The effect of frequency of aided language stimulation on the receptive vocabulary acquisition in children with complex communication needs and intellectual disability

by

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"My success is only by Allah" Quran (11.88)

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ABSTRACT

Aided language stimulation is an augmented input strategy that facilitates the expressive and receptive language of persons who use AAC. The aim of this study was to compare the acquisition of receptive vocabulary items during implementation of aided language stimulation with a frequency of 40% and 70% respectively. An Adapted Alternating Treatment Design was utilised in this study with six participants. Results revealed that three participants showed the greatest acquisition of target receptive vocabulary in the intervention with a frequency of 70% aided language stimulation. Two participants showed greater acquisition of target receptive vocabulary acquisition in the intervention with a frequency of 40% aided language stimulation. One participant showed equal acquisition of target receptive vocabulary in the intervention with a frequency of 40% and 70% aided language stimulation. The results of the study are discussed in relation to the aims. Finally limitations of the study are discussed and recommendations for future research are made.

Keywords: Adapted alternating treatment design, aided language stimulation, augmented input, complex communication needs, frequency of aided language stimulation, intellectual disability, receptive vocabulary acquisition

OPSOMMING

Ondersteunde taalstimulasie is deel van aanvullende invoerstrategieë wat uitdrukkende en reseptiewe taal fasiliteer vir mense wat AAK gebruik. Die doel van die studie was om die aanleer van reseptiewe woordeskat items te vergelyk tydens die implementasie van ondersteunde taalstimulasie met ’n frekwensie van 40% en 70% respektiewelik. ’n Aangepaste alternatiewe behandelings ontwerp was gebruik in die studie met ses deelnemers. Uitslae het gewys dat drie deelnemers die teikenwoordeskat beter aangeleer het in die intervensie met ’n frekwensie van 70% ondersteunde taalstimulasie. Uitslae het dan verder gewys dat twee deelnemers die teikenwoordeskat beter aangeleer het in die intervensie met ’n frekwensie van 40% ondersteunde taalstimulasie. Een deelnemer het ’n everredige aanleer van teikenwoordeskat in al twee intensieve kondisies getoon. Die resultate van die studie word bespreek na verwysing van die doel. Laaste word die beperkins van die studie bespreek en vorstelle vir verde navoring word gemaak.

Kernwoorde: Aangepaste alternatiewe behandelings ontwerp, ondersteunde taalstimulasie, Komplekse kommunikasie behoeftes, frekwensie van ondersteunde taalstimulasie, Intellektuele gebreklikhede, reseptiewe woorde verkryging

CHAPTER 1: PROBLEM STATEMENT AND RATIONALE

1.1 Introduction

Chapter 1 provides the problem statement and rationale for the study. It contains abbreviations used in the study and definitions of frequently used terms. It is followed by an outline of subsequent chapters in the thesis.

1.2 Problem statement and rationale

Children with severe disabilities who require Augmentative and Alternative Communication (AAC) are a heterogeneous group of individuals that present with a range of medical etiologies, physical abilities and intellectual and developmental disabilities (**S**mith, Barker, Barton-Husley, Romski & Sevcik, 2016). This heterogeneous group of children with disabilities has one factor in common: the difficulty they experience with communication using speech (Smith et al., 2016). Rather than using diagnosis, von Tetzchner and Martinsen (1992) identified three functional groups of persons who use AAC, the expressive language group, the supportive language group and the alternative language group. The expressive language group, who use AAC as a permanent means of expression, is characterised by a large gap between their understanding of other people's speech and their ability to express themselves using spoken language (von Tetzchner & Martinsen, 1992). The supportive language group is divided into the developmental group and the situational group. The developmental group, who do not use AAC as a permanent tool, is characterised by their need to use the alternative form to aid the development of speech (von Tetzchner & Martinsen, 1992). The situational group, who do not use AAC as their main form of communication but as a supportive language to accelerate the use and understanding of speech, comprises individuals that have learned how to speak but have difficulty making themselves understood by communication partners (von Tetzchner & Martinsen, 1992). The alternative language group, who use AAC to express themselves and others, used it in order to communicate with them too and is characterised by using little or no speech for communication (von Tetzchner & Martinsen, 1992).

A challenge for children acquiring AAC is the asymmetry between the expressive and receptive modality. Children acquiring AAC receive language input in the form of speech (auditory modality), while their express output is done using their AAC system (visual

modality) (Smith & Grove, 2003). Smith and Grove (2003) suggest that greater symmetry between language input and output is required to aid persons who use AAC to overcome this challenge.

Modelling or augmented input is an intervention approach that aims to address this asymmetry. Augmented input is defined as "incoming communication/language from the child's communication partner that includes speech and is augmented by components of the child's AAC system" (Romski & Sevcik, 1988, p. 65).

The purpose and key components of augmented input have been reinforced over many years of research and have been recently synthesised in two systematic reviews. A systematic review was conducted by Sennott, Light and McNaughton (2016) to determine the effect of aided AAC modelling based interventions on the language acquisition of individuals with Complex Communication Needs (CCN) (Sennott et al., 2016). The review reported gains in the areas of pragmatics, semantic, syntactic and morphological development for young beginning communicators as a result of aided AAC modelling based interventions (Sennott et al., 2016). This review recommended that future studies are required to focus on varied populations, the context of intervention, the intervention dosage level, and the maintenance and generalisation of language skills. They further suggested that greater attention be placed on determining the role of participant profiles. Similarly, a recent systematic review found that augmented input approaches for persons with developmental disabilities and apraxia of speech resulted in positive language outcomes (Allen, Schlosser, Brock, & Shane, 2017). This review highlights that future research should provide more detailed descriptions of AAC systems and AAC stimuli and provide scores and descriptions on participants' pre-intervention receptive, expressive and cognitive abilities (Allen et al., 2017). They further highlight the need to delineate the effect of various dosage of Aided Language Stimulation (AiLgS).

Both these reviews highlight the need for more information pertaining to frequency of AiLgS required to facilitate language learning. The participant profiles would benefit from more specific information in terms of age, diagnosis, cognitive ability or current expressive and receptive language skills.

The current study therefore aims to determine the frequency of AiLgS required to improve receptive vocabulary in children with CCN and intellectual disability (ID).

1.3 Definitions of terms used in this study

1.3.1 *Aided Language Stimulation*

Aided Language Stimulation (AiLgS) is an augmented input strategy first defined by Goossens (1989). AiLgS is pointing to "key symbols on the learner's communication display in conjunction with all ongoing verbal language stimulation being directed toward that (learner)" (Goossens, Crain, & Elder, 1992, p. 11). In this study the AiLgS interventions was the independent variable and was provided with frequencies of 40% AiLgS and 70% AiLgS.

1.3.2 *Augmentative and Alternative Communication*

Augmentative and Alternative Communication (AAC) includes any form of communication used to supplement or replace oral speech that is not functional (ASHA, 2015). An AAC system typically consists of aided and/or unaided methods of communication and includes strategies, techniques and devices used to communicate (Lloyd, Fuller, & Arvidson, 1997). An aided AAC system requires an aid external to the person's physical body (Tönsing, Alant, & Lloyd, 2005).

1.3.3 *Augmented input*

Augmented input is "incoming communication/language from the child's communication partner that includes speech and is augmented by components of the child's AAC system (Romski & Sevcik, 1988, p. 65). There are a variety of augmented input strategies. In this study, AiLgS is the form of augmented input utilised.

1.3.4 *Complex Communication Needs*

In the context of this study, the Index of Augmented Speech Comprehensibility for Children (I-ASCC; Dowden, 1997) will be used to determine if participants present with Complex Communication Needs (CCN). Participants who present with less than 50% intelligible speech in the unfamiliar listener without semantic context when tested with the I-ASCC (Dowden, 1997), will be considered as presenting with CCN.

1.3.5 *Facilitator*

The facilitator is the person pointing to the Picture Communication Symbols (PCS) and using their live voice to provide ongoing verbal language stimulation. For the purpose of this study, the researcher was the facilitator.

1.3.6 *Facilitator board*

Facilitator board refers to a low technology AAC device with PCS symbols arranged on cardboard according to the categories and topics laid out by Goossens and Crain (1986). The facilitator boards used in this study was larger in size than the traditional personal communication boards as they were used for instructional purposes and needed to be clearly visible to the group of participants.

1.3.7 *Frequency of AiLgS*

Frequency of AiLgS refers to the number of times a key symbol on the learner's facilitator board is pointed to while ongoing verbal language stimulation is provided (Goossens, 1989). Goossens (1989) suggested a frequency of 70% AiLgS with a statement:question ratio of 80:20. For the purpose of this study, a frequency of 40% AiLgS and a frequency of 70% AiLgS was used, along with a statement:question ratio of 80:20.

1.3.8 *Intellectual Disability*

Intellectual Disability (ID) refers to deficits in general mental functioning that lead to difficulties in adaptive functioning. Individuals with ID do not meet conventional standards of personal independence and social responsibility with regard to communication, social participation and academic functioning (American Psychiatric Association (APA, 2013). The severity of the ID can be classified as mild, moderate, severe or profound (APA, 2013). In this study, participants presented with severe intellectual disability.

1.3.9 *Picture Communication Symbols*

Picture Communication Symbols (PCS) are a Graphic Representation System that consist of line drawings that represent objects, people, actions and emotions. PCS is a symbol set as it consists of a specific number of symbols that each represent specific meaning and new symbols cannot be generated (Tönsing et al., 2005). For the purpose of this study,

PCS symbols were obtained using Boardmaker Plus v6.1.6 (Mayer-Johnson, 2011), which is a software programme used to create PCS and boards.

1.3.10 *Target receptive vocabulary item*

Receptive language is the words one understands when one hears or reads them (Benjamin & Crow, 2012). Vocabulary can be defined as a total collection of words learned by an individual (McLaughlin, 2006). The target receptive vocabulary items in this study refers to a set of words that were taught to participants using the AiLgS interventions. Participants were required to show understanding of these words and their meaning in response to verbal stimuli. In this study the dependent variable (Gast, 2014) was the number of acquired receptive vocabulary items.

1.4 Abbreviations

Below is a list of abbreviations that are used in this study:

AiLgS	Aided Language Stimulation
AAC	Augmentative and Alternative Communication
CCN	Complex Communication Needs
CI	Confidence Intervals
I-ASCC	The Index of Augmented Speech Comprehensibility for Children
ID	Intellectual Disability
IRD	Improvement Rate Difference
KBIT2	Kaufman Brief Intelligence Test – 2nd edition
LoLT	Language of Learning and Teaching
LSEN	Learners with Special Education Needs
MACS	The Manual Ability Classification System
PCS	Picture Communication Symbols
PND	Percentage of Non-overlapping Data
PPVT-4	Peabody Picture Vocabulary Test – 4th edition
SALAT	South African Language Assessment Tool
TACL-4	The Test of Auditory Comprehension of Language – 4th edition
TASP	Test of Aided-Communication Symbol Performance

1.5 Chapter overview

This study has five chapters. Chapter 1 provides a rationale for the study and outlines the purpose of the study. It contains definitions of frequently used terms and abbreviations and concludes with an outline of subsequent chapters.

Chapter 2 contains an overview of the language acquisition process for persons who use AAC and the AAC interventions that aids this process. It highlights the importance of receptive language acquisition for persons who use AAC, as well as the strategies to improve receptive language abilities. An overview of the studies that have utilised augmented input as an intervention strategy in facilitating receptive language acquisition is discussed. This chapter also highlights the gaps in the literature regarding aided language stimulation and the focus of the current research study.

Chapter 3 discusses the research methodology used in the study. The main and sub-aims are stated, as well as a description of the research design and phases. The objectives, methods, results and recommendations of the pilot study are presented. Thereafter, the main study is discussed with a description of the participants, data collection methods and data analysis procedures employed. Finally, the reliability of the data in the study is presented.

Chapter 4 presents the results of the study and looks at these in relation to the main and sub-aims identified. A visual analysis is presented, followed by statistical analysis.

Chapter 5 discusses the results in terms of the aims and sub-aims of the study. Results are discussed in relation to participant characteristics, relevant literature and studies that focused on augmented input.

Chapter 6 presents the summary of the study, as well as the clinical implications, strengths and limitations of the study, in addition to recommendations for future research.

1.6 Conclusion

This chapter highlighted the importance of the current study and also provided definitions of frequently used terms and abbreviations. It concluded with an outline of subsequent chapters.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter provides an overview of the language acquisition process for persons who use AAC and the AAC interventions that aids this process. It highlights the importance of receptive language acquisition for persons who use AAC, as well as the strategies to improve receptive language abilities. An overview of the studies that have utilised augmented input as an intervention strategy in facilitating receptive language acquisition is discussed. This chapter also highlights the gaps in the literature regarding aided language stimulation and the focus of the current research study.

2.2 Modalities in language acquisition for persons who use AAC

The language acquisition process requires the language learner to organise and interpret the world through a system of symbols and referents (Barton, Sevcik & Romski, 2006). Symbolic communication – when an entity is represented by something other than itself – is the goal for all communicators and develops through the language learner's cognitive and linguistic abilities (Mollica, 2003). Typically developing children are exposed to spoken language input for about a year before they begin to produce spoken language (Romski & Sevcik, 2003). The verbalisation of their first words around 12-15 months signifies their ability to verbalise the relationship between the symbol and its referent (Barton et al., 2006). The ability to understand spoken language provides evidence that symbolic functioning has been achieved (Mollica, 2003). The nature of the relationship between language comprehension and production in the language acquisition process and the role played by the language learner's production experience in the acquisition of the language rules of their community is a matter of debate (Smith & Grove, 2003).

The child with typical development develops language, whereas AAC users using aided AAC systems are required to learn AAC (Smith, 2006). Development is time bound and dependent on environmental and biological variables, whereas learning is related to individual experience (Smith, 2006). There are no clearly defined parameters of this learning process and at times the user is more proficient in the use of their system than the teacher

(Smith, 2006). Teaching may be in conflict with the progression of natural development and learning and interrupts the flow of natural communication (Smith, 2006).

"AAC intervention should aim at enabling a person to communicate as independently as possible in any context" (Tönsing et al., 2005, p. 38). Independent communication is dependent on both the ability to understand language and the ability to express oneself using language.

Von Tetzchner, Grove, Lonke, Barnett, Woll and Clibbens (1996) state that persons who use AAC have to comprehend speech in the auditory modality, while expressive output is in a visual modality. This creates an asymmetrical relationship between the AAC user's language modality and the spoken language of the environment (von Tetzchner et al., 1996). When Communication partners respond to persons who use AAC by using the same mode as the AAC user, thereby creating a symmetrical relationship between modalities. However, by responding with the spoken language of the environment, an asymmetry is created (von Tetzchner et al., 1996). Communication partners may even mix these strategies, resulting in the person who uses AAC not having the same competence in different modes (von Tetzchner et al., 1996).

Smith (2006) states that individuals that can use spoken language input to develop receptive language may have to recode the speech-based message into graphic symbols at the point of transmission. The recoding will therefore be required to mirror the structural characteristics of the spoken language and will be impacted by the communicative efficiency or lexical limitations of the graphic modality (Smith, 2006). Intervention in this instance would focus on improving translation by encouraging expressive output that mirrors spoken language; however, should the AAC user view graphic symbols as independent to ~~as~~ spoken language, then the output would reflect the potential of the visual modality (Smith, 2006), thereby not reflecting spoken language. In this instance, the focus of intervention would be improving communication using the visual modality. Modality-specific adaptations of the message structure would be accepted and the spoken and graphic modalities would develop together and graphic output would not be used to gain skills in spoken language (Smith, 2006). This makes determining the intervention goals challenging.

2.3 AAC interventions to improve the language of persons who use AAC

Augmented input is based on the premise that AAC users need language experiences similar to their non-disabled peers and they should receive input from communication partners in modes that they use and are expected to use later for expression (Goossens et al., 1992; Romski & Sevcik, 1993). The aim of augmented input is to provide a model for the use of graphic symbols as a usable mode of communication while providing an opportunity for language mapping (Dada, 2004). Light (1997) suggests that augmented input creates a greater symmetry between the expressive and receptive modes of the AAC user. The need to provide greater symmetry between language input and output has led to the practice of communication partners modelling AAC as an intervention (Sennott et al., 2016). Communication partner modelling refers to the communication partner modelling aided AAC as they speak and engaging in the in the context of a naturalistic communication interaction (Sennott et al., 2016).

Augmented input can be aided or unaided. Unaided input is when unaided AAC systems, e.g. gestures, manual sign is provided with spoken or auditory input. Aided input pairs aided AAC systems, e.g. PCS symbols, speech generating devices and is one strategy used to facilitate the language acquisition process (Clendon & Anderson, 2016).

Within the field of AAC, the general consensus is that integrating gestures, vocalisations, facial expressions, sign, picture symbols, voice output devices and even computer-based technologies lead to better outcomes across different settings (Wilkinson & Hennig, 2007). Therefore, the rate and quality of augmented input which children who use AAC receive is essential to their development (Romski & Sevcik, 2003).

Augmented input involves a communication partner providing communication input with the AAC user's system in conjunction with speech (Lloyd et al., 1997). Many variants of augmented input strategies have been described in the literature (Clendon & Anderson, 2016), such as AiLgS (Goossens, 1989), the System for Augmenting Language (SAL), (Romski & Sevcik, 1996), Natural Aided Language (Cafiero, 2001), Aided Language Modelling (ALM), (Drager et al., 2006) and Aided AAC Modelling (Binger & Light, 2007). These augmented input strategies have commonalities across them, such as augmenting input to the child, providing a vocabulary expansion model (Drager et al., 2006) and modelling the

use of the AAC system to the user (Sennott et al., 2016). They differ with respect to whether voice output communication aids are used during communication exchanges or using the verbal output of the facilitator (Drager et al, 2006). The SAL requires the use of an electronic speech-generating device, whereas AiLgS, Natural Aided Language and ALM do not require the use of a speech-generating device. Aided AAC Modelling involves any model of AAC use and may or may not include speech-generating devices.

AiLgS is one interactive training that models the interactive use of picture symbols in a meaningful context (Dada, 2004). It is based on the principle that modelling of interactive use is required to facilitate the AAC user's own interactive use of an aided communication system (Dada, 2004). A facilitator points to pictures in conjunction with ongoing language stimulation (Goossens, 1989). AiLgS intends to overcome learning barriers by using picture symbols with ongoing language stimulation that mirrors the environmental variable that is crucial to language development. There are various types of interactive training that can be referred to as augmented input.

Despite these differences, augmented input have two common features: firstly, that the communicative partner draws the learners' attention to the child's AAC system and models the expressive use of the system; and secondly, this modelling is done in a naturalistic communication interaction in the context of the learner's day (Sennott et al., 2016). The core principle is that just as children learning a new language should be immersed in an environment that uses that language, the same is true for persons who use AAC and are expected to communicate using AAC – they should be immersed in an environment that uses AAC (Sennott et al., 2016).

2.4 Synthesis of studies using augmented input

Two recent systematic reviews have been conducted. One aims to determine the effect of aided AAC modelling based interventions on the language acquisition of individuals with CCN (Sennott et al., 2016). The other aims to determine the effectiveness of augmented input approaches for persons with developmental disabilities and apraxia of speech with regard to language outcomes pertaining to receptive and expressive vocabulary, receptive syntax and expressive syntax, as well as to catalogue and, if feasible, establish categories of augmented input approaches, to list and group outcomes targeted and to provide a quality

appraisal of the studies included (Allen et al., 2017). Based on the aims of these two studies and that they were conducted recently, a synthesis of the included studies will be conducted. Table 2.1 provides a synthesis of the studies focused on AAC interventions and AAC modelling based interventions conducted by Sennott et al. (2016) and Allen et al. (2017).

Table 2.1

Summary of Studies Reviewed

Year	Authors	Title	Aim	Participants (Name, sex age, diagnosis,	Design	Procedures	Independent variable	Dependent variables	Results
1983	Lancioni	Using pictorial representations as communication means with low-functioning children	To devise a pictorial system which would allow receptive and eventually productive communication yet require limited discrimination and language skills	Male 1: 8.5, Severe mental retardation Male 2: 12.8, ASD, Severe mental retardation Female 1: 10.4, ASD, Severe mental retardation	A modified version of the multiple-probe technique	Each participant was exposed to training and probing on seven target behaviours: discrimination of objects, discrimination of body positions, discrimination of body positions related to objects, discrimination of simple activities, discrimination of activities involving two children, selection of objects and role, selection of activities	Training procedure using pictorial represent-ations	The seven target behaviours: discrimination of objects, discrimination of body positions, discrimination of body positions related to objects, discrimination of simple activities, discrimination of activities involving two children, selection of objects and role, selection of activities	Pictorial representations may effectively be used a communication means with low functioning individuals. The establishment of these means may be influenced by the training sequence and procedure. This programme fills the gap between simple pictorial strategies previously used with severely handicapped participants and symbolic methods or picture communication boards.
1994	Romski, Sevcik, Robinson & Bakeman	Adult-directed communications of youth with mental retardation using the system for augmenting language	To characterise the naturally occurring adult-directed communications of youth with mental retardation and little or no functional speech who	13 male youths aged between 6.2-20.5, moderate severe mental retardation	Observational method	During the first year, participants were introduced to the SAL in one of two instructional environments to determine if SAL initiations and responses were more successful and effective than	The SAL used in two instructional groups, i.e., home and school environment	The participants had successful communicative events in terms of the partners' response	The SAL had a greater influence on the effectiveness of successful communication than on success. Participants continued to use extant forms of communication in concert with SAL. SAL use influenced how the partner replied to the participants' communication. Initial

Year	Authors	Title	Aim	Participants (Name, sex age, diagnosis,	Design	Procedures	Independent variable	Dependent variables	Results
			used the System for Augmenting Language (SAL), in concert with non-SAL communications (e.g. vocalisations, gestures), to communicate over a two-year period			non-SAL initiations and responses in these environments. In the second year, both instructional groups used the SAL at home and at school. Maintenance of SAL use in initial instructional environment and generalisation to the new environment was assessed.			instructional environment played a role in the success of events but not their effectiveness. Youth were more successful when initiating communication with SAL at school than at home.
1995	Schlosser, Belfiore, Nigam, Blischak & Hetzroni	The effect of speech output technology in the learning of graphic symbols	To determine the effects of added auditory stimuli in the form of synthetic speech on the learning of graphic symbols	Joe, 25, Down syndrome, profound mental retardation Jane, 25, seizure disorder, atypical psychosis, severe range of mental retardation Carl, 25, seizure disorder profound range of	A parallel treatment design	Two training conditions, VOCA and non-VOCA, were implemented, followed by daily probes and maintenance probes	Two instructional conditions: VOCA and non-VOCA communication board. Each lexigram was presented five times for a total of 20 training trials per session	Percentage of lexigrams that were correctly identified, number of sessions to criterion, percentage of training errors to criterion	The presentation of additional auditory stimuli in the form of synthetic speech is effective in assisting individuals with mental retardation to learn associations of graphic symbols with spoken words.

Year	Authors	Title	Aim	Participants (Name, sex age, diagnosis,	Design	Procedures	Independent variable	Dependent variables	Results
				mental retardation					
1995	Heller, Alberto & Romski	Effect of object and movement cues on receptive communication by preschool children with mental retardation	To compare the effects of object cues paired with speech, movement cues paired with speech, and speech alone on the identification of stimulus items by pre-school children with mental retardation during a communication exchange	6 children, 25 to 40mnths old, mental ages raging from 6mnths to 15mnths	Alternating treatments design	Subjects were taught target items using object cues and speech, movement cues and speech or speech alone. When criterion was reached, probes were conducted	Treatment conditions: object cues and speech, movement cues and speech or speech alone. Consisted of three sessions (each corresponding to one of the conditions) and consisting of 15 trials.	Receptive identification of target items assessed using auditory stimuli to object matching	The use of object or movement cues assisted pre-school children with mental retardation in comprehending the intended referent faster than speech alone
2004	Harris & Reichle	The impact of aided language stimulation on symbol comprehension and production in children with moderate cognitive disabilities	To determine the impact of AiLgS on symbol comprehension and production	Jennie, 3.10, Down syndrome, moderate cognitive disability Niles, 5.4, Down syndrome, moderate cognitive disability	Single subject multiple probe design across symbol sets/ activities	Three activities with four symbols assigned to each activity	AiLgS during a scripted routine. The experimenter pointed to a referent in the environment and then pointed to a graphic symbol while	Symbol comprehension and production. Probes were conducted for comprehension of graphic and spoken symbols, production of graphic symbols, comprehension of exclusively graphic symbols and comprehension of	AiLgS facilitates symbol comprehension and production in individuals with moderate cognitive disabilities and CCN with production and comprehension being maintained.

Year	Authors	Title	Aim	Participants (Name, sex age, diagnosis,	Design	Procedures	Independent variable	Dependent variables	Results
				Edie, 4.2, no specified diagnosis, moderate cognitive disability			saying the name of the referent. Each object/symbol was referred to four times during each session.	exclusively spoken symbols.	
2006	Drager, Postal, Carrolus, Castellano, Gagliano & Glynn	The effect of aided language modelling on symbol comprehension and production in 2 pre-schoolers with autism	To examine the effectiveness of aided language modelling (ALM) on symbol comprehension and expression in two children with autism who used few words functionally	Maggie, 4.5, autism Sam, 4.0, autism	Multiple-baseline design across sets of symbol vocab-ulary.	Four vocabulary items taught in three interactive play activities	ALM intervention: the use of language boards, the researcher pointing to a referent in the environment, sequentially pointing to a graphic symbol of the referent while sim-ultaneously vocalising the verbal symbol for the referent. This was done four	Number of target items correctly identified when responding to graphic and verbal stimuli. Number of target items correctly identified when responding to graphic stimuli only. Number of target items correctly identified when responding to verbal stimuli only. Number of referent correctly labelled using graphic symbols.	ALM was effective in increasing symbol comprehension and production in two pre-school children with autism and could be maintained. The results further indicated that AAC symbols can be use in expressive and receptive capacity and adult models can result in acquisition of for some children with autism. Additionally, this study showed that the participants responded as well with the verbal stimuli as with the graphic stimuli.

