

A comparison of the graphic symbol utterances arranged by children with little or no functional speech and children with typical development

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Credit and Thanks!

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ABSTRACT

The structure of graphic symbol utterance constructed by children with typical development and also children with little or no functional speech often differs considerably from spoken utterances. Whether the structure of graphic symbol utterances constructed by these two groups is influenced by similar factors is as yet unknown, as a systematic comparison between the two groups of children has not been conducted. This study aimed to investigate and compare the graphic symbol utterances arranged by children with little or no functional speech with those arranged by their typically developing peers when they were matched according to receptive language age. The utterances were analysed in terms of three variables, namely content, order and intelligibility. The results indicated that children with little or no functional speech do not differ significantly to children with typical development on tasks of graphic symbol utterance construction. The results also indicated that children with higher receptive language age start to use the spoken language word order as a model when arranging graphic symbol utterances more than children with lower receptive language age. The findings suggest that receptive language age plays a role in graphic symbol utterance constructions. The use of structures that do not follow spoken language may be explained by effects of the visual modality.

Keywords:

Augmentative and alternative communication; children with little or no functional speech; children with typical development; graphic symbol utterance construction; graphic symbols; picture communication symbols; school-going children.

OPSOMMING

Kinders met min of geen funksionele spraak en kinders met tipiese ontwikkeling produseer grafiese-simbool-uitinge wat dikwels van die struktuur van gesproke taal verskil. Dit is steeds nie bekend of daar gelyke faktore is wat die struktuur van die grafiese-simbool-uitinge beïnvloed nie, aangesien 'n sistematiese ondersoek tussen die twee groepe kinders nog nie plaasgevind het nie. Die doel van hierdie studie was om die grafiese-simbool-uitinge wat deur kinders met min of geen funksionele spraak en kinders met tipiese ontwikkeling geproduseer is, te vergelyk. Die kinders in elke groep is in terme van hul reseptiewe taal ouderdom afgepaar. Die uitinge is volgens drie veranderlikes geanaliseer naamlik inhoud, struktuur en verstaanbaarheid. Die resultate het getoon dat daar nie 'n groot verskil tussen kinders met min of geen funksionele spraak en kinders met tipiese ontwikkeling op take van grafiese-simbool-uitinge produksie was nie. Voorts het die resultate ook getoon dat kinders met hoër reseptiewe taal ouderdom begin het om die woordorde van gesproke taal meer as 'n model te gebruik in hulle grafiese-simbool-uiting produksie as kinders met laer reseptiewe taal ouderdom. Die bevindinge het ook getoon dat reseptiewe taal ouderdom 'n rol in grafiese-simbool-uiting produksie speel. Die gebruik van strukture wat nie die gesproke taal woordorde volg nie, mag dalk verklaar word aan die hand van die visuele modaliteitseffek.

Sleutelwoorde:

Aanvullende en alternatiewe kommunikasie; grafiese simbole; grafiese-simbool-uiting produksie; kinders met min of geen funksionele spraak; kinders met tipiese ontwikkeling; picture communication symbols; skoolgaande kinders.

CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter aims to give background information, to introduce the problem statement and to give the reasons for conducting the present research study. Following this, frequently used terminology is defined and abbreviations are clarified. Specific notation that is used in this dissertation is also explained. Finally, the chapters that are to follow in this dissertation are outlined.

1.2 Problem Statement

Typically, humans communicate using speech and language; however, there are individuals who have little or no functional speech (LNFS) who require additional or alternative means to communicate with people in their environments. Children in need of augmentative and alternative forms of communication (AAC) who are non- or preliterate are often provided with graphic symbols as an alternative method of expressing themselves (Smith & Grove, 2003). Learning to use graphic symbols for communication takes time, especially for children with physical disabilities (Light & Drager, 2002). For children, graphic symbols should not only be treated as a tool for communication, but also as a means to facilitate and support language development. According to the behavioural theory of language acquisition, typically developing children learn language by imitating, practising and establishing patterns which are reinforced by people in the child's environment (Fromkin, Rodman, & Hyams, 2007). Without much instruction, language acquisition in typically developing children occurs naturally and seems effortless (Fromkin et al., 2007). Conversely, children with LNFS do not have the same experience with graphic symbol communication and do not benefit from spontaneous learning by imitating and repeating graphic symbol construction behaviours of others in their natural environments (Soto, 1999; Sutton, 1999). As a result, these children using AAC face challenges with learning certain aspects of expressive language, such as morphology and syntax.

The impact of graphic symbol use on language skills as well as the processing and development of language has been an area of interest in AAC research. One line of enquiry has looked into the graphic symbol utterances arranged by children in an attempt to understand the asymmetry between receptive (spoken language) and expressive (graphic

symbols) modes. More specifically, questions have been posed regarding how the different receptive and expressive modes relate to each other, what processing takes place between them, and how the use of the visual modality influences expressive language development for children using AAC. One recurrent finding in descriptive studies and case reports is that graphic symbol utterances, produced by children with typical development and children with LNFS, are structured differently to those of the spoken language equivalent which the children understand and/or use (Bruno, 1989; Hjelmquist, Dahlgren Sandberg, & Hedelin, 1994; Smith, 1996; Sutton & Morford, 1998, Sutton, Soto, & Blockberger, 2002; Sutton, Trudeau, Morford, Rios, & Poirier, 2009; Trudeau, Sutton, Dagnais, de Broeck, & Morford, 2007; Udwin & Yule, 1990; Van Balkom & Welle Donker-Gimbrere, 1996). The production of short, simple graphic symbol utterances that do not always follow spoken language word order may result in communication breakdown unless the communication partners are experienced with the graphic symbol utterance construction techniques that are employed by the child using AAC. The use of multi-symbol combinations in an utterance allows for more information to be conveyed and also for the message to be conveyed more effectively. The development of these symbol combination skills is important in order to facilitate learning of communication skills and to support attaining communication goals, such as to express needs and wants, to develop social closeness, to share information and also to fulfil social etiquette routines (Light, 1989).

It is important to understand how children develop skills to use and manipulate graphic symbols in order to represent messages because this knowledge will better guide the intervention process. Factors that have an influence on the use of graphic symbols for communication, as well as the combination of graphic symbols to form multi-symbol utterances, need to be better understood. The results of previous research seem to suggest that both children with LNFS and children with typical development under the age of seven years do not automatically apply the structure of spoken language when constructing graphic symbol utterances. However, since no systematic comparison of the performance of these two groups has been made, the reasons for producing short, incomplete or differently-structured graphic symbol output may differ between the two groups. Children with typical development involved in these investigations have seldom had any experience with AAC, which may account for the structure of their utterances. In contrast, studies conducted with children with LNFS included participants who used AAC systems. The latter group, however, had expressive language impairments and may also have had underlying receptive language

problems, which may have accounted for differently-structured and limited graphic symbol output. Another explanation could be that the graphic modality itself imposes constraints on the output formulated by both children with typical development and children with LNFS. A systematic comparison between these two groups would be able to indicate the possible influence of these potential variables.

The present research study therefore aimed to describe and compare the graphic symbol utterances arranged by children with LNFS and children with typical development who were matched according to receptive language age. Both groups comprised of children who had not had experience in communicating with graphic symbols. The variable that distinguished the groups from each other was their expressive (spoken) language ability. The influence of this variable in graphic symbol utterance construction could therefore be explored. It was hypothesised that similar performance between the two groups would suggest that the graphic modality itself rather than expressive language skill influences graphic symbol utterance construction. Conversely, if children with typical language development constructed graphic symbol utterances that resembled spoken language structure more closely, then expressive language deficits may influence the graphic symbol utterance construction abilities of children with LNFS.

1.3 Terminology

1.3.1 Augmentative and Alternative Communication (AAC)

Augmentative and Alternative Communication is defined as “the supplementation or replacement of natural speech and/or writing using aided and/or unaided symbols” (Lloyd, Fuller, & Arvidson, 1997, p. 524).

1.3.2 Children with little or no functional speech (LNFS)

Children with LNFS are defined as being able to say less than 15 intelligible spoken words (Burd, Hammes, Bornhoeft, & Fisher, 1988; Von Tetzchner, 1997). This term was used because it indicates that the individual has very limited speech and accurately describes the participants in this study. The term ‘complex communication needs’ was not used in this study, as it is very broad and could be confusing as it does not specifically describe that the participants in the study had limited speech (Alant, Bornman & Lloyd, 2006).

1.3.3 Content, order and intelligibility

Content, order and intelligibility were the three variables according to which the graphic symbol utterances constructed by participants were measured. Content refers to the information provided by the graphic symbols in an utterance. Order refers to the linear sequence in which the graphic symbols were arranged to form an utterance. Intelligibility refers to the ability of the graphic symbol utterance to communicate a message comprehensibly.

1.3.4 Graphic symbol utterance

For the purpose of this study, a graphic symbol utterance refers to a visual message consisting of either a single graphic symbol or two or more graphic symbols that are arranged sequentially.

1.3.5 Graphic symbols

Graphic symbols refer to static pictures that represent objects, actions, relations and attributes and so forth which are used to communicate messages in the visual modality (Lloyd & Fuller, 1986). Graphic symbols are a form of aided communication which is different to manual signs which are an unaided form of communication. The graphic symbol set that was used in the present study was Picture Communication Symbols (PCS).

1.3.6 Picture Communication Symbols (PCS)

Picture Communication Symbols (PCS) is an aided symbol set developed by Mayer-Johnson including symbols that depict more than 4500 basic vocabulary items from several categories in picture form (www.mayer-johnson.com/pcs-collections/; <http://ir.dynavotech.com/index.cfm>). There are more than 7000 pictures, either black-and-white or colour line drawings (Beukelman & Mirenda, 2005). This set was chosen as it is widely and frequently used in South Africa (Bornman, Bryen, Kershaw, & Ledwaba, 2011).

1.3.7 Symbols (subject, verb and object)

Subject-symbols refer to graphic symbols depicting subjects, namely woman [] and man []. Verb-symbols refer to symbols depicting actions, such as kick []. Object-symbols refer to graphic symbols depicting common nouns, such as car []. In this study

the term ‘object-symbols’ should therefore not be confused with the term ‘object symbols’, commonly found in the AAC literature and which refers to tangible objects.

1.3.8 Meta-communication skill

Similar to metalinguistic skill, meta-communication skill refers to the awareness and ability of an individual to reflect on and analyse communication holistically (Hjelmquist et al., 1994). It refers to all types of communication and is not exclusive to language. In this study it refers to the ability of children to reflect on spoken language communication and communicating with graphic symbols.

1.3.9 Metalinguistic skill

Metalinguistic skill refers to the ability of an individual to observe and critically analyse language from a distance, as a form of communication (Hjelmquist et al., 1994). In this study it is used to describe children’s ability to analyse and reflect on spoken language, including the word order of spoken language.

1.4 Abbreviations

AAC	Augmentative and Alternative Communication
HRLA	Higher receptive language age
LNFS	Little or no functional speech
LSEN	Learners with special education needs
LRLA	Lower receptive language age
M	Mean
NGO	Non-government organisation
O	Object
PCS	Picture Communication Symbols
RLA	Receptive language age
R-XTACL	Revised Xhosa Test of Auditory Comprehension of Language
S	Subject
SD	Standard deviation
SO	Subject-object
SV	Subject-verb
SVO	Subject-verb-object
TD	Typical development

V	Verb
XERLA	Xhosa Expressive Receptive Language Assessment

1.5 Notation

Graphic symbols are represented by writing the gloss that appears above them in upper case and italics while spoken words are written in italics (Von Tetzchner & Basil, 2011). To illustrate, the graphic symbol of a shoe is represented in this text as *SHOE*, while the spoken word for shoe is represented as *shoe*.

1.6 Overview of Chapters

Six chapters form the body of this dissertation. Chapter 1 begins by introducing the problem statement and the rationale for the present research study. Specific terminology, abbreviations and notation that are used throughout the thesis are defined and an outline of the chapters is provided.

Chapter 2 presents literature and theoretical constructs that relate to and support the present study. Research studies that investigate graphic symbol construction abilities of children with LNFS and children with typical development are discussed. Theories that attempt to explain the actual process of graphic symbol utterance construction as well as factors that may influence graphic symbol utterance construction are reviewed. A discussion of the gaps in current theoretical understanding leads to the presentation of the rationale and hypothesis of the present study.

Chapter 3 explains the methodology of the study. The main aim and the three sub-aims of the research study are presented first followed by a description of the study design. Next, the stages of the study are explained, starting with recruitment and ending with data analysis. Thereafter, the participants are presented by including selection criteria and recruitment strategies as well as a description of the participant characteristics. Equipment and materials, including formal language assessments, are then described. The objectives and outcomes of the pilot study are reported, followed by an explanation of the data collection and analysis procedures. Finally, the measures that were used to ensure reliable data collection and integrity are also described.

Chapter 4 presents the results obtained from statistical analysis of the data. First, the reliability of the data collected and the integrity of the procedures are described. Then the results from the statistical analysis are presented, as the utterances produced by children with LNFS and children with typical development are compared on three variables: content, order and intelligibility. Following this, the results of further analyses of the data are presented, as utterances produced by children with lower receptive language age are compared with children with higher receptive language age; once again on the three variables of content, order and intelligibility.

A discussion of the results is presented in Chapter 5. Interpretations of the results are given with reference to supporting literature. The similarities and differences in the content, order and intelligibility of graphic symbol utterances produced by children with LNFS and those produced by children with typical development are interpreted in the light of current theory. The same is done for utterances constructed by participants with lower receptive language age versus those constructed by participants with higher receptive language age. Further explanations for graphic symbol utterance structures are presented with reference to the theoretical background.

Chapter 6 provides concluding remarks. A summary of the findings is presented followed by clinical implications of the study. An evaluation of the study follows, discussing the strengths and limitations of the study. Finally, recommendations for future research are made.

1.7 Summary

This chapter explained the grounds and rationale for this research. Comparative research between children with LNFS and children with typical development will be able to indicate which factors may be involved in graphic symbol utterance construction. Terminology that is used throughout the thesis was defined and the relevant abbreviations and notation were explained. Finally, an overview of the chapters that form the body of this thesis was presented.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter serves to discuss findings in the field of AAC concerning the construction of graphic symbol utterances by children with LNFS and children with typical development. Three theories, namely the recoding, unimodal and redescription theories are discussed. Furthermore intrinsic and extrinsic factors and compensatory strategies that have been proposed to explain the structure and length of graphic symbol utterances are reviewed. This leads to the presentation of the rationale for the current study.

2.2 Communicating in the Visual Modality

Children who do not develop speech require alternative ways of expressing themselves – ways that supplement or replace spoken language. Many have relatively good receptive language skills and therefore form part of the ‘expressive language group’ of persons in need of AAC (Von Tetzchner & Martinsen, 1992). One way of enabling expression for children in this group is by presenting them with graphic symbols which they can learn to use as a form of communication. This graphic symbol system can become a permanent form of communication for children with LNFS if they do not develop spoken language (Sutton et al., 2002). Representation in the visual modality occurs in three forms, namely enactive, iconic and symbolic representations (Bruner, 1966). Enactive representation is primarily action based and relies on learned motor responses. In the AAC context these may be unaided gestures or facial expressions. Iconic representation occurs in the visual modality where messages are conveyed in the form of images or diagrams, for example pictures. Symbolic representation is the most abstract form of representation and includes written words and other abstract symbols (e.g. Blissymbols) which are arbitrary and are governed by certain rules for combination. Graphic symbol communication often makes use of iconic representation which may develop alongside cognition and linguistic abilities (Mineo Mollica, 2003). Graphic symbols provide children with LNFS a representational form with which they can associate and onto which they can map their knowledge in order to communicate it (Mineo Mollica, 2003). Picture Communication Symbols (PCS) are often used for young children as they form one of the more iconic symbol sets available and research has shown that they can be learnt relatively easily by all age groups (Fuller, Lloyd & Stratton, 1997). Before one can use graphic symbols to communicate one has to learn what they represent and one needs a basic understanding of how to use them. “Picture

understanding and use is not an innate ability, but rather develops over time and with experience, and varies with the demands of the task” (Mineo, Peischl, & Pennington, 2008, p. 162). This implies that there are stages of development and learning in graphic symbol communication.

The ability to identify pictures and to understand what they represent develops at an early age. Toddlers as young as 18 months can point to named pictures, and between 24 and 30 months children develop the ability to understand that a picture is a representation of the real thing (De Loache & Burns, 1994). This does not imply that children will naturally acquire graphic symbol communication at such a young age, but rather that graphic symbol communication intervention can begin at a young age. Learning representational competence involves attaining the following four goals discussed by Mineo Mollica (2003). Initially, one needs to recognise that there is a relationship between graphic symbols and referents; this is known as representational insight. The next goal is dual representation which entails the ability to understand and recognise that a graphic symbol contains information and that it stands for a referent. The next stage is attribute differentiation in which one realises that the graphic symbol and its referent do not share physical attributes. The last stage is symbolic sensitivity, which involves the spontaneous exploration of symbolic representations between entities, for example, generalising a requesting behaviour from one item to other related items. Development of these four different representational competencies will aid graphic symbol communication learning.

Learning to use graphic AAC systems, both low technology and high technology, takes a considerable amount of time for most children and this is increased for children with additional impairments (Light & Drager, 2002). Children have individual learning styles and this may have an impact on the mode that is selected for them as well as the intervention techniques that will be chosen to develop symbolic communication (Iacono, 1992). Graphic symbols can either be learnt implicitly by implied meaning in conversation or explicitly due to the iconicity of the symbols which may hasten learning (Oxley & von Tetzchner, 1999).

The primary challenge with learning a graphic symbol communication system is that it does not parallel spoken language. Pictures and graphic symbols from symbol sets are not equivalent to words as they lack many linguistic characteristics. Therefore graphic symbols cannot be expected to function like spoken language (Fuller et al., 1997). Hence, children

who need to use graphic symbols to communicate have to learn communication in two modalities, namely the spoken and visual modalities. The resulting asymmetry between receptive and expressive communication for children with LNFS has been an ongoing topic of interest in research dealing with language development and AAC.

2.3 Graphic Symbol Utterance Construction

Many children encounter difficulties when learning to combine graphic symbols to form multi-symbol utterances. The application and transfer of spoken language knowledge is not evident in the structure of the graphic symbol expressions of many children with LNFS and children with typical development (Binger & Light, 2008; Bruno, 1989; Hjelmquist et al., 1994; Smith, 1996; Sutton & Morford, 1998, Sutton et al., 2002; Sutton et al., 2009; Trudeau et al., 2007; Udwin & Yule, 1990; Van Balkom & Welle Donker-Gimbrere, 1996). Gerber and Kraat (1992) highlighted the following observations regarding expressions constructed with AAC:

- Utterances are short, simple and restricted.
- Communication strategies and forms are controlled by the AAC medium.
- Linguistic competency does not always show in the child's output.
- Multimodal communication is heavily relied on.

Short utterances with insufficient morphology and syntax may be challenging for unfamiliar communication partners to understand, especially when there is overt ambiguity. In these cases, communication breakdown may be more frequent (Sutton et al., 2002). Tables 2.1 and 2.2 provide an overview of eight studies that relate to the present study. Studies that investigated graphic symbol construction in children with LNFS and children with typical development were identified and the ones that had implications for the present study were reviewed. Three studies that were conducted with individuals with LNFS are presented first and five studies that were conducted with individuals with typical development follow. These specific studies reported on graphic symbol utterance construction of different age groups and under different circumstances. These tables serve as a reference for readers who may be unfamiliar with the specific details of the studies as they are referred to throughout this dissertation.

Findings on the graphic symbol utterance construction skills of individuals who have LNFS are typically obtained from individuals who have had previous experience with AAC

and who have received AAC intervention. Individuals who use graphic symbol communication are expected to follow the syntactic structure of spoken language; however, one of the common findings among individuals who use AAC is that they tend to produce short and simple graphic symbol utterances (Binger & Light, 2008; Hjelmquist et al., 1994; Udwin & Yule, 1990; Van Balkom & Welle Donker-Gimbrere, 1996). Children with LNFS can learn to communicate effectively using AAC and learn to access a wider range of vocabulary, however they learn at a slow pace and their productions remain short (Udwin & Yule, 1990). The participants with LNFS in Kaul's (2003) study were found to increase their spontaneous conversational output after a period of 19 months to between two and three words per utterance that mostly followed the spoken language word order. Two children used word boards, while three used communication boards with pictographic representations. Case studies have presented similar findings (Bedrosian, 1997; Bruno, 1989). Some children are able to learn how to map linguistic and graphic symbol communication skills together to form longer and more grammatically correct utterances after proper instruction. Intervention has proven to increase the number of multi-symbol utterances used by children with LNFS (Binger, Kent-Walsh, Berens, Del Campo, & Rivera, 2008; Binger, Kent-Walsh, Ewing, & Taylor, 2010; Binger & Light, 2007; Nigam, Schlosser, & Lloyd, 2006; Tönsing, 2012). With increased experience and age, individuals who use AAC systems develop stable response patterns that follow spoken language order during utterance construction when the target structures are simple (Trudeau, Sutton, Morford, Côte-Giroux, Pauzé, & Vallée, 2010). In short, as the studies presented in Table 2.1 summarise, children with LNFS who use AAC slowly learn to produce multi-symbol utterances over time and as they get older simple graphic symbol utterances tend to follow the order of spoken language more closely and consistently.

Table 2.1

Studies Reporting on Graphic Symbol Utterance Construction by Individuals with LNFS, in Alphabetical Order

Authors	Aim	n	Participants	Age (years;months)	Method	Findings from children with LNFS
Kaul, 2003	To investigate the differences in language development between speaking children with cerebral palsy (CP) and children with CP and LNFS who used aided AAC.	10	5 children with CP and LNFS, 5 children with CP who could speak	6;1 – 10;7	Four video recording sessions were conducted with each child over a period of 19 months. During these sessions, participants conversed with a familiar communication partner. Fifty utterances were obtained during each session.	Most aided communicators used 2 or 3 word utterances that had word order similar to spoken language. Both groups showed increased utterance length and grammatical marker use over time. Clauses were used most frequently, followed by noun phrases by both groups. Children with LNFS used a more limited range of linguistic structures than children with typical development at the same receptive language age and peers with CP who could speak.
Trudeau, Sutton et al., 2010	To investigate how individuals with LNFS who have used AAC systems for at least 6 months construct and interpret graphic symbol sequences.	27	Individuals with LNFS	8;6 – 49;9	The participants were asked to construct graphic symbol utterances in response to a photograph depicting an action scene. In another session, they were asked to interpret graphic symbol utterances by choosing the appropriate photograph that depicted what the graphic symbol utterance conveyed.	Most participants constructed utterances that followed spoken language word order. The majority of the participants used a stable response pattern during construction tasks and were able to complete construction and interpretation tasks equally well. Syntactic comprehension and cognitive level were the characteristics that separated participants that had stable and instable response patterns.
Udwin & Yule, 1990	To investigate the acquisition of Blissymbols or Makaton by children with cerebral palsy and to document syntactic structure over time.	40	Children with LNFS - 20 using Blissymbols, 20 using Makaton	3;6 - 9;8	Participants included individuals who had been using their AAC method between 1-18 months (mean 10.5 months). They were assessed over a period of 1.5 years at 6 month intervals. Receptive and expressive vocabulary knowledge of training items was assessed. Utterances produced during a 30 minute conversation were analysed in terms of length and grammar.	Both groups acquired new vocabulary, but their progress was slow and their utterances did not increase significantly in length and complexity.

Studies with typically developing children (see Table 2.2) have investigated graphic symbol utterance construction skills of individuals who mostly have not had prior experience with AAC. These studies reported that young children have difficulty using graphic symbols to construct utterances according to spoken language structure even after having had training (Smith, 1996; Sutton et al., 2009), but older children have an increased tendency to apply spoken language grammatical structures to their graphic symbol utterances (Alant, du Plooy & Dada, 2007; Sutton & Morford, 1998; Trudeau et al., 2007). The ability to transfer spoken language rules to the visual modality has been suggested to emerge between the ages of 5 - 12 years and even then the utterances produced by this age group do not always follow spoken language grammar consistently (Smith, 1996; Sutton & Morford, 1998). During this developmental period, children may rely on various abilities such as cognition, linguistic or metalinguistic abilities to construct graphic symbol utterances. Metalinguistic skill refers to the ability of an individual to observe and critically analyse language from a distance, as a form of communication (Hjelmquist et al., 1994). Alternatively there may be other perceptual processes that may contribute to graphic symbol communication skills, but there have been no studies to suggest them as yet. There may not necessarily be a link between expressive language and graphic symbol utterance construction abilities; however more evidence is necessary to substantiate these claims. In other hypotheses, Gerber and Kraat (1992) have suggested that there may even be typical and atypical graphic symbol output development. This could indicate that there may be specific graphic symbol milestones that could be attained at particular ages. This would have implications for children who have not had sufficient exposure to symbolic communication systems. Normative research would need to be conducted to give evidence to substantiate this theory. Much research done with typically developing children has not included graphic symbol representation training. The novelty of communicating in the visual modality may influence the children's responses. More research is needed on the development of graphic symbol communication skills in order to understand how and why children produce the utterances that they do.

Table 2.2

Studies Reporting on Graphic Symbol Utterance Construction by Individuals with Typical Development, in Alphabetical Order

Authors	Aim	n	Participants	Age (years;months)	Methods	Findings
Alant et al., 2007	To investigate the effect of SVO and SOV sequenced input on the graphic symbol and spoken utterances of children with typical development.	40	Typically developing children	7;5 – 8;5	Participants in both groups, one with SVO input and one with SOV input, had to listen to a story and respond to questions using PCS symbols and following this answer the same questions using speech.	For SVO and SOV inputs, children produced varied PCS outputs, but similar speech outputs. The SOV input had a significant effect on the grammatical PCS output. More SVO utterances were produced under the SOV input than expected. Less SVO utterances were produced under the SVO input than expected.
Smith, 1996	To investigate how typically developing children communicate using graphic symbols after training.	5	Typically developing preschoolers	3;5 – 4;7	A 10-week-training programme was implemented to teach graphic symbol construction. Graphic symbols represented nouns, verbs, modifiers, colours and prepositions. After the intervention, each child was seen individually to assess their graphic symbol utterance composition abilities.	The participants struggled to use the communication board to communicate even after weeks of training. Children seemed not to understand the role of pictures in the communication context. Graphic symbol output differed greatly from spoken language equivalent. Output consisted mostly of single graphic symbol utterances.
Sutton & Morford, 1998	To investigate expressive language skills in picture communication in typically developing children.	32	Typically developing children	5;9 - 12;7	Video clips were played and participants were required to explain what happened in the clips using PCS.	Most children did not rely on underlying linguistic knowledge to construct utterances using PCS, however older children produced more utterances that followed spoken language order.

