CHAPTER 1

PROBLEM STATEMENT AND RATIONALE

1.1 Introduction

This chapter provides an orientation to the research. It incorporates background information, the purpose of the research, an explanation of the terminology used, and finally an outline of each of the chapters in the study.

1.2 Problem statement and rationale

Language acquisition literature indicates the importance for typically developing children hearing language in an environment rich in social-communicative interactions prior to their taking the role of speaker (Nelson, 1973). Nelson proposed that typical children produce little speech during early language development, as they are internally processing the language—thereby developing the comprehension of spoken language. The comprehension of spoken language, however, is often taken for granted in research into early childhood language acquisition. While the onset of early word comprehension arguably precedes word production, traditional research has focused on language production rather than comprehension (Romski & Sevcik, 1997).

A similar trend of focusing on expression is evident in the field of alternative and augmentative communication (AAC). Traditionally, the role of AAC systems for individuals with little or no functional speech (LNFS) has been as an output mode for expressing messages. While this is an essential role and the final outcome of AAC intervention strategies, the role of listener is equally important. The comprehension of spoken language provides an essential foundation upon which language production competence can be built. For AAC users it may have the added benefit of being able to link across modalities (auditory to visual).

For most AAC users there are differences between the modalities of language, with the expressive modality being primarily visual (graphics and manual signs) and the receptive modality being speech comprehension (auditory) (Grove & Smith, 1997; Oxley & von

Tetzchner, 1999; Smith, 1997, 1998). For some AAC users, however, graphic symbols underlie both the expressive and the receptive modalities. AAC users therefore have two routes of learning and using symbols. They could either comprehend the AAC symbols or they could comprehend the spoken language (Romski & Sevcik, 1993a).

AAC users' ability to comprehend spoken language varies, from age equivalent comprehension of spoken language to minimal comprehension. Some AAC users comprehend spoken language and therefore come to the AAC acquisition task with an established knowledge of spoken language. These users therefore have an asymmetrical relationship between their own language modes (both expressive and receptive) and the spoken language of the environment (von Tetzchner, Grove, Lonke, Barnett, Woll & Clibbens, 1996). Others who experience difficulty comprehending spoken language require AAC as both the input (receptive) and output (expressive) mode.

The role of graphic symbols in facilitating comprehension of messages, either of the spoken language or of the AAC symbols, is an area that needs further exploration. Studies relating to the perception of pictures have important implications for the role of graphic symbols in facilitating comprehension and symbol learning in AAC users.

Important aspects of picture use or symbolic representation were outlined by DeLoache, DeMendoza and Anderson (1999); DeLoache (1991); and Uttal, Schreiber and DeLoache (1995). The acquisition of representational insights refers to a visual relationship with the symbol or picture. This stage is facilitated by perceptual similarities between the symbol and its referent. The next aspect is the dual representation stage, in which the symbol is perceived as an object in its own right as well as being a representation of a referent. Symbolic sensitivity is the final important benchmark that the above authors identified in the process. This refers to an individual's readiness to perceive the symbolic relationships between symbols and their referents. These benchmarks, plus the work of various other studies (discussed in Chapter 2), indicate that picture comprehension is an acquired skill (DeLoache, 1991; Sigel, 1978). It may further be argued that because these symbols are

learnt, they could be taught. The manner in which they are taught is important, but there has been limited research in this area (Fuller, Lloyd & Stratton, 1997; Schlosser 2003b).

The use of augmented input strategies is one type of instructional technique used in teaching graphic symbols to AAC users. There have been various studies investigating the impact of augmented input strategies on graphic and language learning. Augmented input refers to incoming language or communication that includes speech and is augmented with the AAC system (Romski & Sevcik, 1988). Romski and Sevcik (1992) investigated the impact of the System of Augmenting Language (SAL) on adolescents with intellectual impairment in a longitudinal study. The SAL project provided evidence for the effectiveness of a natural context approach in facilitating language development in persons who use AAC (Romski, Sevcik & Cress, 1996). The results of the SAL project are impressive: all the students learnt to use lexigram symbols and to combine them with gestures or vocalizations and thereby make requests and comments, answer questions and perform other functions (Romski & Sevcik, 1996).

Research into the impact of aided language stimulation on language development has been limited primarily to case studies (Basil & Soro-Camats, 1996; Goossens', 1989), with no empirical research having been conducted to address this question (Beukelman & Mirenda, 1998). Aided language stimulation refers a technique in which a facilitator or communication partner combines the use of AAC with natural speech. There is also an emphasis on providing intervention in an activity-based format within the child's natural contexts or routines. Goossens' (1989) first reported the successful use of aided language stimulation with a six year old girl with cerebral palsy. Seven months of intervention using aided language stimulation seemed to result in more frequent and interactive use of the symbols. An increase in natural speech also emerged.

While the studies discussed above indicate that augmented input has a positive influence on participants, the focus of these studies has been primarily on the impact on expressive use of the symbols, with little emphasis on the receptive language skills. A further general trend of these studies is that besides being of limited scope, they also tend to focus more on the

procedure of SAL as proposed by Romski and Sevcik (1996). There are therefore two areas in relation to augmented input strategies that require further investigation. The first relates to the use of aided language stimulation, specifically regarding the learning of symbols. Aided language stimulation (Goossens' & Crain, 1986) is one strategy of providing augmented input instruction within certain contexts, and it is widely referred to in the literature (Beukelman & Mirenda, 1998; Goossens', 1989; Lloyd, Fuller & Arvidson, 1997; Romski & Sevcik, 2003). However, there is a paucity of research regarding its role in symbol or language learning. The second aspect noted for research in the area of augmented input is that the focus of these studies has been primarily on the expressive use of the symbols. The area of symbol comprehension, or the role of symbols in facilitating symbol comprehension, has been largely neglected. Finally, the role of Voice Output Communications Aids (VOCA) which form part of both these augmented input strategies may also play a facilitative role in teaching symbol - referent relationships (Schlosser Belfoire, Nigam, Blischak & Hetzroni, 1995), although a VOCA was not used in the current study.

The aim of this study is therefore to determine the impact of a three-week-long aided language stimulation program on the receptive language skills of children with LNFS. The aided language stimulation program would focus on three activities that would establish a context for providing the target receptive vocabulary items to the participants.

1.3 Terminology

The following terms are used frequently in the study and are therefore clarified.

1.3.1 Alternative and Augmentative Communication (AAC)

Alternative and augmentative communication is the "supplementation or replacement of natural speech and or writing using aided or unaided symbols" (Lloyd et al., 1997, p. 524) in order to enhance the communication skills of persons with LNFS.

1.3.2 Aided language stimulation

"Aided language stimulation" refers a technique in which a facilitator or communication partner combines the use of AAC with natural speech. This technique augments spoken input so as to enhance the AAC user's comprehension, while simultaneously providing models for using AAC (Lloyd et al., 1997). The facilitator, therefore, simultaneously points to symbols on a facilitator board in conjunction with providing ongoing spoken language stimulation (Goossens', 1989; Goossens' & Crain, 1986). For the purpose of this study, the aided language stimulation did not include the use of a Voice Output Communications Aid (VOCA).

1.3.3 Facilitator

"Facilitator" refers to the individual providing aided language stimulation. For the purpose of this study, the facilitator was the researcher.

1.3.4 Facilitator boards

"Facilitator board" refers to a low-technology AAC device with 16 PCS symbols arranged on cardboard according to Goossens & Crain's (1986) categories and topics. The facilitator board used in this study was larger in dimension than the traditional personal communication boards, because the facilitator used them for instructional purposes; therefore, they needed to be clearly visible to the entire group of participants.

1.3.5 Little or no functional speech (LNFS)

For the purpose of this study, the term "little or no functional speech" will refer to participants who speak fewer than 15 intelligible words (Burd, Hammes, Bornhoeft & Fisher, 1988).

1.3.6 Picture Communication Symbols (PCS)

This refers to a set of symbols composed "primarily of simple line drawings with printed words above them" (Lloyd et al., 1997, p. 537). They comprise a pictographic symbol set with a large number of symbols, which would allow the depiction of a broad array of concepts. (Mayer – Johnson, 1984, 1985).

1.4 Abbreviations

AAC	-	Augmentative and Alternative Communication
LNFS	-	Little or No Functional Speech
SAL	-	System of Augmenting Language
PCS	-	Picture Communication Symbols
VOCA	-	Voice Output Communication Aid

1.5 Chapter Outlines

The research will be presented in five chapters. Chapter 1 provides a basic orientation to and motivation for the study. In Chapter 2 the theories of the acquisition of language, as well as the controversial role of input for typically developing children, are discussed. This is followed by a discussion of an adapted version of Bedrosian's (1997) model of language acquisition for an AAC user. Each of Bedrosian's four components is discussed, namely the child, the AAC system, the instruction, and the communication partner. In particular, the role of partner input is explored. The term "augmented input" is defined, and the underlying cognitive processing involved is contextualized within dual coding theory. Specific augmented input techniques, namely SAL and aided language stimulation, are described and discussed as strategies to enhance expressive and receptive language acquisition in an AAC user. Research relating to the impact of augmented input is highlighted and discussed.

Methodology is the focus of Chapter 3, which includes a description of the aims, objectives, research design, and pilot and main studies. Participant selection criteria, descriptions of the participants, and a discussion of the equipment and materials used are also included in this section. The aided language stimulation and training program is described and discussed. Finally, the chapter includes the data collection and analysis procedures.

Chapter 4 presents an overview of the results obtained. Emphasis was placed on three aspects of the research as they relate to the aims of the study, and these three aspects are schematically presented. The results of the study are discussed in relation to the reliability of data, the type of aided language stimulation provided, and the impact of the aided language stimulation on the participants' target receptive vocabulary items and general receptive language skills. Thus, a discussion of the results is integrated throughout Chapter 4. Possible explanations for the participants' acquisition of the target vocabulary items are suggested, and discrepancies in the acquisition process are discussed and possible reasons postulated.

Finally, Chapter 5 contains the conclusions drawn from this study. The implications of the study are presented, in conjunction with a critical evaluation of the study and recommendations for future research.

1.6 Summary

The current chapter offers a motivation for the study, by providing background information on the role of pictures and in particular graphic symbols used in AAC to facilitate language learning. This is followed by a discussion of the terminology and abbreviations used in the study. The chapter is concluded with an outline of all of the chapters, by which the aims of the study will be realized.

CHAPTER 2

THE USE OF GRAPHIC SYMBOLS IN LANGUAGE LEARNING

2.1 Introduction

2.1.1 Scope of the chapter

This chapter aims to critically discuss the theories of language development in typically developing children, and the application of those theories to alternative communication forms, particularly the acquisition of augmented language. A model for the acquisition of alternate language forms is discussed and provides the theoretical framework for the chapter. Each of the model's four components is expanded on and discussed in relation to the role that graphic symbols play in language learning. The importance of partner input and exposure to a successful user or model of Augmentative and Alternative Communication (AAC) is highlighted. The implications of a lack of an adequate model are discussed in relation to the AAC user. The impact of symbols on receptive language acquisition is discussed, particularly in relation to mapping. Finally, the theoretical merits of augmented input - particularly aided language stimulation are discussed in terms of models of processing. The factors that influence language learning are also expanded on and discussed.

2.1.2 Background

The field of language development has many theories that are not perfectly formulated. Controversial topics include the role of comprehension in language acquisition, "deviant" versus "different" language acquisition in persons with cognitive impairment, and the importance of input in language acquisition (Bloom, 1993). The acquisition of alternate communication forms, such as an Augmentative and Alternative Communication (AAC), is also complex. For most AAC users there are differences between the modalities of language, with the expressive modality being primarily visual (graphics and manual signs) and the receptive modality being speech comprehension (auditory) (Grove & Smith, 1997; Oxley & von Tetzchner, 1999; Smith, 1997, 1998). For some AAC users, however, graphic symbols underlie both the expressive and the receptive modalities. The commonality between these two groups is that successful users of the alternate language forms are rare.

Yet successful models who use the relevant language form are important in imparting language acquisition to an AAC users. The acquisition does not occur in an implicit manner as with typically developing children, but is usually explicitly taught (von Tetzchner & Grove 2003).

2.2 Language acquisition

2.2.1 Theories of language development and their application to alternative communication forms

For many children, language learning evolves successfully and requires no planned intervention, but for others the process of language acquisition is difficult and requires concerted intervention to facilitate the process. This is particularly true for children who have LNFS (fewer than 15 intelligible words) and who need AAC (Burd, et al., 1988). Various theories of language development in typical children have been proposed and discussed. Their applicability to children who acquire alternative communication forms will be explored. Table 2.1 contains a summary of some of the major theories and their contributions, limitations and applications to alternative communication forms. These theories (to varying degrees) emphasize the social dimensions of language acquisition, and were selected for discussion because they highlight the role of a competent language user and language input in the language acquisition process.

Theories of child development try to explain the "what", "how" and "why" of language development. The explanation usually depends on the perspectives of major theories, namely nativism, behaviorism, emergentism, and social constructivism (von Tetzchner & Grove, 2003).

The nativist theorists assume language acquisition to be a species-specific neurological process that arranges linguistic input and categories according to inborn rules (Chomsky, 1957, 1965). Hence, the human propensity for language is the product of a mental organ or faculty (i.e. language acquisition device) and thus there is no learning involved. Such theories argue that there is no learning of language, but rather the growth of the language system

under certain environmental conditions. This theory does not fully consider the non-speech communication modes or alternate

language forms. However, two factors could be extrapolated and seen as important in the acquisition of an alternative communication form. These are, firstly, that the alternative form of communication should be perceived as having a linguistic aspect, and secondly that certain amounts of exposure to the alternative form would be required prior to it being learned. The latter factor (exposure to the alternative communication form) is particularly pertinent to the child who uses AAC. For these individuals, exposure to the alternative communication form is usually limited to training situations. This may, according to the nativist theory, severely limit a child's opportunity to learn the system "naturally" (von Tetzchner & Grove, 2003).

The behavior analytic tradition, in contrast to nativism, argues that language is a learnt behavior. Researchers in this field tend to discuss language learning in relation to reinforcing conditions (Schlinger, 1995; Skinner, 1957). The concept of reinforcing conditions explains why some individuals fail to develop language, but it is unable to explain how and why language does develop. Another limitation is that it fails to offer insights into the cognitive, social and cultural processes involved in language development. However, this approach is concerned with the manner in which the environment affects behavior (Straat, 1974).

Cognitive theorists argue that language depends on meaning and that acquisition is guided by what we know of the world (Bloom, 1993). The use of semantics to understand the acquisition of syntax is based on Piaget's (1954) cognitive development theory. General cognitive theory emphasizes the child's contribution to his or her own development, and how the child's mind constructs theories about the world. This includes aspects of language formed through interaction with communication partners. The development of meaning occurs in relation to the shared experience of the world. Hence, language and cognitive skills develop synchronously

Table 2.1 Summary of some theories of language development				
Theorist	**Theory**	**Contribution**	**Criticism**	**Application to alternative communication forms**
Chomsky (1957, 65)	Nativist	Understanding the innateness of language and the biological basis of language development	It is limited as the social, cognitive and behavioral processes are not addressed.	It addresses primarily verbal forms of communication. However, it proposes the need for exposure to language in its natural form; this aspect is equally relevant to alternative communication forms.
Skinner (1957)	Behaviorist	The importance of reinforcement in language acquisition is discussed	It is limited as the social and behavioral processes and neurological structures are not addressed.	Social reinforcement is an important component of language learning; the alternative communication form must serve the purpose of language in terms of social interaction.
Watson (1930)	Learning theory	The role of learning through experience and adult input is highlighted	Explanation of cognitive processing in terms of interpreting input is sparse.	Indicates the importance of input for the acquisition of alternative communication forms.
Piaget (1954)	Cognitive theory	The role of cognition in language acquisition is highlighted. He identifies the interaction between genetic, psychological and environmental factors in development	Language acquisition is not addressed as a separate issue, although it can be inferred based on this theory.	The interaction between various developmental factors has implications for the acquisition of alternative language communication forms. In addition, the various cognitive stages provide insights on pre-symbolic and symbolic communication.
Elman, Johnson, Karmiloff-Smith (1996)	Emerginist	Language is acquired through the dynamic interplay of multiple processes rather than as a single entity as postulated by the first two theories.	The context and broader social culture is absent from the theory.	Acquisition is through underlying processes, which may differ from the process underlying typical language acquisition.
Vygotsky (1978)	Socio-constructivist	The cultural context, including the beliefs of the learner and partners, is considered.	Intrinsic cognitive learner variables are less emphasized.	Cultural context of a learner is important; i.e. beliefs, values and expectations. The importance of a competent adult providing opportunities across settings is discussed.

The emergenists approach, on the other hand, considers the social and cognitive processes of language development. This approach posits that knowledge is driven by organizations of dynamic processes that function in a complex manner, and language is therefore regarded as a dynamic process (Elman, et al., 1996). This view argues that the acquisition of an alternative communication form is necessitated by the failure to develop language through ordinary processes. Hence, alternative language would develop through a dynamic interplay of processes (including speech perception, production, memory, and cognitive processes as well as the style and sensitivity of communication partners) that are fundamentally different from the processes of typical language development (von Tetzchner & Grove, 2003).

Watson (1930) also ascribed to the orientation that language acquisition is a learnt phenomenon, and placed a major focus on the cognitive aspect. His learning theory was concerned with the importance of input (learning through experience) in the acquisition of language. This is in contrast to the Chomskian psycho-linguistic approach, which is anti-learning in orientation. This emphasis on input is the primary contribution of Watson's theory to understanding the acquisition of alternative communication forms. Specific principles of input are provided with regard to the role of input in parent-child speech interaction (Pine, 1994).

It can be argued that just as children are equipped to acquire language, so are adults inclined to make the tasks easier for them. Adults' communication directed at children has certain characteristics, and is used by both males and females when interacting with infants. These characteristics include slow, high-pitched speech, and exaggerated intonation with smooth contours. This type of communication is referred to as "motherese" or "parentese" (Furrow, Nelson, & Benedict, 1979; Newport, Gleitman & Gleitman, 1977). Several reasons for the use of parentese have been suggested. The first speculation is that it helps to establish a social bond. Other benefits of parentese include its linguistic simplicity. Parental input appears to be optimal in certain ways, as it is virtually perfect from a linguistic standpoint. This optimal quality of parental language provides children with a reliable source of positive evidence or a model of the language (Snow, 1995). (See Section 2.4 for a further discussion on the characteristics of and research into the role of adult input in language acquisition).

Another theory that values the role of adults is that of the socio-constructivist approach (Vygotsky, 1978). This approach argues that language is acquired through the collaboration between a child and adult or more successful peer. Guidance by more successful language users takes place within the context of communication (Bruner, 1975, 1983). The theory does not deny the influence of biology, but maintains that language is not learned only via the biological structures or the reinforcement of certain behaviors. Vygotsky (1978) argues that a language development theory should account not only for the child's intrinsic characteristics and skills, but also for the extrinsic factors that contribute to language learning, including the socio-cultural environment.

Socio-constructivist theory argues that language development in young children does not occur in isolation, but should be viewed as a socially constructed phenomenon. It is embedded in a complex inter-related network of contexts including the physical, functional, language, cultural and social. Light (1997) further discusses each of these networks in detail. The social context is of particular relevance to the person using AAC, because it relates to the interactions between the child and others as well as the type of language used in this context. The cultural context refers to the values, beliefs and expectations of communities and families. Language competencies are therefore jointly constructed before they become an individual skill. The acquisition of alternative communication forms can therefore be understood in terms of social participation; the child learns and develops language through a range of interactions with a parent or a more skilled member of the community.

The term "zone of proximal development" (ZPD) characterizes the role of mother / child interaction in development (Vygotsky, 1978). Within the ZPD the parent can help to raise a child's performance through interaction in a manner that is internalized and generalized. Cognitive apprenticeship suggests that learning occurs in children through active participation in culturally defined situations together with more skilled members of the community. Bruner (1985) introduced the notion of scaffolding to describe the manner in which a mother supports her child's development, for example through fine-tuning her speech to the child's level. The type of scaffolding provided by adults or successful peers varies from direct

explanation and modeling to extension of language and implicit direction (Snow, 1995; Wragg & Brown, 1993).

It is evident that there are radically differing perspectives about the nature of the language acquisition process in typically developing children. The various theories discuss the importance of biology, behavioral reinforcement, cognition, the environment and finally the social aspect. The language developmental processes of children with cognitive impairment are equally controversial. They are argued by some theorists to be the same as that of typically developing children but proceeding at a slower rate (Byrne, 1959; Graham & Graham, 1971; Karlin & Strazulla, 1952; Lackner, 1968) while others argue that the development is different. Full discussion of these studies is beyond the scope of this chapter; however, they serve to highlight the controversies in language acquisition theory for both typically and atypically developing children.

2.2.2 The acquisition of alternate language forms: A model

As already demonstrated, controversies permeate the theories about children who acquire an alternative communication form. However, this field faces the additional complexities of a lack of successful AAC users and of the need for explicit instruction in AAC acquisition, as well as the issue of some alternate language users having different modalities for expression and reception. Bedrosian (1997) proposed a model for language acquisition in children acquiring an alternative communication form or AAC, as illustrated in Figure 2.1. The model of language acquisition proposed is complex. She identifies four major components. These include the child, the partner, the task or instruction, and finally the AAC system.

The model proposes that all of these components are related, and affect alternate language acquisition in an AAC user. The first component refers to the AAC system, specifically the linguistic and non-linguistic modes of the system used by the child. The second component refers to the child and the linguistic knowledge that the child brings to the acquisition process. This includes knowledge about expressive grammar, as well as the intrinsic factors of the child, including the biological foundations (in terms of neurological or neuromotor status, chronological age and developmental level). The third component refers to the partner; the role of the partner was expanded in the model in terms of the partner's role in

scaffolding, as highlighted in Vygotskian socio-constructivist theory. Finally, the instructional approach and communicative task also need to be considered when investigating the efficacy of various interventions in terms of modalities, devices and instruction (Romski, Sevcik & Adamson, 1997). Bedrosian (1997) views these components as being interactive in nature.

This introductory model provides insights into the major components that need to be considered in the language acquisition process. It highlights some of the important theoretical constructs that need consideration when developing a model for language acquisition in AAC users. However, as it is a preliminary model there are aspects that need further exploration and expansion. An aspect important to the understanding of language acquisition is neglected in this model, namely the role of graphic symbols in language learning. While one could argue that this aspect can be incorporated into the AAC systems, for the purpose of this chapter a more in-depth discussion of it within each component is warranted.

Bedrosian's (1997) model has been modified in order to facilitate understanding of the role of graphic symbols in the language acquisition process. The modifications are made across all four components. The component of the child has been expanded in terms of understanding the relationship between the expressive and receptive modalities for an AAC user, and the impact of that relationship on receptive language skills. The issue of receptive language skills is discussed and expanded in terms of the role that extant receptive language skills have in mapping and acquiring new concepts. The second component that needs expansion is the role of the communication partner. While Bedrosian acknowledges the supportive role a partner can play through scaffolding, the role of the partner's communication in providing relevant and sufficient modeling of the AAC system being used needs to be included. The AAC system, the third component, is expanded in terms of understanding the factors that facilitate graphic symbol learning. Finally, the issues of task and instruction are discussed in terms of the natural paradigm of language intervention including augmented input and aided language stimulation.

Another important area that was not adequately addressed in Bedrosian's (1997) model is that of the communicative environment. One could argue that the components of task / instruction and partner address the environment. However, the importance of the communicative environment (which refers to the places, people and contexts in which communication takes place as well as the transmission environment) for AAC users has been specifically highlighted in an AAC model proposed by Lloyd, Quist and Windsor (1990). The role of the environment in enhancing language acquisition was also discussed by Calculator (1997). He discussed the importance of understanding the nature of the spoken or verbal environments of children who use AAC, and the impact that these environments have on language acquisition. It is therefore felt that the environment requires separate delineation and discussion. The expansions of the components in the model provide the italicized text in Figure 2.1. The expanded model will serve as a framework for this chapter.

2.3 The language environment

All theories of language development imply that the environment of language users, and the quality of that environment, are to some extent related to the behavior of the language user. A good language environment consists of partners who use the expressive form and act as language models (Light, 1997; von Tetzchner & Martisen, 1992). Studies have identified aspects of the language environment that differ between children with and without disabilities. Interactions between parents and children with language disorders differ from the norm, because these children encounter difficulties in expressing their wants and needs. Parents therefore adopt more directive styles and are less responsive to the children (Yoder, Warren, McCathren & Leew, 1998).

There are significant differences between the language environments of children acquiring spoken language and those of children acquiring alternative communication forms. The community of speakers that surrounds children who acquire spoken language, and the influence of the spoken language on the child, is usually not planned. For children who use alternative communication, the language environment does not naturally include successful users of the same expressive mode as themselves. For the child who uses alternative

communication, most of the input comes from direct instruction and participation in educational activities (von Tetzchner & Grove, 2003) and therefore does not arise naturally.

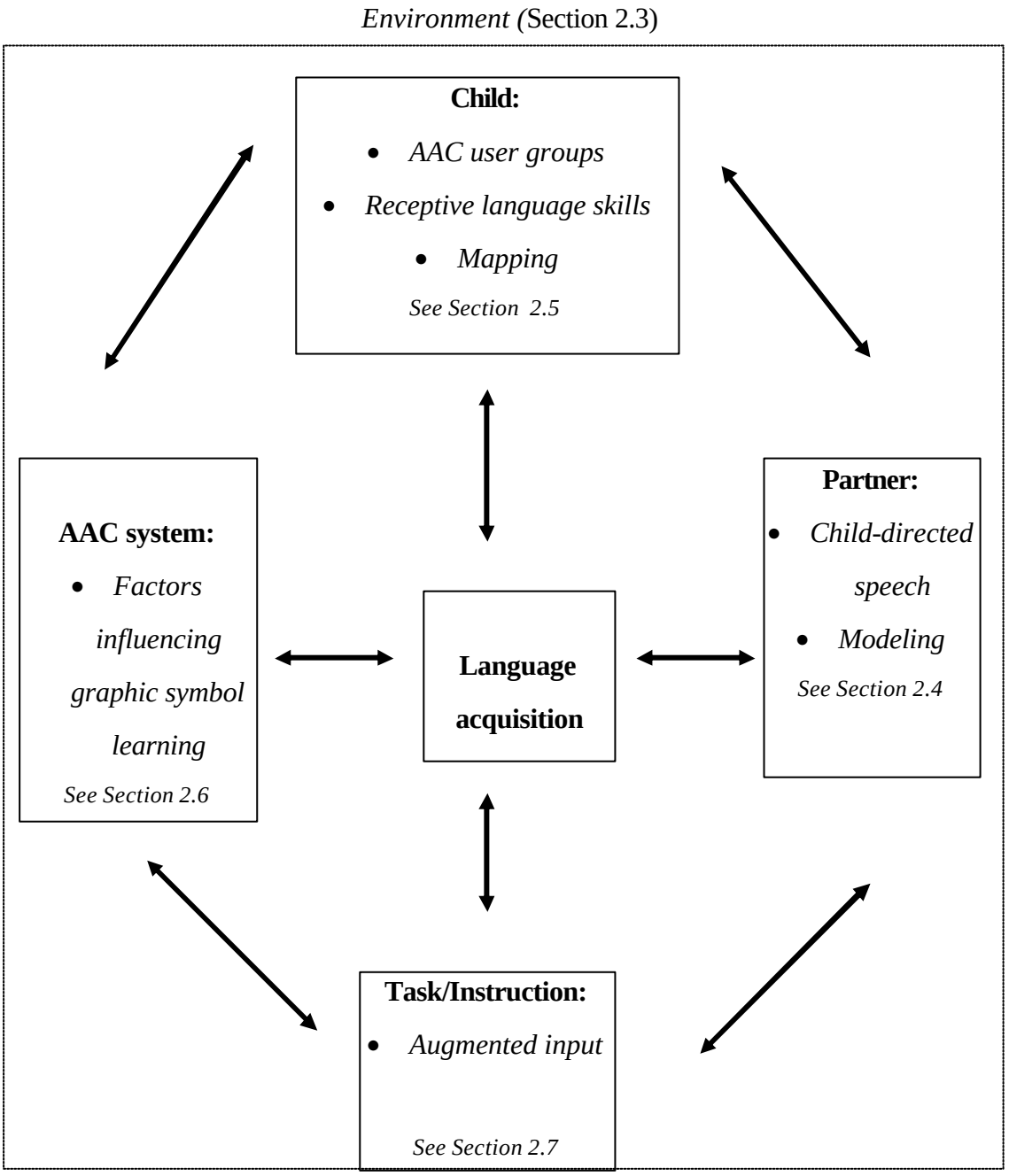

Figure 2.1 Interactive components of the language acquisition process illustrated by Bedrosian, (1997, p.184) (Italicized text in the figure has been added).

In addition, children who use alternative communication forms employ different environmental strategies when compared with typical children. For example, except during the early stages, typically developing children rarely point to pictures as an expressive means of communication, but this strategy is common in AAC users (von Tetzchner & Grove, 2003). Typically developing children usually have communication partners who attribute more specific intentions to them, a factor which is considered to be the driving force in language development (Lock, 1980; Ryan, 1974). In addition, typically developing children tend to communicate about past and future events; these events tend to be less prominent when planning AAC intervention. The lack of normative data for children acquiring alternative communication modes makes it difficult to determine the factors that influence failure and success in intervention, for any particular alternative communication (von Tetzchner & Grove, 2003).

Furthermore, the communication system to be used by the child is often planned by the professional, which may disempower parents and make it difficult for them to adopt the alternative communication form naturally. The language environment of a child who uses alternative communication is therefore consciously planned, and contains explicit teaching which would play little or no role in the development of language in a typical child (von Tetzchner & Grove, 2003). Von Tetzchner and Grove (2003) argue that this is evidenced by the fact that there are few detailed, documented descriptions of alternative communication in the home. It appears that the traditional parent / child interaction has been replaced by the child / professional interaction.

2.4. The Partner: the role of his or her input

The role of partner input in the acquisition of language in typically developing children has been extensively researched. Child-directed speech consists of short, well-formed utterances, contains few grammatical forms, and largely excludes complex sentences (Snow, 1972). It is characteristically higher in pitch, slower in tempo, highly redundant, much more closely tied to the immediate context and has a number special discourse features when compared with adult speech. The simplification of input in child-directed speech enhances children's remarkably swift progress in language learning.

Various studies have examined the relationship between child-directed speech and the acquisition of language in children. The two main studies in this area were conducted by Newport et al., (1977) and Gleitman, Newport & Gleitman, (1984). These authors argue that there is no relationship between the syntactic simplicity of maternal speech and any measure of language progress. They further argue that child-directed speech is largely irrelevant to the process of language acquisition.

Evidence in favor of child-directed speech comes from a study done by Farrar (1990), which identified the relationship between the mother's model of grammatical morphemes and a child's subsequent acquisition of those same morphemes over a six-month period. These findings are challenged by the results of Furrow et al., (1979) study, which found no relationships between mean length of maternal utterances and children's subsequent language growth. Also, certain features of maternal speech and precisely those aspects of children's language development were found not to be related. It is clear that these studies suggest two different accounts of the relationship between child-directed speech and language acquisition.

The relationship between child-directed speech and the child's acquisition of language is much less straightforward than the general model of child-directed speech would have one assume. Snow (1986) raises the point that the differences found in the studies may also be related to the tasks facing children at different stages of development, their own ability to organize linguistic input (Gleitman, et al., 1984), and the unique blend of needs and skills of each child which impact the language acquisition process (Light, 1997). It has been argued that children do not learn language solely by hearing a string of sentences, but that a supporting context is required (Snow, Perlmann & Nathan, 1987). Snow et al., (1987) argue that language input to children is important and should be understood in relation to the environments and context around the child; children's need to map the linguistic structure that they hear to their cognitive construct of the world is also important. The processes within a child are all equally important, and form the third component of Bedrosian's (1997) model, which will be discussed in Section 2.5.

Despite the lack of consistency in the results of different studies relating to the effects of child-directed speech, such studies have raised professional awareness of both the theoretical and methodological issues inherent in studying child-directed speech. While the precise role of input is still controversial, it is clearly an important aspect of the communicative exchange and language acquisition (Snow, 1986). Child-directed speech remains an important research topic in that it provides information about the language that the child is actually hearing; it allows one to investigate the way input interacts with language learning mechanisms within a child; and finally it serves to constrain hypotheses about the way in which children construct language from the input that they receive.

Calculator (1997) believes that for children with LNFS, early language experiences comprise reduced amounts of linguistic input. His conclusion was based on several observations, including the fact that parents of children with severe disabilities spend more time in physical care activities than in play (Light, Kelford-Smith, 1993). In addition, the researchers found that physical care and physical independence are higher priorities for these parents than are language-related skills (e.g. writing and reading), when compared with parents of typically developing children. The interaction patterns between parents and their children with disabilities tend to be more directive, with greater physical contact and decreased face-to-face communication when compared with parents of typically developing children. This pattern is evident even though responsive rather than directive patterns of interaction have been found to facilitate language development (Girolametto, Weitzman, Wiigs & Pearce, 1999; Hanzlik, 1990).

