						SET 1
1. ball	1	2	3	4	E	
2. dog	1	2	3	4	E	
3. spoon	1	2	3	4	E	
4. foot	1	2	3	4	E	
5. duck	1	2	3	4	E	
6. banana	1	2	3	4	E	
7. shoe	1	2	3	4	E	
8. cup	1	2	3	4	E	
9. eating	1	2	3	4	E	
10. bus	1	2	3	4	E	
11. flower	1	2	3	4	E	
12. mouth	1	2	3	4	E	
Number of Errors						

Start Age 4						SET 2
13. pencil	1	2	3	4	E	
14. cookie	1	2	3	4	E	
15. drum	1	2	3	4	E	
16. turtle	1	2	3	4	E	
17. red	1	2	3	4	E	
18. jumping	1	2	3	4	E	
19. carrot	1	2	3	4	E	
20. reading	1	2	3	4	E	
21. toe	1	2	3	4	E	
22. belt	1	2	3	4	E	
23. fly	1	2	3	4	E	
24. painting	1	2	3	4	E	
Number of Errors						

						SET 3
25. dancing	1	2	3	4	E	
26. whistle	1	2	3	4	E	
27. kicking	1	2	3	4	E	
28. lamp	1	2	3	4	E	
29. square	1	2	3	4	E	
30. fence	1	2	3	4	E	
31. empty	1	2	3	4	E	
32. happy	1	2	3	4	E	
33. fire	1	2	3	4	E	
34. castle	1	2	3	4	E	
35. squirrel	1	2	3	4	E	
36. throwing	1	2	3	4	E	
Number of Errors						

Start Age 5						SET 4
37. farm	1	2	3	4	E	
38. penguin	1	2	3	4	E	
39. gift	1	2	3	4	E	
40. feather	1	2	3	4	E	
41. cobweb	1	2	3	4	E	
42. elbow	1	2	3	4	E	
43. juggling	1	2	3	4	E	
44. fountain	1	2	3	4	E	
45. net	1	2	3	4	E	
46. shoulder	1	2	3	4	E	
47. dressing	1	2	3	4	E	
48. roof	1	2	3	4	E	
Number of Errors						

Start Age 6						SET 5
49. peeking	1	2	3	4	E	
50. ruler	1	2	3	4	E	
51. tunnel	1	2	3	4	E	
52. branch	1	2	3	4	E	
53. envelope	1	2	3	4	E	
54. diamond	1	2	3	4	E	
55. calendar	1	2	3	4	E	
56. buckle	1	2	3	4	E	
57. sawing	1	2	3	4	E	
58. panda	1	2	3	4	E	
59. vest	1	2	3	4	E	
60. arrow	1	2	3	4	E	
Number of Errors						

Start Age 7						SET 6
61. picking	1	2	3	4	E	
62. target	1	2	3	4	E	
63. dripping	1	2	3	4	E	
64. knight	1	2	3	4	E	
65. delivering	1	2	3	4	E	
66. cactus	1	2	3	4	E	
67. dentist	1	2	3	4	E	
68. floating	1	2	3	4	E	
69. claw	1	2	3	4	E	
70. uniform	1	2	3	4	E	
71. gigantic	1	2	3	4	E	
72. furry	1	2	3	4	E	
Number of Errors						

- **Complete Set Rule:** Administer all 12 items in the set in order, starting with the first item in the set.
- **Basal Set Rule:** One (1) or zero (0) errors in a set.
- **Ceiling Set Rule:** Eight (8) or more errors in a set.

Start Age 8						SET 7
73. violin	1	2	3	4	E	
74. group	1	2	3	4	E	
75. globe	1	2	3	4	E	
76. vehicle	1	2	3	4	E	
77. chef	1	2	3	4	E	
78. squash	1	2	3	4	E	
79. ax	1	2	3	4	E	
80. flamingo	1	2	3	4	E	
81. chimney	1	2	3	4	E	
82. sorting	1	2	3	4	E	
83. waist	1	2	3	4	E	
84. vegetable	1	2	3	4	E	
Number of Errors						

Start Age 9						SET 8
85. hyena	1	2	3	4	E	
86. plumber	1	2	3	4	E	
87. river	1	2	3	4	E	
88. timer	1	2	3	4	E	
89. catching	1	2	3	4	E	
90. trunk	1	2	3	4	E	
91. vase	1	2	3	4	E	
92. harp	1	2	3	4	E	
93. bloom	1	2	3	4	E	
94. horrified	1	2	3	4	E	
95. swamp	1	2	3	4	E	
96. heart	1	2	3	4	E	
Number of Errors						

Start Age 10						SET 9
97. pigeon	1	2	3	4	E	
98. ankle	1	2	3	4	E	
99. flaming	1	2	3	4	E	
100. wrench	1	2	3	4	E	
101. aquarium	1	2	3	4	E	
102. refueling	1	2	3	4	E	
103. safe	1	2	3	4	E	
104. boulder	1	2	3	4	E	
105. reptile	1	2	3	4	E	
106. canoe	1	2	3	4	E	
107. athlete	1	2	3	4	E	
108. towing	1	2	3	4	E	
Number of Errors						

Start Ages 11–12						SET 10
109. luggage	1	2	3	4	E	
110. directing	1	2	3	4	E	
111. vine	1	2	3	4	E	
112. digital	1	2	3	4	E	
113. dissecting	1	2	3	4	E	
114. predatory	1	2	3	4	E	
115. hydrant	1	2	3	4	E	
116. surprised	1	2	3	4	E	
117. palm	1	2	3	4	E	
118. clarinet	1	2	3	4	E	
119. valley	1	2	3	4	E	
120. kiwi	1	2	3	4	E	
Number of Errors						

Start Age 13						SET 11
121. interviewing	1	2	3	4	E	
122. pastry	1	2	3	4	E	
123. assisting	1	2	3	4	E	
124. fragile	1	2	3	4	E	
125. solo	1	2	3	4	E	
126. snarling	1	2	3	4	E	
127. puzzled	1	2	3	4	E	
128. beverage	1	2	3	4	E	
129. inflated	1	2	3	4	E	
130. tusk	1	2	3	4	E	
131. trumpet	1	2	3	4	E	
132. rodent	1	2	3	4	E	
Number of Errors						