Authors	Aim	n	Participants	Age (years;months)	Methods	Findings
Sutton et al., 2009	To investigate the abilities of pre-schoolers without disabilities in terms of constructing and interpreting graphic symbol sequences.	30	Typically developing preschoolers	3;0 – 4;11	Children were required to construct PCS utterances in response to spoken simple (SVO) and complex (SVOA) sentences with accompanying photographic stimuli. There were 2 types of test conditions: neutral (one picture at a time) and contrast (4 pictures presented at once).	This age group had difficulty with construction and interpretation tasks involving PCS. Three- and 4-year-olds have not yet developed the skills needed to use PCS symbols.
Trudeau et al., 2007	To investigate how syntactic complexity and task demands affect the ability of individuals without communication disorders to compose PCS utterances.	90	Typically developing: 30 children, 30 teenagers, and 30 adults.	7;0 - 8;11, 12;0 - 13;11 and 18 years +	The participants were required to compose graphic symbol utterances to describe photographs presented with spoken French.	Participants had more stable response patterns for simple sentence structures than for complex sentence structures. Children experienced more difficulty with the increased syntactic complexity and increased task demand than teenagers and adults. The researchers hypothesised that other skills were required to construct graphic symbol sequences as the children did not rely solely on transferring spoken language skills into their graphic symbol utterances.

Interestingly, research with typically developing children and children with LNFS has shown that utterance length does increase with age, but even with increased utterance length, the utterances do not always keep to the syntactic structure of spoken language even into adolescence, especially when complex messages are constructed (Binger & Light, 2008; Trudeau et al., 2007; Trudeau, Sutton et al., 2010; Udwin & Yule, 1990). If one considers the various graphic symbol utterance patterns used by children it becomes clear that there are many possible explanations for the patterns observed. As Sutton, Gallagher, Morford and Shahnaz (2000) mentioned, the results from the various studies “suggest that the relationships among AAC production patterns and language representation are not straightforward” (p. 484). Morphologic and syntactic knowledge are among the possible influencing factors in graphic symbol utterance construction. Sutton et al. (2000) suggested that pragmatic variables may also play a role in the graphic symbol utterance construction process. Various theories have been formulated regarding graphic symbol utterance construction.

2.4 Theories of the Graphic Symbol Utterance Construction Process

The evidence, showing that children do not necessarily follow the word order of spoken language when constructing graphic symbol utterances, has given rise to speculations about the actual process of graphic symbol utterance construction. There are three main theories, discussed by Smith and Grove (1999; 2003), that have been formulated to attempt to explain how graphic symbol utterances are constructed, namely, by a process of recoding (supported by the results of Trudeau, Sutton et al., 2010), or by a process of redescription (e.g. Alant et al., 2007; Nakamura, Newell, Alm, & Waller, 1998), or by a process that occurs in one mode (visual or auditory). Figure 2.1, based on the figure in Smith and Grove (1999, pp. 13), below demonstrates the processing routes for the three theories.

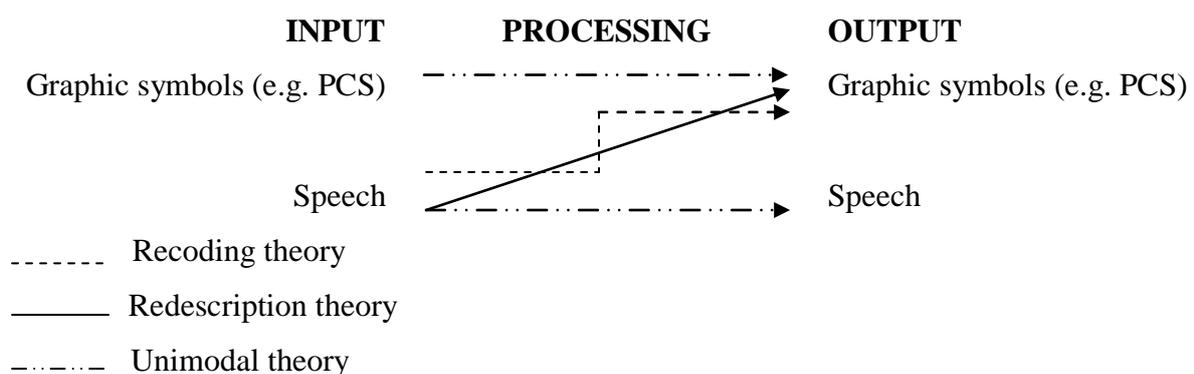


Figure 2.1. Possible processing routes for each theory.

2.4.1. The recoding theory

A common theory of graphic symbol utterance construction is the speech-based hypothesis (Smith & Grove, 2003). It proposes that children with limited speech develop receptive language from hearing spoken language and that this forms a foundation for learning expressive language (Smith, 2006). This receptive language base is built up by associating referents and their spoken labels, and then transferring these labels from the spoken to the visual mode when using AAC (Ronski & Sevcik, 1993). The AAC user forms relationships between the spoken labels for referents and the graphic symbols for those same referents (Ronski & Sevcik, 1993). The process of translating or recoding spoken language into graphic symbols requires significant cognitive and linguistic resources, including vocabulary, grammar and rules of the spoken language model (Renner, 2003; Smith & Grove, 2003). Therefore, according to this theory, graphic symbols should be arranged in utterances in a similar order as words are ordered in spoken languages. The order would therefore reflect either subject-verb-object order (such as in English or isiXhosa) or subject-object-verb (such as in Dutch or Afrikaans). These skills are often delayed for many children with language impairments. This theory would predict that, given adequate linguistic skills, children should be able to construct graphic symbol utterances with the same structure as the spoken utterance. However despite intact receptive and expressive language abilities, the graphic symbol utterances constructed by young typically developing children also does not reflect spoken language as many of their utterances contain single symbols (Smith, 1996). Therefore something other than linguistic skill may be involved in graphic symbol utterance construction. Research comparing the abilities of children with LNFS and children with typical development may support this theory if both groups of children are found to arrange graphic symbol utterances that follow the word order of spoken language. However, if the graphic symbol utterances arranged by these two groups are found to differ, alternative theories may be considered to explain these processes.

2.4.2 The redescription theory

The redescription theory proposes that the individual using AAC may ignore spoken input structure in preference of other structures (Smith & Grove, 1999). This theory states that the individual is sensitive to linguistic rules but disregards them in order to show the relationship between constituents resulting in preference being shown towards certain lexical items or pragmatic priorities (e.g. Alant et al., 2007; Nakamura et al., 1998). To illustrate, semantic preference may be shown to the patient resulting in the patient being placed first in

the utterance and the subject last, such as *BUBBLES BLOW MAN*. Pragmatic preference relates to how the message is relayed, for example the topic may be initiated followed by a comment rather than subject-predicate organisation. This may result in various orders depending on what the individual considers the topic to be; either an object, such as *BUBBLES BLOW* or an action, such as *BLOW BUBBLES*. These semantic and pragmatic preferences may be observed more clearly in utterances depicting complex sentences, such as *the man blows bubbles to the girl* (e.g. *BUBBLES MAN BLOW GIRL*). The order of the elements in the graphic symbol utterance may be reshuffled from the spoken utterance in order to distinguish between agent and patient in the absence of symbols denoting prepositions (e.g. 'to'). Current research has investigated the abilities of typically developing children, adolescents and adults in constructing graphic symbol utterances depicting complex sentences or sentences that have increased syntactic complexity (Trudeau et al., 2007). If research that compares the utterances constructed by children who have LNFS with those constructed by children with typical development finds that both groups produced similar utterances that differed from the spoken language order, it would support the theoretical standpoint of the redescription theory.

2.4.3 The unimodal theory

Alternatively, the theory of the unimodal or intramodal graphic symbol utterance construction process states that the message is formulated within the visual modality and that no reference is made to the spoken modality (Smith & Grove, 1999). The unimodal processing route implies that receptive and expressive processing of graphic symbols occurs in the same modality. This theory may indicate that organisation of graphic symbols in an utterance may relate to specific constraints of the visual modality. Similarities between children with LNFS and children with typical development in graphic symbol utterance constructions may provide evidence to support this theory.

The results of Sutton and Morford's (1998) study with typically developing children using graphic symbols suggested that there is more to intermodal communication than simply transferring grammatical knowledge from spoken language into the visual modality. There might not be a direct link between graphic symbol use and spoken language and graphic symbol utterance construction may exist independently of language (Smith, 1996). This may imply that graphic symbol communication could take place purely in the visual cortex, supporting the unimodal theory. Similarly, the dual coding theory proposes that stimuli are

processed by different cognitive subsystems and these function independently of each other, and that development in one subsystem could promote development in the other and vice versa (Paivio, 1986; 1971). The neurological processing of graphic symbols could take place primarily in the visual cortex independent of the language areas of the brain. Even though the language area and the visual cortex develop separately, children could be taught to use them together by learning to map spoken words onto graphic symbols. According to the compensation hypothesis, compensatory processes are developed to overcome inhibited or disordered behaviours. Therefore natural language compensation could lead to “an alternative neural routing” and “the partial or total loss of language skills in one mode would stimulate the development or improvement of these skills in another mode” (Sutton et al., 2002, p. 195).

2.5 Factors Influencing the Structure of Graphic Symbol Utterances

Various factors have been identified that may account for limited symbols in utterances and the use of structure that is different to spoken language. These include (a) intrinsic variables such as underlying linguistic deficit or lack of metalinguistic skills (Smith, 1996; Sutton & Morford, 1998; Trudeau, Sutton et al., 2010), (b) extrinsic variables such as the effects of the visual modality (Smith, 1996; Soto, 1999) or (c) that the AAC user overcomes limitations of the AAC system by making use of strategies (Soto, 1999). In addition, there are associated hypotheses that correspond to the aforementioned variables that attempt to account for the graphic symbol utterance structure used by individuals in their outputs. These are the expressive language deficit hypothesis, the modality-specific hypothesis and the compensation hypothesis (Smith, 1996; Soto, 1999; Sutton et al., 2002). Some of these factors and theories only apply to children with LNFS and do not explain differences that are observed in children with typical development. This merits the investigation and comparison of both groups of children. The variables and theories that are associated with them are discussed below.

2.5.1 Intrinsic variables

Intrinsic factors include those that pertain to the child’s biological and psychological make-up (Ronski, Sevcik & Adamson, 1997). Expressive language deficit has been proposed as an influencing factor on graphic symbol utterance construction abilities (Smith, 1996). The linguistic deficit hypothesis (Smith & Grove, 2003) proposes that linguistic patterns that characterise language impairment may relate to patterns observed in graphic symbol

utterance constructions, such as short, simple utterances that omit words. Children with LNFS also have fewer opportunities to learn expressive language and therefore they may demonstrate different knowledge of vocabulary and grammar (Sutton et al., 2000). This may result in short graphic symbol utterances and syntactic structures that contrast spoken language. Limited speech comprehension could play a role in graphic symbol communication abilities as it has been proposed that increased speech comprehension enhances graphic symbol acquisition and use (Ronski et al., 1997). However, the fact that typically developing children with intact language skills also produce graphic symbol utterances that differ from spoken utterances seems to refute that a lack of linguistic skills alone can account for reduced graphic symbol output. The results of Trudeau, Sutton et al. (2010) suggested that receptive language and cognition may influence graphic symbol utterance construction, but that they may function independently; receptive language may not be dependent on cognition and vice versa. Participants with better receptive language skills in their study produced utterances with more stable response patterns.

Children may produce single symbol utterances initially and learn to combine symbols later, paralleling typical spoken language development where children with typical development start producing single words and then phrases (Nelson, 1973). Metalinguistic skills have been suggested to play an important role in symbolic communication (Hjelmquist et al., 1994). Linguists propose three views on the development of metalinguistic skills: first, metalinguistic skills emerge with the onset of language acquisition; second, metalinguistic skills emerge when children start school; and third, metalinguistic skills emerge during the school-going years (Tunmer & Herriman, 1984). Sutton and Morford (1998) concluded that certain skills (possibly metalinguistic skills) develop between the ages of 5 and 12 years which allow children to tap into their linguistic knowledge and increase their ability to construct graphic symbol utterances that follow the word order of spoken language. Similarly, Trudeau et al. (2007) suggested that young children lack the necessary metalinguistic skills that may play a role in graphic symbol utterance construction and that with increased age, these skills develop. The results of their study emphasised the potential role of metalinguistic skills in graphic symbol utterance construction. Therefore it is possible that the second theory of metalinguistic skills development may be supported by these previously mentioned studies.

Severe motor impairments may cause excessive physical strain for a child producing a graphic symbol message and this may result in the production of shorter messages which could be seen as a strategy to overcome exertion and to conserve energy (Soto & Seligman-Wine, 2003; Sutton & Morford, 1998). However, there are still many children with LNFS who do not have physical impairments and who do not produce multi-symbol utterances. This indicates that there are other factors that influence graphic symbol output. Personal factors may also influence output; an example may be the lack of motivation to communicate (Udwin & Yule, 1990). Calculator (1997) discusses the possibility of a passive interaction style among both individuals with LNFS who are beginner AAC users or who are experienced in using AAC. He mentioned that this style could be brought about by various factors including predisposition to passivity, environmental factors triggering predisposition, an environment that reacts to AAC in such a way that passivity is dictated, or that passivity may be a compensatory response to environmental experiences. These environmental factors would all be considered extrinsic variables. These factors do not necessarily apply to children with typical development as they are independent and not reliant on others for assistance and therefore should not necessarily have a passive interaction style. For children with typical development, a passive interaction style could perhaps be supported by the personality traits of the child, such as introversion, shyness and so forth. However this personality factor could also apply to children with LNFS.

2.5.2 Extrinsic variables

Extrinsic factors relate to the AAC system as well as the instructional setting (Ronski et al., 1997). Limitations with regards to AAC systems that make use of single-meaning pictures as a form of representation have been well documented, especially in terms of restricted vocabulary, and no means to represent grammatical morphemes on many communication boards (Nakamura et al., 1998; Sutton et al., 2000; Sutton & Morford, 1998). These constraints of single-meaning pictures underlie the modality-specific hypothesis (Sutton et al., 2002). Structural characteristics that may be explained by factors related to the visual mode constitute the modality-specific hypothesis (Soto, 1999). Graphic symbols, from symbol sets such as PCS, do not share similarities with spoken words for the following reasons: (a) they are generally more iconic than abstract spoken words, (b) they do not have the same generative characteristics as spoken language and (c) graphic symbols are selected rather than produced (Smith, 2006). These structural and organisational differences suggest that graphic symbols are not equal to linguistic signs and therefore may not possess the same

underlying semantic, syntactic and morphologic features. Therefore it may not be appropriate to assume that graphic symbol output would resemble typical expressive language output due to the fact that there is a discrepancy in mode (Gerber & Kraat, 1992).

Children may struggle with graphic symbol communication due to incomplete development of representational competence. Smith (1996) stated that pictures occur in many different contexts in our environment and therefore children may have difficulty in differentiating between graphic symbol pictures and pictures in the daily environment, thus not understanding the communicative potential of graphic symbols. In addition, young children may also view graphic symbols as a global representation of meaning that encompasses the entire sentence in one picture instead of separate constituents (Smith, 1996). To illustrate, a picture of a man kicking a ball may be seen as a complete message in itself as it contains an agent, action and patient. Therefore, it might seem redundant to represent the sentence 'The man kicks the ball' by a sequence of pictures showing (a) a man, (b) a man kicking a ball and (c) a ball. The results from Smith's study support the modality-specific hypothesis with particular reference to the use of graphic symbols as 'whole messages' rather than parts of a sequence forming a message. This hypothesis may also be supported by evidence that both young children with LNFS and young children with typical development produce similar graphic symbol output.

Most graphic symbol systems allocate one meaning per picture and this places constraints on vocabulary due to the size of the communication board and limitations of vocabulary display. Children with LNFS have been found to show an overreliance on symbols depicting nouns (Kaul, 2003). This is understandable as graphic symbols showing nouns are easier to identify and learn while the meanings of more abstract graphic symbols are more difficult and time consuming to learn (Romich, 1999). Furthermore, communication boards often tend to be predominated by content words (Trudeau, Morford & Sutton, 2010). The display board and mode of communication are the main factors that limit vocabulary and grammatical markers in single-meaning graphic symbol sets (Sutton & Morford, 1998). Blissymbols is an exception as it is a symbol system more similar to language, as it has linguistic markers (e.g. tenses, plural forms, possessive forms) and one can combine different symbols to form new words. Constraints on the child's memory may also influence symbol selection as the child has to recall that the specific word is included in the vocabulary as well as its location on the display board (Tönsing, 2012).

Due to the fact that graphic communication occurs in the visual modality, the constituent orders produced by children may be affected and they may follow similar orders to signed languages and gestures; however, no parallels between signed languages (manual signs) and graphic symbol sets/systems have been documented (Sutton & Morford, 1998; Sutton et al., 2002). Although manual signs and graphic symbols both occur in the visual modality, there are differences between the two. Manual signs are produced and dynamic and their combination is governed by a set of rules, while graphic symbols are selected and communication with them is static (Tönsing, 2012). In signed languages the verb is often at the end of the utterance; however, this is also common for the grammatical structure of Germanic and Dutch languages. Therefore graphic symbol utterances depicting simple sentences may not necessarily follow the structure of sign language because manual sign order is similar to that of some spoken languages. Another possible influential factor in the visual modality, specifically relating to the physical selection of symbols, is that more than one graphic symbol can be selected simultaneously and placed on the utterance board later (Sutton et al., 2000). This could influence the order in which they are placed in the utterance. Young children may not be concerned with the order in which they arrange their utterances and may select all the graphic symbols they wish to use before arranging them randomly on the utterance board. It is yet to be investigated whether children view the selection process or the arranging of graphic symbols on the utterance board as indicative of order. Organisation of vocabulary may also play a role in graphic symbol utterance construction. Research with children with typical development has shown that placement of word groups on the AAC display has an effect on the structure of the user's output (Alant et al., 2007).

Furthermore, Calculator (1997) discussed the challenges of language development for children with LNFS whose communication partners simplify messages in terms of length and complexity in order to promote comprehension. This language model may negatively impact the language development of the child and also impact their potential expressive abilities if language is the foundation of communicative competence. In this way, extrinsic factors may influence intrinsic factors.

2.5.3 Communication strategies

In order to make AAC more effective, AAC users often make use of strategies to overcome communication challenges and breakdowns in accordance with the compensation

hypothesis (Sutton et al., 2002). Research has shown that competent users of AAC often purposefully ignore morphology and syntax in their graphic symbol utterances in order to focus on semantics and to increase access to other vocabulary (Soto & Seligman-Wine, 2003). This has also been observed in adults with typical development (Trudeau et al., 2007). This may be a strategy used to overcome pitfalls that people who use AAC experience with graphic symbol communication. Often people who use AAC tend to use shorter utterances to effect speedier communication in an attempt to strive towards communication efficiency (Smith & Grove, 2003; Udwin & Yule, 1990). This suggests that they make decisions about the utterances they construct and tend to focus on content and quicker communication rather than grammatically correct structures. Soto and Seligman-Wine (2003) discuss different strategies, such as semantic, pragmatic, phonological or metaphorical strategies, that people who use AAC can employ in order to multiply the meanings of symbols and allow the user access to a wider vocabulary which in turn increases the user's communication successes. The use of these strategies requires a certain degree of metalinguistic and metacommunication skill in order to allow the person who uses AAC to think about language and communication in such a way so as to find possible alternatives to use in solving communication challenges. The development of these skills may result in older children intentionally deviating from spoken language structure so as to overcome constraints that they may incur when constructing utterances. However, younger children, who may not yet have developed these skills, may be influenced by other factors that result in graphic symbol utterances that are arranged in orders that differ from spoken language.

2.6 Research Objectives

To date there has been a vast amount of research investigating graphic symbol utterance construction and interpretation abilities of typically developing children, but fewer studies investigating these abilities of individuals with LNFS for whom AAC is actually intended. Regarding graphic symbol utterance constructions, the results from studies involving children with typical development may not necessarily be generalised to the AAC populations. The graphic symbol communication skills of children with LNFS have not been compared with those of children with typical development, therefore resulting in a gap in theoretical knowledge. Graphic symbol communication abilities, prior to training, have been investigated in children with typical development, as this group of children generally have not had AAC intervention or practice with graphic symbol communication (Alant et al., 2007; Sutton & Morford, 1998; Sutton et al., 2009; Trudeau et al., 2007). Research is lacking

in determining the graphic symbol communication abilities, prior to training, of children with LNFS. This group of children have expressive language deficits and this distinguishes them from children with typical development. Due to the fact that these two groups of children are essentially different, theoretical constructs and factors causing graphic symbol utterance construction that is different to spoken language word order may also be different. A comparative study of these two populations would test current theories and hypotheses and increase our theoretical understanding of the process of graphic symbol utterance construction as well as factors that influence graphic symbol utterances.

Therefore the present study intended to investigate and compare the graphic symbol utterances arranged by children with LNFS with those arranged by children with typical development, without either group having had previous training. Two different populations allowed comparisons to be made between the abilities of these groups. Children with LNFS and children with typical development were matched according to receptive language age, ranging from 3;0 to 6;11. Matching allowed the study to control for effects of expressive language development on graphic symbol communication skills. The graphic symbol utterances of the participants were analysed and compared in terms of the information provided by symbols selected, the order the utterance was arranged in and the overall intelligibility of the utterance. The comparisons drawn between the two populations indicated whether or not these children would have similar development of graphic symbol communication skills or whether there would be differences in this area of development. Similarities in utterance construction between these two populations could indicate that the construction skills of children with LNFS develop similarly to those of typically developing children. Differences between the graphic symbol constructions of typically developing children and children with LNFS could indicate different stages of development, different strategies employed or the fact that spoken language may have an influence on construction abilities.

The hypothesis of this study was that children with LNFS and children with typical development would have similar graphic symbol utterance construction abilities as neither group had had previous experience with graphic symbol communication. They all experienced communicating in the visual modality for the first time. The children's responses would give information as to what they rely on to assist with communicating in the visual modality. Either they would rely on knowledge of other modes of communication, for

example, language or gestures, or alternatively they could treat the visual mode as an independent medium and take into account all the advantages and constraints of the visual modality.

2.7 Summary

This chapter discussed the development of graphic symbol skills. A brief history of research investigating graphic symbol construction abilities as well as the theories that have been developed to account for the various graphic symbol utterance construction behaviours were also explored. A solid understanding of the variables that could affect graphic symbol construction abilities in both typically developing children and children with LNFS is needed in the field of AAC. The present study aims to add to the body of existing literature in this regard.

CHAPTER 3

METHODOLOGY

3.1 Introduction

Chapter 3 describes the methodology used in this research study. The aims of the study are highlighted and the research design, participants and the materials and equipment are discussed. The pilot study and the data collection are reported and finally the data analysis and the relevant statistical procedures and reliability measures are described.

3.2 Aims

3.2.1 *Main aim*

The main aim of this study was to describe and compare the graphic symbol utterances arranged by children with LNFS and children with typical development in terms of content, order and overall intelligibility when the targets had subject-verb-object (SVO) structures.

3.2.2 *Sub aims*

Three sub aims were formulated in order to accomplish the main aim, namely:

- i. To describe and compare the content of graphic symbol utterances arranged by children with LNFS and children with typical development in response to video clips depicting SVO sentences. These were described in terms of correct symbols chosen to match the target vocabulary in the video clips.
- ii. To describe and compare the order of graphic symbols in graphic symbol utterances arranged by children with LNFS and children with typical development in response to video clips depicting SVO sentences, in terms of the order in which elements were placed on the utterance strip.
- iii. To describe and compare the overall intelligibility of graphic symbol utterances arranged by children with LNFS and children with typical development in response to video clips depicting SVO sentences, in terms of the content and order of the utterance to provide an intelligible message.

3.3 Research Design

This quantitative research study used a comparative descriptive group design in order to describe and analyse the structure that children with LNFS and typically developing children used in arranging graphic symbol utterances. According to McMillan and Schumacher (2001) comparative research aims to study two or more groups according to certain variables and to discover whether or not differences between the groups occur. The present study used two contrasting groups of participants, namely children with LNFS and children with typical development, in order to investigate whether or not differences existed between the groups in terms of graphic symbol utterance construction. The groups were matched according to gender and receptive language age and they were contrasted due to the participants' differences in their ability to speak. The groups were controlled as closely as possible to eliminate any effects that the identified variables might have on the comparison. Receptive language age and chronological age were identified as factors that could possibly influence graphic symbol utterance construction abilities of children. It was not possible to control both of these factors and it was decided to control receptive language age rather than chronological age because language development may influence graphic symbol utterance construction abilities (Smith, 1996).

3.4 Stages

The proposal of the current study was submitted to the Research Ethics Committee of the Faculty of Humanities at the University of Pretoria for ethical approval. Once the study was approved the following stages of the study commenced. Figure 3.1 summarises the stages of the study.

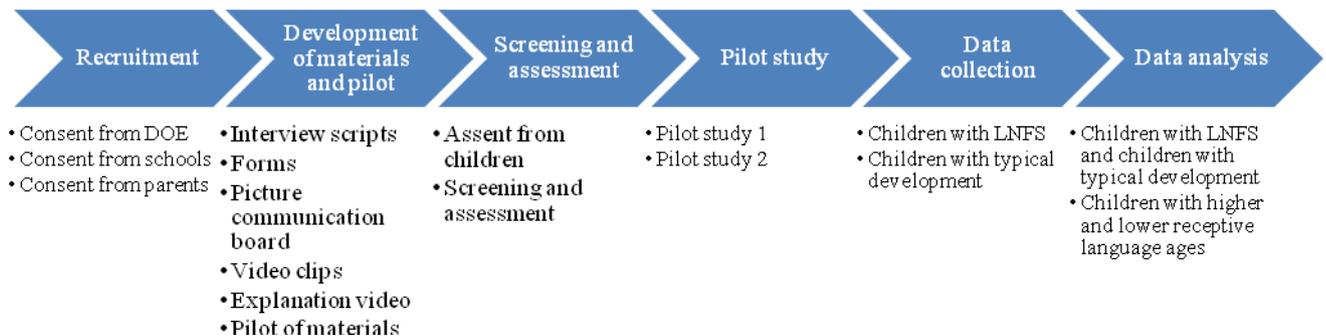


Figure 3.1. Diagram outlining the stages of the study.