Light, Collier and Parnes (1985) found that primary caregivers of preschoolers with physical impairments used a high proportion of communication requests and question - answer routines. Hanzlik (1990) found a similar increase in directive patterns for parents of children with cerebral palsy during an object play task, compared with parents of typically developing children. The input of teachers to children with speech and physical impairments was also found to comprise primarily questions related to educational issues, physical care and instructions. Exchange of humor, general conversation and anecdotes were rarely used (Harris, 1982). It would appear that the language input provided to children with LNFS,

while incomplete, is also qualitatively different from that given to typically developing children (Blockberger & Sutton, 2003).

While it is widely accepted that there is a need to model the use of AAC modalities (Goossens' & Crain, 1986; Light, 1997; McDonald & Schultz, 1973; Smith & Grove 2003), in practice input to children using AAC is typically dominated by speech, with communication partners making no or infrequent use of alternate forms of communication (Bruno & Bryen, 1986; Culp, 1982; Romski & Sevcik, 1996; Wilkinson, Romski & Sevcik, 1994). The Wilkinson et al., (1994) study found that despite receiving encouragement to use AAC modalities together with speech, parents and personnel at a preschool used it on average only 10% of the time. In addition, Sevcik, Romski, Watkins and Deffebach (1995) reported that communication partners used alternate language forms with the AAC user, on average, approximately 10% of the time. The need for young alternative communication users' exposure to the alternative mode is increasingly being recognized (Sevcik et al., 1995; von Tetzchner & Grove, 2003; von Tetzchner & Martisen, 1992). However, there is a lack of evidence relating to the nature of the transactions, and the effects which these transactions may have on the acquisition of alternative language by children (von Tetzchner & Grove, 2003). The reason for this lack of evidence may relate to the heterogeneity of AAC users in terms of their underlying disabilities and intrinsic abilities—in other words, the diversity of AAC users.

The attitudes and expectations of communication partners may also to some extent influence language development in typical children. The attitudes of partners towards the alternate language form are important, as they will influence the environment and the provision of a model of the alternate language form. Grove and McDoughall (1989) found that even in special classrooms, communication partners rarely use manual signs. Studies that have looked at the acquisition of manual signs indicate that the language environment differs from that of an ordinary bilingual setting. The principle difference is that within the bilingual setting the individual is equally well equipped to master both languages due to the exposure to successful models of each, whereas children acquiring manual signs are hardly exposed to successful users of these signs (Martisen & von Tetzchner, 1996).

For an AAC user, it is no easy task to gain sufficient input to master alternative language production. The language produced by AAC users has been described as something resembling a "proton" language or "pidgin" (Mills & Higgins, 1994; von Tetzchner, 1985) rather than stemming from a fluent model which one is surrounded by in everyday life. Children who use AAC have typically not been afforded the opportunity to observe the use of their communicative system by another person (Romski & Sevcik, 1996), and therefore have limited exposure to AAC input (Sevcik et al., 1995). As already indicated (see 2.3), this implies that AAC users' language acquisition does not occur in an incidental manner, as with typically developing children, but is usually taught explicitly (von Tetzchner & Grove 2003). This lack of exposure to input is evident in all AAC users, regardless of which group classification they fall under (namely expressive, supportive or alternate language group, as outlined by von Tetzchner and Martisen (1992). See the following section for a discussion of these categories.

2.5 The child

2.5.1 Classifications of AAC users

Von Tetzchner and Martisen (1992) describe AAC users in terms of three groups, which in turn are described according to the function that an AAC strategy serves. The first group refers to the expressive group, which includes individuals who have good comprehension of the spoken language but are unable to communicate verbally. Their alternative communication system is then usually a permanent expressive means. The second group is the supportive language group, in which the individual requires AAC intervention as an interim support. These people might develop speech as a means of communicating; for example, children with very delayed language development, or individuals who have learnt to speak but whose speech is unintelligible and difficult to understand. AAC strategies then serve to support them in the acquisition of spoken language. Finally, the third group refers to those who require AAC as a language that will be used for the rest of their lives. The alternative communication form is therefore their native language, and they are dependent on it for both receptive and expressive communication.

The above grouping system highlights the point that AAC users may have different modalities for expressive (output) and receptive (input) communication. Typically developing children use both auditory input and output as a means of communication. Some AAC users, in contrast, may have good speech comprehension abilities (auditory) but may employ a visual mode for expression. The relationship between the modes of expression and reception is described as symmetric when the child needs the augmented language for both functions. The relationship is considered asymmetric when the child has good understanding of the spoken form but uses an aided system for production. This complex inter-relationship between the expressive and receptive modes has received attention in the literature only since the late 1990's (Grove & Smith 1997; Oxley & von Tetzchner, 1999; Smith, 1997), and has important implications for understanding the acquisition of alternate language forms.

The acquisition of an aided communication system is argued to be a similar process to that of second language acquisition. However, the AAC asymmetric relationship is not considered truly bilingual, due to the duality of modalities rather than languages (von Tetzchner & Grove, 2003; von Tetzchner, et al.,1996). Theories on the acquisition of second languages can therefore provide insights, albeit limited, or premises when discussing the acquisition of AAC or aided communication systems as a "second language".

Williams & Snipper (1990) describe the total physical response model for the acquisition of second languages. This model has two important characteristics. Firstly, it is a natural approach to the acquisition of a second language. The theory is based on the premise that a second language can be acquired in a manner similar to the way a first language develops, through unconscious connections being made between objects, actions and words. In its simplicity, the model does not address the difference between first and second language acquisition, and thus draws criticism of the approach. The second characteristic of the model is that it aims at developing receptive language; students are not expected to respond orally until they are comfortable doing so. Listening skills are emphasized and developed through observing the language being modeled, and through the students interacting with materials.

This modeling or provision of input is particularly important in the acquisition of language, or a second language.

Krashen's Input Hypothesis makes the strongest claim about the role of input in second language acquisition (Krashen, 1982). Krashen argues that a second language is acquired through the processing of "comprehensible input", which refers to language that is heard or read and understood, and that contains few formal elements. Gass (1988), in her integrated framework, proposes five levels of conversion of input, from ambient speech to output in the spoken form. The first step refers to input as apperception, which refers the perception of some part of the input. The next level is comprehension, which refers to comprehension from either a semantic viewpoint or from a structural viewpoint. Intake refers to the attempted integration of a part of the input that is comprehended. Integration occurs through grammatical analysis, which either takes place immediately or is stored for later use. Finally, output refers to the actual use of the form.

It is important to distinguish "input", which is the production provided by the communication partner, from "uptake", which refers to the part of the message that is selectively processed by the listener. Modifications of speech are therefore important in relation to increasing the comprehensibility of the input (see section 3.6.2.1 for the application of Krashen's Input Hypothesis to the aided language stimulation program). Krashen argues further that novel input need not be simplified in order for it to be comprehensible, because extra-linguistic information can provide meaning (Krashen, 1982; 1985).

The role of input in second language acquisition is evident in the above hypothesis. It is equally important in the acquisition of a first language, as learning theory suggests (see section 2.2.1). The role of augmented input in the acquisition of alternative communication forms (Sevcik et al., 1995) is evident in the discussion above (see section 2.7.2). AAC input also plays a role in facilitating speech comprehension (Romski & Sevcik, 1993b).

2.5.2 The role of comprehension

Speech comprehension provides the learner with an opportunity to focus his or her attention on word forms and reference points in the environment. The literature on early word comprehension describes the emergence of word comprehension (Benedict, 1979; Huttenlocher, 1974) and examines the contextual influences on its development (Oviatt, 1985; Resnick & Goldfield, 1992). Speech comprehension permits the observation and absorption of communication processes prior to the learner actually taking on the role of speaker (Huttenlocher, 1974).

Comprehension, or the ability to understand messages communicated by another person, is complex (Cromer, 1974). Nelson (1973) suggests that typical children (who, early in the language process, produce little speech) rely on internal processing of the language that they hear in order to advance their competence linguistically. According to Miller (1973), comprehension is a private process that occurs in the mind of the listener. Children may appear to comprehend more in contextual situations than in strictly linguistic settings, and comprehension does not always precede production. The latter statement is supported by research that has made it clear that speaking and listening are independent courses of development in young typically developing children (Huttenlocher, 1974).

Bloom and Lahey (1978) discuss the interaction between speaking and understanding. They advance the hypothesis that comprehension and production are interdependent but different, and that these differences require separate descriptions. Explanation of each aspect is needed to understand language development. Despite the controversy relating to receptive and expressive spoken language and their relationship to each other (i.e. whether they are independent from each other or not), evidence exists to support the idea that spoken language comprehension skills are vital in the acquisition of language in typically developing children (Hirsh-Pasek & Golinkoff, 1991; Huttenlocher, 1974; Romski & Sevcik, 1992).

Research with chimpanzees suggests that these primates use speech comprehension in order to acquire the expressive use of arbitrary visual graphic symbols or lexigrams (Savage-Rambaugh, Sevick, Brakke, Rambaugh & Greenfield, 1990). The findings suggest that speech comprehension can be developed in a child even though the child may not be speaking verbally. They further suggest that linkage across modalities (auditory and visual) is possible even when speech is not a viable expressive means. Speech comprehension, then, plays a silent but salient role in language development. It provides an essential foundation upon which productive language competence can be built, and is essential in the acquisition of alternate language forms or AAC systems.

There has been little investigation into the interaction between spoken language comprehension and the acquisition of alternative communication viz. graphic symbols (Romski & Sevcik, 1996; von Tetzchner et al., 1996), as the emphasis of AAC intervention has been on expressive language skills (Roth & Cassat-James, 1989; Nelson, 1992; Romski & Sevcik, 1993a). The task of developing comprehension skills with an AAC user poses certain challenges (Light, 1997). Firstly, while the AAC user hears spoken input and forms hypotheses about the meanings of words, there are few opportunities to test these hypotheses and receive feedback about the use of the words. In addition, adults who interact with AAC learners are unsure about the appropriate levels of input, and usually base the level of input on the AAC user's output abilities. This may result in adults over- or under- estimating the AAC user's comprehension skills.

Many AAC users have stable, functional speech comprehension, and rely on AAC systems primarily as an expressive mode (Beukelman & Garrett, 1988). Children who use AAC systems for expressive communication may in the meantime be developing comprehension of the spoken language as well. Children who use AAC systems as an output mode have two routes of understanding a message: either through the comprehension of speech, or through the understanding of the AAC symbols. The latter group, who have limited comprehension of spoken language, acquire alternative communication forms independent of reference to speech (Romski & Sevcik, 1993a). The ability of an AAC user to use speech comprehension as a foundation for acquiring AAC systems is influenced by various factors

(Romski & Sevcik, 1993b). The first factor is the ability to establish arbitrary relationships between words, objects and events. If it is possible for the learner to establish such relationships, according to Romski and Sevcik (1988) then extant receptive language skills serve as a foundation upon which to build relationships between the AAC symbol and its referent. However, if the AAC user has poor speech comprehension abilities, the relationship between the AAC symbol and its referent is established through contextual cues in the communicative environment (Romski & Sevcik, 1988).

Speech comprehension is particularly important in predicting the rate of acquisition of graphic symbol comprehension. Romski and Sevcik (1996) found that in a longitudinal study of a group of youths with mental retardation, speech comprehension abilities appeared to be a predictor of progress during intervention. Even minimal speech comprehension skills may facilitate the acquisition of vocabulary items, according to Franklin, Mirenda and Phillips (1996). These researchers found that participants (aged between 7 and 21) with severe cognitive impairments who were able to identify pretest objects were more successful on object-object and object-symbol matching than those who were unable to identify at least half of the pretest objects.

2.5.3 Mapping

An individual's ability to use speech comprehension skills as a foundation for AAC learning is likely to be influenced by a variety of factors. These include the ability to establish arbitrary relationships between words, objects and events within a socio-communicative context. The second important factor is the ability to transfer this information from the auditory mode to the visual mode. It is not yet fully understood how a child develops a mapping system between a receptive system in one modality and expressive system in another modality. Direct conceptual mapping between the spoken and alternative languages may take place.

The mapping process requires the partner to help the AAC user to comprehend the relationship between the AAC symbol and its referent (Bloom, 1993; Carey, 1978; Romski & Sevcik, 1992). Language research has shown that speech comprehension, in terms of

vocabulary acquisition, can proceed rapidly in typically developing children because of a set of operating principles that guides the learning of words. One of the more advanced principles that facilitates the child's learning of a word is the "N3C" principle (Golinkoff, Mervis & Hirsh-Pasek, 1994; Mervis & Bertrand, 1993; 1994).

According to the N3C principle, when the child hears a new word in the presence of an unknown object, he or she immediately maps the novel name onto the novel object (Sevcik & Romski, 1997). This principle allows young typically developing children to map the meanings of new words at a rapid rate, even with little exposure to the new words. The behavioral manifestation of the N3C principle is known as "fast mapping" (Bloom, 1993; Carey, 1978; Romski & Sevcik, 1992; Sevcik & Romski, 1997).

Fast mapping facilitates rapid vocabulary expansion in typically developing children (Wilkinson & Green, 1998). The term refers to the phenomenon of receptive language in which an individual learns the association of a referent with a spoken word. Within the field of AAC, it describes the process that uses input to promote rapid symbol acquisition and focuses on helping the AAC user to associate symbols with their referents. The symbols may include pictures, objects, text, graphic or manual signs, and tangible symbols. The communication partner helps the AAC user to associate symbols with their referents by showing, pointing to, or producing the symbol in association with relevant spoken input. The AAC user may or may not have the opportunity to use the symbols expressively.

Current research suggests that many children who use AAC are able to fast map or quickly learn new visual graphic symbols (Hunt-Berg, 1996; Romski, Sevcik, Robinson, Mervis & Bertrand, 1996). Sevcik and Romski (1997), in a study with adolescents with severe cognitive disabilities, found that the participants were able to learn novel symbols when exposed to known objects plus one unknown object and its corresponding novel word symbol. The results further indicated that participants with advanced achievement (who could use their basic understanding of spoken language as a foundation to progress and develop skills in related areas) were more rapidly able to map, retain and generalize the novel words when compared with participants who had only beginning achievement

patterns. Romski and Sevcik (1996) also found that youths with cognitive disabilities were able to demonstrate the N3C principle. On their first exposure, seven school-aged participants were able to map symbol meaning for novel objects. Furthermore, they had retained this knowledge at follow-up after 15 days. The findings suggest that the N3C principle may potentially be used as a symbol-learning strategy.

2.6 AAC systems

2.6.1 Factors influencing graphic symbol learning

Other possible factors that might influence the learning of AAC symbols have been suggested. One of these is iconicity (representativeness), or the perceived visual similarity between the symbol and its referent (Bellugi & Klima, 1976; Brown, 1978; Fristoe & Lloyd, 1979). It seems logical that symbols with a strong resemblance to their referents would be easier to learn and remember than those with a weak visual relationship to the referent (Fuller & Stratton, 1991). The notion of representativeness can apply to a variety of things, including pictures, models, sentences, and mental states (Perner, 1991). Although symbols differ and are used in different ways, they share an essential feature. This feature is that the objects do not represent only themselves, but also something else, namely the referent (Praat & Garton, 1993).

Sigel (1978, p. 105) argues that picture comprehension is a cognitive function, and that through the principle of "conservation of meaning" pictures are comprehended. The meaning of an object remains the same despite the transformation that occurs in terms of the medium. In other words, while the form (medium) changes, its meaning remains unchanged. The formation of representations is assumed to be developmental, and requires exposure to the object (in whatever medium) within the physical environment, coupled with exposure to the definition, use and significance (meaning) of that object. Language relationships are established within a social context, through shared meaning. It has also been argued that picture comprehension is learned, as is evidenced in cross-cultural research. The most common area of difficulty experienced by individuals from non-western cultures regarding pictures is depth perception (Serpell, 1976).

Research investigating how typical children come to understand pictures is extensive. A study by Hotchberg and Brooks (1962) reported that a child kept away from pictures until age two was able to identify pictures when shown them for the first time. Bower (1971) found that from an early age children are able to identify pictures of their mothers. This capability to comprehend pictures is evident in young typically developing children.

Learning new information from pictures is a common experience, because pictures are used to convey information. In a study of two groups of infants aged 24 to 30 months, researchers studied how the infants used photographs as a source of information (Burns, 1990; DeLoache & Burns, 1991). The results indicated that the 30-month-olds were quite successful (72%) in using pictures to obtain information about the real environment. The 24-month-olds were unsuccessful in doing this (13%). It should be noted that the 24-month-olds were able to label the objects in the picture. However, they were unable to use information from the pictures to solve problems in the real environment. This difficulty does not reflect a deficit in the children's thinking. Rather, the poor performance of the 24-month-olds indicates the lack of a representing relationship between a symbol and its referent.

Pictorial graphic signs can be learnt, although they are often reacted to as pictures rather than word meanings by people in the environment (Basil, 1992). Ranaas (1993, cited in von Tetzchner et al., 1996) found that college students tend to perceive PIC symbols as pictures rather than as word meanings representing their written gloss, or alternatively interpreted them metaphorically. The implication is that graphic communication in AAC is understood in a literal and under-extended manner, which may influence the acquisition process in AAC users.

Studies suggest that there are differences between typical and atypical children's use of language to learn the names of objects (Bryant, 1965, 1967). Bryant showed that children with mental retardation had difficulties in forming a verbal connection between the verbal label and the object, when paying attention to objects. Dixon (1981) studied the picture

representation skills of adolescents with mental retardation. She found that five of the seven participants were able to match objects and photographs. She discussed the possibility that for the remaining two subjects, responses were influenced more by physical properties of the symbols, including depth, than their iconicity.

Sevcik and Romski (1986) assessed the matching skills of eight individuals with mental retardation and LNFS, using objects, photographs and line drawings. They found that as the representational complexity increased from objects to pictures to line drawings, the performance of the individuals decreased. Mirenda and Locke (1989) found a similar hierarchy in a study with 40 adolescents with cognitive impairments and LNFS. The importance of language comprehension skills in these types of studies has been acknowledged and documented by Franklin et al., (1996). In the Franklin et al., (1996) study, trends similar to those found by Romski and Sevcik (1996) emerged, in which children with functional receptive language abilities performed better than their counterparts who lacked these skills.

2.6.2 Studies with graphic representation systems

There is, in addition, a large number of studies that look at the processing of pictures in the typically developing child and in the population with disabilities (DeLoache, 1991; Kavanagh & Venezky, 1980; Kikuchi, Yamashita, Sagwa & Wake, 1970; Paivio, 1986). However, the manner in which pictures are processed for communication purposes is less well known (von Tetzchner et al., 1996).

An exploratory study into the use of pictures for communication purposes was conducted by Hughes (1974), who was able to teach nonverbal children with aphasia to associate shapes with particular objects and actions. The system used was a symbolic one similar to that used by Premak (1970); materials used by Hughes were also similar to those used by Premack. Hughes used gestures coupled with some reinforcement for correct choices to teach children the use of shapes as signs for particular objects. Children not only understood the system, but were also were able to manipulate the shapes so as to produce utterances. These

children, however with unable to use the symbols to communicate. Carrier (1974) reported similar findings with children with severe cognitive impairment, as well as with adult aphasics (Spradlin, 1974).

Romski, Sevcik and Pate (1988) argue that learning to communicate symbolically is a complex long term process that requires coordination of many components. Their results were promising, as three out of four young non-speaking women, who had severe cognitive impairment, were able to acquire 20 vocabulary lexigrams and use them either expressively or receptively. The reinforcement for correctly matching the item to the lexigram was food. These results were supportive of the possibility of the acquisition of symbolization in this population. The process of symbolic communication has been argued to have four stages or components (Savage-Rumbaugh, 1986). The first is that a symbol can stand for or represent an object, person, event, or relationship. The second is that there should be experiential knowledge about the symbol and actions, objects and relationships related to that symbol. The symbols should then be used intentionally to convey meaning. Finally, there needs to be decoding of the symbol by the communication partner.

Another study that looked at the use of symbols to communicate was done by Rowland and Schweigert (2000). They used tangible symbols, because these make relatively low demands on cognitive abilities compared to the demands made by arbitrary symbols. A further advantage is that they are permanent and require only recognition out of an array of symbols, rather than recall from memory (Blachman, 1991). They used these symbols in a three-year-long study that evaluated the use of tangible symbols with 41 children with various disabilities. The intervention was provided in an individualized manner using an activity that the child enjoyed. The intervention was provided in a one to one session that was individualized but naturalistic.

The results indicate that the vast majority of the participants (who had a wide variety of abilities) used the symbols to communicate. Some developed further, and used the symbols as a bridge to more arbitrary symbols, and therefore started using speech as a means of expression. Ten participants, however, did not acquire the use of symbols at all. They were

functioning at an intentional level, but had not yet demonstrated presymbolic communication—which has been argued to be the basis for later language acquisition (Bates, Camaioni & Volterra, 1975). Stephenson and Linfoot (1996) maintain that the acquisition of graphic symbols is unlikely to occur if communicative intent is not present. However, Iacono, Carter and Hook (1998) suggest that communicative intent has a necessary but not sufficient role in facilitating symbolic communication.

The use of picture symbols, such as line drawings and photographs, as symbols for receptive and expressive communication is widely documented (Bondy & Frost, 1994; Heller, Allgood, Ware & Castelle, 1996; Johnson, 1994; Schwartz, Garfinkle & Bauer, 1998). It can be further argued that because these symbols are learnt, they could be taught. The manner in which they are taught is important, but there has been limited research in this area (Fuller, et al., 1997).

2.7 Instruction

Contemporary language teaching can be characterized by a continuum running from highly structured didactic teaching to naturalistic child-orientated intervention (Carrow-Woolfolk, 1988; Fey, 1986). At the didactic end of the continuum are behavioral-didactic interventions, designed to teach formal aspects of language using behaviorally-based procedures like modeling, stimulus control and reinforcement. At the other end of the continuum are interaction procedures that are responsive in nature, and which facilitate the development of communication in a social context. Finally, in the middle are hybrid models that adopt some aspects of behavioral methods but apply them in natural contexts. Examples of these include incidental and milieu teaching, which emphasize functional language use while teaching through modeling and reinforcement procedures (Yoder, Kaiser & Alpert, 1991). Studies investigating the use of the various teaching strategies have been conducted (Halle, 1982; Yoder et al., 1991; Yoder, Kaiser, Alpert & Fischer, 1993).

Two major classes of instructional methods are used to teach graphic symbols to AAC users. The first is the “analog” strategies that involve structured drill (e.g. paired associative

learning) activities. Here, the therapist is in control of the environment and stimuli (Camarata, 1996). The second strategy is the natural language paradigm (e.g. aided language stimulation), which provides the child with ample opportunities to learn language through interactions with the therapist (Camarata & Nelson, 1992).

The effect of spoken input versus the use of pictures in paired associative learning, an analog strategy, has been researched. Milgram (1967) studied the ability of children between the ages of four and nine years to learn paired associate pictures using a verbal context when reciting the sentence, or by visual compounds in which a special picture combined with an identical item is represented. The results indicated that the children utilize the verbal mode of representation from as early as four years of age. As a mode of learning, imitating the verbal context was found to be superior to the use of visual compounds. The results thus suggest that the verbal mode is preferred over the visual mode, as well as being more effective in facilitating paired associate learning from four years of age. The reason for this superiority is argued to be that as children's ages increase, the children proceed from a predominantly iconic mode of representation to a more symbolic one in which verbal context or cues are important (Bruner, 1964).

However, Rohwer, Lynch, Levin and Suzuki (1967), in their study of the facilitating effects of paired associate learning, found that more efficient learning occurred during the pictorial condition than in the printed context or the verbal context. Furthermore, Rowder (1970) demonstrated that children learn sentences of words better when provided with integrated pictures (pictures in which components of the sentence integrate with the pictures) than when provided with the spoken form alone. The postulated reason for this is that pictures evoke imagery that shares characteristics of the picture and therefore, have shared meaning.

2.7.1 Models of processing

There are two schools of thought that contribute to understanding the roles of verbal and nonverbal stimuli processing, namely the "amodal" and "dual coding" theories. The amodal model posits that cognitive processing of verbal as well as nonverbal information occur simultaneously. Fuller and Stratton (1991) postulate that this implies that verbal and nonverbal stimuli are interpreted using the same cognitive processes.

The second model of processing that has been applied to AAC is based on Paivio's model of dual processing. Dual coding theory, as its name suggests, outlines two separate cognitive subsystems that process stimuli, depending on whether the stimulus is verbal or nonverbal (Paivio, 1971, 1986). The idea of separate subsystems implies that they are structurally and functionally distinct. Structurally they differ in terms of their representational units and the way these are organized in "higher order structuring" (Paivio, 1986, p. 54). Functionally, either system can be active, either independently or in parallel with the other. The two systems are independent in terms of information processing. However, activity in one subsystem is said to trigger activity in the other. This implies an underlying assumption that there are interconnections between the two systems. Structurally, there are also connections at a representational level, which can be activated under certain conditions.

The structural / functional relationship is important, given that its theoretical implication is that flexible and organized processing activity can function independently as well as in summation. There may even be coordinated processing, for symbolic systems (Paivio, 1986).

The central tenent of dual coding theory, is that both linguistic processes and thought mediate performance in memory and cognitive tasks (Lonke, Lloyd, van Balkom & Arvidson, 1999). Rogers (1979) also proposed a bimodal model of the speech process, which is based on cognitive and message-content dimensions. This model was based on Rogers' studies, which indicated that speech comprehension is facilitated by visual cues. The model postulates that there are visual and vocal dimensions to the speech process, and the dimension that will dominate depends on the availability of a label or gesture to convey meaning. The limitation of this model is that the visual dimension is considered at the level of kinesthetic cues (facial expressions), whereas dual coding theory actually provides a broader definition of nonverbal stimuli—for example, nonverbal stimuli could include graphic symbols.

Dual coding theory has been directly applied within the field of AAC in terms of theorizing about the role graphic symbols play in language learning (Lonke et al., 1999; Fuller & Stratton, 1991). Figure 2.2 illustrates the representational units and their referential and associative connections and interconnections. The connections to both input and output systems are also depicted. The figure illustrates the idea of separate but interconnected systems. The representational units and the manner in which they are organized is clear.

The theory further states that the subsystems are paradoxically both dependent on and independent from each other. The nonverbal system, also called the imagery system, comprises images that correspond to objects. These images are processed spatially. The verbal system, on the other hand, refers to the language and its components, which are combined, to form syllables, words and phrases. The levels of processing are referred to as representational levels. Representational levels relate to the activation of cognitive subsystems according to type of stimulus, with verbal representations being activated by linguistic stimuli and nonverbal representation by nonlinguistic stimuli. The second level, or "referential processing", refers to the activation of nonverbal processing by verbal stimuli and vice versa. In other words, this level concerns the process of imaging words or naming objects. Finally, the associative level refers to the representation within a subsystem, eliciting other representations (Fuller & Stratton, 1991), such as word associations. The dual coding theory is relevant to AAC in terms of understanding the effectiveness of augmented input strategies.

Lonke et al., (1999) applied the central tenet of Pavio's (1971) model to AAC. They argue that graphic symbols are interesting because they offer the AAC user the opportunity to process information based on translucency. The higher the translucency of the graphic symbols, the higher the likelihood of the user focusing on its "imagistic" characteristics (Lonke et al., 1999, p.191). A limitation however of the model is that it provides little insights in to the processing for communication purposes due to its emphasis on modalities of communication. von Tetzchner et al., (1996) recommends that processing models should have a primary emphasis on the receptive and expressive modes of communication.

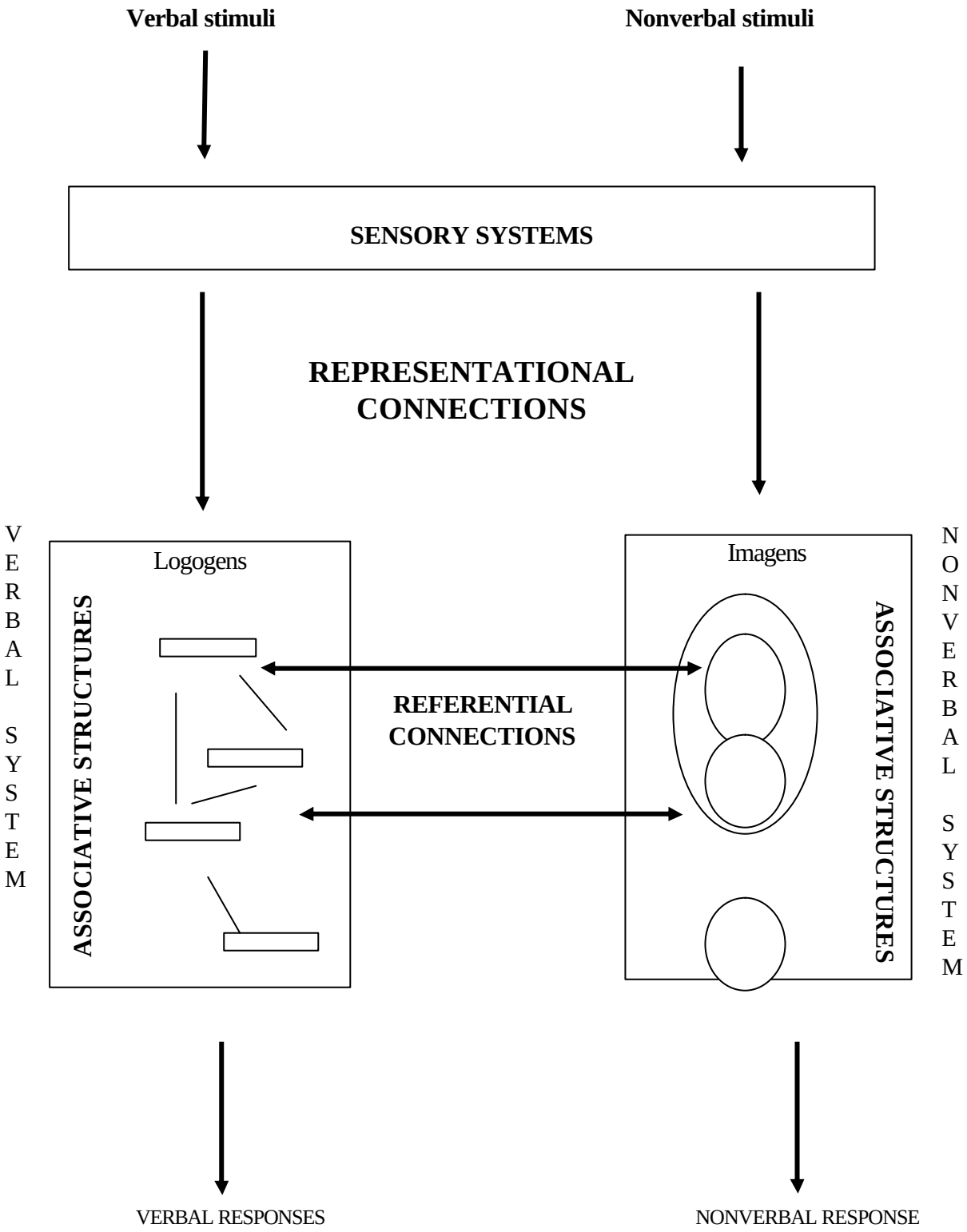

Figure 2.2 A schematic depiction of the structure of verbal and nonverbal symbolic systems (Paivio, 1986, p.67).

2.7.2 Augmented Input

Wood, Lasker, Sigel-Causey, Beukelman and Ball (1998) developed a framework for augmented input in AAC. Augmented input refers to the incoming language or communication that includes speech and is augmented with the AAC system (Romski & Sevcik, 1988b). Wood et al., (1998) propose four components that assist with comprehension through augmented means, thereby enhancing communication for the AAC user. Some of the components, however, refer to both expression and comprehension. The first component refers to augmenting the message to assist the AAC user to comprehend the spoken message; objects, pictures, photographs, gestures and/or voice output techniques are used. It is a partner strategy to assist the person who uses AAC to comprehend the message by facilitating comprehension through the use of one or more modalities. The second component refers to mapping language and symbols; here, the AAC user is helped to associate the symbol with the environmental stimulus. The third component facilitates the retention of the message through referring to a symbol after delay. Finally, the fourth component refers to developing a pool of responses to encourage the AAC user to select from an array of choices or answers.

Within the field of AAC there are two main augmented input strategies. These include aided language stimulation and System for Augmenting Language (SAL) (see section 2.7.2 and 2.7.3). An interesting aspect of the dual coding theory, as it relates to aided language stimulation, is that the verbal and nonverbal representations are activated by the stimuli situation and individual stimuli variables. Specifically, nonverbal representations are activated by the iconicity or concreteness of the stimuli, as with pictures or objects that are highly iconic. Verbal activation occurs when words serve as stimuli, the task demands verbal processing, and the response required is verbal. In aided language stimulation, the verbal input meets two of these three requirements. The nonverbal stimuli are usually Picture Communication Symbols (PCSs), which are described as mostly pictographic (Fuller et al., 1997).