Start Ages 14–16						SET 12
133. inhaling	1	2	3	4	E	
134. links	1	2	3	4	E	
135. polluting	1	2	3	4	E	
136. archaeologist	1	2	3	4	E	
137. coast	1	2	3	4	E	
138. injecting	1	2	3	4	E	
139. fern	1	2	3	4	E	
140. mammal	1	2	3	4	E	
141. demolishing	1	2	3	4	E	
142. isolation	1	2	3	4	E	
143. clamp	1	2	3	4	E	
144. dilapidated	1	2	3	4	E	
Number of Errors						

- **Complete Set Rule:** Administer all 12 items in the set in order, starting with the first item in the set.
- **Basal Set Rule:** One (1) or zero (0) errors in a set.
- **Ceiling Set Rule:** Eight (8) or more errors in a set.

▼ Start Ages 17–18					SET 13
145. pedestrian	1	2	3	4	E
146. interior	1	2	3	4	E
147. garment	1	2	3	4	E
148. departing	1	2	3	4	E
149. feline	1	2	3	4	E
150. hedge	1	2	3	4	E
151. citrus	1	2	3	4	E
152. florist	1	2	3	4	E
153. hovering	1	2	3	4	E
154. aquatic	1	2	3	4	E
155. reprimanding	1	2	3	4	E
156. carpenter	1	2	3	4	E
Number of Errors					

▼ Start Ages 19–Adult					SET 14
157. primate	1	2	3	4	E
158. glider	1	2	3	4	E
159. weary	1	2	3	4	E
160. hatchet	1	2	3	4	E
161. transparent	1	2	3	4	E
162. sedan	1	2	3	4	E
163. constrained	1	2	3	4	E
164. valve	1	2	3	4	E
165. parallelogram	1	2	3	4	E
166. pillar	1	2	3	4	E
167. consuming	1	2	3	4	E
168. currency	1	2	3	4	E
Number of Errors					

					SET 15
169. hazardous	1	2	3	4	E
170. pentagon	1	2	3	4	E
171. appliance	1	2	3	4	E
172. poultry	1	2	3	4	E
173. cornea	1	2	3	4	E
174. peninsula	1	2	3	4	E
175. porcelain	1	2	3	4	E
176. detonation	1	2	3	4	E
177. cerebral	1	2	3	4	E
178. perpendicular	1	2	3	4	E
179. submerging	1	2	3	4	E
180. syringe	1	2	3	4	E
Number of Errors					

					SET 16
181. lever	1	2	3	4	E
182. apparel	1	2	3	4	E
183. talon	1	2	3	4	E
184. cultivating	1	2	3	4	E
185. wedge	1	2	3	4	E
186. ascending	1	2	3	4	E
187. depleted	1	2	3	4	E
188. sternum	1	2	3	4	E
189. maritime	1	2	3	4	E
190. incarcerating	1	2	3	4	E
191. dejected	1	2	3	4	E
192. quintet	1	2	3	4	E
Number of Errors					

Continue on page 6

- **Complete Set Rule:** Administer all 12 items in the set in order, starting with the first item in the set.
- **Basal Set Rule:** One (1) or zero (0) errors in a set.
- **Ceiling Set Rule:** Eight (8) or more errors in a set.

					SET 17
193. incandescent [in kuhn DES uhnt]	1	2	3	4	E
194. confiding [kuhn FYD ing]	1	2	3	4	E
195. mercantile [MUR kuhn teel]	1	2	3	4	E
196. upholstery [uhp HOHL stuh ree]	1	2	3	4	E
197. filtration [fil TRAY shuhn]	1	2	3	4	E
198. replenishing [ri PLE nish ing]	1	2	3	4	E
199. trajectory [truh JEK tuh ree]	1	2	3	4	E
200. perusing [puh ROOZ ing]	1	2	3	4	E
201. barb [BARB]	1	2	3	4	E
202. converging [kuhn VUHR ing]	1	2	3	4	E
203. honing [HOHN ing]	1	2	3	4	E
204. angler [AN gluhr]	1	2	3	4	E
Number of Errors					

					SET 18
205. wildebeest [WIL duh beest]	1	2	3	4	E
206. coniferous [koh NIF uh ruhs]	1	2	3	4	E
207. timpani [TIM puh nee]	1	2	3	4	E
208. pilfering [PIL fuhr ing]	1	2	3	4	E
209. pestle [PE suhl]	1	2	3	4	E
210. reposing [ri POHZ ing]	1	2	3	4	E
211. cupola [KYOO puh luh]	1	2	3	4	E
212. derrick [DER ik]	1	2	3	4	E
213. convex [kon VEKS]	1	2	3	4	E
214. embossed [im BAWST]	1	2	3	4	E
215. torrent [TOHR uhnt]	1	2	3	4	E
216. dromedary [DROM uh dayr ee]	1	2	3	4	E
Number of Errors					

					SET 19
217. legume [LE gyoom]	1	2	3	4	E
218. cairn [KAYRN]	1	2	3	4	E
219. arable [AYR uh buhl]	1	2	3	4	E
220. supine [soo PIYN]	1	2	3	4	E
221. vitreous [VI tree uhs]	1	2	3	4	E
222. lugubrious [loo GOO bree uhs]	1	2	3	4	E
223. caster [KAS tuhr]	1	2	3	4	E
224. terpsichorean [tuhrp sik uh REE uhn]	1	2	3	4	E
225. cenotaph [SEN uh taf]	1	2	3	4	E
226. calyx [KAY liks]	1	2	3	4	E
227. osculating [OS kyuh layt ing]	1	2	3	4	E
228. tonsorial [ton SOHR ee uhl]	1	2	3	4	E
Number of Errors					

Pronunciation Key

ay = long a	u = short u	oo as in *loot*	ee = long e	j = soft g	uh as in *above*	iy = long i
g = hard g	oy as in *coin*	oh = long o	s = soft c	ar as in *farm*	yoo = long u	k = hard c
uhr as in *circle*	a = short a	ow as in *loud*	ir as in *cheer*	e = short e	aw as in *law*	ayr as in *chair*
i = short i	uu as in *foot*	ohr as in *shore*	o = short o			

Note: CAPS within pronunciation indicate primary stress.