Year	Authors	Title	Aim	Participants (Name, sex age, diagnosis,	Design	Procedures	Independent variable	Dependent variables	Results
							times for each item.		
2007	Binger & Light	Effect of aided AAC modelling on the expression of multi-symbol messages by pre-schoolers who use AAC	To examine the effect of using AAC models on the production of multi-syllabic messages by pre-schoolers who use AAC	Valerie, female, 4.3, Prader-Willie syndrome Timmy, male, 3.5, DiGeorge syndrome Robin, female, 4.6, Down syndrome Nathan, male, 4.4, developmental delay, suspected CAS Richard, male, 4.2, developmental delay, suspected CAS	Single subject, multiple probe research design	Five pre-schoolers Three used voice output communication systems, two used non-electronic communication boards received aided AAC models by pointing to two symbols on the child's aided AAC system and then providing a grammatically complete spoken model while engaging in play activities	Aided AAC modelling during play scenarios. The researcher touched a combination of two symbols on the child's AAC device, labelled each of the two symbols while touching each symbol and then provided a spoken model like the spoken models in the baseline. A minimum of 30 aided AAC model were provided in each 15-	Frequency of multi-symbol combination productions during 15-minute play sessions	Aided AAC modelling was effective for increasing the production of multi-symbol messages by four out of five pre-schoolers

Year	Authors	Title	Aim	Participants (Name, sex age, diagnosis,	Design	Procedures	Independent variable	Dependent variables	Results
							minute session		
2008	Rosa-Lugo & Kent-Walsh	Effects of parent instruction on communi-cative turns of Latino children using Augmentative and Alternative communicatio n during storybook reading	To address the current void in research literature on best practices for AAC intervention with Latino children	Alexis, female, 6.10, cystic hygroma Bernado, male, 6.8, developmental delay	Single-subject, multiple-baseline-across-subjects design	Parents were asked to read with their children as they typically would. Baseline measures were taken. Parents underwent an eight-step instructional programme. Generalisation measures were taken to determine if parents were able to generalise their use of the targeted strategy	Parent instructional programme using aided AAC modelling	Parents' percentage of accurate strategy implementation and children's percentage communicative turns out of a total number of opportunities and novel sematic concepts expressed	A small amount of instruction with communication partners can yield a good acquisition of facilitative interaction strategies, resulting in an increase in communication turns, expressive vocabulary
2008	Binger, Kent-Walsh, Berens, Del Campo & Reviera	Teaching Latino parents to support the multi-symbol message productions of their children who require AAC	To evaluate whether an existing instructional programme for caregivers would be valid for Latino parents and to evaluate the effectiveness of the caregiver instructional programme on	Focus group: two participants were professors of education or speech-language pathology. One participant was an AAC expert with Ph.D. in	Mixed methods design with both qualitative and quantitati ve componen ts. Interactio n strategy and acquisitio	The first component was a focus group to validate the intervention programme was conducted. Based on these results, changes were made to the instructional programme. The second component investigated the effectiveness of the	Aided AAC modelling with parents reading the text and providing two-symbol aided AAC model, asking wh-question	Accuracy of caregivers implementation of the targeted strategy in obligatory contexts and frequency of children's multi-symbol utterance production within a ten-minute book reading activity	None of the parents demonstrated use of the instructional strategy prior to instruction. Following the instruction sessions, parents used the strategy consistently 80% of the time or higher. After parent implementation of the strategy, all three participants used symbol combinations consistently and with greater frequency. All achieved criterion of at

Year	Authors	Title	Aim	Participants (Name, sex age, diagnosis,	Design	Procedures	Independent variable	Dependent variables	Results
			the multi-symbol utterance production of Latino children who used AAC	speech-language pathology 1 participant was a Latino father of a child who used AAC Interaction strategy and acquisition of multi-symbol messages: Antonio, 4.1, male, profound phonological process disorder Angela, 3.4, Female, suspected VCFS, profound VPI, suspected CAS Julia, 2.11, F, sub palatal cleft, profound VPI	n of multi-symbol messages used a single subject multiple probe design	instructional programme			least ten symbol combinations per ten minute session for three consecutive sessions.
2009	Dada & Alant	The effect of aided language stimulation on	To develop, implement and describe and	A: 8.5, male, Cerebral Palsy	Single subject, multiple	AiLgS with a frequency of 76% to 93% provided for	AiLgS with a frequency of 76% to 93%	Number of target items correctly identified when	A clearly documented process of AiLgS with four participants measuring

Year	Authors	Title	Aim	Participants (Name, sex age, diagnosis,	Design	Procedures	Independent variable	Dependent variables	Results
		vocabulary acquisition in children with little or no functional speech	AiLgS programme and determine its effects on the acquisition of target vocabulary items	B:10.0, female, Cerebral Palsy C:8.1, female, Cerebral Palsy D: 12.1, female, Cerebral Palsy	probe design, three activities	target vocabulary in three activities		responding to verbal stimuli	specific vocabulary acquisition was provided. AiLgS facilitated the acquisition of the target vocabulary items. Performance was maintained during post intervention. The incorporation of the aided symbols into the intervention could not solely be attributed to the participants' word-object matching abilities
2003	Taylor & Lacono	AAC and scripting activities to facilitate communication and play	To investigate the effects of modelling play and vocabulary within scripted activities on the child's spontaneous functional and symbolic pretend play and symbolic communication	Barry, 3.6, male, mild ID disability, severe communication impairment etiology unknown	Single-subject multiple baseline design was used to measure the effects of intervention across three play contexts. A nonexperimental phase in which the	Intervention involved scripting play activities and modelling vocabulary in speech and AAC modality of sign. An additional intervention phase using an electronic communication device was introduced	Scripting and modelling play, with symbolic communication models for target vocabulary provided in speech and sign. Scripting and modelling play with symbolic communication models for target vocabulary	Rate of spontaneous functional play acts, spontaneous symbolic play acts, spontaneous symbolic communications	Modelling and scripted play activities increased symbolic play with changes in types of functional play, its frequency was erratic across baseline and intervention phases. Improvements in communication were more evident when a multimodal AAC approach was used in modelling than sign alone

Year	Authors	Title	Aim	Participants (Name, sex age, diagnosis,	Design	Procedures	Independent variable	Dependent variables	Results
					electronic device was intro-duced		provided in speech, sign and with Dynavox		
2010	Romski, Sevcik, Adamson, Cheslock, Smith, Barker & Bakeman	Randomised comparison of augmented and nonaugmented language interventions for toddlers with developmental delays and their parents	To compare the language performance of young children with developmental delays who were randomly assigned to one of three parent-coached language interventions	19 females 43 males 21-40mnths Developmenta l delay	Group design	Children with fewer than ten spoken words were randomly assigned to AAC modelling conditions with SGD, AAC prompting condition with SGD and a speech only condition	Augmented communicati on input, augmented communicati on output and spoken communicati on	Augmented word use, spoken word use, vocabulary size, child and parent communication interaction	Increase in AAC target word use and vocabulary knowledge for both AAC conditions. Children in the augmented communication output and input interventions developed a word vocabulary even though their spoken word skills were modest. Children in the spoken communication intervention learned to use about the same percentage of spoken words as the children in the other two in interventions, but they did not have another conventional way to communicate available to them. Parent coached augmented interventions did not hinder spoken language development and provided a way for the children to develop communication skills in the absence of gains in spoken words.

Year	Authors	Title	Aim	Participants (Name, sex age, diagnosis,	Design	Procedures	Independent variable	Dependent variables	Results
2010	Binger, Kent-Walsh, Ewing & Taylor	Teaching educational assistants to facilitate the multisymbol message productions of young students who require AAC	The impact of using a communication partner instructional programme to teach educational assistants how to teach their students to produce symbol combinations on their speech-generating devices	Three educational assistants and three students: Oscar, 6.4, male, DD Adam, 4.6, male, DD, suspected CAS Valerie, 5.8, female, CP, dysarthria	Single-subject multiple-probe-across-participants design	Storybook reading with educational assistant in school	Read, Ask, Answer, Prompt intervention with AAC modelling of three multisymbol models per page	The percentage of strategy steps correctly implemented by the educational assistants on each page of the storybook and The frequency of multisymbol messages produced by the students using their SGD's, within a ten-minute story reading session	All educational assistants used the strategies and maintained them over time The ImPAACT Programme was an efficient and effective method for teaching communication partners to support children who use AAC. All students leaned to produce symbols combination on their SGDs in a short period and reached criterions after a maximum of one hour in the intervention phase. Students used a variety of symbol combinations within the post-instructional sessions spontaneously indicating they generated novel and varied messages.
2010	Kent-Walsh, Binger & Hasham	Effects of parent instruction on the symbolic communication of children using Augmentative and Alternative Communication during storybook reading	To investigate the effects of a communication partner instruction strategy for parents of children using AAC on the communicative turn taking of their children.	Six caregivers Abby, female, 8, CP Brian, Male, 5.4, DS Clea, female, 5, CP Dale, male, 8.3, CP Evan, Male, 4.7, DS	Two single-subject multiple-probe-across-participant design	Baseline measure were collected on how mothers typically read to their children. A focus group was used to measure the cultural appropriateness of the intervention program for African American populations. No	Storybook reading at home with parents using aided AAC modelling	Parent dependent measure: percentage accuracy of implementation of the targeted communication partner interaction strategy Child dependent measure: total number of communicative turns	All six caregivers learned to implement the communication partner interaction strategy. All six children increased their communicative turn taking and used a wider range of semantic concepts

Year	Authors	Title	Aim	Participants (Name, sex age, diagnosis,	Design	Procedures	Independent variable	Dependent variables	Results
				Freddy, male, 5.11, DS		changes were made to the programme. Parent training was conducted. Intervention sessions were conducted. Thereafter, generalisation and maintenance probes occurred		during each ten-minute story-reading session	
2011	Binger, Maguire-Marshal and Kent-Walsh	Using aided AAC models, recasts, and contrastive targets to teach grammatical morphemes to children who use AAC	To investigate the viability of using aided AAC modelling and recasting to teach children who used AAC to produce and maintain the use of a variety of grammatical morphemes	Alex, Male, 11, CP Jessie, Female, 6, CAS Ian, Male, 9, CP	Single-subject, multiple-probe, across-targets design	Three participants were taught to use three grammatical structures using Aided AAC models and recasts during storybook reading	Aided AAC models, recasts, and contrastive targets. The researcher attempted to produce ten aided AAC models and recasts during each 15-minute session. The exact number of models and recasts was not controlled to allow variation in participant motivation,	Use of the three grammatical morphemes	Increase in morphology forms: Aux+main, verb + -ing, poss. 's, third person singular, regular past tense and plural. Criterions was reached quickly, indicating that the intervention package which contained aided AAC models and recasts was effective. No participant maintained use of the first grammatical structure. Successful outcomes for the second and third structure were encouraging but may have been influenced by an indirect form of contrastive modelling provided in Intervention Phase 1 for targets two and three

Year	Authors	Title	Aim	Participants (Name, sex age, diagnosis,	Design	Procedures	Independent variable	Dependent variables	Results
							attention and processing skills		
2014	Solomon-Rice & Soto	Facilitating vocabulary in toddlers using AAC: A preliminary study comparing focused stimulation and augmented input		Three participants aged birth to three years Karl: extreme prematurity resulting in multi system dysfunction Carol: developmental delay Mick-Developmental delay	Within subject adapted alternating treatments design	Focused stimulation and augmented input was provided to participants Each word was modelled ten times each for both conditions	Focused stimulation and augmented input (each word was modelled ten times each for both conditions)	Expressive vocabulary	Expressive vocabulary improved during both conditions and was sustained and generalised for two of the three toddlers
2015	Kent-Walsh, Binger & Buchanan	Teaching Children who use Augmentative and Alternative Communication to ask inverted yes/no questions	To investigate the effects of a direct intervention programme involving aided modelling on the presentation of contrastive	Adam, Male, 4.10. childhood apraxia of speech Bella, female, 6.2, DS Clay, male, 4.9, childhood	Single-case, multiple-probe experimental design across participants	Treatment involved aided modelling and contrastive targets through concentrated modelling and interactive play activities.	Aided modelling and contrastive targets. At the beginning of each intervention session the	Dependent variable 1: Subject_Aux V(is) +main V-ing Dependent variable 2: Aux V (is) + subject+Main V-ing Generalisation Variable 1: Subject	All three participants showed direct treatment effect, producing a greater number of inverted yes/no questions and 'to be' declaratives within the probes following treatment. All three participants

Year	Authors	Title	Aim	Participants (Name, sex age, diagnosis,	Design	Procedures	Independent variable	Dependent variables	Results
		using aided modelling	targets on the aided production of inverted yes/no questions and possible generalisation to other sentence types by children using AAC	apraxia of speech, un-identified DD, possible seizure disorder			researcher and parent provided a series of 20 concentrated models of the target. Additional aided AAC models were provided during the interactive play component.	+ Copular + complement Dependent variable 2: Copular+ Subject+Complement Generalisation variable 3: Subject +Aux V + Reversible V + Object	showed some generalisation to novel sentences

The 18 studies reviewed in Table 2.1 indicate considerable variability in the research designs, participant profiles, the type and dosage of aided AAC intervention used, the dependant and independent variables, target vocabulary used and language outcomes.

2.5 Research design

Of the 17 studies, one study used a group design (Romski et al., 2010) and one study used a mixed methods design with a qualitative and a single subject multiple probe design (Binger et al., 2008). One study used an adapted alternating treatment design (Solomon-Rice & Soto, 2014). One study used an alternating treatment design (Heller, Alberto, & Romski, 1995). One study used a modified version of the multiple probe design (Lancioni, 1983). One study used an observational method (Romski, Sevcik, Robinson, & Bakeman, 1994). One study used a parallel treatment design (Schlosser, Belifore, Nigam, Blischak, & Hetzroni, 1995). Three studies used a single subject multiple baseline design (Drager et al., 2006; Rosa-Lugo & Kent-Walsh, 2008; Taylor & Lacono, 2003). Seven studies used a single subject multiple probe design (Binger & Light, 2007; Binger, Kent-Walsh, Ewing, & Taylor, 2010; Binger, Maguire-Marshal & Kent-Walsh, 2011; Dada & Alant, 2009; Harris & Reichle, 2004; Kent-Walsh, Binger, & Hasham, 2010; Kent-Walsh, Binger & Buchanan, 2015).

It is evident that for studies assessing the effectiveness of one intervention, multiple baseline or multiple probe design was used most frequently, while for studies comparing two or more interventions, adapted alternating treatments designs were used (Allen et al., 2017).

2.6 Participant Variables

Participant profiles varied in terms of gender, age, diagnoses, information on receptive language skills, information on expressive language skills, and ID.

2.6.1. Gender

When reviewing the single subject and group design studies, the total number of participants was 119. Of these, 37 were female and 82 were male.

2.6.2 Age

Within these studies, participants varied in age. Twelve studies involved participants aged 1.7–8 years (Binger & Light, 2007; Binger et al., 2008; Binger et al., 2010; Drager et

al., 2006; Harris & Reichle, 2004; Heller et al., 1995; Kent-Walsh et al., 2010). Kent-Walsh et al., 2015; Romski et al., 2010; Rosa-Lugo & Kent-Walsh, 2008; Solomon-Rice & Soto., 2014; Taylor & Lacono, 2003). Two studies involved participants aged 8.5–12.8 years (Dada & Alant, 2009; Lancioni, 1983). One study used participants ranging from 6–11 years (Binger et al., 2011). One study specifically involved older participants, 25 years of age (Schlosser et al., 1995), and one study had a participant age ranging from 6.2–20.5 years (Romski et al., 1994). It is evident that more research has been conducted on participants aged 3.5–8 years and there has been limited research involving children aged 2–3 years, 8–12 years, 12–18 years and adults. This highlights the need for research involving very young and older participants, as well as across the life span (Sennott et al., 2016).

2.6.3 Diagnosis

Participants in these studies had varied diagnoses. Two studies involved participants with autism spectrum disorder (ASD) (Drager et al., 2006; Lancioni, 1983). Seven studies involved participants with Down syndrome (Binger & Light, 2007; Dada & Alant, 2009; Harris & Reichle, 2004; Kent-Walsh et al., 2010; Kent-Walsh et al., 2015; Romski et al., 2010; Schlosser et al., 1995). Five studies involved participants with cerebral palsy (CP) (Dada & Alant, 2009; Binger et al., 2010; Binger et al., 2011; Kent-Walsh et al., 2010; Romski et al., 2010). Two studies involved participants with childhood apraxia of speech (Binger et al., 2011; Kent-Walsh et al., 2015) which equated to three participants. Two studies included participants with suspected childhood apraxia of speech (Binger et al., 2008; Binger et al., 2010). One study included three participants with profound phonological disorder, profound velopharyngeal insufficiency and sub palatal cleft (Binger et al., 2008). One study involved one participant with extreme prematurity, resulting in multisystem dysfunction (Solomon-Rice & Soto, 1994). A total of five participants with developmental delay were included. One study included one participant with cystic hyroma (Rosa-Lugo & Kent-Walsh, 2008). One study included one participant with Prader Willis syndrome and one participant with DiGeorge syndrome (Binger & Light, 2007). One study included one participant with seizure disorder, atypical psychosis and severe mental retardation, and one participant with seizure disorder and profound ID (Schlosser et al., 1995). One study included one participant with moderate cognitive disability (Harris & Reichle, 2004). One study included one participant with a mild ID and a severe communication impairment of unknown etiology. Four studies involved participants with developmental delay (Binger & Light, 2007; Binger et al., 2010; Rosa-Lugo & Kent-Walsh, 2008; Solomon-Rice & Soto,

2014). Two studies included seven participants with ID (Heller et al., 1995; Romski et al., 1994).

It is evident that there is limited research involving participants with severe ID. Participants in this study therefore included children with CCN and severe ID. A need for controlled studies regarding individuals with CCN and who use alternate access – such as switch access, eye-control access and brain-computer access – has been identified (Sennott et al., 2016). A need to research AAC modelling based interventions with individuals with disabilities associated with CCN, such as traumatic brain injury, aphasia and amyotrophic lateral sclerosis, is also evident (Sennott et al., 2016).

2.6.4 Cognitive Skills

Cognitive skills have been described with considerable variability across studies. Additionally, participants with various level of cognition have been included in the studies. Five studies did not report on cognitive functioning (Binger et al., 2010; Binger et al., 2011; Kent-Walsh et al., 2010; Kent-Walsh et al., 2015; Romski et al., 2010). In the Harris et al. (2004) study, the three participants had moderate cognitive disabilities as determined by a licenced school psychologist. In one study involving three participants, no known cognitive impairment was reported (Binger et al., 2008). In one study, four participants were described by teachers and speech therapists as coping with academic tasks in English (Dada & Alant, 2009). One study included one participant with mild ID (Taylor & Lacono, 2003). Two studies included four participants with profound mental retardation and one participant with profound mental retardation (Lancioni, 1983; Schlosser et al., 1995). One study included 13 participants with moderate or severe mental retardation (Romski et al., 1994). One study included six participants with mental ages of 6-15mnths, as measured by the Bayley Infant Development Scales (Bayley, 1969). One study reported mild, moderate and no cognitive delays in the three participants (Solomon-Rice & Soto, 2014). Greater consistency in how ID is assessed and reported will assist in creating participant profiles in order to determine treatment effectiveness for persons with various degrees of ID (Allen et al., 2017). A need for additional studies involving participants with severe intellectual disability has been identified.

2.6.5 Complex Communication Needs (CCN)

In studies involving participants with CCN, the manner in which participants were classified as presenting with CCN showed great variability. One study required participants to have a spoken word vocabulary of ten or less words as determined by a speech therapist (Romski et al., 1994). One study required fewer than 15 intelligible words as determined by the school speech therapist (Dada & Alant, 2009). One study determined severe communication impairment from analysing a language sample obtained from the classroom and from parent and teacher reports (Taylor & Lacono, 2003). One study used the Goldman Fristoe Test of Articulation to report on intelligibility (Schlosser et al., 1995). One study reported three participants with less than 10% intelligibility as reported by their speech-language therapist (Solomon-Rice & Soto, 2014). Six studies used the Index of Augmented Speech Comprehensibility (I-ASCC, Dowden, 1997) and participants were required to present with less than 50% intelligibility in the no context and sematic context condition (Binger & Light, 2007; Binger et al., 2008; Binger et al., 2010; Binger et al., 2011; Rosa-Lugo & Kent-Walsh, 2008; Kent-Walsh et al., 2015). The remaining six studies did not specify how participants' speech intelligibility was determined. Greater consistency in identifying participants with CCN is required to create a consistent participant profile, as this will allow generalisability of findings (Allen et al., 2017; Sennott et al., 2016).

2.6.6 Language skills

Another area of great variability is the manner in which participants' receptive and expressive language skill was assessed. Eight studies used the Peabody Picture Vocabulary Test (PPVT-4; Dunn & Dunn, 2007) to assess receptive vocabulary (Dada & Alant, 2009; Drager et al., 2006; Harris et al., 1994; Kent-Walsh et al., 2010; Kent-Walsh et al., 2015; Lancioni, 1983; Romski et al., 1994; Rosa-Lugo & Kent-Walsh, 2008). Two of these eight studies reported participants that could not provide reliable responses or establish a basal score (Drager et al., 2006; Lancioni, 1983). Seven studies used The Test of Auditory Comprehension of Language – 3rd edition (TACL-3; Carrow-Woolfolk, 1999) to assess receptive language skills (Binger & Light, 2007; Binger et al., 2008; Binger et al., 2010; Binger et al., 2011; Kent-Walsh et al., 2010; Kent-Walsh et al., 2015; Rosa-Lugo & Kent-Walsh, 2008; Schlosser et al., 1995). One study did not specify the measure used to determine a receptive language age of 8–12mnths (Heller et al., 1995). Two studies used the Reynell Developmental Language Scales (Reynell & Huntley, 1985) to assess receptive and expressive language skills (Dada & Alant, 2009; Taylor & Lacono, 2003). The MacArthur

Communication Development Inventory (Fenson, Dale, Reznik, Thal, Bates, & Hartung, 1993) was used by four studies to assess receptive and expressive vocabulary (Drager et al., 2006; Harris & Reichle, 2004; Romski et al., 2010; Taylor & Lacono, 2003). It was used by four studies to assess expressive vocabulary (Binger & Light, 2007; Binger et al., 2008; Binger et al., 2010; Solomon-Rice & Soto, 2014). One study assessed expressive vocabulary by using parent reports (Kent-Walsh et al., 2015). One study used the Sequenced Inventory of Communication Development (SICD; Hendrick, Prather, & Tobin, 1984) to assess receptive and expressive language and the Clinical Assessment of Language Comprehension (Paul & Miller, 1995) to assess receptive language skills (Romski et al., 2010). Harris et al. (2004) suggests that future research examine the effects of AiLgS on participants with more limited receptive language.

These language assessments were conducted as pre-intervention testing in the above-mentioned studies, with none of the studies conducting post-intervention language assessments.

Therefore, it can be concluded that generalisation issues can be overcome by reporting on the baseline skill level of participants' cognitive, receptive and expressive language skills. This would enable practitioners to determine whom augmented input would benefit (Allen et al., 2017). It has been suggested that further research is required to relate the forms of augmented input to subject characteristics and various types of referents (Heller et al., 1995). It has been suggested that further information regarding individual difference variables could aid in predicting whether additional auditory stimuli is required to promote graphic symbol learning (Schlosser et al., 1995). Drager et al. (2006) recommends that future research should focus on which combination of treatment elements are most efficient with characteristics of individual children and families. Various authors have identified the need to replicate the procedures and targeted strategies they used with natural environments, play activities and participants with a broader range of disabilities, age, language profile, cognitive profile, a variety of AAC systems and other cultural and linguistic groups (Binger & Light, 2007; Binger et al., 2008; Binger et al., 2010; Drager et al., 2006; Kent-Walsh et al., 2010; Kent-Walsh et al., 2015; Romski et al., 1994; Rosa-Lugo & Kent-Walsh, 2008; Taylor & Lacono, 2003).

2.7 Independent variable

The independent variables differed in these studies, as various forms of augmented input were used. Two studies used AiLgS (Dada & Alant, 2009; Harris & Reichle, 2004). One study used ALM (Drager et al., 2006). One study used the SAL (Romski et al., 1994). Five studies referred to the intervention as aided AAC modelling (Binger & Light, 2007; Binger et al., 2008; Binger et al., 2010; Kent-Walsh, 2015; Rosa-Lugo & Kent-Walsh, 2008; Schlosser et al., 1995). One study modelled vocabulary using speech and sign with an additional intervention phase using an electronic communication device (Taylor & Lacono, 2003). One study referred to the intervention as a training procedure using pictorial representations (Lancioni, 1983). One study used aided AAC using object cues and speech, movement cues and speech, and speech cues alone (Heller et al., 1995). One study differentiated between augmented communication output, augmented communication input and spoken communication (Romski et al., 2010). One study referred to the independent variables as focused stimulation and augmented input (Solomon-Rice & Soto, 2014).

Frequency of augmented input was reported in nine studies (Binger & Light, 2007; Binger et al., 2011; Dada & Alant, 2009; Drager et al., 2006; Kent-Walsh et al., 2015; Harris & Reichle, 2004; Heller et al, 1995; Schlosser et al., 1995; Solomon-Rice & Soto., 2014). Within these studies, frequency of augmented input varies from five times per session (Schlosser et al., 1995), four times per session (Harris & Reichle, 2004), every opportunity (Drager et al., 2006), 30 times per 15-minute session (Binger & Light., 2007), between 76% to 93% of AiLgS(Dada & Alant, 2009), or each target vocabulary receiving focused stimulation and augmented input ten times each (Solomon-Rice & Soto, 2014).

The studies found that replicability and generalisation of findings to particular population groups are two of the major factors currently influencing research and practice in this area (Allen et al., 2017; Sennott el al., 2016). Replicability issues can be overcome by providing greater detail regarding AAC systems and AAC stimuli used, and by including information regarding the frequency of augmented input provided (Allen et. al., 2017). Variations in the nature and frequency of AiLgS provided would provide information on the minimal levels of augmented input needed to facilitate change for specific populations and training purposes (Dada & Alant, 2009).

2.8 Dependent variable

The dependent variables in these studies differed. Four studies used receptive vocabulary as a dependent measure (Dada & Alant, 2009; Heller et al., 1995; Lancioni, 1983; Schlosser et al., 1995). Two studies used expressive vocabulary as a dependent variable (Romski et al., 2010; Solomon-Rice & Soto, 2014). Two studies used dependent variables of expressive and receptive vocabulary acquisition (Drager et al., 2004; Harris & Reichle, 2004). Five studies used expressive syntax as the dependent variable (Binger & Light, 2007; Binger et al., 2008; Binger et al., 2010; Binger et al., 2011; Kent-Walsh et al., 2015). Four studies used pragmatic outcomes as a dependent variable (Kent-Walsh et al., 2010; Romski et al., 1994; Rosa-Lugo & Kent-Walsh, 2008; Taylor & Lacono, 2003). None of the studies used receptive syntax as a dependant variable.

Five studies used nouns as their target vocabulary (Drager et al., 2006; Harris & Reichle, 2004; Heller et al., 1995; Schlosser et al., 1995; Taylor & Lacono, 2003). Six studies used nouns, adjectives, adverbs, and prepositions (Binger & Light., 2007, Binger et al., 2008, Binger et al., 2010; Dada & Alant, 2009; Lancioni, 1983; Romski et al., 2010).

Other recommendations for future research include the use of an alternative treatment design using equal yet different and unrelated vocabulary sets (Dada & Alant, 2009). Further recommendations included exploring the differences in the efficacy of AiLgS as a function of fast mapping ability, the effects of AiLgS on expressive and receptive semantics and syntactic using other symbol types, if a differential effect occurs between synthetic or natural speech during AiLgS (Harris & Reichle, 2004). Future research needs to investigate the impact of using aided AAC modelling with and without the use of explicit prompts, in daily life contexts, to teach other linguistic structures and with a variety of communication partners (Binger & Light, 2007). Future research should ensure that interventions include discriminatory learning techniques using concurrent instruction and broader grammar intervention techniques, and how best to integrate grammatical markers into a semantically based system (Binger et al., 2011). Also, empirically validating the effectiveness of targeting specific categories of linguistic rules would be beneficial (Kent-Walsh, 2015).

Most AAC modelling based interventions have provided evidence of improved knowledge for nouns (Sennott et al., 2016). The current study has a set of target vocabulary that includes nouns, prepositions and adjectives. Additionally, a need for greater information

regarding maintenance and generalisation of language skills has been highlighted (Sennott et al., 2016). The current study will include maintenance of receptive vocabulary skills.

The manner in which the dependent variable is assessed bears reference. Some studies conducted probes using auditory stimuli to object matching (Heller et al., 1995). Other studies probed symbol comprehension and production and probes were conducted for comprehension of graphic and spoken symbols, production of graphic symbols, comprehension of exclusively graphic symbols and comprehension of exclusively spoken symbols (Harris & Reichle, 2004). Drager et al. (2006) conducted probes that assessed the number of correctly identified items when responding to graphic and verbal stimuli, graphic stimuli only, verbal stimuli only, referents correctly labelled using graphic symbols, and the frequency of multi-symbol combination productions during a 15-minute play session. It is therefore crucial that the different probe stimuli modes used in studies do not lend themselves to feature matching.

Various issues have been raised regarding augmented input strategies. The studies highlight the need for studies that provide more information regarding intervention dosage level or frequency of augmented input, , the AAC systems and stimuli used, participant profile aspects, maintenance and generalisation, as well as a need for a more varied population, disability and age group to be represented in studies (Allen et al., 2017; Sennott et al., 2016). The current study aims to provide information pertaining to frequency of AiLgS provided to participants and a more detailed description of participant profiles. It included participants with severe ID.

2.9 Conclusion

This chapter has discussed the role of receptive language acquisition for AAC users and the various augmented input strategies that facilitate receptive language acquisition. A summary of articles used in two recent systematic reviews (Allen et al., 2017; Sennott et al., 2016) is given. The current gap in the literature and the focus of this study has been highlighted.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the research methodology used in the study. The main and sub-aims are stated, as well as a description of the research design and phases of the study. Participant sampling, recruitment, selection and descriptive criteria are discussed. The objectives, methods, results and recommendations of the pilot study are presented. Thereafter, the main study is discussed in terms of equipment and materials used and procedures employed. The reliability of the data is presented and finally, the data analysis used is discussed.

3.2 Aims

3.2.1 *Main Aim*

The main aim of the study is to describe and compare the effect of AiLgS with a frequency of 40% and 70% respectively on the acquisition of receptive vocabulary items by children with CCN and ID.

3.2.2 *Sub-aims*

The sub-aims of the study are:

(i) To determine the effect of 40% of AiLgS on the acquisition of target receptive vocabulary items by children with CCN and ID during a craft activity.

(ii) To determine the effect of 70% of AiLgS on the acquisition of target receptive vocabulary items by children with CCN and ID during a procedural discourse activity.

(iii) To compare the efficacy of 70% and 40% of AiLgS on the acquisition of target receptive vocabulary items by children with CCN and ID within a craft and procedural discourse activity.

3.3 Design

An adapted alternating treatment design (Wolery, Gast & Ledford, 2014) was used to compare the effect of aided language stimulation with a frequency of 40% and 70% on the acquisition of receptive vocabulary items of children with CCN and ID. A frequency of 40%

AiLgS intervention during a craft activity was provided and a frequency of 70% AiLgS intervention during a procedural discourse activity was provided. Three target vocabulary sets were used in this study: one assigned to the intervention with 40% AiLgS, one assigned to the intervention with 70% AiLgS, and a third which served as a control set that was not assigned to an intervention. The control set was probed each time the target vocabulary set was probed and served to strengthen the validity of the study.

AATD allows the comparison of two or more instructional strategies with non-reversible behaviours (Wolery et al., 2014). Due to the replications across participants, it provides valuable information about the efficiency of one instructional strategy over another (Wolery et al., 2014). The target receptive vocabulary items of this study met the five criteria of AATD, namely behaviours were non-reversible; they were not in the participants' repertoire; they were independent of each other, as one set could be acquired without influencing performance in the other set; they were functionally equivalent and of equal difficulty (Wolery et al., 2014). An unfair evaluation of strategies can occur if the behaviour sets/chains are not of equal difficulty (Wolery et al., 2014). The sets of target vocabulary items were determined to be equally difficult. A limitation of AATD is that typically there is only one evaluation of the relative efficiency between the compared strategies (Wolery et al., 2014).

Intervention occurred in a small group format of three participants each. The six participants were specifically assigned into Group 1 and Group 2. Data was collected and analysed at an individual level.

During intervention, the intervention with a frequency of 40% AiLgS and the intervention with a frequency of 70% AiLgS was implemented with Group 1 and 2 in a systematically alternating fashion, with a break of at least one hour between sessions to minimise multi-treatment effects (Wolery et al., 2010). If Group 1 received the intervention with a frequency of 40% AiLgS first on a particular day, then Group 2 received the intervention with a frequency of 40% AiLgS first on the following day (See Table 3.1). Intervention probes were conducted before each intervention session on every alternate day, as per the baseline probes.