Augmenting the language skills of children with LNFS may serve as a route towards remediating language deficits and thereby modifying accompanying developmental

difficulties. Teaching approaches for individuals with LNFS have included signs and visual graphic symbols. The reports on language outcomes have been positive, although the long term influence has been sparsely researched (Romski & Sevcik, 1996). Augmented input has many argued advantages, including the provision of a model of how the communication system can be employed, and of real world experience in which the meaning of symbols and their functions can be demonstrated. Finally, the use of augmented input implies that the AAC system is an acceptable and encouraged way of communicating (Romski, et al., 1997).

The success with augmented input supports the idea that AAC users need language experiences similar to those of non-disabled peers. They should receive input from communication partners in modes that they use and are expected to use later for expression (Goossens', Elder, & Crain, 1992; Romski & Sevcik, 1993a). The primary objective of augmented input is to provide a model for the use of graphic symbol as a viable communication mode. This input also provides the opportunity for language mapping. In addition, it facilitates greater symmetry between the expressive and receptive modes of an AAC user (Light, 1997).

Stillman and Battle (1984) were among the first to discuss the technique for augmenting a message. They discussed the use of a calendar box containing objects to provide input for routines. This technique was based on the philosophy proposed by Van Dijk (1966, 1986), which used movement-based approaches to communication. Central to augmenting comprehension is the idea that the materials used to augment the spoken input must be compatible with the motoric, linguistic, sensory and cognitive abilities of the person who requires the augmented input (Wood et al., 1998).

The benefits of using aided augmentative and alternative strategies through visual support have become increasingly apparent in a variety of interventions with children and adults with LNFS, including those with autism (Cafiero, 1998; Johnson, Nelson, Evans & Palazolo, 2003; Mirenda & Ericson 2000; Quill 1997; Rowland & Schweigert, 2000). Other benefits include prompting joint attention in children with autism (Quill, 1998), establishing

conversational referents with children with multiple and severe disabilities (Hunt, Alwell, Goetz & Sailor, 1990: Van Dijk, 1966: Van Dijk & Nelson, 1998), and increasing the comprehension of linguistic concepts in children with autism (Quill, 1997). The facilitation of social interaction and communication intent with children with autism and severe disabilities is a further benefit (Bondy & Frost, 1994; Jolly, Test & Spooner, 1993; Krantz & McClannahan, 1993; Mirenda & Santogrossi, 1985; Schwartz et al.,1998; Zanolli, Dagget & Adams, 1996).

Augmented input has been implemented with adolescents with developmental delays, who received spoken and lexigram input, and who used lexigrams to make requests (Romski & Sevcik, 1992). Garrett and Beukelman (1992) describe augmented input using gestures as well as written words, to increase the comprehension of spoken language by adults with aphasia. Goossens' (1989) used aided language simulation successfully with a child who was unable to speak.

Aided language stimulation (Elder & Goossens', 1994; Goossens' et al., 1992) and the System for Augmenting Language (SAL) (Romski & Sevcik, 1992, 1993b, 1996) are strategies for augmented input that were designed for AAC application based on the principles of milieu teaching. However, additional components were added. Both of these are immersion approaches that aim to teach individuals the understanding of graphic symbols and provide a model for combining symbols in a flexible manner (Beukelman & Mirenda, 1998). Furthermore, opportunities to do this are also provided to the individual.

The approaches are based on the premise that observation of graphic symbols being used extensively by others in natural interactions provides the individual with the opportunity to establish a mental template for the combination and recombination of symbols, in a generative manner, so as to interact or communicate during an activity. The techniques are based on the way natural speakers learn to understand language, and are therefore intended to teach language to an AAC user in a natural way. The use of a naturalistic setting implies that the instructions are embedded within the activities of daily life. There is opportunity for

joint experience in a routine that can facilitate the development of communication (Beukelman & Mirenda, 1998).

The rationale for using a natural communication environment is that this is strongly advocated in the literature as a preferred means of communication instruction. (Beukelman & Mirenda, 1992; Calculator, 1988; Calculator & Jorgensen, 1991; Romski & Sevcik, 1988a). Justification for the use of naturalistic teaching strategies is provided by a study conducted by Oliver and Halle (1982), in which children with mental retardation and LNFS acquired signs through incidental teaching. Yoder et al., (1991) indicate that speaking children acquired early vocabulary better when an incidental teaching strategy was used as opposed to direct instruction. Studies indicate that typical preschool children learn language in highly contextualized settings, and rely on the context and world knowledge for their learning (Paul, 1990). In addition, research conducted on primates indicates that observational experience of symbols promotes symbol learning better than drill and practice (Savage-Rumbaugh et al., 1990).

The SAL comprises five components (Romski & Sevcik, 1996) including a speech communication output device, appropriate vocabulary items, naturalistic communicative exchanges, and the provision of feedback and resources to the participants. SAL differs from aided language stimulation in two ways (Beukelman & Mirenda, 1998). Firstly, in SAL the use of an electronic speech-generating device is critical to intervention (Romski & Sevcik, 1992, 1993b, 1996). Secondly, the techniques used are much simpler and more structured than the elaborate procedures used in aided language stimulation.

2.7.3 Aided language stimulation

Aided language stimulation is interactive training that aims to teach the use of picture symbols, through modeling the interactive use of these picture symbols in a meaningful context. It operates under the premise that modeling of interactive use is necessary to promote the learner's own interactive use of an aided communication system. This instruction requires a facilitator, who could be a teacher, therapist, parent or aide. This person points to picture symbols in conjunction with ongoing language stimulation (Goossens', 1989; Goossens' et al., 1992; Goossens', Jennings & Kinahan, 2000). The

approach of aided language stimulation is similar to that of total communication approaches used in the population with hearing impairment. For example, the facilitator may say " Put the jelly in the bowl" while pointing to the symbols "put", "jelly", "in" and "bowl" on a board, vest or electronic device or other display. It is therefore imperative that the displays must be accessible to the facilitator. The facilitator is required to prepare in advance the vocabulary items for the learners for each activity.

Aided language stimulation has a variety of instructional techniques that include augmented input, and which facilitate the use of the communication displays. Various techniques can be used to augment input, for example by pointing to or highlighting the symbols as spoken input is provided. The highlighting can be done using the index finger, a torch light or a squeaky toy to draw attention to the symbols being used. Goossens' et al.,(2000) suggest that the facilitator should have certain skills in providing aided language stimulation. The first is the skill in providing input that has more comments than questions, therefore providing more input and not emphasizing output or expression from the child. In addition, aided language stimulation should be provided 70% of the time (Goossens' et al.,2000).

The displays used in aided language stimulation rely on a grammatical category strategy, namely a modified version of the Fitzgerald Key (Fitzgerald, 1949). The Fitzgerald Key was developed for teaching the deaf the grammar of spoken English. It was based on the assumption that understanding precedes use, and that visualization through categorizations of words assists with understanding language. As early as 1963, Sayre applied the Fitzgerald Key to the use of communication board displays for children with cerebral palsy. The key organizes symbols from left to right into categories such as "who", "doing", modifiers, "what", "where" and "when" expressions and rules (Fitzgerald, 1949). Modifications to the key were sought as the original was found to be too complex and impractical for displays (Sayre, 1963). The standardized displays used in aided language stimulation have also been based on a modified version of the Fitzgerald Key, with the following categories: miscellaneous words (social words, "wh" words, exclamations, negative words, pronouns); verbs; descriptors; prepositions and nouns. These categorization strategies also use color coding of the grammatical categories to enhance easier visual access (Beukelman &

Mirenda, 1998). See Section 3.6.2.2 (Appendixes 1 to 3) for examples of the displays used in this study.

2.7.4 Studies using augmented input strategies.

The impact of SAL on language development has been researched and documented by Romski and Sevcik (1992), who conducted a two-year-long longitudinal study using 13 adolescents. The adolescents had LNFS, were mentally retarded and were ambulatory. They were provided with speech-generating devices, that were also used by facilitators in loosely structured naturalistic settings based on the principles of SAL (Romski & Sevcik, 1996). Symbol combinations that were functional emerged for ten of the participants. The symbol combinations included verb + noun, descriptor + noun, and noun + regulator (social). Qualitative and quantitative differences in the participants' intelligibility were also found. The SAL project provided evidence for the effectiveness of the total immersion approach in facilitating language development in persons who use AAC (Romski et al., 1996). The results of the SAL project are impressive, as all the students learnt to use lexigram symbols and to combine them with gestures or vocalizations and thereby make requests and comments, answer questions and perform other functions (Romski & Sevcik, 1996). AAC users' understanding of verbal messages during interaction can be enhanced by augmented input.

Romski, Sevcik, Robinson and Bakeman (1994) observed youths with mental retardation and LNFS over a two-year period. The participants were introduced to the SAL during daily interactions. The results indicated that the participants used the SAL in conjunction with their existing communication means. The combined use of SAL plus existing means of communication was more effective than the use of existing communication alone, when learners interacted with adults both at school and at home. Extant receptive communications skills influence the manner in which an augmented communication system is learnt and used.

The impact of aided language stimulation on language development has been limited primarily to case studies (Basil & Soro-Camats, 1996; Goossens', 1989) with no empirical research having been conducted to address this question (Beukelman & Mirenda, 1998).

Goossens' (1989) first reported the successful use of aided language stimulation with a six year old girl with cerebral palsy. Seven months of intervention using aided language stimulation seemed to result in more frequent and interactive use of the symbols. An increase in natural speech also emerged.

Hunt-Berg's (1996) research suggests that simultaneously speaking and pointing to a graphic symbol is not sufficient for AAC users to fast map the graphic symbol, and that the facilitator would need to explicitly point to the graphic symbol and its referent. However, Hunt-Berg's (1996) evidence was based on nouns, and further investigation is required regarding verbs, adjectives and other grammatical structures.

Peterson, Bondy, Vincent and Finnegan (1995) assessed the effects of interventions in three communicative input modalities on task performance with two boys with autism. The three input modalities were spoken language alone, pictorial or gestural input alone, and augmented input (pictorial and spoken input). The results indicated that spoken input alone did not facilitate task performance as effectively as augmented input. Another study investigated augmented input story reading (Wood & Siegel-Causey, 1997), where the use of communication storyboards alone was compared with communication storyboards plus augmented input. The exact number of graphic symbols learnt could not be determined precisely. However, two of the four participants showed an increase in the use of newly introduced symbols during the communication storyboard plus augmented input condition.

While the studies discussed above indicate that augmented input has a positive influence on participants, the focus of these studies has been primarily on the impact on expressive use of the symbols. A possible exception is the Peterson et al., (1995) study. The impact of aided language stimulation on the receptive abilities of learners has not been directly investigated, except during the language comprehension assessments which were conducted as part of the study. This is in contradiction with the premise or assumption that aided language stimulation is an input strategy aimed at increasing receptive language abilities (Goossens' et al., 2000).

2.7.5 Vocabulary comprehension skills

Input is most clearly linked to vocabulary acquisition, and learning specific words depends on having being exposed to them in the environment (Blockberger & Sutton, 2003; Whitehurst, 1997). In a longitudinal study, Harris, Barret, Jones and Brookes (1988) investigated the relationship between input and early lexical development. They found that there was a strong relationship between children's initial use of words and the most frequently occurring use of the words by the mothers. Similarly, Hart and Risley (1995) found that productive vocabularies of three year olds were two and a half times greater, on average, for a group of children exposed to approximately three times as many words as a control group of children. It is hypothesized that children with LNFS are exposed to fewer words due to the likelihood of restricted experiences and conversational partners (Blockberger & Sutton 2003).

Another important aspect related to vocabulary acquisition is the selection of vocabulary for AAC users. Vocabulary for pre-literate AAC users can be selected via three strategies (Beukelman, McGinnis & Morrow, 1991). The first strategy emphasizes developmental information, the second focuses on environmental conditions (Karlan & Lloyd, 1983), and finally there is the functional approach. Banajee, Dicarlo and Striklin (2003) provide an extensive review of these various strategies. The developmental approach involves the use of developmental vocabulary lists (Fristoe & Lloyd, 1980; Holland, 1975; Lahey & Bloom, 1977; Reichle, Williams & Ryan, 1981). These lists contain words which have been selected according to language inventories, which in turn have been developed in accordance with language acquisition principles. An ecological inventory process identifies vocabulary for specific communication environments. Finally, the functional communication approach selects vocabulary based on communication functions, such as requesting, commenting and greeting.

Vocabulary selection in aided language stimulation is based on the premise that models of interactive use are paramount to children learning to use AAC systems interactively. Hence, the vocabulary selected should be conducive to aided language stimulation by the adult, and should therefore lend itself to interactive use by the child (Goossens', 1989).

The purpose of this study is to explore the impact of aided language stimulation on the receptive vocabulary of children. This is an area that needs to be investigated. There is also a need to identify the critical factors in aided language stimulation that contribute to its success (Beukelman & Mirenda, 1998).

2.8 Conclusions

The role of augmented input in language acquisition in AAC users has recently been investigated (Section 2.7.4). The positive results, in terms of enhancing comprehension of speech, have been hypothesized to be attributable to the processing of verbal and nonverbal stimuli as suggested by Pavio (1971). Pavio's theory posits separate though interconnected systems for processing different stimuli. However, evidence for the facilitatory role of augmented input, particularly aided language stimulation, in language acquisition has been limited to a few studies. The studies have focused on determining the impact of aided language stimulation on measures that tap expressive communication. The impact on the acquisition of receptive vocabulary has been not been investigated.

The impact of aided language stimulation on receptive language is a key area of interest, because one of the fundamental principles of aided language stimulation is that it is a strategy to enhance comprehension of speech (Goossens', 1989). The aim of this study, therefore, is to determine the impact of aided language stimulation on the receptive language abilities of children with LNFS.

2.9 Summary

This chapter has discussed the acquisition of language, and has proposed an adapted version of Bedrosian's (1997) model to understand aspects that are important to language acquisition in an AAC user. The controversial role of input with typical children was highlighted. The role of augmented input was discussed as a strategy to enhance the acquisition of language, both expressive and receptive, in AAC users. Furthermore, the role of augmented input as an enhancing strategy was contextualised within the dual processing

theory (Paivio, 1971), which argues that verbal and nonverbal stimuli are processed via separate though connected systems. The importance of a natural learning context was highlighted, particularly for the augmented input strategy of aided language stimulation. Evidence concerning the role of augmented input was discussed, and attention was drawn to the paucity of research in this important area.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

The focus of this study was to determine whether an aided language stimulation program, designed to increase the receptive vocabulary of the participants, would indeed result in an increase in the participants' receptive vocabulary abilities. This chapter discusses the research methodology that was used in this study. Firstly, the aims and sub aims of the study are identified, followed by a discussion of the research design and phases. The pilot study is then presented in terms of its aims, results and recommendations. Finally, descriptions of the participants, data collection procedures, and data analysis that were used in the main study will be given.

3.2 Methodology

3.2.1 Research Question

What is the impact of aided language stimulation on the receptive vocabulary of children with little or no functional speech (LNFS)?

3.2.2 Main Research Aim

To develop and implement an aided language stimulation program, and determine its impact on the receptive language of children with LNFS.

3.2.3 Sub aims

i. To develop an aided language stimulation program based on the principles of aided language stimulation, as outlined by Goossens', Crain and Elder (1994).
ii. To determine the receptive vocabulary and receptive language abilities of the participants prior to the implementation of the aided language program.
iii. To implement the aided language stimulation program to the participants.

iv. To determine the impact of the aided language stimulation program on the receptive language abilities of the participants.

3.3. Research design

The research design utilized for this study is a multiple participant multiple-probe design across behaviors (Mc Reynolds & Kerns, 1983; Schlosser, 2003b). In the multiple-probe design, the same treatment is sequentially applied to separate though independent target behaviors, for a single participant. The purpose of this design is to determine if a single treatment is effective in changing behaviors in each participant (Barlow & Hersen, 1984). The multiple probe design was selected as it allows for noncontinuous data collection. While continuous data collection is preferred, the use of noncontinuous data collection is suggested by Horner & Baer (1978) and Schlosser, (2003) when repeated measure could result in reactivity with participants changing behavior as a result of repeated testing rather then because of the treatment. .Another is that a priori of stability could be made as was evident from the three baseline measures. Finally, although perhaps less relevant to the current study relates to the settings or behaviors observed. The multiple probe design with the strategic location of baseline measures is important as it can demonstrate a stable baseline in the untreated baselines. The logic of the multiple probe design would then be that the change in behaviors occurred only when the treatment was introduced.

For the purpose of this study, the target behaviors were the target receptive vocabulary items that would be taught. Eight target receptive vocabulary items would be taught in each activity, namely: arts and crafts, food preparation and story time activities. Hence a total of 24 target receptive vocabulary items were identified for the three-week intervention period. The treatment provided was the aided language stimulation program. This design was selected because it requires continual data collection to provide the researcher with a complete picture of each participant's performance, thereby allowing a better understanding of the effects of the program.

This design involves the identification and measurement of responses over time, to provide baselines. After three consecutive baseline measures, the aided language stimulation program

was implemented in one activity, producing a change in it; little or no changes were noted in the other two activities' baselines. This simultaneous measurement of several concurrent target behaviors in the other two activities further strengthens the design used in this study (Barlow & Hersen, 1984).

The aided language stimulation program was applied in a group format to four participants. However, in accordance with the simultaneous replication design, assessment of each participant was done individually, providing individual data for each treated participant. This data would be plotted individually (Barlow & Hersen, 1984).

3.3.1 Research phases

The research consists of two main sections. Section 1 is the pre-experimental phase consisting of five phases, and Section 2 is the experimental phase consisting of four phases. The phases are outlined in Table 3.1 below. Each phase is described in detail in different sections of this chapter as indicated in the table.

The ability to identify line drawings test forms is Phase 1.2 of the research phases. The procedure utilized to develop the test are outlined in Table 3.2. The aims, description, procedure results and recommendations are highlighted in the table.

Table 3.1 Research Phases

Section 1: Pre-experimental phase				
Phase 1.1	Phase 1.2	Phase 1.3	Phase 1.4	Phase 1.5
Development of the aided language stimulation program.	Development of the ability to identify line drawings test.	Develop an informal receptive language test.	Develop probe test material.	Conduct a pilot study.
This phase aimed at developing an appropriate aided language stimulation program based on the principles outlined by Goossens' et al., 1994). The aided language stimulation program comprised three activities, viz. an arts and crafts, food preparation and story time activity (Appendix 1-3 respectively). See section 3.6.2.1 for more detail.	To ensure that typically developing children were able to cope with the task, 25 typically developing children were tested. See Table 3.2 for further information on the development of the test, and Section 3.6.2.10 for a description of the test.	Two standardized receptive language tests were utilized. An additional informal test was developed to ascertain the participants' receptive language abilities (Appendix 8).	In order to probe the acquisition of the 24 target vocabulary items, a test using real objects was developed. See Section 3.6.2.9 and (Appendix 9 & 15).	A pilot study was conducted to determine the feasibility of the study. The objectives of the pilot study were to evaluate and test the applicability of the aided language stimulation program, the implementation of the program and the measuring instruments (Katzennelenbogen, Yach & Joubert, 1991). See Table 3.3 for the objectives, results and the recommendations of the pilot study.

Section 2: Experimental phase					
Phase 2.1	Phase 2.2	Phase 2.3	Phase 2.4	Phase 2.5	Phase 2.6
Identification of participants	Pre-intervention assessment.	Obtaining baseline measures.	Program implementation.	Probes Measures.	Post-intervention assessment.
Potential participants were screened. Only those who meet the subject selection criteria were included in the study. See Section 3.5.1 and Table 3.4.	The pre-intervention assessment comprised: • Reynell Language Development Scale • Peabody Picture Vocabulary Test (PPVT-R): Form L • The informal receptive language test See Section 3.6.2.7 & 3.6.2.8 for more detail.	Three consecutive baseline measures were obtained for each participant on all 24 targets receptive vocabulary items. A minimum of three consecutive baseline measures is recommended for any study (Barlow & Hersen, 1984). See section 3.7.3.1.	Each activity lasted the duration of one week. The activity was implemented each day for five consecutive days, totaling five sessions per activity. See Section 3.7 for more detail.	Probes on all 24 target receptive vocabulary items were conducted on the first, third and fifth session for each activity. The probes were conducted prior to the implementation of the session. See Section 3.6.2.10.	The post-intervention assessment included: • Reynell Language Development Scale and • Peabody Picture Vocabulary Test (PPVT–R): Form M • The informal receptive language test See Section 3.6.2.7 & 3.6.2.8 for more detail.

Table 3.2 The development of the ability to identify line drawings test				
Aim	**Description**	**Procedure**	**Results**	**Recommendations**
Development of a word list.	A list of 23 items was developed.	The list included four items that Holland (1975) suggests for language intervention in young children. The remaining 19 items were selected from Fristoe & Lloyd's (1980) list of suggested vocabulary items for initial sign lexicon.	The lexicon of two items were considered to be potentially unfamiliar.	The two items were replaced with South African lexicon i.e. "candy" was replaced with "sweets", and "cookie" was replaced with "biscuit" to enhance understanding.
Validation of the word list.	This list was provided to the extended community of stakeholders (Schlosser, 1999a).	7 students registered for the degree Ph.D. (AAC) at the University of Pretoria and 2 AAC specialists were consulted. They were required to select items that they thought would be familiar to children between the ages of 3 and 4 years (Appendix 4)	They agreed that the words would be understood. However, the general consensus was that two words should be replaced.	It was suggested that the word "bead" be replaced with "puzzle", and the word "juice" be replaced with "drink".
Refine the word list	The list of 23 items was then refined to a 20-item word list..	The researcher subjectively considered the iconicity of the PCS that corresponded to the word list.	The PCS for "puzzle" and "blocks" were perceived by the researcher to be low in transparency.	The words "blocks", "puzzle" and "baby" were removed from the list. The latter was similar to the doll and would be confusing for the participants.
To administer and pretest the test on typically developing children (Schlosser 1999b).	Using the 20-item list, the test was developed. Four items presented by PCS were placed on black cardboard with the dimensions of 21cm X 29,5 cm. Each PCS was 7,5cm X 9cm in dimension. The background of each PCS was colored yellow. Each page was laminated.	The school principals' and parents' consent was obtained (Appendix 5 & 6 respectively). The participants attended a preschool in the Pretoria region, in the suburbs of either Laudium or Hatfield. The test was conducted on **25** typically developing children. Each child was assessed individually. The child was shown a page with four PCSs and asked "Show me the _____". The child was required to point to the item requested. Non-specific intermittent feedback was provided (e.g., "keep going" or "you're doing fine") to sustain participation. The results were scored on the sheet (Appendix 7).	The sample comprised 12 boys and 13 girls. Their ages ranged from 3.5 years to 5.0 years. Seven children were in the age range of 3.5 to 4.0; five in the 4.0 to 4.5 year range; and 13 in the 4.5-5.0 year range. The results revealed that 20 of the 25 children scored 100% on the task. The remaining 5 children scored 95% on the task.	The items that were incorrectly identified were "doll" and "apple", with the children choosing "cat" and "orange" respectively. Since 95% of the children were able to cope with the task, it was decided that the materials would be valid for use in an informal assessment of the participants, in this research project (Schlosser, 1999b). The criteria for being able to identify line drawings was set at 18/20 to account for the errors made by the typical children.

3.4 Pilot study

The objective of this pilot study was to refine and pre-test the quality of the aided language stimulation program and to assess the feasibility of the study. Table 3.3 outlines the objectives, materials and equipment, procedures, results and recommendations of the pilot study.

Three boys attending a school for learners with mental disabilities, in the Gauteng province, participated in the pilot study. Consent was obtained from the principal and parents (Appendix 10 & 11). The participants met the criteria specified for participants in the main study (See Section 3.5.1). As reported by the speech therapist, the boys had LNFS and had received no prior exposure to AAC strategies. They communicated primarily through vocalizations, pointing and a few gestures. They were all attending the junior class at that school. Two of the participants had no formal diagnosis and one was diagnosed as having "Cat cry" syndrome. The school's speech therapist reported that they all had normal vision and hearing, and were ambulatory. Their ages ranged from 7.2 to 11.0 years.

The procedure for the pilot study was similar to that used in the main study, as outlined in Figure 3.1 and Section 3.7

The results of the pilot study necessitated minor modifications to the target vocabulary list, the parent and teacher checklist, and sequencing of the aided language stimulation program. Results of the aided language stimulation program indicated that the participants identified with the program, activities and group strategy for implementation. The results of the analysis of the aided language program revealed that it met the criteria stipulated for aided language stimulation. The procedure for data collection and analysis was also considered to be feasible in relation to this study.

Table 3.3 Objectives, results and recommendations following the pilot study				
Objectives	**Materials and equipment**	**Procedures**	**Results**	**Recommendations**
1. To evaluate the method of video recording the sessions to ensure that the recording was clear for later transcription.	A Panasonic NVRZ1 VHS-C video camera was placed on a tripod to record the session.	The children were placed in a circular position around the researcher. Only the backs of the participants were visible. This facilitated clearer recordings and visibility of both the researcher and facilitator board.	This arrangement seemed viable because both the researcher and the facilitator board were visible.	This arrangement would be used for the main study.
2. To evaluate the appropriateness of the aided language stimulation materials used: • Matrix size of the facilitator board. • The time taken for each session.	A 16-matrix size facilitator board for each activity. Approximately 15-20 minutes per session, comprising a 3 or 4 step activity.	The aided language stimulation comprised three activities. Each activity was implemented for the duration of five sessions. Each session was approximately 20 minutes. Week one: Food preparation activity. Week two: Arts and crafts activity Week three: Story time activity.	The participants coped with the activity in terms of the matrix size. However, 30-minute sessions tended to be tiresome for the participants. The participants seemed to prefer weeks one and three's activities.	It was decided that the sequence of the activities would be changed to ensure sustained participation. Week one: Arts and crafts Week two: Food preparation Week three: Story time The sessions would be reduced to 15 - 25 minutes
3. To test the applicability and usefulness of the parent and teacher checklist.	Parent and Teacher Checklist (Appendix 12).	The teachers and parents were provided with the checklist and requested to complete it.	Both the parents and teachers were uncertain as to whether the participants would understand the line drawings, and therefore found the section difficult	The section on identification of line drawings of the checklist was excluded, as the parents and teachers did not know this information. In addition, the information was not required for data analysis and could therefore

			to complete.	be excluded (Appendix 12).
Objectives	**Materials and equipment**	**Procedures**	**Results**	**Recommendations**
4. To determine the appropriateness of the target vocabulary selected, utilizing the opinions of the immediate stakeholders, that is parents and teachers (Schlosser, 1999a).	Teacher and Parent check list (Appendix 12).	The teacher and parents were asked to select words that they thought that their children would understand. However, parents and teachers preferred to do this in consultation with the researcher.	The targets were refined somewhat because the children already understood many of the nouns.	Some target words were replaced due to participants' familiarity with them: Food preparation: pudding, bowl, chocolate, pour and milk. Arts and crafts: sticky, eyes, hair, glue, scissors, paint. Story time: bed, chair, mummy, daddy, baby.
5. To determine the appropriateness of the probe measures.	Probe measures test (Appendix 9 & 15).	A test was developed using real objects. For each of the 24 targets there were 4 foils. The test was developed in consultation with 7 students registered for the Degree Ph.D. AAC. See section 3.6.2.10 for more information on the test.	The test was successful in assessing the target items. In addition, it served the function of conducting probes.	The test was implemented with a few minor changes, in accordance with the changes made to the targets as discussed above.
6. To determine the appropriateness of the pre- and post-intervention assessment measures.	The Reynell Language Scale (Reynell & Huntley, 1985) and the PPVT – R (Dunn & Dunn, 1981) were utilized for this purpose.	The participants were tested using these standardized tests as instructed in the manual. However, testing on the PPVT -R commenced on the first test item in order to provide participants with success in the test.	The participants were able to cope with this task, with the modification to the PPVT – R proving useful. The Reynell Language Developmental Scale was a useful test which	An informal receptive language test was added to obtain additional information on the participants' receptive language abilities. A hearing screening was added to the pre-assessment protocol, to ensure that participants had

			provided a broad overview of their skills.	normal hearing sensitivity.
Objectives	**Materials and equipment**	**Procedures**	**Results**	**Recommendations**
7. To determine the ease of reporting probes for the target vocabulary.	The Probe Sheet was used (Appendix 15).	When conducting the probes, scores were kept using the probe sheet.	The sheet facilitated accurate record keeping.	The Probe Sheet would be utilized in the main study.
8. To determine the nature and frequency of the aided language stimulation provided by the trainer.	Video transcripts.	Videos were transcribed verbatim. Thereafter the researcher watched the videos to transcribe the use of aided language stimulation.	The transcriptions revealed that the nature and frequency of the aided language simulation provided was sufficient.	It was felt that the researcher had acquired the skill of providing aided language stimulation for the specified activities.
10. To test the intended analysis of the data.	Probe Sheet; Video transcriptions.	The data obtained was analyzed using descriptive parameters of frequency, ratios, means and percentages.	Data were obtained about the nature and frequency of the aided language stimulation. However, a more in-depth description of the language utilized in program was identified.	A further two additional language analysis techniques were added, to quantify the language used in aided language stimulation. This included the Type Token Ratio (TTR) and the Mean Length of Utterance (MLU).

3.5 Main study

The experimental phase of the study is described here. The first aspect of this phase was the identification of the participants.

3.5.1 Criteria for selection of participants

Participant selection criteria in AAC research are complex, and have been the subject of many debates with in the field of AAC (Bedrosian, 1995; Higginbotham, 1995; Higginbotham & Bedrosian, 1995). These authors suggest certain points that require careful consideration in AAC studies. Such points include questions about whom the participants represent, methodological issues, issues of external validity, and research economics. Based on some of these recommendations, certain selection criteria were established and are outlined in Table 3.4 below.

3.5.2 Description of the school

The study was conducted at a school for learners with mental disabilities because the numbers of candidates for AAC in these schools are high (Matas, Mathy-Laikko, Beukelman & Legresley, 1985). The school was registered with the Department of Education, and was selected due to its accessibility to the researcher. Hence, convenience sampling was used (Dooley, 1995). Permission to conduct the study was obtained from the Gauteng Department of Education. In addition the school principal, teachers and parents consented to the study being conducted (Appendix 18, 19, 20 respectively).

The school had approximately 20 teachers, one speech language and hearing therapist, two occupational therapists and one physiotherapist. The school catered for learners from 4 years to 21 years of age, and had a preschool, boarding house and adult workshop on its premises. The medium of instruction at the school was English.

Table 3.4 Criteria for participation				
No.	**Criteria**	**Motivation**	**Method**	**Results**
1.	LNFS	Participants were described as having LNFS, in accordance with the aims of this study. LNFS was defined as possessing a vocabulary of fewer than 15 intelligible words (Burd, et al., 1988).	The teacher and speech language therapist agreed that the participants fitted the criteria. In addition, the Reynell Language Developmental Scale (Reynell & Huntley, 1985) was used to assess each participant.	Seven potential participants were identified. They were considered to have met the selection criteria, as there was consensus amongst the professionals. This was further supported by the participants' performance on the expressive component of the Reynell Language Developmental Scale (Reynell & Huntley, 1985).
2.	Normal hearing abilities	It was essential that the participants had normal hearing, in order to ensure that the aided language stimulation input was heard. This was to rule out the possibility of poor hearing abilities influencing the results.	An individual hearing screening protocol suitable for 3-year-old typical children was utilized for this purpose (ASHA, 1985). The hearing screening included impedance measures. The hearing screening protocol was aimed at identifying participants who have hearing impairments that interfere with communication and ensure that the participants met the selection criteria. The protocol comprised both acoustic immittance measures viz. Tymponometry and pure tone air conduction testing (ASHA, 1985). The outer ear was examined using an otoscope. Thereafter a tympanogram was obtained and classified based on the criteria stipulated in the Grason Stradler (2000) manual. Finally, pure tone air conduction signals at the frequencies of 500, 1000, 2000 and 4000 Hz at 20dbHl were presented. The researcher and an assistant conducted the hearing screening. The assistant was a speech and hearing therapist with a Ph.D. in AAC, who had previous audiological assessment experience. The assistant provided the instructions while the researcher administered the test.	The participants were screened individually and were conditioned using play audiometry. The hearing screening was conducted in a small carpeted room at the school. The testing was done during school hours when the ambient noise level was minimal. Participants' responses and results were recorded (Appendix 16). Failure to respond to the recommended screening levels at any frequency in either ear constituted a failure. In addition, a tympanogram that did not fall into the criteria for normal middle ear functioning constituted failure of the hearing screening. A re-screening was conducted a week later. Participants who failed the re-screening were excluded from the study. The parents and teachers were informed about the results of the screening, and recommendations for a complete hearing assessment were made for those who failed the re-screening (Appendix 17). Finally, five of the seven participants passed the hearing screening.