Classification by Part of Speech for the *Peabody Picture Vocabulary Test*, Fourth Edition (PPVT™–4), Form A

Directions: Circle the item numbers of the lowest and highest PPVT–4 items administered. For incorrect responses, draw a line through the open box to the right of the item number. Tally and sum each category column. Then, write the totals by category for # Taken and # Incorrect in the summary box to the right.

Totals	PPVT–4 Form A		
	Noun	Verb	Attribute
# Taken			
# Incorrect			

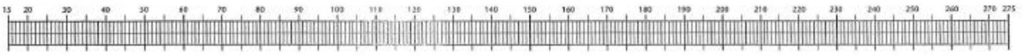
Item	Noun	Verb	Attribute	Item	Noun	Verb	Attribute	Item	Noun	Verb	Attribute	Item	Noun	Verb	Attribute	Item	Noun	Verb	Attribute	Item	Noun	Verb	Attribute
1				39				77				115				153				191			
2				40				78				116				154				192			
3				41				79				117				155				193			
4				42				80				118				156				194			
5				43				81				119				157				195			
6				44				82				120				158				196			
7				45				83				121				159				197			
8				46				84				122				160				198			
9				47				85				123				161				199			
10				48				86				124				162				200			
11				49				87				125				163				201			
12				50				88				126				164				202			
13				51				89				127				165				203			
14				52				90				128				166				204			
15				53				91				129				167				205			
16				54				92				130				168				206			
17				55				93				131				169				207			
18				56				94				132				170				208			
19				57				95				133				171				209			
20				58				96				134				172				210			
21				59				97				135				173				211			
22				60				98				136				174				212			
23				61				99				137				175				213			
24				62				100				138				176				214			
25				63				101				139				177				215			
26				64				102				140				178				216			
27				65				103				141				179				217			
28				66				104				142				180				218			
29				67				105				143				181				219			
30				68				106				144				182				220			
31				69				107				145				183				221			
32				70				108				146				184				222			
33				71				109				147				185				223			
34				72				110				148				186				224			
35				73				111				149				187				225			
36				74				112				150				188				226			
37				75				113				151				189				227			
38				76				114				152				190				228			
# Taken				# Taken				# Taken				# Taken				# Taken				# Taken			
# Incorrect				# Incorrect				# Incorrect				# Incorrect				# Incorrect				# Incorrect			

Comparison of PPVT™-III and PPVT–4 Scores Over Time

Administration Date	Edition and Form: PPVT-III		PPVT–4		Standard Score: Norms			Score*	Raw Score	GSV*
________	☐ A	☐ B	☐ A	☐ B	☐ Age	☐ Grade: Fall	☐ Grade: Spring	____	____	____
________	☐ A	☐ B	☐ A	☐ B	☐ Age	☐ Grade: Fall	☐ Grade: Spring	____	____	____
________	☐ A	☐ B	☐ A	☐ B	☐ Age	☐ Grade: Fall	☐ Grade: Spring	____	____	____
________	☐ A	☐ B	☐ A	☐ B	☐ Age	☐ Grade: Fall	☐ Grade: Spring	____	____	____
________	☐ A	☐ B	☐ A	☐ B	☐ Age	☐ Grade: Fall	☐ Grade: Spring	____	____	____
________	☐ A	☐ B	☐ A	☐ B	☐ Age	☐ Grade: Fall	☐ Grade: Spring	____	____	____ (Table 8.7)

*** Do not compare standard scores across editions (i.e., PPVT-III and PPVT–4 scales). GSV scores may be compared across editions.**

Using GSV Scores to Measure Change



The GSV (growth scale value) score is designed for measuring change over time. Like a raw score, the GSV score is an indicator of absolute, not relative, performance. If an examinee's vocabulary increases, his or her GSV score will increase. The GSV scale is like a yardstick, and plotting GSV scores over time can reveal how the examinee's vocabulary performance has changed.

The standard score serves a different purpose, which is to tell how the examinee's score compares with the average score at a particular age. It is a helpful supplement to the GSV when evaluating change. If an examinee's standard scores are the same on both occasions, then the examinee's vocabulary performance has increased at the average rate for that age. If the standard score declines from the first testing to the next, the examinee still may have improved in vocabulary knowledge (as shown by a higher GSV), but the rate of growth was below average.

Refer to Appendix G in the PPVT–4 Manual for further information on interpreting change in GSV scores.

To use the GSV "yardstick" to show changes in performance over time, complete the following steps:

1. Write a sequence number next to the GSV score of each PPVT-III and PPVT–4 administration you entered on this page, starting with 1 for the earliest administration.
2. Mark the points on the GSV yardstick corresponding to each GSV score.
3. Write the corresponding administration sequence number next to each mark on the GSV yardstick.

PEARSON **P.O. Box 1416 Minneapolis, MN 55440 800.627.7271 www.PearsonAssessments.com www.SpeechandLanguage.com** PsychCorp

Appendix O: Childhood Autism Rating Scale

C • A • R • S

The Childhood Autism Rating Scale

Eric Shopler, Ph. D., Robert J. Reichler, M.D.,
and Barbara Rochen Renner, Ph. D.