The recruitment stage involved obtaining consent to recruit participants at schools first from the Eastern Cape Department of Education and then from the principals of the schools that were identified. Consent to screen and assess the children was then obtained from the parents of the children who were identified by the teachers. The second stage was to develop and source materials such as interview scripts, forms, video clips and a picture communication board that would be used to assess potential participants and that would be used in the pilot and main studies. Formal receptive language assessment measures were also obtained during this stage. The materials that were to be used in the pilot and main studies were tested on typically developing children in order to establish whether or not they were appropriate. The next stage of this study was the assent, participant screening and assessment stage. This stage involved screening children to identify potential participants and then assessing those that passed the screening. During this stage participants with typical development were matched to participants with LNFS. The pilot stage of the study was carried out in two parts, namely Pilot Study 1 and Pilot Study 2. The first pilot study was conducted with two typically developing children and this study highlighted problematic areas with the study procedures and materials. Adjustments were made to the procedures and materials and then pilot study two was conducted with one typically developing child and one child with LNFS. Following the analysis of Pilot Study 2, the data collection stage was carried out. The final stage was the analysis stage in which the data were analysed and the results were interpreted and discussed. Reliability of procedures and data transcription was also determined during this stage.

3.5 Participants

Participants were selected using a non-probability method, namely purposive sampling which involves selecting candidates that have specific characteristics (Bless, Higson-Smith, & Kagee, 2006). The researcher attempted to include as many participants with LNFS as possible that met the selection criteria and who could be identified in the research area. This study included a total number of 26 participants divided into two groups, 13 typically developing children and 13 children with LNFS. Although a sample of 15 participants per group is recommended in comparative research (McMillan & Schumacher, 2010, pp. 142), the present study had to exclude four participants with LNFS as they did not cooperate during data collection and were not able to perform the study activity. Consequently, their matching typically developing peers also had to be excluded. Recruitment of additional participants to make up for the loss would have had to take place in

regions outside of the selected area which would have resulted in additional contextual variables as well as logistical and financial constraints.

3.5.1 Selection criteria

The selection criteria applied to both groups of participants, namely the children with LNFS and the children with typical development. Table 3.1 summarises the selection criteria for the participants and lists the justifications for the criteria as well as the measures used to determine them. The only difference between the two groups was that the one group of children could speak and that the other group had little or no functional speech.

Table 3.1

Selection Criteria for Participants

Criterion	Justification	Measure
isiXhosa home-language, monolingual home environment	Monolingualism would assist in eliminating the effects of second language. Bilingualism is a variable with unknown effects in graphic symbol utterance construction.	Biographical information interview
Receptive language age between 3;0 and 6;11 years	Current research is investigating construction abilities of typically developing preschoolers (Boyer, Trudeau, & Sutton, 2012). Typically developing children aged 7;0-8;0 start to manipulate graphic symbols in terms of spoken language structure (Trudeau et al., 2007). Therefore research is focusing on children younger than 7 years.	The R-XTACL (Leggo, 1992) and XERLA (Bortz, 2001)
Functional vision and hearing	The study required that the participants be able to see the PCS (4cm x 4 cm in size) and be able to listen to verbal instructions to perform the research activity.	Biographical information questionnaire
Able to access and manipulate the graphic symbols without assistance	The study required that the participants be able to select and arrange the graphic symbols independently. Assistance from the researcher would interfere with utterance construction.	Biographical information questionnaire
No prior experience with using graphic symbols for communication purposes.	Experience with the use of graphic symbols for expression may influence children's ability to construct graphic symbol utterances (Tönsing, 2012). This criterion therefore aimed at eliminating this potentially confounding variable.	Biographical information questionnaire
Able to identify 70% of the symbols used in the study.	In order to use the symbols in an expressive task, children were required to understand what the symbol represented. They were required to point to a symbol following a verbal request from the researcher.	Symbol assessment

Criterion	Justification	Measure
Half of the participants should have little or no functional speech, defined as being able to produce less than 15 intelligible spoken words (Burd et al., 1988; Von Tetzchner, 1997).	This criterion allowed for a comparison to be made between children with typical speech development and children who have LNFS.	Biographical information interview and screening. Parents gave a list of the words the children could say. Children were required to verbally name five body parts as well as all the symbols on the graphic symbol display board to determine their speech intelligibility.

Initially, the selection criteria stipulated that all participants should have English as their home language; however during the recruitment stage of this study only one child with LNFS whose home language was English was found¹. Therefore the home language criterion was changed from English to isiXhosa, which is the second most spoken language in South Africa after isiZulu and is the dominant language spoken by 83.4% of people who live in the Eastern Cape, the province in which the study was conducted (Statistics South Africa, 2004). The researcher was able to conduct all field work (assessment, telephone interviews, data collection etc.) in isiXhosa as she had learnt the language at university and had also used the language in her work for the last two years. isiXhosa is a Bantu language and forms part of the Nguni language family, which relates isiXhosa to many other African languages. isiXhosa makes use of many prefixes and suffixes, as it is an agglutinative language. isiXhosa nouns are categorised into 15 noun classes and each noun class dictates which affixes should be used for words that relate to the noun in a sentence. Parts of speech that qualify the noun must agree with the noun according to its class. isiXhosa-speaking children start using nominal and verbal agreement around 2;0 years (Pascoe & Smouse, 2012). In isiXhosa, as with English, word order is very important in determining the subject and object of a simple sentence; the position of the word in the sentence will dictate whether it is the agent or the patient. isiXhosa-speaking children have been found to be aware of the rules of the language, such as syntax, by the age of 2;6 years (Pascoe & Smouse, 2012). The language follows a subject-verb-object constituent order for simple sentences, which is the same as English word order. Therefore changing the selection criterion to isiXhosa still allowed the research question to be answered.

¹ South Africa has 11 official languages and English is the home language of only 3.6% of the population in the Eastern Cape (Statistics South Africa, 2004).

The skills involved in transferring spoken language rules to the graphic communication modality have been suggested to emerge between the chronological ages of 5 to 12 years (Sutton & Morford, 1998; Udwin & Yule, 1990). Research investigating the development of these skills in typically developing children has focused on various age groups ranging from preschoolers to teenagers (Alant et al., 2007; Smith, 1996; Sutton & Morford, 1998; Sutton et al., 2009; Trudeau et al., 2007; Trudeau, Sutton et al., 2010;). The current study targeted children with an isiXhosa receptive language age between 3;0 and 6;11 (years;months). This range encompasses the ranges reported in previous research investigating children's graphic symbol utterance construction abilities, both children with LNFS and children with typical development (Binger & Light, 2007; Kaul, 2003; Smith, 1996; Sutton & Morford, 1998; Sutton et al., 2009; Trudeau, Morford, & Sutton, 2010; Udwin & Yule, 1990). The similar range allowed comparison between the results of the present study and those of previous studies.

3.5.2 Recruitment and selection of participants

Recruitment took place after approval had been granted by the relevant Research Ethics Committee at the University of Pretoria (see Appendix A) and after the title had been registered (Appendix B). Recruitment regions were restricted to the Cacadu district (Western District Municipality and Nelson Mandela Metropole) and the Amathole district (see map of the Eastern Cape in Appendix C). These districts include two metropolitan cities, namely, Port Elizabeth and East London. The recruitment region was restricted to the aforementioned districts due to logistical and financial constraints. The two districts were within approximately a 200km radius from Grahamstown, the city in which the researcher resided. Recruitment of children with typical development was done at a preschool and a primary school in Grahamstown. Recruitment of participants with LNFS in the districts started at the following three sources:

- Government schools for learners with special education needs (LSEN) that were identified on the Eastern Cape Department of Education website,
- Private speech therapists in the recruitment regions that were identified from the South African Speech Language and Hearing Association website,
- Day care centres and non-government organisation (NGO) special schools that were suggested to the researcher by therapists who worked at the LSEN schools

Children with LNFS were recruited first. Proprietors of 18 private speech therapy practices were contacted. None of the private speech therapists that were contacted had any clients that met the selection criteria. Twenty-four primary schools for LSEN and two day care centres for LSEN were identified in the Cacadu and Amathole districts. Of these, 16 government primary schools for LSEN, one NGO school for LSEN and one day care centre for LSEN were identified in the Cacadu district. Seven primary schools for LSEN and one day care centre for LSEN were identified in the Amathole district. Possible participants were identified by teachers at five of the 24 schools and at one of the two day care centres in the districts.

Permission was requested from the Eastern Cape Department of Education to approach the special schools identified. Once permission was granted by the Eastern Cape Department of Education (see Appendix D) the schools were contacted and dates were set to meet the principals to discuss the study and obtain consent to conduct the research study at the schools (see Appendix E). After consent was obtained from each school's or day care centre's principal to screen for participants at the school, the researcher made contact with appropriate class teachers with whom she dealt from then on. The teachers were sent an email explaining which children would be appropriate for screening for the study. They then compiled a list of names and telephone numbers of children they had identified as being possible candidates for the study and sent it to the researcher. The parents of these identified children were contacted telephonically to obtain verbal consent for screening and assessment. The telephonic explanation of the study, the obtaining of verbal consent and the parent interview was scripted (see Appendix F). Once verbal consent had been obtained, the identified children were screened and assessed.

Assessment was conducted in isiXhosa by the researcher whose isiXhosa skills were adequate for the task. The children were asked for assent to work with the researcher during the screening and assessment stage. Children gave assent by vocalising or nodding or shaking their heads. The vocalisation was interpreted by the teacher to mean yes or no respectively. All the children gave assent to participate in the screening and assessment. Twenty nine children with LNFS were identified for screening by the teachers at the special schools identified. The screening involved a brief interview with the child. First the child was greeted and their response was observed. Then they were required to name five body parts as well as name the 20 symbols on the graphic symbol communication board that would be used in the

study, to determine whether or not they had intelligible speech (25 words in total). Three children could respond with speech during the screening. They were praised on their speech and thanked for their time and they were taken back to class. Twenty-six children could not respond verbally during the screening and they moved on to the assessment. Most of these children (22) did not vocalise and instead, they attempted to use gestures. Four children could vocalise, but could not articulate the words. Assessment involved three measures, namely the R-XTACL (Leggo, 1992), the XERLA (Bortz, 2001) and an assessment of identification of the graphic symbols that were to be used in the study (see Section 3.6.2.3). Of the initial 29 children screened and assessed, 18 candidates met the requirements of the study and were given consent letters to give to their parents or guardians (see Appendix G). The consent letter contained the details of the research and a written consent form which was to be signed by the parent or guardian. Eleven candidates did not meet the requirements for participation in the study due to the following reasons:

- Three candidates had more than 15 intelligible spoken words as all 25 assessment words were intelligible to the researcher;
- Seven candidates could not carry out the receptive language assessments due to severe language and cognitive impairments;
- One candidate did not cooperate during assessment despite his assent to participate.

Recruitment of participants with typical development took place at a preschool and a primary school, both located in Grahamstown. Permission was requested from the Eastern Cape Department of Education to approach the mainstream primary school and then consent was obtained from the principals of the preschool and primary school to conduct screening and recruitment at the schools. Recruitment started at the preschool and consent letters were sent to parents of the learners in the Grade R² class. Most of the participants were found at the preschool, but it was necessary to approach the primary school for more male candidates. Letters were sent to the parents of the boys in the Grade R class at the primary school. Screening and assessment commenced once the researcher had received consent.

Children with typical development were screened and assessed in order to find matches for the participants with LNFS that had already been identified. Twenty-seven

² Grade R stands for the reception grade and is the last year of preschool before Grade 1.

candidates were screened. The screening of the candidates with typical development included conducting the R-XTACL. Those candidates that were identified as matches for participants with LNFS in terms of gender and receptive language age according to the R-XTACL were then assessed further with the XERLA and graphic symbol assessment. Eighteen candidates met the requirements of the study and were also given consent letters to give to their parents or guardians (see Appendix G). Nine candidates were not appropriate matches for the participants with LNFS in terms of receptive language age and were therefore excluded.

3.5.3 Description of Participants

Thirty-six children from monolingual, isiXhosa speaking homes were selected to participate in this study. To begin with, there were 18 children who had LNFS and 18 children who were typically-developing, however, during data collection four children with LNFS were not able to do the study activity and they had to be excluded from the study along with their matching peers with typical development. Another matched pair was used in the pilot study and the responses of these two participants were not included in the main study. The study therefore comprised of 26 participants, 13 with LNFS and 13 with typical development. There were 12 female and 14 male participants. Table 3.2 gives an overview of the participant pairs in terms of gender, diagnosis, chronological age, receptive language age and PCS symbol identification scores.

Table 3.2
 Description of Participant Characteristics Used for Matching

Participants with LNFS						Participants with typical development						
Gender	Diagnosis	CA	Receptive language			PCS	Gender	CA	Receptive language			PCS
			R-XTACL	XERLA (raw score)	XERLA (raw score)				R-XTACL	XERLA (raw score)	XERLA (raw score)	
F	CP	5;5	55	3;4	16	14	F	5;2	57	3;5	30	16
M	CP	9;5	62	3;8	19	15	M	5;5	62	3;8	28	17
M	CP	8;10	68	4;2	22	17	M	5	68	4;2	28	14
F	CP	14	69	4;3	24	17	F	5;8	68	4;2	29	16
F	CP	8;7	71	4;10	23	18	F	5;2	70	4;8	31	19
F	CP	16;1	73	5;2	28	17	F	5;7	74	5;3	28	14
M	CP	8;1	76	5;5	31	16	M	6	76	5;5	27	19
M	CP	10;1	78	5;7	33	17	M	5;10	76	5;5	28	19
M	CP	13;6	78	5;7	32	20	M	5;8	80	5;9	30	18
F	CP	14;3	82	6;1	30	16	F	5;8	79	5;8	25	19
F	CP	9	86	6;5	30	20	F	8	86	6;5	34	20
M	CP	9;7	88	6;7	30	19	M	8;8	86	6;5	32	20
M	CP	11;11	91	6;9	32	18	M	5;8	89	6;8	30	20

Note: CA = Chronological age.; r.s. = raw score; l.a. = language age

3.6 Equipment and Materials

3.6.1 Equipment

Data collection procedures were recorded using a digital video camera, namely the Kodak easyshare C1450. Video clips were played to the participants on a Samsung laptop (model R530).

3.6.2 Materials used during screening and assessment

3.6.2.1 Biographical information interview script

Biographical information about potential participants was obtained from parents or legal guardians of the children by means of a telephonic interview in isiXhosa (see Appendix F). The interview script was developed with reference to the Ages and Stages Questionnaire (Squires & Bricker, 2009), a parent self-report tool. The interview requested personal information about the participant including name, date of birth, language(s), school, medical diagnosis, vision, hearing and physical abilities as well as previous exposure to or use of AAC. Interviews for the children with LNFS included questions about speech, speech intelligibility, receptive language and use of picture communication, while interviews for children with typical development omitted such questions.

3.6.2.2 Receptive language assessments

There are very few South African language assessments available and even fewer assessments exist in isiXhosa (Mphahlele, 2006; Pascoe & Smouse, 2012; Penn, 1998). Translations of English tests do exist; however, these do not have norms for the South African population (Penn, 1998). The present study made use of two assessments of receptive language. First, the revised isiXhosa translation of The Test of Auditory Comprehension of Language (TACL) (Carrow, 1973), the R-XTACL (Leggo, 1992), was used. Second, a South African language assessment, the Xhosa Expressive Receptive Language Assessment or XERLA (Bortz, 2001) was used. Often translated tests lose validity, because through the process of translation meaning may be lost and with it, the structures that are targets for assessment. The TACL was first translated into isiXhosa (XTACL) by Willenburg (1987) and administered to 40 Xhosa-speaking children between the ages 3;0-6;9. Willenburg modified, eliminated and inserted other test items in order to ensure that the test was as relevant as possible to the grammar of isiXhosa. This translation was revised and improved

by Leggo (1992) in terms of cultural validity (grammatical structure and concept or picture stimulus) and the revised test was administered to 25 isiXhosa speaking 4;7-5;10 year olds. The results were compared with those obtained by Willenburg (1987) and Carrow (1973). Leggo (1992) found that the revised isiXhosa TACL (R-XTACL) was more effective in identifying grammatical development due to the specific isiXhosa grammatical revisions that were made to the test. The revision (R-XTACL) of the original isiXhosa translation of the TACL was used to test potential participants in the present study to determine their receptive language ages. The XERLA (Bortz, 2001) was also administered in order to validate the scores obtained in the R-XTACL. The XERLA is a translation³ of the isiZulu Expressive Receptive Language Assessment which was normed on South African 5-year-old isiZulu speaking children (Bortz, 2001). The relevant assessment forms and assessment materials for each of the tests were used during the assessment phase. The XERLA is a measure that specifically takes the structure of the grammar of Nguni languages (e.g. the nominal and verbal agreement) into account. This aspect is often lost in using translations of language tests that target morphology and syntax.

3.6.2.3 Symbol assessment

The symbols that were to be used in the main study were used in the symbol identification assessment. See Section 3.6.3.3 for a description of the symbols. Children were asked to point to all 20 graphic symbols on the display board as they were named in a random order. The participants' responses were marked on a symbol assessment form (Appendix H). Children had to be able to identify at least 70% of the symbols to be included in the study.

3.6.2.4 Consent letters and forms

The consent letter explained details of the study including what was expected of the participant and also gave information pertaining to possible benefits, confidentiality and responsibility of the researcher and participant. The consent letter was originally written in English however, when the target group for the study changed to children from isiXhosa speaking homes, the consent letter was translated into isiXhosa (Appendix E). A translator whose home language is isiXhosa was approached to assist in translating the letter from English into isiXhosa. She was a student doing her honours in Linguistics and she had done translating (English to isiXhosa) for researchers before. Once the translator had completed

³ isiZulu and isiXhosa are the two most widely spoken languages in South Africa (Statistics South Africa, 2011). They are both Nguni-languages and thus similar in vocabulary and grammatical structure.

the translation which she did with the researcher to ensure that she understood the content of the letter, the letter was blind back-translated into English by another isiXhosa-speaking individual (see Appendix I). This woman was a social worker who had had no formal experience with translating, but whose home language was isiXhosa and who had been educated in English, at school and university. The back-translated version matched the original version and no adjustments were made to the consent letter.

3.6.3 Materials used during data collection

3.6.3.1 Assent

Assent was requested from each participant before conducting the data collection procedures. If a participant could not answer verbally or by nodding or shaking the head, two symbols were used to obtain assent, one smiling face with a hand showing ‘thumbs up’ and one disinterested face with a hand showing ‘thumbs down’. A symbol of a STOP sign was provided if participants wanted to indicate that they wished to discontinue the activity (see Appendix J).

3.6.3.2 Stimulus material

Twelve video clips and four demonstration video clips were created to depict scenes that would elicit transitive subject-verb-object (SVO) structures from the participants. Sixteen SVO structures were produced based on vocabulary from the study by Sutton and Morford (1998). These transitive structures shown in Tables 3.3 and 3.4 were depicted in video clips.

Table 3.3

Demonstration Items

	Item	Length (in seconds)
1	woman kick shoe	5
2	woman smell flower	6
3	man drop book	2
4	man blow hand	3

Table 3.4

Stimulus Items

	Item	Length (in seconds)
1	man bite arm	8
2	woman smell cup	11
3	man blow bubbles	9
4	woman bite book	9
5	woman kick flower	14
6	man drop shoe	6
7	woman blow candle	6
8	man kick car	6
9	man water chair	10
10	woman drop bear	3
11	man smell banana	7
12	woman water hands	7

Ten of the structures were non-predictable, such as *woman bite book*, and two were predictable, namely, *man blow bubbles* and *woman blow candle*. The vocabulary from the Sutton and Morford (1998) study was referred to when choosing vocabulary for the present study as these authors had selected iconic symbols to ensure that the meanings of the pictures would be easily identifiable by children without training and would have little demands on memory. Agents (woman and man) and verbs (drop, water [i.e. to water something], blow, smell and bite) were the selected subject and verb vocabulary items that were chosen from the Sutton and Morford (1998) study. The verb *buy* was not included as the structure for buy would entail the use of two people and this may have affected the target SVO structures. The video clip may have been interpreted as someone selling something instead of buying something. *Buy* was replaced with *kick*. Only five of the twelve objects in the Sutton and Morford (1998) study were used in the present study. The researcher changed the remaining seven objects due to the fact that South African children may not have had previous experience with these objects or due to the fact that they would have had to be big enough to be kicked - for structures targeting the verb kick. The researcher wanted to ensure that what was being portrayed in the video clips was culturally relevant to South African children. The video clips ranged from 3 seconds to 14 seconds in duration. The length of each clip was dependent on the amount of time it took to carry out the targeted action.

The video clips were filmed at an angle that showed all the elements of the scene. The camera was stationary during filming. There was no speaking in the video clips, the only sounds that were allowed were the sounds made through performing the actions, such as the water pouring from the watering can. Two actors were used to perform the clips, a man and a woman. For clips that depicted structures where 'hands' was the object, such as *woman water hands*, another actor's hands were used, however only the hands of the second actor were visible on the video clip. This ensured that the child would not include another subject or possessive structure in their graphic symbol utterance. The video clips were tested on two typically developing children, an English-speaking boy and an isiXhosa-speaking girl, both aged 7 years old. They were requested to explain verbally what happened in the video clips. This was done to ensure that the content of the video clips was iconic and easily identifiable to children. The children correctly interpreted all the video clips.

3.6.3.3 *Graphic symbol communication display*

The materials were based on those used by Sutton and Morford (1998). The vocabulary that was used in the present study included two agents (*MAN, WOMAN*), six verbs (*BITE, BLOW, DROP, WATER* [i.e. to water something], *KICK, SMELL*) and 12 objects - all common nouns (*ARM, CUP, BUBBLES, BOOK, FLOWER, SHOE, CANDLE, CAR, CHAIR, DOLL, BANANA, HANDS*).

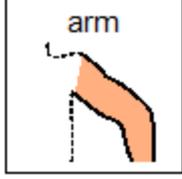
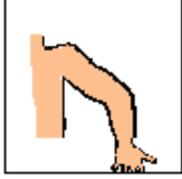
The twenty PCS (Mayer-Johnson, 2009), for the chosen vocabulary, were adapted to increase their iconicity as some concepts are more difficult to identify (Worah, 2008) and also to reduce the demands associated with using graphic symbol communication (Light & Drager, 2002). The graphic symbols were adapted according to the following rules:

1. The gloss was omitted from all the symbols in order not to give children who were literate an advantage over those who were not literate. This rule was applied to all 20 symbols.
2. Symbols indicating plurals (e.g. shoes) were made singular (e.g. shoe) in accordance with the target sentence (e.g. man drop shoe).
3. Body parts that stood alone (e.g. nose) were changed to include adjacent body parts in order to contextualise the body part, as children tend to represent concepts grounded in context rather than in isolation (Light & Drager, 2007, p. 208).
4. Action symbols were changed to exclude specific referents (e.g. the symbol for 'smell' was changed in order to omit the flower because there are many things that can be smelt).
5. When objects were removed from action symbols, action curves were added to give impression of movement e.g. scent lines in action picture of 'smell'.

Symbols that were changed and the reasons for these changes are given in Table 3.5. In addition, all 20 symbols were changed according to Rule 1.

Table 3.5

Changes Made to the PCS

Original PCS	Adapted PCS	Justification
		The referent, the ball, was removed from the action symbol (Rule 3). Action lines were added (Rule 5).
		The symbol for shoes was changed to show only one shoe to correctly represent 'shoe' (Rule 2).
		Part of a hand was added to the symbol for 'arm' and the body was coloured in (Rule 3).
		The flower was removed from the symbol for 'smell' (Rule 4) and in its place action lines, indicating smelling, were drawn (Rule 5). A mouth, an eye and an eyebrow were added to the symbol (Rule 3).
		The flower and the grass were removed from the symbol for 'water' (Rule 4).
		An eye and an eyebrow were added to the symbol for 'bite' (Rule 3).

The graphic symbols, measuring 4cm x 4cm, were laminated and hook Velcro was attached to the back of each symbol. They were attached to a symbol display board measuring 25cm x 40cm which was covered with cobalt blue carpeting material (see Figure 3.2). There was also a separate graphic symbol utterance display strip (4cm x 20cm), also covered in cobalt blue carpeting material onto which the participants arranged their graphic symbol utterances (see Figure 3.3). A raised lip was created on the left hand edge of the utterance board in order to indicate where the participant should put their first symbol.



Figure 3.2. Picture communication display board layout.



Figure 3.3. Graphic symbol utterance display strip.

The 20 PCS were placed in a specific order, namely, subjects in the top row, verbs in the second row and objects in the last two rows. Taxonomic organisation was used instead of semantic-syntactic organisation because the study wanted to prevent the display dictating the organisation of the utterances constructed. Research has found that when categories of symbols are placed from left to right on a display, this order has an impact on children's output (Alant et al., 2007). In the present study, the categories of symbols were placed one below the other, rather than left to right because the latter layout may have had a predictive influence on the utterances that the participant would construct. Therefore, the subject-symbols were placed in the top row, the verb-symbols in the second row and the object-symbols in the third and fourth rows. Figure 3.2 shows the layout of the communication board. The layout was constant and after the completion of each response, the researcher placed the symbols back into their original places.

3.6.3.4 Props

A soft toy Furby was used during the data collection activity. This is a small creature toy with big eyes and fur, and is shown in Figure 3.4. A brown cylindrical waste paper basket with slats/bars was used as a cage for the Furby. Children were told that it couldn't understand isiXhosa and that it only understood pictures.



Figure 3.4. The Furby.

3.6.3.5 Explanation video and script

After the pilot study an explanation video was developed that explained exactly what was expected of the participants, in order to ensure that each participant was given exactly the same instructions. The actress was an isiXhosa-speaking woman who grew up and lived in the Eastern Cape. The video was tested on a typically developing isiXhosa-speaking child aged 6;0 in order to determine if it was appropriate and easily understandable. This child was younger than the intended participants because one can assume that if a younger child can understand the explanation, older children would too. It was well received by this child as well as both pilot participants in the second pilot study. The children interacted with the woman in the video by nodding and responding verbally. A translated script of the explanation video is given in Appendix K. The researcher also used a procedural script in order to ensure that each session was conducted in the same manner (see Appendix L).