No.	Criteria	Motivation	Method	Results
3.	Ability to identify line drawings	The ability to identify line drawings was vital to the aided language stimulation program, to ensure that the aided language stimulation was comprehensible to the participants. The participants were evaluated using the "Ability to identify line drawings test" which was developed for the purpose of this study.	The test was developed from the final 20-item word list identified in Table 3.2. The ability to identify line drawings was assessed in a similar manner to the PPVT - R (Dunn & Dunn, 1981) in which the child, in response to an auditory input, had to select one of four PCS symbols. The test comprised 20 pages with 4 PCS's on each page arranged in a 2 X 2 format. One PCS was the target item and 3 were foils. The foils were selected from the remaining 19 items on the list. Each item on the list was used either 3 or 4 times as a foil. The foils were not located in the same quadrant for two consecutive test items. The position of the target item was randomized to ensure scanning across each quadrant (Schlosser & Lloyd, 1997). (Appendix 7).	The participant was seated at a table. The researcher instructed the child as follows: "We are going to look at a few pictures. I will say, 'Show me the ____' and you will point to the picture. Let's start." The researcher had the sheet on her lap (Appendix 7) and she recorded the participants' responses on it, with either a positive or negative symbol indicating either a correct or incorrect response respectively. One participant was excluded from the study, as she did not obtain 18/20 as required.
4.	Age	Participants were required to be between the chronological ages of 8.0 and 11.0 years. This was to ensure the appropriate selection of activities.	Participants' school records verified their ages.	The ages of the participants varied from 8.1 to 12.1 years.
5	Receptive language abilities	It was important that the participants were unable to identify the target vocabulary items.	The baseline measures confirmed this as well as the parent and teacher checklist (Appendix 13 & 14). Various language assessment measures were utilized for a description of the language skills of the participants. See Table 3.9 for a description of these measures.	The participants were unable to identify the target vocabulary items. Their language skills on the assessment measures varied across participants as described in Table 4. 8.

3.5.3 Description of the setting

The intervention sessions were implemented at the school, in a small room adjacent to the occupational therapist's office. The room was painted white and contained a small table and five small plastic chairs. The room controlled for visual and auditory distractions (Schlosser, et al., 1995).

3.5.4 Description of the participants

Participants were identified by the school speech and language therapist and teacher as having LNFS and possessing a vocabulary of fewer than 15 intelligible words, as well as being able to identify some line drawings.

Seven children were identified as potential participants by the therapists and teachers. Consent was obtained from the parents to assess their children's hearing, identification of line drawings and language skills. Two participants were excluded because they failed the hearing screening and re-screening. One participant was excluded as she did not meet the criteria on the ability to understand line drawings test; she scored 10/20. Hence, four participants met the selection criteria and their parents consented to their participation in the study. See Table 3.5 for a description of the participants. The criteria by which the participants were described was based on the literature which suggests that it is important for participants to be described in as full detail as possible, (Wickstrom, Goldstein & Johnson, 1985; Romski & Sevcik, 1988b).

All the participants were diagnosed as having either cerebral palsy or Down syndrome, resulting in severe dysarthria and poor speech intelligibility. The participants were all second language English speakers and had been attending the English medium school for a minimum of four years. They received all their academic and other instructions in English while at school. The teachers and speech therapist described them as coping with their academic tasks in English. None of the participants had received prior AAC intervention. Both the parents and teachers indicated on their respective checklists that the participants did not understand the target

receptive vocabulary items (Appendix 13 & 14). In addition, the research established three consecutive baselines for these targets, to ensure that the participants did not understand the target receptive vocabulary items that were going to be utilized in the intervention phase.

3.6 Equipment and materials

3.6.1 Equipment

Video recorder

A Panasonic NVRZ1 VHS-C video camera was utilized in this study. It was placed on a Panasonic tripod stand. The video cassettes used were Panasonic Super high grade. The footage was then transferred onto a Sony Super E 180 DXF1 VHS video cassette.

Screening audiometer

A Grason Stradler GSI 38 screening audiometer with its standard headphones was utilized. It is a versatile combination instrument that provides testing capabilities for screening audiometry as well as other functions (Grason Stradler, 2000). The audiometer was calibrated both by a technician at the company and then by the researcher, using the daily calibration test on the day of the screening.

Easel

A black chalkboard easel with three wooden legs was used. The facilitator boards were mounted with Prestick onto this easel for the duration of the activity. The dimensions of the frame of the easel were 55cm X 60 cm. Two strips of Velcro were attached to the back of the easel, where the target receptive vocabulary items were placed for easy access during the activity.

Table 3.5 Description of the participants

Criteria	Participants			
	Participant A	**Participant B**	**Participant C**	**Participant D**
Age **Gender** **Diagnosis** **Grade** **Boarding school** **Attending school**	8.5 Male Cerebral palsy Junior class A Stayed on school days 4 years	10. 1 years Female Cerebral palsy Junior class A Stayed on school days 5 years	8.1 Female Cerebral palsy Junior class A Stayed on school days 4 years	12.1 Female Down syndrome Junior class B Did not stay at boarding school 5 years
Home language	Zulu	Sepedi	Sepedi	Sepedi
Physical status	Right hemiplegia with greater involvement of the lower extremities. Able to direct select.	Right hemiplegia with more involvement of the upper extremities Able to direct select.	Right hemiplegia with more involvement of the upper extremities. Able to direct select.	Physically able bodied, except for difficulties with gross and fine motor skills during some functional activities reported by the occupational therapist. Able to direct select.
Activities of daily living	Independent in terms of eating, dressing and walking.	Independent in terms of eating, dressing and walking.	Independent in terms of eating and walking. Required some assistance with fine motor skills for dressing.	Independent in terms of eating, dressing and walking.
Communication	Used vocalizations, natural gestures and speech.	Used vocalizations, natural gestures and speech.	Used vocalizations, natural gestures and speech.	Used vocalizations, natural gestures and speech.
Speech characteristics	His speech was intelligible to familiar partners and less so to unfamiliar partners. His speech included substitutions and omissions.	Her speech had frequent misarticulations, and was characterized by substitutions and omissions. She had difficulty with lip closure and was unable to produce bilabials resulting in speech with a vowel-like quality	Her speech was unintelligible to both familiar and unfamiliar partners. Her misarticulations comprised primarily omissions.	Her speech was intelligible to familiar partners and less so to unfamiliar partners. Her speech included substitutions and omissions. Her tongue mobility was compromised, which resulted in a tongue thrust with the associated impact on her speech intelligibility and characteristics.
Hearing screening	Passed	Passed	Passed	Passed
Identification of line drawings	19/20	18/20	20/20	19/20

3.6.2 Materials

3.6.2.1 Description of the aided language stimulation program

Theoretical framework

The theoretical framework for the development of this program was based on the assumption that adequate input is fundamental to the language acquisition process. Krashen (1982; 1985) suggests certain principles that enhance input to be comprehensible and adequate for facilitating language acquisition, in particular second language acquisition. Krashen's principles for adequate input for second language acquisition are applied to the aided language stimulation program. Table 3.6 illustrates Krashen's principles and provides explanations for them, and discusses each one in relation to the aided language stimulation program.

Table 3.6 Application of Krashen (1985) principles to the aided language stimulation program.

Principle	**Description**	**Program**
1. Language learning is determined by the codes available.	A natural context, which facilitated exposure to language used in daily interactions, was identified.	Three activities were identified that were familiar with in the participants' academic program.
2. Input should be comprehensible. It is a fundamental requirement, otherwise input becomes noise.	Meaning is successfully negotiated when the conversational partner is able to adjust speech and use extra linguistic information and contexts. The language acquirer should have sufficient linguistic competence to regulate the input.	The program facilitated the use of slower, clearer articulation and syntactic simplification, i.e. shorter sentences. More use of high frequency vocabulary was facilitated by the symbols on the facilitator board.
3. Input should be interesting / relevant.	The input should achieve total focus for the learner. Materials that are relevant and interesting should be developed, so that the learner is not aware of the learning occurring.	Each activity was done for five consecutive days and the participants were highly motivated to do the activities each time.
4. Sufficient quantity of input is required.	According the Total Physical Response, ten hours of input of this nature is required prior to expressive use of the target receptive vocabulary items (Krashen1982).	The participants were exposed to 75 minutes per activity per week. This was considered sufficient based on the results of the pilot study.

Principle	Description	Program
5. The grammatical nature of the input should not be a conscious concern.	Provide input that is not consciously sequenced. It is postulated that input will naturally contain a variety of structures and there will therefore be sufficient variations in grammar, suitable for all participants.	The program was not concerned with the grammatical nature of the input. However, an analysis in terms of the Type Token Ratio (TTR) and Mean Length of Utterance (MLU) were done.
6. Filter level should be low so that the learner is able to understand the message.	The activity and materials should build on the participants strengths so that the participants are open to the input provided by the teacher or facilitator.. In addition, the facilitator should not insist on production too early in the process.	The program, due to its short duration, did not require expressive output using either speech or AAC from the participants.

3.6.2.2 Facilitator boards

Three activities were identified for the purpose of this study, namely arts and crafts, food preparation, and story time (Appendix 1 – 3 respectively). A facilitator board for each activity was developed, based on principles outlined by Goossens' et al., (1994). Each facilitator board was 50cm X 70 cm in dimension and was made of black cardboard 5mm in thickness. The boards were laminated in a matte finish. After lamination two strips of Velcro were placed on each board.

Each facilitator board contained 16 core symbols that were permanently fixed onto the board. Each facilitator board had 8 additional target receptive vocabulary items or symbols. The target receptive vocabulary items were removable and could be manipulated by the researcher. They could be attached to the strips of Velcro during the demonstration of the activity.

The core symbols and target symbols each measured 10cm X 10 cm. The symbols used were black and white line drawings from commercially available Picture Communication Symbols (PCS) using the Boardmaker™ software program (Mayer-Johnson, 1984, 1985). Each symbol had the corresponding written gloss above the

picture in Arial font size 16. Each symbol had a colored background depending on the category of the words, as suggested by Goossens' et al., (1994, p.11). Verbs were colored pink, descriptors blue, prepositions green, nouns yellow; miscellaneous words (including wh- words, exclamations, pronouns and negative words) were colored orange.

3.6.2.3Activities

Table 3.7 provides an overview of the three activities used in the program.

Table 3.7 Activities used in the aided language stimulation program

Activity	Project	Steps	Group Activity
Arts and Crafts.	Making a sheep.	1. Put on the glue 2. Put on the cotton wool 3. Decorate the picture with colored pens.	A single project activity was used in which the entire group of participants collaboratively assembled one project. This is an easier task for the individual providing aided language stimulation to manage when providing aided language stimulation, as in the current study (Goossens' et al., 2000). A group strategy also enhanced the consistency of the input across the participants.
Food Preparation.	Making pudding.	1. Pour in the pudding 2. Add the milk 3. Stir it.	
Story Time.	Goldilocks and the three bears	The story was retold according to Daly (1993). The introduction of the family of bears. Goldilocks visits when they are out. Their return and dismay at finding an intruder in their home. Finding Goldilocks and her leaving the home.	

3.6.2.4 Target receptive vocabulary items.

The selection of appropriate vocabulary items is a critical aspect of AAC intervention. The target items were selected for this program according to the premise that models of interactive use are paramount for children learning the use of AAC system interactively. Hence, facilitator boards not conducive to aided language stimulation by the adult are also not conducive to interactive use by the child (Goossens', 1989). Eight target receptive vocabulary items were selected for each activity, and were aimed at mediating

communication in a target activity. A total of 24 target receptive vocabulary items were therefore identified.

The words utilized in the study were also available on the composite vocabulary lists outlined by Yorkson, Dowden, Honsinger, Marriner and Smith (1988). These authors encourage the use of composite vocabulary lists because they allow one to choose from a range of vocabulary sizes, prevent guessing which standardized vocabulary lists adequately serve the client, and allow the amalgamation of small lists into a single large source of vocabulary items.

Table 3.8 Comparison of target vocabulary to standard vocabulary lists

No.	Target	Composite list	Occurrence	Motivation
1	Sheep	Standard vocabulary composite list	3	
2	Cotton wool	Does not appear on any of the lists		Appropriate for activity
3	More	Non-speaker composite vocabulary list	6	
4	Less	Non-speaker composite vocabulary list	3	
5	Decoration	Does not appear on any of the lists		Appropriate for activity
6	Messy	Does not appear on any of the lists		Appropriate for activity
7	Same	Non-speaker composite vocabulary list	3	
8	Different	Non-speaker composite vocabulary list	2	
9	Taste	Standard vocabulary composite list	5	
10	Yummy	Does not appear on any of the lists		Appropriate for activity
11	Strawberry	Does not appear on any of the lists		Appropriate for activity
12	Empty	Non-speaker composite vocabulary list	3	
13	Full	Non-speaker composite vocabulary list	4	
14	Big	Non-speaker composite vocabulary list	5	

No.	Target	Composite list	Occurrence	Motivation
15	Small	Non-speaker composite vocabulary list	2	
16	Pink	Non-speaker composite vocabulary list	6	
17	High	Non-speaker composite vocabulary list	2	
18	Low	Standard vocabulary composite list	5	
19	Soft	Non-speaker composite vocabulary list	3	
20	Hard	Non-speaker composite vocabulary list	5	
21	Three	Non-speaker composite vocabulary list	3	
22	Hot	Non-speaker composite vocabulary list	6	
23	Cold	Non-speaker composite vocabulary list	6	
24	Broken	Non-speaker composite vocabulary list	2	

The appropriateness of the target receptive vocabulary items was determined by the researcher, in terms of each child's ability to cope with the target as measured in the baselines. In addition, both the parents and teacher rated the child as not understanding the target receptive vocabulary items (Appendix 13 & 14), thus providing social validation of the baseline measures (Schlosser, 1999a).

3.6.2.5 Teaching criteria

The teaching criteria describe a predetermined maximum number of teaching trials or sessions (Schlosser, 1999b), and are a useful guideline in situations where little data to predict performance is available. The teaching criteria were set at five sessions per activity for this program.

3.6.2.6 Pre- and post-intervention assessment measures

These assessment measures were aimed at gaining information on the participants' understanding of the form and content of spoken language, including lexical knowledge and semantic syntactic relationships (Light, 1997). A comprehensive assessment of the participants' receptive language abilities was necessitated by the nature of the study as well as the fact that users who learn language through augmented means bring with them a range of receptive language skills that can affect achievement patterns (Cirrin & Rowland, 1985; Romski & Sevcik, 1993a; Romski, Sevcik, & Pate, 1988). Furthermore, Light (1997) argues that a thorough assessment of comprehension skills is important as it (a) provides the communication partner with guidelines as to the level of input; and (b) it provides information on when augmented input would facilitate comprehension; and finally (c) it provides information on discrepancies between expressive and receptive abilities, which would provide information on areas that are within the AAC user's "zone of proximal development". Table 3.9 outlines the pre- and post-intervention assessment measures that were used in the study.

3.6.2.7 Reynell Developmental Language Scale

Reynell Developmental Language Scale (Reynell & Huntley, 1985) is a standardized test that comprises scales to assess both expressive and receptive language abilities. It includes modifications for use with children with hearing impairments, or those who are shy and reluctant to participate in the testing.

3.6.2.8 Peabody Picture Vocabulary Test – R

The Peabody Picture Vocabulary Test – Revised (PPVT – R) (Dunn & Dunn, 1981) was utilized to assess the participants' receptive vocabulary. The spoken word is given as an auditory stimulus, and the participant is asked to point to one of the four line drawings.

Table 3.9 Pre- and post-intervention assessment measures			
Assessment Measure.	Reynell Developmental Language Scale (Reynell & Huntley, 1988.	Peabody Picture Vocabulary Test – Revised (PPVT – R) (Dunn & Dunn, 1981).	Informal Comprehension Test (based on Miller & Paul, 1995).
Motivation.	The test was utilized as it was developed out of a clinical need for assessing children with multiple handicaps. Miniature objects and photographs are used, which are appropriate due to their saliency (Franklin et. al, 1996).	This test was utilized as it is often used with children with LNFS (Romski & Sevcik 1996). Also, it is often used as a marker for general language levels (Blockburger & Sutton, 2003).	This test was developed for the purpose of this study in order to gain additional information on the receptive abilities of the participants.
Procedure.	The test was administered in the format outlined in the manual. The miniature objects and photographs were placed on a table in front of the participant. The child was asked a question or provided with an instruction, and was required to respond by pointing to the appropriate object or photograph or by manipulating the objects. The responses were recorded on the test sheet, and the participant was provided with non-specific feedback.	The test was administered in the format outlined in the manual, except that the test commenced on the first item. The researcher sat at a desk in front of the participant, with the test material placed between researcher and participant. The researcher asked the participant a question; e.g. "Show me the ….". The participant was required to respond by pointing to the appropriate line drawing from four options. The responses were recorded on the test sheet, and the participant was provided with non-specific feedback.	While the participant interacted with the materials, the researcher would provide an instruction or question. The participant was required to respond by pointing to the appropriate object. The responses were recorded on the test sheet, and the participant was provided with non-specific feedback.
Scoring.	Raw scores were calculated for the test.	Raw score and age equivalence score was calculated.	Responses were indicated on a sheet (Appendix 8).

3.6.2.9 The informal receptive language test

An informal receptive language test (Appendix 8) was developed to gain information on the participants' comprehension skills. This test was based on Miller & Paul's (1995) recommendations for assessing comprehension skills based on informal non-standardized procedures and activities. These activities are norm referenced because they were developed based on normal developmental data. The test developed for the current study comprised six sections, which are outlined in Table 3.10 below.

Table 3.10 Sections of the Informal Comprehension Test

No.	Section	Material	Setting	Example of questions
1	Action words	Toys - doll, car, ball, brush, shoe, horse, cow, spoon, cup	When playing with toys	Pat it (referring to the object that the child is playing with)
2	Early two-word relations	Toys - doll, car, ball, brush, shoe, horse, cow, spoon, cup	When playing with toys	Where is the shoe?
3	Assessing illocutionary intents in requests	Toys - doll, car, ball, brush, shoe, horse, cow, spoon, cup	When playing with toys	Pat the doll
4	Comprehension of 2-3 word instructions.	Toys - doll, car, ball, brush, shoe, horse, cow, spoon, cup	When playing with toys	Make the doll eat
5	Comprehension of locative body placement	Cardboard box	When exploring the box	Hide in the box
6	Word order comprehension	29 stimulus plates of four line drawings each. The first 5 plates pretest the 20 vocabulary items used in this section. The participants were required to demonstrate knowledge of each vocabulary item prior to testing on the remaining 24 plates.	Seated at a table opposite to the researcher. The pictures were presented in a book format.	Show me "Pushing the girl"

3.6.2.10 The probe test

Horner & Baer (1978) suggest that the probe should (a) elicit responses that have no scheduled consequences; (b) be non reactive; and (c) be scheduled infrequently within other conditions. The probes used in this session met two of the three specified criteria. Probes were used to measure the acquisition of target receptive vocabulary items in the various activities, thereby increasing experimental control. The unit of analysis was the participants' own responses across activities (Baumeister, 1984).

The probe test was developed for dual purposes. Firstly, it functioned as a test to establish the three consecutive baselines prior to the implementation of the aided language stimulation program. Second, the probe test served to assess the participants' acquisition of the target receptive vocabulary items during the implementation of the aided language stimulation program. Objects were used in this test because Franklinet et al., (1996) found that typically developing children performed better on a task involving pointing to an item from an array of objects rather than an array of photographs. The test was reviewed by the extended community of stakeholders comprising seven Ph.D. (AAC) students, a national and an international expert in the field of AAC (Schlosser, 1999a). The test comprised 24 objects that represented the target items. Each target item had four distracting stimuli or foils, which were displayed during the test. The participant was asked a question and was required to point to the corresponding object. See Appendix 9 for the Probe Test and the questions asked for each probe. See Section 3.6.2.10 for a description of the implementation of the probes.

3.7 Data collection

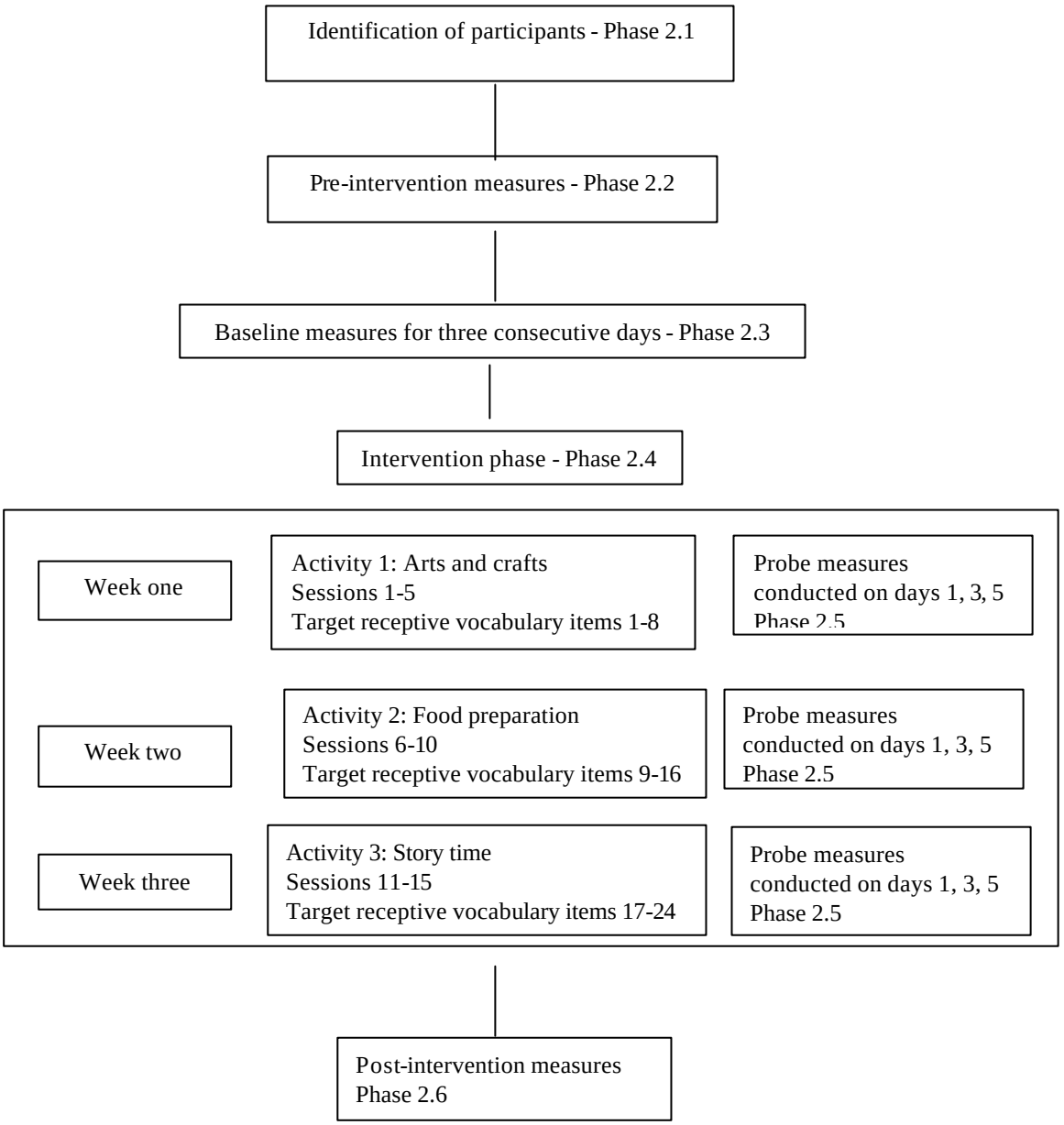

Figure 3.1. A schematic representation of the procedure used in the experimental phase of this study.

3.7.1 General procedures

The procedure used during the experimental phase for Phases 2.2 to 2.6 was as follows:

Consent from the Gauteng Department of Education was obtained to conduct the study. Thereafter the school principal was contacted, and consent to conduct the study was obtained. Potential participants for the study were identified in consultation with the speech therapist at the school. Parental consent was obtained from the parents of the potential participants (Appendix 18, 19, 20). Those participants who met the selection criteria were included in the study.

Once the participants were identified, pre-intervention assessment measures were conducted. In addition, three consecutive baseline measures were obtained for each participant for the 24 target receptive vocabulary items. The program was then implemented for the duration of the three weeks as outlined in Figure 3.1. Probes were conducted three times during each week by the researcher. Finally, post-intervention assessment measures were obtained at the end of the three-week programme.

3.7.2 Pre- and post-intervention assessment measures

Once the four participants had been identified, the following pre- and post-intervention assessments were conducted (as outlined in Section 3.6.2.6). The initial tests were conducted before the implementation of the aided language stimulation programme, over a period of two consecutive days. The setting for all assessments, both pre- and post-intervention, was a small room at the school, as described in Section 3.5.3.

Table 3.11 Pre- and post-intervention assessment measures

Test	Reynell Developmental Language Scale (Reynell & Huntley, 1988).	Peabody Picture Vocabulary Test – Revised (PPVT – R) (Dunn & Dunn, 1981).	Informal Comprehension Test (based on Miller & Paul, 1995).
Day	Day 1.	Day 1.	Day 2.
Duration	30 minutes.	30 minutes.	30 minutes.

3.7.3 Program implementation

3.7.3.1 Baselines

Baselines provide a measure against which to determine the later effects of an independent variable, in this case the aided language stimulation program (Horner & Baer, 1978). After the completion of the pre-intervention assessment measures, baseline measurements were conducted over three consecutive days. The researcher used the probe test procedures to obtain the baseline measures (Section 3.6.2.10). Baseline measures for all 24 target receptive vocabulary items for each participant were taken, utilizing the probe sheet (Appendix 15).

3.7.3.2 Training Procedure

The aided language stimulation program comprised three activities. Each activity was implemented for five consecutive days, that is, in five sessions. The sessions were conducted in the mornings and lasted for between 15 and 25 minutes per day. During each session the participants were exposed to the target receptive vocabulary items three times. All the sessions were video taped. The sessions were loosely scripted by the limited vocabulary items on the facilitator board, and by the nature of the activity. The sessions comprised the steps outlined in Table 3.12 below. Appendices 22, 23, 24 are transcripts of a session for each activity. A second rater rated 40% of the transcripts, as discussed in section 3.7.3.3.

A probe has been defined as the introduction of a change in a condition at some point in the intervention, in order to evaluate the intervention (Horner & Baer, 1978). The probes in this study served as the independent measure. Three times each week, namely on days 1, 3 and 5, the participants were tested or probed for comprehension of the target receptive vocabulary items being taught in that week, as well as of items for the other two activities (Appendix 15).

Table 3.12 Examples of the steps involved in the activities			
Criteria	**Arts and crafts**	**Food preparation**	**Story Time**
Introduction.	"Look what we're going to be making today. We are going to make a picture. A picture of a sheep."	"Look what we're going to make today. We are going to make something that tastes yummy."	"Today we are going to read a story. Look, a story about Goldilocks and the three bears."
Outline of activity/ story.	"What do we need to make the picture? We need a picture of the sheep, and glue and cotton wool."	"What do we need to make some yummy pink pudding? We need a bowl and a spoon. We need to get the pudding and milk too."	Reading the story by Daley (1993). Table 3.7 illustrates the main ideas of the story.
Obtaining participation in doing the activity.	"Who is going to help me to make the picture of the sheep? B says, 'Let me help.'"	"Who is going to help me to open the milk?"	"What happened next? Goldilocks went upstairs to sleep."
Conclusion	"The picture looks lovely. Are we finished making the picture of the sheep? Yes, we finished putting on the cotton wool and decorations. We're finished."	"Everybody's bowls are empty. We finished making the strawberry pudding and we finished tasting it. Yummy. Now we're finished."	"Goldilocks was caught. She said, 'Uh oh, they caught me being naughty', and she ran away. She never came back to visit the three bears again.

The participant sat at a table in front of the researcher, who placed the target objects in front of the participant (Appendix 9). Three distracting stimuli or foils were also presented. The researcher conducted the probes by instructing the participant to point to the correct object, for example: " Show me the ____". The researcher provided non-specific intermittent feedback (e.g. "keep going" or "you're doing fine") to sustain participation. After each item was presented, the researcher marked the probe sheet (Appendix 15) with a positive or negative sign, indicating a correct and incorrect response respectively. The participant assisted the researcher in putting the objects away. The researcher then moved on to the next item.

3.7.3.3 Procedure for inter-rater agreement

The measures of reliability applicable to the study are reflected in the table below.

Table 3.13 Reliability measures		
Data	**Aspect**	**Type of reliability**
Videotape transcription	Accuracy of transcriptions. Treatment integrity in terms of frequency and nature of aided language stimulation provided	Inter-rater reliability
Videotape transcription	Type token ratio	Inter-rater reliability
Videotape transcription	Mean Length of utterance	Inter-rater reliability

The videos were transcribed because the transcriptions provided a means of ensuring treatment integrity .To ensure the researcher transcribed the videotapes adequately, a second rater (an independent, qualified speech and hearing therapist) independently checked all the transcriptions. Errors were noted and the researcher re-observed the videotapes and made changes to the transcripts accordingly. There was 90% agreement between the rater and researcher on the transcripts. The reliability of the transcripts was essential because these served as the primary data for this study.

In addition, the second rater independently coded 40 % of the transcripts in terms of the TTR and MLU. The videotapes were randomly selected to represent all three weeks' activities. Two sessions of each activity were randomly selected for these inter-rater agreement measures, as reflected in Table 3.14.

Table 3.14 Transcripts that were rated by the second rater			
Week	**Activity**	**Sessions**	**Duration**
1	Arts and crafts	1, 2	50 minutes
2	Food preparation	3, 4	50 minutes
3	Story time	1, 5	40 minutes

3. 8 Data analysis and statistical procedures

All the data was transcribed and coded in the pre-designed column. The researcher encoded the data, which was subsequently computerized for statistical analysis with the SAS program.

3.8.1 Analysis of transcriptions

The video recordings of the sessions took place in the room in which the program was implemented, as described in Section 3.5.3. The videotapes were repeatedly viewed and transcribed verbatim (Appendices 22-24). The transcription was segmented into utterances using the criterion of "terminal intonation contour or rising or falling" (Miller, 1981, p.22). The transcriptions were analyzed in relation to the three independent measures, which monitored the intervention fidelity. These were (a) the frequency of the aided language stimulation (b) the nature of the aided language stimulation, and (c) the total number of times the target vocabulary item was modeled by the researcher in the session. These independent measures were coded on the transcripts in columns V1 to V7 (Appendix 25).

3.8.2 Frequency of aided language stimulation

The frequency of aided language stimulation is defined as the number of times aided language stimulation is provided. Aided language stimulation is defined as the simultaneous pointing to the symbol as spoken input is provided. Goossens' et al., (2000) suggest that the frequency of aided language stimulation should be 70%. The frequency in the current study was calculated using the transcripts and videos. Each time the researcher provided aided language stimulation, that is, named and pointed at the symbol simultaneously, was marked in blue on the transcripts. Thereafter the transcripts were observed for missed opportunities to use aided language stimulation. The missed opportunities were marked in pink. The frequency of used opportunities and missed opportunities were then counted and tallied in the respective column on the

transcript (V1 and V2). The totals for each session were added. The frequency of aided language stimulation was calculated per session using the formula:

$$\frac{\text{Number of times aided language stimulation provided}}{\text{Total number of opportunities for aided language stimulation}} \text{ X } 100$$

3.8.3 Nature of aided language stimulation

The nature of aided language stimulation refers to the type of input that the participants received. According to Goossens' et al., (2000) it is important that more comments and statements be provided to participants, rather than questions. The recommended ratio of statements to questions is 80:20.

The nature of the aided language stimulation was calculated by coding each utterance on the transcript in column V3 as either a statement (coded "1") or a question (coded "2"). The ratio for statements to questions was calculated for each session.

3.8.4 Frequency of use of target receptive vocabulary item

Each target receptive vocabulary item was allocated numbers of one to 24. The transcripts were analyzed; each time the researcher used the target vocabulary item and simultaneously pointed to the symbol, this was recorded in column V4 on the transcript. The frequency of use of each target receptive vocabulary item was therefore tallied for each session. A minimum of 3 times per target per session was set.

3.8.5 Mean Length of Utterance (MLU)

The MLU was computed for each session transcript using the adapted procedures of Brown (1973). The procedure used in the current study differs from Brown's only in that (a) 50 instead of 100 utterances were analyzed and (b) the first pages of the transcript were not omitted. The adapted procedure outlined by Miller (1981) was therefore also used. The first 50 consecutive utterances in the sample were counted. The morphemes in each utterance were counted, and tallied in column V5. A morpheme was defined as a minimal meaningful unit of a language. Decisions on what

constitutes a morpheme were based on Brown's (1973) recommendation, and included:

- Stuttering is marked as a repeated effort at a single word, unless it is produced for emphasis (example "no, no, no"). In the latter case, each occurrence is counted separately.
- Fillers such as "mm" or "oh" were not counted.
- Compound words forming proper names were counted as single words.
- Irregular past tense ("got", "did" and "went") were counted as one morpheme.
- Diminutives were counted as one morpheme.
- Auxiliaries ("will", "have", "can") were counted as separate morphemes.
- Catenatives ("gonna", "wanna") were counted as single morphemes.
- Inflections including possessives ('s), plural (s), regular past tense (ed) and progressive (ing) were counted as separate morphemes.
- The MLU was computed using the following formula:

$$\frac{\text{The total number of morphemes counted in 50 utterances}}{\text{Total number of utterances}}$$

3.8.6 Type Token Ratio (TTR)

TTR provide a means of quantifying vocabulary (Miller, 1981). While the TTR can only be compared to data for children aged three to eight years, it would provide a valuable description on the nature of the aided language stimulation offered.