A learning criterion of 100% correct identification of target words in the probe conditions, over two consecutive probes was set. A teaching criterion, a predetermined maximum number of teaching sessions, and a learning criterion, a predetermined level of performance that indicates acquisition (Schlosser, 2003), was set A teaching criterion of ten days (weekdays excluding weekends) was set as it allowed the termination of teaching when the learning criterion was not achieved. This also prevented boredom and fatigue from repeated exposure to the same activity.

After one week of withdrawal of intervention, maintenance probes were conducted for three sets of vocabulary once a week for three weeks.

Table 3.1
Implementation of intervention

Participant Groups	Participants	Day	Intervention	Intervention
Group 1	1, 3, 5	1	40% AiLgS	70% AiLgS
Group 2	2, 4, 6	1	70% AiLgS	40% AiLgS
Group 1	1, 3, 5	2	70% AiLgS	40% AiLgS
Group 2	2, 4, 6	2	40% AiLgS	70% AiLgS

3.4 Phases

This study comprised two phases: the pre-experimental phase and the experimental phase. The pre-experimental phase was concerned with obtaining the relevant ethical approval, permissions and consent, as well as the development of materials used in the study and baseline probes.

The experimental phase of the study consisted of implementation of the intervention with a frequency of 40% and 70% AiLgS, probe tests and maintenance probe tests.

3.5 Equipment and Materials

3.5.1 Equipment

3.5.1.1 Video recording equipment

A Canon video recorder (Legria HF R806) mounted on a tripod was used to capture pre-assessment, intervention sessions and probes. An SD video camera card was used to record the sessions.

3.5.1.2 Boardmaker Plus v6.1.6 (Mayer Johnson, 2011)

Boardmaker Plus v6.1.6 (Mayer Johnson, 2011) was used to create the PCS on the AiLgS facilitator boards.

3.5.1.3 Easel

An easel was used to hold the facilitator board. The length of the easel legs were 57cm. The dimensions of the easel board were 96cm x 66.5cm.

3.5.2 Materials

3.5.2.1 Materials for pre-experimental phase

Permission and consent letters were used. These contained information pertaining to what the study entailed, its purpose, selection criteria of participants, intervention and assessment procedures participants would undergo, and requirements from the relevant participants and teachers. The letters also explained that participation was voluntary and that participants could withdraw from the study at any time, as well as mentioned that the data collected would be stored at the University of Pretoria for 15 years.

3.5.2.1.1 Ethics clearance from the University of Pretoria (UP)

Ethics clearance was obtained from the University of Pretoria. The reference number is 98088336 (GW20171038HS) (Appendix 1).

3.5.2.1.2 Research Approval from the Gauteng Department of Education (GDE)

A letter to obtain permission to conduct research at the selected GDE school was obtained. Clearance was obtained from the GDE (Appendix 2).

3.5.2.1.3 Permission letter to the school principal

A letter to obtain permission to conduct research at the school was sent to the school principal. Permission to conduct the study at the selected school was obtained (Appendix 3).

3.5.2.1.4 Permission letter to the School Governing Body (SGB)

A letter to obtain permission to conduct research at the relevant GDE School was sent to the SGB. Permission to conduct the study at the selected school was obtained (Appendix 4).

3.5.2.1.5 Letter of consent from caregivers of participants

A letter to obtain consent from caregivers of participants was sent home (Appendix 5).

3.5.2.1.6 Letter of consent from teachers

A letter to obtain consent from teachers was given to them. The consent letter contained information pertaining to what the study entailed, its purpose, assessment and intervention procedures participants would undergo, the use of results and information obtained in the study, as well as what would be expected of the teacher (Appendix 6).

3.5.2.1.7 Assent from participants

Assent to participate in the study was obtained from each participant prior to the commencement of pre-assessment testing, pre-intervention testing, participation in each intervention session, post-intervention testing and maintenance testing. Assent was obtained by the researcher asking the participant if they would participate and if a video camera could be used.

3.5.2.1.8 Parent questionnaire

The parent questionnaires were sent home for parents to complete. These contained questions regarding biographical information, medical history, receptive understanding of target vocabulary items and schooling history (Appendix 7).

3.5.2.1.9 Teacher questionnaire

The teacher questionnaire was completed by the relevant class teacher for each participant. It contained questions regarding biographical information, medical history, receptive understanding of target vocabulary items, schooling history, current therapy received, participation in the classroom, and attention and concentration levels (Appendix 8).

3.5.2.1.10 The Index of Augmented Speech Comprehensibility for Children (I-ASCC)

The researcher devised a set of picture stimuli derived from the stimulus items for the I-ASCC (Dowden, 1997). The researcher elicited the target word and recorded the verbal output. The participants' productions were listened to by unfamiliar listeners in the no semantic cues context. Participants with less than 50% intelligible words were included the study.

3.5.2.1.11 Peabody Picture Vocabulary Test – Fourth Edition (PPVT-4)

This standardised receptive vocabulary test (Dunn & Dunn, 2007) was used to determine English receptive vocabulary skills of participants. Each test page consisted of four colour pictures. The researcher said a word and participants were requested to point to the corresponding picture (Dunn & Dunn, 2007). It was selected for its use as a receptive vocabulary test within the South African context (Dada, 2004).

3.5.2.1.12 The ability to identify line drawings test

This test devised by Dada (2004) was reproduced with the exception of substituting the line drawing representing doll with that of the line drawing representing toothbrush. Black and white PCS symbols with a yellow background, 7.5cm x 9cm, were placed on a black piece of cardboard, 21cm x 29.5cm. Four PCS symbols were presented per board, i.e., one target PCS with three foil PCS. Participants were required to be able to select, with 90% accuracy, line drawing symbols in response to a spoken label provided by the researcher (Dada, 2004). Identification of 20 PCS symbols was assessed. Participant responses were recorded on a test sheet.

3.5.2.1.13 Kaufman Brief Intelligence Test Second Editions (KBIT 2)

The KBIT 2 (Kaufman & Kaufman, 2004) is a brief standardised test that can be individually administered. It measures the verbal and nonverbal intelligence of persons aged four to 90 years. The inclusion of both verbal and nonverbal subtests provided flexibility when testing a person with special needs (Kaufman & Kaufman, 2004).

3.5.2.1.14 The Test of Auditory Comprehension of Language – 4th edition (TACL-4)

The TACL-4 (Carrow-Woolfolk, 2014) is a standardised test used to describe participants' receptive language abilities in English. Participants were required to point to a picture stimuli in response to a spoken work, phrase or sentence. Subtests administered

include receptive vocabulary, grammatical morphemes and elaborated phrases and sentences. The test can be administered on children aged 3 to 12 years.

3.5.2.1.15 The South African Language Assessment Tool

The South African Language Assessment Tool (Bortz, 1997) was used to assess receptive language performance of the participants' home language. This test was administered on participants whose home languages were isiZulu, Setswana, Sesotho, Tshivenda and Xitsonga. The ZERLA can be administered on ages 2.6–5.5 years and the SERLA, TWSERLA, VERLA, SHERLA can be administered on ages 3.9–4.3 years.

3.5.2.1.16 Test of Aided-Communication Symbol Performance (TASP)

The TASP (Bruno, 2010) is intended to be one of the tools used as part of an AAC assessment to provide a starting point for designing or selecting an appropriate AAC device page set. It consists of the following subtests: symbol size and number, grammatical encoding, categorisation skills and syntactic performance. It can be administered on children and adults with CCN.

3.5.2.1.17 The Manual Ability Classification System (MACS)

The MACS (Eliasson et al., 2006) was developed to classify how children with cerebral palsy use their hands when using or manipulating objects. It involves asking teachers and/or parents' questions that focus on the child's ability to handle objects in daily activities during school, play, leisure, eating and dressing, and can be used on children ages four to 18 years (Eliasson, et al., 2006).

3.5.2.2 Materials for experimental phase

3.5.2.2.1 Description of the aided language stimulation programme

The current study used principles of the AiLgS programme highlighted by Goossens (1989) and Dada (2004). Goossens' (1989) study highlighted the interactive nature of aided language stimulation as the interventionist pointed to a symbol on the child's communication display while providing verbal output stimuli. The four component framework for augmented input developed by Wood, Lasker, Sigel-Causkey, Beukelman and Ball (1998) was applied. The first component involves augmenting the message with objects, pictures, photographs, gestures and/or voice output to assist the AAC user to understand the spoken

message. The second component is mapping language and symbols so the AAC user is able to associate the symbol with the environmental stimulus. The third component is referring to the symbol after delay to assist with retention. The fourth component is developing a set of responses for the AAC user to select from an array of answers or choices.

In the current study, the researcher provided spoken language input while completing a craft and procedural discourse activity with the participants. The researcher pointed to the PCS symbols on the facilitator board within two seconds of providing spoken language input. Two scrips were created for providing AiLgS: one for the intervention with 40% AiLgS (Appendix 13) and the other for the intervention with 70% AiLgS (Appendix 14). Each intervention script had a question statement ratio of 80:20. Two scripted activities were used during AiLgS intervention: a craft activity, 40% AiLgS (Appendix 13) and a procedural discourse activity, 70% AiLgS (Appendix 14). The scripts were similar in length with each target word appearing twenty times in each script. The script for the craft activity provided 40% AiLgS, calculated by 20÷100 x 40 = 8. Therefore AiLgS was provided 8 times for each target word. The script for the procedural discourse activity provided 70% AiLgS, calculated by 20÷100 x 70 = 14. Therefore AiLgS was provided 14 times for each target word. During the craft activity a kiwi fruit was made using green and brown clay. Fur was placed on the outer layer of brown clay to replicate the texture of a kiwi fruit's skin. Thereafter, a bow and arrow was used to shoot the kiwi fruit. During the procedural discourse activity, a pot, soil, seeds, water and a violin were used to plant a cactus seed to grow a cactus for Mother's Day. After the seed was planted the soil was watered and the participants played music using a violin to help the seed grow.

3.5.2.2.2 Facilitator boards

Facilitator boards were devised based on principles outlined by Goossens, Crain and Elder (1994). Two matte black facilitator boards were developed for this study with dimensions of 50cm x 70cm. Each board contained 12 PCS symbols, four target vocabulary symbols and eight core symbols. PCS were created using Boardmaker Plus v6.1.6 (Mayer Johnson, 2011) software. PCS were 10cm x 10cm in dimension and laminated. Each symbol had the corresponding written gloss above the picture in Junior ABC font, as this is the font used in the school at which the study was conducted. Font size 18 was used. As suggested by Goossens et al., (1994, p. 11) picture symbols were in black and white with a coloured background depending on the category of the words. Verbs were depicted with a pink

background, prepositions green, adjectives blue, nouns yellow and the remaining word categories orange (Goossens et al., 1994). Core symbols remained fixed on the facilitator boards while the target vocabulary symbols were attached behind the board and placed on the board during AiLgS. One board was developed for the intervention with frequency of 40% AiLgS (Appendix 9) and the other for the intervention with a frequency of 70% AiLgS (Appendix 10). Three strips of adhesive Velcro were placed vertically on the front of the board to hold the core symbols. One strip of Velcro was placed behind the board to hold the target receptive vocabulary symbols.

3.5.2.2.3 Target receptive vocabulary items

Three sets of target receptive vocabulary items were selected for this study as described in Table 3.2. Two sets were linked to the intervention with 40% AiLgS and 70% AiLgS respectively. The third set acted as a control set to detect history and maturation effects and was not linked to an intervention. Although the control set was not used during an intervention and was not associated with an intervention activity, in keeping with AATD principles, all vocabulary sets are required to be equally difficult (Wolery et al., 2014). This was ensured in three ways. Firstly, vocabulary was selected from vocabulary lists for which norms exist (Wolery et al., 2014): Vocabulary was selected from core vocabulary lists, composite word lists and developmental checklists. Secondly, as suggested by Wolery et al., 2014, experts were consulted to rate the difficulty of potential target vocabulary. A panel of Master's students was consulted and words they disagreed on were excluded with replacement words being selected upon agreement from the entire panel. Thirdly, a logical analysis of the target words was conducted by considering they were all related to the activity at hand and that each set consisted of two nouns, a preposition and an adjective. Table 3. 2 lists the target vocabulary items.

Table 3.2

List of target receptive vocabulary items

Intervention with 40% AiLgS	**Intervention with 70% AiLgS**	**Control Set**
Kiwi	Cactus	Squirrel
Arrow	Violin	Wedge
Furry	Tall	Tiny
On	Under	Beside

3.5.2.2.4 Probe test

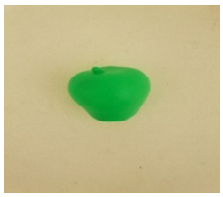
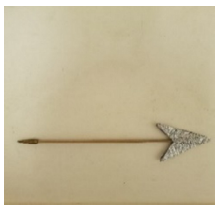
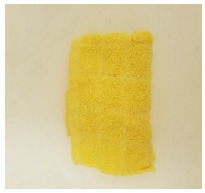
The probe test was used to establish three consecutive baseline scores of zero prior to intervention, to ensure participants did not show receptive knowledge of the target words. The probe test was used to assess the participants' acquisition of the target receptive vocabulary items during intervention and during the maintenance phase. It was used in baseline testing, before intervention sessions (on alternating days) and during the maintenance probe. Participants were seen individually and seated on a chair in front of the table. Each target item was presented with three foils. Target and foil items were placed horizontally and in random order in front of the participant. The probe test was used to determine the acquisition of the target receptive vocabulary items. Receptive vocabulary acquisition was probed using auditory stimuli to object matching. For example, the researcher would say, "Show me the cactus" and the participant would be required to select one of the four items. A script for the probes was used to ensure procedural integrity of the probes (Appendix 13). Results were marked on a probe answer sheet (Appendix 14).

Objects representing the eight target receptive vocabulary items (four from 40% AiLgS, four from 70% AiLgS) and the four control set items were used. Each target object was presented along with three foil items. Foil items were actual objects or toys. For example, for the target word cactus the foils used were flowers, a succulent and a pot of soil. Table 3.3 contains the probe question and photographs of the objects used during the probes.

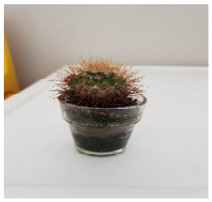
A baseline for each participant was established once they had completed three probe tests in which they scored 0 for the target items in each test (8 items in per test, (four from 40% AiLgS, four from 70% AiLgS, 0/24 in total).

Table 3.3

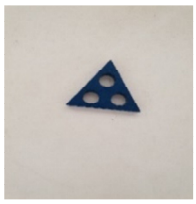
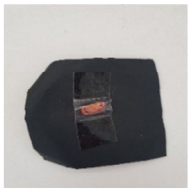
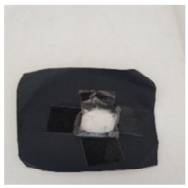
Probe test for intervention with 40% AiLgS

Intervention with 40% AiLgS					
No.	**Probe Stimuli**	**Target receptive vocabulary item**	**Foil 1**	**Foil 2**	**Foil 3**
1.	Show me the kiwi	Kiwi	Lemon	Apple	Grapes
					
2.	Show me the arrow	Arrow	Hook	Paintbrush	Ruler
					
3.	Show me the one that is furry	Furry unicorn	Dinosaur	Tennis ball covered in buttons	Wash cloth
					
4.	Show me the one that is on	Marble on a tub	Marbles inside a tub	Marble under a tub	Empty tub
					

Probe test for intervention with 70% AiLgS

Intervention with 70% AiLgS					
No.	**Probe Question**	**Target Item**	**Foil 1**	**Foil 2**	**Foil 3**
1.	Show me the cactus	Cactus	Flowers	Succulent	Pot of sand
					
2.	Show me the violin	Violin	Tambourine	Bells	Guitar
					
3.	Show me the one that is tall	Deodorant can	35g glue stick	10g glue stick	Lip ice
					
4.	Show me the one that is under	Clay under a tub	Clay on top of a tub	Clay inside a tub	Empty tub
					

Probe test for control set

Control Set					
No.	**Probe Question**	**Target Item**	**Foil 1**	**Foil 2**	**Foil 3**
1	Show me the squirrel	Squirrel	Mouse	Dog	Cat
					
2	Show me the wedge	Wedge	Triangle	Moon	Star
					
3	Show me the one that is tiny	Grain of rice	Pasta	Bean	Ball
					
4	Show me the one that is beside	Pom pom beside cup	Pom pom behind cup	Pom pom on top of cup	Pom pom in front of cup
					

3.6 Pilot Study

3.6.1 *Objectives*

The pilot study was conducted to determine the viability of the methodology, the appropriateness of the settings, the quality of the video recordings, the AiLgS scripts, target receptive vocabulary items and control vocabulary sets and activities chosen, and the feasibility of the probe measures. The pilot study was conducted at the same site as the main study and comprised two participants who met the selection criteria of the study as discussed in Section 3.7.

3.6.2 Summary of pilot study

Table 3.4 depicts the objectives, procedures, results and recommendations of the pilot study.

Table 3.4

Summary of pilot study

Objectives and materials	Procedures	Results	Recommendations for main study
1.To evaluate the appropriateness of the measures used in participant selection			
a) Parent Questionnaire (Appendix 7)	Questionnaires were sent home for parents to complete and return to school in a sealed envelope.	Questionnaires were appropriate and provided the required information.	No changes were made.
b) Teacher Questionnaire (Appendix 8)	Class teachers completed the questionnaire for each child.	Teacher questionnaires were appropriate and yielded sufficient information.	None
c) Index of Augmented Speech Comprehensibility for Children (I-ASCC; Dowden, 1997)	The test was administered with individual children by the researcher.	The test was appropriate and provided the necessary information.	None
d) Peabody Picture Vocabulary Test – Fourth Edition (PPPV-4; Dunn & Dunn, 2007)	The test was administered with individual children by the researcher.	The test was appropriate and provided the necessary information.	None
e) The ability to identify line drawings test (Dada, 2004)	The test was administered with individual children by the researcher.	The test was appropriate and provided the necessary information.	None
f) Test of nonverbal intelligence-fourth edition (TONI-4; Brown et al., 2010)	The test was administered with individual children by the researcher.	Participants struggled to understand the requirement of the test, could not perform the trial examples. A basal could not be established.	The KBIT2 (Kaufman & Kaufman, 2004) will be used instead.
2. To determine the adequacy of the video recordings in terms of video recording visibility, clarity and audibility of the sound and visibility of the interactive white board.	Recordings of the intervention and probe sessions were watched to ensure that the camera was placed in the correct position so that the facilitation board projected on the interactive white board, the researcher and participants were visible.	The audibility and clarity of the video recordings was poor. The large size of the room and high ceilings impacted negatively on the sound quality. The visual clarity was compromised by the reflection of light off the shiny surface of the interactive white board and thus the picture symbols, their colours and the written gloss were not visible in the video recordings.	A smaller intervention room and a low technology facilitator board was recommended.
3. To determine if the venue was appropriate for small group intervention and individual probes	The video recordings of intervention and probe sessions were watched to ensure that the lighting was sufficiently dim to ensure visibility of the facilitation board projected on the interactive white board, but ensure visibility of the activities and materials used.	The venue was appropriate for small group interventions but was far from the participants' classrooms.	A more convenient class was recommended.

Objectives and materials	Procedures	Results	Recommendations for main study
4. To ensure facilitator boards were appropriate (Appendix 11 & 12) and could be seen by the participants	Two facilitator boards were created, one per activity conducted. Facilitator boards were projected onto an interactive white board. Video recordings were viewed to determine if PCS were visible	PCS were appropriate. Poor visual clarity was obtained when the interactive white board was used	The interactive white board was not used. Low technology facilitator boards were used instead
5. To evaluate the probe sessions in terms of: a) Appropriates of the probe items used for targets vocabulary and foil items	The researcher observed if target and foil items were easily identified by participants and did not cause too much distraction	Probe objects were appropriate	None
b) The appropriateness of the probe script (Appendix 13)	The researcher observed if participants were able to understand what was required of them	Participants did not require a trial of the probe as they understood the task	Trial removed from probe script
c) The feasibility of conducting probes with visual stimuli, auditory stimuli and paired visual and auditory stimuli	The researcher conducted probes as per the probe script and looked at the information it provided		None
d) The appropriateness of the time allocated for conducting the individual probes.	ten minutes per participant was allocated	Probes took eight minutes per participant.	None
e) To determine the appropriateness of the probe answer sheet (Appendix 14)	The researcher marked off participant responses on the probe answer sheet and calculated scores	A different test sheet was used per probe set and this made data analysis challenging.	The test sheet was adjusted to put all probes from the all phases on the same answer sheet
f) To determine the interrater reliability of the probes	The inter-rater checked probe sheets against the video recordings for 40% of the baseline and intervention probe measures	No difficulties	None
6. To determine the accuracy of the procedural integrity checklists for the intervention and probes (Appendix 15, 16, 17)	The inter-rater calculated procedural integrity for 40% of the randomly selected probes and intervention scripts	Checklists were appropriate for use by the inter-rater.	None

The pilot study revealed that the TONI-4 (Brown et al., 2010) was not a suitable test to determine the intelligence of participants as a basal could not be established for two participants. In addition, the use of the interactive white board was contraindicated. The visual clarity of the video was compromised as the light shining from the projector onto the white board made it impossible to see the PCS, their colour or written gloss. The large size of the room and high ceilings impacted negatively on the sound quality. The materials developed for the study in terms of the probe test, probe answer sheet and script were appropriate and feasible for use in the main study.

3.7 Participants

3.7.1 *Sampling and recruitment*

The study was approved by the Research Ethics Committee of the Faculty of Humanities of the University of Pretoria (Appendix 1). Permission to conduct data collection in schools was granted by the Gauteng Department of Education (Appendix 2). The school was purposively selected for the main study as it caters for learners with intellectual disabilities, developmental delay, autism, Down syndrome, epilepsy, cerebral palsy, attention deficit disorder, attention deficit hyperactivity disorder microcephaly and hydrocephaly between the ages of 6–21 years. Permission letters were sent to the school principal and governing body (Appendix 3 & Appendix 4). Upon approval, parents and educators were provided with information letters and consent forms (Appendix 5 & Appendix 6).

3.7.2 Participant selection criteria

Non-probability, purposeful convenience sampling was used to select participants who met the selection criteria outlined in Table 3.5. Thirteen consent forms were sent out to caregivers/legal guardian of potential participants who met selection criteria. Twelve legal guardians granted consent for their children/wards to participate. On receipt of educator and parental consent letters, parent and educator questionnaires were sent (Appendix 7 & 8). Twelve potential participants provided assent but six were excluded. One potential participant showed receptive identification of the target vocabulary items, two potential participants were unable to establish a stable baseline and three potential participants were unable to identify 90% of the line drawings in the ability to identify line drawings test (Dada, 2004). The remaining six participants met selection criteria (Table 3.5) and gave assent to participate.

Table 3.5

Participant selection criteria

Criterion	Justification	Measure used
Complex Communication Needs (CCN)	Participants are required to have CCN i.e., less than 50% intelligible speech in the sematic context – unfamiliar listener condition in the Index of Augmented Speech Comprehensibility for Children (I-ASCC; Dowden, 1997). The I-ASCC assists in determining candidacy for AAC use (Dowden, 1997)	Index of Augmented Speech Comprehensibility for Children (I-ASCC; Dowden, 1997)
Participants obtain an age equivalent score of 2 years or older when assessed using the Peabody Picture Vocabulary Test – Fourth Edition (PPVT-4; Dunn & Dunn, 2007)	To ensure similar receptive vocabulary skills among participants	Peabody Picture Vocabulary Test – Fourth Edition (PPVT-4; Dunn & Dunn, 2007)
Age	Children between 8–14 years were selected to ensure selection of the appropriate target vocabulary and activities (Dada, 2004)	Parent questionnaire
Attending school with English as a language of learning and teaching (LoLT) for 1.5 years	LoLT is English at the selected school and the intervention will be conducted in English	Parent and Teacher questionnaires
Able to identify line drawings with a frequency of 90%	AiLgS was conducted using line drawings and participants should be able to identify line drawings in response to a spoken label (Dada, 2004)	The ability to identify line drawings test (Dada, 2004)
Able to concentrate for a 15-minute period of time on an activity	Aided language stimulation input will occur for 15 minutes, participants are required to be able to maintain attention for 15 minutes to ensure attention and concentration difficulties do not impact on results	Teacher questionnaire and Parent questionnaire
No reported visual and hearing impairments	Participants are required to see and hear AiLgS input as it involves the facilitator pointing to a picture symbol on a facilitator board and providing ongoing language stimulation (Goossens, 1989)	Parent questionnaire and Teacher questionnaire.
Moderate to severe intellectual ability	A recent systematic review suggests studies with diverse population groups to determine treatment effectiveness for specific participant skill profiles (Allen et al., 2017)	Kaufman Brief Intelligence Test Second Edition (KBIT2; Kaufman & Kaufman, 2004)
Score of 0/8 on three consecutive probe tests	Require a stable baseline prior to implementing the AiLgS intervention	Probe Test

3.7.2 *Description of participants*

Participants are described according to diagnosis, age, grade, previous therapies received, prior AAC intervention, current mode of communication and gender. Table 3.6 provides a summary of participants.

Participant 1 was an 8.5-year-old female with a diagnosis of Down syndrome. Her performance on the I-ASCC indicated 0% intelligibility in the context of unfamiliar listener without semantic cues. She presented with an age-equivalent score of <2 years for receptive vocabulary when using the PPVT-4. She scored 95% on the Ability to identify a line drawing test. The KBIT-2 indicated an IQ in the Lower extreme (≤69). Her receptive language age equivalent was <3 years in all three sub tests when using the TACL-4. The results of the TASP indicated that she was able to select from a maximum of 66 cells on a communication board with a square size of 3 inches x 4 inches and a picture size 5 inches x 8 inches. The grammatical encoding subtest indicated that she was able to identify 80% of the people category, 50% of the transparent verbs, and 34% in the location category. She was able to identify 0% in the pronoun, opaque verb, preposition, article category and 25% of the adjective/adverb category. In the subordinate categorisation subtest she was able to categorise 75% in the transportation category, 50% in the food category, 75% in the clothes category and 100% in the animal category. In visual categorisation test she was able to categorise 0% in the people category, verbs, things and places category. She achieved 0% in the auditory and category closure test. With regard to the syntactic performance subtest she achieved 0% on 2-word, 3-word and 4-word utterances in the cues, response to questions and picture descriptions test. She spoke IsiZulu as a first language and obtained a raw score of 18 on the SALAT, exposure to English as the LoLT was 3 years. She was on a Level III on the MACS. At the time of the study she received school-based speech therapy and did not present with any visual or hearing difficulties. At the time of the study she did not receive AAC intervention and used key word signing and gesture to communicate.

Table 3.6

Description of participants (n=6)

Participant	Age Sex	Diagnosis	I-ASCC	PPVT-4	Ability to identify Line drawings Test	KBIT-2	TACL-4			SALAT	Exposure to English as the LoLT	MACS	AAC system
							Vocab.	Gram. Morph.	Elab. Phrases & sentences				
Participant 1	8.5 F	Down syndrome	0%	<2 years	95%	Lower extreme (≤69)	<3yrs	< 3yrs	< 3yrs	RS=18	3 years	Level III	None
Participant 2	9.10 M	Down syndrome	0%	<2 years	95%	Lower extreme (≤69)	<3yrs	<3yrs	<3yrs	RS=5	4 years	Level III	Yes, low-tech aided communication book
Participant 3	10.2 F	Down syndrome	0%	2 years	90%	Lower extreme (≤69)	<3yrs	<3yrs	<3yrs	RS=8	4 years	Level III	Yes, low-tech aided communication book
Participant 4	10.2 F	Down syndrome Hypothyroidism, Myasthenia Gravis	0%	2 years	90%	Could not establish a basal	<3yrs	<3yrs	<3yrs	RS=8	3 years	Level III	Key word signing
Participant 5	12.2 M	Down syndrome	26%	3.2 years	95%	Lower extreme (≤69)	3.6yrs	3yrs	3.6yrs	RS=36	3 years	Level II	Key word signing
Participant 6	13.7 M	Down syndrome	3%	2.1 years	95%	Lower extreme (≤69)	*<3yrs	*<3yrs	*<3yrs	RS=6	5 years	Level II	Yes, low-tech aided communication book

Note: * scored using table for ages 11.11 to 12.11years

LoLT= Language of learning and teaching, PPVT-4 = Peabody Picture Vocabulary Test – Fourth Edition (Dunn & Dunn, 2007), I-ASCC= Index of Augmented Speech Comprehensibility for Children (Dowden, 1997), KBIT-2= Kaufman Brief Intelligence Test Second Edition (Kaufman & Kaufman, 2004), TACL-4= The Test of Auditory Comprehension of Language – 4th Edition (Carrow-Woolfolk 2014), SALAT= The South African Language Assessments Tool (Bortz, 1997)， MACS= The Manual Ability Classification System (Eliasson et al., 2006).