3.6.3.6 Record and score sheet for data collection

Each response was transcribed on a record and scoring sheet with the participant's number and group on it (see Appendix M). A space was provided on the record sheet, next to

the target, to transcribe the participant's response and analyse the structure. A score grid was provided next to these spaces to write the information, order and intelligibility scores for each response.

3.6.3.7 Procedural integrity measures

A checklist was developed for an external observer to evaluate the procedural integrity of the study (see Appendix N).

3.7 Pilot Studies

Two pilot studies were conducted before commencement of data collection for the main study. The pilot studies were only conducted once the study had been approved by the relevant Research Ethics Committee at the University of Pretoria and permission had been granted to conduct research at schools in the Eastern Cape by the Eastern Cape Department of Education (see Appendices A and D).

3.7.1 First pilot study

3.7.1.1 Participants

The first pilot participant (PP1A) was an isiXhosa-speaking girl aged 7;0 with typical development. Her receptive language age was 5;4 years according to the R-XTACL. She had no visual or auditory problems and she was able to access and manipulate pictures without assistance. She identified 17 of the 20 graphic symbols correctly.

The second pilot participant (PP1B) was an isiXhosa speaking girl aged 5;5 with typical development. The R-XTACL correlated her receptive language abilities with those of a child aged 4;11. She had no visual or auditory problems and she was able to access and manipulate pictures without assistance. She identified 18 out of the 20 graphic symbols correctly.

3.7.1.2 Objectives, materials, results and recommendations

The goals of the first pilot study, the procedures, the results obtained as well as the adjustments made can be seen in Table 3.6. The aims of the first pilot study were met.

Table 3.6

First Pilot Study

Objectives	Materials	Procedures	Results	Adjustments made
To identify any errors in the materials or procedures	Twenty graphic symbols on communication display board, utterance strip, Furby in cage, laptop with 12 video clips saved to the harddrive and a record sheet for each participant.	Video clips were played to the participants and they were required to communicate what they had seen in the video clips using the graphic symbols provided.	<ol style="list-style-type: none"> The pilot study with PP1A revealed an incorrect symbol on the board. The symbol for 'hands' was missing and in its place was the symbol for 'ball'. This caused confusion with the target 'woman water hands' in which PP1A chose the symbols <i>WATER</i> + <i>DROP</i>. <i>DROP</i> has a hand in the symbol and this is probably the reason why the participant chose it. Scoring on the record sheet revealed an incomplete form. There should have been 2 columns for scoring, one for information scores and one for order scores. These were added manually on the hardcopy and added to the electronic copy. 	Corrected symbols on the communication board and made changes to the score columns on the record sheet.
To identify verbal prompts that should be included	Scripted anticipated prompt sheet	During the graphic symbol communication activity helpful prompts were identified.	The four prompts that were used with PP1A and PP1B were recorded.	Included the isiXhosa translation of: <ul style="list-style-type: none"> • What happened here? • What did you see? • Take the pictures and put them here. • Are you finished? • Show the animal. • Look at the video • Show me with pictures • Take the pictures that are the same as the video
To calculate the activity duration	Stopwatch	The activity was timed using the stopwatch.	Each participant took between 25 and 30 minutes to carry out the study activity.	Allocated at least 30 minutes for typically developing children to complete the study activity.
To test the efficiency of the data collection procedure and to determine if the instructions are understandable	Scripted explanation sheet.	Before and during the graphic symbol communication activity the participants' reactions to the instructions and the proceedings were noted.	It was evident that PP1A was not entirely familiar with the location of all the symbols on the display board. The first response from PP1A was 2 verbs. She placed these with a time delay and it seemed as if she was revising her response, but she did not change the first symbol, instead she left it on the board. She might have needed some time before starting the activity to familiarise herself with the pictures and where they were placed on the board.	Added a pre-data collection symbol familiarisation. Added repeating each video clip and pausing it the 2 nd time around so that picture remained on the screen in order to allow the participant to recall what happened in the video clip. Included trial video clips to familiarise the participants with the study activity before it starts.

3.7.2 Second pilot study

3.7.2.1 Participants

The first pilot participant for the second pilot study (PP2A) was an isiXhosa-speaking girl aged 5;0 with typical development. Her receptive language was on a 4;0 year-old level according to the R-XTACL. She scored 28 out of 30 on the XERLA, She had no visual or auditory problems and she was able to access and manipulate pictures without assistance. She identified 18 out of 20 graphic symbols correctly. She attended a preschool and was in the grade R class.

The second pilot participant for the second pilot study (PP2B) was a girl with cerebral palsy and LNFS aged 8;9. She understood isiXhosa only, as it was her home language Her receptive language age was on a 3;9 year-old level according to the R-XTACL. She scored 22 out of 35 on the XERLA. She had no visual or auditory problems and she was able to access and manipulate pictures without assistance. She identified 11 out of the 20 graphic symbols correctly. PP2B was in Grade 1 at a school for children with physical disabilities. Her mother reported that she could understand isiXhosa well because she could follow verbal instructions. PP2B's mother reported that the child could only say one word clearly, namely 'mama' meaning mother and that her speech was not intelligible. PP2B had had no previous experience or exposure to graphic symbol communication.

3.7.2.2 Objectives, results and recommendations for the main study

Adjustments were made to the materials, prompts, scripts and procedures as recommended after the first pilot study and the effects of the changes were observed in a second pilot study. The objectives, results and final adjustments made to the materials, prompts and procedures are shown in Table 3.7.

Table 3.7

Second Pilot Study

Objectives	Materials	Procedures	Results	Adjustments made
To observe and test the procedures and identify any more improvements	Twenty graphic symbols on communication display board, utterance strip, Furby in cage, laptop with four demonstration clips and 12 video clips saved to the harddrive and a record sheet for each participant.	Demonstration video was played to participants. Video clips were played to the participants and they were required to communicate what they had seen in the video clips using the graphic symbols provided.	Both participants in the second pilot study put more than 3 symbols on their utterance boards. PP2A put 4 consistently, while PP2B put between 4 and 7 symbols. PP2B possibly had perseveration which is common with brain injury, this is the tendency to repeat a motor task. Even when there was no more space on the utterance strip to put more symbols, PP2B continued to add symbols placing them one on top of the other. The order in which she placed them was noted and transcribed.	In order to prevent participants from deviating from left to right placement, a lip was constructed on the left edge of the utterance board and the height of the board was changed from 7cm to 4cm, the same height as the PCS symbols. This eliminated the possibility of symbols being placed above other symbols.
To test the demonstration videos	Four demonstration videos, laptop, 20 PCS on communication display board and utterance strip.	The demonstration procedures followed this order: <ul style="list-style-type: none"> • Video 1 – demonstrated by researcher • Video 2 – attempted by participant • Video 3 – demonstrated by researcher • Video 4 – attempted by participant 	It was found that the participants had difficulty understanding the procedures and that it may be helpful if the participant could repeat a clip that was done by the researcher.	The demonstration procedures were changed to follow this order: <ul style="list-style-type: none"> • Video 1 – demonstrated by researcher • Video 2 – demonstrated by researcher, replayed and attempted by participant • Video 3 – demonstrated by researcher • Video 4 – attempted by participant
To identify any other verbal prompts that may be required	Scripted anticipated prompt sheet	During the graphic symbol communication activity helpful prompts were identified.	Two more prompts were identified.	Included the isiXhosa translation of: <ul style="list-style-type: none"> • Start here • Show that animal what you saw in the video

Objectives	Materials	Procedures	Results	Adjustments made
To identify any problems with the scoring of the participants' responses	Response sheet for each participant	After the graphic symbol communication activity, the researcher scored the transcribed responses of each participant.	<p>The 2-point scoring system for order did not differentiate between 2-symbol utterances and 3-symbol utterances.</p> <p>The scores for information and order were insufficient. The need was identified for a third score to describe the overall intelligibility of the participants' utterances thereby combining information and order.</p>	<p>The original scoring guidelines were adapted for the order category. The original scoring was according to a 2-point scale and it was changed to a 3-point scale. A maximum of 2 points were allocated to SVO structures and 1 point was allocated to SV, SO and VO structures. Zero points were allocated to structures that did not follow isiXhosa grammar.</p> <p>Another score was also developed to give an overall intelligibility rating of the utterance. The participant was given 1 point for each correct symbol in an order according to isiXhosa grammar. A maximum of 3 points could have been allocated to each utterance.</p>

3.8 Procedures

3.8.1 Ethical considerations

Data collection, including the pilot study, only commenced after the study had been cleared by the Research Ethics Committee of the Faculty of Humanities at the University of Pretoria (see Appendix A) and consent had been granted by the Eastern Cape Department of Education (see Appendix D). Consent was also obtained from the principal of the school and the parent or legal guardian of the child. Letters were sent to the principal and the parents explaining the details of the research study (see Appendices E and G). The consent letters explained details of the study and what was expected of the participant as well as other information pertaining to confidentiality and responsibility. The letters to the parents were translated into isiXhosa so that they would be able to understand fully in their home language what the study entailed (see Appendix G). Verbal consent was also obtained during the telephonic interview with the parents. Assent to participate in the study was obtained from each participant. Participants that could answer yes or no gave assent verbally. For participants who could not give verbal assent pictures were used (see Appendix J). The participant could point to a picture of a happy face with hands indicating ‘thumbs up’ if he or she wished to participate and to a picture of a disinterested face with hands showing ‘thumbs down’ if he or she did not wish to participate. Participants were told that they could stop doing the activity if they wanted to by pointing to a STOP card that was placed next to them during the data collection session.

3.8.2 Data collection

Once the assessment and pilot study phases had been completed, the data collection phase began. Data was collected at a convenient venue for the participants. The schools were approached for the use of one of their rooms for data collection, as the child’s school seemed to be the most convenient venue. Each school allowed the researcher to use a quiet room with a table and chairs. The room differed from school to school, and included a principal’s office, an occupational therapy room, a physiotherapy office, a staff room and a store room. The data collection room was set up before the participants entered the room. The digital video camera was set up and ready for capturing of assent and the data collection procedures. The communication board was arranged for each participant to ensure that they all had the same layout of the symbols on the board. Each participant was collected from their classroom and was seen individually for data collection.

The researcher followed a script to obtain assent to participate in the activity (see Appendix J). Before the study activity commenced the researcher named and pointed out all the graphic symbols that were to be used in the study so as to familiarise the participants with the symbols that were available to them and their location on the display board. Participants watched the explanation video which explained the activity they would do (for a translated script of this video, see Appendix K). The activity was set up to resemble a game in which the participant had to communicate the message played in the video clip using graphic symbols to a small creature (the toy Furby) trapped in a cage. The aim of the game was to communicate all the messages in order to free the creature. The participants were instructed in the explanation video that the creature did not understand spoken language and could only understand graphic symbols. The use of the creature made the communication task meaningful. A demonstration and trial was conducted before the study started. This involved the researcher playing Clip 1 and demonstrating the target response, playing Clip 2 and demonstrating the target response. Clip 2 was then replayed and the participant was required to attempt giving a PCS utterance to match what was portrayed in the clip. The researcher then played Clip 3 and demonstrated the target response. Finally Clip 4 was played and the participant attempted the PCS utterance. This demonstration and trial procedure was not a training procedure, instead it was primarily to familiarise the participants with the task they were about to do. Therefore, no corrective feedback was given, instead participants were given general encouragement, such as “Are you finished? Show the animal.”. The spoken equivalent of the PCS symbols was not given. The activities focused only on the visual modality. The only spoken language that was used was for instructions and prompts given by the researcher.

The study activity consisted of the participant watching a series of 12 video clips, one at a time, in a predetermined order. After each video clip the participant was required to arrange the relevant graphic symbols to communicate what happened in the clip. Video clips were played twice and the video was paused during the action, only on the second viewing, so that there was a static referent of what happened in the video clip. Again, no spoken language equivalents were given for the graphic symbol utterances that the participants constructed. Participants were prompted if they did not start arranging a graphic symbol utterance once the video clip had been paused. A prompting script was followed to ensure that all prompts were uniform and consistent across participants and did not include corrective feedback (See Appendix L). The prompting script was used when the participant

was unsure of what to do or if the participant looked to the researcher for input. Video recordings were made of each session. Data collection was conducted first with participants with LNFS, followed by data collection with typically developing participants.

3.9 Data Analysis

3.9.1 Scoring

Each participant's graphic symbol utterances were transcribed and analysed according to isiXhosa semantics and syntax in terms of content and order of the graphic symbol utterances. An intelligibility rating was given to the overall utterance for correct symbols and for symbols that were placed in an order similar to that of isiXhosa grammar. The scoring guidelines for content and order are represented in Table 3.8.

Table 3.8
Scoring Guidelines for Content and Order Scores

Scoring categories	Responses	Score	Maximum Score
Content	Nothing or non-target symbol	0	3
	Target S, or V, or O	1 for each element	
Order of elements	No order or different to isiXhosa word order (SOV, VSO, VOS, VS, OSV, OVS, OS, OV, VSV)	0	2
	Same as isiXhosa word order (SV, SO, VO)	1	
	Same as isiXhosa word order (SVO)	2	

In terms of content scoring, participants received points for placing a symbol that correctly depicted the referents and actions in the video clips. They received content points for correct symbols only. In terms of order scoring, participants only received order points if the utterance contained more than two elements. Utterances that contained one symbol were awarded no order points because one symbol was not considered to be a sentence. Order points were also only awarded to utterances that resembled word order of isiXhosa. Partial utterances containing two elements were awarded two order points if they were placed in the following orders: SV, SO or VO. Two order points were allocated to utterances that followed an SVO order. No points were given to utterances containing three symbols that were not placed in an order that followed isiXhosa structure, for example SVV. Intelligibility points

were allocated to utterances that contained correct symbols in an order according to isiXhosa grammar. Table 3.9 shows scoring guidelines and examples of utterances for intelligibility.

Table 3.9
Intelligibility Scoring Guidelines

Target utterance: woman kick flower		
Intelligibility score	Score description	Example of utterance constructed for the target 'woman kick flower'
5	Three symbols containing target information and order according to isiXhosa	<i>WOMAN</i>
4	Two symbols containing target information and order according to isiXhosa	<i>KICK FLOWER</i>
3	Two symbols containing target information	<i>FLOWER WOMAN</i>
2	Single symbols with target information Two out of three symbols with target information Three out of four symbols with target information	<i>FLOWER</i> <i>WOMAN FLOWER SHOE</i> <i>SHOE FLOWER WOMAN KICK</i>
1	One out of two symbols with target information Two out of four symbols with target information One out of three symbols with target information	<i>FLOWER SHOE</i> <i>WOMAN SHOE FLOWER WATER</i> <i>FLOWER MAN SHOE</i>
0	Overall content and order do not relate to target	<i>BEAR SHOE HAND MAN</i>

3.9.2 Statistical measures

3.9.2.1 Descriptive statistics

Means (M) and standard deviations (SD) were used to summarise the performance of the groups on the three variables, content, order and intelligibility.

3.9.2.2 Inferential statistics

Inferential statistics were used to determine whether differences between the two groups were statistically significant across the measured variables. They also showed the equivalence of the two groups of children, namely children with LNFS and children with typical development. The Wilcoxon's matched-pairs signed-ranks test is a nonparametric test that allows comparison of the central tendency of two independent, matched groups (Howell, 2004). It was used to determine whether or not differences exist between children with LNFS and children with typical development across the three variables, content, order and intelligibility. This test was used rather than the Chi-square test as the Wilcoxon test can

accommodate small groups. Fisher's Exact Test is a technique that allows one to run multiple comparison *t* tests between pairs of means when the analysis of variance is significant (Howell, 2004). This test is used to determine relationships between two categorical variables, and in the current study it was used to determine differences between children with higher and lower receptive language age across the three variables. The Chi-square test was not used because the sample was small and the frequencies were too small.

3.10 Reliability

3.10.1 Procedural integrity

An external observer analysed 20% of the data collection video recordings to determine the procedural integrity of the data collection procedures. A procedural integrity checklist was used to rate the procedures (see Appendix N). The percentage of steps adhered to was calculated by dividing the number of steps adhered to by the total number of steps and multiplying by 100, as shown in the formula below.

$$\frac{\text{Number of steps adhered to}}{\text{Total number of steps}} \times 100$$

3.10.2 Reliability of transcription and scoring

The same independent observer was also required to transcribe the responses of 20% of the participants' data, which was randomly selected, to evaluate the reliability of the researcher's transcriptions of the data. Point-by-point agreement on the transcription was calculated by the following formula:

$$\frac{\text{Number of agreements}}{\text{Number of agreements plus disagreements}} \times 100$$

The independent observer furthermore scored each response on content, order and intelligibility according to the scoring guidelines. Point-by-point agreement on the data scoring was calculated by the following formula:

$$\frac{\text{Number of agreements}}{\text{Number of agreements plus disagreements}} \times 100$$

3.11 Summary

This chapter described the aims and design of the study. It explained the stages of the study, including recruitment of participants, assessment of participants, the pilot study and data collection procedures of the main study. Participants and materials and equipment were also discussed. The results of the pilot study were explained as well as adjustments and recommendations for the main study. Finally, data analysis methods and reliability measures were presented.

CHAPTER 4

RESULTS

4.1 Introduction

This chapter begins with an analysis and report of the integrity of the procedures and the reliability of the data collection. Following this verification, the results of the statistical analyses are presented. The analyses aimed to reveal any significant differences between the two participant groups in terms of the content, order and intelligibility of their graphic symbol utterances. The results are discussed according to the sub-aims of this study. Further, the results for both groups are combined and analysed across two new groups which are divided according to the participants' receptive language ages. Finally, additional observations of the study are presented.

4.2 Reliability and Integrity of Data and Procedures

4.2.1 Procedural integrity of demonstration and study activities

An independent observer, a qualified speech and language therapist, watched the video recordings of 20% of the sessions that were randomly selected from each group (i.e. three sessions per group) and used the checklist in Appendix N to score the procedural integrity. Table 4.1 shows the procedural integrity scores obtained for the demonstration and study activities. The procedures conducted during the demonstration and study activities were both conducted with 100% accuracy.

Table 4.1

Overall Procedural Integrity for Demonstration and Study Activities

	Participants						Total
	P2.13	P2.2	P2.3	P1.8	P1.6	P1.11	
Procedural integrity of demonstration	100%	100%	100%	100%	100%	100%	100%
Procedural integrity of study activity	100%	100%	100%	100%	100%	100%	100%

4.2.2 Reliability of transcription and scoring of the responses

The same independent observer transcribed and scored the responses given by the participants during the same six randomly selected sessions as above. These transcriptions

and scores were compared with those obtained by the researcher and the percentage agreement was determined. Table 4.2 shows the percentage agreement obtained for transcription and scoring for each of the six participants. The sum of percentage agreements divided by the number of participants showed that the researcher and the independent observer agreed 100% on the transcription of the responses and 99.54% on the scoring of responses, indicating high interobserver agreement.

Table 4.2
Percentage Agreement for Transcription and Scoring

	Participants						Total
	P2.13	P2.2	P2.3	P1.8	P1.6	P1.11	
Percentage agreement for transcription	100%	100%	100%	100%	100%	100%	100%
Percentage agreement for scoring	91.7%	100%	100%	100%	100%	100%	99.54%

4.3 Equivalence of groups

Table 4.3 presents the mean values (M) and standard deviation (SD) as well as the Wilcoxon p-values for each group on variables pertaining to receptive language skills, symbol identification skills and chronological age to indicate the extent of equivalence among the groups.

Table 4.3
Equivalence of Groups

Group	R-XTACL Raw Score			XERLA Raw Score			Symbol Identification Score			Chronological Age (Months)		
	M	SD	p	M	SD	p	M	SD	p	M	SD	p
LNFS	75.0	10.36	0.8988	26.92	5.51	0.6450	17.23	1.79	0.4429	128.08	36.44	0.0010**
TD	74.7	9.56		29.23	2.31		17.77	2.17		71.54	13.17	

**p<0.01

Statistical analysis, using the Wilcoxon test, showed that there were no significant differences between the two groups (children with LNFS and children with typical development (TD)) in terms of receptive language age on the R-XTACL (p = 0.8988) and XERLA (p = 0.6450) tests respectively and neither on symbol identification (p = 0.4429).

This indicates that the groups were similar on the variables that the researcher wished to control. There was, as expected, a significant difference between the groups in terms of chronological age ($p = 0.0010$). The average age of children with LNFS was higher (128.08 months) than that of the participants with typical development (71.54 months).

4.4 Comparison of Results across Children with LNFS and Children with Typical Development in Terms Of Content, Order and Intelligibility

Raw scores were analysed using the Wilcoxon Test. The results are discussed under Sections 4.4.1 – 4.4.3.

4.4.1 The content provided in graphic symbol utterances

The content scores reflected the number of target symbols used over the twelve test items per participant. Each video clip had three target (i.e. expected) symbols associated with it, namely, an S-, V-, and O-symbol that described what happened in the clip. Each target symbol received one point and the maximum possible score was 36 (three points for each of the 12 items). The total score reflected the total number of targets achieved across the twelve test items. The first statistical analysis using the Wilcoxon test showed no significant difference between children with LNFS and children with typical development in terms of content score obtained ($p = 0.7992$). Both groups of children produced utterances with similar content scores. Children with LNFS selected 17.38 symbols on average ($SD = 7.98$) while children with typical development selected an average of 17 symbols ($SD = 4$).

Further analysis determined the number of responses that contained target subject-symbols, target verb-symbols and target object-symbols for each participant and whether or not there were differences between the two groups in terms of the specific target symbols that were used. Table 4.4 shows the means, standard deviations and p-values for the number of target subject-symbols, verb- symbols and object-symbols used by each group of children (see Appendix O for a table of scores per item).

Table 4.4

Means, Standard Deviations and p-Values for the Number of Target Symbols Used By Each Group

Group	Subject-symbols			Verb-symbols			Object-symbols		
	Mean	SD	p	Mean	SD	p	Mean	SD	p
LNFS	4.31	4.82	0.3449	4.92	1.98	0.1731	7.79	2.62	0.5906
TD	1.92	3.35		6.23	2.38		8.46	1.71	

According to the Wilcoxon test the number of target symbols (subject, verb and object) used were not significantly different between the two groups. More target object-symbols were used by both groups of children than target verb- or subject-symbols. Children with LNFS and children with typical development made use of target object-symbols most frequently ($n = 106$, 68% and $n = 114$, 73% respectively), and there was no significant difference between the groups ($p = 0.5906$). Children with LNFS selected 7.79 target object-symbols ($SD = 2.62$) on average while children with typical development selected 8.46 target object-symbols ($SD = 1.71$). This was followed by a lesser use of verb-symbols by children with LNFS and children with typical development ($n = 64$, 41% and $n = 81$, 52 % respectively). Children with LNFS selected 4.92 target verb-symbols ($SD = 1.98$) on average while children with typical development selected 6.23 target verb-symbols ($SD = 2.38$). This difference was also not significant as the p-value was 0.1731. Both groups used the subject-symbols infrequently in their utterances; however, children with typical development used subject symbols more infrequently than children with LNFS ($n = 25$, 16% and $n = 56$, 36% respectively). However, this was not significantly different between the groups according to the Wilcoxon test ($p = 0.3449$). Children with LNFS selected 4.31 target subject-symbols ($SD = 4.82$) on average while children with typical development selected 1.92 target subject-symbols ($SD = 3.35$).

4.4.2 The order of graphic symbol utterances

The scores allocated to evaluate the structure of the symbols in the participants' utterances were given according to how closely the utterances followed the isiXhosa word orders. Zero points were allocated to utterances that did not follow isiXhosa word order or that contained only one symbol, as a single symbol is not typically regarded as a structured sentence. One point was allocated to an utterance that contained two symbols that followed

isiXhosa structure and, two points were allocated to an utterance containing three symbols that followed isiXhosa word order. Therefore a maximum score of 24 points could be obtained in total for the 12 utterances (maximum 2 points per utterance). The Wilcoxon test was used to analyse the data. No significant difference was found between the participants' scores for order ($p = 0.4849$), therefore both groups had similar total scores for the structures of their responses. The average order scores for each group were 3 ($SD = 4.55$) for children with LNFS and 3.31 ($SD = 3.7$) for children with typical development.

Analysis of the specific structures produced by each group yielded interesting results. The structures that were produced were either single-symbol utterances or multi-symbol utterances that conformed to isiXhosa word order or that differed considerably from the spoken word order. The overall structures of both groups varied considerably in that they both used a variety of different structures. Fisher's Exact test showed a significant relationship between the groups and the types of structures they produced, namely; single symbol utterances, multi-symbol utterances with different order or multi-symbol utterances with an order according to isiXhosa word order ($p < 0.0001$). Table 4.5 presents a summary of the frequency of single symbol and multi-symbol use between the two groups.

Table 4.5

The Frequency of Overall Single Symbol and Multi-Symbol Use Between the Two Groups

	Children with LNFS		Children with typical development		p
	n	%	n	%	
Single symbols	68	43.6%	29	18.6%	
Symbol combinations according to isiXhosa grammar	29	18.6%	31	19.9%	<0.0001 ***
Symbol combinations different to isiXhosa grammar	59	37.8%	96	61.5%	
TOTAL	156		156		

*** $p < 0.001$

The data presented in Table 4.5 indicates that both children with LNFS and children with typical development used more symbol combinations than single symbols; however, most of these multi-symbol utterances had structures different to isiXhosa grammar. Children with LNFS composed 88 multi-symbol utterances (56.4%) and 68 single symbol utterances (43.6%), differing by only 20 responses. This ratio of single symbol utterances to multi-

symbol utterances was thus 4.4:5.6 for children with LNFS, which was relatively close. On the other hand, children with typical development produced much fewer single symbol utterances ($n = 29$; 18.6%) and more multi-symbol utterances produced ($n = 127$ or 81.4%). The ratio of single symbol utterances to multi-symbol utterances was therefore 1.9:8.1, which was relatively great. Children with LNFS composed more single symbol utterances than children with typical development ($n = 68$, 43% and $n = 29$, 19% respectively). The single symbol utterances of both groups were either object-symbols or verb-symbols. None of the single symbol utterances were subject-symbols. Regarding symbol combination, children with LNFS composed 29 out of 156 utterances (18.6%) with structure following the order of isiXhosa grammar, while children with typical development composed 31 out of 156 utterances (19.9%) according to isiXhosa grammar. The groups' abilities to construct graphic symbols according to isiXhosa were comparable. The structures of the remaining utterances for each group were very different to isiXhosa word order. Children with typical development constructed more utterances with unique word orders than children with LNFS ($n = 96$, 61.5% and $n = 59$, 37.5% respectively). All the different structures used by the participants in each group are presented in Table 4.6 and a summary of the most frequently used structures is presented in Table 4.7.