Rules for counting the number of words are based on Templin's (1957) work.

- Contractions were counted as two words.
- Contractions of verbs were counted as one word.
- A verbal combination is counted as separate words.
- "Oh boy", "all right", "uh oh" and other expressions that function as a unit were counted as one word.
- Articles were counted as one word.

- Bound morphemes, noun and verb inflections were not counted as one word.

Computing TTR

1. The first 50 utterances were identified and used, as this was consistent with the strategy used in computing MLU.
2. The total number of words expressed was calculated according to the rules above, and tallied in column V6.
3. The total number of different words was counted and tallied in column V7.
4. The following formula was used:

$$\frac{\text{Total number of different words}}{\text{Total number of words}}$$

5. The result is the TTR.

3.8.7 Probes

Each participant's scores on the probe sheets (Appendix 9) were graphically represented using a scatter plot. Hence, a graphic representation of each participant's performance on all three activities was possible.

3.8.9 Statistical Analysis

The three activities (comprising five sessions each) were compared in terms of the statistical differences between the frequencies of aided language stimulation, MLU and TTR. The Kruskal Wallis test, a distribution free test, was used for this analysis. It was chosen as it can be used in situations where there are multiple samples, which in this study were derived from multiple sessions (Steyn, Smith, du Toit & Strasheim, 2000). Participants' performance on the pre- and post-assessment measures were presented in a Table and statistically compared using the Wilcoxon test, a distribution free test which uses the formula:

$$W = ? R_1 - \frac{n_1 (n_1 + 1)}{2}$$

with R?being the rank of the joint sample (Steyn et al., 2000).

3.9 Summary

This chapter presented the methodology used in the study. The aims and sub aim of the study were presented, as were the research design and the motivation for adopting the design. A description of the pilot study and its results and recommendations followed. The main study was discussed in terms of the participants, procedures, equipment, materials, data collection and analysis procedures.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

The results of the study will be described and discussed in this chapter, in relation to the fourth sub-aim, namely to determine the impact of the aided language stimulation program on the receptive language abilities of the participants. Three aspects will delineate the means by which this sub-aim will be described and discussed; these are outlined in the schematic representation in Figure 4.1. Firstly, the reliability of these data in terms of video transcriptions and data analysis procedures will be described. The second aspect will be a description of the aided language input provided to the participants. Finally, the impact of the aided language stimulation program on a) the acquisition of target vocabulary for each participant and b) the participants' receptive language abilities will be discussed. Certain standardized and non-standardized measures are used.

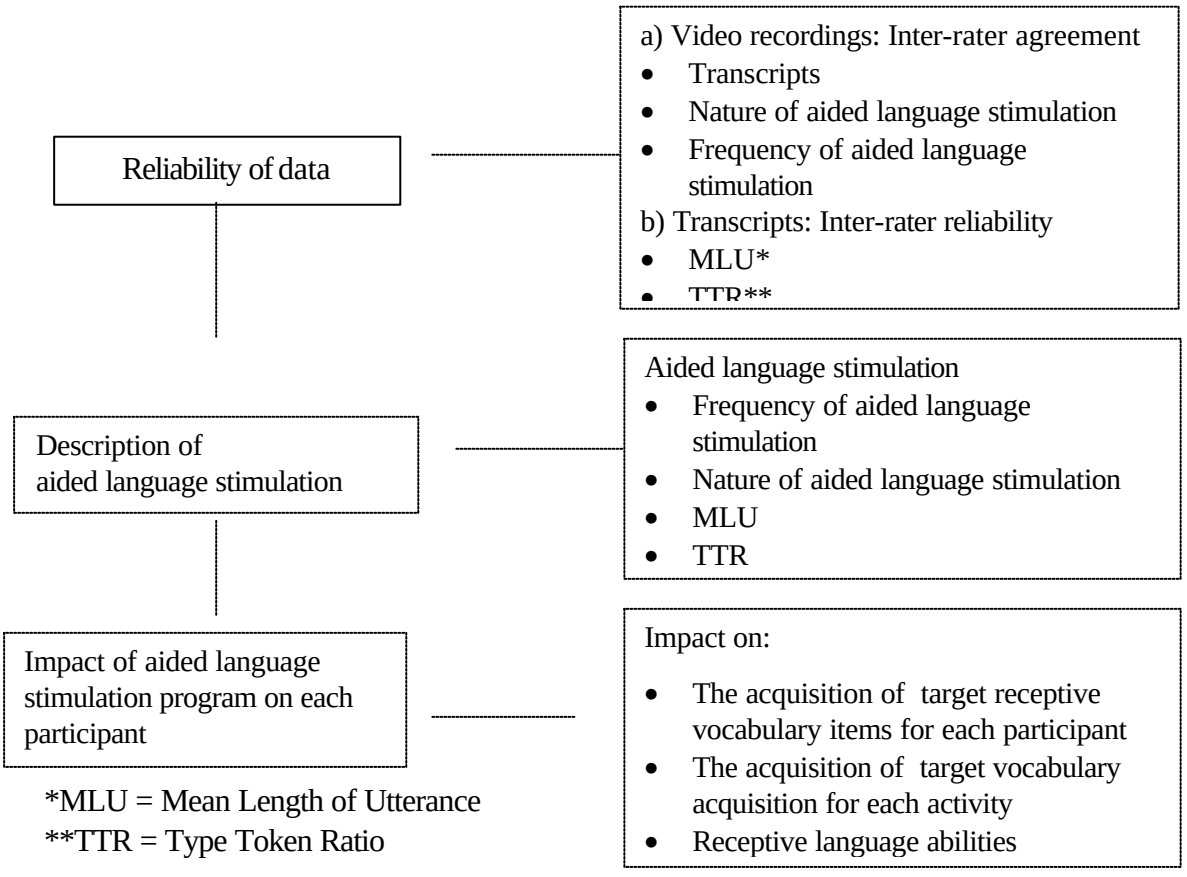

Figure 4.1 Schematic representation of the results of this chapter

4.2 Reliability

4.2.1 Inter-rater agreement of video recordings

Reliability refers to the consistency of measurement or method of measurement (McMillan & Schumacher, 2001). There are various types of reliability, one of which is "agreement", which McMillan and Schumacher describe as the consistency of observation. The concept of agreement reliability was applicable to the data used in this study. Agreement reliability is established by having an observer or raters independently rate something and then comparing their observations.

For the purpose of conducting this study, an Honors student in AAC functioned as an external rater to assess inter-rater reliability. Inter- rater agreement was determined in relation to the independent variable; that is, the nature of the aided language stimulation provided. The external rater observed 100% of the video recordings. This exceeded the 15 % recommendation suggested by Hensilwood and Ogilvy (1999). The video recordings were rated in terms of the accuracy of their transcriptions, as well as the nature and frequency of aided language stimulation provided. Discrepancies were discussed based on a reviewing of the video recording. The researcher and rater reached consensus, and, where appropriate, changes were made to the transcripts (Hasson, Keeney & McKenna, 2000). It was vitally important that, after discussion, there should be 90% agreement between the researcher and external rater in terms of the transcripts, because this data would serve as the primary data for two aspects of the study.

It is evident from Table 4.1 that the inter- rater agreement for the video recordings was between 90 and 95%. This indicates a good inter- rater agreement score, since it exceeds McMillan and Schumacher's (2001) recommendation of 70%.

Table 4.1 Inter- rater agreement results for video recordings						
Activity	**Rating**	**Session 1**	**Session 2**	**Session 3**	**Session 4**	**Session 5**
Arts and crafts	Transcripts	95%	90%	95%	95%	95%
	Nature of aided language stimulation	95%	95%	95%	100%	100%
	Frequency of aided language stimulation	90%	95%	90%	95%	95%
Food preparation	Transcripts	90%	95%	90%	95%	90%
	Nature of aided language stimulation	95%	95%	95%	95%	95%
	Frequency of aided language stimulation	95%	95%	90%	95%	95%
Story time	Transcripts	95%	95%	95%	95%	95%
	Nature of aided language stimulation	95%	95%	90%	95%	95%
	Frequency of aided language stimulation	90%	90%	95%	95%	95%

4.2.2 Inter- rater agreement for data in transcripts

After consensus was reached between the researcher and external rater about the accuracy of the transcriptions, a second rater rated 40% of the transcripts (Hasson et al., 2000). These ratings concerned the Mean Length of Utterance (MLU) and Type Token Ratio (TTR). This was to ensure the accuracy of the calculations for the MLU

and TTR. Two sessions for each activity were randomly chosen. This exceeded the 15 % recommendation suggested by Hensilwood and Ogilvy (1999).

It is evident from Table 4.2 that the inter- rater agreement scores were between 90 and 95%. This exceeded the 70% recommendation of McMillan and Schumacher (2001). Hence, the inter- rater agreement scores of the data used in this study were deemed to be acceptable.

Table 4.2 Inter- rater agreement results for transcripts

Activity	Criteria	Session 1	Session 2	Session 3	Session 4	Session 5
Arts and crafts	MLU	93%	94%			
	TTR	90%	94%			
Food preparation	MLU			93%	95%	
	TTR			90%	96%	
Story time	MLU	90%				96%
	TTR	93%				95%

4.3 Description of the Aided Language Stimulation Input

The nature of the aided language stimulation is described below. The frequency of aided language stimulation was calculated using the formulae in section 3.8.2. It is recommended that the frequency of aided language stimulation should be 70%, according to the criteria cited by Goossens' et al., (2000). In addition, these authors recommend that the aided language stimulation should contain a statement-to-question ratio within the vicinity of 80:20. The MLU and TTR were calculated (see Sections 3.8.5 and 3.8.6) in order to obtain further information on the nature of the language stimulation.

Table 4.3 provides an overview of the nature of the input provided in all three activities. It is evident that the frequency of aided language stimulation and the statement-to-question ratio meet the criteria specified by Goossens' et al., (2000). There appears to be a slight improvement across the activities in terms of the frequency of the aided

language simulation activity. The frequency of the aided language stimulation for the arts and crafts activities ranges from 76 to 87%, followed by the food preparation activity, which ranges from 85 to 92%, and finally the story time activity, which ranges from 85 to 93%. The slight improvement may be attributed to the activities allowing for increasingly better provision of the aided language input. The story time activity, in particular, was tightly scripted, which allows for easier provision of aided language stimulation (Goossens' et al., 2000).

The MLU for the activities fell into the same range across the activities. The MLU for the arts and crafts activity over the five sessions ranged from 6.52 to 7.0 followed by the food preparation activity with a range of 5.48 to 6.7, and finally the arts and crafts activity with a range of 6.1 to 7.58. This meant that the MLUs for the three activities were primarily in post stage five (Miller, 1981), which indicates an advanced pattern of structural development in terms of the input provided. The equivalent chronological age for this stage of development is 4 years and 8 months (for an MLU of 6.00). An age equivalent for an MLU with a score of 7.0 is not available. Hence, the nature of the input provided to the participants was beyond that suitable for a child aged 4 years and 8 months. This indicates that the input was at an appropriate level in comparison with the participants' receptive language abilities, which were approximately between the ages of 4 and 4.5 years (see Table 4.7). The match between the level of input and participants' actual level of development and potential for development is an important Vygotskian principle (Vygotsky, 1978) which is used to facilitate scaffolding, and therefore learning.

The TTR for the arts and crafts activity ranged from 4.0 to 4.8, followed by the food preparation activity, which ranged from 3.3 to 4.3, and finally the story time activity, which ranged from 3.5 to 4.0.

Tables 4.3 illustrates that the frequency and the type of aided language stimulation provided met the criteria specified by Goossens' et al., (2000). This implies that the nature of the aided input was adequate in relation to the set criteria. In addition, within the augmented input framework proposed by Wood, et al., (1998) (discussed in Chapter 2 Section 2.7.2), it is evident that the aided language stimulation program met four of the components of augmented input. Firstly, the spoken input was augmented

with graphic symbols, in this case PCS symbols. Secondly, the aided language stimulation program focused primarily on developing comprehension skills through the use of the graphic symbols, and there was no emphasis on the participants producing the vocabulary items. Thirdly, the retention of the symbols was facilitated through a delay in referring to them so that there was an association between the graphic symbol and the environmental stimulus. Finally, there was an array of stimuli to choose from when selecting a target item. This facilitated the development of a pool of responses. While the above augmented input framework provides insights into what constitutes augmented input, it offers fewer insights into understanding the language acquisition process.

Table 4.3 Nature of aided language input for the various activities															
	Arts and Crafts Activity					Food Preparation Activity					Story Time Activity				
	Sessions					Sessions					Sessions				
Criteria	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
Frequency of aided language stimulation	76%	85%	85%	84%	87%	85%	86%	85%	92%	87%	90%	93%	93%	89%	85%
Nature of aided language stimulation Statement: Question	86:14	91:9	91:9	89:11	91:9	92:8	91:9	93:7	96:4	94:6	97:3	93:7	94:6	96:4	95:5
MLU (Mean Length of Utterance)	6.52	6.86	7.00	7.00	6.6	6.42	6.92	7.18	5.48	6.7	6.46	6.5	6.1	7.58	7.78
TTR (Type Token Ratio)	4.70	4.0	4.7	4.8	4.3	4.3	4.1	3.6	3.3	4.2	3.5	3.5	3.5	4.0	3.9

4.3.1 Comparison of the three activities

Table 4.4 presents the mean and standard deviation of the scores. The Kruskal-Wallis Test was used to compare the means across three related variables (Steyn, et al., 2000).

Table 4.4 Means for three activities

Criteria	**Arts and crafts activity**		**Food preparation activity**		**Story time activity**		**P value***
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	
Frequency of aided language stimulation	83.40[1] **	4.28	87.00[12]	2.92	90.00[2] **	3.32	p<0.045*
MLU	6.80[1]	0.23	6.54[1]	0.66	6.89[1]	0.75	p<0.7788
TTR	4.47[1] **	0.35	3.92[12]	0.46	3.66[2] **	0.24	p<0.0233*

* at 5% significance level ($p \leq 0.05$)

** means with different subscripts differ significantly with the 5 % level

Table 4.4 illustrates the means, standard deviations and p values for three activities across three criteria. The table illustrates that there is a statistically significant p value for the frequency of aided language stimulation and TTR. This indicates a statistically significant difference across all of the activities for these two criteria. It is evident that there is a statistically significant difference in the p value for the arts and crafts and story time activities, in terms of the frequency of aided language stimulation and TTR. It is postulated that the differences between the arts and crafts and story time activities may be attributed to the natures of these two activities. The story time activity, it may be argued, lends itself to more augmented input, as it is more tightly scripted than the arts and crafts activity (Goossens' et al., 2000). This tight script would facilitate efficiency in providing aided language stimulation, accounting for the higher mean in the aided language stimulation. This argument is supported by teachers who were trained in aided language stimulation having reported that they experienced the most difficulty using aided language stimulation with the arts and crafts

activity board (Dada & Alant, 2004). However, the tight script would limit the variety of words available, resulting in the story time activity having a statistically significant lower mean for the TTR when compared to the arts and crafts activity, as evidenced in Table 4.4.

4.4 Impact on Receptive Language Abilities

4.4.1 Acquisition of target vocabulary

Figures 4.2 to 4.5 illustrate the performance of the participants over the training period. While the aided language stimulation was provided in a group format to ensure treatment integrity across the participants, the results of the intervention are presented individually for each participant. Figure 4.2 illustrates participant A's performance during the three-week intervention period. A consistent pattern emerges for participant A. There is a stable baseline, and when the activity is introduced there a change in performance, which remains stable even after a new activity is introduced. Figure 4.2 (a) illustrates that participant A obtained 5/8 correct target items during the second probe of the intervention phase (week 1 day 3). This increased to 8/8 (week 1 day 5) and was maintained until the final probe (week 3 day 5) where it decreased by one point. This figure strongly indicates that the arts and crafts target vocabulary items were acquired during the intervention phase and maintained in the post intervention phase. A similar pattern is evident in Figure 4.2 (b), which indicates a fairly stable baseline (except for the probes in week 1 on day 3 and day 5). The intervention occurred in week 2 on day 1. On the second probe of the intervention phase (week 2 day 3), participant A obtained 6/8. This increased to 8/8, which was maintained for the next three probes. Finally, in the food preparation activity, shown in figure 4.2 (c), a stable baseline was evident until the intervention phase, which occurred in week 3 on day 1. Participant A scored 6/8 and 7/8 on the second and final probes (week 3, days 3 and 5) respectively.

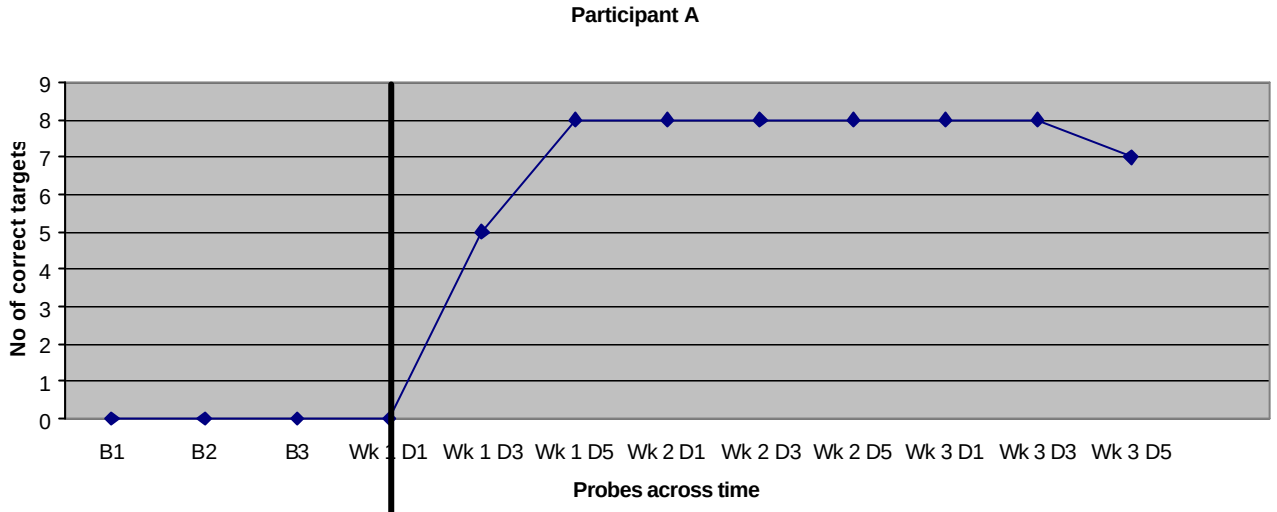

Figure 4.2(a) Arts and Crafts Activity

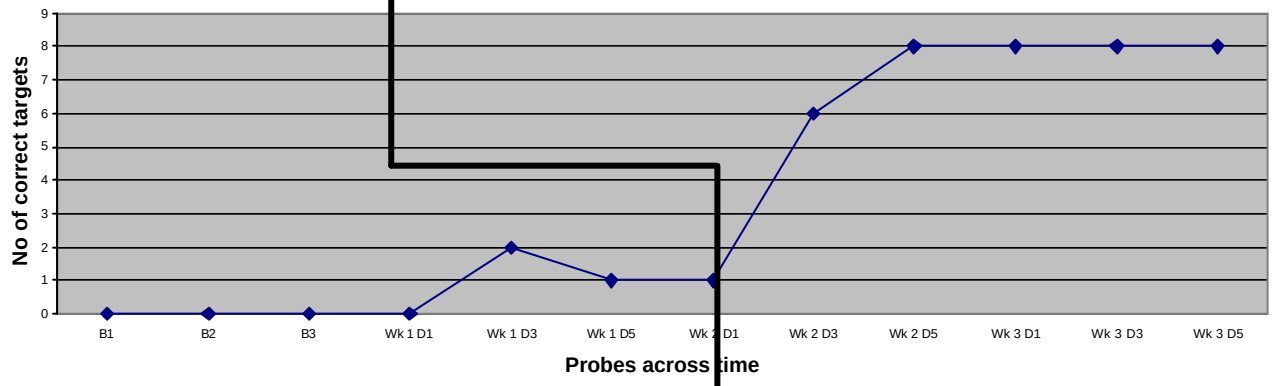

Figure 4.2(b) Food Preparation Activity

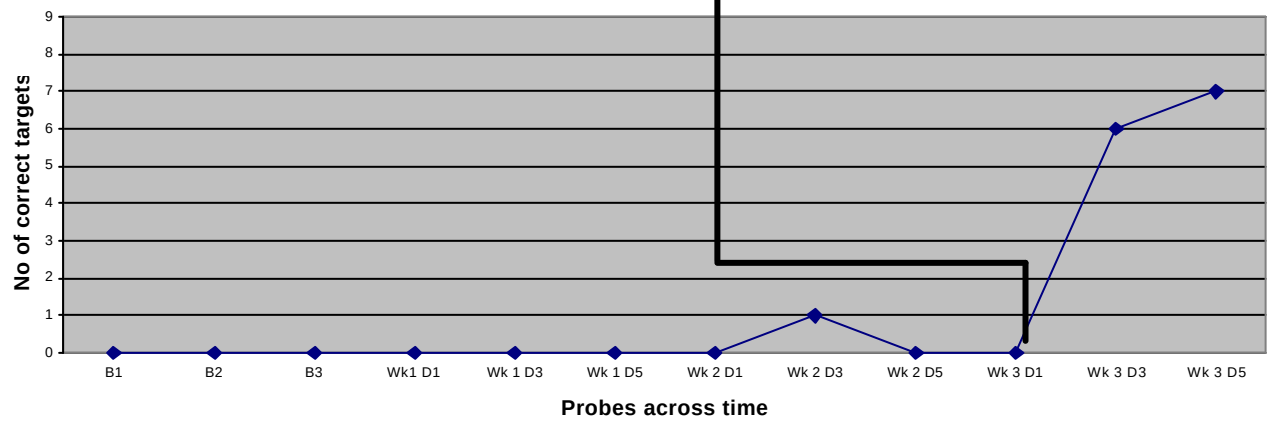

Figure 4.2(c) Story Time Activity

Figure 4.3 illustrates participant B's performance during the three-week intervention period. A consistent pattern emerges for participant B. There is a stable baseline and when the activity is introduced there a change in performance, which remains stable even after a new activity is introduced. Figure 4.3 (a) illustrates that Participant B obtained 2/8, 4/8 and 6/8 correct target items during the probes of the intervention phase (week 1; days 1, 3 and 5). This score increased to 8/8 during week 2 (day 1), and then decreased to 7/8 and 5/8 later during week 2, on days 3 and 5 respectively. In week 3 it increased again to 7/8 for two consecutive probes, and finally decreased by one point on the final probe, at 6/8. A similar pattern is evident in Figure 4.3 (b), which indicates a fairly stable baseline (except for the probe of week 1 day 5). The intervention occurred on week 2 day 1. On the second probe of the intervention phase (week 2 day 3), participant B obtained 6/8. This remained stable for two consecutive probes and increased to 7/8 for the last two consecutive probes in week 3. Finally, in the food preparation activity shown in Figure 4.3 (c), a fairly stable baseline (except during week 1 on days 3 and 5) was evident until the intervention phase, which occurred on week 3 day 1. Participant B scored 5/8 and 7/8 on the final two probes respectively.

Figure 4.4 illustrates participant C's performance during the three-week intervention period. A consistent pattern emerges for participant C. There is a stable baseline and when the activity is introduced there a change in performance, which remains stable even after a new activity is introduced. Figure 4.4 (a) illustrates that participant C obtained 3/8 correct target items during the second probe of the intervention phase (week 1 day 3). This increased to 8/8 on week 1 day 5, and dropped by two points on week 2 day 1. The next five consecutive probes yielded a consistent score of 7/8. This figure strongly indicates that the arts and crafts target vocabulary items were acquired during the intervention phase and maintained in the post intervention phase. A similar pattern is evident in Figure 4.4 (b), which indicates a fairly stable baseline. The intervention occurred on week 2 day 1. On the second probe of the intervention phase, participant C obtained 6/8 (week 2 day 3). This increased to 8/8, which was maintained for the next four probes. Finally, in the food preparation activity illustrated in Figure 4.4 (c), a stable baseline was evident until the intervention phase,

which occurred on week 3 day 1. Participant C scored 5/8 on the second and final probes respectively (week 3, days 3 and 5).

Figure 4.5 illustrates participant D's performance during the three-week intervention period. A consistent pattern emerges for participant D. There is a stable baseline and when the activity is introduced there a change in performance, which remains stable even after a new activity is introduced. Figure 4.4 (a) illustrates a stable baseline with participant D obtaining 3/8 correct target items during the probe of week 1 day 5. This score increased to 7/8 (week 2 day 1), but dropped on the probes of week 2, to 5/8 and 2/8. The variable performance by Participant D in the arts and crafts activity after the intervention period may be attributed to the participant being tired and therefore not responding well. Alternatively, the participant could have been more engaged in the current intervention program viz. food preparation and therefore was less involved with the probe activity relating to the non target items. The participants performance increased again to 6/8 in the third week, and maintained at 7/8 for two consecutive probes. Figure 4.3 (b) indicates a fairly stable baseline. The intervention occurred on week 2 day 1. On the second and third probes of the intervention phase, participant D obtained 7/8. This decreased to 6/8, and then increased to 7/8 for the final two probes. Finally, in the food preparation activity illustrated in Figure, 4.3 (c) a stable baseline was evident until the intervention phase, which occurred in week 3 (day 1). Participant D scored 6/8 on the final two probes.