Participant 2 was a 9.10-year-old male with a diagnosis of Down Syndrome. His performance on the I-ASCC indicated 0% intelligibility in the context of unfamiliar listener without semantic cues. He presented with an age equivalent score of <2 years for receptive vocabulary when using the PPVT-4. He scored 95% on the Ability to identify a line drawing test (Dada, 2004). The KBIT-2 indicated an IQ in the lower extreme (≤69). His receptive language age equivalent was <3 on all three subtests of the TACL-4. The results of the TASP indicated that he was able to select from a maximum of 66 cells on a communication board with a square size of 3inches x 4inches and a picture size 5inches x 8inches. The grammatical encoding subtest indicated that he was able to identify 60% of the people category, 63% of the transparent verbs, and 34% in the location category. He was able to identify 0% in the pronoun, opaque verb, preposition, article category and 13% of the adjective/adverb category. In the subordinate categorisation subtest, he was able to categorise 100% in the transportation, food and animals category and 75% in the clothes category. In visual categorisation test, he was able to categorise 0% in the people category, verbs, things and places category. He achieved 0% in the auditory and category closure test. With regard to the syntactic performance subtest, he achieved 0% on two-word, three-word and four-word utterances in the cues, response to questions and picture descriptions test. isiXhosa is his first language and he obtained a raw score of five on the SALAT exposure to English as the LoLT was four years. He is on a Level II on the MACS. At the time of the study he received AAC intervention weekly and used a low technology aided communication book consisting of six A4 boards with eight Boardmaker Plus v6.1.6 (Mayer Johnson, 2011), PCS symbols on each board.

Participant 3 was a 10.2-year-old female. Her diagnosis is Down syndrome. Her performance on the I-ASCC indicated 0% intelligibility in the context of unfamiliar listener without semantic cues. She presented with an age equivalent score of 2 years for receptive vocabulary when using the PPVT-4. She scored 95% on the Ability to identify a line drawing test (Dada, 2004). The KBIT-2 indicated an IQ in the lower extreme (≤69). Her receptive language age equivalent was < 3 year on all three subtest of the TACL-4. The results of the TASP indicated that she was able to select from a maximum of 16 cells on a communication board with a square size of 11/2 inches and a picture size 11/4 inches. The grammatical encoding subtest indicated that she was able to identify 40% of the people category, 50% of the transparent verbs, and 0 in the location category. She was able to identify 0% in the pronoun, opaque verb, preposition, adjective /adverb and article category.

In the subordinate categorisation subtest she was able to categorise 50% in the transportation category, 75% in the food category, 50% in the clothes category and 100% in the animal category. In visual categorisation test she was able to categorise 50% in the people category, 25% in the verbs category, 75% in the things category and 100% in the places category. She achieved 0% in the auditory and category closure test. With regard to the syntactic performance subtest, she achieved 0% on two-word, three-word and four-word utterances in the cues, response to questions and picture descriptions test. Sesotho was her first language and she obtained a raw score of eight on the SALAT, exposure to English as the LoLT was 4 years. She was on a Level III on the MACS. At the time of the study she received AAC intervention weekly and used a low technology aided communication book consisting of two A4 boards with four Boardmaker Plus v6.1.6 (Mayer Johnson, 2011), PCS symbols on each board.

Participant 4 was a 10.2-year-old female with a diagnosis of Down syndrome, hypothyroidism and Myasthenia gravis. Her performance on the I-ASCC indicated 0% intelligibility in the context of unfamiliar listener without semantic cues. She presents with an age equivalent score of 2 years for receptive vocabulary when using the PPVT-4. She scored 90% on the Ability to identify a line drawing test. The KBIT-2 indicates an IQ in the lower extreme (≤69). Her receptive language age equivalent was <3 on all three subtests of the TACL-4. The results of the TASP indicated that she is able to select from a maximum of 32 cells on a communication board with a square size of 11/4 inches and a picture size 1inch. The grammatical encoding subtest indicated that she was able to identify 40% of the people category, 63% of the transparent verbs, and 34% in the location category. She was able to identify 0% in the pronoun, opaque verb, preposition, article category and adjective/adverb category. In the subordinate categorisation subtest, she was able to categorise 100% in the transportation, clothes and animal category and 50% in the food category. In visual categorisation test, she was able to categorise 0% in the people category, verbs, things and places category. She achieved 0% in the auditory and category closure test. With regard to the syntactic performance subtest she achieved 0% on two-word, three-word and four-word utterances in the cues, response to questions and picture descriptions test. Tswana is her first language and she obtained a raw score of eight on the SALAS, exposure to English as the LoLT was three years. She is on a Level III on the MACS. She did not receive AAC intervention and uses key word signing and gesture to communicate.

Participant 5 was a 12.2-year-old male with a diagnosis of Down syndrome. His performance on the I-ASCC indicated 26% intelligibility in the context of unfamiliar listener without semantic cues. He presented with an age equivalent score of 3.2 years for receptive vocabulary when using the PPVT-4. He scored 95% on the Ability to identify a line drawing test. The KBIT-2 indicated an IQ in the lower extreme (≤69). His receptive language age equivalent was 3.6 years on the vocabulary subtest, 3 years on the grammatical morphemes subtest and 3.6 years on the elaborated sentences sub-test on TACL-4. The results of the TASP indicated that he is able to select from a maximum of 128 cells on a communication board with a square size of 1/2 inches and a picture size 3/4 inches. The grammatical encoding subtest indicated that he was able to identify 100% of the people, transparent verbs location category. He was able to identify 0% in the pronoun, opaque verb and article category, 20% in the preposition category and 25% of the adjective/adverb category. In the subordinate categorisation subtest, he was able to categorise 100% in the transportation, food, clothes and animals category. In visual categorisation test, he was able to categorise 100% in the people category, 25% in the verbs and places category and 50% in the thing category. He achieved 0% in the auditory and category closure test. With regard to the syntactic performance subtest he achieved 0% on two-word, three-word and four-word utterances in the cues, response to questions and picture descriptions test. Sesotho is his first language and he obtained a raw score of 36 on the SALAT, exposure to English as the LoLT was three years. He is on a Level II on the MACS. At the time of the study he did not receive AAC intervention and used key word signing and gesture to communicate.

Participant 6 was a 13.1-year-old male with a diagnosis of Down syndrome. His performance on the I-ASCC indicated 3% intelligibility in the context of unfamiliar listener without semantic cues. He presented with an age equivalent score of 2.1 years for receptive vocabulary when using the PPVT-4. He scored 95% on the Ability to identify a line drawing test. The KBIT-2 indicates an IQ in the lower extreme (≤69). His receptive language age equivalent was <3 on all three subtests of the TACL-4. The results of the TASP indicated that he is able to select from a maximum of 66 cells on a communication board with a square size of 3/4 inches and a picture size 5/8 inches''. The grammatical encoding subtest indicated that he was able to identify 20% of the people, 63% of the transparent verbs and 67% of the location category. He was able to identify 0% in the pronoun, opaque verb, article, preposition and adjective/adverb category. In the subordinate categorisation subtest he was able to categorise 100% in the food category, 50% of transportation and clothes category

and 75% in the animals' category. He scored 0% in all categories of the visual, auditory and category closure categorisation test. With regard to the syntactic performance subtest, he achieved 0% on two-word, three-word and four-word utterances in the cues, response to questions and picture descriptions test. Sesotho is his first language and he obtained a raw score of 6 on the SALAT, exposure to English as the LoLT was five years. He is on a Level II on the MACS. At the time of the study he received AAC intervention weekly and used a low technology aided communication book consisting of three A4 boards with six Boardmaker Plus v6.1.6 (Mayer Johnson, 2011), PCS symbols on each board.

3.8 Procedures

Upon approval from the University, the Department of Education and the SGB, and obtaining permission, consent and assent, pre-experimental data collection began, followed by the experimental phase. All probes and interventions were conducted in a small room with one door and a set of windows such that the participants sat facing away from the windows. The room was controlled for visual distractions by removing all posters from the walls.

3.8.1 Pre-experimental data collection procedures

Twelve potential participants were identified. These participants were assessed to determine if they met the selection criteria outlined in Table 3.5. Six participants met the selection criteria and were further assessed using measures that would aid in providing participant descriptions. These tests included the Test of Auditory Comprehension of Language – 4th Edition (TACL-4; Carrow-Woolfolk 2014) to measure receptive language, The South African Language Assessments Tool (Bortz, 1997), to determine proficiency in home language, The Test of Aided-Communication Symbol Performance (TASP; Bruno, 2010), to determine skill regarding symbols within aided AAC systems and The Manual Ability Classification System (MACS; Eliasson et al., 2006), to describe how participants manipulate objects with their hands.

Thereafter, the baseline phase began. The probe test was conducted as described in the methodology section. The probe test was conducted until a stable baseline of 0/8 correct responses was obtained over three consecutive probe tests. Baseline probes were conducted to ensure data are stable (Wolery et al., 2014). A minimum of three observations per set is

required to ensure a stable baseline (Wolery et al., 2014). Positive reinforcement, that was not performance based, was provided at regular intervals during probes. The rationale behind this is that the purpose of AADT is to compare the efficiency of instructional strategies and not about reinforcement effectiveness (Wolery et al., 2014) and therefore reinforcement will preserve the purpose of the comparison (Wolery et al., 2014). Noncontingent reinforcement through a response independent schedule for the delivery of reinforcement was provided during the probe testing and included statement such as "Good job" or "You working so well". Additionally, noncontingent reinforcement is provided within learning and classroom environments and will therefore ensure that participants demonstrate their optimal performance instead of artificially deflated performance levels (Wolery et al., 2014). In this study, the baseline probe was conducted for all three sets of vocabulary, however a stable baseline was only required for the sets of vocabulary associated with the 40% and 70% AiLgS intervention. In this study a stable baseline was obtained after 3 consecutive probes only. Thereafter, intervention commenced. A script for the probes was used to ensure procedural integrity during administration of the baseline, intervention and maintenance probes. Responses were marked on the respective score sheet (Appendix 14).

3.8.2 Experimental phase

The experimental phase consisted of the intervention, intervention probes and maintenance probes. Participants were divided into two groups of three participants each as described in section 3.3. Intervention with a frequency of 40% AiLgS and 70% AiLgS was implemented in a systematically alternating fashion as described in Section 3.3 and Table 3.1. During both interventions, participants were seated in a semi-circle around a table in front of the easel holding the facilitator board. The researcher was positioned in front of the participants and next to the easel. The camera was positioned behind participants. A smaller table was positioned to the left of the researcher and held the items used in the activity. This allowed easy access to items required during the craft and procedural discourse activity. During the AiLgS intervention, participants took turns to interact with the materials used during the intervention. The intervention scripts (Appendix 9 and Appendix 10) were used to ensure that intervention was provided at the stipulated frequencies. In the intervention with a frequency of 40% AiLgS, each target word was used 20 times in the intervention script and of the 20 times AiLgS was provided 40% of the time i.e., eight times. In the intervention with a frequency of 70% AiLgS, if the target word was used 20 times in the intervention script then AiLgS was provided 70% of the time i.e., 14 times. Intervention probes were

conducted every second day during the intervention as described in section 3.3. The learning criteria was not reached by participants. When teaching criteria was reached, intervention was withdrawn for one week. Thereafter, maintenance probes were conducted once a week for three weeks as described in section 3.3.

3.9 Procedural Integrity

Three types of reliability were obtained for this study. The first refers to the procedural integrity of the intervention, the second refers to the procedural adherence to the probe script and the third relates to the scoring of the data reliability. An independent speech therapist served as an inter-rater. She randomly selected and rated 40% of the video recordings, across groups, and completed the procedural checklists (Appendix 15 and Appendix 16).

3.9.1 *Procedural integrity of intervention*

Procedural integrity refers to the degree to which the independent variable (i.e., intervention) was implemented according to the intention of the researcher (Schlosser, 2003). Adherence to the 40% AiLgS intervention script (Appendix 9) and the 70% AiLgS intervention script (Appendix 10) were calculated for integrity of intervention by the inter-rater using a procedural integrity checklist (Appendix 15 and Appendix 16). Each step was scored as done or omitted and converted to a percentage. Procedural integrity was calculated using the formula of Kuoch and Mirenda (2003, p. 222), as follows:

$$x = \frac{number\ of\ correct\ steps\ executed\ by\ researcher}{total\ number\ of\ possible\ steps} x\ 100$$

Procedural integrity in comparative studies affects the ability to determine the effectiveness of each intervention in its own right, as well as the comparison of the interventions in terms of effectiveness and efficacy (Schlosser, 1999). Acceptable and comparable procedural integrity data for both interventions are essential to compare the interventions to one another (Schlosser, 1999). Table 3.7 illustrates the procedural integrity scores of the intervention, which were higher than the acceptable score of 80% (Ayres & Gast, 2010).

Table 3.7*Procedural integrity of the intervention*

	40% AiLgS							
Session	1	4	6	8	12	15	18	20
Raw Score	72/74	73/74	74/74	74/74	73/74	74/74	74/74	74/74
Percentage	97%	99%	100%	100%	99%	100%	100%	100%

	70% AiLgS							
Session	2	5	7	9	11	15	17	19
Raw Score	64/66	66/66	66/66	64/66	66/66	66/66	66/66	66/66
Percentage	97%	100%	100%	97%	100%	100%	100%	100%

Inter-rater agreement was between 97% and 100% for the frequency of AiLgS provided and for the statement:question ratio of 80:20 that Goossens, 1989 suggests.

3.9.2 *Procedural integrity of probe*

The procedural adherence to the probe script was undertaken to ensure the probe test was conducted the same way across participants. Approximately 40% of the probe videos were randomly selected and scored by an inter-rater using a procedural integrity checklist for probe sessions (Appendix 17). The adherence to the script was calculated using the formula above (Kuoch & Mirenda, 2003, p. 222). Table 3.8. illustrates the procedural integrity of the probe.

Table 3.8
Procedural integrity of probe

	Baseline Phase					
Session	1	2	3	4	5	6
Raw Score	$\frac{37}{37}$	$\frac{37}{37}$	$\frac{36}{37}$	$\frac{37}{37}$	$\frac{36}{37}$	$\frac{37}{37}$
Percentage	100%	100%	97%	100%	97%	100%

	Intervention Phase									
Session	7	8	9	10	11	12	13	14	15	16
Raw Score	$\frac{37}{37}$	$\frac{36}{37}$	$\frac{37}{37}$	$\frac{37}{37}$	$\frac{35}{37}$	$\frac{37}{37}$	$\frac{37}{37}$	$\frac{37}{37}$	$\frac{37}{37}$	$\frac{36}{37}$
Percentage	100%	97%	100%	100%	95%	100%	100%	100%	100%	97%

	Maintenance Phase					
Session	17	18	19	20	21	22
Raw Score	$\frac{36}{37}$	$\frac{37}{37}$	$\frac{37}{37}$	$\frac{36}{37}$	$\frac{37}{37}$	$\frac{37}{37}$
Percentage	97%	100%	100%	97%	100%	100%

3.9.3 *Scoring of the data reliability*

All probe answer sheets were checked by an inter-rater to ensure that the researcher marked answers correctly on the answer sheet and that results were tallied correctly. Inter-rater reliability was then calculated using the Tawney and Gast (1984) inter-rater reliability formula, as below:

$$x = \frac{number\ of\ agreement\ between\ raters}{(number\ of agreements + disagreements)} * 100$$

There was 100% agreement on the scoring of the probe answer sheets.

3.10 Data Analysis

Data collected was reviewed and interpreted in line with the aims and sub-aims of the study. The results of the probe tests were presented graphically and a visual analysis of the graphs was conducted. The percentage of correct responses per intervention was calculated and depicted per participant and per session. Data was analysed visually and statistically

using the What Works Clearinghouse recommendations for single-case design (Kratochwill, Hitchcock, Horner, Levin, Odom, Rindskopf & Shadish, 2010).

3.10.1 *Visual Analysis of data*

Each participant served as their own control in an adapted alternating treatment design. Results from probes were analysed at an individual level. Comparison of the correct number or responses obtained during the intervention with a frequency of 40% AiLgS and the intervention with a frequency of 70% AiLgs are represented visually. Visual analysis assists in providing evidence of a relationship between the independent variable and an outcome variable and the strength and magnitude of the relationship (Kratochwill et al., 2013). Line graphs were used to compare the effect of the intervention with a frequency if 40% AiLgS and the intervention with a frequency of 70% AiLgS on the acquisition of target vocabulary items. Visual analysis of six outcome measures is required to determine the effect of the intervention, namely level, trend, variability, immediacy of effect, overlap and consistency of data patterns across similar phases (Kratochwill et al., 2013). These features were used to determine if there was an effect at three different points in time, and this in turn documents a causal relationship so that an inference can be made that changes in the dependent variable were caused by changes in the independent variable (Kratochwill et al., 2013). These features will be defined in Chapter 4 section 4.2.

3.10.2 *Statistical analysis*

Calculating the effect size is advocated to supplement visual analysis, non-overlap techniques are not synonymous with visual analysis (Kratochwill et al., 2013). The effect size of the treatment was calculated using Improvement Rate Difference (IRD). IRD provides an indication of the percentage of improvement in performance between the baseline phase and the intervention phase performance (Parker et al., 2009). IRD provides a robust improvement rate that has been shown to equal Cohen's Kappa and Cramer's V (Parker et al., 2009). IRD is a simple, low effort, low-technology approach that is more sensitive than PND, particularly in overlap data situations, and is more strongly validated by external measures (Parker et al., 2009). IRD has strong inter-scorer reliability and correlates well with para-metric and non-parametric effect sizes and meets APA publication standards of providing the Confidence Interval (CI), (Parker et al., 2009).

1. IRD was calculated in two steps: First the improvement rate within each baseline and treatment phase was calculated. Improvement rate (IR) is

$$IR = \frac{number\ of\ improved\ data\ points}{total\ number\ of\ data\ points\ in\ that\ phase}$$

Determining whether a data point is improved or not is dependent on the phase. In baseline phase, an improved data point is one that equals or is greater than any data point from the treatment phase. In the treatment phase, an improved data point is one which is greater than all data points from the baseline phase. Improved implies that behaviours that treatment aims to increase do so, or that behaviours treatment aims to reduce decrease (Parker, Vannest, & Brown, 2009).

2. Secondly the IRD is calculated by, subtracting the IR of the baseline phase (IR_B) from that of the treatment phase (IR_T)

$$IR_T - IR_B = IRD$$

IRD scores can be represented as a percentage (100% =1.00), and reflect the amount of data which is overlapping between the baseline and treatment phases. Scores of 50% or lower indicate that at least half of the data is overlapping between phases, and hence any improvement noted is at a chance level. A negative IRD indicates a decrease in results during the treatment phase to below those in the baseline phase. CIs were calculated at 85%. These provided an indication of the confidence one has in the obtained IRD with wide CIs indicating that the IRD is less trustworthy (Parker et al., 2009).For this study, IRD was calculated using the online statistical calculator available at www.singlecaseresearch.org (Vannest, Parker, Gonen, & Adiguzel, 2016), and CI's were calculated using SPSS software using a two tailed parametric t-test (Michiels, Heyvaert, Meulders, & Onghena, 2017)

IRD has been shown to be more sensitive to effect in certain cases than PND. Furthermore it allows for meta-analysis where there are multiple phases of data and contrasts may be evident. In spite of this, due to the widespread application in single-case designs of PND (Scruggs & Mastropieri, 2013), this was also calculated in order to allow for comparison from this study to other existing studies.

PND is a calculation of the percentage of data points in the intervention phase which are improved on the highest data point in the baseline phase (Scruggs & Mastropieri, 2001, 2013). PND is calculated using the formula:

$$PND = \frac{number\ of\ data\ points\ in\ treatment\ phase\ higher\ than\ the\ highest\ in\ baseline\ phase}{total\ number\ of\ data\ points\ for\ treatment\ phase}$$

3.11 Conclusion

In this chapter, the research methodology used in this study was outlined, as was the main aim and sub-aims. The pre-experimental and experimental phase were described and explained, as were the data collection methods. A discussion regarding data analysis was also included, with a focus on data reliability.

CHAPTER 4: RESULTS

4.1 Introduction

This chapter discusses the results of the study in relation to the sub-aims of the study, to describe and compare the effect of AiLgS with a frequency of 40% and 70% on the acquisition of target receptive vocabulary items of children with CCN and ID. Firstly, procedural integrity of the AiLgS intervention is presented, as is procedural integrity of the probe script and reliability of the data captured. Secondly, the results of the adapted alternating treatment design are present graphically, followed by a visual analysis of the data in terms of level, trend stability, variability, immediacy of the effect, overlap and consistency of data in similar phases. Statistical analysis of effect size in single-case research is also presented using IRD, CI and PND. The chapter concludes with a summary of the results.

4.2 Terminology used in description of the results

It is recommended by Kratochwill et al. (2013) that the standard for description of single Subject designs should include the terms used during visual analysis of the data, as well as statistical analysis of this single subject design as level, trend, immediacy of effect, overlap, consistency of data, Percentage Non-overlapping Data (PND) and Improvement Rate Difference (IRD).

4.2.1 *Level*

Level refers to the mean of the outcome measures within a phase (Kratochwill et al., 2013). Level stability refers to the range of data point values – when the range of values is small, data is said to be stable (Gast & Spriggs, 2014). Level change is the amount of change within one treatment condition across phases (Gast & Ledford, 2014). Level change was calculated by finding the difference between the medians of the intervention and baseline phases (Gast & Ledford, 2014).

4.2.2 *Trend*

Trend refers to the slope of the best-fitting straight line for the outcome measures (Kratochwill et al., 2013). The size of the trend will be calculated using trend relative change. Trend relative change will be calculated by subtracting the mean in the intervention phase from the mean in the baseline phase. A positive result shows an improving trend and a

negative result indicates a deteriorating trend (Horner et al., 2012). A steady trend with little or no slope is indicated by a trend relative change of +/- 3 (Horner et al., 2012).

4.2.3 *Variability*

Variability describes the deviation of scores around the trend (Horner et al., 2012). The introduction of the independent variable can cause changes in the stability of the trend from one phase to the next (Horner et al., 2012). To determine stability, a stability envelope is drawn on either side of the trend. For this study a stability trend of +1 and -1 from the trend line was used, as results are not represented as a percentage (Gast & Spriggs, 2010). A stable trend will be reflected by 80% of the data falling within the stability envelope. A variable trend will be reflected when more than 20% of the data falls outside of the stability envelope.

4.2.4 *Immediacy of effect*

Immediacy of effect refers to the change in level between the last three data points in one phase and the first three data points in the next phase (Kratochwill et al., 2013). For the purpose of this study the three data points in the baseline phase will be compared to the first three data points in the intervention phase. The immediacy of effect provides an indication of how quickly a change occurred after the introduction of the independent variable.

4.2.5 *Overlap*

Overlap refers to the proportion of data in one phase that overlaps with data from the previous phase (Kratochwill et al., 2013). For the purpose of this study the overlap between data points in the baseline and intervention will be considered using the percentage of non-overlapping data (PND). PND scores above 90% indicate very effective intervention, scores between 70% and 90% indicate effective intervention, scores between 50% and 70% indicate questionable intervention, and scores below 50% indicate ineffective intervention (Scruggs & Mastropieri, 2001).

4.2.6 *Effect*

Improvement Rate Difference, with confidence intervals (IRD) were calculated to determine the effect size of the intervention with a frequency of 40% AiLgS and a frequency of 70% AiLgS.

IRD Values of 0.7 and above show large effects, values between 0.5 and 0.7 show moderate effects and values of 0.5 and below show small or questionable effects (Parker et al., 2009). Positive IRDs indicate that intervention phase responses are equal to or higher than points in the baseline, while negative IRDs indicate higher values in the baseline phase than in the intervention phase (Parker et al., 2009).

4.3 Visual analysis of intervention with a frequency of 40%AiLgS and 70% AiLgS on receptive vocabulary acquisition of children with CCN and ID

This section describes each participant's performance regarding receptive vocabulary acquisition for intervention with a frequency of 40% AiLgS and 70% AiLgS. The results are presented graphically reflecting the number of sessions and the number of correct responses during the intervention with a frequency of 40% AiLgS and 70% AiLgS.

4.3.1 *Participant 1*

Figure 4.1 represents the number of correct responses achieved by Participant 1 during intervention at 40% AiLgS 70% AiLgS and the control set.

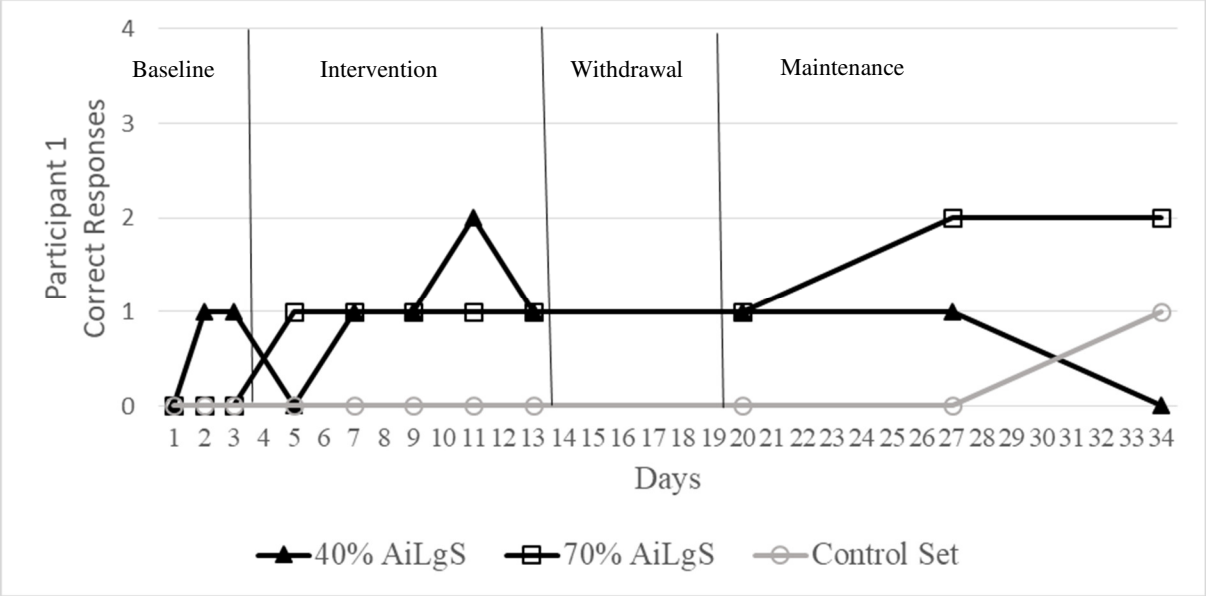


Figure 4.1. Number of correct responses achieved by Participant 1 during intervention with a frequency of 40% AiLgS, 70% AiLgS and the control set

During the intervention with a frequency of 40% AiLgS, Participant 1 had a stable baseline of zero correct responses for three consecutive baseline probes, Days 1, 2 and 3. Their performance showed no change upon introduction of the 40% AiLgS intervention and remained at zero correct responses for Days 5, 7, 9, 11 and 13. After one week of withdrawal, zero correct responses were obtained until Session 34, when one correct answer was obtained. Participant 1 did not reach learning criterion and intervention stopped when teaching criterion was reached. Participant 1 did not show acquisition of target receptive vocabulary in the intervention with a frequency of 40% AiLgS.

A stable baseline is indicated. Mean levels in the baseline, intervention and maintenance phases were 0, 0 and 0 respectively. All phases showed a flat and stable trend, with no variability or immediacy.

During the intervention with a frequency of 70% AiLgS, Participant 1 had a stable baseline of zero correct responses for three consecutive baseline probes, Days 1, 2 and 3. Their performance immediately changed to one correct response (25%) upon introduction of the 70% AiLgS intervention. Participant 1's performance remained one correct response (25%) over five consecutive intervention probes, Sessions 5, 7, 9, 11 and 13. After one week of withdrawal, one correct response (25%) was obtained in maintenance probe one, Session 20. An increase to two correct responses (50%) on maintenance probe two and three, Session 27 and 34 respectively Participant 1 did not reach learning criterion and intervention stopped when teaching criterion was reached.

A stable baseline of 0 is indicated. Mean levels of the baseline, intervention and maintenance probe were 0, 1 and 1.667 respectively, all phases showed a stable trend.

An accelerating trend was evident between the baseline and intervention phases. Trend relative change was +1 to the intervention phase. There was no variability in the baseline and intervention phases, and the effect of intervention was immediate.

4.3.2 *Participant 2*

Figure 4.2 represents the number of correct responses achieved by Participant 2 during intervention with a frequency of 40% AiLgs, 70% AiLgS and the control set.

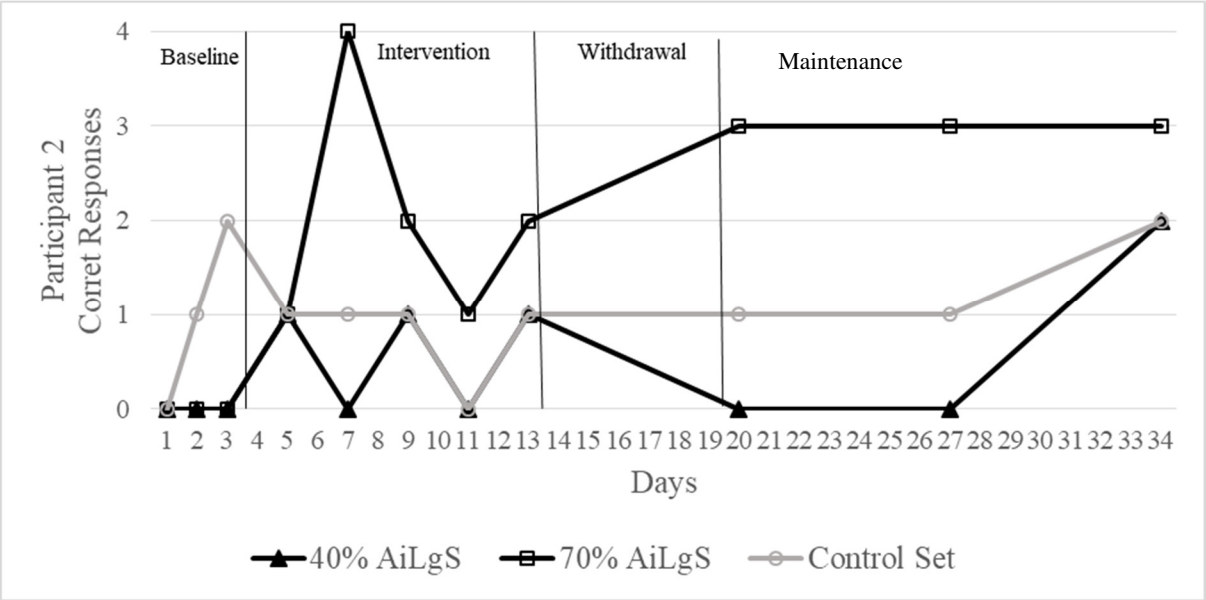


Figure 4.2. Number of correct responses achieved by Participant 2 during intervention with a frequency of 40% AiLgS, 70% AiLgS and the control set.