Published by:
WESTERN PSYCHOLOGICAL SERVICES
Publishers and Distributors
12031 Wilshire Boulevard
Los Angeles California 90025-1251

Name: _____ Sex: _____

ID Number: _____

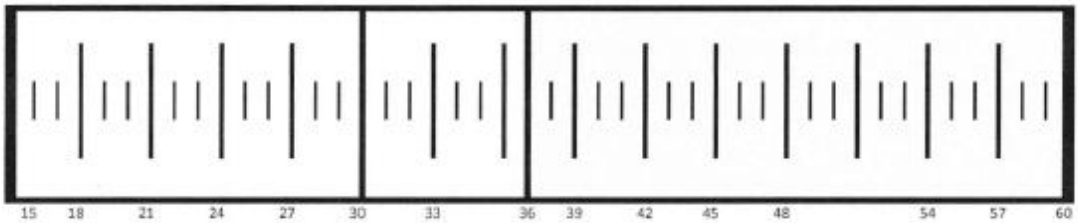
Test Date: Year _____ Month _____ Day _____

Birth Date: Year _____ Month _____ Day _____

Chronological Age: Years _____ Months _____

Rater: _____

Category Rating Scores															
I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	Total Score



CARS Rating Sheet

Directions: For each category, use the space provided below each scale for taking notes concerning the behaviours relevant to each scale. After you have finished observing the child, rate the behaviours relevant to each scale. For each item, circle the number which corresponds to the statement that best describes the child. You may indicate the child is between two descriptions by using half ratings of 1.5, 2.5, or 3.5. Abbreviated rating criteria are presented for each scale. See chapter 2 of the Manual for detailed rating criteria.

	I. RELATING TO PEOPLE
1	Evidence of difficulty/abnormality in relating to people • The child's behaviour is appropriate for his/her age. Some shyness, fussiness or annoyance at being told what to may be observed, but not to an atypical degree.
1.5	
2	Slightly abnormal relationships • The child may avoid looking the adult in the eye. Avoid the adult or become fussy if interaction is forced, be excessively shy, not be as sensitive to the adult as its typical, or cling to parents somewhat more than most children of the same age.
2.5	
3	Moderately abnormal relationships • The child shows aloofness (seems unaware of adults) at times. Persistent and forceful attempts are necessary to get the child's attention at times. Minimal contact is initiated by the child.
3.5	
4	Severely abnormal relationships • The child is consistently aloof or unaware of anything the adult is doing. He/she almost never responds or initiates contact with the adult. Only the most persistent attempts to get the child's attention have any effect.

Observations:

	III. EMOTIONAL RESPONSE
1	Age-appropriate and situation-appropriate emotional responses • The child shows the appropriate type and degree of emotional response as indicated by a change in facial expression, posture and manner.
1.5	
2	Mildly abnormal emotional responses • The child occasionally displays what inappropriate type and/or degree of emotional response. Reactions are somewhat unrelated to the objects or events surrounding them.
2.5	
3	Moderately abnormal emotional responses • The child shows definite signs of inappropriate type and/or degree of emotional response. Reactions may be quite inhibited or excessive and unrelated to the situation; may grimace, laugh, or become rigid even though no apparent emotion-producing objects or events are present.
3.5	
4	Severely abnormal emotional responses • Responses are seldom appropriate to the situation, once the child gets in a certain mood, it is very difficult to change the mood. Conversely, the child may show wildly different emotions when nothing has changed.

Observations:

	II. IMITATION
1	Appropriate imitation • The child can imitate sounds, words, and movements which are appropriate for his/her skill level.
1.5	
2	Mildly abnormal imitation • The child imitates simple behaviours such as clapping or single verbal sounds most of the time; occasionally, imitates only after prodding or after a delay.
2.5	
3	Moderately abnormal imitation • The child imitates only part of the time and requires a great deal of persistent and help from the adult; frequently imitates only after a delay.
3.5	
4	Severely abnormal imitation • The child rarely or never imitates sounds, words or movements even with prodding and assistance from the adult.

Observations:

	IV. BODY USE
1	Age-appropriate body use • The child moves with the same ease, agility, and coordination of a normal child of the same age.
1.5	
2	Mildly abnormal body use • Some minor peculiarities may be present, such as clumsiness, repetitive movements, poor coordination, or the rare appearance of unusual movements.
2.5	
3	Moderately abnormal body use • Behaviours that are clearly strange or unusual for a child of his age may include strange finger movements, peculiar finger or body turning, staring or picking at the body, self-directed aggression, rocking, spinning, wiggling or toe-walking.
3.5	
4	Severely abnormal body use • Intense or frequent movements of the types listed above are signs of severely abnormal body use. These behaviours may persist despite attempts to discourage them or involve the child in other activities.

Observations:

	V. OBJECT USE
1	Appropriate use of, and interest in toys and other objects • The child shows normal interest in toys and other objects appropriately for his/her skill level and uses these toys in an appropriate manner.
1.5	
2	Mildly inappropriate interest in, or use of, toys and other objects • The child may show atypical interest in a toy or play with it in an inappropriately childish way (e.g. banging or sucking on the toy).
2.5	
3	Moderately inappropriate interest in, or use of, toys and other objects • The child may show little interest in toys or other objects, or may be preoccupied with using an object or toy in some strange way. He/she may focus on some insignificant part of a toy, become fascinated with light reflecting off the object, repetitively move some part of the object, or play with one object exclusively.
3.5	
4	Severely inappropriate interest in, or use of, toys and other objects • The child may engage in the same behaviours as above, with greater frequency and intensity. The child is difficult to distract when engaged in these inappropriate activities.
Observations:	

	VIII. LISTENING RESPONSE
1	Age-appropriate listening response • The child's visual behaviour is normal and appropriate for that age. Vision is used together with other senses as a way to explore a new object.
1.5	
2	Mildly abnormal visual response • The child must be occasionally reminded to look at objects. The child may be more interested in looking at mirrors or lighting than peers, may occasionally stare off into space, or may also avoid looking people in the eye.
2.5	
3	Moderately abnormal visual response • The child must be reminded frequently to look at what he/she is doing. He/she may stare into space, avoid looking people in the eye, look at objects from an unusual angle, or hold objects very close to their eyes.
3.5	
4	Severely abnormal visual response • The child consistently avoids looking at people or certain objects and may show extreme forms of other visual peculiarities described above.
Observations:	