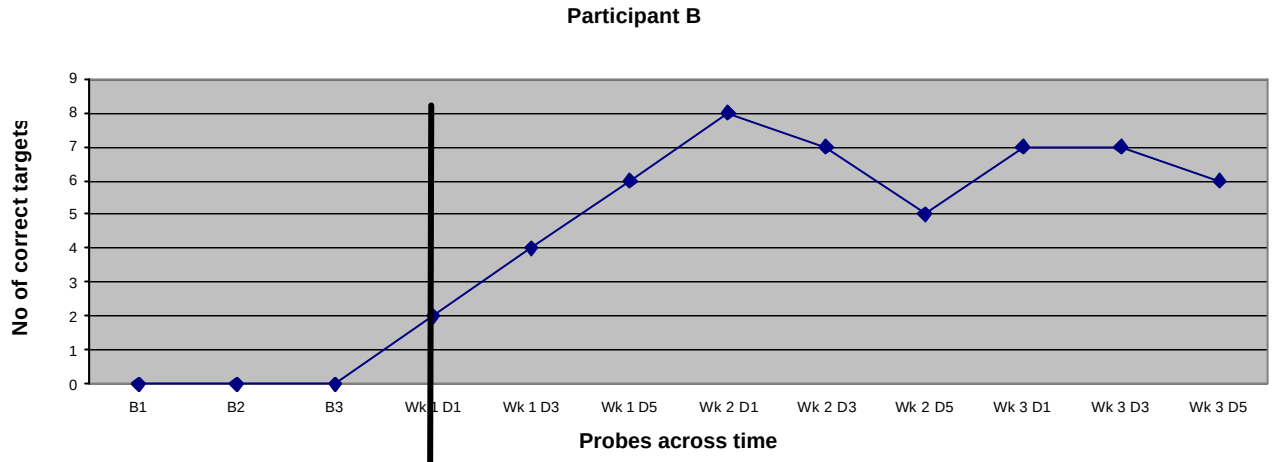

Figure 4.3(a) Arts and Crafts Activity

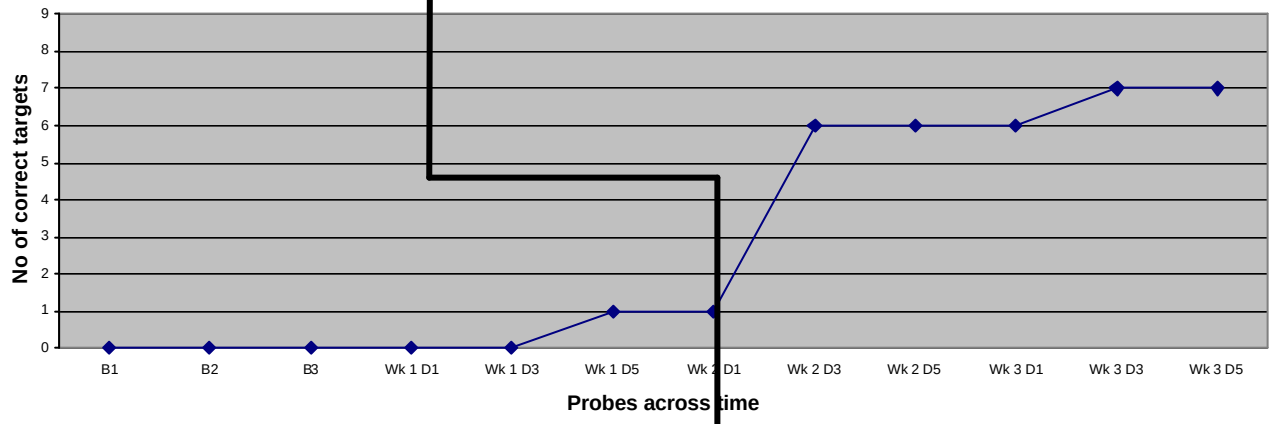

Figure 4.3 (b) Food Preparation Activity

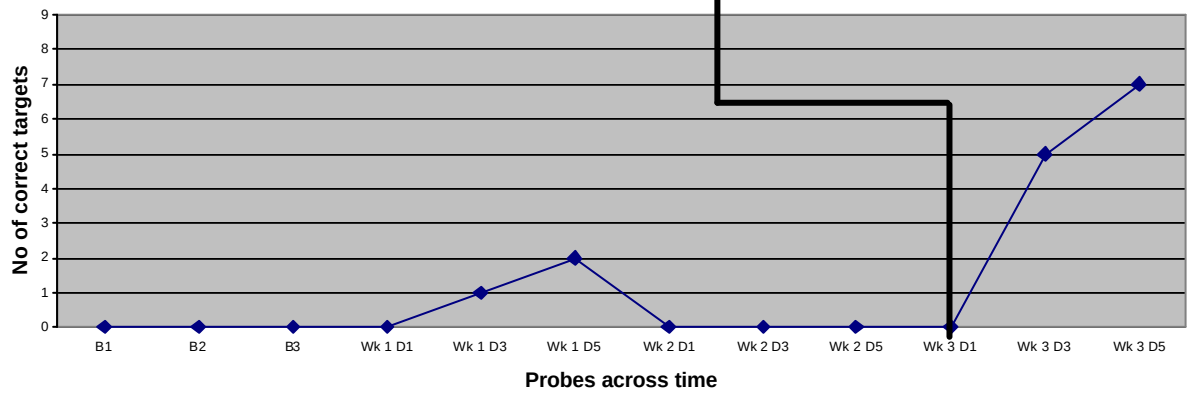

Figure 4.3(c) Story Time Activity

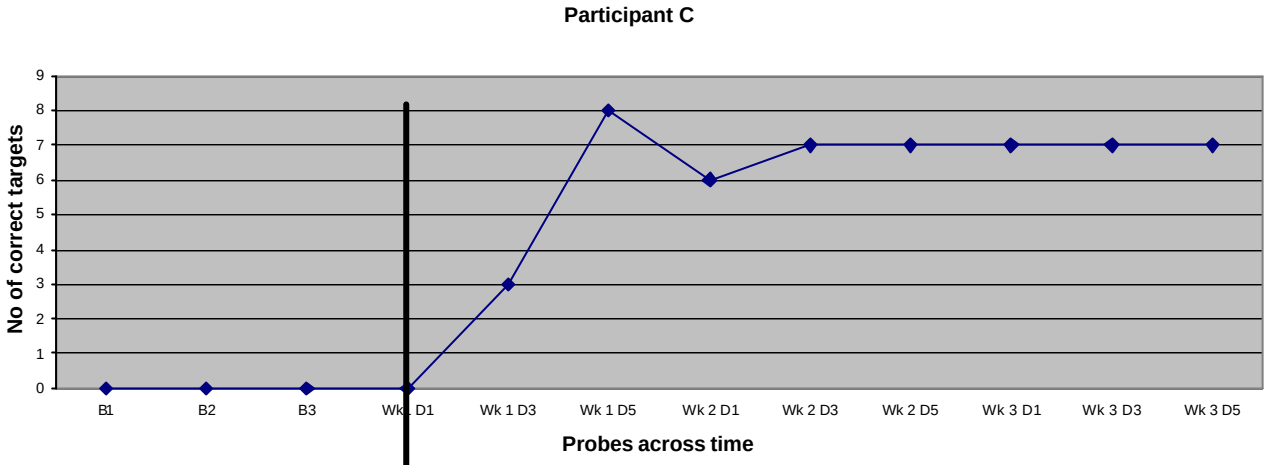

Figure 4.4(a) Arts and Crafts Activity

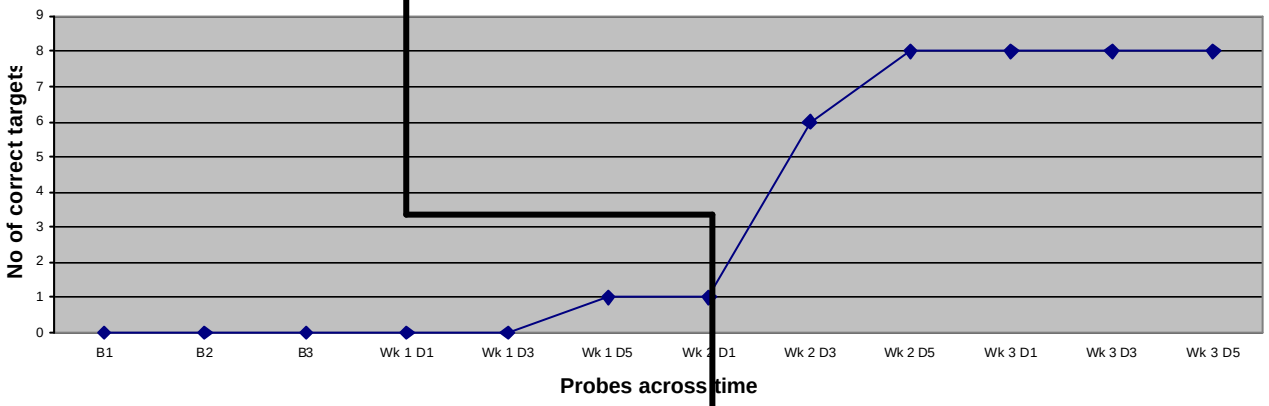

Figure 4.4(b) Food Preparation Activity

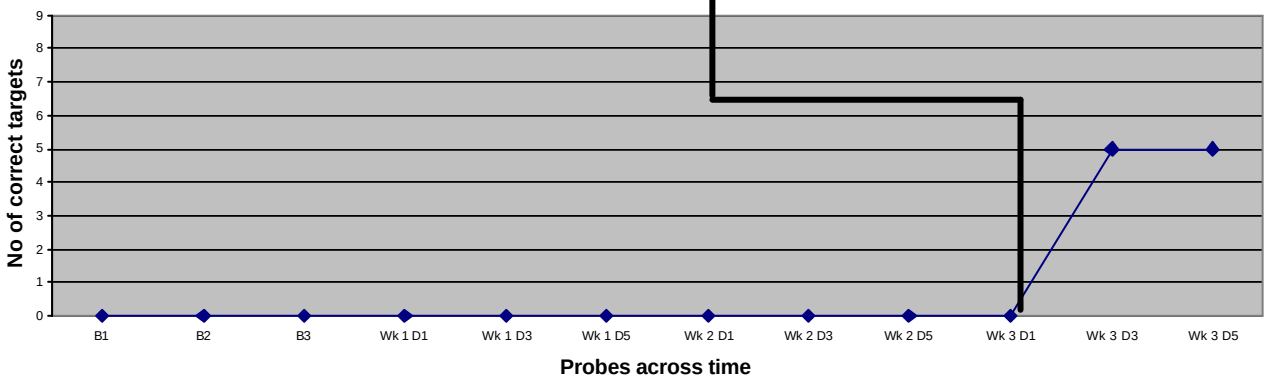

Figure 4.4(c) Story Time Activity

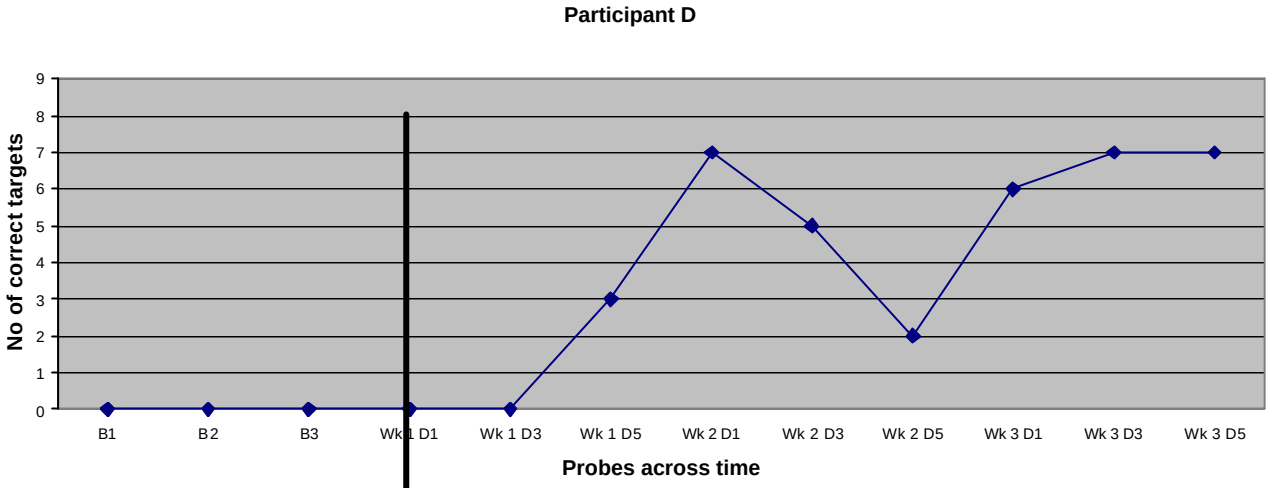

Figure 4.5(a) Arts and Crafts Activity

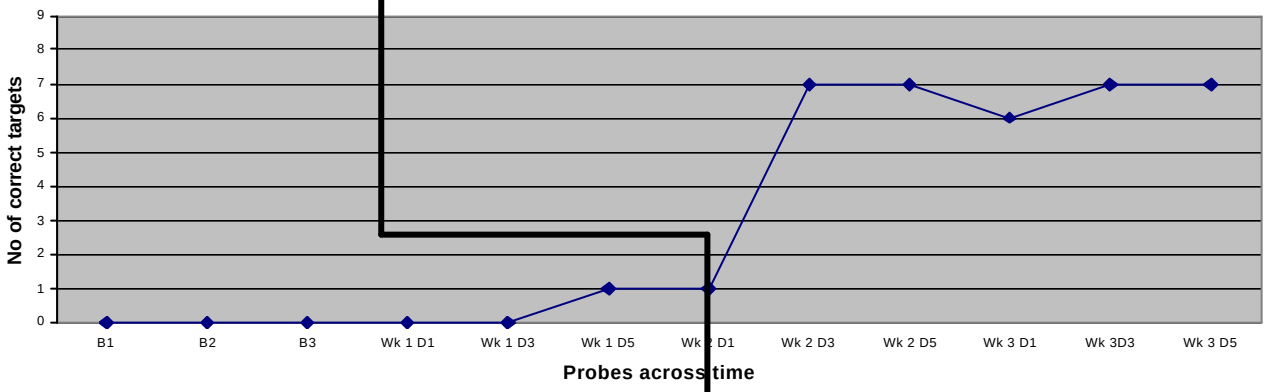

Figure 4.5(b) Food Preparation Activity

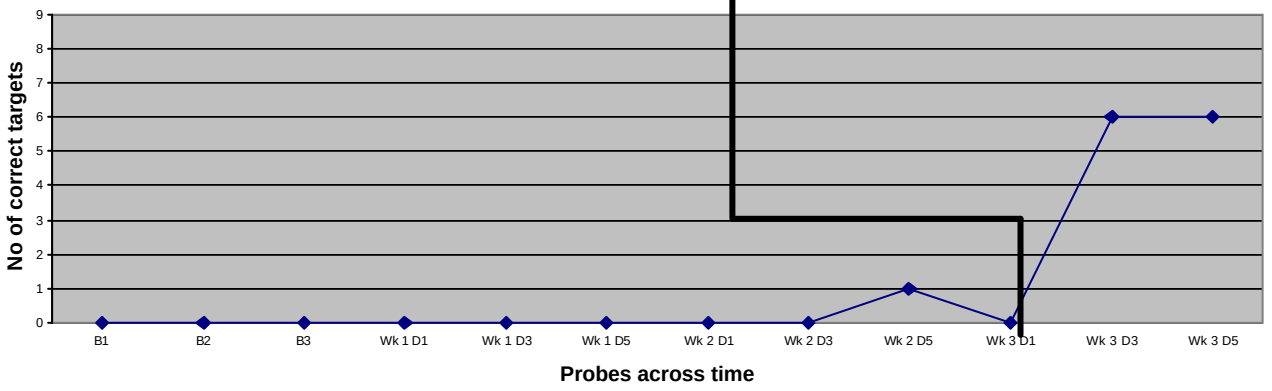

Figure 4.5(c) Story Time Activity

It is evident from Figures 4.2 to 4.5 that the introduction of the aided language stimulation program facilitated the acquisition of the target receptive vocabulary items for that activity. This performance was maintained during the weeks when aided language stimulation ceased for that particular activity. The results in these figures indicate that aided language stimulation had a positive impact on the acquisition of the target receptive vocabulary items.

The findings further support the literature, which indicates that augmented input plays a facilitated role in language development in persons with LNFS (see Chapter 2, Section 2.7.4 for discussions on these various studies). It is postulated that the augmented input played a facilitatory role in the acquisition of the target vocabulary items for a variety of reasons. A possible explanation is that the aided language stimulation program was rich in contextual learning due to its activity-based nature. Research suggests that vocabulary acquisition is highly dependent on experience (Watkins & DeThorne, 2000), indicating that vocabulary comprehension and production are linked closely to environmental experience, interactions and exposure. Environmental experience plays an important role, according to Light and Lindsay (1991), in developing our models of the world. Such models are actively constructed based on experiences and encounters, and they allow us to anticipate events that will occur next. Our internal models are the source of our knowledge and are constructed gradually from experiences. Persons with LNFS have different experiences (McNaughton & Lindsay, 1995) and a potentially restricted knowledge base, due to the limited experiences or opportunities which are available to them (in terms of the participant's personal experiences and his or her individual models of the world) and which could be a contributing factor in the rate of vocabulary acquisition. Crais (1990) further supports the role of environment, and relates vocabulary development to both overall speech comprehension and the learning environment. The important role of the environment in language acquisition is highlighted in Chapter 2 Section 2.3, and was added to Bedrosian's (1997) model of language acquisition for AAC users. This model may provide valuable insights into disparities in terms of the frequency and rate of acquisition of target vocabulary items across the participants.

While Figures 4.2 to 4.5 indicate that the participants acquired most of the target vocabulary items, there are individual differences across participants. This may be attributed to a variety of factors. The first factor to be discussed relates to the child component of Bedrosian's (1997) model (Figure 2.1), particularly speech comprehension abilities. A factor commonly discussed in the literature is that of the participants' speech comprehension skills. The literature argues that children or participants who have good speech comprehension abilities are more successful with picture-based language systems than are those who have poor or no language comprehension skills (Carr, Wilkinson, Blackman, & McIlvane, 2000; Franklin et al., 1996; Mollica, 2003; Romski & Sevcik, 1992, 1993a; Rowland & Schweigert, 2000; Sevcik & Romski, 1986, 1997). These studies generally found that participants with better speech comprehension skills acquired picture-based language systems better than their counterparts with poorer speech comprehension skills. Sevcik, Romski and Wilkinson (1991) argue that the comprehension of spoken language is evidence of functioning at a symbolic level, which enables the recasting of existing knowledge, both conceptual and linguistic, onto the picture-based language form. However, this does not imply that picture-based representation should be postponed until an individual demonstrates language comprehension skills. The diversity in terms of the participants' receptive language skills is evident in Table 4.7. It is clear from the table that participants B and D performed better on the receptive language tasks. It is also evident from Table 4.5 that they acquired the target items faster.

Language researchers indicate, with considerable evidence, that children are active in the language learning process and use their existing knowledge, both perceptual and linguistic, to organize new words. This process of learning new words is referred to as mapping, and was discussed in Chapter 2 Section 2.5.3. It was argued that speech comprehension abilities play an important role in the acquisition of novel vocabulary items through mapping (Sevcik & Romski 1986). Research indicates that many children who acquire AAC are able to fast map, which would account for the rapid acquisition of the targets by some participants (Hunt-Berg, 1996; Romski et al., 1996; Sevcik & Romski 1986).

An important and related concept that could potentially explain the differences in acquisition of targets relates to that of "symbolic sensitivity", a term coined by DeLoache, et al.,(1999). This refers to a general readiness to look for symbolic relationships between symbols and their referents. Participants with this sensitivity would acquire symbols or new vocabulary items more easily than participants without this sensitivity.

Differences in participants' performances may be related to other intrinsic or personal factors as well. Rowland and Schweigert (2000) suggest that motivation is an important factor which facilitates learning, and that activities should therefore be structured around tasks that are enjoyable. Another factor cited by Mollica (2003) is that of neurological functioning, particularly that of visual perceptual systems, which are integral to the acquisition of picture-based language representation. The participants in this study reportedly had functional perceptual skills, though three had all suffered insult to the central nervous system. It is therefore possible that their visual systems may also have been mildly affected, which may account for the varying performances by the participants (Damasio, 1985; Troscianko 1987). Individual learning styles (Nelson, 1973; Iacono,1992) is another potential area that could explain individual differences. While learning styles are difficult to determine in AAC users (Iacono, 1992), they have the potential to play an important role in vocabulary acquisition. Iacono (1992) suggests that learners with gestalt methods of processing and expressive styles would prefer aided symbols, namely PCS, where they can use a single selection to express a whole phrase. Those who use analytical processing and referential styles may prefer to encode word for word, and would therefore prefer highly iconic symbols. While the learning styles of the participants in this study are not known, it is important to consider the variety of factors that influence vocabulary acquisition, in order to understand the comprehensive nature of vocabulary acquisition and development.

The areas of cognitive processing (including executive processes), selective attention, and long term memory (including declarative, procedural and linguistic knowledge) are important personal factors that could influence the participants' learning (Light & Lindsay, 1991). The latter authors also suggest that motor systems and vocalizations are critical to learning, because they initiate a feedback loop through which the child can learn about the

environment. The participants in this study all presented with similar motoric abilities, although there were variations in their vocalizations—the extent of which was not assessed. It is evident that the variations at a personal level amongst participants are many. Wachs (1996) points out that there are multiple influences on development and that many of these influences covary with each other.

The second component of Bedrosian's (1997) model that is important to consider is that of the AAC system, and particularly the factors influencing graphic symbol learning. This includes the iconicity of the symbols (Fuller, Lloyd & Schlosser, 1997; Mizuko & Reichle, 1989). Iconicity is a multidimensional phenomenon that is influenced by various factors, including shape, color, size and possibly culture (Biederman, 1987; Fuller et al., 1997; Sigel 1978). The iconicity of the vocabulary items in this study varied substantially, from highly iconic (viz. sheep, strawberry, pink, broke) to translucent symbols (more, less, cotton wool, same, different, messy, decorate, soft, hard, high, low, hot, cold, empty, full, yummy, taste, big, small), and finally an opaque symbol (three). The features of PCS symbols are also important in terms of understanding how the symbols are processed. Mc Naughton and Lindsay (1995) suggest that the processing of graphic symbols has implications for literacy acquisition. They describe type one geometric structures as comprising more pictures or line drawings, while type two algebraic structures are exemplified by sequenced symbols such as Blissymbolics and traditional orthography. The influence of the type of structure on literacy acquisition is explored in the above-mentioned literature. Hence, graphic symbols with type two structure are potentially more closely related to traditional orthography. PCS symbols used in this study, which were primarily a symbol set (Lloyd, et al., 1997), have a type one classification. The implications of the type of structure of graphic symbols for vocabulary acquisition or language learning are not evident in the literature. It is postulated that the difference in the type of structure of PCS (i.e. type 1) and speech (i.e. type 2) may have a contribution towards vocabulary acquisition. This can also be placed within the context of the asymmetry between the input (speech and PCS) and output (PCS) modalities. The differences across modalities include the auditory and visual modality differences as well as type of structure.

The final two components of the model relate to the instruction and the partner. Regarding the issue of instruction, it is interesting to note that the aided language stimulation program did not include the use of Voice Output Communication Aids (VOCAs). This was in contrast with the SAL (as outlined in Chapter 2 Section 2.7.2), in which one component of the SAL was a VOCA. In addition, the literature indicates the important role that VOCAs play in improving both expressive and receptive language abilities (Brady 2000; Light, Roberts, Dimarco & Greiner, 1998; Paul, 1997; Romski & Sevcik, 1996). Brady (2000) studied the impact of a VOCA to teach two children with severe cognitive disabilities to request objects. Her findings indicated a relationship between VOCA use and gains in speech comprehension abilities. In addition, Schlosser, et al., (1995) found that participants in their study required fewer trails to learn abstract graphic symbols when using a VOCA when compared to a system without VOCA. There are, however, other studies that indicate that children with disabilities are able to acquire graphic AAC symbols for communication purposes, without the use of VOCAs (Bondy & Frost, 1993; Lloyd et al., 1997; Schepis & Reid 1995; Sigafoos, 1998). The findings of the current study support the literature, which indicates that children with developmental disabilities are able to point to graphic symbols to communicate, and that graphic symbols can be used to facilitate language learning.

The instructions and partner components of the model are postulated to have a smaller effect on the individual variations in the participants' acquisition of the target vocabulary items, as these two components were kept consistent over the four participants. The same partner, that is, the researcher, was utilized each time to provide the aided language stimulation program. In addition, presentation of the aided language stimulation in a group format ensured that all the participants received the same input. Group format rather than a one-on-one format was selected for a variety of reasons. Firstly, it ensured that the same treatment was applied across participants; and secondly, it is more consistent with current clinical practice. One-on-one training paradigms usually involve the therapist and child in a distraction-free environment. The intervention is focused on predetermined goals. The efficacy of such training is well documented (Lovaas, Berberich, Perloff & Schaffer, 1966; Risley & Wolf, 1967). However, the most severe criticism of one-on-one training is that while it does facilitate the teaching of language form, it is not comprehensive enough to

facilitate learning the function of language (Oliver & Halle, 1982). In addition, it is usually structured and therefore fails to generalize across settings. This method would therefore contradict the principle of using natural communication environments and highly contextualized settings (Paul, 1990), which is currently strongly advocated in the literature as a preferred communication instruction (Beukelman & Mirenda, 1992; Calculator, 1988; Romski & Sevcik, 1988b; Calculator & Jorgensen, 1991). However, Yoder et al., (1991) indicate that the superiority of the communication instruction should be considered in relation to the developmental level of the child. The aided language stimulation program, which is in line with using a natural communication environment for instruction, was activity-based.

Table 4.5: Number of correct responses for each participant on each activity												
	Arts and crafts Activity				**Food preparation activity**				**Story time activity**			
Probes	**Participants**				**Participants**				**Participants**			
	A	**B**	**C**	**D**	**A**	**B**	**C**	**D**	**A**	**B**	**C**	**D**
Baseline 1	0	0	0	0	0	0	0	0	0	0	0	0
Baseline 2	0	0	0	0	0	0	0	0	0	0	0	0
Baseline 3	0	0	0	0	0	0	0	0	0	0	0	0
Week 1 Day 1	0	2	0	0	0	0	0	0	0	0	0	0
Week 1 Day 3	0	4	3	0	0	0	0	0	0	1	0	0
Week 1 Day 5	3	6	8	3	1	1	1	1	0	2	0	0
Week 2 Day 1	7	8	6	7	2	1	1	1	0	0	0	0
Week 2 Day 3	5	7	7	5	7	7	6	7	0	0	0	0
Week 2 Day 5	2	5	7	2	7	7	8	7	1	0	0	1
Week 3 Day 1	6	7	7	6	6	7	8	6	0	0	0	0
Week 3 Day 3	7	7	7	7	7	8	8	7	6	5	5	6
Week 3 Day 5	7	6	7	7	7	8	8	7	6	7	5	6

4.4.2 Participants' performance for each activity

Table 4.5 illustrates all the participants' performances across all three activities. It is evident that the participants obtained a stable baseline across activities. For the arts and crafts activity, the participants acquired the target items during week one, the intervention phase. However, their performance improved even when the implementation of the arts and crafts activity had ceased. For the remaining probes, there is fluctuation across participants (except participants A and C). The participants' performance on the food preparation activity was consistent. During the final probe the participants obtained either 7/8 or 8/8, indicating that each participant acquired the target items for the food preparation activity. A similar trend occurs for the story time activity. The participants obtained a stable baseline until the implementation of the activity in week three. During the final probe they obtained scores of between 5/8 and 7/8. This indicates the acquisition of the target vocabulary items after the introduction of the activity. Table 4.6 provides greater insights into exactly which target vocabulary items were acquired. However, it should be noted that all the target items for the story time activity were not acquired during the intervention period. It is possible that the items were not acquired, as the trend of the other activities is that the maximum score was usually achieved in following the intervention period after the final exposure to the aided language stimulation program.

It is interesting to note that the acquisition of target vocabulary items, despite the diverse performances of participants, was clearly evident for each participant. It is postulated that the emphasis of aided language stimulation on activity-based intervention provides an impetus for language learning. Theorists suggest that learning is facilitated through social interaction or processes (Vygotsky, 1978) and through the active participation of the child (Piaget, 1967), and commences at the student's point of understanding—thereby encouraging the child's full participation (Dewey, 1976). These are important conceptual foundations for learning, and it has been argued that activity-based intervention is strongly aligned towards these concepts (Bricker & Cripe, 1992). Activity-based intervention has been the subject of much research (Giumento, 1990; Bricker & Gumerlock, 1988; Bailey & Bricker 1985; Bricker & Sheehan, 1981). The

results generally indicate that with activity-based intervention, children acquire skills rapidly and also generalize skills to other contexts.

Rowland and Schweigert (1993) have identified variables in the environment that may affect functional communication. The nature of the activity is one such variable, and they argue that the degree of congruency between an activity and a participant's preferences can affect the participant's communication. There are five other identified variables which may influence the probability of functional communication. These include, firstly, the adequacy of the child's communication system, and secondly its adequacy to facilitate interaction, participation and initiation during communication. The third aspect relates to the adults' interactional style, with directive styles resulting in fewer opportunities for the child to initiate, and more responsive communication partners facilitating the child's communicative performance. Fourth, the materials used are important; and fifth, the group dynamics and specific provision of opportunities for communication are also important.

Activity-based intervention, as with aided language stimulation, emphasizes the importance of group work. In the current study, an activity-based aided language stimulation program was presented in a group format. This format was used to ensure procedural integrity. However, it was also postulated that this format would be useful, as it would facilitate cooperative learning—which would ensure the child's involvement in the learning processes. Cooperative learning is described as having four elements that are crucial to learning (Johnson, Johnson, Holubec & Roy, 1984), and which are aligned with activity-based intervention due to their stance that the child is active in the learning process. The first element is positive interdependence, which refers to goal structures that are aligned to the lesson. In the case of the aided language stimulation program, the target vocabulary items were selected based on the nature of the activity. There was an element of individual accountability since each participant was probed individually. Finally, the small group format would facilitate social interaction and learning through the interactions.

4.4.3 The acquisition of specific target vocabulary items

Table 4.6 illustrates the acquisition of each vocabulary item for the four participants during each probe. It is evident that the vocabulary items were acquired across the participants during the probes. The frequency with which the targets were acquired is presented in Figure 4.6.

Table 4.6 The acquisition of specific target vocabulary items over the intervention period

No	**Target**	**Word class**	**Number of participants with the correct responses**								
			Week 1 Day 1	Week 1 Day 3	Week 1 Day 5	Week 2 Day 1	Week 2 Day 3	Week 2 Day 5	Week 3 Day 1	Week 3 Day 3	Week 3 Day 5
1	Sheep	Noun	1	3	4	4	4	4	4	4	4
2	Cotton wool	Noun	0	1	3	4	4	4	4	4	4
3	More	Adjective	0	1	3	4	3	4	4	4	4
4	Less	Adjective	1	1	3	4	3	3	3	3	3
5	Decoration	Noun	0	0	4	4	4	4	4	4	4
6	Messy	Adjective	0	2	4	4	4	4	4	4	4
7	Same	Adjective	0	1	2	3	3	2	3	4	3
8	Different	Adjective	0	1	2	3	3	2	3	4	3
9	Taste	Verb	0	0	0	0	4	4	4	4	4
10	Yummy	Adjective	0	0	2	1	4	4	4	4	4
11	Strawberry	Noun	0	1	0	0	3	4	3	3	4
12	Empty	Adjective	0	1	0	1	2	3	3	3	3
13	Full	Adjective	0	0	0	0	3	4	4	4	4
14	Big	Adjective	0	0	0	0	4	4	4	4	4
15	Small	Adjective	0	0	2	1	4	4	3	4	4
16	Pink	Adjective	0	0	0	0	3	1	2	3	3

No	Target	Word class	Number of participants with the correct responses								
			Week 1 Day 1	Week 1 Day 3	Week 1 Day 5	Week 2 Day 1	Week 2 Day 3	Week 2 Day 5	Week 3 Day 1	Week 3 Day 3	Week 3 Day 5
17	High	Adjective	0	0	0	0	1	0	0	4	4
18	Low	Adjective	0	0	0	0	0	0	0	4	4
19	Soft	Adjective	0	0	0	0	0	0	0	2	3
20	Hard	Adjective	0	0	0	0	0	0	0	1	0
21	Three	Adjective	0	0	0	0	0	0	0	4	2
22	Hot	Adjective	0	0	0	0	0	0	0	3	4
23	Cold	Adjective	0	0	0	0	0	0	0	4	4
24	Broken	Adverb	0	0	0	0	0	0	1	2	4

Figure 4.6 illustrates the frequency of correct responses for the target vocabulary items. It illustrates that the targets “yummy” and “small” were correct with a frequency of 75%. This was followed by “sheep”, “taste”, “big”, “high”, “low” and “cold” with a frequency of 67%. The targets “strawberry”, “full” and “hot” obtained a frequency of 58% and “messy”, “empty,” “three” and “broken” with a frequency of 50%. “Less” and “soft” were correct with a frequency if 42%, “cotton wool”, “more”, “decoration”, “pink”, “same”, “different” and “hard” were correct with a frequency of 34%. Finally the targets “pink”, “same” and “different” were acquired with a 25% frequency and “hard” with 8%. It is evident that the targets were acquired with varying frequencies across the various activities.

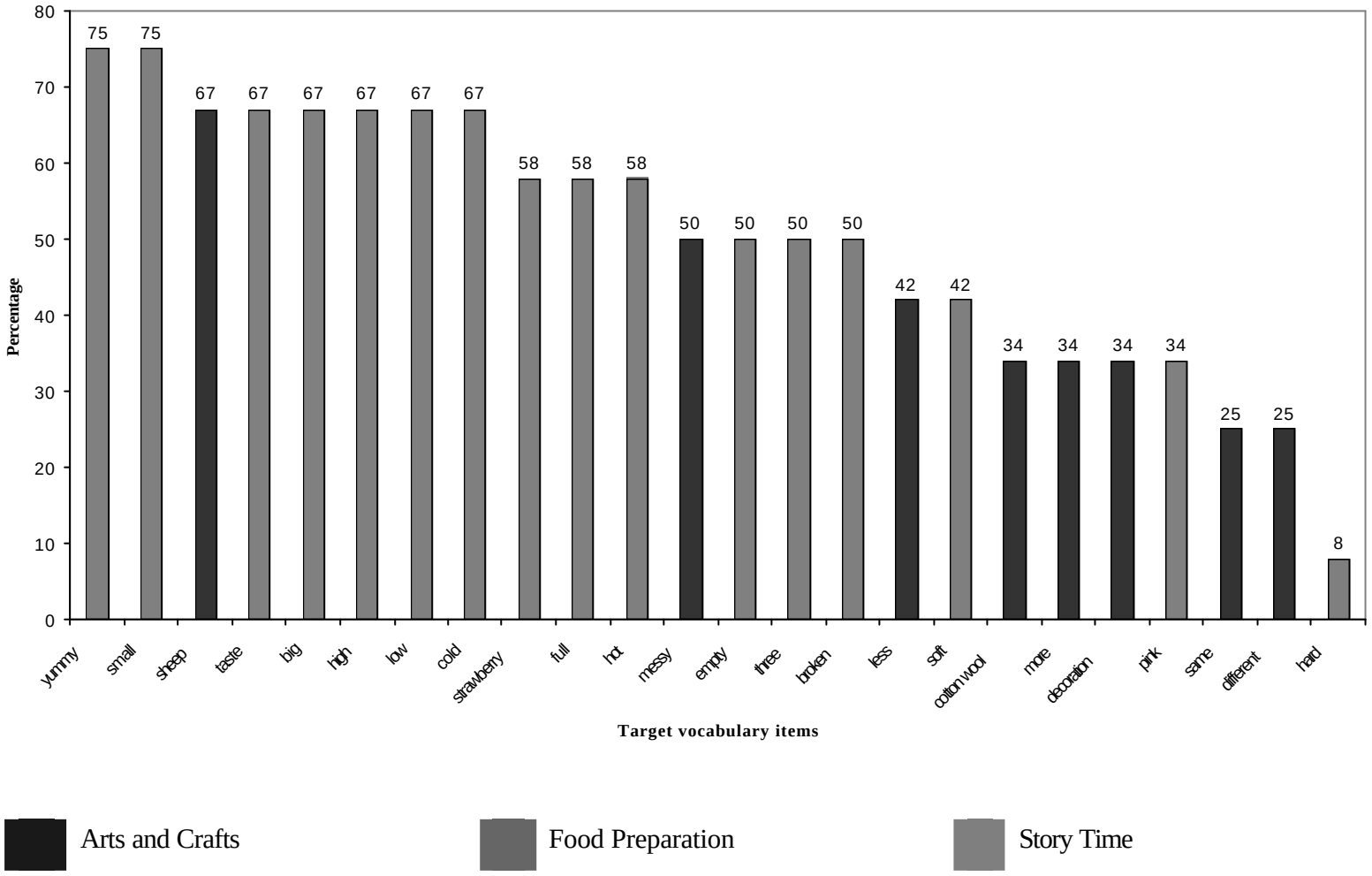

Figure 4.6 Frequency of acquisition of targets

4.5 Comparison of the frequency of aided language stimulation input and correct responses

Figure 4.7 (a-c) illustrates the mean input required for certain outputs (in this case number of correct responses) across all four participants for each activity. Figure. 4.7 (a-c) illustrates that as the mean input for the target vocabulary item increases the number of correct responses by the participants increases. Figure 4.7 (a) illustrates that for the target "sheep", the participants obtained three correct responses after a mean input of 69. However, the figure also illustrates that despite a mean input of 94, participants only got one correct response for the target "decoration". This seems to suggest that the vocabulary items themselves have a role in the acquisition process.

Figure 4.7 (b) illustrates a similar trend, with the number of correct responses increasing as the mean input increases. Again it is evident that the mean input does not necessarily imply that the target will be acquired. For example, the target "taste" has a mean input of 133 and two correct responses; while with a mean input of 59, 87 and 90 respectively, the targets "small", "empty" and "yummy" have three correct responses each. Finally, Figure 4.7 (c) illustrates that the target "broken" had three correct responses with a mean input of 33. This was the only target for this activity that had three correct responses. The remaining targets achieved a maximum of two correct responses each, with mean inputs varying between 26 and 55.

It is evident from Figure 4.7 (a-c) that the number of correct responses increases as the mean input increases. This tends to indicate that the aided language input had a facilitatory role on the acquisition of the target vocabulary items. The literature, too, indicates that input is an important aspect of vocabulary acquisition (Chapter 2 Section 2.4). Whitehurst (1997), in particular, concluded that vocabulary acquisition is the aspect of language that is most influenced by the nature of the input. Another study by Harris et al., (1988) indicated that there is a strong relationship between the frequency of the use of words by mothers and the acquisition of the same words by children.