During the intervention with a frequency of 40% AiLgS, Participant 2 had a stable baseline of zero correct responses for three consecutive baseline probes, Days 1, 2 and 3. Performance immediately changed upon introduction of the 40% AiLgS intervention to one correct response (25%) in intervention probe one, Day 5. His performance decreased to zero correct responses intervention probe two, Day7. His performance increased to one correct responses (25%) in intervention probe three, Day 9, decreasing to zero correct responses in intervention probe four, Day 11. His performance increased to one correct response (25%) in intervention probe five, Day 13. After one week of withdrawal, zero correct responses were obtained in maintenance probe one and two, Day 20 and 27. An increase to two correct responses (50%) was noted in maintenance probe three, Day 34. Participant 2 did not reach learning criterion and intervention stopped when teaching criterion was reached. Participant 2 showed no acquisition of target receptive vocabulary in the intervention with a frequency of 40% AiLgS.

A stable baseline of 0 is indicated. Mean levels of the baseline, intervention and maintenance probe were 0, 1 and 1 respectively. Level stability was demonstrated in baseline, intervention and maintenance phases. Change in level was 0.

An accelerating trend was evident between the baseline and intervention phase. Trend relative change was +0.6 for the intervention phase. Variability indicated a stable trend as 100% of the data points in the baseline and intervention phase fell within the stability envelope. There was no variability in the baseline and intervention phases, and the effect of intervention was immediate.

The last three data points in the baseline phase were 0, 0 and 0. The first three data points in the intervention phase were 1, 0 and 1. Immediacy of effect was noted. Consistency of data patterns was 100% in the baseline phase, 100% in the intervention phase and 67% in the maintenance phase.

During intervention with a frequency of 70% AiLgS, Participant 2 had a stable baseline of zero correct responses for three consecutive baseline probes, Days 1, 2 and 3. His performance immediately changed to one correct response (25%) upon introduction of the 70% AiLgS intervention. Participant 2's performance indicates one correct response (25%) in intervention probe one, Day 5, increasing to four correct responses (100%) in intervention probe two, Day 7. His performance decreased to two correct responses (50%) on intervention probe three, Day 9. A further decrease to one correct response (25%) in intervention probe four, Day11 was noted with an increase to two correct responses (50%) to intervention probe five, Day 13. After one week of withdrawal, three correct responses (75%) were obtained for three consecutive maintenance probes, Day 20, 27 and 34. Participant 2 did not reach learning criterion and intervention stopped when teaching criterion was reached. Participant 2 showed maintenance of target vocabulary in the intervention with a frequency of 70% AiLgS.

A stable baseline of 0 is indicated. Levels of the baseline, intervention and maintenance probe were 0, 2 and 3 respectively. Level stability was demonstrated in baseline, intervention and maintenance phases. Change in level was 2.

An accelerating trend between the baseline and intervention phase. Trend relative change was +2 in the intervention phase. There was no variability in the baseline and intervention phases, and the effect of intervention was immediate.

4.3.3 *Participant 3*

Figure 4.3 represents the number of correct responses achieved by Participant 3 during intervention with a frequency of 40% AiLgS, 70% AiLgS and the control set.

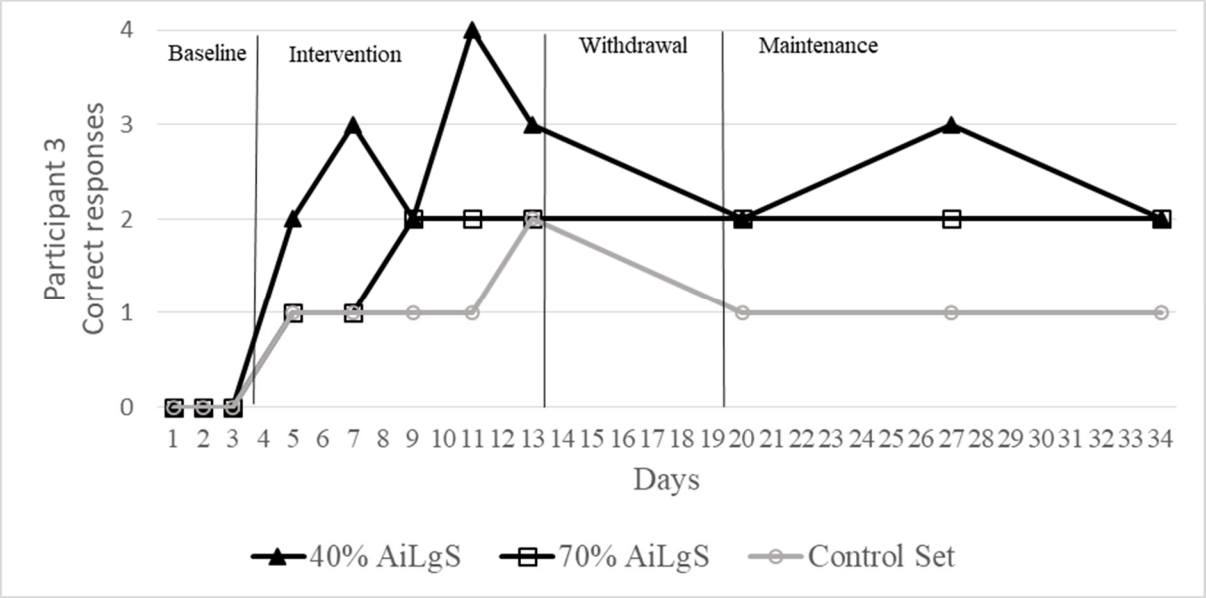


Figure 4.3. Number of correct responses achieved by Participant 3 during intervention with a frequency of 40% AiLgS, 70% AiLgS and the control set.

During the intervention with a frequency of 40% AiLgS, Participant 3 had a stable baseline of zero correct responses for three consecutive baseline probes, Days 2 and 3. Performance immediately changed upon introduction of the intervention with a frequency of 40% AiLgS to two correct response (50%) in intervention probe one, Day 5. Performance increased to three correct responses (75%) intervention probe two, Session 7, decreasing to two correct responses (50%) in in intervention probe three,-Day 9. Performance increased to four correct responses (100%) in intervention probe 4, Day 11 and decreased to three correct responses (75%) in intervention probe five, Day 13. After one week of withdrawal, two correct responses (50%) were obtained in maintenance probe one, Day 20, increasing to three correct responses (75%) in intervention probe two, Day 27, and decreasing to two correct responses (50%) in maintenance probe three, Day 34. Participant 3 did not reach learning criterion and intervention stopped when teaching criterion was reached.

A stable baseline of 0 is indicated. Levels of the baseline, intervention and maintenance probe were 0, 3 and 2 respectively. Level stability was demonstrated in baseline, intervention and maintenance phases. Change in level was 3.

An accelerating trend in the intervention phase. Trend relative change was +2.55 for the intervention phase. A variable trend was evident in the intervention phase as 0% of the data points fell within the stability envelope. A stable trend was evident in the intervention phase as 80% of the data points fell within the stability envelope.

The last three data points in the baseline phase were 0, 0 and 0. The first three data points in the intervention phase were 2, 3 and 2. Immediacy of effect was noted. Consistency of data patterns was 100% in the baseline phase, 80% in the intervention phase and 100% in the maintenance phase.

During intervention with a frequency of 70% AiLgS, Participant 3 had a stable baseline of zero correct responses for three consecutive baseline probes, Days 1, 2 and 3. Her performance immediately changed to one correct response (25%) upon introduction of the 70% AiLgS intervention. Participant 3's performance indicates one correct response (25%) in intervention probe one and two, Days 5 and 7. Performance increased to two correct responses (50%) in intervention probe three, four and five, Days 9, 11 and 13. After one week of withdrawal, two correct responses (50%) were obtained for three consecutive maintenance probes, Days 20, 27 and 34. Participant 3 did not reach learning criterion and intervention stopped when teaching criterion was reached. Participant 3 showed receptive language acquisition and maintenance of target vocabulary in the intervention with a frequency of 70% AiLgS.

A stable baseline of 0 is indicated. Levels of baseline, intervention and maintenance were 0, 2 and 2 respectively. Level stability was demonstrated in baseline, intervention and maintenance phases. Change in level was 2.

An accelerating trend was evident in the intervention phase. Trend relative change was +1.35 in the intervention phase. There was no variability in the baseline and intervention phases, and the effect of intervention was immediate.

The last three data points in the baseline phase were 0, 0 and 0. The first three data points in the intervention phase were 1, 1 and 2. Immediacy of effect was noted. Consistency of data patterns were 100% in the baseline, 100% in the intervention phase and 100% in the maintenance phase.

4.3.4 *Participant 4*

Figure 4.4 represents the number of correct responses achieved by Participant 4 during intervention with a frequency of 40% AiLgS, 70% AiLgS and the control set.

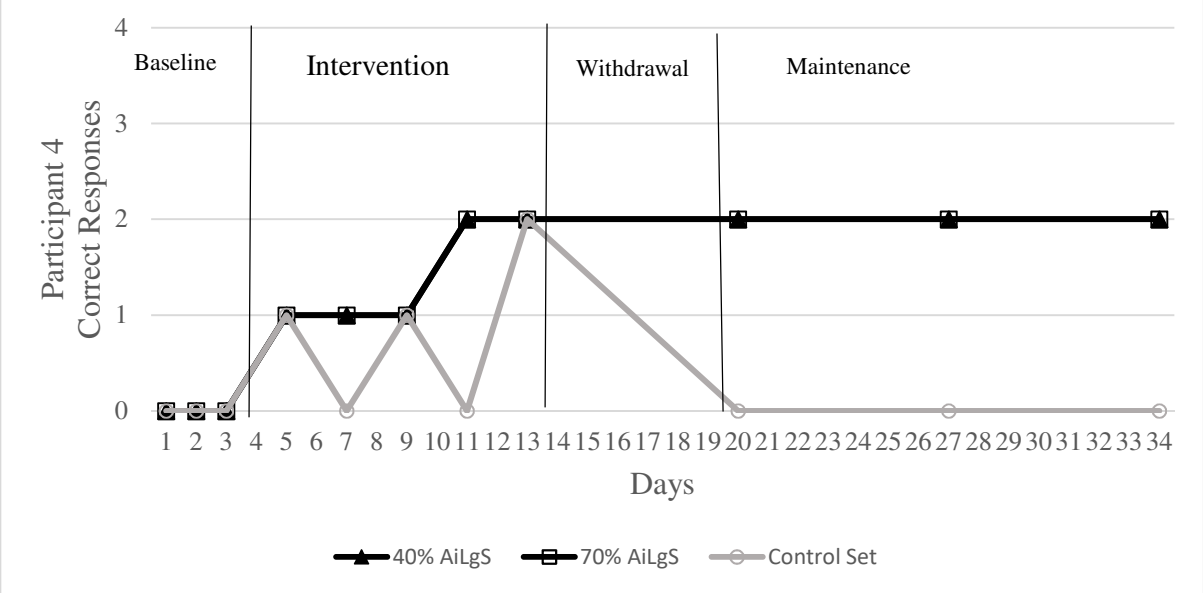


Figure 4.4. Number of correct responses achieved by Participant 4 during intervention with a frequency of 40% AiLgS, 70% AiLgS and the control set.

During intervention with a frequency of 40% AiLgS, Participant 4 had a stable baseline of zero correct responses for three consecutive baseline probes, Days 1, 2 and 3. Her performance immediately changed upon introduction of the 40% AiLgS intervention to one correct response (25%) in intervention probe one, Days 5. Her performance increased to three correct responses (75%) in intervention probe two, Days 7, decreasing to one correct response (25%) in intervention probe three, Day 9. Her performance increased to three correct responses (75%) in intervention probe four, Day 11, and decreased to two correct responses (50%) in intervention probe five, Day 13. After one week of withdrawal, two

correct responses (50%) were obtained in maintenance probe one, Day 20, increasing to three correct responses (75%) in intervention probe two and three, Days 27 and 34. Participant 4 did not reach learning criterion and intervention stopped when teaching criterion was reached.

A stable baseline of 0 is indicated. Levels of the baseline, intervention and maintenance probe were 0, 2 and 3 respectively. Level stability was demonstrated in baseline, intervention and maintenance phases. Change in level was 2.

An accelerating trend was evident from the baseline to the intervention phase. Trend relative change was +2 for the intervention phase. There was no variability in the baseline and intervention phases, and the effect of intervention was immediate.

The last three data points in the baseline phase were 0, 0 and 0. The first three data points in the intervention phase were 1, 3 and 1. Immediacy of effect was noted. Consistency of data patterns was 100% in the baseline phase, 0% in intervention phase and 100% in the maintenance phase.

During intervention with a frequency of 70% AiLgS, Participant 4 had a stable baseline of zero correct responses for three consecutive baseline probes, 1, 2 and 3. Her performance did not immediately change upon introduction of the 70% AiLgS intervention. Her performance was zero correct responses in intervention probe one, Day 5, increasing to one correct response (25%) in intervention probe two, Day 7. Her performance increased to two correct responses (50%) in intervention probe three, Day 9. Her performance decreased to one correct response (25%) in intervention probe four and five, Days11 and 13. After one week of withdrawal two correct responses (50%) were obtained for maintenance probes one and two, Day 20, 27. Performance decreased to one (25%) correct response in maintenance probe 3, Day 34. Participant 4 did not reach learning criterion and intervention stopped when teaching criterion was reached.

A stable baseline of 0 was evident. Levels of baseline, intervention and maintenance were 0, 1 and 2 respectively. Level stability was demonstrated in baseline, intervention and maintenance phases. Change in level was 1.

An accelerating trend was evident from the baseline to the intervention phase. Trend relative change was +1 in the intervention phase. There was no variability in the baseline and intervention phases, and the effect of intervention was immediate.

The last three data points in the baseline phase were 0, 0 and 0. The first three data points in the intervention phase were 0, 1 and 2. Immediacy of effect was noted at intervention probe two, Day 7. Consistency of data patterns was 100% in the baseline phase, 100% in the intervention phase and 100% in the maintenance phase.

4.3.5 *Participant 5*

Figure 4.5 represents the number of correct responses achieved by Participant 5 during intervention with a frequency of 40% AiLgS, 70% AiLgS and the control set.

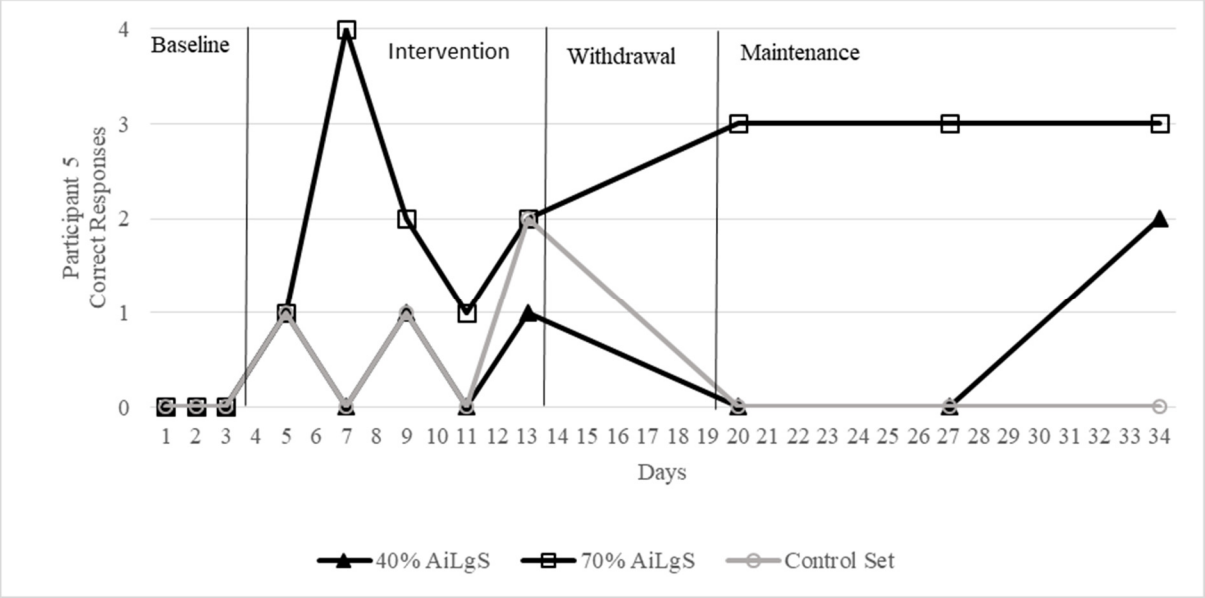


Figure 4.5. Number of correct responses achieved by Participant 5 during intervention with a frequency of 40% AiLgS, 70% AiLgS and the control set

During intervention with a frequency of 40% AiLgS, Participant 5 had a stable baseline of zero correct responses for three consecutive baseline probes, Days 1, 2 and 3. His performance immediately changed upon introduction of the 40% AiLgS intervention to one correct response (25%) for three consecutive intervention probes, Days 5, 7 and 9. Responses increased to two correct responses (50%) for two consecutive intervention probes,

Days 11 and 13. After one week of withdrawal, two correct responses (50%) were obtained for three consecutive maintenance probes, Days 20, 27 and 34. Participant 5 did not reach learning criterion and intervention stopped when teaching criterion was reached. Participant 5 showed receptive language acquisition and maintenance of selected vocabulary in the intervention with a frequency of 40% AiLgS.

A stable baseline of 0 is indicated. Levels of the baseline, intervention and maintenance probe were 0, 1 and 2 respectively. Level stability was demonstrated in baseline, intervention and maintenance phases. Change in level was 1.

An accelerating trend was evident between the baseline and intervention phase. Trend relative change was +1 for the intervention phase. There was no variability in the baseline and intervention phases, the effect of intervention was immediate.

The last three data points in the baseline phase were 0, 0 and 0. The first three data points in the intervention phase were 1, 1 and 1. Immediacy of effect was noted. Consistency of data patterns was 100% in the baseline phase, 100% in the intervention phase and 100% in the maintenance phase.

During the intervention with a frequency of 70% AiLgS, Participant 5 had a stable baseline of zero correct responses for three consecutive baseline probes, Days 1, 2 and 3. His performance immediately changed upon introduction of the 40% AiLgS intervention to one correct response (25%) for three consecutive intervention probes, ~~Sessions~~ Days 5, 7 and 9. Responses increased to two correct responses (50%) for two consecutive intervention probes Days 11 and 13. After one week of withdrawal, two correct responses (50%) were obtained for three consecutive maintenance probes, Days 20, 27 and 34. Participant 5 did not reach learning criterion and intervention stopped when teaching criterion was reached. Participant 5 showed receptive language acquisition and maintenance of selected vocabulary in the intervention with a frequency of 70% AiLgS.

A stable baseline of 0 is indicated. Levels of baseline, intervention and maintenance were 0, 1 and 2 respectively. Level stability was demonstrated in baseline, intervention and maintenance phases. Level change was 1.

An accelerating trend from the baseline to intervention phase. Trend relative change was +1 in the intervention phase.

There was no variability in the baseline and intervention phases, the effect of intervention was immediate. Consistency of data patterns was 100% in the baseline phase, 100% in the intervention phase and 100% in the maintenance phase.

4.3.6 *Participant 6*

Figure 4.6 represents the number of correct responses achieved by Participant 6 during intervention with a frequency of 40% AiLgS, 70% AiLgS and the control set.

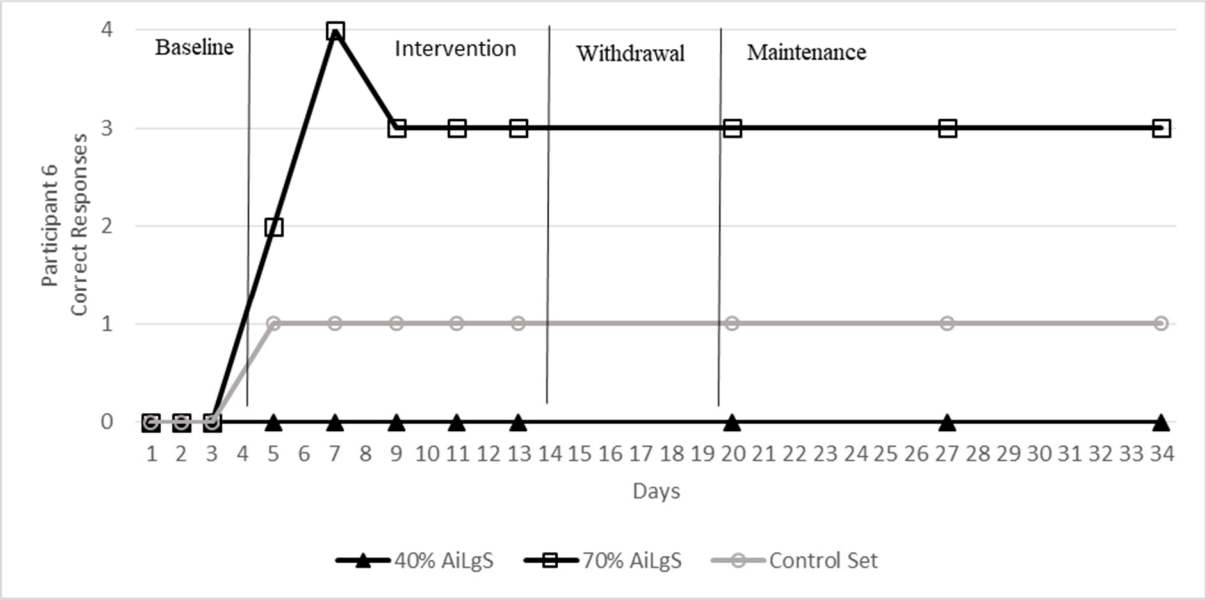


Figure 4.6. Number of correct responses achieved by Participant 6 during intervention with a frequency of 40% AiLgS, 70% AiLgS and the control set.

During intervention with a frequency of 40% AiLgS, Participant 6 had a stable baseline of zero correct responses for three consecutive baseline probes, Days 1, 2 and 3. His performance did not show change upon introduction of the intervention with a frequency of 40% AiLgS and remained zero correct responses in five consecutive intervention probes, Days 5, 7, 9, 11 and 13. After one week of withdrawal, zero correct responses were obtained in three consecutive maintenance probes, Days 20, 27 and 34. Participant 6 did not reach

learning criterion and intervention stopped when teaching criterion was reached. Participant 6 showed no acquisition of target receptive vocabulary in the intervention with a frequency of 40% AiLgS.

A stable baseline of 0 is indicated. Levels of the baseline, intervention and maintenance probe were 0, 0 and 0 respectively. Level stability was demonstrated in baseline, intervention and maintenance phases. Change in level was 0.

The trend direction showed zero-celerating trend from the baseline to the intervention phase. Trend relative change was 0 for the intervention phase. Variability indicated a stable trend in the baseline and intervention phase as 100% of the data points fell within the stability envelope.

The last three data points in the baseline phase were 0, 0 and 0. The first three data points in the intervention phase were 0, 0 and 0. No immediacy of effect was noted. Consistency of data patterns was 100% in the baseline intervention and maintenance phase.

During intervention with a frequency of 70% AiLgS, Participant 6 had a stable baseline of zero correct responses for three consecutive baseline probes, Days 1, 2 and 3. His performance immediately changed to two correct responses (50%) upon introduction of the 70% AiLgS intervention in intervention probe 1, session 5. His performance increased to four correct responses (100%) in intervention probe two, session 7. Three correct responses (75%) were maintained in three consecutive intervention probes, session 9, 11 and 13. After one week of withdrawal, three correct responses (75%) were obtained for three consecutive maintenance probes, session 20, 27 and 34. Participant 6 showed receptive language acquisition and maintenance of target receptive vocabulary. Participant 6 did not reach learning criterion and intervention stopped when teaching criterion was reached.

A stable baseline of 0 is indicated. Levels of the baseline, intervention and maintenance probe were 0, 3 and 3 respectively. Level stability was demonstrated in baseline, intervention and maintenance phases. Level of change was 3.

The trend direction showed an accelerating trend from the baseline to the intervention phase. Trend relative change was +3 in the intervention phase. Variability indicated variable

trend in the baseline as 0% of the data points fell within the stability envelope. A stable trend was noted in the intervention phase as 80% of the data points fell within the stability envelope.

The last three data points in the baseline phase were 0, 0 and 0. The first three data points in the intervention phase were 2, 4 and 3. Immediacy of effect was noted. Consistency of data patterns was 100% in the baseline phase, 60% in the intervention phase and 100% in the maintenance phase.

4.4 Comparison of intervention with a frequency of 40% AiLgS and 70% AiLgS on the receptive vocabulary acquisition of children with CCN and ID

To determine effects within single-case design, six outcome measures are used: level, trend stability, variability, immediacy of the effect, overlap, and consistency of data in similar phases. Visual analysis of the above-mentioned assesses if there are indications of effect at three different points in time. If criterion is met, the data documents a causal relation, therefore allowing the inference that change in the outcome variable is functionally related to manipulation of the independent variable (Kratochwill et al., 2013). Table 4.1 shows the summary of the comparison of intervention with a frequency of 40% AiLgS and 70% AiLgS on the receptive vocabulary acquisition of all six participants.

4.4.1 *Participant 1*

For the intervention with a frequency of 40% AiLgS, participant 1's PND for the baseline and intervention phase was 0%, which accord to Scruggs and Mastropieri (2001), indicates ineffective intervention. IRD was -1 85% CI (-1.000; -1.000). IRD indicates small or questionable effects (Parker et al., 2009).

For the intervention with a frequency of 70% AiLgS, participant 1 PND for the baseline and intervention phase was 100%, indicating very effective intervention (Scruggs & Mastropieri, 2001). IRD was 1 85% CI (1.000; 1.000). IRD indicates large effects (Parker et al., 2009). IRD for the control set was -0.6, indicating no effect (Parker et al., 2009).

Participant 1 showed the greatest receptive vocabulary acquisition in the intervention with a frequency of 70% AiLgS.

4.4.2 Participant 2

For the intervention with a frequency of 40% AiLgS, participant 2 PND for the baseline and intervention phase was 60%, indicating questionable intervention (Scruggs & Mastropieri, 2001). IRD was -0.4 85% CI (-1.000; -0.173). IRD indicates that baseline phase responses are equal to or higher than points in the intervention phase, with small or questionable effects (Parker et al., 2009).

For the intervention with a frequency of 70% AiLgS, participant 1 PND for the baseline and intervention phase was 100%, indicating very effective intervention (Scruggs & Mastropieri, 2001). IRD was 1 85% CI (1.000:1.000). IRD indicates large effects (Parker et al., 2009). IRD for the control set was -0.6, indicating no effect (Parker et al., 2009).

Participant 2 showed the greatest receptive vocabulary acquisition in the intervention with a frequency of 70% AiLgS.

4.4.3 Participant 3

For the intervention with a frequency of 40% AiLgS, participant 3 PND for the baseline and intervention phase was 100%, indicating very effective intervention (Scruggs & Mastropieri, 2001). IRD was 1 85% CI (1.000; 1.000). IRD indicates large effects (Parker et al., 2009).

For the intervention with a frequency of 70% AiLgS, participant 3 PND for the baseline and intervention phase was 100%, indicating very effective intervention (Scruggs & Mastropieri, 2001). IRD was 0.26685% CI (-1.000:0.629). IRD indicates small or questionable effects (Parker et al., 2009). IRD for the control set was 1, indicating effect (Parker et al., 2009).

Participant 3 showed the greatest receptive vocabulary acquisition in the intervention with a frequency of 40% AiLgS.

Table 4.1

Summary of the comparison of intervention with a frequency of 40% AiLgS and 70% AiLgS on the receptive vocabulary acquisition of participants.