Table 4.6

The Different Structures Used By the Two Groups

	Structures	Number of structures for children with LNFS	Number of structures for children with typical
Typical isiXhosa structure	VO	6	19
	SO	14	9
	SV	-	2
	SVO	9	1
	Subtotal	29	31
Single symbols	V	29	10
	O	39	19
	Subtotal	68	29
Different to isiXhosa structure			
	2 symbol combinations		
	OO	1	13
	OS	8	3
	OV	2	5
	VV	-	1
VS	-	1	

	Structures	Number of structures for children with LNFS	Number of structures for children with typical
3 symbol combinations	OOO	2	4
	OOV	3	1
	OVV	1	1
	OSO	2	1
	OVO	1	4
	OVS	1	-
	OOS	3	1
	OSV	2	1
	SVV	2	-
	SOV	5	-
	SSV	1	-
	SVV	1	-
	SVS	-	1
	VVV	-	2
	VOV	1	1
	VSV	1	1
	VOS	3	-
	VOO	1	4
	VVO	1	3
	4 symbol combinations	OOOO	3
OOOV		2	5
OOVO		-	3
OOVV		-	1
OVOV		-	1
OVVV		-	1
OVOO		1	1
OSOO		2	2
VOOV		2	1
VVVO		1	2
VVOO		1	4
VOOO		-	13
VOVV		-	1
VOOS		-	1
VOSS		-	1
VSOO		-	1
SVOV		1	-
SOOV		1	-
SVVO		1	-
SVOO		-	1
5 symbol combinations	OOOOO	2	-
	VOOOO	-	1
	Subtotal for combinations	59	96
TOTAL		156	156

Note: S = subject, V = verb, O = object

Table 4.7

The Structures That Were Used Most Frequently By the Two Groups

Children with LNFS		Children with typical development	
Structure	No. of times used	Structure	No. of times used
O	39	VO	19
V	29	O	19
SO	14	OO	13
SVO	9	VOOO	13
		V	10
		SO	9
		OOOO	8
TOTAL	91		91

Descriptive statistics indicated that the structures that were used most frequently by the participants differed for the two groups. From Table 4.7 it is evident that children with LNFS primarily used four different structures, two single symbol utterance types (O and V) and two relating to isiXhosa word order (SO and SVO). Children with typical development used more varied structures. The most common structures that they used included two structures following isiXhosa grammar (VO and SO), two single symbol utterance types (O and V) and three structures that had unique combination characteristics (OO, VOOO and OOOO). The majority of multi-symbol utterances arranged by children with typical development were four symbol utterances that had structures that differed from the spoken language target (VOOO and OOOO; $n = 21$). From Table 4.6, one can see that children with typical development arranged more four symbol utterances than children with LNFS ($n = 46$ and $n = 15$ respectively). Most of these symbol combinations contained multiple object-symbols or multiple verb-symbols.

Previous research has shown that organisation of categories of symbols on the display board can affect the structure of the utterances produced (Alant et al., 2007; Nakamura et al., 1998). The current study had three vocabulary categories, namely, subject-symbols, verb-symbols and object-symbols. Graphic symbols were arranged from left-to-right within the respective category. The vocabulary categories were then arranged one below the other and not next to each other from left-to-right (refer to Figure 3.2). This organisation was chosen to reduce the effects that linear organisation has on SVO and SOV utterance structures. From Table 4.6 it is clear that very few SOV structures were produced and they were only produced by children with LNFS ($n = 5$). There were almost double the number of SVO structures produced than SOV structures and these were also produced primarily by children with LNFS.

4.4.3 The intelligibility of graphic symbol utterances

Intelligibility scores were given to each of the participants' utterances to give an indication of how understandable the overall utterance was. Higher scores indicated that target symbols and target order were used, while lower scores indicated that few target symbols were used and utterances followed unique structures that differed from isiXhosa word order. Table 3.9 in Section 3.9.1 gives the scoring guidelines and examples. The maximum score per utterance was 5, while the maximum total score per participants was 60 (12 X 5).

The graphic symbol utterances constructed by children with LNFS showed no significant difference in terms of intelligibility scores obtained when compared with the scores given to utterances constructed by children with typical development ($p = 0.3772$ according to the Wilcoxon test). The average intelligibility scores were 24.92 (SD = 11.62) for children with LNFS and 20.61 (SD = 13.7) for children with typical development. Figure 4.1 below shows the percentages of utterances falling at each intelligibility score for each group.

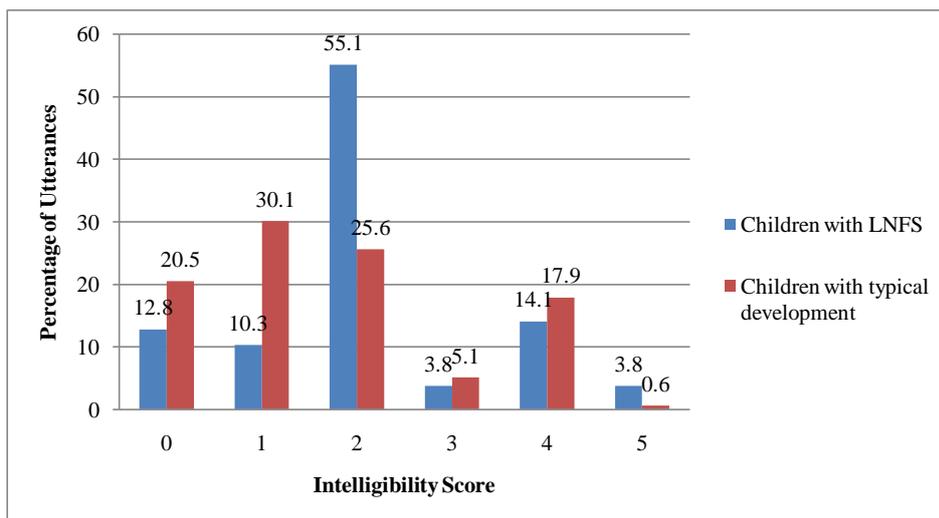


Figure 4.1. Comparison of the percentage of utterances falling at each intelligibility score for children with LNFS and children with typical development.

Comparison of the total number of scores obtained per group for each intelligibility score, using Fisher's Exact test revealed a significant relationship between the groups and the distribution of the intelligibility scores ($p < 0.0001$). According to the data presented in Figure 4.1 (see Appendix P also), the majority of graphic symbol utterances composed by children with LNFS had an intelligibility rating of 2 ($n = 86, 55.1\%$). This means the utterances contained either (a) single symbols with target information, (b) two out of three symbols with target information, or (c) three out of four symbols with target information (see Table 3.9 for examples of intelligibility score ratings). These utterances did not necessarily follow isiXhosa word order. Children with typical development tended to produce most graphic symbol utterances that received an intelligibility score of 1 with either (a) one out of two symbols with target information, (b) two out of four symbols with target information, or (c) one out of three symbols with target information ($n = 47, 30.1\%$). This was closely followed by 40 utterances (25.6%) receiving an intelligibility score of 2 (see Appendix P for table showing the number of utterances falling at each score for each participant).

4.4.4 Summary of findings between children with LNFS and children with typical development

The mean scores, standard deviations and p-values are presented in Table 4.8 for content, order and intelligibility scores. The results indicate that children with LNFS and children with typical development do not show significant differences in the way in which they construct graphic symbol utterances when compared in terms of content, order and intelligibility scores, as can be seen in Figure 4.2.

Table 4.8
Comparison of the Groups on the Three Variables

Group	Content Score			Order Score			Intelligibility Score		
	M	SD	p	M	SD	p	M	SD	p
LNFS	17.38	7.98	0.7992	3.0	4.55	0.4849	24.92	11.62	0.3772
TD	17.0	4.0		3.3	3.7		20.61	13.68	

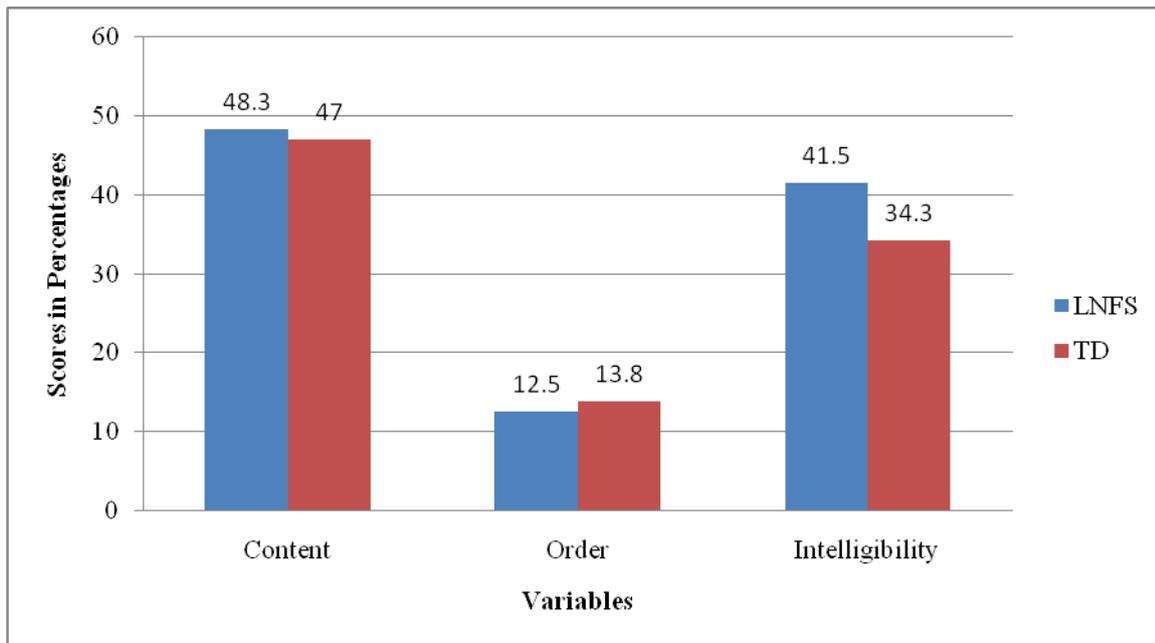


Figure 4.2. Comparison between the total score (converted to percentage) obtained by children with LNFS and children with typical development.

They also did not differ significantly in terms of the number of target symbols used in their utterances. However, the groups were proven significantly different in terms of the types of structures produced and the distribution of intelligibility scores which they obtained. Children with LNFS used more single symbol structures in their responses while children with typical development used more unique multi-symbol combinations that did not follow isiXhosa word order in their responses. Most of the intelligibility scores obtained by children with LNFS were scores of 2 while children with typical development mostly obtained intelligibility scores of 1.

4.5 Comparison of Results across Receptive Language Age Groups

Due to the fact that no significant differences were found between children with LNFS and children with typical development in terms of content, order and intelligibility scores, the data from both groups were combined and divided to form two new groups according to receptive language age (RLA). Table 4.10 presents a comparison between the receptive language scores and the symbol identification scores across the two receptive language age groups.

Table 4.9

Equivalence of Groups

Group	Participants	R-XTACL Raw Score			XERLA Raw Score			Symbol Identification Score		
		M	SD	p	M	SD	p	M	SD	p
LRLA	10	65.0	5.64	0.0003***	25.0	5.01	0.0142*	16.3	1.64	0.0200*
HRLA	16	81.12	5.77		30.0	2.37		18.25	1.81	

* $p < 0.05$ *** $p < 0.001$

The lower receptive language age (LRLA) group consisted of 10 participants, five with LNFS and five with typical development. Their receptive language ages ranged from 3;4 to 4;10 according to the R-XTACL (18 month range). The higher receptive language age (HRLA) group consisted of 16 children, eight with LNFS and eight children with typical development who had receptive language ages from 5;2 to 6;9 according to the R-XTACL (19 month range). Statistical analyses of the two language age groups, using the Wilcoxon test, showed significant differences in terms of R-XTACL ($p = 0.0003$) and XERLA ($p = 0.0142$) scores as well as symbol identification scores ($p = 0.0200$).

4.5.1 The content provided in graphic symbol structures

The Wilcoxon test showed no significant differences between the different language age groups in terms of content scores ($p = 0.1737$). Children with LRLA had an average content score of 14.9 (SD = 5.09) while children with HRLA had an average content score of 18.62 (SD = 6.53), indicating that children with HRLA provided more information in their utterances than children with LRLA.

Data was further analysed to determine which symbols were most frequently used, as shown in Table 4.10. Note that there is a discrepancy in the number of participants in each group (10 with LRLA and 16 with HRLA) therefore the percentage is used for comparing the raw numbers of target symbols selected by each group (n). Table 4.10 shows the means and p -values for the number of target subject-symbols, verb-symbols and object-symbols used by each receptive language age group (see Appendix Q for a table showing individual scores).

Table 4.10

Means, Standard Deviations and P-Values for the Number of Target Symbols Used By Each Group

Group	Participants	Subject-symbols			Verb-symbols			Object-symbols		
		M	SD	p	M	SD	p	M	SD	p
LRLA	10	1.7	2.41		5.4	2.17		7.9	2.64	
HRLA	16	4	4.94	0.6061	5.69	2.36	0.7715	8.81	2.26	0.4613

Results from the Wilcoxon test proved that the groups were not significantly different in terms of the number of target symbols used for each of the categories: S, V and O. For target object-symbols used the p-value was 0.4613 with an average number of 7.9 target object-symbols (SD = 2.64) for the LRLA group and an average number of 8.81 (SD = 2.26) for the HRLA group. For target verb-symbols used the p-value was 0.7715 with an average number of 5.4 target verb-symbols (SD = 2.17) for the LRLA group and an average number of 5.69 for the HRLA group (SD = 2.36). For target subject-symbols the p-value was 0.6061 with an average number of 1.7 target subject-symbols (SD = 2.41) for the LRLA group and an average number of 4 target subject-symbols (SD = 4.94) for the HRLA group. Both receptive language age groups used target object-symbols most frequently (66% for the LRLA group and 73% for the HRLA group), followed by a close similarity in verb-symbol use (45% for the LRLA group and 47% for the HRLA group). Both groups used the subject-symbols infrequently in their utterances; however, children with LRLA used subject-symbols slightly more infrequently than children with HRLA (14% and 33% respectively).

4.5.2 The order of graphic symbol structures

The LRLA group was found to be significantly different on the 5% level to the HRLA group in terms of order scores ($p = 0.0342$ on the Wilcoxon test). Children with LRLA had an average order score of 1.1 (SD = 1.73) and children with HRLA had an average order score of 4.44 (SD = 4.6). Fisher's Exact test indicated a significant relationship between the two age groups and the types of structures used, namely, single symbol utterances, multi-symbol utterances with different order or multi-symbol utterances with an order according to isiXhosa word order ($p < 0.0001$). This data is presented in Table 4.11. Note that the raw

scores are not comparable because of the discrepancy in the number of participants in each group therefore the percentage is a better alternative for comparison.

Table 4.11

The Frequency of Overall Single Symbol and Multi-Symbol Use Between the Two Groups

	LRLA group		HRLA group		p
	n	%	n	%	
Single symbols	41	34.2%	56	29.2%	
Symbol combinations according to isiXhosa grammar	7	5.8%	53	27.6%	<0.0001***
Symbol combinations different to isiXhosa grammar	72	60%	83	43.2%	
TOTAL	120		192		

***p<0.001

From Table 4.11 one can see that children with lower receptive language age composed slightly more single symbol utterances than children with higher receptive language age (34.2% and 29.2% respectively). Both receptive language age groups used more multi-symbol utterances than single symbol utterances and the groups were quite comparable on these variables. Children with lower receptive language age produced fewer utterances according to isiXhosa grammar than children with higher receptive language age (5.8% and 27.6% accordingly). Children with lower receptive language age constructed more utterances with unique word orders than children with higher receptive language age (60% and 43.2% respectively). All the different structures used by the participants in each receptive language age group are presented in Table 4.12. Again, note that the raw scores are not comparable because of the discrepancy in the number of participants in each group therefore the percentage is a better alternative for comparison. Children with lower receptive language age produced more four symbol utterances than children with higher receptive language age (30.8% and 13% correspondingly). Children with lower receptive language age were the only ones to produce utterances containing five symbols.

Table 4.12

The Different Structures Used By the Two Groups

	Structures	Number of structures for LRLA group	Number of structures for HRLA group
Typical isiXhosa structure	VO	6	19
	SO	1	22
	SV	-	2
	SVO	-	10
	Subtotal	7 (5.8%)	53 (27.6%)
Single symbols	V	18	21
	O	23	35
	Subtotal	41 (34.2%)	56 (29.2%)
Different to isiXhosa structure			
	2 symbol combinations		
	OO	2	12
	OS	4	7
	OV	2	5
	VV	-	1
	VS	-	1
	3 symbol combinations		
	OOO	5	1
	OOV	1	3
	OVV	2	-
	OSO	-	3
	OVO	3	2
	OVS	1	-
	OOS	-	4
	OSV	3	-
	SOV	-	5
	SSV	-	1
	SVV	-	3
	SVS	-	1
VVV	2	-	
VOV	1	1	
VSV	1	1	
VOS	1	2	
VOO	2	3	
VVO	2	2	

	Structures	Number of structures for LRLA group	Number of structures for HRLA group
4 symbol combinations	OOOO	7	3
	OOOV	3	4
	OOVO	1	2
	OOVV	-	1
	OVOV	-	1
	OVVV	1	-
	OVOO	1	1
	OSOO	5	-
	VOOV	2	1
	VVVO	2	1
	VVOO	3	2
	VOOO	7	6
	VOVV	1	-
	VOOS	1	-
	VOSS	1	-
	VSOO	1	-
	SVOV	-	1
	SOOV	1	-
	SVVO	-	1
	SVOO	-	1
5 symbol combinations	OOOOO	2	-
	VOOOO	1	-
	Subtotal for combinations	72 (60%)	83 (43.2%)
TOTAL		120	192

4.5.3 The intelligibility of graphic symbol utterances

Overall intelligibility scores for both receptive language age groups also showed precise significant differences ($p = 0.0500$ according to the Wilcoxon test). Children in LRLA group had an average intelligibility score of 15.9 (SD = 9.3) while children in HRLA group had an average intelligibility score of 27.06 (SD = 12.76). Figure 4.3 shows the percentage of utterances constructed by each receptive language age group that correspond to each intelligibility score (see Appendix R for a table showing data per participant).

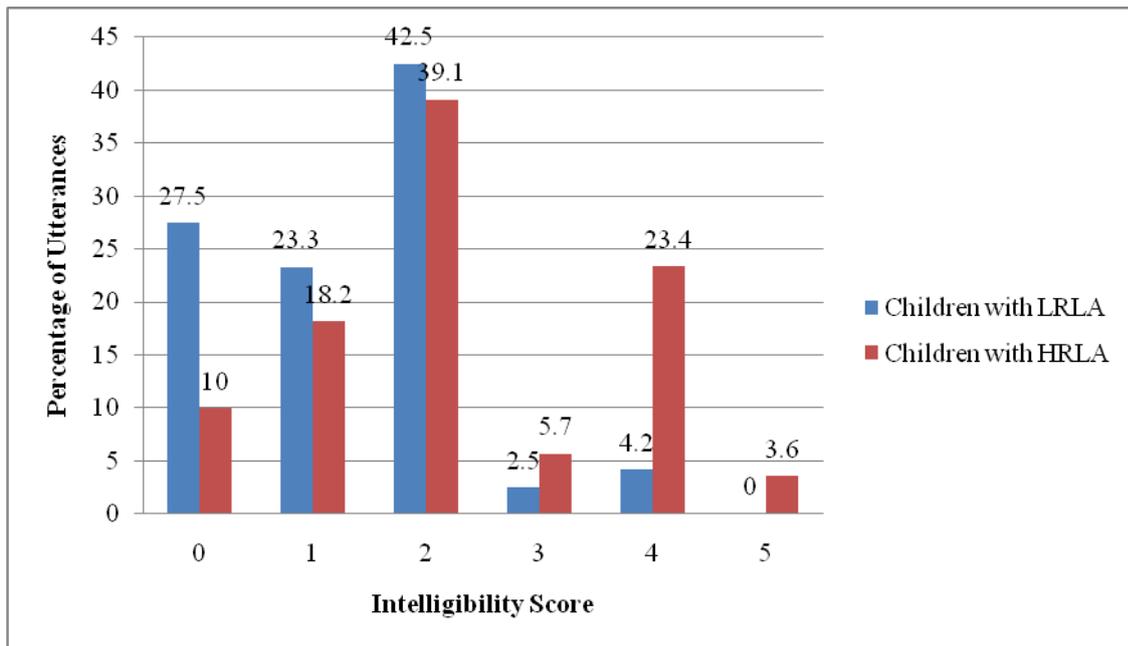


Figure 4.3. Comparison of the percentage of utterances falling at each intelligibility score for children with LRLA and children with HRLA.

Fisher’s Exact Test revealed a significant relationship between the groups and the distribution of the intelligibility scores ($p < 0.0001$). From Figure 4.3, it is clear that the utterances of children with lower receptive language age tended to be given lower intelligibility scores (a total of 93.3% of utterances fell at intelligibility scores of 0, 1 and 2), while the number of utterances falling at the different scores was more evenly distributed for children with higher receptive language age (67.3% of utterances fell at scores 0, 1 and 2, while the remaining 32.7% were given scores of 3, 4 and 5). Children with lower receptive language age had more 0 scores for intelligibility than children with higher receptive language scores (27.5% and 10%). The majority of utterances composed by children with lower receptive language age and children with higher receptive language age obtained intelligibility scores of 2 (42.5% and 39.1% respectively). The utterances consisted of any of the following: (a) single symbols with target information, (b) two out of three target pieces of information, or (c) three out of four target pieces of information (see Table 3.9 for examples of utterances obtaining two intelligibility points). These utterances did not necessarily follow isiXhosa word order.

Children with higher receptive language age produced more utterances with intelligibility scores of 4 than children with lower receptive language ages (23.4% and 4.2%). This score indicates that utterances consisted of three symbols with target information, but

did not follow an order according to isiXhosa. Also, the HRLA group was the only group to produce utterances with an intelligibility rating of 5 indicating that the utterances consisted of three symbols with the target information and following isiXhosa SVO word order (3.6%). This indicates that children with higher receptive language age start to follow the spoken language model more and that their utterances are more intelligible as a result.

4.5.4 Summary of findings across receptive language age groups

Children in both groups did not differ significantly on the content variable. Their content scores did not differ significantly and the number of target symbols used per group did not differ significantly. The two groups showed significant difference in terms of the order and intelligibility variables. Table 4.13 presents the means, standard deviations and p-values for each of the variables, while Figure 4.4 presents the comparison of the percentages of the groups' raw scores.

Table 4.13

Comparison of Groups on the Three Variables

Group	Participants	Content Score			Order Score			Intelligibility Score		
		M	SD	p	M	SD	p	M	SD	p
LRLA	10	14.9	5.09	0.1737	1.1	1.73	0.0342*	15.9	9.3	0.0500
HRLA	16	18.62	6.53		4.44	4.6		27.06	12.76	

*p<0.05

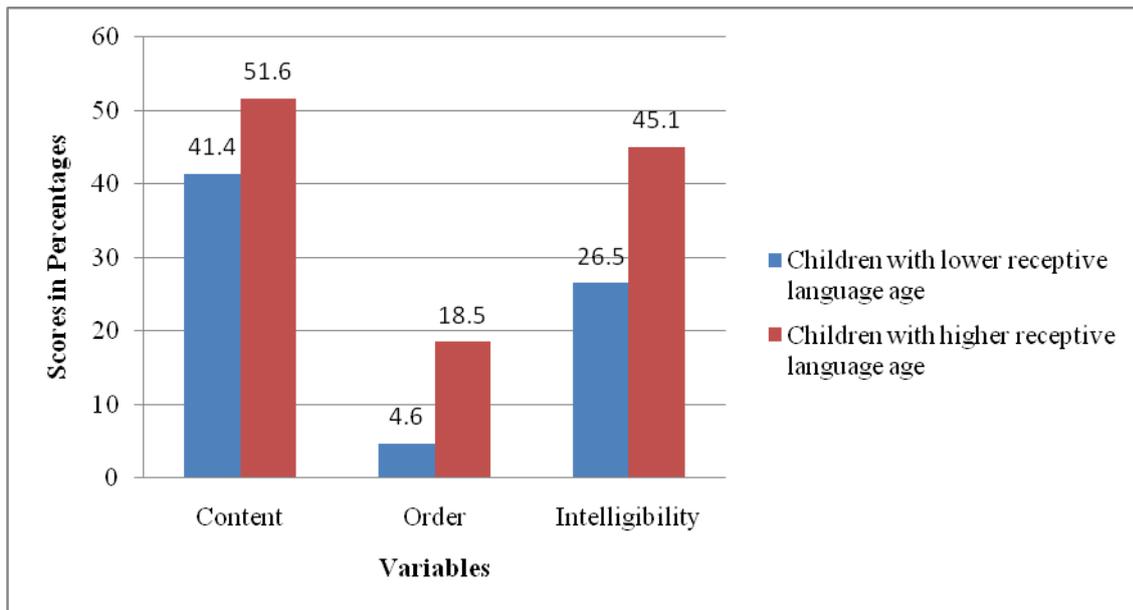


Figure 4.4. Comparison between the total scores (converted to percentage) obtained by children with LRLA and children with HRLA.

The order scores and the intelligibility scores of children with lower receptive language age were lower than those of children with higher receptive language age. Children with lower receptive language age constructed responses that contained mostly multi-symbol utterances that were different to isiXhosa word order. Children with higher receptive language age also produced mostly multi-symbol utterances, but there was a similar distribution of utterances that conformed to isiXhosa word order and utterances that did not follow isiXhosa word order. In terms of intelligibility, children with lower receptive language age produced more utterances with an intelligibility rating of 0 than children with higher receptive language age. Children with higher receptive language age produced some utterances that received intelligibility ratings of 5, while children with lower receptive language age produced none receiving such a high intelligibility score.