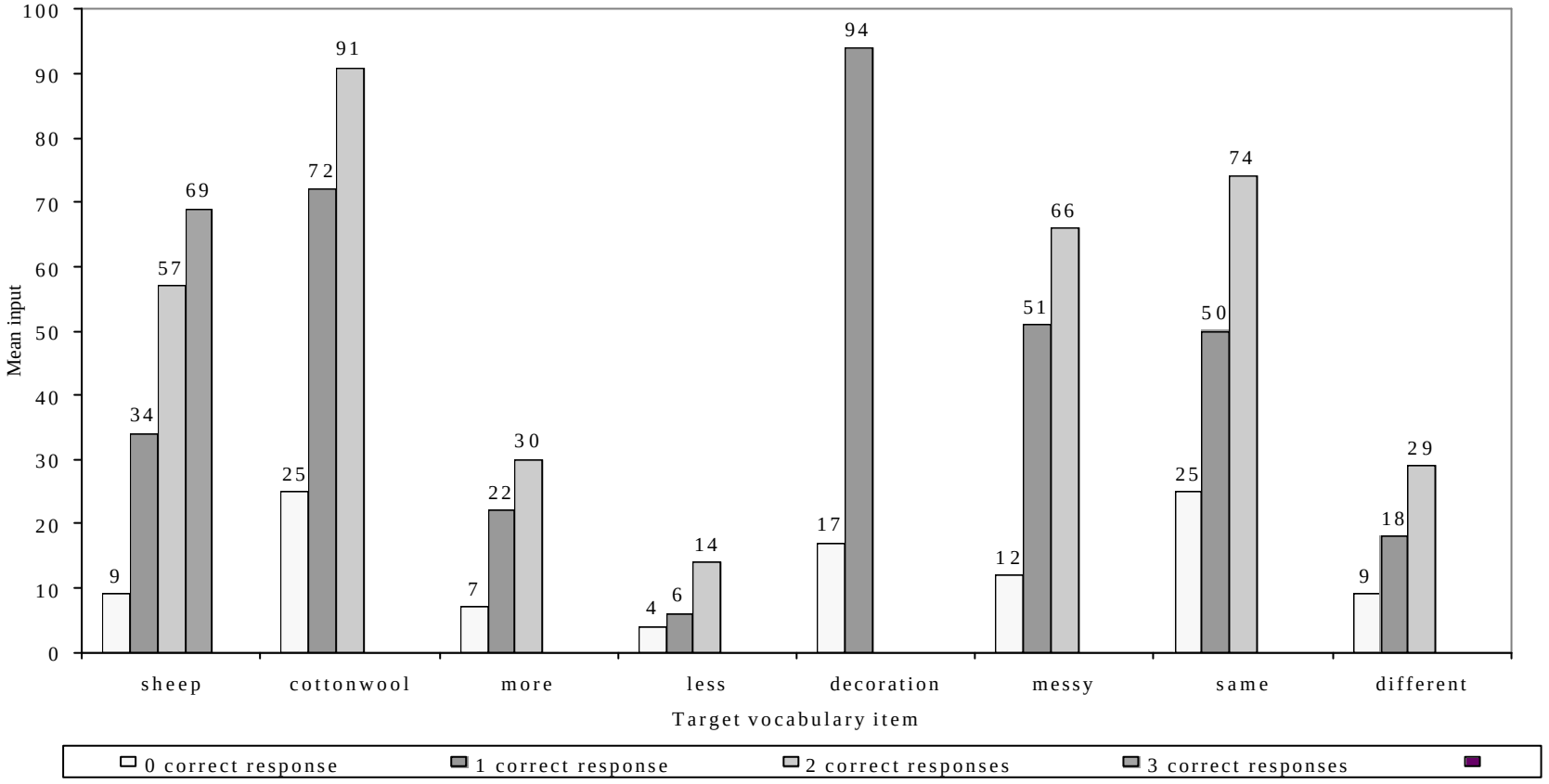

Figure 4.7 (a) Mean input for arts and crafts activity

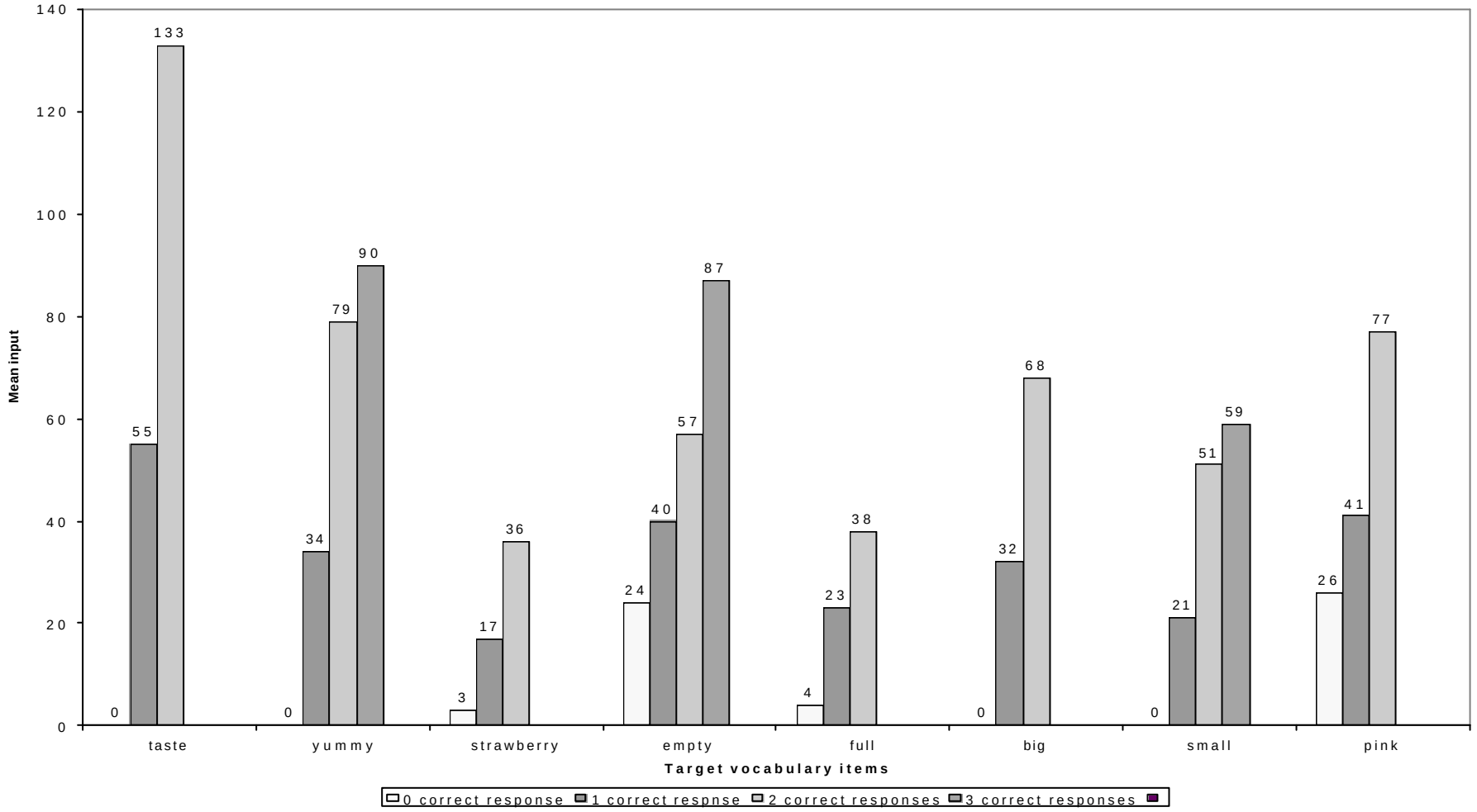

Figure 4.7 (b) Mean input for food preparation activity

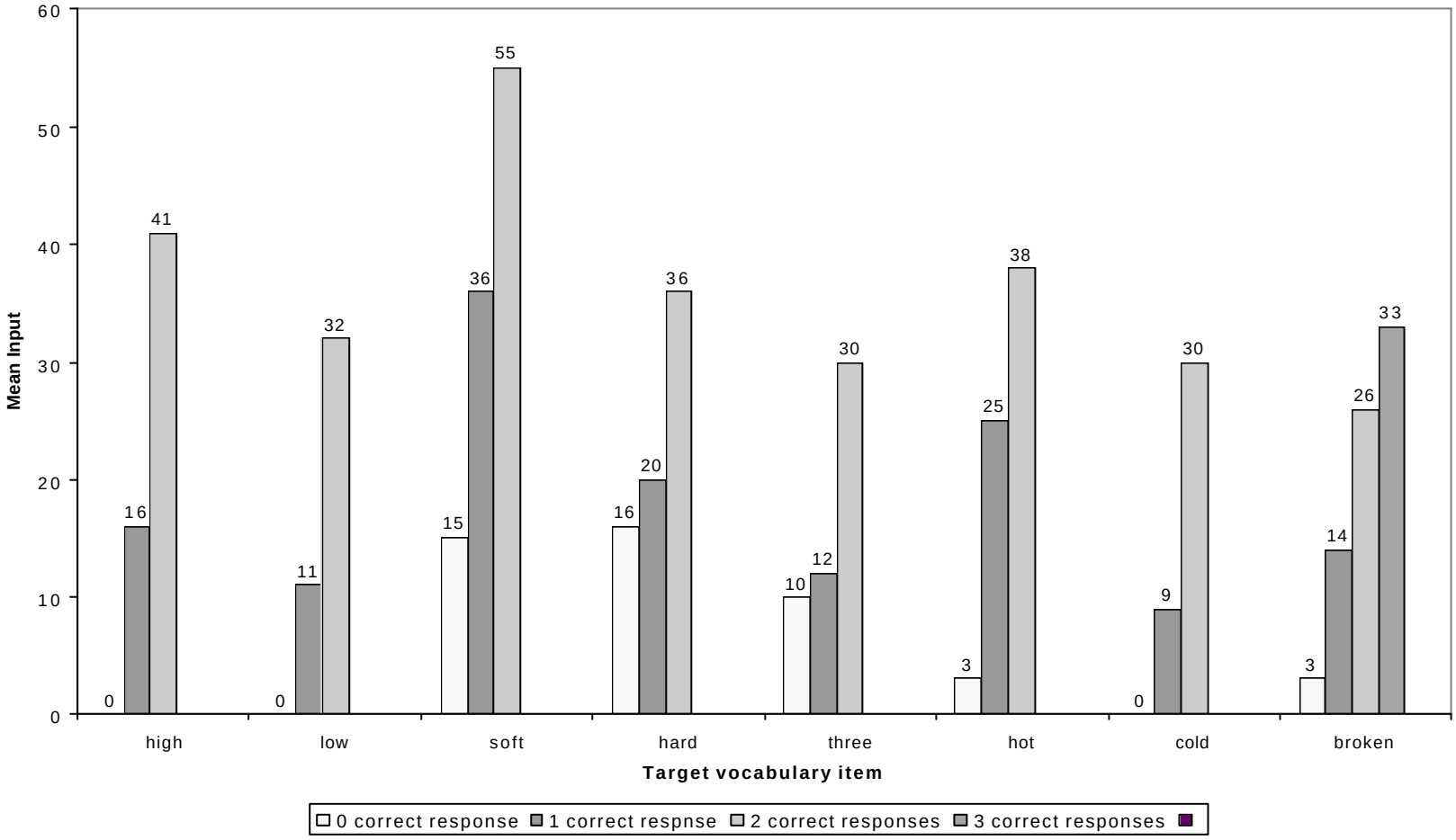

Figure 4.7 (b) Mean input for story time activity

While there is evidence that input plays an important role in vocabulary acquisition, there is little information on the frequency of input to facilitate vocabulary acquisition. The total physical response method proposed by Asher (1977) used within the field of second language acquisition proposes that at least ten hours of instruction, made up primarily of commands, is required to facilitate acquisition. This method is conceptually similar to aided language stimulation as it emphasizes the building of receptive language prior to expecting expressive skills. Further, it suggests that sufficient quantities of input are required. However, within the field of aided language stimulation, there are no set criteria for the amount of input required. The current aided language stimulation program comprised five 45-minute sessions per activity, totaling three and a quarter hours, which is lower than the amount proposed by Asher. The issue of sufficient input is important because input above the required amount may become redundant and may therefore not be utilized by the participant. It is possible that additional vocabulary items could be introduced instead, thereby providing more efficient use of intervention time. On the other hand, it could be argued that while we are not certain of the precise amount of input required to facilitate learning, the redundant input may play a facilitatory role in maintaining the target items in the non-intervention period, as evidenced in Figures 4.2 to 4.5.

4.6 Impact of aided language stimulation program on general receptive language abilities

The participants' performances on the pre- and post-assessment measures are indicated in Table 4.7 below. The table indicates that there was an improvement in performance, in terms of raw scores obtained, for all the participants on all the measures. This indicates that there was a general improvement in their language skills as measured by the assessment measures listed below.

Table 4.7 The raw scores of each participant on the pre- and post-intervention assessment measures

	Pre-intervention assessment measures					Post-intervention assessment measures				
Participant	PPVT - R	Language age (in years from test)	Reynell Expressive Scale	Reynell Receptive scale	Informal Language Test	PPVT - R	Language age (in years from test)	Reynell Expressive Scale	Reynell Receptive scale	Informal Language Test
A	15	4.0	11	36	24	26	4.5	13	40	41
B	18	4.0	15	40	35	40	6.0	17	45	48
C	10	3.5	9	34	32	20	4.5	19	39	35
D	20	4.5	15	31	33	48	6.0	15	39	39

While this difference in the raw scores seemed substantial, it needed to be ascertained statistically. Table 4.8 illustrates the means and standard deviations for the pre- and post-intervention assessment measures. The Wilcoxon test was used to determine whether the difference between the pre- and post-intervention assessment measures was statistically significant. It is a distribution free test and was suitable for this comparison (McMillan & Schumacher, 2001; Steyn et al., 2000). The 5% level of significance was utilized for this test.

Table 4.8 illustrates that there was no statistically significant difference between the pre- and post- intervention assessment measures. This may be attributed to two reasons. Firstly, the sample size was small and it is possible that this could have resulted in the difference not being statistically evident. A second reason may be that the assessment scales may not be suitable for determining small changes in performance. Crais (1990) argues that the difficulty with frequently used methods of assessing vocabulary (as in this study) is that they provide information on correct and incorrect responses, but little information on the type and degree of partial knowledge which the student possibly used. The results from such measures may therefore be limited. It is also possible that the intervention period of three may have been

too short for measurable changes to be noted in the general receptive language abilities of the participants.

Table 4.8 Mean, standard deviation and p value for receptive language assessment

No	Assessment Measures	Mean			Standard Deviation			p value
		Pre test	Post test	Difference	Pre test	Post test	Difference	
1	PPVT R	15.75	33.50	17.75	4.35	12.78	8.73	0.13
2	Language age (in years from test)	12.50	13.50	1.00	3.00	3.42	1.15	0.5
3	Reynell Expressive Scale	35.25	40.75	5.50	3.77	12.79	1.73	0.13
4	Reynell Receptive Scale	3.25	3.75	0.50	0.50	3.42	0.58	0.5
5	Informal Language Test: Section 1 - Action words	1.5	3.50	2.00	0.58	2.88	0.81	0.13
6	Informal Language Test: Section 2 - Early two-word relations	1.75	2.75	1.00	0.96	0.50	0.82	0.25

No.	Assessment Measures	Mean			Standard Deviation			P value
		Pretest	Post test	Difference	Pretest	Posttest	Difference	
7	Informal Language Test: Section 3- Assessing illocutionary intents in requests	5.75	7.25	1.50	2.63	2.50	1.91	0.5
8	Informal Language Test: Section 4- Comprehension of 2-3 word instructions.	3.25	3.50	0.25	2.22	1.91	0.50	1.0
9	Informal Language Test: Section 5 - Comprehension of locative body placement	15.50	20.00	4.50	3.11	1.41	4.20	0.25
10	Informal Language Test: Section 6 - Word order comprehension	31.10	40.70	9.75	4.84	5.44	6.39	0.13

* at 5% significance level ($p \leq 0.05$)

4.7 Summary

This chapter highlights the results of the aided language stimulation program. The reliability measures of data collection are presented. The impact of aided language stimulation on the acquisition of target vocabulary items for each of the four participants is presented. The results indicate that the aided language stimulation program facilitated the receptive acquisition of the target vocabulary items in most of the participants. A discussion of the variations in the rate of acquisition amongst participants is given, and reasons for the variations are postulated. Finally, the impact of the aided language stimulation program on the general receptive language abilities of the participants is discussed and the possible reasons for the absence of a statistically significant improvement in this area are discussed.

CHAPTER 5

CONCLUSIONS, EVALUATIONS AND RECOMMENDATIONS

5.1 Introduction

The aim of the current study was to determine the impact of an aided language stimulation program on the receptive language abilities of children with LNFS. The aided language stimulation program lasted three weeks. The study was primarily concerned with a description of the aided language input and its impact on the receptive language abilities of the participants, particularly in relation to their comprehension of the target vocabulary items.

This chapter contains a summary of the conclusions regarding the impact of the aided language stimulation program on the receptive language abilities of the participants. This is followed by a discussion of the clinical implications of the research, and an evaluation of the strengths and weaknesses of the study. Finally, recommendations are made for future research.

5.2 Conclusions

5.2.1 Reliability of data

The inter- rater agreement of all of the transcripts of the video recordings was between 90% and 95%, indicating good inter- rater agreement scores for the transcriptions of the video recordings. This was important as the transcripts formed the mature portion of the data utilized in this study. An inter- rater agreementscore of 90-95% was also achieved for 40 % of the transcripts in relation to the data contained within the transcripts, namely the nature and frequency of the aided language stimulation program as well as the TTR and MLU.

5.2.2 Description of the aided language stimulation program

The nature and frequency of the aided language stimulation for all five sessions of each activity met the criteria for aided language stimulation as stipulated by Goossens' et al. (2000). The criteria stipulated by Goossens' et al.(2000) is 70% for the frequency of aided

language stimulation. The results of the current study for the frequency of the aided language stimulation was between 76% and 93%, indicating more than adequate aided language stimulation. In addition, the nature of the aided language stimulation met the criteria stipulated by Goossens' et al. (2000) for a statement-to-question ratio of 80:20.

5.2.3 The impact on the acquisition of target vocabulary items

The impact of the aided language stimulation program on the participants' acquisition of the target vocabulary items varied, with participants comprehending most of the vocabulary items. The results indicated that the aided language stimulation program was effective in developing the participants' comprehension of the target vocabulary items. There was, however, no statistically significant improvement in their general receptive language abilities. This finding indicates that the impact of the aided language stimulation program was rather specific in facilitating the acquisition of the vocabulary items targeted in the aided language stimulation program.

5.3 Implications of the Study

The most important clinical implication of this study is that a three-week intervention program in aided language stimulation is sufficient to facilitate the acquisition of at least 24 vocabulary items receptively. This implication is supported by the findings that each participant acquired some of the receptive vocabulary items during each intervention week. The other implications include:

- While aided language stimulation is implemented in certain contexts within the pre-school environment, there has been limited research or evidence to describe its impact on the language development of children. The current study therefore marks the initial research attempt to systematically explore the impact of aided language stimulation on the receptive language abilities of children.

- The importance of activities in implementing aided language stimulation programs was highlighted by the current study. The activities provided a loose script for the aided

language stimulation, allowing for the researcher to provide sufficient and efficient aided language stimulation.

- The activities also provided a functional context and a language-rich environment to facilitate the provision of aided language input. The functional context also enabled the participants to experience the activities, which facilitated vocabulary learning.

- While the aided language stimulation program did not facilitate a statistically significant change in the participants' receptive language abilities, it is postulated that the intervention period of three weeks was too short to facilitate a change in this regard.

- The aided language stimulation program was implemented in a group format. This format ensures that the development of language skills need not only occur in one- on-one therapy sessions. The group format appeared to facilitate the acquisition of the targets, and ensured that the activities were in fact motivating to the participants. Furthermore, the group format ensured the continued motivation and participation of each of the participants. It is argued that this format allowed the participants to learn through collaborative learning.

- Finally, it should be noted that the aided language stimulation program did not include a component of VOCA's. The findings of this study therefore have important clinical implications for developing countries—in their contexts of limited resources or access to high-technology VOCA's. The results suggest that the acquisition of target receptive vocabulary items can be facilitated in the absence of VOCA's.

5.4 Evaluation of the Study

- One strength of this study is that the aided language stimulation program was compatible with the target vocabulary items utilized in the study. Thus, the aided language stimulation program could be used to facilitate the acquisition of the selected vocabulary items.

- Another strength of this study lies in its methodology of using a research design with multiple probes. The multiple probe design demonstrated that the changes in the acquisition of the target receptive vocabulary items occurred only after the intervention for those particular targets. There was a stable baseline prior to the implementation of each intervention.

- In addition, the group design ensured that the four participants received precisely the same aided language stimulation.

- The use of raters further increased the procedural integrity of the study. Raters were utilized in both the transcriptions of the video recordings as well as in the ratings of the analysis of the transcriptions.

- The organization of the aided language stimulation—five sessions per activity—is congruent with the five-day academic week for participants. The program can be aligned with the curriculum goals, to facilitate the monitoring of children's progress on a weekly basis.

- A weakness of the study was that it did not consider the expressive language component of the participants. Hence, there is little information on their development in this area.

- Finally, the study included only four participants, and is therefore limited in terms of the generalizability of results.

5.5 Recommendations for Future Research

Recommendations for future research are as follows:

- A replication of this study on a larger number of participants is warranted. This could include younger preschool children with LNFS. It is recommended that the multiple participants multiple baselines across behaviors in a group formant utilized in this study would be an appropriate design for such a study. A variety of configurations could be used in terms of the amount of input provided (Schlosser, 2003), so as to determine the impact of varying aided language inputs on the acquisition of the targets. The variations in input could vary in terms of the definitions of aided language stimulations 80% of the time as used in this study to 70%, 60% and 50% of the time. The variations in the nature of aided language stimulation will provide valuable insights in to the quantity of input necessary for vocabulary acquisitions

- Variations in terms of the outcomes of the aided language could also be extended to include the expressive language abilities of the participants. The acquisition of the target vocabulary items could be probed at both a receptive and expressive level. The intervention period of three weeks spanning five sessions each is thought to be sufficient to probe both the expressive and receptive language acquisition domains. In addition, it would be essential to ensure that the assessment measures of general language development utilized are sensitive to changes in language development albeit small changes.

- Aided language stimulation programs that have been adapted to suit the curriculum needs of the participants should be developed and implemented. Their impact on facilitating the learning of more academic skills should be explored. The use of aided language stimulation in teaching concepts relating to the weather, for example “rain formation” can be done using aided language stimulation. This can also be done using a control group design as discussed below.

- A control group design could be useful in contrasting the impact of aided language stimulation with the control condition of no aided language stimulation. The control group would receive the language stimulation program without the aided language input. However, matching of the two groups (to control for factors related to heterogeneity rather than the interventions) would be critical

- A control group design could also be useful in contrasting the impact of an aided language stimulation program with and without a VOCA. The role of VOCA in facilitating language development when used with aided language stimulation can be further explored. This would provide some information on the efficacy of aided language stimulation with or without VOCA for intervention purposes.

- A study exploring the impact of aided language stimulation on individuals who are unable to identify line drawings would provide valuable insights for clinical practice. R. Sevcik (personal communication, 5 March 2004) reported that in the preliminary findings of current research, the ability of participants to identify line drawings does not appear to play an important role in symbol learning.

5.6 Summary

This chapter summarizes the results of the research as described in Chapter 4. The positive impact of the aided language stimulation program is summarized. This is followed by a discussion of the clinical implications of the study. Through an evaluation of the research and discussion of the current study's strengths and weaknesses, it is evident that this study makes many valuable contributions to the field of AAC. However, there are still a number of issues that need to be addressed in future research, and some of these have been outlined in this section.

REFERENCES

American Speech Hearing Association. (1985). Guidelines for identification audiometry. *ASHA*, 49-53.

Asher, J. (1977). Learning another language through actions: The complete teacher's guide. Los Galos, California: Sky Oaks Publication.

Bailey, E., & Bricker, D. (1985). Evaluation of a three year early intervention demonstrations project. *Topics in Early Childhood Special Education, 5*, 52-56.

Banajee, M., Dicarlo, C., & Stricklin, S.B. (2003). Core vocabulary determination for toddlers. *Augmentative and Alternative Communication, 19*, 67-73.

Barlow, D.R., & Hersen, M. (1984*). Single case experimental designs: Strategies for studying behavior change*. (2nd ed.). New York: Pergamon Press.

Basil, C. (1992). Social interaction and learnt helplessness in severely disabled children, *Augmentative and Alternative Communication, 8*, 188-199.

Basil, C., & Soro-Camats, E. (1996). Supporting graphic language acquisition by a girl with multiple impairments. In S. von Tetzchner, & M. H. Jensen (Eds.), *European Perspectives* on a*ugmentative and alternative communication:* (pp. 270 – 291). London: Whurr Publishers.

Bates, E., Camaioni, L., & Volterra, V. (1975) The acquisition of performatives prior to speech. *Merrill- Palmer Quarterly, 21*, 205-226.

Baumeister, A.A. (1984). Some methodological and conceptual issues in the study of cognitive processes with retarded people. In P. Brooks, R. Sperber & C. Mc

Cauley (Eds.), *Learning and cognition in the mentally retarded* (pp. 1-38). New Jersey: Lawrence Erlbaum Associates.

Bedrosian, J.L. (1995). Limitations in the use of non disabled subjects in AAC research. *Augmentative and Alternative Communication, 11*, 6-10.

Bedrosian, J.L. (1997). Language acquisition in young AAC system users: Issues and directions for future research. *Augmentative and Alternative Communication, 13*, 179-185.

Bellugi, U., & Klima, E. (1976). Two faces of sign : Iconic and abstract. *Annals of the New York Academy Sciences, 280*, 514-538.

Benedict, H. (1979). Early lexical development: comprehension and production. *Journal of Child Language, 6*, 183-200.

Beukelman, D.R., & Garrett, K. (1988). Augmentative and alternative communication for adults with acquired severe communication disorders. *Augmentative and Alternative Communnication, 4*, 104-121.

Beukelman, D.R., McGinnis, J., & Morrow, D. (1991). Vocabulary selection in augmentative and alternative communication. *Augmentative and Alternative Communication, 7*, 171-185.

Beukelman, D.R., & Mirenda, P. (1998). *Augmentative and alternative communication: Management of severe communication disorders in children and adults*. (2nd ed.). Baltimore: Paul H. Brookes. Publishing.

Beukelman, D.R. & Mirenda, P. (1992). *Augmentative and alternative communication: Management of severe communication disorders in children and adults*. (3rd ed.). Baltimore: Paul H. Brookes. Publishing.

Biederman, I. (1987). Recognition by components: A theory of human image understanding. *Psychological Review*, *94*, 115-145.

Blachman, B.A. (1991). Early communication intervention for children's reading problems: Clinical applications of the research in chronological awareness. *Topics in Language Disorders*, *12*, 51-65.

Blockberger, S., & Sutton, A. (2003). Toward linguistic competence: Language experiences and knowledge of children with extremely limited speech. In J.C. Light, D.R. Beukelman, & J. Reichle (Eds.), *Communicative competence for individuals who use AAC from research to effective practice* (pp. 63-106). Baltimore: Paul H. Brookes. Publishing.

Bloom, L. (1993). *The transition from infancy to language: Acquiring the power of expression.* Cambridge: University Press.

Bloom, L., & Lahey, M. (1978). *Language development and language disorders*. New York: John Wiley & Sons .

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

Bondy, A.S., & Frost, L.A. (1993). Mands across the water: A report on the application of the pciture exchange communication system in Peru. *The Behavior Analyst*, *16*. 123-128.

Bower, T.G.R. (1971). The object in the world of an infant. *Scientific American*, *225*, 30-38.

Brady, N.C. (2000). Improved comprehension of object names following voice output communication aid use: Two case studies. *Augmentative and Alternative Communication, 16,* 197-204.

Bricker, D., & Cripe, J.J.W. (1992). *An activity based approach to early intervention*. Baltimore: Paul H. Brookes. Publishing.

Bricker, D., & Gumerlock, S. (1988). Application of a three level evaluation plan for monitoring child progress and program effects. *Journal of Special Education, 22*, 66-81.

Bricker, D., & Sheehan, R. (1981*).* Effectiveness of an early intervention program as indexed by child change. *Journal of the Division for Early Childhood, 4,* 11-27.

Brown, R. (1973). *A first language*. Cambridge: Harvard University Press

Brown, R. (1978). Why are signed languages easier to learn than spoken languages? Part Two. *Bulletin of American Academy of Arts and Sciences, 32*, 25-44.

Bruner, J. (1964). The course of cognitive growth. *American Psychologist*, *19*,1-15.

Bruner, J. (1975). The ontogenesis of speech acts. *Journal of Child Language,* 1-19.

Bruner, J. (1983). *Child's talk: Learning to use language*. New York: Norton.

Bruner, J. S. (1985). Vygotsky: A historical and conceptual perspective. In J. V. Wertsch. (Ed.), *Culture, communications and cognition: Vygotskian perspectives* (pp. 21-34). Cambridge: Cambridge University Press.

Bruno, J., & Bryen, D. (1986, September). *The Impact of modeling procedures n physically disabled nonspeaking children.* Paper presented at the biennial conference of the International Society for AAC, Cardiff, Wales.

Bryant, P. E. (1965). The effect of verbal labeling and recall and recognition in severely subnormal and normal children. *Journal of Mental Deficiency Research*, *9*, 229-286.

Bryant, P. E. (1967). Verbalization and immediate memory of complex stimuli in normal and severely sub normal children. *British Journal of Social Clinical Psychology*, *6*, 212-219.

Burd, L., Hammes, K., Bornhoeft, D., & Fisher, W. (1988). A North Dakota prevalence study of nonverbal school-age children. *Language, Speech, and Hearing Services in Schools*, *19*, 371-373.

Burns, N.M. (1990). *Emergence of the understanding of pictures as symbols in very young children*. Unpublished master's thesis, University of Illinois, Urbana-Champaign, Illinois.

Byrne, M. C. (1959). Speech and language development of athetoid and spastic children. *Journal of Speech and Hearing Disorders*, *24*, 231-240.

Cafiero, J. (1988). Communication power for individuals with Autism. *Focus on Autism and Other Developmental Disabilities*, *13*, 113-122

Calculator, S.N. (1988). Promoting the acquisition and generalization of communication skills by the augmented speaker with mental retardation. *Augmentative and Alternative Communication*, *4*, 94-103.

Calculator, S.N. (1997). Fostering early language acquisition and AAC use: Exploring reciprocal influences between children and their environments. *Augmentative and Alternative Communication*, *13*, 149 – 157.

Calculator, S.N., & Jorgensen, C. (1991). Integrating AAC instruction into regular educational settings: Expounding on their practices. *Augmentative and Alternative Communication*, *7*, 204- 212.

Camarata, S.M. (1996). On the importance of integrating naturalistic language intervention and speech intelligibility training. In L.K.Koegel, & R.L. Koegel (Eds.), *Positive behavioral support: Including people with difficult behavior in the community* (pp. 333-351). Baltimore: Paul H. Brookes Publishing

Camarata, S.M., & Nelson, K.E. (1992). Treatment efficiency as a function of target selection in remediating of child language disorders. *Clinical Linguistics and Phonetics*, *6*, 167-178.

Carey, S. (1978). The child as a word learner. In M. Halle, J. Bresnan, & G.A. Mutter (Eds.), *Linguistic theory and psychological reality* (pp. 264-293). Cambridge, Massachusetts: MIT Press.

Carr, D., Wilkinson, K.M., Blackman, D., & McIlvane, W.J. (2000). Equivalence classes on individuals with limited verbal repertoire. *Journal of Experimental Analysis of Behavior*, *74*, 101-114.

Carrier, J. (1974). Non-speech noun usage training with severely and profoundly retarded children. *Journal of Speech and Hearing Research*, *17*, 510-512.

Carrow-Woolfolk, E. (1988). *Theory, assessment and intervention in language disorders: An integrative approach*. Philadelphia: Grune & Stratton.

Chomsky, N. (1957). *Syntactic Structures*. The Hague: Mouton.

Chomsky, N. (1965). *Aspects of the theory of syntax*. Cambridge, MA: MIT Press.

Cirrin, F., & Rowland, C. (1985). Communicated assessment of nonverbal youths with severe / profound mental retardation. *Mental Retardation, 23,* 52-62.

Crais, E.R. (1990). World knowledge to word knowledge. *Topics in Language Disorders, 10*, 45-62.

Cromer, R.F. (1974). Receptive language in the mentally retarded: processes and diagnostic distinctions. In R.L. Schiefelbush, & L.L. Lloyd (Eds.), *Language perspectives: Acquisition, retardation and intervention* (pp. 237-26). London: University Park Press.

Culp, D. (1982). *Communication interactions – nonspeaking children using augmentative systems.* Unpublished manuscript, Callier Centre for Communication Disorders, Dallas, TX.

Dada, S., & Alant, E. (2004). Teacher training for AAC classroom implementation. In E. Alant & L. Lloyd (Eds.), *Augmentative and Alternative Communication: Beyond Poverty*. London: Whurr Publisher. (Accepted for publication).

Daley, A. (1993). *Goldilocks and the three bears*. London: Ladybird Books.

Damasio, A.R. (1985). Disorders of complex visual processing: Agnosias, achromatopsia, balents syndrome, and related difficulties of orientation and construction. In M.M. Mesulum (Ed.), *Principles of behavioral neurology*. (pp. 259-288). Philadelphia: F.A. Davis Company.

DeLoache, J.S , & Burns, N.M. (1991). Early understanding of the representational function of pictures. *Cognition*, *52*, 83-110.

DeLoache, J.S. (1991). Symbolic functioning in very young children: understanding of pictures and models, *Child Development*, *62*, 736 – 752.

DeLoache, J.S., DeMendoza, O.A.P., & Anderson, K.M. (1999). Multiple factors in early symbolic use: Instructions similarity and age in understanding a symbolic referent relation. *Cognitive Development*, *14*, 299- 312.

Dewey, J. (1976). *Experience and education*. New York: Colliers Books.

Dixon, L.A. (1981). A functional analysis of photo-object matching skills of severely retarded adolescents. *Journal of Applied Behavioral Analysis*, *14*, 465-478.

Dooley, D. (1995). *Social research methods*. New Jersey: Prentice Hall Incorporated.

Dunn, L., & Dunn., L. (1981). *Peabody Picture Vocabulary Test: Revised*. Circle Pines : American Guidance Service.