	VI. ADAPTATION TO CHANGE
1	Age-appropriate response to change • While the child may notice or comment on changes in routine, he/she accepts these changes without undue distress.
1.5	
2	Mildly abnormal adaptation to change • When an adult tries to change tasks the child may continue the same activity or use the same materials.
2.5	
3	Moderately abnormal adaptation to change • The child actively resists changes in routine, tries to continue the old activity, and is difficult to distract. He/she may become angry and unhappy when an established routine is altered.
3.5	
4	Severely abnormal adaptation to change • The child shows severe reactions to change. If a change is forced, he/she may become extremely angry or uncooperative and respond with tantrums.
Observations:	

	IX. TASTE, SMELL, AND TOUCH RESPONSE AND
1	Normal use of, and response to, taste, smell and touch • The child explores new objects in an age appropriate manner, generally by feeling and looking. Taste or smell may be used when appropriate.. When reacting to minor, everyday pain, the child express discomfort but does not overreact.
1.5	
2	Mildly abnormal use of, and responses to, taste, smell and touch • The child may persist in putting objects in his or her mouth may smell or taste inedible objects may ignore or overreact to mild pain that a normal child would express as discomfort.
2.5	
3	Moderately abnormal use of, and response to, taste, smell, and touch • The child may be moderately preoccupied with touching, smelling, or tasting object or people.. The child may either react too much or too little.
3.5	
4	Severely abnormal use of, and response to, taste, smell and touch • The child is preoccupied with smelling, tasting, or feeling objects more for the sensation than normal exploration or use the objects.. The child may completely ignore pain or react very strongly to slight discomfort.
Observations:	

	VII. VISUAL RESPONSE
1	Age-appropriate visual response • The child's visual behaviour is normal and appropriate for that age. Vision is used together with other senses as a way to explore a new object.
1.5	
2	Mildly abnormal visual response • The child must be occasionally reminded to look at objects. The child may be more interested in looking at mirrors or lighting than peers, may occasionally stare off into space, or may also avoid looking people in the eye.
2.5	
3	Moderately abnormal visual response • The child must be reminded frequently to look at what he/she is doing. He/she may stare into space, avoid looking people in the eye, look at objects from an unusual angle, or hold objects very close to their eyes.
3.5	
4	Severely abnormal visual response • The child consistently avoids looking at people or certain objects and may show extreme forms of other visual peculiarities described above.
Observations:	

	X. FEAR OR NERVOUSNESS
1	Normal fear or nervousness • The child's behaviour is appropriate both to the .... And to his or her age.
1.5	
2	Mildly abnormal fear or nervousness • The child occasionally shows too much or too little fear or nervousness compared to the reaction of a normal child of the same age in a similar situation.
2.5	
3	Moderately abnormal fear or nervousness • The child shows either quite a bit more or a bit less fear than is typical even for a younger child in a similar situation.
3.5	
4	Severely abnormal fear or nervousness • Fears persist even after repeated experience with harmless evens or objects. It is extremely difficult to calm or comfort the child. The child may, conversely, fail to show appropriate regard for hazards with other children of the same age avoid.
Observations:	

	XI. VERBAL COMMUNICATION
1	Normal verbal communication, age and situation appropriate.
1.5	
2	Mildly abnormal verbal communication • Speech shows overall retardation. Most speech is meaningful however, some echolalia or pronoun reversal may occur. Some peculiar words or jargon may be used occasionally.
2.5	
3	Moderately abnormal verbal communication • Speech may be absent. When present, verbal communication may be a mixture of some meaningful speech and some peculiar speech such as jargon, echolalia, or pronoun reversal. Peculiarities in meaningful speech include excessive questioning or preoccupation with particular topics.
3.5	
4	Severely abnormal verbal communication • Meaningful speech is not used. The child may make infantile squeals, weird or animal-like sounds, complex noises approximating speech, or may show persistent, bizarre use of some recognisable words or phrases.
Observations:	

	XIII. ACTIVITY LEVEL
1	Normal activity level for age and circumstances • The child is neither more active nor less active than a normal child of the same age in a similar situation.
1.5	
2	Mildly abnormal activity level • The child may be mildly restless or somewhat "lazy" and slow moving at times. The child's activity level interferes only slightly with his or her performance.
2.5	
3	Moderately abnormal activity level • The child may be quite active and difficult to restrain. He or she may have boundless energy and may not go to sleep readily at night. Conversely, the child may be quite lethargic and need a great deal of prodding to get him or her to move about.
3.5	
4	Severely abnormal activity level • The child exhibits extremes of activity or lethargy and may even shift from one extreme to the other.
Observations:	

	XI. NONVERBAL COMMUNICATION
1	Normal use of nonverbal communication, age and situation appropriate
1.5	
2	Mildly abnormal use of nonverbal communication • Immature use of nonverbal communications may only point vaguely, or reach for what he or she wants, in ... where same age child may point or gesture more specifically to indicate what he or she wants.
2.5	
3	Moderately abnormal use of nonverbal communication • The child is generally able to express needs or desires nonverbally, and cannot understand the nonverbal communication of others.
3.5	
4	Severely abnormal use of nonverbal communication • The child only uses ... or peculiar gestures which have no apparent meaning, and show no awareness of meanings associated with the gestures of facial expressions of others.

Observations:

	XIII. LEVEL AND CONSISTENCY OF INTELLECTUAL
1	Intelligence is normal and reasonably consistent across various areas •
1.5	
2	Mildly abnormal intellectual functioning • The child is not as smart as typical children of the same age: skills appear fairly evenly retarded across all areas.
2.5	
3	Moderately abnormal intellectual functioning • In general, the child is not as smart as typical children of the same age, however, the child may function nearly normally in one or more intellectual areas.
3.5	
4	Severely abnormal intellectual functioning • While the child generally is not as smart as the typical child of his age, he or she may function even better than the normal child of the same age in one or more areas.