		Participant 1		Participant 2		Participant 3		Participant 4		Participant 5		Participant 6	
		40% AiLgS	70% AiLgS	40% AiLgS	70% AiLgS	40% AiLgS	70% AiLgS	40% AiLgS	70% AiLgS	40% AiLgS	70% AiLgS	40% AiLgS	70% AiLgS
Stable Baseline		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Level	Baseline	0	0	0	0	0.25	0.25	0	0	0	0	0	0
	Intervention	0	1	0.6	2	2.8	1.6	2	1	1.4	1	0	3
Trend		0	+1	+0.6	+2	+2.55	+1.35	+2	+1	+1	+1	0	+3
Variability	Baseline	100%	100%	100%	100%	0%	1000%	100%	100%	100%	100%	100%	0%
(%)	Intervention	100%	100%	100%	80%	80%	100%	60%	100%	100%	100%	100%	80%
Immediacy of effect		X	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓
IRD (CI at 85%)		0	1 (1:000; 1:000)	0.6 (0.685; 2.815)	1 (1.061; 2.139)	1 (1:000; 1.000)	0.75 (0.778; 1.922)	1 (1.015; 2.984)	0.8 (0.304; 1.696)	1 (0.964; 1.836)	1 (1.000; 1.000)	0	1 (2.304; 3.696)
PND		0%	100%	60%	100%	100%	100%	100%	80%	100%	100%	0%	100%

Note: IRD= Improvement rate difference, PND= Percentage of non-overlapping data

4.4.4 Participant 4

For the intervention with a frequency of 40% AiLgS, participant 4 PND for the baseline and intervention phase was 100%, indicating very effective intervention (Scruggs & Mastropieri, 2001). IRD was 1 85% CI (1.000; 1.000). IRD indicates large effects (Parker et al., 2009).

For the intervention with a frequency of 70% AiLgS, participant 4 PND for the baseline and intervention phase was 80%, indicating effective intervention (Scruggs & Mastropieri, 2001). IRD was -0.285% CI (-1.000; 0.015). IRD indicates small or questionable effects (Parker et al., 2009). IRD for the control set was -0.6, indicating no effect (Parker et al., 2009).

Participant 4 showed the greatest receptive vocabulary acquisition in the intervention with a frequency of 40% AiLgS.

4.4.5 Participant 5

For the intervention with a frequency of 40% AiLgS, participant 5 PND for the baseline and intervention phase was 100%, indicating very effective intervention (Scruggs & Mastropieri, 2001). IRD was 1 85% CI (1.000; 1.000). IRD indicates large effects (Parker et al., 2009).

For the intervention with a frequency of 70% AiLgS, participant 5 PND for the baseline and intervention phase was 100%, indicating effective intervention (Scruggs & Mastropieri, 2001). IRD was 1 85% CI (1.000; 1.000). IRD indicates large effects (Parker et al., 2009). IRD for the control set was -0.4, indicating no effect (Parker et al., 2009).

Participant 5 showed equal receptive vocabulary acquisition in the intervention with a frequency of 40% AiLgS and 70% AiLgS.

4.4.6 Participant 6

For the intervention with a frequency of 40% AiLgS, participant 6 PND for the baseline and intervention phase was 0%, indicating ineffective intervention (Scruggs & Mastropieri, 2001). IRD was 0 indicates small or questionable effects (Parker et al., 2009).

For the intervention with a frequency of 70% AiLgS, Participant 6 PND for the baseline and intervention phase was 100%, indicating very effective intervention (Scruggs & Mastropieri, 2001). IRD was 1 85% CI (2.304; 3.696). IRD indicates large effects (Parker et al., 2009). IRD for the control set was -0.2, indicating no effect (Parker et al., 2009).

Participant 6 showed the greatest receptive vocabulary acquisition in the intervention with a frequency of 70% AiLgS.

4.5 Summary of the effect of frequency of AiLgS on the acquisition of receptive vocabulary items

Results varied across the six participants. The results of the study indicates that the intervention with a frequency of 70% AiLgS was more effective for Participants 1, 2 and 6. In the intervention with a frequency of 70% AiLgS, participants demonstrated a change in level, level stability, positive accelerating trend directions, trend stability, immediacy of effect, PNDs of 100%, indicating very effective intervention, and IRDs of 1, indicating large effects. Maintenance was demonstrated in the 70% AiLgS intervention for participants 1, 2 and 6. Participant 1 and 6 showed no receptive language acquisition in the 40% AiLgS intervention, with PNDs of 0% and IRDs of 0. Participant 2 showed a PND of 60% in the intervention with a frequency of 40% AiLgS, indicating questionable intervention, and IRD of 0.6, indicating small or questionable effects. The intervention with a frequency of 40% AiLgS was more effective for Participants 3 and 4. This was supported by level stability, accelerating trend directions, trend stability, immediacy of effect, PNDs of 100%, indicating very effective intervention, and IRDs of 1, indicating large effects. In the intervention with a frequency of 70% AiLgS, Participant 3 obtained a PND of 100% and IRD of 0.75, indicating large effects. Participant 4 had a PND of 80% and IRD of 0.8, indicating large effect. Participant 5's results indicated that the intervention with a frequency of 40% AiLgS and the 70% AiLgS intervention were equally effective. Both interventions showed equally improving trends, stable variability, consistency of data patterns, PNDs of 100% and IRDs of 1, indicating very effective intervention and large effects. Participant 5 showed maintenance for the intervention with a frequency of 40% AiLgS and 70% AiLgS.

4.6 Conclusion

The results of the adapted alternating treatment design were presented with a visual analysis of the data in terms of level, trend stability, variability, immediacy of the effect, overlap and consistency of data in similar phases. Statistical analysis of effect size in single-case research was presented, using PND and IRD of all six participants. The chapter concluded with the description of the effect of intervention with a frequency of 40% AiLgS and 70% AiLgS on the receptive vocabulary acquisition of children with CCN and ID.

CHAPTER 5: DISCUSSION

5.1 Introduction

Results will be discussed in terms of participant characteristics, citing, comparing and analysing against relevant literature and studies that focused on augmented input.

5.2 The effect of intervention with a frequency of 40% AiLgS and 70% AiLgS on the acquisition of target receptive vocabulary items

In an attempt to create a homogenous group of participants for this study stringent selection criteria were used for the selection of participants. Factors related to these characteristics will be discussed in relation to the results of the study.

Participant results were considered and varying results across the six participants were evident. The intervention with a frequency of 70% AiLgS was effective for all participants 1, 2 and 6, and this was supported by level stability, accelerating trends in intervention, trend stability, immediacy of effect, high consistency of data points between phases and high PND and IRD values. Maintenance was demonstrated in the 70% AiLgS intervention for Participants 1, 2 and 6. The intervention with a frequency of 40% AiLgS was effective for Participant 2, 3 and 4, and this was supported by level stability, accelerating trend directions, stable trend variability, immediacy of effect, high consistency of data points between phases, and high PND and IRD values. Participants 3 and 4 demonstrated maintenance in the intervention with a frequency of 40% AiLgS. Participant 5's results indicated that intervention with a frequency of 40% AiLgS and 70% AiLgS was equally effective. Both interventions showed equally improving trends, stable variability, consistency of data patterns and equally high PND and IRD values. Participant 5 demonstrated maintenance for the intervention with a frequency of 40% AiLgS and 70% AiLgS.

The findings of this study can be added to research evidence supporting augmented input providing various improved language skills (Allen et al., 2017; Dada et al., 2004; Drager et al.,2006; Goossens, 1989; Harris & Reichle, 2004; Preis, 2006; Romski, et al., 2010; (Sennott et al., 2016)(Sennott et al., 2016)(Sennott et al., 2016)Sennott, et al., 2016).

The variability in participant performance regarding the effect of intervention with a frequency of 40% AiLgS and 70% AiLgS will be discussed, as well as comparing the results to other studies and literature involving augmented input.

Participants in the study have all had varying degrees of exposure to English as the language of learning and teaching. This was determined by the number of years participants have been attending the school at which they were currently enrolled. Participants 1, 2 and 6 showed greater receptive vocabulary acquisition in the intervention with a frequency of 70% AiLgS. Their exposure to English as the LoLT was three years, four years and five years respectively. Participants 3 and 4 showed greater receptive vocabulary acquisition in the intervention with a frequency of 40% AiLgS. Their exposure to English as the LoLT was four years and three years respectively. Participant 5 showed equal receptive vocabulary acquisition in the intervention with a frequency of 40% AiLgS and 70% AiLgS. His exposure to English as the LoLT was five years, with higher receptive language scores in English and when assessed in his first language. The number of years the participants were exposed to English as LoLT was between 3 and 5 years and therefore exposure to English could not be considered as having an impact on their results.

Dada and Alant (2004) provided AiLgS with a frequency between 76% to 93% to participants with CCN. Results indicated that the AiLgS intervention met the criterion used in clinical settings and while the AiLgS intervention facilitate the acquisition of target vocabulary, the methodology used did not allow the conclusion that the inclusion of the augmented input was solely responsible for the gain in receptive vocabulary (Dada, 2004).

5.3 Receptive Language

Participants' receptive language skills were assessed using two receptive language assessments: the PPVT-IV (Dunn & Dunn, 2007), as this assessed receptive vocabulary at a one-word level, and the TACL-4 (Carrow-Woolfolk 2014), as this assessed receptive language components including receptive vocabulary, grammatical morphemes and elaborated sentences and phrases, that provided information on understanding of language at a sentence level. These assessments were essential as receptive vocabulary acquisition was the focus of the study and receptive language was used throughout the intervention.

In this study, Participants 1, 2, and 6 showed the greatest receptive vocabulary acquisition in the intervention with a frequency of 70% AiLgS. Their respective scores on the PPVT-IV (Dunn & Dunn, 2007) were <2 years, <2 years and 2.1 years. Participants 3 and 4 showed the greatest receptive vocabulary acquisition in the intervention with a frequency of 40% AiLgS. They each obtained an age equivalency of 2 years on the PPVT-IV (Dunn & Dunn, 2007). Participant 5 showed equal receptive vocabulary acquisition in the intervention with a frequency of 40% and 70% AiLgS. Participant 5 obtained an age equivalency of 3.2 years on the PPVT-IV (Dunn & Dunn, 2007). These findings may indicate that all participants acquired the receptive vocabulary items, irrespective of their receptive vocabulary scores; however, these scores may play a role in determining the frequency of augmented input required to achieve receptive vocabulary acquisition. It may indicate that receptive vocabulary age equivalent scores have an impact on the frequency of augmented input required to achieve receptive vocabulary acquisition. The participant with the highest score for one-word receptive vocabulary, when assessed using the PPVT-IV (Dunn & Dunn, 2007), showed equal receptive vocabulary acquisition in the intervention with a frequency of 40% and 70% AiLgS. Participants 1 and 2, with the lowest scores, showed the greatest receptive vocabulary acquisition in the intervention with a frequency of 70% AiLgS.

Similarly, Dada and Alant (2009) found that participants with good speech comprehension skills, as measured by the PPVT-Revised (Dunn & Dunn, 1981) and the Reynell Receptive Scale (Reynell & Huntley, 1985), showed greater receptive language acquisition when receiving intervention provided at a frequency of at least 70% AiLgS. This could be attributed to the ability to understand spoken language, providing evidence that symbolic functioning has been achieved (Romski & Sevcik, 2003). This enables the recasting of existing conceptual and linguistic knowledge onto the graphic symbol-based form.

The TACL-4 (Carrow-Woolfolk 2014) was used to assess the receptive syntax skills of participants. The receptive vocabulary, grammatical morphemes and elaborated sentences and phrases subtests were conducted on all participants. Participants 1, 2, 3, 4 and 6 all scored <3 years for each of the subtests. Participant 5 scored 3.6 years on vocabulary, 3 years on grammatical morphemes and 3.6 years on elaborated sentences and phrases. Participant 5 showed equal improvement in the intervention with a frequency of 40% AiLgS and 70%

AiLgS. This may further support the suggestion that participants with greater receptive syntax skills are able to acquire receptive vocabulary at a frequency of 40% AiLgS and 70% AiLgS. It may indicate that participants with poorer receptive language skills show receptive language acquisition at 70% AiLgS.

Speech comprehension may provide the foundation to build productive language competence and those with receptive language difficulties may derive maximal benefit from AiLgS (Romski & Sevcik, 2003). Literature suggests that individuals with good speech comprehension skills are more successful with picture-based language systems than those with poor or no comprehension skills (Franklin, Mirenda & Phillips, 1996; Romski & Sevcik, 1992, 1993).

5.4. Intelligence quotients

Participants in this study obtained intelligence quotients of lower extreme (≤69) as assessed by The KBIT 2 (Kaufman & Kaufman, 2004). They demonstrated varying results in receptive language acquisition during intervention with a frequency of 40% AiLgS and 70% AiLgS.

Similarly improved symbol comprehension in individuals with moderate and profound cognitive disability was evident in several studies (Dada & Alant, 2009; Harris & Reichle, 2004, Romski et al., 1994). Similarly, two studies included participants with profound cognitive disabilities (Lancioni, 1983, Romski et al., 1994; Schlosser et al., 1995). Various studies did not report on cognitive functioning and the importance of including this information is evident. Further studies including participants with severe intellectual disability are required (Allen et al., 2017; Sennott et al., 2016).

5.5 Intelligibility rating

The I-ASCC (Dowden, 1997) was conducted to ensure all participants met the criteria of CCN. Participants 1, 2, 3 and 4 obtained 0% intelligibility, Participant 5 obtained 26% intelligibility and Participant 6 obtained 3% intelligibility. Participant 5 demonstrated equal improvement in receptive language acquisition in the intervention with a frequency of 40% AiLgS and 70% AiLgS. This may indicate speech intelligibility has a role in receptive vocabulary acquisition. It was challenging to find previous studies that supported this

hypothesis as the manner in which participants were classified as the determination of CCN varied across studies. Some studies required participants to have a spoken word vocabulary of ten or less words as determined by a speech therapist (Romski et al., 1994). One study involving one participant determined severe communication impairment from analysing a language sample obtained from the classroom and from parent and teacher reports (Taylor & Lacono, 2003). Some did not specify how participants' speech intelligibility was determined, while other studies used the Index of Augmented Speech Comprehensibility (I-ASCC, Dowden, 1997) and participants were required to present with less than 50% intelligibility in the no sematic context condition (Binger & Light, 2007; Binger et al., 2008; Binger et al., 2010; Binger et al., 2011; Kent-Walsh et al., 2015; Rosa-Lugo & Kent-Walsh, 2008). However, these studies looked at the impact of augmented input on expressive language skills. Therefore, more consistent means of assessing CCN are required in single subject designs.

5.6 Language exposure

The SALAT (Bortz, 1997) was used to assess participants' proficiency in their home language. Participant 1 achieved a raw score of 18, Participant 2 achieved a raw score of 5, Participants 3 and 4 achieved a raw score of 8, Participant 5 achieved a raw score of 36 and Participant 6 achieved a raw score of 6. Participants 1, 2, and 6 showed similar scores, raw scores of 18, 5 and 6 respectively, and demonstrate that the 70% AiLgS intervention was effective. Participants 3 and 4 both achieved raw scores of 8 and showed the 40% AiLgS intervention was effective. Participant 5 achieved the best proficiency in home language with a raw score of 36. Participant 5 demonstrated equal improvement in receptive language acquisition in the 40% and 70% AiLgS intervention.

Proficiency in home language may allow fast mapping to occur. Fast mapping occurs when an individual hears a new word in the presence of an unknown object and is able to map the new word to the new object (Mervis & Bertrand, 1994). Fast mapping allows children to map the meaning of new words at a rapid rate, even with little exposure to the new words. Harris and Reichle (2004) conducted a study that indicated the ability to fast-map influences the effectiveness of aided language stimulation. Individuals that do not show evidence of fast mapping may require differing amounts and types of language input than individuals that can fast map (Romski, Sevcik, Robinson, Mervis & Bertrand, 1995).

5.7 Conclusion

This chapter presented the results of the study. The effect of intervention with a frequency of 40% AiLgS and 70% AiLgS on the acquisition of receptive vocabulary was discussed in relation to participant characteristics. These characteristics were receptive vocabulary, intelligence quotients, intelligibility of expressive speech and language exposure. Relevant literature and studies that focused on augmented input were discussed in relation to the findings of this study.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

This chapter provides a summary of the results of the findings, followed by the clinical implications. It also makes recommendations for future research.

6.2 Summary of findings

The main aim of the study was to compare the effect of intervention with a frequency of 40% AiLgS and 70% AiLgS respectively on the acquisition of target receptive vocabulary items in children with CCN and ID.

The results of the study indicated that the intervention with a frequency of 70% AiLgS was more effective for Participants 1, 2 and 6. This was indicated by PNDs of 100%, indicating very effective intervention, and IRDs of 1, indicating large effects. Maintenance was demonstrated in the 70% AiLgS intervention for Participants 1, 2 and 6. Participants 1 and 6 showed no receptive language acquisition in the 40% AiLgS intervention with PNDs of 0% and IRDs of -1. Participant 2 showed a PND of 60% in the intervention with a frequency of 40% AiLgS, indicating questionable intervention, and an IRD of -0.4, indicating small or questionable effects.

The intervention with a frequency of 40% AiLgS was more effective for Participants 3 and 4. This was supported by PNDs of 100%, indicating very effective intervention, and IRDs of 1, indicating large effects. In the intervention with a frequency of 70% AiLgS, Participant 3 obtained a PND of 100% and IRD of 0.266, indicating small or questionable effects, while Participant 4 had a PND of 80% and IRD of -0.2, indicating no effect. Participant 5's results indicated that the intervention with a frequency of 40% AiLgS and the 70% AiLgS intervention were equally effective. Both interventions showed PNDs of 100% and IRDs of 1, indicating very effective intervention and large effects. Participant 5 showed maintenance for the intervention with a frequency of 40% AiLgs and 70% AiLgS.

Overall, the results revealed that three participants showed the greatest receptive vocabulary acquisition in the intervention with a frequency of 70% AiLgS. Two participants showed the greatest receptive vocabulary acquisition in the intervention with a frequency of

40% AiLgs. One participant showed equal receptive vocabulary acquisition in the intervention with a frequency of 40% AiLgS and 70% AiLgS.

6.3 Clinical implications of the study

The main clinical implication is that children with ID are able to acquire target receptive vocabulary items in intervention with a frequency of 40% AiLgS and 70% AiLgS. A larger number of participants (n = 3) showed language acquisition in the intervention with a frequency of 70% AiLgS. This may suggest that AiLgS with a frequency of 70% may be the preferred dosage.

A second implication is that the AiLgS intervention used low technology augmented input comprising facilitator boards and activities that are cost-effective for developing countries (Dada, Murphy & Tönsing, 2017). In addition, receiving intervention for ten to 15 minutes once a day showed gain in receptive language acquisition, suggesting that intervention is cost-effective and efficient to facilitate behaviour change that is large enough to be of clinical significance (Allen et al., 2017).

The study was unique in that it did not provide one-on-one intervention. Intervention was implemented in a small group setting, comprising three participants in each group. It was reflective of the classroom environment, indicating that participants can benefit from AiLgS in a group setting.

Additionally, in this study, one facilitator board was used for all participants. Participants were not required to navigate through pages or picture symbols on their own communication devices. Vocabulary relevant to the activity was located on a single display, which allowed participants to focus cognitive and motor resources on the activity at hand (Binger et al., 2010).

6.4 Evaluation of the study

6.4.1 *Strengths of the study*

A strength of the study was the research design. AATD allows comparison of two or more instructional strategies with non-reversible behaviours (Wolery et al., 2014). The

research design afforded the use of a control set and a withdrawal of intervention that allowed a maintenance phase to be implemented. The research design added to the internal validity of the study by eliminating extraneous variables that could provide an alternate explanation for the findings (Gast & Ledford, 2014).

A further strength of the study was that it met the standards of the What Works Clearing House Design Pilot Standards for SCDs, Version 1.0 (Kratochwill et al., 2013). The standard is that in alternating treatment design there should be at most two data points per phase, at least five per condition (Kratochwill et al., 2013). The current study met this standard.

The target behaviour of the study, acquisition of target receptive vocabulary items, met all five criteria of AATD. The behaviours were non-reversible, they were not in the participants' repertoire, they were independent, as one vocabulary set could be acquired without impacting on the others, behaviours were functionally equivalent and likely to be influenced by the same environmental variables, and behaviour sets/chains were of equal difficulty (Wolery et al., 2014). The study ensured that vocabulary sets were equivalent as described in Chapter 3 section 3.3. This involved looking at the number of syllables in each word and the parts of speech. Ensuring equivalence of the three sets of target vocabulary items improved internal validity of the study (Schlosser, 2003).

The small group format proved to be an advantage as it ensured participants received the same intervention, ensuring procedural integrity between groups of participants.

This study provides detailed written and visual information about the stimuli and AiLgS intervention used that will allow for replication and full contextualisation of the results (Allen et al., 2017).

Another strength is the large sample size. A larger sample provides more information regarding generalisability (Allen et al., 2017; Schlosser, 2003; Sennott et al., 2016).

A further strength is that the procedural integrity of the intervention was consistently high at 80%. The procedures for the probes and reliability of data capturing were reliable.

The procedural integrity scores of the 40% and 70% AiLgS intervention and the adherence to the probe script were above the acceptable score of 80% (Ayres & Gast, 2010).

6.4.2 *Limitations of the study*

A limitation of the study is that the dependent measure only determined acquisition of one-word receptive vocabulary without considering change in receptive language abilities. Furthermore, the study did not consider the impact of the intervention on expressive vocabulary. Future research is needed across syntactic, morphological, syntactic, semantic and pragmatic domains (Sennott et al., 2016).

A further limitation is that in AATD there is only one evaluation of the relative efficiency between the compared strategies (Gast & Ledford, 2014). This can be overcome by repeating the comparison with two new behaviour sets, of equal difficulty, with another AATD. If one intervention is still superior there will be greater confidence in the differences between conditions because of the intra-subject replication (Gast & Ledford, 2014).

6.5 Recommendations for future research

The systematic review conducted by Allen et al. (2017) indicated that studies rated as strong in terms of quality implemented aided AAC modelling or aided language modelling. This was largely attributed to the fact that these interventions have rigid procedures that reduce threats to internal validity (Allen et al., 2017). Therefore it is suggested that the most crucial ingredient going forward is the inclusion of well-defined dosages and detailed descriptions of the AAC systems used (Allen et al., 2017). Future research should consider interventions with varying frequencies, well-defined frequencies will provide clinicians with guidelines for proving augmented input in clinical settings.

The current study used vocabulary that consisted of two nouns, one adjective and one preposition in each target set of vocabulary. Future research could vary the parts of speech targeted. Additionally, future research is required across semantic, syntactic, morphological and pragmatic domains affected by augmented input (Sennott et al., 2016).

Factors that may influence the effect of augmented input, such as the role of fast mapping (Mervis & Bertrand, 1994), joint attention (Adamson, Bakeman, Deckner &

Romski, 2009), and overall scope and sequence of vocabulary learning for individuals, should be considered (Sennott et al., 2016).

Participants with different language profiles, age groups and IQ scores would provide more information regarding generalisability (Allen et al., 2017; Sennott et al., 2016). Reporting on participant baseline skill level in the areas of expressive and receptive language and cognition will allow for treatment effectiveness for specific participant skill profiles to be developed (Allen et al., 2017; Sennott et al., 2016).

Variations of the dependent variable could be extended to include the expressive vocabulary abilities of participants and receptive language abilities. Being able to combine words and parts of words is important as it provides access to the generative power of language. Studies have demonstrated that AAC modelling based interventions increase the use of multi-symbol utterances in a play context (Binger & Light, 2007) and shared story book reading (Binger et al., 2008; Binger et al., 2010). This evidence suggests that further research in the areas of syntax and morphology would be beneficial.

Future studies could also include the impact of different probe stimuli on receptive vocabulary acquisition. For example, three sets of vocabulary could all be targeted using 70% AiLgS but each set could be probes with different stimuli, for example, auditory stimuli to object matching, visual stimuli to object matching and auditory and visual stimuli to object matching.

6.6 Conclusion

This chapter concluded the study. It provided a summary of the findings, followed by the clinical implications of the findings. It reviewed the strengths and limitations of the study and concluded by providing recommendations for future research.

REFERENCES

Adamson, L., Bakeman, R., Deckner, D.F., & Romski, M.A. (2009). Joint engagement and the emergence of language in children with autism and Down syndrome. *Journal of Autism and Developmental Disorders, 39,* 84-96.

Allen, A.A., Schlosser, R.W., Brock, K.L., & Shane, H.C (2017). The effectiveness of aided augmented input techniques for persons with developmental disabilities: a systematic review. *Augmentative and Alternative Communication, 33*(3), 149-159. doi:10.1080/07434618.2017.1338752

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (DSM-5®)*. Washington, DC: Author.

American Speech-Language Hearing Association (ASHA). (2015). Retrieved on 22 February 2015 from http://www.asha.org/public/speech/disorders/AAC.htm

Ayres, K & Gast, D.L. (2010). Dependent measures and measurement procedures. In D.L. Gast (Ed), *Single Subject research Methodology in Behavioural Sciences* (p129-165). New York, NY: Routledge.

Barton, A., Sevcik, R. A., & Romski, M. A. (2006). Exploring visual-graphic symbol acquisition by pre-school age children with developmental and language delays. *Augmentative and Alternative Communication*, *22*(1), 10–20. doi: 10.1080/07434610500238206

Bayley, N. (1969). *Bayley Scales of Infant Development.* San Antonio, TX: The Psychlogical Corporation.

Benjamin, A, & Crow, J.T. (2012). *Vocabulary at the core: Teaching the common core standards.* Larchmont, NY: Eye On Education, Inc

Binger, C., Kent, J., Berens, J, Del Campo, S., & Rivera, D. (2008). Teaching Latino parents to support the multi-symbol message productions of their children who require AAC.

Augmentative and Alternative Communication, *24*(4), 323-338. doi: 10.1080/07434610802130978

Binger, C., Kent-Walsh, J., Ewing, C., & Taylor, S. (2010). Teaching educational assisstants to facilitate the multisymbol message productions of young students who require augmentative and alternative communication. *Americal Journal f Speech-Language Pathology, 19,* 108-120. doi: 10.1044/1058-0360(2009/09-0015)

Binger, C., & Light, J. (2007). The effect of aided AAC modeling on the expression of multi-symbol messages by preschoolers who use AAC. *Augmentative and Alternative Communication*, *23*(1), 30–43. doi:10.1080/07434610600807470

Binger, C., Maguire-Marshall, M., & Kent-Walsh, H. (2011). Using aided AAC models, recasts, and contrastive targets to teach grammatical morphemes to children who use AAC. *Journal of Speech, Language, and Hearing Research, 54,* 160-176. doi: 10.1044/1092-4388(2010/09-0163)

Bortz, M. (1997). *South African language assessments.* Ponteland, United Kingdom: STASS Publications.

Brown, L., Sherbenou, R.J., & Johnsen, S.K. (2010). *Test of nonverbal intelligence (4th edition.* Austin, Texas: Pro-Ed.

Bruno, J. (2010). *Test of aided-communication symbol performance.* Pittsburg, PA: Dyna Vox Mayer-Johnson.

Cafiero, J. (2001). The effect of an augmentative communication intervention on the communication, behaviour, and academic program of an adololescent with autism. *Focus on Autism and Other Developmental Disabilities, 16,* 94-103.

Carrow-Woolfolk, E. (1999). *Test for auditory comprehension of language (3rd ed.).* Austin, TX: Pro-Ed.

Carrow-Woolfolk, E. (2014). *Test for auditory comprehension of language (4th ed.).* Austin, TX: Pro-Ed.

Clendon, S., & Anderson, K. (2016). Syntax and morphology in aided language development. In M.M. Smith & J. Murray (Eds.), *The silent partner? Language, interaction and aided communication (pp119-140).* Surey, United Kingdom: J & R Press Ltd.

Dada, S. (2004). The impact of aided language stimulation on the receptive language abilities of children with little or no functional speech. Unpublished doctoral dissertation, University of Pretoria, Pretoria, South Africa.

Dada, S., & Alant, E. (2009). The effect of aided language stimulation on vocabulary acquisition in children with little or no functional speech. *American Journal of Speech-Language Pathology*. doi: 10.1044/1058-0360(2008/07-0018)

Dada, S., Murphy, Y., & Tönsing, K. (2017). Augmentataive and alternative communication practices: a descriptive study of the perceptions of South African speech-language therapists. *Augmentative and Alternative Communication, 33(4),* 189-200.

Dowden, P. (1997). Augmentative and alternative communication: Decision making for children with severely unintelligible speech. *Augmentative and Alternative Communication, 13,* 48-58.

Drager, K. D. ., Postal, V. J., Carrolus, L., Castellano, M., Gagliano, C., & Glynn, J. (2006). The effect of aided language modeling on symbol comprehension and production in 2 preschoolers with Autism. *American Journal of Speech-Language Pathology*, *15*(May), 112–125. doi: 1058-0360/06/1502-0112

Dunn, L.M., & Dunn, D.M. (1981). *Peabody picture vocabulary test -Revised.* Circle Pines, MN:AGS.

Dunn, L.M., & Dunn, D.M. (2007). *Peabody picture vocabulary test (4th ed.).* San Antonio, TX: Pearson.

Eliasson, A., Krumlinde-Sundholm, L., Rösblad, B., Beckung, E., Arner, M.,Ohrvall, A., & Rosenbaum, P. (2006). The manual ability classification system (MACS) for children

with cerebral palsy: scale development and evidence of validity and reliability. *Developmental Medicine & Child Neurology, 48(7), 549-554* .

Fenson, L., Dale, P., Reznik, S., Thal, D., Bates, E., Hartung, J., et al. (1993). *MacArther Communication Development Inventories: User's guide and technical manual.* San Diego, CA: Singular.

Franklin, K., Mirenda, P., & Phillips, G. (1996). Comparison of five symbol assessment protocols with non-disabled preschoolers and learners with severe cognitive intellectual disabilities. *Augmentative and Alternative Communication, 12,* 63-77.

Gast, D.L. (2014). General factors in measurement and evaluation. In D.L. Gast & J.R. Ledford (Eds), *Single case research research methodology applications in special education and behavioural sciences* (pp. 1-18). New York, NY: Routledge

Gast, D.L., & Ledford, J.R. (2014). Applied research in education and behavioural sciences. In D.L. Gast & J.R. Ledford (Eds), *Single case research research methodology applications in special education and behavioural sciences* (pp. 1-18). New York, NY: Routledge

Gast, D.L. & Spriggs, A.D. (2010). Visual analysis of graphic data. In D.L. Gast (Ed.), *Single Subject Research Methodology in Behavioural Sciences* (pp166-198). London: Psychology Press.

Gast, D.L., & Spriggs, A.D. (2014). Visual analysis of data. In D.L. Gast &J.R. Ledford (Eds), *Single case research research methodology applications in special education and behavioural sciences* (pp. 297-345). New York, NY: Routledge

Goossens, C. (1989). Aided communication intervention before assessment: a case study of a child with cerebral palsy. *Augmentative and Alternative Communication*, *5*. 14-26.

Goosens' C., & Crain, S. (1986). *Augmentative communication intervention resource.* Wauconda, IL: Don Johnson.

Goossens, C., Crain, S., & Elder, P. (1992). *Engineering the preschool environment for*

interactive, symbolic communication. Birmingham, AL: Southeast Augmentative Communication Conference Publications.

Goossens, C., Crain, S., & Elder, P.S. (1994). *Communication Displays for engineered Preschool Environments. Book II.* Solana Beach: MayerJohnson Company.

Harris, M. D., & Reichle, J. (2004). The impact of aided language stimulation on symbol comprehension and production in children with moderate cognitive disabilities. *American Journal of Speech-Language Pathology*, *13*(May), 155–167. doi: 1058-0360/04/1302-0155

Heller, K.W., Alberto, P.A., & Romski, M.A. (1995). Effect of object and movement cues on receptive communication by preschool children with mental retardation. *American*

Hendrick, D., Prather, E., & Tobin, A. (1984). *Sequenced Inventory of Communication Development.* Los Angeles: Western Psychological Services.

Horner, R.H., Swaminathan, H., Sugai, G., & Smolkowski (2012). Considerations for the systematic analysis and use of single-case research. *Education and Treatment of Children (35)*2, 269-290.

Kaufman, A.S., & Kaufman, N.L. (2004). *Kaufman Brief Intelligence Test Second Edition.* San Antonio, TX: Pearson

Kent-Walsh, J., Binger, C., & Buchanan, C. (2015). Teaching children who use augmentative and alternative communication to ask inverted Yes/No questions using aided modeling. *American Journal of Speech-Language Pathology, 24,* 222-236. doi: 10.1044/2015_AJSLP-14-0066

Kent-Walsh, J., Binger, C., & Hasham, Z. (2010). Effects of parent instruction on the symbolic communication of children using augmentative and alternative communication during storybook reading. *American Journal of Speech-Language Pathology, 19,* 97-107. doi: 10.1044/1058-0360(2010/09-0014)

Kratochwill, T.R., Hitchcock, J.H., Horner, R.H., Levin, J.R., Odom, S.L., Rindskopf, D.M.,

& Shadish, W.R. (2010). Single-case design technical documentation. Retrieved from What Works Clearinghouse website: http://ies.ed.gov/ncee/wwe/pdf/wwe/sed/pdf.

Kratochwill, T.R., Hitchcock, J.H., Horner, R.H., Levin, J.R., Odom, S.L., Rindskopf, D.M., & Shadish, W.R. (2013). Single-case intervention research design standards. *Remedial and Special Education 34*(1), 26-38. doi: 10.1177/0741932512452794

Kuoch, H. & Mirenda, P. (2003). Social story interventions for young children with autism spectrum disorders. *Focus on Autism and other Developmental Disabilities, 18,* 219-227.

Lancioni, G.E. (1983). Using pictorial representations as communication means with low-functioning children. *Journal of Autism and Developmental Disorders, 13(1),* 87-105. doi: 0162-3257/83/0300-008

Light, J. (1997). "Let's go star fishing: reflections on the contexts of language learning for children who use aided AAC. *Augmentative and Alternative Communication, 13,* 158-171. doi: 10.1080/07434619712331277978

Lloyd, L.L., Fuller, D., & Arvidson, H. (1997). *Augmentative and alternative communication: A handbook of principles and practice.* Boston: Allyn & Bacon.

Mayer-Johnson (2011). Boardmaker Plus v.6.0.6. Pitsburg, USA: DynaVox Systems LLC

McLaughlin, S. (2006). *Introduction to language development second edition.* Edmond, OK: Thomson Delmar Learning.

McMillan, J.H., & Schumaker, S. (2014). *Research in education evidence based enquiry (7th Edition).* Essex, United Kingdom:Pearson Education Limited.

Mervis, C.B., Bertrand, J. (1994). Acquisition of the novel name-name less category (N3C) principle. *Child Development, 65,* 1646-1662.

Mollica, B.S. (2003). Representational competence. In J.C. Light J.C., D.R. Beukelman and J. Reichle, J (Ed.), *Communicative competance for individuals who use AAC from research to effective practice* (pp 163-195). Baltimore, Maryland: Paul H. Brookes.

Parker, R. I., Vannest, K.J., Brown, L. (2009). The improvement rate difference for single case research. *Exceptional Children, 75,* 135-150. doi: 10.1177/0145445511399147

Paul, R., & Miller, J. (1995). *The clinical Assessment of Language Comprehension*. Baltimore: Brookes

Preis, J. (2006). The effect of picture communication symbols on the verbal comprehension of commands by young children with autism. *Focus on Autism and Other Developmental Disabilities*, *21*(4), 194–210.

Reynell, J.K., & Huntley, M. (1985). *Reynell Developmental Language Scale.* Windsor, England: Nfer-Nelson.

Romski. M.A., & Sevcik, R. (1988). Augmentative and alternative communication systems: considerations for individuals with severe intellectual disabilities. *Augmentative and Alternative Communication*, 4, 83-93. doi:10.1080/07434618812331274667.

Romski. M.A., & Sevcik, R. (1993). Language comprehension: considerations for augmentative and alternative communication. *Augmentative and Alternative Communication, 9*, 281-285.

Romski M, & Sevcik, R.A., (1992). Developing augmented language in children with severe mental retardation. In S.F. Warren & j. Reichle (Eds.), *Communication and language intervention series: Vol 1. Causes and effects in communication and language intervention* (pp. 113-130). Baltimore: Brookes.

Romski, M, & Sevcik, R.A., (1996). *Breaking the speech barrier: Language development through augmented means.* Baltimore, Maryland: Paul H. Brookes Publishing.

Romski, M, & Sevcik, R.A. (2003). Enhancing communication development. In J.C. Light, Beukelman, D.R. and Reichle, J (Ed.), *Communicative competance for individuals who use AAC from research to effective practice* (pp 147-162). Baltimore, Maryland: Paul H. Brookes.

Romski, M., Sevcik, R. A., Adamson, L. B., Cheslock, M., Smith, A., Barker, R. M., &

Bakeman, R. (2010). Randomised comparison of augmented and nonaugmented language intervertions for toddlers with developmental delays and their parents. *Journal of Speech, Language and Hearing Research*, *53*(April), 350–365. doi: 10.1044/1092-4388(2009/08-0156)

Romski, M., Sevcik, R. A., Robinson, B., & Bakeman, R. (1994). Adult-Directed communications of youth with mental retardation using the sysyem for augmenting language. *Journal of Speech and Hearing Research, 37*, 617-628.

Romski, M., Sevcik, R. A., Robinson, B., Mervis, C.B., & Bertrand, J. (1995). Mapping the meaning of novel visual symbols by youth with moderate or severe mental retardation. *American Journal on Mental Retardation, 100*, 391-402. doi: 0022-4685/94/3703-0617

Rosa-Lugo, L. I., and Kent-Walsh, J. (2008). Effects of parent instruction on communicative turns of Latino children using augmentative and alternative communication during storybook reading. *Communication Disorders Quarterly, 30*(1), 49-61. doi: 10.1177/1525740108320353

Schlosser, R. (1999). Comparative efficacy of interventions in augmentative and alternative communication. *Augmentative and Alternative Communication*, *15*(1), 56–68. doi: 10.1080/07434619912331278575

Schlosser, R.W. (2003). Single-Sunject experimental designs. In R.W. Schlosser (Ed.), *The efficacy of augmentative and alternative communication: Towards eveidence-based practice (pp 85-145).* San Diego, California: Elsevier Science.

Schlosser, R.W., Belfiore, P.J., Nigam, R., Blischak, D., & Hetzroni, O. (1995). The effects of speech output technologyin the learning of graphic symbols. *Journal of Applied Behavior Analysis, 28*, 537-549.

Scruggs, T.E., & Mastropieri, M.A. (2001). How to summarise single-participant research: Ideas and applications. *Exceptionality: A Special Education Journal, 9,* 227-244. doi: 10.1207/S15327035EX09045

Scruggs, T.E., & Mastropieri, M.A. (2013). PND at 25: Past, present, and future trends in summarizing single-subject research. R*emedial and Special Education. 34,* 9-19. doi:10.1177/0741932512440730.

Sennott, S. C., Light, J. C., & McNaughton, D. (2016). AAC modeling intervention research review. *Research and Practice for Persons with Severe Disabilities*, *41*(2), 101–115. doi:10.1177/1540796916638822

Smith, A.L., Barker, R.M., Barton-Hulsey, A., Romski, M. & Sevcik., R.A. (2016). In Sevcik, R.A. & Romski, M. (Ed.), *Communication interverventions for individuals with severe disabilities explorinf research challenges and opportunities (pp123-145).* Baltimore, Maryland: Paul H. Brookes Publishing Company.

Smith, M. (2006). Speech, language and aided communication: Connections and questions in a developmental context. *Disabilityand Rehabilitation, 28*(3), 151-157. doi: 10.1080/0963820500077747

Smith, M.M., & Grove, N.C. (2003). Asymetry in input and output for individuals who use AAC. In J.C. Light J.C., D.R. Beukelman and J. Reichle, J (Ed.), *Communicative competance for individuals who use AAC from research to effective practice* (pp 163-195). Baltimore, Maryland: Paul H. Brookes.

Solomon-Rice, P.L., & Soto, G. (2014). Facilitating vocabulary in toddlers using AAC: A preliminary study comparing focused stimulation and augmented input. *Communication Didorders Quarterly, 35,* 204-215.

Tawney, J.W., & Gast, D.L. (1984). *Single subject research in special education.* Columbus:Charles. E. Merrill.

Taylor, R., & Lacono, T. (2003). AAC and scripting activities to facilitate communication and play. *Advances in Speech Language Pathology, 5*(2), 79-93. doi: 10.1080/14417040510001669111

Tönsing, K.M., Alant, E., & Lloyd, L.L. (2005). Augmentatative and alternative

communication. In E. Alant and L.L. Lloyd (Eds), *Augmenatative and alternative communication and severe disabilities: Beyond poverty.* (pp. 30-67). London: Whurr.

von Tetzchner, S & Martinsen, H. (1992). *Introduction to symbolic and augmentative communication.* London: Whurr Publishers.

von Tetzchner, S., Grove, N., Loncke, F., Barnett, S., Woll, B., & Clibbens, J. (1996). Preliminaries to a comprehensive model of augmenative and alternative comunication. In S. von Tetzchner & M.H. Jensen (Eds.), *European perspectives on augmentative and alternative communication* (pp.19-36).

Wilkinson, K.M., & Hennig, S. (2007). The state of research and practice in augmentative and alternative communication for children with developmental/Intellectual disabilities. *Mental Retardation and Developmental Disabilities (13), 58-69.*

Wolery, W., Gast, D.L., & Ledford, J.R. (2014). Comparison designs. In D.L. Gast & J.R. Ledford (Eds), *Single case research research methodology applications in special education and behavioural sciences* (pp. 297-345). New York, NY: Routledge.

Wood, L.A., Lasker, J., Sigel-Causkey, E., Beukelman, D., & Ball, L. (1998). Input framework for augmentative and alternative communication. *Augmentative and Alternative Communication, 14,* 261-267.

APPENDICES

Appendix 1: Ethics approval from the University of Pretoria

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities
Research Ethics Committee

14 December 2017

Dear Ms Laher

Project:	**The effect of frequency of aided language stimulation on the receptive vocabulary acquisition in children with little or no functional speech and intellectual disability**
Researcher:	**Z Laher**
Supervisor:	**Prof S Dada**
Department:	**Centre for Augmentative and Alternative Communication**
Reference number:	**98088336 (GW20171038HS)**

Thank you for your response to the Committee's letter of 6 November 2017.

I have pleasure in informing you that the Research Ethics Committee formally **approved** the above study at an *ad hoc* meeting held on 14 December 2017. 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: tracey.andrew@up.ac.za

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

Research Ethics Committee Members: Prof MME Schoeman (Deputy Dean); Prof KL Harris; Mr A Bizos; Dr L Blokland; Ms A dos Santos; Dr R Fasselt; Ms KT Govinder; Dr E Johnson; Dr C Paneblanco; Dr C Puttergill; Dr D Reyburn; Dr M Soer; Prof E Taljard; Prof V Thebe; Ms B Tsebe; Ms D Mokalapa

Appendix 2: Approval of research - Gauteng Department of Education (GDE)

GAUTENG PROVINCE
Department: Education
REPUBLIC OF SOUTH AFRICA

8/4/4/1/2

GDE RESEARCH APPROVAL LETTER

Date:	04 December 2017
Validity of Research Approval:	05 February 2018 – 28 September 2018 2017/336
Name of Researcher:	Laher Z
Address of Researcher:	[redacted]
	[redacted]
	[redacted]
Telephone Number:	[redacted]
Email address:	[redacted]
Research Topic:	The effect of frequency of aided language stimulation on the receptive vocabulary acquisition in children with little or no functional speech and intellectual disability
Number and type of schools:	One LSEN School
District/s/HO	[redacted]

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.

04/12/2017

1

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

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 outlines 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
CES: Education Research and Knowledge Management

DATE: 04/12/2017

Office of the Director: Education Research and Knowledge Management
7th Floor, 17 Simmonds Street, Johannesburg, 2001
Tel: (011) 355 0488
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Appendix 3: Principal information and permission letter

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities

October 2017

PERMISSION LETTER TO SCHOOL PRINCIPAL

Dear Principal

REQUEST TO CONDUCT RESEARCH AT YOUR INSTITUTION

I am currently a master's student at the Centre of Augmentative and Alternative Communication at the University of Pretoria. In partial fulfilment of the requirements of this degree I am conducting a study to determine the effect of frequency of aided language stimulation on the receptive language acquisition in children with little or no functional speech and intellectual disability. This research project is being conducted under the supervision of Prof Shakila Dada.

Rationale for the study

For learners who have little or no functional speech Augmentative and Alternative Communication (AAC) offers and means to assist in expressing their needs, wants, thoughts and feelings as well as developing social relationships. Proficient use of AAC for communication is a goal of intervention. Research has shown that an Aided Language Stimulation is a strategy that may assist learners with little or no functional speech and intellectual disability to acquire receptive language skills.

Aided Language Stimulation involves a facilitator (teacher, parent, therapist, caregiver) pointing to a picture symbol on a facilitator communication board and providing ongoing verbal language input (Goossens', 1989). While there is evidence to suggest that Aided Language Stimulation improves understanding of vocabulary, there is no known evidence of how much Aided Language Stimulation is required. This study therefore aims to determine the effect of 40% and 70% of aided language input on the receptive vocabulary acquisition of children with little to no functional speech and intellectual disability.

Objectives of the study

The main objective of the study is to compare the effect of aided language stimulation with a frequency of 40% and 70% respectively on the receptive language abilities of children with little or no functional speech and intellectual disability during a craft activity and a procedural

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www.caac.up.ac.za

discourse activity. During the process of attaining the main objective of the study the following sub-aims will be considered:

1. To determine the effect of 40% of aided language stimulation on the acquisition of target receptive vocabulary items of children with little or no functional speech and intellectual disability.
2. To determine the effect of 70% of aided language stimulation on the acquisition of target receptive vocabulary items of children with little or no functional speech and intellectual disability.
3. To compare the efficiency of 70% and 40% of aided language stimulation on the acquisition of target receptive vocabulary items of children with little or no functional speech and intellectual disability.

Expectations of the school

Upon approval of this request, permission will be granted to the researcher to conduct the study at your school.

This will involve providing the researcher with names of learners who have intellectual disabilities as this will assist in identification and recruitment of participants. Participants will be assessed and those who meet the selection criteria will be included in either the pilot or main study. You will be granting the researcher permission the use of a classroom, chairs, desks, tables and an interactive white board for the duration of the study. You would grant the researcher permission to withdraw learners from class to complete the study with in agreed upon non academic times.

The pre assessment will take approximately 2 hours per participant. In addition, intervention will occur for fifteen minute over a period of eight days. The intervention will include stimulating language comprehension using aided language stimulation. Thereafter, there will be a withdrawal of the intervention will occur for five days followed by a maintenance assessment that will be conducted once a week for three weeks.

Pending consent from parents and assent from participants, you will be granting the researcher permission to video-record sessions conducted with participants during the research period. Video recordings are part of the data collection process and will be treated as confidential.

Who can participate in this study

Specific selection criterial have been set out for children to participate in this study related to their age and receptive language skills. The potential participants parents and/or guardians should give their informed consent for their children's participation in the study. Participanst will also be required to provide their assent.

Access to results of the study

Upon completion of the study research results will be presented to the principal, teachers, parents and participants. Research data will be stored in hard copy and electronic copy at the University of Pretoria for fifteen years as part of the ethical requirements of the University. All data will be

the effect of 40% and 70% of aided language input on the receptive vocabulary acquisition of children with little to no functional speech and intellectual disability.

Objectives of the study

The main objective of the study is to compare the effect of aided language stimulation with a frequency of 40% and 70% respectively on the receptive language abilities of children with little or no functional speech and intellectual disability during a craft activity and a procedural discourse activity. During the process of attaining the main objective of the study the following sub-aims will be considered:

1. To determine the effect of 40% of aided language stimulation on the acquisition of target receptive vocabulary items of children with little or no functional speech and intellectual disability.
2. To determine the effect of 70% of aided language stimulation on the acquisition of target receptive vocabulary items of children with little or no functional speech and intellectual disability.
3. To compare the efficiency of 70% and 40% of aided language stimulation on the acquisition of target receptive vocabulary items of children with little or no functional speech and intellectual disability.

Expectations of the school

Upon approval of this request, permission will be granted to the researcher to conduct the study at your school.

This will involve providing the researcher with names of learners who have intellectual disabilities as this will assist in identification and recruitment of participants. Participants will be assessed and those who meet the selection criteria will be included in either the pilot or main study. You will be granting the researcher permission the use of a classroom, chairs, desks, tables and an interactive white board for the duration of the study. You would grant the researcher permission to withdraw learners from class to complete the study with in agreed upon non academic times.

The pre assessment will take approximately 2 hours per participant. In addition, intervention will occur for fifteen minute over a period of eight days. The intervention will include stimulating language comprehension using aided language stimulation. Thereafter, there will be a withdrawal of the intervention will occur for five days followed by a maintenance assessment that will be conducted once a week for three weeks.

Pending consent from parents and assent from participants, you will be granting the researcher permission to video-record sessions conducted with participants during the research period. Video recordings are part of the data collection process and will be treated as confidential.

Who can participate in this study

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their informed consent for their children's participation in the study. Participanst will also be required to provide their assent.

Access to results of the study

Upon completion of the study research results will be presented to the principal, teachers, parents and participants. Research data will be stored in hard copy and electronic copy at the University of Pretoria for fifteen years as part of the ethical requirements of the University. All data will be treated confidentially. Results may be shared in article formats with other professionals and at conference presentations, without identifying the school or the participants.

Contact details

Should you require any further information you are welcome to contact the researcher on 0812709786 or the research supervisor Professor Shakila Dada on (012) 420-3851.
Please find attached copies of the letters and permission slips that will be sent to parents/guardians of learners who meet the selection criteria of this study. I trust that information provided is sufficient to enable you to grant the researcher permission to conduct the proposed study at your school. It would be much appreciated if you would complete the attached reply slip as proof of permission being granted for this study to be conducted at your school.

Yours Sincerely

Zakiyya Laher
Student
[redacted]

Prof. Shakila Dada
Supervisor
[redacted]

REPLY SLIP

PERMISSION TO CONDUCT THE STUDY

TOPIC

The effect of frequency of aided language stimulation on the receptive language acquisition in children with little or no functional speech

Zakiyya Laher
Researcher
[redacted]

Prof. Shakila Dada
Supervisor
[redacted]

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

Place tick where appropriate:

☐ I do consent to participate in the study and that

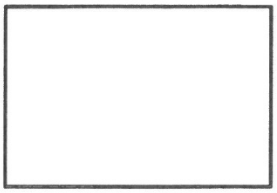
1) We have received and read the request to conduct research at this institution from Zakiyya Laher.
2) We understand that requirements for the completion of the study.
3) We agree to allow Zakiyya Laher to conduct the study at (*School name*)_____ in accordance with the requirements stipulated in the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

☐ I do consent to participate in the study and that

Signed at _____ on the _____ of _____ 2017

Signature of School Principal _____

Signature of Student researcher _____
School Stamp



Appendix 4: SGB information and permission letter

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities

October 2017

PERMISSION LETTER TO SCHOOL GOVERNING BODY

[redacted]

Dear SGB Members

REQUEST TO CONDUCT RESEARCH AT YOUR INSTITUTION

I am currently a master's student at the Centre of Augmentative and Alternative Communication at the University of Pretoria. In partial fulfilment of the requirements of this degree I am conducting a study to determine the effect of frequency of aided language stimulation on the receptive language acquisition in children with little or no functional speech and intellectual disability. This research project is being conducted under the supervision of Prof Shakila Dada.

Rational for the study

For learners who have little or no functional speech augmentative and alternative communication (AAC) has become the best communication modality to assist in expressing their needs, wants and thoughts. Proficient use of AAC is dependent on various aspects. One of the aspects is the ability to understand language. Greater understanding of language is crucial in developing the expressive use of language as well as aiding understanding of vocabulary and in turn concepts. Research has shown that an aided language stimulation assists learners with little or no functional speech and intellectual disability with receptive language acquisition. Aided language stimulation involves a facilitator (teacher, parent, therapist, caregiver) pointing to a picture symbol on a facilitator communication board and providing ongoing verbal language input (Goossens', 1989). Aided language stimulation has proven to result in greater use of symbols and improved understanding of vocabulary. The question of how much aided language stimulation a learner requires to show improvement in receptive vocabulary learning has arisen. Studies have shown that 70% and more aided language input results in improvement. This study aims to determine

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wwwcaac.up.ac.za

the effect of 40% and 70% of aided language input on the receptive vocabulary acquisition of children with little to no functional speech and intellectual disability.

Objectives of the study

The main objective of the study is to compare the effect of aided language stimulation with a frequency of 40% and 70% respectively on the receptive language abilities of children with little or no functional speech and intellectual disability during a craft activity and a procedural discourse activity. During the process of attaining the main objective of the study the following sub-aims will be considered:

1. To determine the effect of 40% of aided language stimulation on the acquisition of target receptive vocabulary items of children with little or no functional speech and intellectual disability.
2. To determine the effect of 70% of aided language stimulation on the acquisition of target receptive vocabulary items of children with little or no functional speech and intellectual disability.
3. To compare the efficiency of 70% and 40% of aided language stimulation on the acquisition of target receptive vocabulary items of children with little or no functional speech and intellectual disability.

Expectations of the school

Upon approval of this request, permission will be granted to the researcher to conduct the study at your school.

This will involve providing the researcher with names of learners who have intellectual disabilities as this will assist in identification and recruitment of participants. Participants will be assessed and those who meet the selection criteria will be included in either the pilot or main study. You will be granting the researcher permission the use of a classroom, chairs, desks, tables and an interactive white board for the duration of the study. You would grant the researcher permission to withdraw learners from class to complete the study with in agreed upon non academic times.

The pre assessment will take approximately 2 hours per participant. In addition, intervention will occur for fifteen minute over a period of eight days. The intervention will include stimulating language comprehension using aided language stimulation. Thereafter, there will be a withdrawal of the intervention will occur for five days followed by a maintenance assessment that will be conducted once a week for three weeks.

Pending consent from parents and assent from participants, you will be granting the researcher permission to video-record sessions conducted with participants during the research period. Video recordings are part of the data collection process and will be treated as confidential.

Who can participate in this study

Specific selection criterial have been set out for children to participate in this study related to their age and receptive language skills. The potential participants parents and/or guardians should give

their informed consent for their children's participation in the study. Participanst will also be required to provide their assent.

Access to results of the study

Upon completion of the study research results will be presented to the principal, teachers, parents and participants. Research data will be stored in hard copy and electronic copy at the University of Pretoria for fifteen years as part of the ethical requirements of the University. All data will be treated confidentially. Results may be shared in article formats with other professionals and at conference presentations, without identifying the school or the participants.

Contact details

Should you require any further information you are welcome to contact the researcher on 0812709786 or the research supervisor Professor Shakila Dada on (012) 420-3851.
Please find attached copies of the letters and permission slips that will be sent to parents/guardians of learners who meet the selection criteria of this study. I trust that information provided is sufficient to enable you to grant the researcher permission to conduct the proposed study at your school. It would be much appreciated if you would complete the attached reply slip as proof of permission being granted for this study to be conducted at your school.

Yours Sincerely

Zakiyya Laher
Student
[redacted]

Prof. Shakila Dada
Supervisor
[redacted]

REPLY SLIP

PERMISSION TO CONDUCT THE STUDY

TOPIC

The effect of frequency of aided language stimulation on the receptive language acquisition in children with little or no functional speech

I , _____, Chairman of the SGB of (*School name*) hereby stipulate that:

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

Signed at _____ on the _____ of _____ 2017.

_____

Chairman of SGB

School Stamp

Appendix 5: Parent information and consent letter

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities

October 2017

Dear Parent/ Guardian

I am a master's student at the Centre of Augmentative and Alternative Communication at the University of Pretoria. In partial fulfilment of the requirements of this degree I am conducting a study to determine the effect of frequency of aided language stimulation on the receptive language acquisition in children with little or no functional speech and intellectual disability. Prof Shakila Dada is the supervisor on this project.

Rationale for the study

For learners who have little or no functional speech Augmentative and Alternative Communication (AAC) offers and means to assist in expressing their needs, wants, thoughts and feelings as well as developing social relationships. Proficient use of AAC for communication is a goal of intervention. Research has shown that an Aided Language Stimulation is a strategy that may assist learners with little or no functional speech and intellectual disability to acquire receptive language skills.

Aided Language Stimulation involves a facilitator (teacher, parent, therapist, caregiver) pointing to a picture symbol on a facilitator communication board and providing ongoing verbal language input (Goossens', 1989). While there is evidence to suggest that Aided Language Stimulation improves understanding of vocabulary, there is no known evidence of how much Aided Language Stimulation is required. This study therefore aims to determine the effect of 40% and 70% of aided language input on the receptive vocabulary acquisition of children with little to no functional speech and intellectual disability.

Aim of the study

The main aim of the study is to compare the effect of aided language stimulation with a frequency of 40% and 70% respectively on the receptive language abilities of children with little or no functional speech and intellectual disability during a craft activity and a procedural discourse activity.

Procedure

Should your child meet the selection criteria of the study he or she will:

1. Be required to assent to participate in the study

Fakulteit Geesteswetenskappe
Lefapha la Bomotho

Centre for Augmentative and Alternative Communication, Room 2-36, Com path Building, Lynnwood Road
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Email saak@up.ac.za
www.caac.up.ac.za

2. Will undergo language assessments in English as well as their home language.
3. Will be part of a group intervention where they will make a pen holder and plant a seed while receiving aided language stimulation to teach them new vocabulary associated with these activities
4. Will undergo assessment to determine if they learnt new vocabulary
5. Intervention and assessment sessions will be video recorded and will be treated confidentially.
6. The interventions and assessments will not interfere with your child's academic time.

Expectation of you as a parent
Should you wish for your child to participate in the study your will be required to:
1. Complete the reply slip
2. Complete a parent questionnaire regarding your child's age, diagnosis, home language, vocabulary knowledge, previous assessments and therapy and abilities at home

Risks and benefits to you child
There will be no harm or risk to participants during this study. There is no direct benefit to you as a parent, however your child may benefit from the aided language stimulation program and may contribute to the development of more effective teaching methods for learners with little to no functional speech and intellectual disabilities.

Rights of participants
You as parents and/or guardians have the right to withdraw your child from the study at any time without any consequence. Your child has the right to withdraw from the study at any time without any consequence. Participation is voluntary.

Access to results of the study
Following the completion of the study, research results will be available to you in written format. Research data will be stored in hard copy and electronic copy at the University of Pretoria for fifteen years as part of the ethical requirements of the University. Results may be shared in article formats with other professionals and at conference presentations, however names of participants and the name of the school will not be disclosed at any time.

Contact details
Should you require any further information you are welcome to contact us. Kindly complete the attached reply slip.

Laher
Zakiyya Laher
Student
[redacted]

Dada
Prof. Shakila Dada
Supervisor
[redacted]

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UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities

Official use:
Participant nr:

Please complete this form and return it by hand in the envelope provided to the teacher

PARENTAL INFORMED CONDENT: CONSENT REPLY SLIP

RESEARCH TITLE: *The effect of frequency of aided language stimulation on the receptive language acquisition in children with little or no functional speech.*

Your Child's Name: _____

Your Name: _____

Date: _____

Research Student: Zakiyya Laher

Supervisor: Prof. Shakila Dada

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

I hereby (*please tick to indicate consent*):

☐ **Voluntarily declare my consent for my child to participate in this study.**
Accordingly, I consent to the following research conditions:

☐ Completing a parent questionnaire and providing the researcher with information regarding my child's name, age, home language, pre-existing conditions, vision and hearing competency, previous and current therapies and ability to perform everyday tasks.