4.6 Additional Observations

Some exceptional graphic symbol communication skills were observed in some of the participants' responses, both children with LNFS and children with typical development. Children from both groups were able to self-correct when they noticed that they had taken a non-target symbol. They would remove the unwanted symbol from the utterance strip and put it back onto the graphic symbol display board before re-selecting the target symbol. One of

the participants with LNFS used a gesture to request another symbol on the communication board to incorporate the patient into his response for item 12, *WOMAN WATER HANDS (OF PERSON)*, even though the patient was out of view in the video clip.

The two verb symbols *SMELL* and *BLOW* were used interchangeably by five participants. Both of these symbols contain the profile of a face with curved lines indicating smelling or blowing. These two concepts seemed to be difficult to discriminate visually for both groups of children due to the fact that they had not had previous vocabulary training. The criterion set for inclusion was that participants had to identify at least 70% of the symbols used in the study correctly however all the symbols were named for participants before the study activity commenced. The verb *DROP* and the object *HANDS* were also confused by both groups of children, possibly because the symbol of the verb contains a hand and an arrow indicating the direction down with a partial block below it. This was mistaken by two participants for the object *HANDS*.

The two objects *HANDS* and *ARM* were used in 34.6% of the participants' responses. Six children with typical development and three children with LNFS would place either the *HANDS* symbol or the *ARM* symbol in many of their graphic symbol utterance e.g. *BLOW ARM BUBBLES* (man blow bubbles) or *CANDLE BLOW HANDS* (woman blow candle). On the video clips, the arms of the actors were involved in the action, for example, the man held the bubble-wand with his hand and blew bubbles and the woman held the candle with her hands and blew it out. It seems as if the children saw it necessary to include these details, *ARM* or *HANDS*, because they were actively involved in the action. This behaviour was also observed for the items which displayed kicking. A few participants also included the *SHOE* symbol into their utterances to give it credit for doing the kicking. This phenomenon occurred across all receptive language ages and across participants with LNFS and typical development.

A few of the children with typical development and the children with LNFS initially responded to the prompt question during the study activity in their natural communication mode. Children with typical development gave a verbal response while children with LNFS used gestures or at least imitated the actions that were portrayed in the video clips. These children were prompted to rather use the graphic symbols to communicate the message.

4.7 Summary

The chapter first presented evidence to show that the procedures were conducted accurately and that the transcription and scoring of the raw data was reliable. The groups were shown to be equivalent on the predetermined variables. The results were compared across children with LNFS and children with typical development and following this the data was combined and participants were regrouped into two new groups, namely those with lower receptive language age and those with higher receptive language age. The statistical results indicated that children with LNFS and children with typical development have similar graphic symbol utterance construction abilities. The advantage of spoken language does not seem to have an effect on the graphic symbol output of children on a receptive language age level ranging from 3;4 to 6;9. However, receptive language age did have a significant effect on the children's graphic symbol utterance construction abilities. Children with LNFS and children with typical development who had higher receptive language ages had an increased tendency to apply isiXhosa word order to the visual modality.

CHAPTER 5

DISCUSSION

5.1 Introduction

This chapter aims to interpret and discuss the findings obtained in the present research study. To begin with, the results are discussed according to the aims of the study in terms of content, order and intelligibility, from the analyses conducted with the children with LNFS and the children with typical development. Following this, the results which were obtained from the children with lower and higher receptive language ages are discussed in terms of content, order and intelligibility. These findings are compared with those reported by other researchers. Finally, possible explanations for the participants' responses are explored and discussed by referring to relevant literature.

5.2 Findings from Analysis of the Graphic Symbol Utterances Arranged By Children with LNFS and Children with Typical Development

The goal of the present study was to describe and compare the graphic symbol utterances for SVO targets arranged by children with LNFS and children with typical development in terms of content, order and overall intelligibility. The results of the present study confirm that children with LNFS and children with typical development produced similar graphic symbol utterances when they use graphic symbols without prior training. The findings suggest that the presence of speech does not directly influence the construction of graphic symbol utterances. Specific results are discussed below in terms of content, order and intelligibility for children with LNFS and children with typical development.

5.2.1 Content

No significant differences between the children with LNFS and children with typical development were found when the data was analysed in terms of content scores and the types of target symbols that were used to form the utterances. This could possibly indicate that the children had similar ways of expressing the information of their messages. Both the input and output occurred in the visual mode and therefore the similar results between the two groups may be explained by the unimodal theory of processing graphic symbols. Both groups used more target object-symbols than target verb- and subject-symbols. Both children with typical development and children with LNFS tended to use object-symbols almost one and a half

times as much as verb-symbols in their graphic symbol utterances. Kaul (2003) had a similar finding as children in her study used more nouns than verbs. This reliance on object-symbols has been reported by other researchers and has been attributed to a dependence on concrete symbols, probably because they are more easily recognisable than abstract action words (Iacono, 1992). This finding supports the notion that extrinsic variables, such as the visual modality, have an influence on the graphic symbol utterance construction abilities of children. The placement of the object-symbols on the display board could have also added to the increased possibility of children selecting them due to the arrangement of the groups of graphic symbols on the display, that is, one group below the other. The graphic symbols were arranged in specific groups on the picture display board, namely, subject-symbols together, verb-symbols together and object-symbols together. These groups were arranged one below the other in order to eliminate the effects of linear input which was identified by Alant et al. (2007). The object-symbols were placed at the bottom of the display board, which happened to be closest to the participant. This position may have contributed to the participants' over-reliance on object-symbols. Again, this would support the modality-specific hypothesis, which states that the structure of graphic symbol output is influenced by the constraints of the visual modality, as placement of input may have an effect on the graphic symbol utterance outputs generated by children.

Some of the children with LNFS and children with typical development tended to include additional object-symbols such as *HANDS*, *ARM* and *SHOE* in their graphic symbol utterances. This was an interesting finding as it supports the modality-specific hypothesis, which states that the graphic symbol utterance structures are influenced by constraints of communicating in the visual modality (Sutton et al., 2002). These participants deemed it necessary to incorporate the limb or shoe that was involved in carrying out the action. This would not necessarily be included in a spoken sentence, unless it was giving a detailed account using a complex sentence, for example, 'The woman kicked the flower with her shoe.' or 'The man held the bubble-wand with his hand and blew bubbles.' This finding should be investigated further to add to existing knowledge of communicating using graphic symbols. Communicating messages in the same modality as the eliciting stimuli gives rise to the possible inclusion of many other aspects that the communicator wishes to incorporate.

5.2.2 Order

The results of analysing the data in terms of order scores revealed no significant differences between the groups, children with LNFS and children with typical development. However there were statistically significant differences between children with LNFS and children with typical development in terms of the types of structures each group preferred to use. Specific findings regarding multi-symbol utterances and single symbol utterances are discussed for children with LNFS and children with typical development.

5.2.2.1 Multi-symbol utterances

Most of the children's utterances were not limited to being telegraphic in nature as both groups of children composed more multi-symbol utterances than single symbol utterances. However, the ratio of multi- to single symbol utterances was much higher in children with typical development (127:29) than in children with LNFS (88:68). Children with LNFS had a more equal ratio between multi- and single symbol utterances. The children used a variety of different structures in their utterances that were not similar to isiXhosa word order. The majority of multi-symbol utterances arranged by children with typical development tended to be four symbols in length and did not adhere to the spoken isiXhosa target order. Most of these children were between 5 and 6 years old. Experience in representing spoken language in the visual mode, when learning to write in a left to right progression at school, would possibly add to the transparency of the task of representing spoken language in graphic symbol form (Trudeau et al., 2007). Therefore school-going children may find it easier to communicate using graphic symbols than younger children who have not yet learnt to read and write and who have had no previous experience with the left-to-right convention. Typically developing children aged 7 to 8 years are proposed to have the linguistic and metalinguistic abilities necessary to transpose short and simple spoken structures into graphic symbol utterances (Trudeau et al., 2007). Targets depicting more complex sentences are more difficult for children aged 7 to 9 years to transpose as they do not consistently arrange graphic symbol utterances that adhere to spoken language for these targets (Trudeau et al., 2007). The results from the present study suggest that, without prior training in graphic symbol use, the graphic symbol utterances of children between 5 and 7 years do not automatically reflect syntactic knowledge of spoken language structures. These results support the modality-specific hypothesis which proposes that structures differing from spoken language word orders are related to extrinsic factors involved in communicating in the visual modality (Sutton & Morford, 1998). Both groups of children produced many

different multi-symbol utterances which did not always follow the structure of isiXhosa spoken language. This suggests that all isiXhosa children, regardless of their ability to speak, do not necessarily formulate an utterance in spoken language (isiXhosa) and then transpose it into graphic symbol communication. The theory of redescription may explain these different orders used by some of the participants in the present study. Children may have shown a preference for pragmatic priorities and constructed their utterances starting with the topic and following with the comment. This would explain some of the different structures observed in the present study; however, the data does not directly indicate that pragmatic preference was the reason for the structures produced.

Sutton and Morford (1998) found that all children with typical development between the ages 5;9 and 12;7 tended to use mostly VO sequences when composing graphic symbol utterances in response to videos depicting SVO stimuli. In the current study, the most frequent response structure used by children with typical development was VO or O. This indicates that there were slight similarities to the responses of the children reported Sutton and Morford's (1998) study. Children with LNFS, however, mostly had responses consisting of single symbols, namely verb-symbols or object-symbols.

One of the differences between the current study and other studies including children with LNFS is that the present study included children with LNFS who did not have prior experience in communicating with graphic symbols. Trudeau, Sutton et al. (2010), Kaul (2003) and Udwin and Yule (1990) investigated the abilities of individuals who had existing AAC systems. The present study showed that children who have had no previous experience with AAC do not necessarily follow the word order of spoken language. In contrast, Trudeau, Sutton et al. (2010) showed that individuals who are experienced with using AAC have an increased tendency to rely on spoken language syntax in the construction of graphic symbol utterances. Similar findings were reported by Kaul (2003) who investigated the development of symbol combination skills in children with LNFS. Implementation of AAC and intervention has been shown to have a positive effect on the length and structure of graphic symbol utterances (Binger & Light, 2007; Binger et al., 2008; 2010; Nigam et al., 2006; Tönsing, 2012) despite the fact that even with training children with LNFS develop slowly and still display limitations in the average number, length and complexity of the utterances they produce.

It is interesting to note that both children with LNFS and children with typical development attempted to respond in their natural communication mode, spoken language or gestures. This shows that both groups of children present with the ability to communicate the message despite children with LNFS not having a linguistic mode of communication.

5.2.2.2 *Single-symbol utterances*

Children with LNFS tended to produce more utterances that contained single symbols. This is similar to the results obtained with younger typically developing children in the study done by Smith (1996). Smith suggested the possibility of the graphic symbol communication task not being as transparent as expected. Young children and children with LNFS may not necessarily understand the concept of communicating in the visual modality. These findings also support the modality-specific hypothesis, indicating that extrinsic factors may influence the construction task. Smith (1996) observed that PCS utterances of young children tend to be single symbol utterances while the spoken utterance is often a full phrase or sentence e.g. *BED* versus “Sleeping in the bed”. She proposes several possible explanations that may account for single symbol utterance constructions. Some of these are discussed below. The way the current results support or do not support these propositions is also described.

- Children who use graphic symbols to communicate may use ellipsis. This refers to the purposeful omission of symbols. Appropriate use of ellipsis entails the omission of symbols that are not crucial to the overall message or the omission of symbols that contextual clues may provide. This may be a communication technique used by children when communicating with graphic symbols. The use of ellipsis may indicate that children who use graphic symbol communication may have high expectations of their communication partners or place high demands on their communication partners in understanding implied and related meaning in their graphic symbol utterances. The fact that the communication task in the present study was artificial may have also had an impact on the children’s responses as they understood that the Furby was a toy, who could not really interpret their messages. Hence it is possible that, in the present study, children may have summarised the overall message by selecting the most representative symbol as the utterance and implying meaning through that symbol. Additionally, children may not be aware that the omission of certain symbols renders an incomplete message.

- The use of complementary utterances entails using bimodal communication (e.g. both speech and graphic symbols) where the one mode provides information that the other mode omits. This was not observed in the present study as children were not required to speak while they constructed graphic symbol utterances and none of the participants attempted to use this strategy. The use of single-symbol utterances therefore cannot be attributed to the use of complementary utterances alone.
- Single-symbol utterances may be a result of the global representation characteristic of graphic symbols and also observed in PCS. A graphic symbol may be thought of as encapsulating the whole meaning of the message in one entity. Holistic picture meaning is universally accepted for all pictures in the daily environment and it seems to be more appropriate to convey meaning in the visual mode in one picture than conveying meaning in sequential pictures. This supports the dual coding theory which proposes that visual stimuli are processed independently of linguistic stimuli (Paivio, 1986; 1971). The exception to this is cartoon strips, which convey meaning over a sequence of pictures and depict one event leading to another. However, the fact that cartoon strips are read by older children suggests that this ability to interpret or convey meaning via sequences of pictures may develop later, perhaps with the development of literacy.

Single-symbol utterances may also possibly be a result of extrinsic factors such as visual modality constraints. The transferring of the message from the dynamic video clip to the static picture communication board may place limitations on the number of symbols that the child selects. The present study was conducted purely in the visual modality and did not give a spoken language stimulus. Video clips were the sole stimulus material (similar to those used by Sutton and Morford [1998]) and the dynamic nature of the video clip enabled a clearer presentation of the action than a static single-meaning picture. However, once the action had been completed during the second playing, the video was paused and only the object and the subject remained in the frame. This could possibly explain why more object-symbols were selected rather than verb-symbols in single-symbol utterances. The absence of a spoken language stimulus allowed effects of the visual modality to be explored.

The absence of a spoken language model may have also influenced the graphic symbol combinations. Many of the previous studies which investigated constructing graphic

symbol messages used spoken sentences and static pictures as stimuli for the graphic symbol utterance construction task (Trudeau et al., 2007; Trudeau, Sutton et al., 2010). Therefore the task involved conveying a message from a single static and single-meaning picture using multiple static single-meaning graphic symbols with a spoken sentence as a model. All but one of the participants in the Trudeau et al., (2007) study and all the participants in the Trudeau, Sutton et al. (2010) study produced SVO sequences for simple targets. In the present study, more single symbol utterances were produced which may be due to the fact that no verbal model was given to the participants with the visual stimulus materials. This may indicate that without a verbal model, only visual aspects may be considered by children when communicating with graphic symbols, potentially resulting in single-symbol utterances.

In the present study five children with LNFS and two children with typical development composed single symbol utterances most of the time. Intrinsic variables may account for this, as some researchers have proposed that telegraphic utterances may be constructed as a result of physical or motor difficulties (Soto & Seligman-Wine, 2003; Sutton & Morford, 1998). Although none of the participants with cerebral palsy in this study had severe physical impairments that impeded them from selecting symbols and constructing utterances, they needed to exert more effort than children with typical development in order to select and manipulate symbols. This may be a reason for more children with LNFS consistently producing a high number of single symbol utterances. The physical impairments associated with cerebral palsy may have made it more effortful for them to select and construct graphic symbol utterances. Bearing this in mind it is interesting that a few children with typical development also produced single symbol utterances consistently. Therefore the construction of single symbol utterances may not necessarily be a result of physical impairment if some children with typical development also consistently produce single-symbol utterances.

5.2.3 *Intelligibility*

As with the previous two variables, content and order, intelligibility scores did not vary significantly between children with LNFS and children with typical development. However significant differences were observed between the two groups in terms of the types of scores obtained. The majority of intelligibility scores obtained by children with LNFS were scores of 2 while children with typical development obtained more intelligibility scores of 1 and the difference in mean between the two groups indicated that children with LNFS

constructed slightly more intelligible utterances than children with typical development. The difference in score type obtained is possibly due to the fact that children with typical development tended to produce long utterances of four symbols that did not always relate to the target. This decreased the overall intelligibility of the message. On the other hand children with LNFS tended to produce single-symbol utterances which usually related to the target. Single-symbol utterances containing target symbols were more intelligible than four symbol utterances that contained symbols unrelated to the target. The single symbol utterances are more specific, despite the fact that two thirds of the message is omitted. The multi-symbol utterances gave too much information that was irrelevant to the target message, hence losing focus of the message. Trudeau et al. (2007) mentioned that in order to realise graphic symbol communication competence, metalinguistic skills need to have developed as metalinguistic abilities seem to play an important role in graphic symbol communication. Increased metalinguistic skills may help improve the intelligibility of the message.

While short utterances and/or word order deviating from spoken utterances seems to characterise the graphic symbol output of children in general, the fact that children in the current study had no prior experience in graphic symbol communication should not be overlooked. Using the graphic symbol communication system for the first time and the resulting unfamiliarity may lead to the production of different structures. Graphic symbol vocabulary was sometimes confused by participants, which resulted in symbols with similar characteristics being used interchangeably. More experience with the graphic symbol communication system may improve familiarity with the symbols and their meanings. Due to the fact that the participants had had no previous experience with graphic symbol communication it was possible to observe their perceptions and natural behaviours when manipulating the symbols. Some children attempted to follow spoken language structures, while others treated the communication system as different to speech. These latter participants also tended to describe other things that they saw in the video clips, such as arms, hands and shoes, as these symbols were available to them on the communication board.

Intrinsic variables such as the possibility of passive communication style, discussed by Calculator (1997), may be a possible reason for short graphic symbol utterances that are arranged by children with LNFS. However, children with LNFS showed enthusiasm when constructing their graphic symbol utterances and, judging by the researcher's observations, seemed much more engaged in the activity than children with typical development. This may

possibly be due to the fact that this new communication experience was very exciting and liberating for children with LNFS who had not previously been able to communicate with such ease and success. On the other hand, children with typical development have not had much experience with communication breakdown and the graphic symbol communication exercise was perhaps perceived as more limiting to communication than speech. Each child would have had his or her own personal factors that influenced the graphic symbol utterances that were produced.

5.2.4 Summary of findings across children with LNFS and children with typical development

The graphic symbol utterances constructed by the children with LNFS and children with typical development were comparable on scores of content, order and intelligibility. This indicates that expressive language deficit may not necessarily explain limitations experienced by individuals using AAC in terms of the construction of multi-symbol utterances. Both children with LNFS and children with typical development did not arrange many graphic symbol utterances that followed the word order of spoken language, therefore the recoding theory may not be the process that the children used. The fact that structures composed by both groups deviated from the SVO targets supports the notion that the graphic symbol modality itself influences how utterances are constructed, therefore supporting the modality-specific hypothesis and also the unimodal theory. Additionally, the unexpected structures used by the participants may be explained by the redescription theory as they may have shown pragmatic preferences.

5.3 Findings from Analysis of the Graphic Symbol Utterances Arranged By Children with Lower and Higher Receptive Language Age

Due to the fact that no significant differences were found between the utterances constructed by children with LNFS and children with typical development, the data was collapsed and reanalysed according to two new groups differing in receptive language abilities (receptive language age 4 – 4;10 versus 5;2 – 6;9) to determine the influence of this factor on graphic symbol utterance construction. The findings of this analysis suggest that increased receptive language age has a statistically significant effect on the order and overall intelligibility of graphic symbol utterances arranged by both children with LNFS and children with typical development. The results also indicate that increased receptive language age may be a variable that results in the construction of graphic symbol utterances that conform to the

spoken language word order. Children with a higher receptive language age constructed more utterances that followed isiXhosa word order than children with lower receptive language age. None of the participants had had previous experience in communicating with graphic symbols and therefore these results are not affected by experience. The specific differences and similarities are discussed according to the variables that were analysed, namely, content, order and intelligibility.

5.3.1 Content

Statistical analysis of this variable did not yield significantly different results between the two receptive language age groups. These results are equivalent to the findings mentioned in 5.2.1 across children with LNFS and children with typical development. Possible explanations could include that children below the receptive language age of 6;9 years (the highest receptive language age in the study) have limited skills in terms of transferring a message in the visual modality from a dynamic medium to a static medium. This may relate to constraints of the visual modality or that the necessary development of skills that support graphic symbol communication have not yet been established.

Overall children gave half the information that was required in their graphic symbol representations of the message. Children from both groups relied on object-symbols more than on verb- or subject-symbols which is similar to the findings of Kaul (2003). As mentioned previously, this over-reliance on object-symbols may be as a result of the video input freezing on the last frame and this would show the subject and the object. The constraints of the visual modality may therefore have influenced the children's graphic symbol utterance productions by affecting their selection of different symbol types. Additionally, the placement of the symbols on the display board may have contributed to object-symbols being selected more as they were placed at the bottom of the board and may therefore have been more accessible.

5.3.2 Order

Children in the different receptive language age groups were shown to be significantly different in terms of scores obtained for the order used in their graphic symbol utterances. Children with lower receptive language ages (3;4 – 4;10 years) had lower order scores than children with higher receptive language ages (5;2 – 6;9 years). This suggests that with increase in receptive language age children tend to apply order that more closely resembles

spoken language word order to their graphic symbol utterances. Therefore intrinsic variables, namely receptive language level, seem to play a role in graphic symbol utterance construction. Analysis of the different structure types used by children with lower and higher receptive language age showed statistically significant differences between the two groups. Children with receptive language ages between 3;4 and 4;10 years produced mostly multi-symbol utterances with structures different to that of isiXhosa word order. Children with receptive language ages between 5;2 and 6;9 years produced multi-symbol utterances with a similar distribution of structures following isiXhosa word order and structures with different orders to the spoken language target. These findings support those of other studies that have also found an increased tendency of older children with higher receptive language ages to rely on spoken language word order (recoding theory) when using graphic symbols to communicate (Sutton & Morford, 1998). The findings specific to multi-symbol utterances and single symbol utterances are discussed below.

5.3.2.1 Multi-symbol utterances

Comparison of children according to receptive language age showed that children with lower receptive language age tended to disregard spoken language word orders when constructing utterances in the visual modality. They also often produced utterances with symbols that exceeded the number of target symbols required. These symbols were arranged in very unique orders which did not follow isiXhosa word order. Conversely, children with higher receptive language age tended to follow the word order of spoken language more when constructing their graphic symbol utterances. These findings are comparable with the findings of Sutton and Morford (1998). However these utterances, in the present study, were still in the minority as most of the multi-symbol utterance structures differed from the spoken language word order. Trudeau, Morford, and Sutton (2010) found that older children also tend to rely more on spoken language word order strategies when interpreting graphic symbol utterances. This suggests that production and interpretation skills involved in graphic symbol communication may conform to spoken language targets with increased receptive language age.

One of the major differences between the findings of the present research study and previous studies is that children tended to produce utterances that exceeded the target number of symbols and these utterances had a variety of different combinations. These results may suggest that other factors, which have not yet been accounted for, may be involved in

communicating in the visual mode. The children's responses may have reflected their impression of the task (i.e. that longer utterances may have been better) and due to the social desirability effect or the Hawthorne effect, may have resulted in longer utterances. The increase in the productivity of participants may be due to the fact that they knew they were being observed and therefore continued selecting and adding symbols to their utterance to make them seem better. The results may also reflect personal factors observed when children selected one or two symbols pertaining to the target and then adding pictures that they may have liked. This would support the notion that younger children do not have the metalinguistic skills necessary to understand the communication task fully. Another explanation for the long graphic symbol utterances involves the utterance strip. The utterance strip was 20cm in length which was longer than what was needed for a 3-symbol utterance. This length was chosen to prevent 'visual prompting' for 3-symbol utterances. However the additional space on the board may have prompted children to place additional symbols.

This research study did not enable testing of the compensation hypothesis seeing as though the participants did not use the communication system long enough to develop or learn strategies. However the following results may have been communication strategies that the participant employed. Less than half of the participants inserted additional symbols such as, *HANDS*, *ARM*, or *SHOE*. These symbols increased the length of the participants' utterances however they were not target symbols. This phenomenon occurred across all receptive language ages. It supports the proposition that the visual modality may be treated differently to spoken language and may also support the unimodal theory as the processing of additional visual input resulted in additional or unexpected graphic symbol output.

5.3.2.2 *Single symbol utterances*

The children who constructed single symbol utterances were distributed evenly across the two receptive language age groups. This indicates that increase in receptive language age was not necessarily associated with an increase in mean length of utterance. Despite the fact that older children did produce some graphic symbol utterances that followed spoken language word order, more single-symbol utterances were produced. This may indicate that children with higher receptive language age may still have emerging skills that allow recoding to occur, as metalinguistic skills may assist children to refer to the spoken language structures when constructing utterances using graphic symbols. Increased metalinguistic skills will better enable the children to transpose spoken language into graphic symbol form

in accordance with the recoding theory of graphic symbol utterance construction. These metalinguistic skills may not have developed for most children below the age of 7 years as discussed by Trudeau et al. (2007). If metalinguistic skills are related to receptive language age then the children in the present study, with receptive language ages ranging from 3;4 to 6;9 years, may have been on a pre-metalinguistic level. These findings are congruent with the finding of Smith (1996) and Sutton et al. (2009). Their studies found that typically developing preschoolers had difficulty using the graphic symbol communication board and produced mostly single symbol utterances.

The present study did not require the children to give verbal output due to the fact that half of the participants had LNFS and could not communicate verbally. This differs from the Sutton and Morford (1998) study which did require the participants to give the spoken language form of the target. The Trudeau et al. (2007) study also included the auditory spoken language model as a stimulus along with the static picture. The presence of the spoken language equivalent may have had an effect on productions or given a clue or a model as to the structure that participants in the study could use in their graphic symbol utterances. This may have prompted recoding and may have resulted in graphic symbol utterances that adhered more closely to the spoken language word order.

5.3.3 *Intelligibility*

A statistically significant difference was observed between the intelligibility scores of the two receptive language age groups. The children with lower receptive language age obtained lower intelligibility scores whereas children with higher receptive language age obtained higher intelligibility scores. The children with lower receptive language age also produced more utterances which received an intelligibility rating of zero, indicating that their utterances did not relate to the target at all, while children with higher receptive language age produced more utterances with higher intelligibility ratings. The higher receptive language group was also the only group to receive intelligibility ratings of 5. This high score indicates that the utterances contained all the target symbols which were arranged in a word order according to isiXhosa grammar. Only a few children with higher receptive language age produced utterances that obtained intelligibility ratings of five. These results can point to the possibility that children with higher receptive language age as well as increased metalinguistic skills have an increased tendency to transpose from spoken language into graphic symbols. The recoding theory may apply to children with increased receptive

language age and may explain the process of graphic symbol utterance construction for older children. On the other hand, other factors, such as intrinsic and extrinsic factors, may influence the graphic symbol utterance construction abilities of younger children and the unimodal theory may explain these behaviours.