Observations:

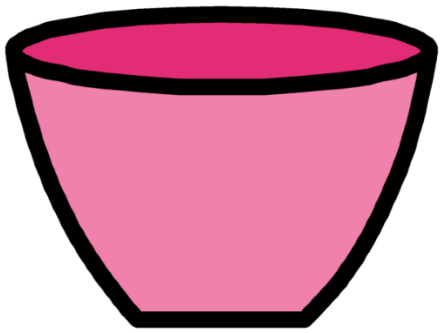
	XV. GENERAL IMPRESSIONS
1	No autism • The child shows none of the symptoms characteristic of autism.
1.5	
2	Mild autism • The child shows only a few symptoms or only a mild degree of autism.
2.5	
3	Moderate autism • The child shows a number of symptoms or a moderate degree of autism.
3.5	
4	Severe autism • The child shows many symptoms or an extreme degree of autism.

Observations:

Appendix P: Picture Communication Symbols

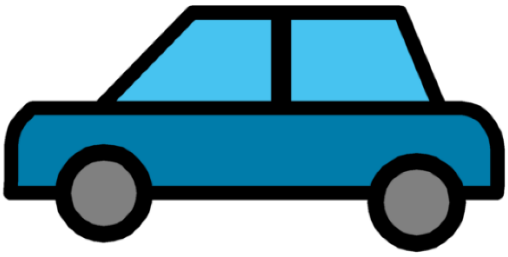
Doll

Bowl

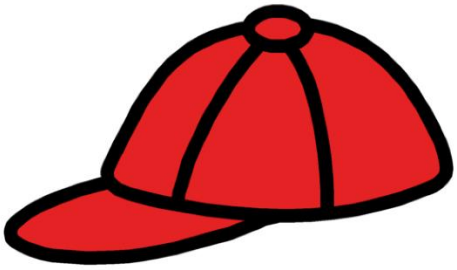


Spoon

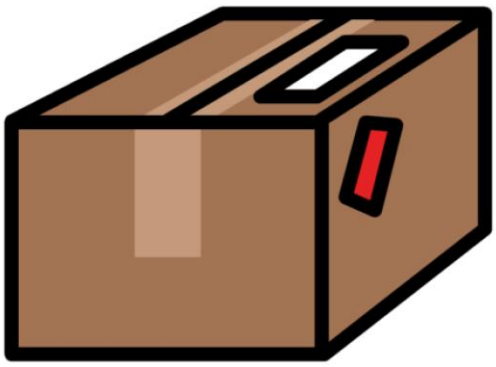
Car



Cap



Box



Appendix Q: Procedural Integrity Protocol

Procedural Integrity Protocol

Participant Number: _____

Day 1

Screening

(please tick ✓)

Procedure	Completed
Greet	
Confirm Consent Form is signed	
Obtain Participant Assent	
Noun Knowledge Task	
Preposition Knowledge Task	
Matching Task	
Peabody Picture Vocabulary Test – fourth edition (PPVT-4)	
Childhood Autism Rating Scale (CARS) (possibly with teacher)	
Token	

Day 2 – Trial Items

Procedure	Script	Completed
Participant Assent Obtained		
Inform participant that we are starting with trials	We are going to start now. You need to listen carefully and look at the pictures on the iPad.	
	I am going to put two toys on the table.	
	I will ask you to move the toys around.	
Trial 1. Put the **doll** and **box** in front of the participant.		
Start PCS on the iPad. Point to the relevant PCS on the iPad and say:	Put the doll IN the box.	
If child responds appropriately go to Trial 3. If child does not respond repeat: Demonstrate required action whilst repeating instruction.	Put the doll IN the box.	
Trial 2. Remove previous toys. Put the **spoon** and **car** in front of the participant.		
Start PCS on the iPad. Point to the relevant PCS on the iPad and say:	Put the spoon IN FRONT OF the car.	
If child responds appropriately go to Trial 3. If child does not respond repeat: Demonstrate required action whilst repeating instruction.	Put the spoon IN FRONT OF the car.	
Trial 3. Remove previous toys. Put the **doll** and **box** in front of the participant.		
Start PCS on the iPad. Point to the relevant PCS on the iPad and say:	Put the DOLL IN FRONT OF the BOX.	
If child responds appropriately go to Experimental Tasks. If child does not respond repeat: Demonstrate required action whilst repeating instruction.	Put the DOLL IN FRONT OF the BOX.	
Trial 4. Remove previous toys. Put the **cap** and **bowl** in front of the participant.		
Start PCS on the iPad.		

Point to the relevant PCS on the iPad and say:	Put the CAP IN the BOWL.	
If child responds appropriately go to Experimental Tasks. If child does not respond repeat: Demonstrate required action whilst repeating instruction.	Put the CAP IN the BOWL.	
Start Experimental Task		

Group 1 (Condition A; Condition B)

Aided Input Experimental Task (please tick ✓)

Procedure	Script	Completed
Participant Assent Obtained		
Turn on Recording equipment		
Inform the participant that we are starting with the experimental task	You are going to start listening to how you must move the toys around.	
	I will record you while you are moving the toys around.	
Tell the participant what s/he will be doing.	You need to listen carefully and look at the pictures on the iPad.	
	I am going to put two toys on the table.	
	I will ask you to move the toys around.	
	We are going to start.	
Aided Instructions		
CA.1 Put the **spoon** and **bowl** in front of the participant		
Start PCS on iPad Point to relevant PCS on iPad as you say:	Put the spoon ON the bowl	
CA.2 Remove previous toys Put the **cap** and **bowl** in front of the participant		
Change PCS on iPad Point to relevant PCS on iPad as you say:	Put the cap UNDER the bowl	
CA.3 Remove previous toys Put the **doll** and **bowl** in front of the participant		
Change PCS on iPad Point to relevant PCS on iPad as you say:	Put the doll BEHIND the bowl	
Provide neutral reinforcement	You are on track!	
CA.4 Remove previous toys Put the **spoon** and **bowl** in front of the participant		
Change PCS on iPad Point to relevant PCS on iPad as you say:	Put the spoon NEXT TO the bowl	