☐ The use of video recordings of the research sessions of the group of which my child will form a part. I understand that these recordings will be used for data collection and analysis purposes and may be used as part of a presentation of the research findings at conferences.

OR

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

_____ _____

Signature of Parent/Guardian of Participant **Date**

Appendix 6: Teacher information and consent letter

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities

October 2017

Dear Teacher

REQUEST TO CONDUCT RESEARCH AT YOUR INSTITUTION

I hereby wish to inform you that I have received permission to conduct my proposed research study at your institution.

Research topic

The effect of frequency of aided language stimulation on the receptive language acquisition in children with little or no functional speech.

Rational for the study

For learners who have little or no functional speech augmentative and alternative communication (AAC) has become the best communication modality to assist in expressing their needs, wants and thoughts. Proficient use of AAC is dependent on various aspects. One of the aspects is the ability to understand language. Greater understanding of language is crucial in developing the expressive use of language as well as aiding understanding of vocabulary and in turn concepts. Research has shown that an aided language stimulation assists learners with little or no functional speech and intellectual disability with receptive language acquisition. Aided language stimulation involves a facilitator (teacher, parent, therapist, caregiver) pointing to a picture symbol on a facilitator communication board and providing ongoing verbal language input (Goossens', 1989).

Aided language stimulation has proven to result in greater use of symbols and improved understanding of vocabulary. The question of how much aided language stimulation a learner requires to show improvement in receptive vocabulary learning has arisen. Studies have shown that 70% and more aided language input results in improvement. This study aims to determine the effect of 40% and 70% of aided language input on the receptive vocabulary acquisition of children with little to no functional speech and intellectual disability.

Objectives of the study

The main objective of the study is to compare the effect of aided language stimulation with a frequency of 40% and 70% respectively on the receptive language abilities of children with little or no functional speech and intellectual disability during a craft activity and a procedural discourse activity.

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
wwwcaac.up.ac.za

Faculty of Humanities
Fakulteit Geesteswetenskappe
Lefapha la Bomotho

Expectations of you as the teacher

Upon approval of this by the principle, you are requested to assist in the following way:
You will be required to identify learners that may have less that fifteen intelligible words aged between 8 and 12 years. You will be required to complete a teacher questionnaire regarding learner biographical information, diagnosis, functioning in various classroom based activities. Only relevant information pertaining to disability, age, gender, therapies received and home language will be accessed by the researcher. All information will be treated as strictly confidential.

Pending consent from parents and assent from participants, you would allow participants meeting the selection criteria to leave the classroom during the intervention period (approximately 3 weeks), during times that do not conflict with teaching times. Thereafter, intervention will be withdrawn for one week and I would need to see the participants once a week for three weeks.

Access to results of the study

Upon completion of the study research results will be presented to the principal, teachers, parents and participants. Research data will be stored in hard copy and electronic copy at the University of Pretoria for fifteen years as part of the ethical requirements of the University. Results may be shared in article formats with other professionals and at conference presentations with out any identifying information.

Contact details

Participation in this study is voluntary and you may with draw from the study at any time.

Should you require any further information you are welcome to contact us at the details below.

It would be appreciated if you would complete the attached reply slip.

Yours Sincerely

Zakiyya Laher
Researcher
[redacted]
laherz@hotmail.co.za

Prof. Shakila Dada
Supervisor
[redacted]
shakila.dada@up.ac.za

REPLY SLIP

Consent to participate in the research study

TOPIC

The effect of frequency of aided language stimulation on the receptive language acquisition in children with little or no functional speech

Zakiyya Laher
Researcher
[redacted]

Prof. Shakila Dada
Supervisor
[redacted]

I, _____, a teacher at (*School name*) _____ hereby stipulate that:

Place tick where appropriate:

☐ I do consent to participate in the study and that

1) I have received and read the request to conduct research at this institution from Zakiyya Laher.
2) I understand that requirements for the completion of the study.
3) I agree to assist Zakiyya Laher with the identification of possible 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

Signed at _____ on the _____ of _____ 201__.

_____
Teacher

Appendix 7: Parent questionnaire

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Faculty of Humanities

Biographical Questionnaire for parents

Dear parent/guardian

Many thanks for allowing your child to participate in this study. Could you please complete the questions below and return in the envelope provided to the school.

Many thanks

Zakiyya Laher

Official use:

Participant nr:

BIOGRAPHICAL INFORMATION:

Childs Name: _____
Childs Date of Birth: _____
Gender: _____
Diagnosis: _____
What language/languages is your child exposed to at home? _____
_____

Please tick (√) the relevant answer:

CURRENT THERAPY RECEIVED:

	YES	NO
1. Is your child currently receiving speech therapy?		
2. Does your child use an Augmentative and Alternative Communication (AAC) device at home?		

VISION

	YES	NO
3. Does your child have any visual problems?		
4. Does your child wear glasses?		

HEARING

	YES	NO

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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

5. Does your child have any hearing difficulties?		
6. Does your child use a hearing aid?		
7. Does your child respond when being called?		

MOTOR SKILLS

	YES	NO
8. Can your child point to items/objects they want?		
9. Can your child use a spoon to feed themselves?		
10. Can your child peel off a sticker and place it on a target or on a piece of paper or object?		
11. Can your child use a pair of scissors to cut paper?		
12. Can your child use a pencil to write their name?		
13. Can your child hold a glass to drink water?		
14. Can your child open and close buttons on a shirt independently?		
15. Can your child dress independently?		
16. Can your child open or close a zip independently?		
17. Can your child open or close a door independently?		

VOCABULARY CHECKLIST

Please place a √ next to each word. A tick under the **YES** column will mean your child understands the word. A tick under the **NO** column will mean your child does not understand the word. If you are not sure if your child understands the word or not please place a √ under the **UNSURE** column. Pease see example below:

Example:

WORD	YES	NO	UNSURE
tortoise		√	

Please complete:

WORD	YES	NO	UNSURE
Kiwi			
Arrow			
On			
Furry			
Cactus			
Violin			
Under			
On			

Appendix 8: Teacher questionnaire

UNIVERSITEIT VAN PRETORIA
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Faculty of Humanities

Biographical Questionnaire for Teachers

Dear teacher

Many thanks for your assistance with the research study. Could you please complete the questions below regarding (*learners name*) so that I may have a better understanding of him/her.

Thanking you in advance

Zakiyya Laher

Official use:

Participant nr:

BIOGRAPHICAL INFORMATION:

Learners Name: _____
Learners Date of Birth: _____
Gender: _____
Diagnosis: _____
How long has the learner been at this school? _____
How long has the learner been in your class? _____

Please tick (√) the relevant answer:

CURRENT THERAPY RECEIVED:

	YES	NO
1. Does the learner currently receive speech therapy?		
2. Does the learner use an Augmentative and Alternative Communication (AAC) device at school?		

VISION

	YES	NO
3. Does the learner have any visual problems?		
4. Does the learner wear glasses?		
5. Is the learner able to see pictures displayed on the Interactive White Board?		

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Lefapha la Bomotho

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Email saak@up.ac.za
www.caac.up.ac.za

HEARING

	YES	NO
5. Does the learner have any hearing difficulties?		
6. Does the learner use a hearing aid?		
7. Does the learner respond when being called by a person not facing him/her?		
8. Does the learner have any difficulty hearing you in the classroom environment?		

MOTOR SKILLS

	YES	NO
8. Can the learner point to objects they want?		
9. Can the learner hold a pencil?		
10. Can the learner peel off a sticker and place it on a piece of paper or object?		
11. Can the learner hold a pair of scissors to cut paper?		
12. Can the learner write their name?		
13. Can the learner hold a glass to drink water and drink independently?		
14. Can the learner open/close their lunch box independently?		
15. Can the learner eat their snack/lunch independently?		
16. Can the learner grasp and release small items such as beads or pegs on a peg board?		

COGNITIVE

	YES	NO
17. Can the learner identify objects by pointing to them?		
18. Can the learner follow one part instructions?		
19. Can the learner listen to an instruction without interrupting?		
20. Can the learner select one object from an array of four objects presented to them?		
21. Can the learner concentrate on a task for 15 minutes?		
22. Can the learner attend to the Interactive White board for 15 minutes?		
23. Can the learner divert their attention from the Interactive White Board to the activity at hand and then back to the Interactive White Board?		

LANGUAGE OF LEARNING AND TEACHING

	YES	NO
24. Does the learner understand English as the language of learning and teaching?		
25. Can the learner use English as the language of learning and teaching to communicate?		

COMMUNICATION AND PICTURE COMMUNICATION SYMBOLS

	YES	NO
26. Has the learner been exposed to Boardmaker picture communication symbols at school?		
27. Can the learner recognise Boardmaker picture communication symbols during lessons?		
	YES	**NO**
28. Does the learner use gesture to communicate?		
29. Does the learner use key word signing to communicate?		
30. Does the learner use picture communication symbols to communicate?		

VOCABULARY CHECKLIST

Please place a √ next to each word. A tick under the **YES** column indicates the learner understands the word. A tick under the **NO** column indicates the learner does not understand the word. If you are uncertain if the learner understands the word or not please place a √ under the **UNSURE** column. Pease see example below:

Example:

WORD	YES	NO	UNSURE
tortoise		√	

Please complete:

WORD	YES	NO	UNSURE
Kiwi			
Arrow			
On			
Furry			
Cactus			
Violin			
Under			
Tall			

Please feel free to mention any additional information here:

_____

_____

_____

_____

_____

_____

_____

Appendix 9: Intervention script for 40% AiLgS intervention

AiLgS highlighted in yellow

Hello everyone

I am so happy you are all here to help me

We are going to make a KIWI

Then we will shoot it with an ARROW

A KIWI is a fruit

I like KIWI

It is tasty and FURRY

Do you like KIWI?

Do you like KIWI?

Do you like KIWI?

Do you like KIWI?

Here is a FURRY KIWI ON a plate

It has a FURRY brown peel with fur ON it

Feel it

It feels FURRY

Feel it

It feels FURRY

Feel it

It feels FURRY

Feel it

It feels FURRY

Look at the KIWI ON the plate

Let me cut it so you can see how it looks inside

Look it is green inside

With a FURRY brown peel

Look this is what we need to make it

We need green clay

We need brow clay

It feels FURRY

This is what we need to make it FURRY

We are going to make it FURRY by putting fur ON it

Look here is the fur we will put ON to make it FURRY

We will make a FURRY KIWI and then shoot it with an ARROW

Look here is the ARROW ON the table

You like shooting with an ARROW

I like shooting with an ARROW

Let me get the clay

We need green clay to make the inside

We need to put brown clay ON the green clay to make the peel

We need to put fur ON to make it FURRY

Let me start rolling the clay

Now we must put the brown clay ON the green clay

Let me take some brown clay and put it ON the KIWI

Who wants to put more brown clay ON the KIWI?

Put the clay ON the KIWI

Who wants to put more brown clay ON the KIWI?

Put the clay ON the KIWI

Now let us make the it FURRY

Put the fur ON the KIWI to make it FURRY

The fur will make it FURRY

Who wants to put more fur ON the KIWI?

Put the fur ON the KIWI to make it FURRY

Who wants to put more fur ON the KIWI?

Put the fur ON the KIWI to make it FURRY

Look it is ON the table

We have a FURRY one to shoot with an ARROW

Now let us shoot it with an ARROW

Look I will shoot it with the ARROW

Did I hit it with an ARROW?

Who wants to shoot it with an ARROW?

Ok you shoot it with an ARROW

Did you hit it with the ARROW?

No

Now you shoot it with an ARROW

Did you hit it with the ARROW?

No

Now you shoot it with an ARROW

Did you hit it with the ARROW?

No

Now you shoot it with an ARROW

Did you hit it with the ARROW?

No

Did you have fun shooting the ARROW?

I had fun shooting the ARROW

Appendix 10: Intervention script for 70% AiLgS intervention

AiLgS highlighted in yellow

Hello everybody!

I need some help to make mums mother's day present

We are going to plant a seed to grow a CACTUS

Who is ready to plant a seed to grow a CACTUS?

Look this is a TALL CACTUS

Look this is what we need to grow a CACTUS

We need a TALL pot

We need sand

We need seeds

We need a VIOLIN

Look the VIOLIN is UNDER the table

A VIOLIN plays beautiful music

Why do we need a VIOLIN?

If we play music with a VIOLIN it will help our CACTUS grow TALL

Water, sunshine and music from the VIOLIN will help our CACTUS grow TALL

Look here is the TALL pot

Is this the TALL pot?

No, this is the TALL pot

Let me put sand into the TALL pot

Let me put more sand

Let me plant a seed UNDER the sand

Let me press the seed UNDER the sand

The seed needs to go UNDER the sand so it can grow

We will press the seed UNDER the sand

We need more seeds UNDER the sand

Who wants to press the seed UNDER the sand?

Press the seed UNDER the sand

Look the seed is UNDER the sand

Who wants to press the seed UNDER the sand?

Press the seed UNDER the sand

Look the seed is UNDER the sand

Who wants to press the seed UNDER the sand?

Press the seed UNDER the sand

Look the seed is UNDER the sand

Who wants to press the seed UNDER the sand?

Press the seed UNDER the sand

Look the seed is UNDER the sand

Do we want our CACTUS to grow TALL?

Yes

Look we want a TALL CACTUS like this one

Is this a TALL CACTUS?

No

Is this a TALL CACTUS?

Yes this is a TALL CACTUS

Now we need to water the seed so our CACTUS can grow TALL

Look the water is UNDER the table

What else can we do to make our CACTUS grow TALL?

We can play music with our VIOLIN to help our CACTUS grow TALL

The VIOLIN is UNDER the table

Who can help me play the VIOLIN?

Look this is how you play the VIOLIN

You hold the VIOLIN like this

You can play the VIOLIN

Good now our CACTUS will grow TALL

You play the VIOLIN so beautifully

Now you can play the VIOLIN

Good now our CACTUS will grow TALL

You play the VIOLIN so beautifully

Now you can play the VIOLIN

Good now our CACTUS will grow TALL

You play the VIOLIN so beautifully

Now you can play the VIOLIN

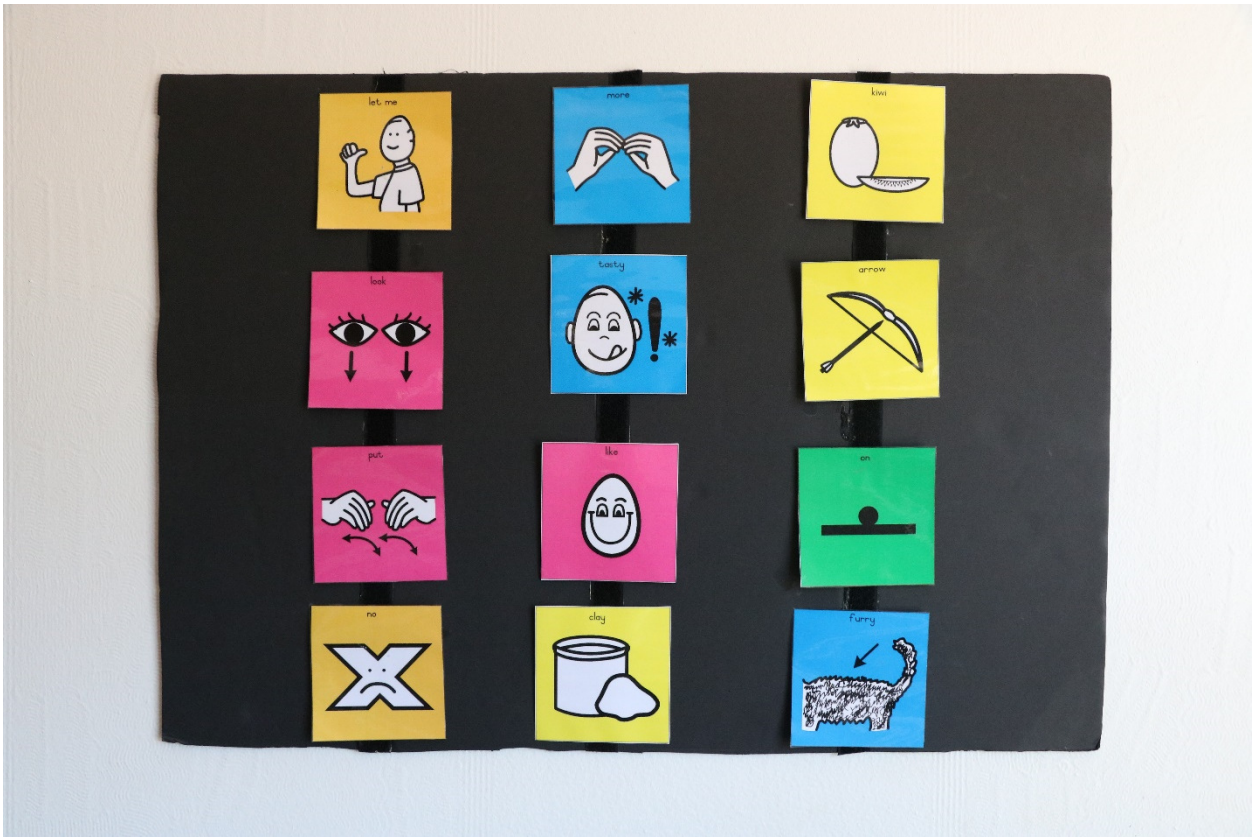
You play the VIOLIN so beautifully

Good now our CACTUS will grow TALL

Our CACTUS will grow because we played the VIOLIN

Will our CACTUS be beautiful?

Appendix 11: Facilitator board for 40% AiLgS intervention



Appendix 12: Facilitator Board for 70% AiLgS Intervention

Appendix 13: Probe script for auditory stimuli to object matching probe

Hello! I am going to ask you a question and you have to point to the answer. Is that ok?

PROBE:

No.	Spoken label researcher will produce	Target Object	Foil 1	Foil 2	Foil 3
1.	Show me the kiwi	Kiwi	Lemon	Apple	Grapes
2.	Show me the arrow	Arrow	Heart	Moon	Star
3.	Show me the one that furry	Furry key ring	Plastic dinosaur	Tennis ball covered in buttons	Wash cloth
4.	Show me the one that is on	Marble on a tub	Marble inside a tub	Marble under a tub	Empty tub
5.	Show me the cactus	Cactus	Flowers	Succulent	Pot of sand
6.	Show me the violin	Violin	Tambourine	Bells	Guitar
7.	Show me the one that is tall	Deodorant can	35g glue stick	10g glue stick	Lip ice
8.	Show me the one that is under	Clay under a tub	Clay on top of a tub	Clay inside a tub	Empty tub

Control set:

No.	Spoken label researcher will produce	Target Object	Foil 1	Foil 2	Foil 3
1.	Show me the squirrel	Squirrel	Mouse	Dog	cat
2.	Show me the wedge	Wedge	Triangle	Moon	Star
3.	Show me the one that is tiny	Grain of rice	Pasta	Bean	Small ball
4.	Show me one that is beside	Pom pom beside cup	Pom pom behind cup	Pom pom in front of cup	Pom pom on top of cup

Appendix 14: Probe answer sheet

The item the participant points to will be indicted with a - . After the probe results will be tallied.

No.	Target Word	Target Object	Foil 1	Foil 2	Foil 3	Total
1.	Kiwi	Kiwi	Lemon	Apple	Grapes	
B1						
B2						
B3						
P1						
P2						
P3						
P4						
P5						
M1						
M2						
M3						
2.	Arrow	Arrow	Hook	Paintbrush	Ruler	
B1						
B2						
B3						
P1						
P2						
P3						
P4						
P5						
M1						
M2						
M3						

No.	Target Word	Target Object	Foil 1	Foil 2	Foil 3	Total
3.	Furry	Furry unicorn	Plastic dinosaur	Tennis ball covered in buttons	Wash cloth	
B1						
B2						
B3						
P1						
P2						
P3						
P4						
P5						
M1						
M2						
M3						
4.	On	Marble on a tub	Marble inside a tub	Marble under a tub	Empty tub	
B1						
B2						
B3						
P1						
P2						
P3						
P4						
P5						
M1						
M2						
M3						
5.	Cactus	Cactus	Flowers	Succulent	Pot of sand	
B1						
B2						

No.	Target Word	Target Object	Foil 1	Foil 2	Foil 3	Total
B3						
P1						
P2						
P3						
P4						
P5						
M1						
M2						
M3						
6.	Violin	Violin	Tambourine	Bells	Guitar	
B1						
B2						
B3						
P1						
P2						
P3						
P4						
P5						
M1						
M2						
M3						
7.	Tall	Deodorant can	35g glue stick	10g glue stick	Lip ice	
B1						
B2						
B3						
P1						
P2						
P3						
P4						
P5						

APPENDIX 14

No.	Target Word	Target Object	Foil 1	Foil 2	Foil 3	Total
M1						
M2						
M3						
8.	Under	Clay under a tub	Clay on top of a tub	Clay inside a tub	Empty tub	
B1						
B2						
B3						
P1						
P2						
P3						
P4						
P5						
M1						
M2						
M3						

CONTROL SET:

No.	Target word	Target Object	Foil 1	Foil 2	Foil 3	√/ (x)
1.	Squirrel	Squirrel	Mouse	Dog	Cat	
B1						
B2						
B3						
P1						
P2						
P3						
P4						
P5						
M1						
M2						

No.	Target word	Target Object	Foil 1	Foil 2	Foil 3	√/ (x)
M3						
2.	Wedge	Wedge	Triangle	Moon	Star	
B1						
B2						
B3						
P1						
P2						
P3						
P4						
P5						
M1						
M2						
M3						
3.	Tiny	Grain of rice	Pasta	Bean	Small ball	
B1						
B2						
B3						
P1						
P2						
P3						
P4						
P5						
M1						
M2						
M3						
4.	Beside	Pom pom beside cup	Pom pom behind cup	Pom pom in front of cup	Pom pom on top of cup	
B1						
B2						
B3						

APPENDIX 14

No.	Target word	Target Object	Foil 1	Foil 2	Foil 3	√/ (x)
P1						
P2						
P3						
P4						
P5						
M1						
M2						
M3						

Appendix 15: Procedural integrity checklist for procedural integrity of the 40% AiLgS intervention

Checklist Legend

√ = Researcher used statement and pointed to words highlighted to be AiLgS words

X= place a X over words that are highlighted to be AiLgS words but are not pointed to

○ = circle words that that are omitted

Hello everyone	
I am so happy you are all here to help me	
We are going to make a KIWI	
Then we will shoot it with an ARROW	
A KIWI is a fruit	
I like KIWI	
It is tasty and FURRY	
Do you like KIWI?	
Do you like KIWI?	
Do you like KIWI?	
Do you like KIWI?	
Here is a FURRY KIWI ON a plate	
It has a FURRY brown peel with fur ON it	
Feel it	
It feels FURRY	
Feel it	
It feels FURRY	
Feel it	
It feels FURRY	
Feel it	
It feels FURRY	
Feel it	
It feels FURRY	
Look at the KIWI ON the plate	
Let me cut it so you can see how it looks inside	
Look it is green inside	
With a FURRY brown peel	
Look this is what we need to make it	
We need green clay	
We need brow clay	
It feels FURRY	
This is what we need to make it FURRY	
We are going to make it FURRY by putting fur ON it	
Look here is the fur we will put ON to make it FURRY	
We will make a FURRY KIWI and then shoot it with an ARROW	
Look here is the ARROW ON the table	
You like shooting with an ARROW	
I like shooting with an ARROW	

Let me get the clay	
We need green clay to make the inside	
We need to put brown clay ON the green clay to make the peel	
We need to put fur ON to make it FURRY	
Let me start rolling the clay	
Now we must put the brown clay ON the green clay	
Let me take some brown clay and put it ON the KIWI	
Who wants to put more brown clay ON the KIWI?	
Put the clay ON the KIWI	
Who wants to put more brown clay ON the KIWI?	
Put the clay ON the KIWI	
Now let us make the it FURRY	
Put the fur ON the KIWI to make it FURRY	
The fur will make it FURRY	
Who wants to put more fur ON the KIWI?	
Put the fur ON the KIWI to make it FURRY	
Who wants to put more fur ON the KIWI?	
Put the fur ON the KIWI to make it FURRY	
Look it is ON the table	
We have a FURRY one to shoot with an ARROW	
Now let us shoot it with an ARROW	
Look I will shoot it with the ARROW	
Did I hit it with an ARROW?	
Who wants to shoot it with an ARROW?	
Ok you shoot it with an ARROW	
Did you hit it with the ARROW?	
No	
Now you shoot it with an ARROW	
Did you hit it with the ARROW?	
No	
Now you shoot it with an ARROW	
Did you hit it with the ARROW?	
No	
Now you shoot it with an ARROW	
Did you hit it with the ARROW?	
No	
Did you have fun shooting the ARROW?	
I had fun shooting the ARROW	

AiLgS Scoring:

____ Script items used correctly

____AiLgS words not pointed to

____Words that were omitted

____: ___ Statement:Question ratio

Appendix 16: Procedural integrity checklist of procedural integrity of the 70% AiLgS intervention

Checklist Legend

√ = Researcher used statement and pointed to words highlighted to be AiLgS words

X= place a X over words that are highlighted to be AiLgS words but are not pointed to

○ = circle words that that are omitted

Hello everybody!	
I need some help to make mums mother's day present	
We are going to plant a seed to grow a CACTUS	
Who is ready to plant a seed to grow a CACTUS?	
Look this is a TALL CACTUS	
Look this is what we need to grow a CACTUS	
We need a TALL pot	
We need sand	
We need seeds	
We need a VIOLIN	
Look the VIOLIN is UNDER the table	
A VIOLIN plays beautiful music	
Why do we need a VIOLIN?	
If we play music with a VIOLIN it will help our CACTUS grow TALL	
Water, sunshine and music from the VIOLIN will help our CACTUS grow TALL	
Look here is the TALL pot	
Is this the TALL pot?	
No, this is the TALL pot	
Let me put sand into the TALL pot	
Let me put more sand	
Let me plant a seed UNDER the sand	
Let me press the seed UNDER the sand	
The seed needs to go UNDER the sand so it can grow	
We will press the seed UNDER the sand	
We need more seeds UNDER the sand	
Who wants to press the seed UNDER the sand?	
Press the seed UNDER the sand	
Look the seed is UNDER the sand	
Who wants to press the seed UNDER the sand?	
Press the seed UNDER the sand	
Look the seed is UNDER the sand	
Who wants to press the seed UNDER the sand?	
Press the seed UNDER the sand	

Look the seed is UNDER the sand	
Who wants to press the seed UNDER the sand?	
Press the seed UNDER the sand	
Look the seed is UNDER the sand	
Do we want our CACTUS to grow TALL?	
Yes	
Look we want a TALL CACTUS like this one	
Is this a TALL CACTUS?	
No	
Is this a TALL CACTUS?	
Yes this is a TALL CACTUS	
Now we need to water the seed so our CACTUS can grow TALL	
Look the water is UNDER the table	
What else can we do to make our CACTUS grow TALL?	
We can play music with our VIOLIN to help our CACTUS grow TALL	
The VIOLIN is UNDER the table	
Who can help me play the VIOLIN?	
Look this is how you play the VIOLIN	
You hold the VIOLIN like this	
You can play the VIOLIN	
Good now our CACTUS will grow TALL	
You play the VIOLIN so beautifully	
Now you can play the VIOLIN	
Good now our CACTUS will grow TALL	
You play the VIOLIN so beautifully	
Now you can play the VIOLIN	
Good now our CACTUS will grow TALL	
You play the VIOLIN so beautifully	
Now you can play the VIOLIN	
You play the VIOLIN so beautifully	
Good now our CACTUS will grow TALL	
Our CACTUS will grow because we played the VIOLIN	
Will our CACTUS be beautiful?	

AiLgS Scoring:

____ **Script items used correctly**

____ **AiLgS words not pointed to**

____ **Words that were omitted**

____: ___ **Statement:Question ratio**

Appendix 17: Procedural integrity checklist for adherence to probe script

Checklist Legend:

√ = Tick questions used

X = cross over words that are on the script but not used

^ = ^ to indicate a word used that is not on the script

Probe using auditory stimuli to object matching

No.	Spoken label researcher will produce	√	X	^
	Hello! I am going to ask you a question and you have to point to the answer. Is that ok?			
1.	Show me the kiwi			
2.	Show me the arrow			
3.	Show me the one that furry			
4.	Show me the one that is on			
5.	Show me the cactus			
6.	Show me the violin			
7.	Show me the one that is tall			
8.	Show me the one that is under			

Control set:

No.	Spoken label researcher will produce	√	X	^
1.	Show me the squirrel			
2.	Show me the wedge			
3.	Show me the one that is tiny			
4.	Show me one that is beside			

√	**Total number of statements used correctly (out of 37)**	
X	**Total number of words that are on the script but not used**	
^	**Total number of words used but are not on script**	
P	**Total number of PCS presented correctly (out of 24)**	
N	**Total number of PCS not presented correctly (out of 24)**	

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DECLARATION OF ORIGINALITY

This document must be signed and submitted with every essay, report, project, assignment, dissertation and/or thesis.

Full names of student:.....Zakiyya Laher .....

Student number: u98088336.....

Declaration

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

2. I declare that this dissertation (e.g. 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.

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