5.3.4 Summary of findings across children of different receptive language ages

The findings arising from analysis of the data, separated according to lower and higher receptive language age groups, revealed some statistically significant differences. These findings support the notion that with increased receptive language age and possibly increased metalinguistic skills children are better equipped to produce graphic symbol utterances that mirror spoken language structure more closely. Results obtained from children with higher receptive language may possibly support the recoding theory of graphic symbol utterance construction. It seems that the constraints inherent in the graphic symbol modality are increasingly circumvented by children as they gain receptive language and presumably metalinguistic skills. However, the results still clearly show that graphic symbol utterance construction and receptive (spoken) language abilities are not related in the same way as receptive and expressive (spoken) language abilities. Even the children with higher receptive language age did not produce many SVO sequences, and the content scores did not vary significantly between the groups. These findings once again support that modality has a significant influence on graphic symbol utterance construction, as has been concluded from previous research.

5.4 Summary

This chapter discussed the findings of the present research study, namely that children with LNFS and children with typical development have similar graphic symbol construction abilities, when comparing content, order and intelligibility of graphic symbol utterances. These findings and the influences of the visual modality and extrinsic factors were interpreted as supportive of the modality specific hypothesis and also the unimodal theory. At the same time, findings indicated that there were significant differences between the structure and intelligibility of utterances constructed by children with lower versus those with higher receptive language skills. It was proposed that increased receptive language age enabled children to circumvent the modality-specific constraints by applying metalinguistic strategies. Therefore, the recoding theory may only apply to children with higher receptive language age as increased metalinguistic abilities come with language development. The graphic symbol utterance constructions of younger children may be explained by the influence of intrinsic

factors, namely receptive language age. Utterances that did not follow spoken language word order may be explained by the theory of redescription as children may have avoided spoken language structures in preference of other influences, such as pragmatics.

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

This study aimed to describe and compare the graphic symbol utterances arranged by children with LNFS and children with typical development. The construction of graphic symbol utterances was elicited with video clips depicting SVO structures.

This final chapter gives an overview of the findings of the study and presents the conclusions that were arrived at. Following this, clinical implications of the findings are described. An evaluation of the study is provided by discussing the strengths and limitations of the study and finally, recommendations for future research are presented.

6.2 Summary of Findings

This study investigated and compared the graphic symbol utterance constructions of children with LNFS and children with typical development. This allowed for the exploration of the possibility of expressive language deficit having an effect on graphic symbol communication. The study expected to find similarities between the two groups and to support the hypothesis of expressive language not having an effect on the graphic symbol communication abilities of children who did not have prior experience with graphic symbol communication.

The study was conducted with 13 children with LNFS and 13 children with typical development who were closely matched in terms of receptive language age. The study activity was designed to elicit graphic symbol utterances and the stimuli were presented in video clips that depicted SVO structures. This allowed for analysis of adherence to spoken language structures.

The results of the study suggested that children with LNFS and children with typical development did not differ significantly in terms of the content of the utterances and the order in which the graphic symbols are arranged as well as the overall intelligibility of the graphic symbol utterance. Thus, these two groups seemed to have similar graphic symbol construction abilities without having had previous graphic symbol communication training. These findings add to the current understanding of the development of communication skills

in the visual modality. The ability to speak does not seem to play a significant role in the production of graphic symbol utterances by children who are exposed to this task for the first time, seeing as though the children with typical development did not have significantly different scores of content, order or intelligibility regarding their graphic symbol responses when compared to children with LNFS. These findings support the modality-specific hypothesis as communicating in the visual modality was similar for children with speech and children with LNFS. Therefore expressive language abilities do not necessarily play a role in graphic symbol utterance construction. Young children may treat the visual modality as different from spoken language and not generalise rules of spoken syntax. Therefore expressive language deficit may not necessarily explain limitations experienced by individuals using AAC in terms of constructing multi-symbol utterances. These results led to the analysis of the data according to different receptive language age groups.

Further analysis of the data, separated into groups according to lower (3;4 – 4;10) and higher (5;2 – 6;9) receptive language age revealed significant differences in terms of scores of order and intelligibility but not content. These results suggested that increased receptive language skills do contribute to graphic symbol utterances following spoken language structure and having increased intelligibility over time. The receptive language abilities and possibly the metalinguistic and metacommunication skills of children may also play a significant role in the graphic symbol construction. The effects of the visual modality were observed in responses of the participants as with increased receptive language age, the participants were able to accommodate visual modality constraints in favour of utterances that followed spoken language structure. The results clearly indicate that the asymmetry between receptive and expressive modes does not provide children with equal communication abilities to what receptive and expressive spoken language abilities provide. These findings also support the modality-specific hypothesis. However, children with higher receptive language age start to produce more graphic symbol utterances that follow spoken language word order and this may be evidence in support of the recoding theory. The children in the present study had receptive language ages ranging from 3;4 to 6;9 years. Due to the fact that even the children with higher receptive language age did not arrange many SVO graphic symbol utterances this may indicate that children with receptive language ages below 7 years may still be developing skills that would result in stable response structures following spoken language word orders. Alternatively, the different structures used in the children's responses may be explained by the redescription theory which states that spoken language

may not necessarily be used as a model for graphic symbol utterance construction when preference is shown for other structures that may convey other aspects of communication, such as pragmatics.

This research study is the first to compare children with LNFS and children with typical development. Previous assumptions regarding the similarities of these groups have been confirmed. These findings only apply to children who have not had previous experience with graphic symbol communication. They may not be generalised to the learning of graphic symbol communication and AAC intervention. The visual modality has been identified as a possible influencing factor in graphic symbol utterance construction, and the findings of the present study have confirmed this claim. Receptive language was acknowledged as a variable that contributes to the ability to arrange graphic symbol utterances that follow the word order of spoken language. In addition, metalinguistic and metacommunication skills were suggested as also contributing to children's ability to construct messages in the visual modality.

6.3 Clinical Implications

The findings of the present research study indicate that communicating in the visual modality is not necessarily affected by the ability to produce spoken language, but more by the ability to understand spoken language, as children with higher receptive language age produced more SVO structures. The graphic symbol combination skills of children with LNFS and children with typical development are similar and therefore both groups of children start with the same abilities in graphic symbol communication. Therefore the findings of previous research that has investigated the graphic symbol communication abilities of children with typical development could be applied to children with LNFS, provided that both groups have similar receptive language abilities and have not had exposure to graphic symbol communication. If both groups have similar abilities in graphic symbol communication it is likely that results found with one group could be generalised to the other group. However, it is not yet determined whether or not children with LNFS and children with typical development have similar learning styles during graphic symbol communication training. Therefore the results of the present study do not indicate that the findings of research done with children with typical development in terms of graphic symbol training may be generalised to populations with LNFS.

The findings of this research study with different receptive language age groups showed that children with lower receptive language age (3;4 – 4;10 years) tend to produce more utterances with unique symbol sequences that differ from spoken language structure than children with higher receptive language age (5;2 – 6;9 years). This implies that children who start learning graphic symbols from a younger age may need more support during intervention than children with higher receptive language age to promote language development and metalinguistic skills and also to teach recoding. It is also evident that receptive language learning needs to be supported and promoted during graphic symbol communication intervention as it has a correlation with graphic symbol utterances being constructed in an order similar to that of spoken language (Romski & Sevcik, 1993; Sevcik, 2006).

In addition, this research study has ethics implications as potential candidates for AAC intervention have been identified. Currently none of the schools have speech therapists to implement intervention. Therefore the researcher will write a letter of motivation, indicating that there is a great need for the employment of a speech therapist at the schools. This letter will be given to the principals of the schools and to the Eastern Cape Department of Education.

6.4 Evaluation of the Study

6.4.1 Strengths of the study

To the researcher's knowledge, this study is the first to systematically compare how children with LNFS and children with typical development (matched on receptive language skills) arrange graphic symbol utterances. The participants from each group were matched closely, as there was no statistical significance between the two groups on the variables which were controlled, allowing for close comparison between the two groups. In view of the fact that one target group (children with LNFS) came from a very small population that needed to comply with stringent selection criteria, the sample size of 13 participants per group can be viewed as sizeable. This is also one of the few studies involving participants with a home language other than English, therefore broadening the knowledge base on the graphic symbol utterance construction of children with another home language, namely, isiXhosa. The study activity focused on simple SVO structures thereby keeping the response data exclusive and particular to this specific structure. The explanation of the study activity was presented to the participants in the form of a video. The actress in the explanation video

was a first-language speaker of isiXhosa. This ensured that the instructions were given in a uniform manner across participants. Finally, this study had a high rate of procedural integrity and data reliability.

6.4.2 Limitations of the study

The sample size was smaller than the recommended size of at least 15 participants per group for comparative research (McMillan and Schumacher, 2010, pp. 142). As explained above, stringent selection criteria and a very specific population group made recruitment of more participants with LNFS difficult. The initial sample size of 17 participants with LNFS was reduced to 13 in the main study - four participants had to be excluded as they were not able to carry out the study activity. This small sample could have affected the statistical analysis as statistically significant differences are more easily found in large sample groups. Cognitive assessment was not conducted with the participants and therefore the possibility of cognition having an effect on graphic symbol communication abilities was not controlled for. The present study only investigated the production of graphic symbol utterances and did not include the comprehension of graphic symbol utterances. This would have been a beneficial element to include.

The target utterances were not all unpredictable. There were two items that were predictable, namely, *man blow bubbles* and *woman blow candle*. These structures may have had an effect on the utterance structure. Considering that one usually only blows bubbles and candles, children may have only selected the object-symbol for these items as the action is implied. However no obvious effects were observed. Stability of response patterns was not analysed formally, but observations of the responses for these two items against other responses revealed that both verb-symbols and object-symbols were used for these items. These items also did not yield responses that corresponded more closely to the target than others.

The participants with LNFS had a wide chronological age range (5;5 – 16;1) compared to the participants with typical development (5;0 – 8;8). This could have had inconspicuous confounding effects on the study. Older children may have potential advantage because of their age.

Changes with regards to the materials may have yielded different results. First, the communication partner in the activity was a toy, perhaps a human communication partner would have resulted in different responses from the children. Second, the layout of the board may have influenced the children's responses. Objects were all placed at the bottom of the board which may have caused more object-symbols to be selected compared to verb-symbols and subject-symbols.

6.5 Recommendations for Further Research

This research study brings to light certain recommendations for future research. First, the present study could be replicated with the focus on interpretation of simple graphic symbol utterances. Participants could match a graphic symbol utterance to the video clip they had just watched. Alternatively, they could be requested to decode a graphic symbol utterance and be required to act out what they understood from the utterance. This would give information regarding how children with LNFS and children with typical development compare on tasks of graphic symbol utterance interpretation. Second, the present study could be conducted with children from a different language group with a spoken language that does not have an SVO word order. Comparisons could be drawn between the results obtained in the present study and the results that would be obtained from the research with the other language group. The effects of different languages on communication in the visual modality are not fully understood and there may be languages with word order that is similar to languages in the visual mode, such as sign language. Third, a similar study could be done with a population of children who have not developed receptive or expressive spoken language due to hearing impairment, but who communicate using sign language and the results could be compared with those obtained in the present study. This would give information pertaining to the visual modality only, seeing as though the effects of spoken language would be ruled out due to the participants having hearing impairment. Visual modality constraints could be investigated if the receptive spoken language variable was excluded. Fourth, this study could be replicated with an aim to investigate the effects of intervention and how the children with LNFS and children with typical development learn to use graphic symbol communication. This would indicate whether or not children with LNFS have similar learning patterns as children with typical development. Fifth, the present study could be replicated with older children or adolescents. This would give an indication as to whether or not children continue to show similar graphic symbol construction abilities as they grow older. Sixth, the study could be replicated with a change in AAC system. Speech

generating devices may elicit different results to low-tech AAC systems such as was used in the present study. Finally the present study could be replicated with a change in target structures. Other structures, such as complex structures could be targeted and the responses of the two groups of children could be investigated.

6.6 Summary

This final chapter concluded the findings of the study. Specific attention was drawn to the influence of the visual modality on graphic symbol utterance construction. The implications of the findings in clinical practice were discussed. The study was evaluated in terms of strengths and limitations and future research directions were recommended to further the investigation of graphic symbol utterance construction and AAC intervention.

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Appendices

Appendix A

**Approval letter from Research Ethics Committee of the Faculty of Humanities at the
University of Pretoria**



UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities
Office of the Deputy Dean

2012-04-03

Dear prof Bornman

Project: A comparison of the structure used to arrange graphic-symbol-strips between children with little or no functional speech and their typically developing peers
Researcher: SN Penkler
Supervisor: Prof J Bornman
Department: Augmentive and Alternative Communication
Reference: 11374099

The above application was **approved** by the **Postgraduate Committee** on 13 March 2012. The application was reviewed by the **Research Ethics Committee** on 29 March 2012, and is **conditionally approved** due to the following:

Please ensure that the Informed Consent form includes data storage information.

Once the relevant proof has been submitted, data collection may commence.

Sincerely

Prof. John Sharp
**Chair: Postgraduate Committee &
Research Ethics Committee**
Faculty of Humanities
UNIVERSITY OF PRETORIA
e-mail: john.sharp@up.ac.za



UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities
Research Ethics Committee

2012-06-01

Dear Prof Bornman

Project: A comparison of the structure used to arrange graphic-symbol-strips between children with little or no functional speech and their typically developing peers
Researcher: SN Penkler
Supervisor: Prof J Bornman
Department: CAAC
Reference number: 11374099

I am pleased to be able to tell you that the Letter of Informed Consent, including the data storage form, was received as previously required per letter dated 03 April 2012, and the above application was therefore **approved** by the **Research Ethics Committee** on 31 May 2012. 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 the actual research depart significantly from the proposed research, it will be necessary to apply for a new research approval and ethical clearance.

The Committee requests you to convey this approval to the researcher.

We wish you success with the project.

Sincerely

Prof John Sharp
Chair: Postgraduate Committee &
Research Ethics Committee
Faculty of Humanities
UNIVERSITY OF PRETORIA
e-mail: john.sharp@up.ac.za

Research Ethics Committee Members: Dr L Blokland; Prof M-H Coetzee; Dr JEH Grobler; Prof KL Harris; Ms H Klopper; Prof A Mlambo, Dr C Panebianco-Warrens; Prof J Sharp (Chair); Prof GM Spies; Prof E Taljard ; Dr FG Wolmarans, Dr P Wood

Appendix B

Title Registration

Our Ref: Ms P Woest / 11374099
Tel: 012 420 2736
Fax: 012 420 2698
E-mail: petru.woest@up.ac.za



UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities

28 May 2013

Miss SN Penkler
24 Doves on Huntley
Huntley Street
GRAHAMSTOWN
6139

Dear Miss Penkler

TITLE REGISTRATION: FIELD OF STUDY – MA IN AUGMENTATIVE AND ALTERNATIVE COMMUNICATION

I have pleasure in informing you that the following has been approved:

TITLE: A comparison of the graphic symbol utterances arranged by children with little or no functional speech and children with typical development

SUPERVISOR: Dr K Tönsing

CO-SUPERVISOR: Prof J Bornman

I would like to draw your attention to the following:

- ENROLMENT PERIOD**
 - You must be enrolled as a student for at least one academic year before submission of your dissertation/essay.
 - Your enrolment as a student must be renewed annually before 31 March, until you have complied with all the requirements for the degree. You will only be able to have supervision if you provide a proof of registration to your supervisor.
- APPROVAL FOR SUBMISSION**

On completion of your dissertation/essay enough copies for each examiner must be submitted to Student Administration, together with the prescribed examination enrolment form signed by you, which includes a statement by your director of studies that he/she approves of the submission of your dissertation/essay.
- NOTIFICATION BEFORE SUBMISSION**

You are required to notify me at least three months in advance of your intention to submit your dissertation/essay for examination.
- INSTRUCTIONS REGARDING THE PREPARATION OF THE DISSERTATION/ESSAY AND THE SUMMARY APPEAR ON THE REVERSE SIDE OF THIS LETTER.**

Yours sincerely

for DEAN: FACULTY OF HUMANITIES

Appendix D

Permission letter from Eastern Cape Department of Education



STRATEGIC PLANNING POLICY RESEARCH AND SECRETARIAT SERVICES
Steve Vukile Tshwete Complex • Zone 6 • Zwelitsha • Eastern Cape
Private Bag X0032 • Bhisho • 5605 • REPUBLIC OF SOUTH AFRICA
Tel: +27 (0)43 702 7428 • Fax: +27 (0)43 702 7427 • Website: www.ecdoe.gov.za

Enquiries: Dr Heckroodt

Email: bernetia@iafrica.com

4 April 2013

Ms. SN Penkler
20 Camelia Crescent
Sunnyridge Park
Port Elizabeth
6045

Dear Ms. Penkler

PERMISSION TO UNDERTAKE A MASTERS THESIS: A COMPARISON OF THE STRUCTURE USED TO ARRANGE GRAPHIC-SYMBOL-STRIPS BETWEEN CHILDREN WITH LITTLE OR NO FUNCTIONAL SPEECH AND THEIR TYPICALLY DEVELOPING PEERS

1. Thank you for your application to change your research.
2. Your application to conduct the above mentioned research the participant selection criteria from English children to Xhosa children as it was difficult to find English participants that met the selection criterion of having no speech.. Permission is granted as per your request to change the schools to recruit participants of the following schools: Lonwabo, D.D. Siwisa, Kuyasa and Vukuhambe. The Eastern Cape Department of Education (ECDoE) hereby approves the changes in the research on condition that:
 - a. there will be no financial implications for the Department;
 - b. institutions and respondents must not be identifiable in any way from the results of the investigation;

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- c. you present a copy of the written approval letter of the Eastern Cape Department of Basic Education (ECDBE) to the Chief Directors and Directors before any research is undertaken at any institutions within that particular district;
 - d. you will make all the arrangements concerning your research;
 - e. the research may not be conducted during official contact time, as educator's programmes should not be interrupted;
 - f. should you wish to extend the period of research after approval has been granted, an application to do this must be directed to the Director: Strategic Planning Policy Research and Secretarial Services;
 - g. the research may not be conducted during the fourth school term, except in cases where a special well motivated request is received;
 - h. your research will be limited to those schools or institutions for which approval has been granted, should changes be effected written permission must be obtained from the Director – Strategic Planning Policy Research and Secretariat Services;
 - i. you present the Department with a copy of your final paper/report/dissertation/thesis free of charge in hard copy and electronic format. This must be accompanied by a separate synopsis (maximum 2 – 3 typed pages) of the most important findings and recommendations if it does not already contain a synopsis. This must also be in an electronic format.
 - j. you are requested to provide the above to the Director: The Strategic Planning Policy Research and Secretarial Services upon completion of your research.
 - k. you comply to all the requirements as completed in the Terms and Conditions to conduct Research in the ECDBE document duly completed by you.
 - l. you comply with your ethical undertaking (commitment form).
 - m. You submit on a six monthly basis, from the date of permission of the research, concise reports to the Director: Strategic Planning Policy Research and Secretariat Services.
3. The Department reserves a right to withdraw the permission should there not be compliance to the approval letter and contract signed in the Terms and Conditions to conduct Research in the ECDBE.
 4. The Department will publish the completed Research on its website.

Appendix D

5. The Department wishes you well in your undertaking. You can contact the Director, Dr. Annetia Heckroodt on mobile number 083 275 0715 and email: annetia.heckroodt@edu.ecprov.gov.za should you need any assistance.


DR AS HECKROODT
DIRECTOR, STRATEGIC PLANNING POLICY RESEARCH AND SECRETARIAT SERVICES

Appendix E

Letter to principal



UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA
Faculty of Humanities

Date

Address of School

The Principal

RE: Request to conduct research at (school's name)

I would like to ask permission to conduct research at your school. Please take some time to read the information presented here, which will explain the details of this study.

Title of the Research Project:

A comparison of the structure used to arrange graphic-symbol-strips between children with little or no functional speech and their typically developing peers.

WHAT IS THIS RESEARCH STUDY ALL ABOUT?

This research study aims to investigate how typically developing children and children with speech problems use pictures to communicate. Each child that participates in this study will do exactly the same activity. They will receive a board with pictures on it and will be required to use these pictures to explain what they see in several video clips that will be played to them. These video clips will show simple actions e.g. a man kicking a ball. There are no right and wrong answers in this study. The main focus is to find out how children would communicate using pictures.

WHAT IS EXPECTED OF THE SCHOOL?

This research study requires 20 children with little or no functional speech and 20 typically developing children. These children should be between the ages of 7 and 9. I would like to request permission to look for participants at your school and to conduct the research activity with each participant. The activity should take approximately 1 ½ hours. I would also like to request permission to use one of the school rooms to conduct the data collection with the children. It is hoped that the data collection will take no longer than a week.

WILL I HAVE ACCESS TO THE RESEARCH RESULTS?

The research results will be made available upon request following the completion of the project. The research data will be stored both as hard copy as well as in electronic format at the *Centre for Augmentative and Alternative Communication* at the University of Pretoria for 15 years.

WHO CAN BE CONTACTED IF I HAVE ANY FURTHER QUESTIONS?

Should you require any further information, you are welcome to contact me at or stephpenkler@gmail.co.za.

Thank you in advance for your time and co-operation!

Yours sincerely,



Stephanie Penkler
Researcher
071 306 3708



Professor Juan Bornman
Supervisor
012 402 2001

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Appendix F

Parent or Caregiver Interview Framework

Original English Version

Preamble – establish whether or not I am speaking to the right person.

Hello, my name is Stephanie Penkler. I am a speech therapist and I am doing a research study at _____ school. The principal gave me your number because I would like to work with children at the school. Is it OK for me to chat to you?

No – Can I call you at a more convenient time?

Yes: I would like to ask your permission to work with your child. This will basically mean that I will do some language assessments with (name) and possibly also involve him/her in an activity. This should take about 1 ½ hours. I will send a letter explaining what the study is about and what activities (name) will have to do. Would you be willing to consider allowing (name) to participate in the study?

(If yes) – Thank you! Along with the letter that explains what the study is all about I shall send a slip which you will sign if you are happy to let your child participate in the study. If you decide later that you don't want your child to participate that's not a problem.

(If no) – Alright, that's not a problem. Thank you for your time. Have a lovely day further. Goodbye.

Would you mind answering some questions about your child so that I can learn a little bit about them before we start with the study? This will take about (add time). If it is not convenient now, I can call later.

(If yes) – Ask questions.

(If no) – No problem. When would be a more appropriate time for me to call you?

Thank you very much for your time! I really appreciate it. Have a lovely day further.

QUESTIONS (questions marked with an asterisk do not apply to children with typical development)

1. Can you give me the full names of (say child's name)

2. What is (name)'s date of birth?

3. What language do you speak at home?

4. What other languages does (name) speak/hear at home? Are languages just spoken at home or spoken to the child, what does he/she understand? What language does he/she understand best? _____
5. Does your child have a medical diagnosis? No Yes
Please specify _____
6. Can your child move his/her arms to pick things up?

7. Do you think your child can hear well?

8. Do you think your child has any problems seeing? Does he/she wear glasses? _____ -

9. *Do you think your child understands well? What does he/she do to make you realise he/she understands?

10. *Can you understand what your child says?

11. *When (name) tries to speak, does he/she use only one word at a time or does he/she try to say a sentence? (If child tries to say sentences) – Can you give me an example of what he/she would say?

12. *Can other people understand what he/she says?

13. *How many words would you think can he/she say clearly?

14. *Does your child use pictures to communicate or to say something?

15. Does your child know anyone who uses pictures to communicate?

isiXhosa Translation

Molo, igama lam nguStephanie Penkler. Ndisebenzisana nabantwana abangakwazi ukuthetha kunye nabangakwazi ukuthetha kakuhle. Ndenza uphando e_____. Inombolo yakho yomnxeba ndiyifumene kuMr. _____ kuba ndifuna ukusebenzisana nabantwana balapha esikolweni. Kulungile ukuba ndithethe nawe?

Hayi – Ndingaphinde ndikufounele nini?

Ewe – Ndicela ukusebenzisana nomntwana wakho. Lonto ithetha ukuba ndizokwenza uvavanyo kwilimi lomntwana wakho, ndisebenzisane naye. Ingathetha ixesha elinga (time). Ndizokuthumelela incwadi echazayo ukuba oluphando lungantoni na, nokuba umntwana wakho uzokube esenza ntoni na. Ungavuma ukuba ndisebenzisane nomntwana wakho? (Ukuba uthe ewe) Enkosi! Kule ncwadi ndizoyithumela ineencukhaca, ndizokufaka kunye nephethshana ekufuneka ubhale kulo ukuba uyavuma ukuba ndisebenzisane nomntwana wakho. Ukuba uyewatshitsha ingqondo, ungafuni ukuba ndisebenzisane naye, akukho ngxaki.

(Ukuba uthe hayi) – Ok, akukho ngxaki. Enkosi ngexesha lakho. Ulonwabele usuku lwakho. Usale kakuhle.

Uyavuma ukuba uphendule imibizo ngomntwana wakho, ukuze ndizokwazi ukufunda kancinci ngaye phambi kokuba siqhubeke ngoluphando? Izokuthatha ixesha eli(time). Ukuba awuzokwazi ngelixesha, ndingaphinda ndikufounele ngelinye ixesha.

(Ukuba hayi) – Akukho ngxaki. Leliphi ixesha endingaphinda ndikufounele ngalo? Enkosi ngexesha lakho. Ulonwabele usuku lwakho. Usale kakuhle.

IMIBUZO

1. Ngubani igama lomntwana wakho elipheleleyo?

2. Wazalwa nini? _____

3. Nithetha oluphi ulwini ekhaya?

4. Zeziphi ezinye izilwini ezithethwayo ekhaya? Umntwana uyazazi ezinye izilwimi, niyazithetha naye? Leluphi ulwimi aluthanda kakhulu?

5. Umntwana wakhe waxilongwa ngugqirha watsho ukuba umonakalo uphi? Ewe/hayi? Waye wathini ugqirha?

6. Umntwana uyakwazi ukusebenzisa iingalo zakhe aphakamise izinto?

7. Ucinga ukuba umntwana wakho uva kakuhle?

8. Ucinga ukuba umntwana wakho ubona kakuhle? Uyazinxiba izipeks?

9. *Ucinga ukuba umntwana wakho uyayiqonda into oyithethayo? Yintoni ayenzayo ekubangela ucinge ukuba uyaqondisisa?

10. *Uyakwazi ukuthetha umntwana wakho? Uyayi qonda into ethethwa ngumntwana wakho?

11. *Xa ethetha, uthetha igama elinye okanye usebenzisa amagama amanintsi? Ungandinika umzekelo wento anoyithetha?

12. *Abanye abantu bayayi qonda into ayithethayo?

13. *Mangaphi amagama ocinga ukuba uyakwazi ukuwathetha kakuhle?

14. *Umntwana wakho ukhe asebenzise imifanekiso xa ezama ukuthetha?

15. Umntwana wakho ukhona umntu amaziyo osebenzisa imifanekiso xa ethetha?

Appendix G
Consent letter to parents

Original English Version



UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA
Faculty of Humanities

Date

Dear caregiver

Title of the Research Project:

A comparison of the structure used to arrange graphic-symbol-strips between children with little or no functional speech and their typically developing peers.

Principal Investigator: Stephanie Penkler

Contact Number:

The principal investigator is a masters student at the University of Pretoria conducting this research project under the supervision of a supervisor.

Supervisor: Professor Juan Borman

Contact Number: 012 402 2001

Your child is being invited to take part in a research project. Please take some time to read the information presented here, which will explain the details of this project. Please ask the study staff any questions about any part of this project that you do not fully understand. It is very important that you are fully satisfied that you clearly understand what this research entails and how your child could be involved. Also, your child's participation is **entirely voluntary** and you are free to decline to participate. If you say no, this will not affect you or your child negatively in any way whatsoever. Your child is also free to withdraw from the study at any point, even if you do agree for him or her to take part.

This study has been approved by the Research Ethics Committee at Pretoria University and will be conducted according to the ethical guidelines and principles of the international Declaration of Helsinki, South African Guidelines for Good Clinical Practice and the Medical Research Council (MRC) Ethical Guidelines for Research.

What is this research study all about?

This research study aims to investigate how typically developing children and children with speech problems use pictures to communicate. Each child that participates in this study will do exactly the same activity. They will receive a board with pictures on it and will be required to use these pictures to explain what they see in several video clips that will be played to them. These video clips will show simple actions e.g. a man kicking a ball. There are no right and wrong answers in this study. The main focus is to find out how children would communicate using pictures.

Why has your child been invited to participate?

Your child has been invited to participate in this study because he or she is in the appropriate age group that the study is targeting.

What will your child's responsibilities be?

Your child's responsibilities will be to attend one session. The session will entail an assessment section in which the child's understanding of language will be assessed. This should not take longer than 30 minutes. The second section involves taking part in the study activity – watching video clips and using pictures to communicate. This activity should not take longer than one hour.

Will your child benefit from taking part in this research?

Your child will not receive any benefit or compensation for participation in this study. The benefit will be for therapists and children that have to communicate with pictures because they cannot speak. Your child's contribution in this research study will be highly valued as it will aid to further research in this field.

Are there in risks involved in taking part in this research?

There are no risks involved in this research. Your child is only required to give up a bit of his or her time to complete the activity in which he or she will have to arrange pictures to communicate a message.

Video recording

During the data collection it will be necessary to video record the session with your child. This is to keep a record of the session so that in the event of the data being lost or ruined, the researcher can collect the data again by watching the video recording.

Who will have access to your responses and video recording?

This study aims to keep all information confidential. Only the researcher will have access to your child's responses and video recording. Your child's responses will not be linked to his or her name and they will not be shown to any other individual other than the researcher. All the responses will be tallied up to draw conclusions for the research. No names will be used in the representation of this study.

What will happen in the unlikely event of some form injury occurring as a direct result of your taking part in this research study?

No injuries are expected. However in the unlikely event that the participant is injured by external conditions during contact with the researcher, the researcher will not be held responsible.

Will you be paid to take part in this study and are there any costs involved?

Participants will not be paid to take part in the study. There will be no costs involved for you, if you do take part.

Will I have access to the research results?

The research results will be made available upon request following the completion of the project. The research data will be stored both as hard copy as well as in electronic format at the *Centre for Augmentative and Alternative Communication* at the University of Pretoria for 15 years. The research results may be published in an article in a scientific journal.

Further research

If the data collected during this research study is ever needed for further research, you will be contacted by the researcher who will inform you of the research study and request your permission to use the data collected in this study.

Who can be contacted if I have any further questions?

Should you require any further information, you are welcome to contact me at or stephpenkler@gmail.co.za.

Thank you in advance for your time and co-operation!

Yours sincerely,



Stephanie Penkler
Researcher
071 306 3708



Professor Juan Bornman
Supervisor
012 402 2001

isiXhosa Translation



UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities
Usuku:

Mzali

Igama lophando:

Ukutholekisa phakathi kabantwana abangakwaziyo ukuthetha nabalingani babo, indledla abasebenzisa ngayo imifanekiso ukuze ba qhagamishele nabanye abantu.

Igama lomphandi: Stephanie Penkler

Inombolo yakhe:

Lo wenza uphando ngumfundi ophumelele isidanga sesibini kwiyunivesithi yasePitoli. Usebenza phantsi komongameli wakhe.

Igama lomongameli: Kerstin Tonsing

Inombolo yakhe: 012 420 4729

Igama lomongameli: Professor Juan Bornman

Umntwana wakho uyaminywa ukuba athethe inxaxheba kuphando. Nceda uthathe ithuba ufunde esisimemo kunye neencukhaca malungana noluphando. Ukuba unayo imibuzo malungana noluphando, nceda ubuze nabani na osebenza koluphando. Kubaluleke kakhulu ukuba wonwabe ngokupheleleyo ngandlela oluphando luzo kuqhutywa ngalo, nangokuba umntwana wakho uzokwenza ntoni na kolu phando, kwaye ubene ngaciselo ephela ngoluphando. Umntwana wakho akanyazelekanga ukuba athathe inxaxheba, kwaye uvuma ukuba uthatha inxaxheba ngokuzithandela. Ukuba awuvumi, lonto ayizokonakalisa umntwana wakho nangeyiphi na indlela. Umntwana wakho uvumelekile ukuba ayeke ukuthatha inxaxheba koluphando nanini na efuna, nokuba uvumile ukuba athathe inxaxheba.

Oluphando luvunywele ukuba lwenziwe ngabe Research Ethics Committee kwiyunivesithi yasePitoli, kwaye lizokuqhutywa ngemigangatho nemigaqo evunyiweyo ngabe international Declaration of Helsinki, South African Guidelines for Good Clinical Practice nabe Medical Research Council (MRC) Ethical Guidelines for Research.

Lunga ntoni oluphando?

Oluphando lizama ukuqonda ukuba abantwana abangakwazi ukuthetha, nabane ngaxi yokuthetha bayi sebenzisa njani imifanekiso ukuze baqhagamishele nabanye abantu. Wonke umntwana oye wathatha inxaxheba kuluphando uzokwenza into efanayo. Bazokunikwa ibodi

enemifanekiso ekufanele basebenzise lemifanekiso ukuze bachaze ukuba kwenzeka ntoni na kwiteyiphu abazozibukela. Eziteyiphu zizokubonisa izenzo ezilula, umzekelo utata okhaba ibhola. Akhukho npendulo ilungileyo kungekho npendulo ingabunganga koluphando. Eyona nto ijongiweyo koluphando kukuba abantwana baqhagamishelana njani na nabanye abantu ngemifanekiso.

Kuthe ni lento umtwana wakho emenyiwe ukuba athathe inxaxheba?

Umntwana wakho umenyiwe ukuba athathe inxaxheba kuba eneminyaka efunekayo kwabantwana abafunwayo koluphando.

Yintoni iranduva lomntwana wakho?

Umntwana wakho unexanduva lokuba aye kumhlangano omnye. Lomhlangano uzoba ene candelo lokuvawanya ukuba umntwana wakho uluvisisa njani na ulwimi oluthethwayo. Eli candela lizokuthatha imizuzu eyi30. Kwicandelo lwesibini umntwana wakho uzokubukelo iteyiphu aze asebenzise imifanekiso ukubonakalisa uqhagamishelwano. Lomhlangano uzokuthatha iyure.

Umntwana wakho uzokufumana ntoni ngoku thatha inxaxheba?

Umntwana wakho akazokufumana nto ngoku thatha inxaxheba koluphando. Umntwana wakho uzokunceda ngoko ngeza kulwazi malungana nendlana abantwana abangakwazi ukuthetha abasebenzisa ngayo imifanekiso ukuze baqhagamishelane nabantu. Uncedo lwakhe luncane kakhulu.

Ikhona ingozi ekuthatheni inxaxheba koluphando?

Akukho ngozi koluphando. Umntwana wakho uyacelwa nje ba asiphe ixeshana lakhe ukuba asebenzise imifanekiso ukuze acacise umyalezo.

Ukurekhoda

Ngexesha lomhlangano kuya nyanzeleka ukuba kurekhodwe umhlangano nomntwana wakho. Kwenzelwa ukuba kubekho ubungqina, ukuze ukuba ingxelo inga lahleka umphandi anagkwazi ukubukela iteyiphu, kunga nyanzeleki ukuba aqhinde aqale uphando ekuqaleni.

Ngubani ozobona iimpindulo zakho kunye neteyiphu yomntwana wakho?

Oluphando lozokugcina yonke into emfihlakalweni . ngumpandi yedwa ozokubona iimpindlo zomntwana wakho kunye neteyiphu. Iimpindulo zomntwana wakho wakho azizokudityaniswa negama lakhe kwaye akekho omnye umntu ozozibona. Zonke iimpindlo zizo kubalwa kuze kufunyanwe isigqiobo esingaphambili koluphando. Akho magama azosetyenziwa koluphando.

Kuzkwenziwa ntoni na ukuba umntwana wakho uye wonzakala ngenxa yoluphando?

Ukonzakala akulindelekanga. Kodwa, ukuba umtathi nsasheba uye wonzakaliswa zizinto ezinga dibenanga nophando, umphandi akazokufunyanwa enowanduva.

Uzokubatalwa ukuba uthathe inxaxheba okanye zikhona indleko?

Abazoku thatha inxasheba abazokubatalwa. Akukho ndleko.

Ndizokuzofumana iziphumo?

Iziphumo zizokufumaneka xa uye wazicela xa uphando luqityiwe. Iziphumo zizokugcinwa ephapheni nasekhompyutheni eCentre for Augmentative and Alternative Communication kwiyunivesithi yasePitoli iminyaka eyil 5. Iziphumo zinga papashwa kwiphepha-ndada lenzuluwazi.

Olunye uphando

Ukuba iziphumo zoluphando ziye zafuneka ukuba zisetyenziswe kolunye uphando kuzo kuqhagamishelwana nawe uxelelwe kwaye ucelwe ukuba zisetyenziswe.

Ukuba uneminye imibuzo ugathetha nabani na?

Ukuba uneminye imibuzo wamkelekile ukuba uqhagamishelane nam ku okanye stephenkler@gmail.co.za

Enkosi nevesha lwakho nange ntsebenziswano yakho

Ozithobileyo,



Stephanie Penkler
Umphandi
071 306 3708



Kerstin Tönsing
Umongameli
012 420 4729



Professor Juan Borman
Umongameli
012 402 2001

Appendix H

Symbol assessment form

Participant: _____

Group: _____

Symbol Assessment

Subjects	Correct	Incorrect
man / umfana		
woman / intombi		
Verbs		
bite / oluma		
blow / evuthela		
drop / owisa		
water (i.e. to water something) / encenceshela		
kick / kaba		
smell / onukisa		
Objects		
car / imoto		
shoe / isihlangu		
cup / ikopi		
chair / isitulo		
candle / i-khandlela		
arm / ingalo		
book / incwadi		
flower / i-flower		
hand / isandla		
bubbles / i-bubbles		
bear / unopopi		
banana / ibhanana		

Total number correct	/20
Percentage correct	
Continue with study	YES NO

Appendix I

Back-translation of consent letter into English

Date

Dear Parent

Research Topic

To compare the level of communication using pictures/images between children with speech and language difficulties and their peers with no such difficulty.

Name of researcher: Stephanie Penkler

Contact number:

The researcher is obtaining her second degree at the University of Pretoria. She is working with her supervisors.

Name of supervisor: Kerstin Tonsing

Contact number: 012 402 2001

Name of supervisor: Professor Juan Bornman

Your child is invited to take part in the research study. Please carefully take your time to read the invitation details about the study. If you have any questions please contact anyone involved for more explanation. Your satisfaction with the medium of how the research is conducted is very important to us. It is important that you be fully informed about this investigation and what your child will be doing. Your child is not obliged to participate in this investigation and you are approving participation at your own will. Your child will be taking part voluntarily in the study. If you are not willing it will not harm your child in any way. Your child is allowed to stop participation in this investigation anytime she or he is willing. If you are not happy about your child's involvement, you are welcome to withdraw him/her.

This investigation has been approved for conduction be the REC of the University of Pretoria and it will be conducted with rules and regulations approved by IDH, SAGGCP and MRC EGR.

What is the research about?

This investigation tries to investigate how children who can talk and those who have speech problems use pictures to communicate with other people. To compare the communication of using pictures and images between children with speech and language disabilities and their peers with no such disability. All children that participate in this investigation will do the same thing. They will be given a board with pictures and they will use the pictures to tell what is happening in the tapes that they will watch. These tapes will be showing simple acts e.g. a man kicking a ball. There is no incorrect or correct responses in the study. The importance is to measure the communication medium between these two groups.

Why is it important for your child to take part?

Your child is a research target for the study because of his/her age.

What will be your child's role?

To attend one research meeting. The aim of the meeting will be to test how your child responds on spoken language. The duration of the session will be 30 minutes. The second phase will take 1 hour. An audio-visual material showing communication process will be watched by participants.

What your child will benefit?

No rewards for your child when he/she participates. She/he will play an important role in the science of communication of using pictures and images.

Are there any dangers in the study?

No dangers are in the study. Your child is requested to give us some time to use pictures to explain the process.

Recording

During the study the proceedings will be recorded to give evidence. In case the hand written material is lost, the researcher will use the tape/audio material.

Who is going to see the responses that are tape/recorded of your child?

The research findings will be highly confidential. Only the researcher will view the responses and behaviour of your child during the study. No names of the children will be used in the study.

In case your child got injured during the study, what will happen?

No injuries expected, but if the participant got injured out of the participating area the researcher is not responsible for any injuries occurred.

Any contributions or payments required?

No contributions for participating and also no rewards for participants.

Will we get results of the study?

The findings of the study will be available when the study is completed on request. They will also be kept in a computer and a reading material at the University of Pretoria for 15 years. The findings can be published in a science newspaper.

Another research?

If the findings of the study will be used for another study you will be contacted to give permission.

Enquiries

Contact the researcher stephpenkler@gmail.com

Thank you very much for your cooperation.

Sincerely

Appendix J

Assent and discontinuation materials

Participant Assent Script

Researcher: Would you like to play this game with me? If you want to play, touch the happy face and if you don't want to play touch the sad face.

Can we leave this video recorder on over here? Touch the happy face if you don't mind having the video recorder on or touch the sad face if you don't want the video recorder on.



YES



NO

Researcher: If you want to stop playing the game all you have to do is touch this stop sign.



Appendix K

Script of explanation video

English version

Let me explain what we are going to do today. We have to help this poor animal. He is locked up in this cage and we have to give him the code to get him out. What we have to do is watch some videos on this computer. We'll watch one at a time. After each video you have to explain to the animal what was in the video. You see, he cannot understand our language, so you have to show him using these pictures. He only understands pictures. You take the pictures off the board like this and put them onto this board. When you have put all the pictures that will explain what you see in the video, you must show the board to the animal. These pictures are the code you see. When you've finished watching all the videos and have given all the pictures to explain, the door will open and the animal will be free!

isiXhosa version

Mandikuchazele ukuba sizokwenza ntoni namhlanje. Sizokunceda esisilwanyane sihluphekileyo. Sitixelekile, kufuneka sisinike imifanekiso ukuze siphume. Into ekufuneka siyenzile kukubukela apha. Emveni kokubukela kufuneka sicacisele esisilwanyane ukuba bekusenzeka ntoni. Esisilwanyana asisazi isiXhosa, kengoku kufuneka simcacisele ngokusebenzisa lemifanekiso. Uqonda imifanekiso qha. Ukupha imifanekiso kule bodi ngoluhloba, uyifake kulena ibodi. Xa ugqibile ukuyifaka yonke imifanekiso ecacisayo ukuba kwenzeke ntoni na, kufuneka ubonise isilwanyane ibodi. Xa sesigqibile ukubukela, saze sagqiba nokubonisa isilwanyane ukuba kwenzeke ntoni na, ucango luzokuvuleka siphume isilwanyane!

Appendix L

Procedural and prompting script

1. Greet, introduce

Hello, how are you?

Molo, kunjani?

2. Obtain assent

Would you like to play a game with me? [Would you like to look at some pictures with me?]

If you want to play touch the happy face and if you don't want to play touch the sad face.

Can we leave this video recorder on over here? Touch the happy face if you don't mind having the video recorder on or touch the sad face if you don't want the video recorder on.

If you want to stop playing the game all you have to do is touch this stop sign.

Uyafuna ukudlala nam? [Uyafuna ukujonga imifanekiso nam?] Ukuba uyafuna ukudlala nam, bamba lomfanekiso uncumileyo, ukuba awufuni ukudlala nam, bamba lomfanekiso uqumbileyo.

Ndingabeka lekamera ilaytileyo apha? Ukuba uyafuna bamba lomfanekiso uncumileyo, ukuba awufuni bamba lomfanekiso uqumbileyo.

Xa ufuna ukuyeka ukudlala, uze ubambe loStop [ukuba ufuna ukuyeka ukujonga imifanekiso uze ubambe loStop].

3. Picture communication symbol naming

Let's look at these pictures. Here is the woman, the man etc.

Masijonge imifanekiso. Nanku umama, utata etc.

Point to each symbol while naming them verbally.

4. Explanation video

Let's look at the video.

Masijonge ivideo.

Play the video on the laptop. (After video) *Do you understand? Let's start.*

Uyaqonda? Masiqale.

5. Demonstration activity

Clips 1 and 3

Bring child's attention to the video e.g. *jonga ivideo (look at the video)*.

Play the video clip on the laptop. Replay the clip and pause on the last frame.

Ask a prompt question e.g. *Wenza ntoni? (What is happening?)*

Construct the appropriate graphic symbol SVO utterance by taking the symbols off the display board and arranging them on the utterance strip. Explain each action to the child

e.g. *Ndithatha iyafana ku le video. (I'm taking the same as the video.) Siyaqala apha. (We start here.) Beka imifanekiso so. (Attach the pictures like this.)*

Demonstrate showing graphic symbol utterance to the animal.

Clips 2 and 3

Bring child's attention to the video e.g. *jonga ivideo (look at the video)*.

Play the video clip on the laptop. Replay the clip and pause on the last frame.

Ask a prompt question e.g. *Wenza ntoni? (What is happening?)* and facilitate trial by child.

General prompts and questions should be given to guide the child through the activity (see prompt script below).

6. Study activity

Bring child's attention to the video e.g. *jonga ivideo (look at the video)*.

Prompt question e.g. *Wenza ntoni? (What is happening?)*

General prompts and questions (see prompt script below).

Prompting Script

Kwenzekentoni apha? (What happened here?)

Ubona ntoni? (What did you see?)

Thatha imifanekiso nebeka apha. (Take the pictures and put them here.)

Uqibile? (Are you finished?)

Bonise esisilwanyane. (Show the animal.)

Jonga ivideo (Look at the video)

Ndibonise ngemfanekiso (Show me with pictures)

Thatha imifanekiso iyafana ku le video. (Take the pictures that are the same as the video)

Qala apha (Start here)

Bonisa esisilwanyana into uyibonileyo ku le video (Show that animal what you saw in the video)

Appendix M
Record sheet for data collection
Record Sheet

Participant _____

Group _____

	Target	Participant Response	Response Structure	Scores		
				Information	Order	Intelligibility
1	man bite arm umfana oluma ingalo					
2	woman smell cup intombi enukisa ikopi					
3	man blow bubbles umfana ovuthela i- bubbles					
4	woman bite book intombi eluma incwadi					
5	woman kick flower intombi ekaba iflower					
6	man drop shoe umfana owisa isihlangu					
7	woman blow candle intombi evuthela i- khandlela					
8	man kick car umfana okaba imoto					
9	man water chair umfana oncenceshela isitulo					
10	woman drop doll intombi ewisa unopopi					
11	man smell banana umfana onukisa ibanana					
12	woman water hands intombi encenceshela izandla					
TOTALS						

Appendix N
Procedural integrity checklist

Participant _____

 Assent obtained Head nod Vocalisation None

 Explanation of withdrawal Yes No
DEMONSTRATION CLIPS

	Example	Child's attention brought to video e.g. Jonga ivideo	Prompt question e.g. Wenza ntoni?	Demonstration by researcher	Explanation e.g. Ndithatha iyafana ku le video. Siyaqala apha. Beka imifanekiso so.	Demonstrate showing animal	Trial by child	General prompts and questions e.g. Wenza ntoni? Uqibile? Bona fo esilwanyana. Thatha imifanekiso iyafana ku le video. Ubona ntoni?	No corrections of participant's responses
1	Woman kick shoe								
2	Woman smell flower								
3	Man drop book								
4	Man blow hand								

STUDY CLIPS

	Example	Child's attention brought to video e.g. Jonga ivideo	Prompt question e.g. Wenza ntoni?	General prompts and questions e.g. Wenza ntoni? Ndibonisa ngenfanekiso. Thatha imifanekiso iyafana ku le video. Ubona ntoni? Qala apha. Uqibile? Bona fo esilwanyana.	No corrections of participant's responses	No physical, visual or auditory distractions
1	Man bite arm					
2	Woman smell cup					
3	Man blow bubbles					
4	Woman bite book					
5	Woman kick flower					
6	Man drop shoe					
7	Woman blow candle					
8	Man kick car					
9	Man water chair					
10	Woman drop doll					
11	Man smell banana					
12	Woman water hand					

Appendix O

Table showing the number of target symbols selected for each group per item for children with LNFS and children with typical development

Item	Group	S	V	O	Total Score
1	LNFS	4	9	4	17
	TD	3	10	5	18
2	LNFS	5	4	10	19
	TD	2	5	11	18
3	LNFS	4	7	6	17
	TD	1	6	7	14
4	LNFS	6	5	6	17
	TD	1	7	12	20
5	LNFS	5	4	11	20
	TD	3	7	11	21
6	LNFS	6	1	13	20
	TD	3	2	12	17
7	LNFS	6	4	11	21
	TD	1	5	11	17
8	LNFS	5	5	11	21
	TD	2	8	12	22
9	LNFS	3	12	5	20
	TD	2	13	3	18
10	LNFS	5	2	11	18
	TD	2	1	13	16
11	LNFS	3	2	13	18
	TD	3	4	13	20
12	LNFS	4	9	5	18
	TD	2	13	4	19
Totals	LNFS	56 (36%)	64 (41%)	106 (68%)	226
	TD	25 (16%)	81 (52%)	114 (73%)	220

Appendix P

The number of utterances falling at each intelligibility score for each participant for children with LNFS and children with typical development

	Participant	Intelligibility scores					Total	
		0	1	2	3	4		5
Children with LNFS	1.1	5		7				
	1.2	3	4	5				
	1.3			12				
	1.4	7	5					
	1.5		1	10		1		
	1.6	1		11				
	1.7	1	2	9				
	1.8	3	2	7				
	1.9			7	4	1		
	1.10				1	11		
	1.11			6		4	2	
	1.12		2	4	1	5		
	1.13			8			4	
	Total n	20	16	86	6	22	6	156
	Total (%)	(12.8%)	(10.3%)	(55.1%)	(3.8%)	(14.1%)	(3.8%)	
Children with typical development	2.1	5	6	1				
	2.2	2		10				
	2.3	7	4	1				
	2.4		2	3	3	4		
	2.5	4	6	2				
	2.6		1	11				
	2.7		9		1	2		
	2.8	6	6					
	2.9	8	4					
	2.10		3	2	3	3	1	
	2.11					12		
	2.12		1	5		6		
	2.13		5	5	1	1		
	Total n	32	47	40	8	28	1	156
	Total (%)	(20.5%)	(30.1%)	(25.6%)	(5.1%)	(17.9%)	(0.6%)	

Appendix Q

Table showing the number of target symbols selected for each group per item for children with lower and higher receptive language age

Item	Group	S	V	O	Total Score
1	LRLA	1	7	3	11
	HRLA	6	12	6	24
2	LRLA	2	5	7	14
	HRLA	5	4	14	23
3	LRLA	0	5	3	8
	HRLA	5	8	10	23
4	LRLA	1	4	6	11
	HRLA	6	8	12	26
5	LRLA	3	4	9	16
	HRLA	5	7	13	25
6	LRLA	2	1	9	12
	HRLA	7	2	16	25
7	LRLA	2	4	8	14
	HRLA	5	5	14	24
8	LRLA	1	5	8	14
	HRLA	6	8	15	29
9	LRLA	1	10	4	15
	HRLA	4	15	4	23
10	LRLA	2	1	9	12
	HRLA	5	2	15	22
11	LRLA	2	1	10	13
	HRLA	4	5	16	25
12	LRLA	0	7	3	10
	HRLA	6	15	6	27
Totals	LRLA	17/120 (14%)	54/120 (45%)	79/120 (66%)	150/360
	HRLA	64/192 (33%)	91/192 (47%)	141/192 (73%)	296/576

Appendix R

The number of utterances falling at each intelligibility score for each participant for children with lower and higher receptive language age

	Participants	Intelligibility scores					Total
		0	1	2	3	4	
LRLA	1.1	5		7			
	1.2	3	4	5			
	1.3			12			
	1.4	7	5				
	1.5		1	10		1	
	2.1	5	6	1			
	2.2	2		10			
	2.3	7	4	1			
	2.4		2	3	3	4	
	2.5	4	6	2			
	Total n	33	28	51	3	5	120
	Total (%)	27.5%	23.3%	42.5%	2.5%	4.2%	
HRLA	1.6	1		11			
	1.7	1	2	9			
	1.8	3	2	7			
	1.9			7	4	1	
	1.10				1	11	
	1.11			6		4	2
	1.12		2	4	1	5	
	1.13			8			4
	2.6		1	11			
	2.7		9		1	2	
	2.8	6	6				
	2.9	8	4				
	2.10		3	2	3	3	1
	2.11					12	
2.12		1	5		6		
2.13		5	5	1	1		
	Total n	19	35	75	11	45	192
	Total (%)	10%	18.2%	39.1%	5.7%	23.4%	3.6%