Elder, P., & Goossens', C. (1994). *Engineering training environments for interactive augmentative communication: Strategies for adolescents and adults who are moderately / severely delayed.* Birmingham, AL: Southeast Augmentative and Alternative Communication Conference Publications.

Elman, J., Bates, E., Johnson, M., & Karmiloff-Smith, A. (1996). In J. Elman, E. Bates, M. Johnson, A.Karmiloff-Smith, D.Parisi, & K. Plunkett (Eds.), *Rethinking innateness: A connectionist perspective on development* (pp. 347-391). Cambridge: MIT Press.

Farrar, M.J. (1990). Discourse and the acquisition of grammatical morphemes. *Journal of Child Language*, *17*, 607-624.

Fey, M. (1986). *Language intervention with young children*. San Diego: College Hill Press.

Fitzgerald, E. (1949). *Straight language for the Deaf*. Michigan: Edward Brothers Incorporated.

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

Fristoe, M., & Lloyd, L.L. (1979). Nonspeech communication. In N.R. Ellis (Ed.), *Handbook of mental retardation: Psychological theory and research* (2nd ed., pp. 401-430). New York: Earlbaum Associates.

Fristoe, M., & Lloyd, L.L. (1980). Planning an initial expressive sign lexicon for persons with severe communication impairment. *Journal of Speech and Hearing Disorders*, *45*, 170-180.

Fuller, D.R., Lloyd, L.L., & Stratton, M. (1997). Aided AAC symbols. In L.L. Lloyd, D. Fuller, & H. Arvidson (Eds.), *Augmentative and Alternative Communication: Principles and Practice* (pp. 48-79). Boston: Allyn Bacon.

Fuller, D.R., & Stratton, M.M. (1991). Representativeness versus translucency: Different theoretical backgrounds, but are they really different concepts? A position paper. *Augmentative and Alternative Communication*, *7*, 51-58.

Fuller, D.R., Lloyd, L.L., & Schlosser, R.W. (1997). What do we know about graphic AAC symbols and what do we still need to know about them? In E. Bjorck Åkesson & P. Lindsay (Eds.), *Communication… naturally: Theoretical and methodological considerations in augmentative and alternative communication. Proceedings of the Fourth ISAAC Research Symposium* (pp. 113- 125). Västerås, Sweden: Mälardalen University Press.

Furrow, D., Nelson, K., & Benedict, H. (1979). Mothers' speech to children and syntactic development: Some simple relationships. *Journal of Child Language, 6*, 423-442.

Garret, K., & Beukelman, D. (1992). Augmentative communication approaches for persons with severe aphasia. In K. Yorkson (Ed.), *Augmentative Communication in the Medical Setting* (pp. 245-338). Tuscon: Communication Skill Builders.

Gass, S. (1988). Integrating research areas: a framework for second language acquisition. *Applied Linguistics, 9*, 198-217.

Girolametto, L., Weitzman, E., Wiigs, M., & Pearce, P. (1999). The relationship between two maternal language measures and language development on toddlers with expressive vocabulary delays. *American Journal of Speech-Language Pathology, 8*, 364-374.

Giumento, A. (1990). *The effectiveness of two intervention procedures on the acquisition and generalization of object labels by young children who are at risk or who have developmental delays*. Unpublished doctoral thesis, University of Oregon.

Gleitman, L.R., Newport, E.L., & Gleitman, H. (1984). The current status of the motherese hypothesis. *Journal of Child Language, 11*, 43-79.

Golinkoff, R.M. , Mervis, C.B., & Hirsh-Pasek, K. (1994). Early objects labels: the case for a developmental lexical principles framework. *Journal of Child Language, 21*, 125-155.

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

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

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

Goossens', C., Elder., P., & Crain, S. (1992*). Engineering the preschool environment for interactive symbolic communication.* Birmingham, AL: Southeast Augmentative and Alternative Communication Conference Publications.

Goossens', C., Jennings, D., & Kinahan, D. (2000, August). *Facilitating strategies for group activities in engineered AAC classrooms.* Pre-conference workshop presented at the Ninth Biennial Conference of ISAAC: Washington DC.

Graham, J. T., & Graham, L.W. (1971). Language behaviour of the mentally retarded: Syntactic characteristics. *American Journal of Mental Deficit*, *75*, 625-623.

Grason Stradler. (2000). *Grason Stradler instructional manual GSI, GSI 38*. New Hempshire: Milford.

Grove, N., & McDougall, S. (1989). An exploration of the communication skills of Makaton students: Part 2: Interviews with teachers and speech therapists. *Report to Leverhulme Trust*, London: Saint George's Hospital Medical School.

Grove, N., & Smith, M. (1997). Input output asymmetries in AAC. *ISAAC Bulletin, 50*, 1-3.

Halle, J.W. (1982). Teaching functional language to the handicapped: An integrative model of natural environment teaching techniques. *TASH, 7*, 29-37.

Hanzlik, J. (1990). Nonverbal interaction patterns of mothers and their infants with cerebral palsy. *Education and Training in Mental Retardation, 25*, 333-343.

Harris, D. (1982). Communicative interactions processes involving nonvocal physically handicapped children. *Topics in Language Disorders, 2*, 21-37.

Harris, M., Barret, M., Jones, D., & Brookes, S. (1988). Linguistic input and early word meaning. *Journal of Child Language, 15*, 77-94.

Hart, B., & Risley, T.R. (1995). *Meaningful differences in everyday experiences of young American children.* Baltimore: Paul H. Brookes Publishing Company.

Hasson, F., Keeney, S., & McKenna, H. (2000). Research guidelines for the Delphi survey technique. *Journal of advanced nursing, 32,* 1008-1015.

Heller, K.W., Allgood, M.H., Ware, S.P., Castelle, M.D. (1996). Use of dual communication boards at vocational sites by students who are deaf-blind. *Review, 27*, 180 –190.

Hensilwood, L. & Ogilvy, D. (1999). Narrative discourse productions in older language impaired learning disabled children: Employing structure reliability measures. The South African Journal of Communication Disorders, *46*, 45-53.

Higginbotham, D.J. (1995). The use of non-disabled subjects in AAC research: Confessions of a research infidel. *Augmentative and Alternative Communication, 11*, 2-5.

Higginbotham, D.J., & Bedrosian, J.L. (1995). Subject selection in AAC research: Decision points. *Augmentative and Alternative Communication, 11*, 11-13.

Hirsh-Pasek, K., & Golinkoff, R. (1991). Language comprehension: A new look at some old themes. In N. Krasnegor, D Rumbaugh, R. Schieffelbusch, & M. Studdert-Kennedy (Eds.), *Biological and behavioral determinants of language development* (pp. 301-320). Hillsdale New Jersey: Erlbaum.

Hochberg, J., & Brooks, V. (1962). Pictorial recognition as an unlearned ability: A study of one child's performance. *American Journal of Psychology, 75*, 624-628.

Holland, A.L. (1975). Language therapy for children: Some thoughts on context and content. *Journal of Speech and Hearing Disorders, 40*, 514-523.

Holland, A.L. (1975). Language therapy for children: Some thoughts on context and content. *Journal of Speech and Hearing Disorders, 40*, 514 - 523.

Horner, R.D., & Baer, D.M. (1978). Multiple probe techniques: A variation of the multiple baseline. *Journal of Applied Behavior Analysis, 11*, 189-196.

Hughes, J. (1974). Acquisition of non-vocal language by aphasic children. *Cognition, 3*, 41-55.

Hunt, P., Alwell, M., Goetz, L., & Sailor, W. (1990). Generalized effects of conversation skills training. *Journal of the Association of Persons with Severe Handicaps, 15*, 250- 260.

Hunt-Berg, M. (1996). *Learning Graphic Symbols: The roles of visual cues in interaction*. Unpublished doctoral dissertation, University of Nebraska - Lincoln.

Huttenlocher, J. (1974). The origins of language comprehension. In R.L. Solso (Eds.), *Theories in cognitive psychology: The Loyola symposium* (pp. 331-367). Hillsdale New Jersey: Lawrence Earlbaum Associates.

Iacono, T, A. (1992). Individual learning styles and augmentative and alternative communication, *Augmentative and Alternative Communication, 8*, 33- 40.

Iacono, T., Carter, M., & Hook, J. (1998). The identification of intentional communication in students with severe multiple disabilities. *Augmentative and Alternative Communication, 14*, 102-114.

Johnson, D.W., Johnson, R.T., Holubec, E., & Roy, P. (1984). *Circles of learning: Cooperation in the classroom*. Alexandria: Association for supervision and curriculum development.

Johnson, R. (1994). *The Picture Communication Symbols Combination Book*. Solana Beach, California: Mayer Johnson Company.

Johnson, S., Nelson, C., Evans, J., & Palazolo, K. (2003). The use of visual supports in teaching young children with autism spectrum disorders to initiate interactions. *Augmentative and Alternative Communication, 19*, 86-103

Jolly, A.C., Test, D.W., & Spooner, F. (1993). Using badges to increase initiations of children with severe disabilities in a in a play setting. *Journal of the Association of Persons with Severe Handicaps, 18*, 46-51.

Karlan, G., & Lloyd, L.L. (1983). Considerations in planning communication intervention: Selecting a lexicon. *Journal of the Association for Persons with Severe Handicaps, 8*, 13-25.

Karlin, I.W., & Strazulla, M. (1952). Speech and language problems of mentally deficient children. *Journal of Speech and Hearing Disorders*, 17, 286-294.

Katzenellenbogen, J., Joubert, G., & Yach, D. (1991). *Introductory manual for epidemiology in Southern Africa*. Tygerberg: Medical and Research Council.

Kavanaugh, R.J.F., & Venezky, A.L. (1980). *Orthography reading and dyslexia*. Baltimore: University Park Press.

Kikuchi, T., Yamashita, Y., Sagwa, K., & Wake, T. (1979). An analysis of tactile letter confusions. *Perceptions and Psychophysics, 26*, 259-301.

Krantz, P.J. & McClannahan, L.E. (1993). Teaching children with autism to initiate to peers: Effects of a script fading procedure. *Journal of Applied Behavior Analysis, 26* (1), 121-132.

Krashen, S. (1982). *Principles and practice in second language acquisition*. London: Pergeman Press Limited.

Krashen, S. (1985). *The input hypothesis*. London: Longman Publishers.

Lackner, J.R.A. (1968). The developmental study of language behavior in retarded children. *Neuropsychologia, 6*, 301-320.

Lahey, M. & Bloom, L. (1977). Planning a first lexicon: Which words to teach first. *Journal of Speech and Hearing Disorders, 42*, 340-349.

Light, J., & Lindsay, P. (1991). Cognitive science and augmentative and alternative communication. *Augmentative and Alternative Communication, 7*, 186 –203.

Light, J., Collier, B., & Parnes, P. (1985). Communication patterns between young non speaking physically disabled children and their primary caregivers: Part 1. Discourse patterns. *Augmentative and Alternative Communication, 1*, 74-83.

Light, J., Kelford - Smith, A. (1993). Home literacy experiences of preschoolers who use AAC systems and of their non disabled peers. *Augmentative and Alternative Communication, 9*, 10-25.

Light, J., Roberts, B., Dimarco, R., & Greiner, N. (1998). Augmentative and alternative communication to support receptive and expressive communication for people with autism. *Journal of Communication disorders, 31*, 153- 180.

Light, J. (1997). " Lets go star fishing": Reflections on the context of language learning for children who use aided AAC. *Augmentative and Alternative Communication, 15*, 13-24.

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

Lloyd, L.L., Quist, R.W., & Windsor, J. (1990). A proposed augmentative and alternative communication model. *Augmentative and Alternative Communication, 6*, 172-183.

Lock, A. (1980). *The Guided Reinvention of Language*. London: Academic Press.

Lonke, F.T., Lloyd, L.L., van Balkom., H., & Arvidson, H. (1999). Graphic symbols and information processing. In. F.T. Lonke, J.Clibbens, H.H Arvdison, & L.L. Lloyd.(Eds.), *Augmentative and alternative communication: New directions in research practice* (pp. 190-191). London: Whurr publishers.

Lovaas, O.I., Berberich, J.P., Perloff, B.F., & Scheffer, B. (1966). Acquisition of imitative speech by a schizophrenic child. *Science, 151*, 705-707.

Martisen, H., & von Tetzchner, S. (1996). Situating augmentative and alternative communication intervention. In S. von Tetzchner, & M.H. Jensen (Eds.), *European perspectives on augmentative and alternative communication:* (pp. 37-48). London: Whurr Publishers.

Matas, J.A., Mathy-Laikko, P., Beukelman, D.R., & Legresley, K. (1985). Identifying the non-speaking population: A demographic study. *Alternative Augmentative Communication, 1*, 17-31.

Mayer-Johnson, R. (1984). *The Picture Communication Symbols*. Solana Beach: Mayer-Johnson.

Mayer-Johnson, R. (1985). *The Picture Communication Symbols*. Solana Beach: Mayer-Johnson.

McNaughton, S., & Lindsay, P. (1995). Approaching literacy with AAC graphics. *Augmentative and Alternative Communication, 11*, 212-228.

Mc Reynolds, L.V., & Kerns, K.P. (1983). *Single subject experimental designs in communicative disorders*. Baltimore: University Park Press.

McDonald. E.T., & Schultz, A.R. (1973). Communication boards for cerebral palsied children. *Journal of Speech and Hearing Disorders, 38*, 73-88.

McMillan, J.H., & Schumacher, S. (2001). *Research in education* (5th ed.). New York: Longman

Mervis, C.B., & Bertrand, J. (1993). Acquisition of early language labels: The role of operating principles and input. In A. Kaiser, & D. Gray (Eds.), *Enhancing*

children's communication: Research foundations for intervention (pp. 287-316). Baltimore: Paul H. Brookes Publishing.

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

Milgram, N.A. (1967). Verbal context versus visual compound in paired-associates learning by children. *Journal of Experimental Child Psychology*, *5*, 597-603.

Miller, J.F. (1981). *Assessing language production in children: experimental procedures*. Baltimore: University Park Press.

Miller, J.F.,& Paul, R. (1995). *The clinical assessment of language comprehension*. Baltimore: Paul H Brookes Publishing.

Miller, R.J. (1973). Cross-cultural research in the perception of pictorial materials. *Psychological Bulletin*, *80*, 135-150.

Mills, J., & Higgins, J. (1994). An environmental approach to delivery of micro computer based and other communication systems. *Seminars in Speech and Language*, *5*, 35 – 45.

Mirenda, P., & Santogrossi, J. (1985). A prompt free strategy to teach pictorial communication system use. *Augmentative and Alternative Communication*, *1*, 143- 150.

Mirenda, P., & Ericson, K. (2000). Augmentative communication and literacy. In A.M. Wetherby & B.M. Prizant (Eds.), *Autism Spectrum Disorders: A transactional developmental perspective* (pp. 333-369). Baltimore: Paul H. Brookes Publishing.

Mirenda, P., & Locke, M.A. (1989). A comparison of symbol transparency in non speaking persons with intellectual disabilities. *Journal of Speech and Hearing Disorders*, *54*, 131-140.

Mizuko, M., & Reichle, J. (1989). Transparency and recall of symbols among intellectually handicapped adults. *Journal of Speech and Hearing Disorders*, *54*, 627 – 633.

Mollica, M. (2003). Representational competence. In J.C. Light, D.R., Beukelman, & J. Reichle (Eds.), *Communicative competence for individuals who use AAC from research to effective practice* (pp. 107-145). Baltimore: Paul H Brookes Publishing Company.

Nelson, K. (1973). Structure and strategy in learning to talk. *Monographs of the Society for Research in Child Development*, *28*, 1-2.

Nelson, N. (1992). Performance is the prize: Language comprehension and performance amongst AAC users. *Augmentative and Alternative Communication*, *8*, 3-18.

Newport, E., & Gleitman, H., & Gleitman, L. (1977). Mother I'd rather do it myself: Some effects and non effects of maternal speech style. In E.E. Snow, & C.A. Ferguson (Eds.), Talking *to children: Language input and acquisition*. New York: Cambridge University Press.

Oliver, C., & Halle, J. (1982). Language training in everyday environment: Teaching functional signs to a retarded child. *Journal of the Association for the Severely Handicapped*, *7*, 50-62.

Oviatt, S. L. (1985). Tracing developmental change in language comprehension ability before 12 months of the age. *Papers and Reports on Child Language Development*, *24*, 87-94.

Oxley, J., & von Tetzchner, S. (1999). Reflections on the development of alternate language forms. In F. Lonke, J. Clibbens, H. Arvidson, & L.L.Lloyd (Eds.), *Augmentative and alternative communication: New directions in research and practice* (pp. 62-74) London: Whurr Publishers.

Paivio, A. (1971). *Imagery and verbal responses*. Toronto: Rinnehart and Winston.

Paivio, A. (1986). *Mental representations: A dual coding approach*. New York: Oxford University Press.

Paul, R. (1990). Comprehension strategies: Interactions between world knowledge and the development of sentence comprehension. *Topics in Language Disorders, 10,* 63-75.

Perner, J. (1991). *Understanding the representational mind*. Cambridge: Massachusetts: MIT Press / Bradford Books.

Peterson, S., Bond, A., Vincent. Y., & Finnegan, C. (1995). Effects of altering communicative input for students with autism and no speech: Two case studies. *Augmentative and Alternative Communication, 11*, 93-100.

Piaget, J. (1954). *The Construction of reality in the child*. New York: Basic Books.

Piaget, J. (1967). *The origins of intelligence in children*. New York: Norton.

Pine, J.M. (1994). The language of primary caregivers. In C. Gallaway, & B. Richards (Eds.), *Input and interaction in language acquisition* (pp. 253- 265). Cambridge: Cambridge University Press.

Praat , C., & Garton, A.F. (1993). Systems of representation in children. In C. Praat, & A.F. Garton (Eds.), *Systems of representation in children development and use* (pp. 1- 9). Chister England: John Wiley Sons.

Premack, D. A. (1970) Functional analysis of language. *Journal of Experimental Analysis Behaviour*, *14*, 107-125.

Quill, K.A. (1997). Instructional considerations for young children with autism: The rationale for visually cued instruction. *Journal of Autism and Developmental Disorders, 27*, 697-714.

Quill, K.A. (1998). Environmental supports to enhance social communication. *Seminars in Speech and Language, 19*, 407 -423.

Reichle, J., Williams, W., & Ryan, S. (1981). Selecting signs for the formulation of an augmentative communicative modality. *Journal of the Association for Persons with Severe Handicaps, 6*, 69-84.

Resnick. J.S., & Goldfield, B.A. (1992). Rapid change in lexical development in comprehension and production. *Developmental Psychology, 28*, 406 –413.

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

Risley, T., & Wolf, M. (1967). Establishing functional speech in echolalic children. *Behaviour Research and Therapy*, *5*, 73-88.

Rogers, W.T. (1979). The relevance of body motion cues to both functional and dysfunctional communication behavior. *Journal of Communication Disorders, 12,* 273- 282.

Rohwer, W.D., Lynch, J.R., Levin, J.R., & Suzuki, N. (1967). Pictorial and verbal factors in the efficient learning of paired-associates. *Journal of Educational Psychology*, *58*, 278-284.

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

Romski, M.A., & Sevcik, R.A. (1988b). Augmentative communication system acquisition and use: A model for teaching and assessing progress. *NSSLHA Journal*, *15*, 61-75.

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

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

Romski, M.A., & Sevcik, R.A. (1993b). Language learning through augmented means: The process and its product. In P.A. Kaiser, & D.B. Gray (Eds.), *Communication and Language Intervention Series: Vol 1. Causes and effects in communication and language intervention* (pp. 113-130). Baltimore: Paul H. Brookes Publishing.

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

Romski, R.A., Sevcik, R.A & Adamson, L.B. (1997). Framework for studying how children with developmental disabilities develop language through augmented means. *Augmentative and Alternative Communication*, *13*, 172- 178.

Romski M.A., & Sevcik, R.A. (2003). Augmented input. In J.C. Light, D.R., Beukelman, & J. Reichle (Eds.), *Communicative competence for individuals who use AAC from research to effective practice* (pp. 147-162). Baltimore: Paul H Brookes Publishing Company.

Romski, R.A., Sevcik, R.A. & Adamson, L.B. (1997). Framework for studying how children with developmental disabilities develop language through augmented means. *Augmentative and Alternative Communication*, *13*, 172- 178.

Romski, M.A., Sevcik, R.A., & Cress, C. (1996, August). *Research in augmentative and alternative communication development for toddlers: Considerations for practice*. Paper presented at the seventh biennial conference of the International Society for AAC, Vancouver, Canada.

Romski, M.A., Sevcik, R.A., & Pate, J.L. (1988). Establishment of symbolic communication in persons with severe retardation. *Journal of Speech and Hearing Disorders*, *53*, 94-107.

Romski, M. A., Sevcik,.R.A., Robinson, B., Bakeman, R. (1994). Adult-directed communication of youth with mental retardation using the system or augmenting language. *Journal of Speech and Hearing Research*, *57*, 617-62 8.

Romski, M. A., Sevcik, R.A., Robinson, B.F., Mervis, C.B., & Bertrand, J. (1996). Mapping the meanings of novel visual symbol by use with moderate or severe mental retardation. *American Journal on Mental Retardation, 100*, 391-402.

Roth, F.P., & Cassatt-James, E.L. (1989). The language assessment process: Clinical implications for individuals with severe speech impairments. *Augmentative and Alternative Communication*, *5*, 162- 172.

Rowder, W.D. (1970). Images and pictures in children's learning: Research results and educational implications. *Psychological Bulletin, 73,* 393-403.

Rowland, C., & Schweigert, P. (1993). Analyzing the communication environment to increase functional communication. *JASH, 18,* 161- 176.

Rowland, C. & Schweigert, P. (2000). Tangible symbols, tangible outcomes. *Augmentative and Alternative Communication, 16*, 61-205.

Ryan, J. (1974). Early language development: Towards a communicative analysis. In M.P.M. Richards (Ed.), *The integration of a child into a social world* (pp. 185-213). London: Cambridge University Press.

Savage-Rumbaugh, E.S., Sevcik, R.A., Brakke, K., Rumbaugh, D.M., & Greenfield, P. (1990). Symbols: Their communicative use, comprehension, and combination on bonobos. In L.P. Lipsitt & C. Rove- Collier (Eds.), *Advances in infancy research* Vol. 6 (pp. 221- 278). Norwood, NJ: Ablex.

Savage-Rumbaugh., E.S. (1986). *Ape language: from conditioned response to symbol*. New York: Columbia University Press.

Sayre, M.J. (1963). Communication for the nonverbal cerebral palsied. *Cerebral Palsy Review*, *24*, 3-8.

Schepis, M.M., & Reid, D.H., (1995). The effects of a voice output communication aid on interactions between support personnel and an individual with multiple disabilities. *Journal of Applied Behavior Analysis, 28*, 73-77.

Schlinger, H.D. (1995). *A behavior analytic view of child d development*. New York: Plenum Press.

Schlosser, R.W. (1999a). Social validation of interventions in augmentative and alternative communication. *Augmentative and Alternative Communication, 15*, 234-247.

Schlosser, R.W. (1999b). Comparative efficacy of intervention in augmentative and alternative communication,. *Augmentative and Alternative Communication, 15*, 56- 68.

Schlosser, R.W. (2003a). Selecting graphic symbols for an initial request lexicon. In R.W. Schlosser (Ed.). *The efficacy of Augmentative and Alternative Communication: Toward evidence – based practice* (pp. 347 – 401). California: Elsevier Science.

Schlosser, R.W. (2003b). *The efficacy of augmentative and alternative communication: Toward evidence – based practice*. California: Elsevier Science.

Schlosser, R.W., & Braun, U. (1994). Efficacy of AAC interventions: Methodological issues in evaluating behaviour change, generalizations, and effects. *Augmentative and Alternative Communication*, *10*, 207-222.

Schlosser, R.W., & Lloyd, L.L. (1997). The effects of paired-associate learning versus symbol explanation on Blissymbols comprehension and production**.** *Augmentative and Alternative Communication*, *13*, 226-238.

Schlosser, R.W., Belfoire, P.J., Nigam, R., Blischak, D., & Hetzroni, O. (1995). The effects of speech output technology in the learning of graphic symbols. *Journal of Applied Behavior Analysis*, *28*(4), 537-549.

Schwartz, I.S., Garfinkle, A.N., & Bauer, J. (1998). The picture communication exchange system: Communicative outcomes for young children with disabilities. *Topics in Early Childhood Special Education, 18,* 144-159.

Serpell, R. (1976). *Culture's influence on behavior*. London: Methuen.

Sevcik, R. & Romski , M.A. (1986). Representational matching skills of persons with severe retardation. *Augmentative and Alternative Communication, 2,* 160-164.

Sevcik, R.A., & Romski, M.A. (1997). Comprehension and language acquisition: evidence from youth with severe cognitive disabilities. In L.B. Adamson, & M. A. Romski (Eds.), *Communication and language acquisition: discoveries from a typical development* (pp. 187- 200). Baltimore: Paul H. Brookes Publishing.

Sevcik, R.A., Romski, M.A., Watkins, R. & Deffenbach, K. (1995). Adult partner – augmented input to youth with mental retardation using the system for augmenting language (SAL). *Journal of Speech and Hearing Research, 38*, 902-912.

Sevcik, R.A., Romski, M.A., Wilkinson, K. (1991). Roles of graphic symbols in the language acquisition process of persons with severe cognitive disabilities. *Augmentative and Alternative Communication, 7*, 161-170.

Sigafoos, J. (1998). Assessing conditional use of graphic mode requesting in a young boy with autism. *Journal of Developmental and Physical Disabilities, 10,* 133- 151.

Sigel, I.E. (1978). The development of pictorial comprehension. In B.S. Rodman, & W.E. Coffmann. (Eds.), *Visual Learning, Thinking and Communication* (pp. 93- 111). New York: Academic Press.

Skinner, B. F. (1957). *Verbal Behavior*. New York: Appleton Century Crofts.

Smith, M. (1997). The medium or the message: A study of speaking children using communication boards. In S. von Tetzchner, & M. Martisen (Eds.), *European perspectives* on a*ugmentative and alternative communication:* (pp. 119-136). London: Whurr Publishers.

Smith, M. (1998). *Pictures of language: The role of Picture Communication Symbols in the language acquisition of children with severe speech and physical disabilities*. Unpublished doctoral dissertation, Trinity College, Dublin.

Smith, M.M., & Grove, N.C. (2003). Asymmetry in input and output for individuals who use AAC. In J.C. Light, D.R., Beukelman, & J., Reichle, J (Eds.), *Communicative Competence for Individuals who use AAC from Research to Effective Practice* (pp. 63-106). Baltimore: Paul H. Brookes Publishing Company.

Snow, C.E. (1972). Mothers' speech to children learning language. *Child Development*, *43*, 549-565.

Snow, C.E. (1986). Conversations with children. In P. Fletcher, & M. Garman (Eds.), *Language acquisition: Studies in second language development* (pp. 69-90). Cambridge: University Press.

Snow, C.E. (1995). Issues in the study of input: Finetuning universality, individual and developmental differences and necessary causes. In P. Fletcher, & B. MacWhinney (Eds.), *The handbook of child language* (pp. 180-193). Oxford: Blackwell Press.

Snow, C.E., Perlmann, R., & Nathan, D. (1987). Why routines are different: towards a multiple-factors model of the relationship between input and language acquisition. In K. Nelson, & A. van Kleeck (Eds.), *Children's Language.* Vol V1, Hillsdale: Erlbaum.

Spradlin, J. E. (1974). Discussion summary-development of receptive language. In R.L. Schiefelbush, & L.L Lloyd (Eds.), *Language perspectives acquisition, retardation and intervention* (pp. 269-281). London: University Park Press.

Stephenson, J., & Linfoot, K. (1996). Intentional communication and graphic symbol use by students with severe intellectual disability. *International Journal of Disability, Development and Education, 43*, 147 – 165.

Steyn, A.G.W., Smit, C.F., du Toit, S.H.C., & Strasheim,C. (2000). Modern statistics in practice (4th ed.). Pretoria: Van Schaik Publishers.

Stillman, R., & Battle, C. (1984). Developing pre language communication in the severely handicapped: An interpretation of the Van Dijk Method. *Seminars in Speech and Language, 5*, 159- 170.

Straat, (1974). Behaviorism and cognitive theory in the study of language: A neopsycholinguistics. In R.L. Schiefelbush & L.L. Lloyd (Eds.), *Language perspectives acquisition, retardation and intervention* (pp. 615-646). London: University Park Press.

Templin, M.C. (1957). Certain language skills in children: Their development and interrelationships. *Child Welfare Monog. No 26*. Minneapolis: University of Minnesota Press.

Troscianko, Y. (1987). Color vision: Brain mechanisms. In R.L. Gregory (Ed.), *The Oxford companion to the mind*. (pp. 150-152) Oxford: Oxford university Press.

Uttal, D.J., Schreiber, K.V., & DeLoache, J.S. (1995). Waiting to use a symbol: The effects of delays on children's use of models. *Child Development, 66*, 1875-1891.

Van Dijk, J. (1966). The first steps of the deaf-blind children towards language. *The International Journal of the Education of the Blind, 15*, 112-114.

Van Dijk, J. (1986). An educational curriculum for the deaf-blind multi-handicapped persons. In D. Ellis (Ed.), *Sensory impairments in mentally handicapped people* (pp. 374-382). San Diego: College Hill.

Van Dijk, J., & Nelson, C. (1998). History and change in education of children who are deaf-blind since the rubella epidemic of the 1960's: Influence of methods in development in the Netherlands. *Deaf Blind Perspectives, 5*, 1-5.

von Tetzchner, S. (1985). Words and chips – pragmatics and pidginization of computer aided communication. *Child Language Teaching and Therapy*, *1*, 295-305.

von Tetzchner, S., & Grove, N. (2003). *Augmentative and alternative communication developmental issues*. London: Whurr Publishers.

von Tetzchner, S., Grove, N., Lonke, F., Barnett, S., Woll, B., & Clibbens, J. (1996). Preliminaries to a comprehensive model of augmentative and alternative communication. In S. von Tetzchner, & M.H. Jensen (Eds.), *European perspective augmentative and alternative communication:* (pp. 19-36) London: Whurr Publishers.

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

Vygotskty, L. (1978). *Mind in society: The development of higher psychological processes.* Cambridge: Harvard University Press.

Wachs, T.D. (1996). Known and potential processes underlying developmental trajectories in childhood and adolescence. *American Psychological Association, 32* (4), 796-801.

Watkins, R.V. , & DeThorne, L.S. (2000). Assessing children's skills from word knowledge to word-learning potential. *Seminars in Speech and Language*, *21*(3), 235-245.

Watson, J.B. (1930). Behaviourism. Chicago: University of Chicago.

Whitehurst, G.J. (1997). Language processes in context: Language learning in children reared in poverty. In L.B. Adamson, M.A. Romski (Eds.), *Communication and language acquisition: Discoveries form a typical development* (pp. 233-266). Baltimore: Paul H Brookes Publishing

Wickstrom, S., Goldstein, H., & Johnson, L. (1985). On the subject of subjects. Suggestions for describing subjects in language intervention studies. *Journal of Speech and Hearing Disorders*, *50*, 282-286.

Wilkinson, K., Romski, M.A., & Sevcik, R.A. (1994). Emergence of visual graphic symbol combinations by youths with moderate or severe mental retardation. *Journal of Speech and Hearing Research*, *37*, 883-985

Wilkinson, K.M., & Green, G. (1998). Implications of fast mapping for vocabulary expansion in individuals with mental retardation. *Augmentative and Alternative Communication*, *14*, 162- 170.

Williams, J.D., & Sniper, G.C. (1990). *Literacy and bilingualism*. New York: Longman.

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

Wood, L.A., Siegel-Causey, E. (1997, January). *Let's read a story: Using augmentative and alternative communication during story book interactions*. Paper presented at the sixth symposium on literacy and disabilities, Durham, NC.

Wragg, E., & Brown, G. (1993). *Explaining*. London: Routledge.

Yoder, P.J , Kaiser, A., & Alpert, K. (1991). An exploratory study of the interaction between language teaching methods and child characteristics. *Journal of Speech and Hearing Research, 34*, 155-167.

Yoder, P.J , Kaiser, A., Alpert, K. & Fischer, R. (1991). Following the child's lead when teaching nouns to preschoolers with mental retardation. *Journal of Speech and Hearing Research, 36*, 158-197.

Yoder, P.J., Warren, S.F., McCathren, R., & Leew, S.V. (1998). Does adult responsivity to child behavior facilitate communication development? In S.F. Warren, J. Reichle (Vol. Eds.), *Communication and language intervention series: Vol. 7 Transitions in pre-linguistic communication* (pp. 39-58). Baltimore: Paul H. Brookes Publishing Company.

.

Yorkson, K.M., Dowden, P.A., Honsinger, M.J., Marriner, N., & Smith, K. (1988). A comparison of standard and user vocabulary lists. *Augmentative and Alternative Communication, 4*, 189- 210.

Zanolli, K., Daggett, J., & Adams, T. (1996). Teaching preschool autistic children to make spontaneous initiations to peers using priming. *Journal of Autism and Developmental Disorders, 26*, 406-422.