CA.5 Remove previous toys Put the **doll** and **car** in front of the participant		
Change PCS on iPad Point to relevant PCS on iPad as you say:	Put the doll ON the car	
CA.6 Remove previous toys Put the **cap** and **box** in front of the participant		
Change PCS on iPad Point to relevant PCS on iPad as you say:	Put the cap NEXT TO the box	
Provide neutral reinforcement	You are on track!	
CB.1 Remove previous toys Put the **cap** and **box** in front of the participant		
Change PCS on iPad Point to relevant PCS on iPad as you say:	Put the CAP ON the BOX	
CB.2 Remove previous toys Put the **doll** and **box** in front of the participant		
Change PCS on iPad Point to relevant PCS on iPad as you say:	Put the DOLL UNDER the BOX	
CB.3 Remove previous toys Put the **spoon** and **bowl** in front of the participant		
Provide neutral reinforcement	You are on track!	
Change PCS on iPad Point to relevant PCS on iPad as you say:	Put the SPOON BEHIND the BOWL	
CB.4 Remove previous toys Put the **doll** and **car** in front of the participant		
Change PCS on iPad Point to relevant PCS on iPad as you say:	Put the DOLL NEXT TO the CAR	
CB.5 Remove previous toys Put the **spoon** and **car** in front of the participant		
Change PCS on iPad Point to relevant PCS on iPad as you say:	Put the SPOON UNDER the CAR	
CB.6 Remove previous toys		

Put the **cap** and **car** in front of the participant		
Change PCS on iPad Point to relevant PCS on iPad as you say:	Put the CAP BEHIND the CAR	
Remove the toys from the table		
Thank the participant	Thank you very much. You are a star.	
Give participant token		
Turn off recording equipment		
Take participant back to class		

Completed By: _____

Checked By: _____

Group 2 (Condition B; Condition A)

Aided Input Experimental Task (please tick ✓)

Procedure	Script	Completed
Participant Assent Obtained		
Turn on Recording equipment		
Inform the participant that we are starting with the experimental task	You are going to start listening to how you must move the toys around.	
	I will record you while you are moving the toys around.	
Tell the participant what s/he will be doing.	You need to listen carefully and look at the pictures on the iPad.	
	I am going to put two toys on the table.	
	I will ask you to move the toys around.	
	We are going to start.	
Aided Instructions		
CB.1 Put the **cap** and **box** in front of the participant		
Change PCS on iPad Point to relevant PCS on iPad as you say:	Put the CAP ON the BOX	
CB.2 Remove previous toys Put the **doll** and **box** in front of the participant		
Change PCS on iPad Point to relevant PCS on iPad as you say:	Put the DOLL UNDER the BOX	
CB.3 Remove previous toys Put the **spoon** and **bowl** in front of the participant		
Provide neutral reinforcement	You are on track!	
Change PCS on iPad Point to relevant PCS on iPad as you say:	Put the SPOON BEHIND the BOWL	
CB.4 Remove previous toys Put the **doll** and **car** in front of the participant		
Change PCS on iPad Point to relevant PCS on iPad as you say:	Put the DOLL NEXT TO the CAR	
CB.5		

Remove previous toys Put the **spoon** and **car** in front of the participant		
Change PCS on iPad Point to relevant PCS on iPad as you say:	Put the SPOON UNDER the CAR	
CB.6 Remove previous toys Put the **cap** and **car** in front of the participant		
Change PCS on iPad Point to relevant PCS on iPad as you say:	Put the CAP BEHIND the CAR	
Provide neutral reinforcement	You are on track!	
CA.1 Put the **spoon** and **bowl** in front of the participant		
Start PCS on iPad Point to relevant PCS on iPad as you say:	Put the spoon ON the bowl	
CA.2 Remove previous toys Put the **cap** and **bowl** in front of the participant		
Change PCS on iPad Point to relevant PCS on iPad as you say:	Put the cap UNDER the bowl	
CA.3 Remove previous toys Put the **doll** and **bowl** in front of the participant		
Change PCS on iPad Point to relevant PCS on iPad as you say:	Put the doll BEHIND the bowl	
Provide neutral reinforcement	You are on track!	
CA.4 Remove previous toys Put the **spoon** and **bowl** in front of the participant		
Change PCS on iPad Point to relevant PCS on iPad as you say:	Put the spoon NEXT TO the bowl	
CA.5 Remove previous toys Put the **doll** and **car** in front of the participant		
Change PCS on iPad Point to relevant PCS on iPad as you say:	Put the doll ON the car	
CA.6 Remove previous toys Put the **cap** and **box** in front of the participant		

Change PCS on iPad Point to relevant PCS on iPad as you say:	Put the cap NEXT TO the box	
Remove the toys from the table		
Thank the participant	Thank you very much. You are a star.	
Give participant token		
Turn off recording equipment		
Take participant back to class		

Completed By: _____

Checked By: _____

Appendix R: Record Form

Participant Number: ____

Record Form

Trial Number	Instruction	Level of Aided Input	Correct	Incorrect
1	Put the doll IN the box	Pr		
2	Put the spoon IN FRONT OF the car	Pr		
3	Put the DOLL IN FRONT OF the BOX	S+Pr+L		
4	Put the CAP IN the BOWL	S+Pr+L		

Instructions: Script 1

Instruction Number	Instruction	Level of Aided Input	Correct	Incorrect
CA.1	Put the spoon *ON the bowl	**Pr		
CA.2	Put the cap UNDER the bowl	Pr		
CA.3	Put the doll BEHIND the bowl	Pr		
CA.4	Put the spoon NEXT TO the bowl	Pr		
CA.5	Put the doll ON the car	Pr		
CA.6	Put the cap NEXT TO the box	Pr		
CB.1	Put the CAP ON the BOX	***S+Pr+L		
CB.2	Put the DOLL UNDER the BOX	S+Pr+L		
CB.3	Put the SPOON BEHIND the BOWL	S+Pr+L		
CB.4	Put the DOLL NEXT TO the CAR	S+Pr+L		
CB.5	Put the SPOON UNDER the CAR	S+Pr+L		
CB.6	Put the CAP BEHIND the CAR	S+Pr+L		

* Text in CAPS was represented with PCS

Completed By: _____

Checked By: _____

Participant Number: ____

Record Form

Trial Number	Instruction	Level of Aided Input	Correct	Incorrect
1	Put the doll IN the box	Pr		
2	Put the spoon IN FRONT OF the car	Pr		
3	Put the DOLL IN FRONT OF the BOX	S+Pr+L		
4	Put the CAP IN the BOWL	S+Pr+L		

Instructions: Script 2

Instruction Number	Instruction	Level of Aided Input (%)	Correct	Incorrect
CB.1	Put the *CAP ON the BOX	***S+Pr+L		
CB.2	Put the DOLL UNDER the BOX	S+Pr+L		
CB.3	Put the SPOON BEHIND the BOWL	S+Pr+L		
CB.4	Put the DOLL NEXT TO the CAR	S+Pr+L		
CB.5	Put the SPOON UNDER the CAR	S+Pr+L		
CB.6	Put the CAP BEHIND the CAR	S+Pr+L		
CA.1	Put the spoon *ON the bowl	**Pr		
CA.2	Put the cap UNDER the bowl	Pr		
CA.3	Put the doll BEHIND the bowl	Pr		
CA.4	Put the spoon NEXT TO the bowl	Pr		
CA.5	Put the doll ON the car	Pr		
CA.6	Put the cap NEXT TO the box	Pr		

* Text in CAPS was represented with PCS

Completed By: _____

Checked By: _____

Appendix S: Excel Data Collection Form

						Condition A						Condition B									
Participant Number	**Gender**	**Set**	**Age**	**PPVT-4 Age Equivalent**	**CARS**	**1 on**	**2 under**	**3 behind**	**4 next to**	**5 on**	**6 next to**	**1 on**	**2 under**	**3 behind**	**4 next to**	**5 under**	**6 behind**	**CA Total**	**CB Total**	**TOTAL**	**Difference**

Appendix T: Research Feedback Brochure

Feedback Brochure

Sheryll Ngwira
Student
sherylngwira@gmail.com

Prof. Shakila Dada
Research Supervisor
shakila.dada@up.ac.za

Center for Augmentative and Alternative Communication

University of Pretoria

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

The effects of quantity of aided input on the accuracy of instruction following in children with Autism Spectrum Disorder

Introduction

We know that children with Autism Spectrum Disorder have difficulty with communication. They often experience challenges with understanding instructions, especially instructions containing prepositions. We also know that when instructions are given with pictures (aided input), children with ASD understand the instructions better.

What did we want to know?

Do children with ASD understand instructions containing prepositions better when a picture (aided input) is provided for:

1. the preposition only – 25% of the instruction
   or
2. the subject, preposition and place – 75% of the instruction

Who participated in the study?

17 boys diagnosed with ASD who:

- ✓were between 6.6 years and 10.8 years;
- ✓had no visual or hearing problems;
- ✓had English as their home language; or had exposure to English for at least 1 year at school;
- ✓could identify all of the objects used;
- ✓could match the objects to pictures of the objects; and
- ✓could not follow instructions containing prepositions during the screening.

What did we do?

We used 12 instructions in total:

- 6 of the instructions were verbally given with 25% aided input
- 6 of the instructions were verbally given with 75% aided input.

The researcher gave the instruction verbally whilst pointing at the picture shown to the child using an iPad and the GoTalk Now App and the child's response was recorded.

How did we do it?

Example of an instruction containing a preposition:
"Put the doll on the car."

25% aided input – the picture for 'on' was provided

75% aided input – the pictures for 'doll', 'on' and 'car' were provided

What did we find?

The results (Fig. 1) showed that some children followed the instructions:

- ↑ better with 25% aided input
- ↑ better with 75% aided input
- → the same with 25% and 75% aided input

There was no statistically significant difference between the two conditions of aided input

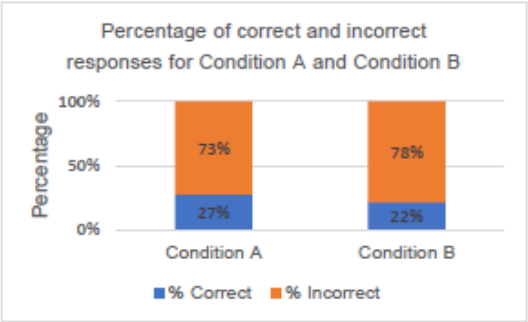


Figure 1. Percentage of correct & incorrect responses

What does this mean?

- Each child diagnosed with ASD is unique.
- Some children will need less aided input and other children will need more aided input to help them understand instructions containing prepositions.
- It is important to assess each child and determine their needs.
- There is a need for studies with larger numbers of children.

National Research Foundation

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Appendix U: Certificate of Language Editing

DECLARATION

I herewith declare that I,

Isabel M Claassen (APSTrans (SATI)),

full-time freelance translator, editor and language consultant

of

[redacted]

and
accredited member (No. 1000583) of the South African Translators' Institute (SATI)

completed the *language editing** of an M. dissertation entitled

The effects of quantity of aided input on the accuracy of instruction following by children with Autism Spectrum Disorder

which had been submitted to me by

Sheryll Ngwira
Speech Therapist & Audiologist

E-mail: [redacted]

Date completed: 15-06-2019

Please note that no responsibility can be taken for the veracity of statements or arguments in the document concerned or for changes made subsequent to the completion of language editing. Also remember that content editing is not part of a language editor's task and is in fact unethical.

Appendix V: Declaration of originality

UNIVERSITY OF PRETORIA

DECLARATION OF ORIGINALITY

This document must be signed and submitted with every

essay, report, project, assignment, dissertation and/or thesis.

Full names of student: SHERYLL NGWIRA

Student number: 18303481

Declaration

1. I understand what plagiarism is and am aware of the University's policy in this regard.

2. I declare that this MINI-DISSERTATION (eg essay, report, project, assignment, dissertation, thesis, etc) is my own original work. Where other people's work has been used (either from a printed source, Internet or any other source), this has been properly acknowledged and referenced in accordance with departmental requirements.

3. I have not used work previously produced by another student or any other person to hand in as my own.

4. I have not allowed, and will not allow, anyone to copy my work with the intention of passing it off as his or her own work.

SIGNATURE OF STUDENT: 

SIGNATURE OF SUPERVISOR: