CHAPTER 5
DISCUSSION

5.1 Introduction

The results obtained in the study are discussed in this chapter. Possible reasons for and influences on the performance of the participants are explored with reference to relevant literature. Results are compared to other intervention studies that targeted graphic symbol combinations. Possible reasons for differences and similarities are explored.

5.2 Effect of the intervention on symbol combination skills

Based on the results from the probe test, a clear effect of the intervention on symbol combination skills (repeated across all three behaviours targeted) could only be shown for Participant 1. The overall effect for Participants 2 and 3 was low or questionable. At the same time, Participant 2 performed increasingly better on each type of relation, while Participant 3's performance was inconsistent. Performance on the generalization items was generally very similar to that observed for intervention items, suggesting that participants applied whatever skills they gained from the intervention to the untrained exemplars from the matrix. All three participants seemed to perform better during shared storybook reading than during the probe test. The gap in performance was especially marked for Participant 3, suggesting that the probes did not tap the participant's ability fully.

Three other interventions targeting graphic symbol combinations have shown clearer and less ambiguous effects (Binger et al., 2008, 2010; Nigam et al., 2006). There are various possible reasons for the differences observed, including differences in selection criteria resulting in different participant characteristics, as well as differences in intervention procedures, design and measurement criteria. (For an overview, please see the table summarizing the most important aspects of these three studies as well as those of the current study that is provided in Appendix AB.) In the following sections, factors that may have influenced the results of the current study are explored. These factors are grouped under child-related factors, task- and instruction-related factors, AAC system-related factors as well as partner- and environment-related factors (cf. Figure 2.1, Section 2.4.1). Where appropriate, factors are compared to other studies that targeted graphic symbol combinations.

5.2.1 Child-related factors

5.2.1.1 Selection criteria

While homogeneity of participants in single subject studies increases the likelihood of consistent findings and is therefore highly desirable, it is difficult to achieve, especially amongst participants in need of AAC, where heterogeneity is the rule rather than the exception (Bedrosian, 2003). Additionally, in South Africa, there is great cultural and linguistic heterogeneity amongst the general population (as illustrated by the fact that 11 official languages are recognized in the country). Furthermore, intervention histories of children with disability also often vary considerably, because early intervention services are not always readily available, known about, or considered important by caregivers. A lack of official policies mandating services and regulating the type of services rendered to children with disabilities (e.g. provision of AAC to children with limited speech) further contributes to a lack of standardized services.

In conceptualizing the study, the literature was consulted to ensure that the criteria for selection would be set in such a way that participants who would benefit maximally by the intervention would be selected. Furthermore, homogeneity amongst participants was hoped to be achieved regarding crucial variables such as language comprehension, language and speech production, sensory status and preintervention levels of the dependent variable (see Section 3.7.1). However, some criteria (e.g. prior experience in the use of graphic symbols for expression, English home language) set in previous studies (Binger et al., 2008; Binger & Light, 2007) could not be applied in this study, in view of the fact that, in South Africa, the landscape of children in need of AAC looks differ from that in developed countries (cf. also Dada & Alant, 2009).

The variation in performance observed amongst the three participants may therefore in part be attributed to differences in participant characteristics, which the selection criteria failed to rule out. None of the participants had English as a home language. Additionally Participant 2 understood less than 80% of the target combinations (he understood only 70%), and had the lowest comprehension score (76%) of the graphic symbols used in the study. His language capabilities in both English and in his home language also tested lowest amongst the three

participants. He was also the only participant who did not have experience in using graphic symbols for expressive purposes. These characteristics may explain his initial struggle to produce graphic symbol combininations.

At the same time, Participant 3 performed worst overall on the intervention probes, although having tested superior to Participant 2 in English and home language skills, comprehension of target combinations and comprehension of graphic symbols used in the study. However, she clearly performed better during shared storybook reading. Thus, it seems that factors other than the capabilities that were tested affected performance on the intervention probes, particularly for Participant 3. These may include other inherent characteristics in interaction with the particular nature of the probes conducted, as well as possible outside influences.

5.2.1.2 Comprehension and expressive use of graphic symbols

In the current study, Participants 1 and 3 had experience in the use of graphic symbols for expressive purposes. Their understanding of the graphic symbols used in the study was also considerably better (100% and 95% respectively) than that of Participant 2 (76%). Both these participants responded relatively quickly with correct symbol combinations to the first level of prompting during shared storybook reading. Participant 2, in turn, who did not have experience with using graphic symbols expressively (although he had some receptive experience), took longer to learn to produce the symbol combinations during shared storybook reading. Experience in the use of graphic symbols for expression did not seem directly related to probe test performance in the case of Participant 3; however, other factors seemed to have influenced her performance (see Section 5.2.2).

In the study by Binger et al. (2008), participants also had minimal or no prior exposure to aided AAC. However, the participants could (or were taught to) recognize at least 90% of the graphic symbols used in the study prior to the commencement of intervention. Participants in the study conducted by Binger et al. (2010) all had prior experience in using aided AAC, although the exact symbols used were not indicated. This may have benefited their learning. The participants' understanding of the graphic symbols used in the study was not reported.

Participants in the study conducted by Nigam et al. (2006) had experience with the expressive use of graphic symbols. They could (or were taught to) recognize and use the graphic symbols used in the study, albeit only to a criterion of two correct responses across four trials per symbol. Prior exposure to aided symbols and/or training to comprehend the symbols used in the studies may have contributed to the production of graphic symbol combinations evidenced in these studies. It is interesting to note that the participant who did not learn the combinations in the study conducted by Nigam et al. (2006) had the smallest lexicon of graphic symbols on his board and reportedly used the smallest number of symbols. He furthermore needed training to recognize and use three symbols (the other two participants needed training on none or one symbol respectively) and he needed between 12 and 20 training sessions to do so. The authors hypothesized that his limited graphic symbol vocabulary may have contributed to his lack of learning.

In spoken language development, the ability to utter single words typically precedes the ability to produce word combinations; and word combinations also tend to appear only once the expressive vocabulary has reached a size of 50-100 words (Bates et al., 1995). Whether children using AAC follow similar or alternative routes in language development is still a matter of debate (Gerber & Kraat, 1992; Nigam et al., 2006; Von Tetzchner & Grove, 2003). Extrapolations from typical language development are further complicated by the fact that children whose speech is severely limited often use a variety of modalities to express themselves, such as vocalizations, word-approximations, gestures and signs as well as pointing to objects, people and graphic symbols. It still seems unclear whether expression through single graphic symbols specifically (rather than expressive use of symbols per se, regardless of modality) typically precedes use of graphic symbol combinations. In the study by Trudeau et al. (2010), the duration of using a graphic symbol-based AAC system did not predict the ability of children and adults to adopt syntactic strategies when producing graphic symbol utterances. However, all participants in the study had been using their systems for at least 6 months, and had at least 30 graphic symbols on their systems. Clearly, all had some experience with expressing themselves with graphic symbols.

Research on graphic symbol use in typically developing children does seem to suggest that expressive skills in one modality (e.g. speech) do not automatically transfer to another modality (e.g. graphic symbols) (Smith, 1996; Sutton & Morford, 1998; Sutton, et al., 2010; Trudeau et al., 2007). Modality-specific expressive experience thus seems to pose a learning advantage, promoting advances in linguistic skills in that specific modality. The randomized comparison group study by Romski et al. (2010) suggested that, for toddlers with significant risk for speech-language delays, prompting aided output facilitated expressive language development to a greater extent than providing aided input did. Specifically, expressive vocabulary growth and type/token ratio increases were greater for the augmented output group.

The current results seem to corroborate previous findings in that experience with using single graphic symbols expressively seemed to enhance the ability to learn to produce symbol combinations.

5.2.1.3 Receptive language skills

Although the receptive language measures (measuring understanding of spoken language) that were used in the study were not standardized for the targeted population, the scores obtained nevertheless enabled some level of comparison to be made between participants, particularly regarding their English skills. Receptively, Participant 2 received the lowest overall raw scores, age equivalents and/or standard scores on all measures of English and home language proficiency, which may have been linked to his slow progress both during shared storybook reading and as measured during intervention probes. Participant 1, in turn, scored highest overall on English and home language receptive abilities and progressed the fastest and the most of the three participants. He was furthermore the only participant who retained the symbol combination skills after intervention ceased. Participant 3 achieved higher receptive language scores than Participant 2, but her scores were considerably lower than those of Participant 1. Her overall performance during shared storybook reading was slightly lower than that of Participant 1 (86% of responses correct on first level of prompting, as compared to 91% for Participant 1) but considerably higher than that of Participant 2 (42%), whereas her performance on the intervention probes was erratic and overall weakest of all three participants.

Higher spoken receptive language skills have been associated with ability to produce more complex graphic symbol output in school-aged children using AAC (Sevcik, 2006). This finding was corroborated in the study by Trudeau et al. (2010), where higher receptive language skills (but not bigger receptive vocabularies) in children and adults using graphic symbol-based AAC systems were associated with the ability to adopt syntactic strategies when producing graphic symbol utterances. Similarly, in persons with typical language skills, increased age is associated with increasing skill in constructing complex graphic symbol output, possibly due to increasing linguistic and metalinguistic skills (Smith, 1996; Sutton & Morford, 1998; Sutton et al., 2010). Results of the current study generally seem to affirm the association between receptive language skills and the ability to produce more complex graphic symbol output, although Participant 3's performance on the probes seems worse than predicted by her receptive language skills.

The ability to move to graphic symbol combinations was specifically associated with a receptive language age equivalent of at least 24 months in the results reported by Sevcik (2006). In typical spoken language development, word combinations often already occur in the child's speech at a younger receptive language age (from 18 months) [Ingram, 1989]), underlining the position that receptive and expressive skills relate differently to one another within modalities compared to across modalities. In the current study, all participants tested at a receptive (spoken) language age equivalent above 2 years (lowest 2;6; PPVT-4 [Dunn & Dunn, 2007]). However, the participant with the lowest score clearly still had greater difficulty in acquiring the combinations during shared storybook reading; gains as measured by means of the probe test were modest.

It is interesting to note that Participant 2 and 3 both achieved the same raw score on the understanding of sentence structure (subtest of the CELF–Preschool^{UK} [Wiig et al., 2000]), which was clearly lower than that of Participant 1. Similarly, these two participants scored lower on the comprehension of the spoken form of the target combinations, with Participant 2 scoring lowest. In their study involving children and adults using graphic symbol based AAC systems, Trudeau et al. (2010) found that receptive syntax rather than receptive vocabulary correlated with the ability to produce stable response patterns in constructing graphic symbol sequences. Poorer

receptive syntactic skills may thus have contributed to the poorer performance of Participants 2 and 3.

In the study by Binger et al. (2008), participants had English receptive language age equivalents comparable to the participants in the current study; however, scores of the participants in the former study were age appropriate, indicating that children had typical receptive language development. In the current study, the test results showed borderline (Participant 1) to profound delays (Participants 2 and 3) in receptive language skills. When considering chronological age, the participants in the former study may have had greater language potential, as evidenced by the absence of receptive language delays. The participants in the study by Binger et al. (2010) had higher receptive language age equivalents than two of the participants in the current study (Participants 2 and 3)—the latter being the two participants that did not show convincing effects of the intervention. No formal test results regarding receptive language skills are available for the participants described by Nigam et al. (2006), making any comparisons difficult.

In addition, most participants from the three studies (Binger et al., 2008; 2010; Nigam et al., 2006) had English as their first language. These factors may have contributed to their better performance, although their exact contribution remains unclear. One participant (Binger et al., 2010) had English as a second language, yet still performed well on the intervention. However, he had significantly better speech comprehensibility according to the I-ASCC (Dowden, 1997) (30% in the no context condition), which may have influenced his superior performance.

In the current study, second language factors may have influenced participants' performance. According to the recoding route hypothesis (Smith & Grove, 1999; see also Section 2.4.4.3), metalinguistic skills and specifically translation skills may enhance the formulation of aided output that conforms to the structure of spoken language (Smith, 2006). Multilingual environments, in turn, seem to enhance metalinguistic and translation skills in children (Bialystok, 1988; Malakoff & Hakuta, 1991). It follows that bi- or multilingualism may equip children to compose more complete and complex graphic output. However, whether multilingual skills are indeed the same or at least similar to multimodal skills remains a matter of

speculation. Furthermore, while the participants in this study were receptively bilingual, their limited expressive skills may have offset any metalinguistic gains that expressive bi- or multilingual children may have.

Contrary to popular belief, early exposure to a second language does not mean higher levels of achievement in the language or that learning it is more effortless than later in life (Marinova-Todd, Marshall, & Snow, 2000). Children who receive their early education in a second language only have actually been found to struggle more, academically, than those who switch to a second language as the educational medium later in their school career (Heugh, 2000; Thomas & Collier, 2002). Although language policy in the South African education system acknowledges the superiority of home language education in the early grades, practice does not follow suit for a variety of reasons. These include the better standard of education in historically advantaged (English and Afrikaans medium) schools resulting in parents choosing these above home language medium schools, as well as the multilingual nature of the urban environment (Heugh, 2000). In special education, lack of home language medium schools and services furthermore aggravates this situation, resulting in a great proportion of learners learning through a second language from an early age. Of the three participants, only Participant 1 was exposed to English at home. Yet, all participants were immersed in an educational situation where English was the medium of instruction. Participant 3 had also been exposed to Afrikaans as an educational medium, this being a third language for her. Additional to the demands of learning to use expressive modalities to replace or supplement speech, the participants were also contending with a receptive second language as instructional medium. This may have resulted in a number of language and communication-related stressors, which may have limited their ability to fully meet the demands of yet another one (graphic symbol combinations) within the limited time of the current study.

5.2.1.4 Expressive abilities

Expressive abilities of children who require AAC are difficult to determine, since measures need to make provision for modes other than speech alone (Gerber & Kraat, 1992). Use has been made of parent report (e.g. MacArthur Communicative Development Inventory [Fenson et al., 1993]) and of nonstandardized measures of intelligibility (e.g. I-ASCC [Dowden,

1997]). In this study, the adapted LDS (Rescorla, 1989) and the I-ASCC (Dowden, 1997) were used as measures of expressive vocabulary as well as speech intelligibility. Of the three participants, Participant 1 had the largest expressive vocabulary (189 words, thus marginally bigger than Participant 2) as well as the largest clearly articulated spoken expressive vocabulary (139 words) as determined by the LDS (Rescorla, 1989). He also had the most intelligible speech (13% and 27% as judged by an unfamiliar partner in the no context and semantic context conditions respectively) according to the I-ASCC (Dowden, 1997). Participant 2 followed with a marginally smaller expressive vocabulary (185 words), but a substantially smaller clearly articulated spoken vocabulary (79 words), as well as 10% less speech intelligibility in both conditions. Participant 3 had the smallest expressive vocabulary (158 words) and a very small clearly articulated spoken vocabulary (14 words), as well as the least intelligible speech. She was also the only participant who was reported to never having been observed to combine concepts expressively in any modality. It is interesting to note that Participant 3 had the lowest percentage of responses that conformed to the structure of the models given during shared storybook reading (see Table 4.8). Her lack of speech coupled with her lack of combination experience may have had an influence (see also Section 5.3).

In typical language development, word combinations generally begin to emerge once the child's single word expressive vocabulary has reached a size of 50-100 words (Bates et al., 1995). Although the data gathered via the adapted LDS suggests that all participants exceeded the 100 word threshold in their expressive vocabularies, these findings need to be interpreted with caution (see also Section 3.8.2.4), because the inclusion of less linguistic modes of expression (such as pointing to objects and persons) might have inflated scores. As research on graphic symbol production with speaking participants furthermore indicates, linguistic skills are not automatically transferred between modalities (Smith, 1996; Sutton & Morford, 1998; Sutton et al., 2010). The fact remains that both Participants 2 and 3 showed relatively poor performance during the intervention probes, with Participant 2 also performing the poorest of all three participants during shared storybook reading. Reduced expressive skills and reduced speech intelligibility may have contributed to their overall poorer performance.

On average, participants in the study by Binger et al. (2008) had less intelligible speech than the participants in the current study, as determined by the I-ASCC (Dowden, 1997); even so they learnt to produce graphic symbol combinations. Reduced speech intelligibility alone is therefore unlikely to account for a lack of learning graphic symbol combinations. Speech intelligibility measures for the participants in the study by Binger et al. (2010) were significantly better than for the participants in the current study. Measures for the participants in the study by Nigam et al. (2006) were not reported. Due to lack of specific data regarding expressive vocabulary size for the participants in the studies reported by Binger et al. (2008; 2010), as well as Nigam et al. (2006), direct comparisons to the participants in the current study could not be made.

5.2.1.5 Physical abilities and experiences

Children with physical disabilities tend to have reduced patterns of participation (Imms, Reilly, Carlin, & Dodd, 2008; Law et al., 2006), which are exacerbated by lack of functional speech (Thirumanickam, Raghavendra, & Olsson, 2011). Higher care demands taking up time and energy of caregivers, inaccessible environments and negative attitudes have been found to be underlying reasons (King et al., 2003; Mihaylov, Javis, Colver, & Beresford, 2004). Reduced participation in children with severe physical disabilities often leads to decreased opportunities for socialization, smaller social networks and increased passivity (Basil, 1992). Reduced participation patterns are specifically seen in children who are unable to walk. Assistive devices to allow independent mobility (e.g. powered wheelchairs) have been suggested as methods to increase participation (Mihaylov et al., 2004).

From a social constructivist perspective, decreased participation and lack of opportunities for socialization have direct consequences for language development and language skills. Increased passivity associated with severe physical disability may, furthermore, lead to reduced motivation to engage in any goal-directed behaviour, including communication (Basil, 1992) and would further hamper the development of language and communication.

Participants in the current study all had physical disabilities. However, only Participant 3 did not have independent mobility (Participant 1 had an electric wheelchair and Participant 2 was

ambulatory). Her severe physical involvement coupled with the lack of independent mobility may have been associated with a lack of opportunities to participate, leading to general passivity and learnt helplessness, which could possibly have had an influence on her responses during the probe test (see also Section 5.2.2).

Participants in the other three studies that targeted graphic symbol combinations all seemed to have been mobile, with the exception of one participant in the study by Nigam et al. (2006). Lack of independent mobility did not seem to affect her performance negatively. However, as will be discussed in Section 5.2.2.1, there was considerably more congruence between the intervention and measurement in that study and intervention was conducted with smaller sets of target items over a longer time, which may have offset any effects of a passive interaction style.

5.2.2 Task- and instruction-related factors

5.2.2.1 Probe test

The internal validity of multiple probe designs can be threatened by repeated measurement. Inhibitive effects may result from lack of contingent feedback as well as fatigue and/or boredom due to repeated and lengthy testing sessions (Gast & Ledford, 2010, p. 294; Schlosser, 2003c, p. 33). In this particular study, measurement probes consisted of requesting participants to label 30 pictures. The format of the measurement may not have been very motivating for participants. Although measures were taken to prevent fatigue (breaks after every 10 items administered) and increase motivation (provision of reinforcements such as access to toys, providing stickers and collection of tokens which could be exchanged for small toys), the reinforcements given were additional to the activity itself; the activity itself did not provide its own reinforcement. In contrast, the storybook reading activity used during intervention provided its own reinforcement. Furthermore, during the administration of the probe test, no contingent feedback was given to prevent learning taking place from the test itself. Participants therefore did not know whether their responses were correct or not. Rather, noncontingent encouragement was given to encourage participants to continue the procedure. However, giving rewards (or encouragement) independent of performance can disadvantage learning (Basil, 1992).

Measurement and intervention were conducted in two different contexts, using different picture material for elicitation. While intervention took place within a storybook reading situation, measurement was conducted using a picture description format. The reason for choosing a different format for the measurement than for the intervention was, first to avoid reactivity to repeated readings of the same story affecting the measurement. In order to collect a minimum of three data points per phase, each story would have had to be read at least nine times.

Second, the format of the probe test facilitated the evaluation of generalization across the matrix. If this had been attempted within the storybook reading situation, additional stories and picture material would have been needed. Third, combinations across the three different types of semantic relations could be tested in random order during probes (rather than, for example, testing all attribute-entity combinations first, then all possessor-possession combinations followed by all agent-action combinations, as would have been needed had all three types of relations been tested within stories). This procedure thus prevented order effects from affecting the performance during probes. Fourth, use of the probe test enabled the testing of symbol combinations out of the context within which these combinations were acquired, thereby assessing decontextualized learning. This eliminated the possibility that participants' responses were just phrases that were learnt by rote and produced without comprehension.

While there were compelling reasons for choosing the probe test format as a way of measuring the effect of the intervention, using the storybook reading situation to gather baseline and intervention performance measures could possibly have had the advantage of increasing the participants' awareness of response requirements, as contingent feedback was given during intervention. This may have made participants aware of the desired response, thus increasing chances of producing it. The actual structure of the probes necessitated participants to generalize the production of the combinations learnt during storybook reading to a picture description situation where different materials were used to elicit the combinations. The lack of congruence between the two situations coupled with the lack of contingent feedback during picture description may have made it more difficult for participants to produce the combinations learnt during storybook reading in the picture description task used for measuring their progress.

The use of the treatment boost was intended to make the correspondence between intervention and probes more salient to the participants. It seemed to have some effect in boosting the performance of participants, as can be seen by level changes upon its introduction (e.g. Participant 2, Session 17; Participant 3, Sessions 8 and 17). However, it may not have been sufficient in bridging the gap between shared storybook reading and probe contexts.

In other studies targeting the production of graphic symbol combination skills (Binger et al., 2008, 2010; Nigam et al., 2006), more congruence was evident between intervention and measurement procedures. Binger et al. (2008) measured production of multisymbol messages within storytelling situations, with (intervention) and without (baseline) the caregivers using the Read, Ask and Answer strategy during reading. The intervention which Binger et al. (2010) made use of differed from this study only in that an additional step (Prompt) was added to the strategy, and that educational assistants were taught to implement the intervention. Nigam et al. (2006) demonstrated an action and required participants to describe it, both during baseline and intervention. Additional prompts and models were provided during intervention. Thus, there was congruence between intervention and measurement in these studies.

The type of behaviour targeted in each of the studies was aligned closely with the intervention method of choice. Binger et al. (2008; 2010) did not target specific types of symbol combinations, but measured any multisymbol production. The intervention was naturalistic, taking place within a natural context, and followed the child's lead. Nigam et al. (2006) targeted specific combinations and thus made use of a structured teaching situation. The current study attempted to target specific combinations but did so via a more naturalistic situation, namely a storybook reading context. In order to still measure specifically though, the probe test was devised. This resulted in lack of congruence between the intervention and the measurement contexts, which may have negatively affected results.

In the current study, performance during shared storybook reading in response to the first level of prompting (verbally and visually drawing attention to the aspect of the story illustration showing the target combination) was, on most occasions, superior to performance during the

intervention probes. This seems to underline the fact that the nature of the probes probably dampened participants' performance to some extent. Participant 3, especially, seemed to perform considerably worse on the intervention probes than during shared storybook reading, although there were isolated occasions of very good performance (e.g. Session 9 for the attribute-entity combinations, and Session 26 for the possessor-possession combinations). It seems that she performed inconsistently in a situation where no contingent feedback was provided. Basil (1992) commented on the fact that children with severe motor impairments are often given free rewards as a result of reduced expectations from adults. Such free rewards may increase passivity and reduce learning.

Informal observation and information obtained through interaction with family members and service providers seemed to suggest that the adults had little expectation of Participant 3 to progress and to become more independent, while there were higher expectations of Participants 1 and 2 (see Section 5.2.4). It seems possible that Participant 3 received more rewards that were noncontingent. The probe test might have represented yet another situation during which noncontingent rewards were given, producing inconsistent responses that did not reflect the skills gained during shared storybook reading.

During Sessions 8, 11, 13 and 15 Participant 1 also evidenced a lack of correspondence between performance during intervention probes and performance during shared storybook reading. As indicated in Section 4.4.1.3, Session 8 was the first session conducted at home, and during Sessions 11- 5 Participant 1 was battling a cold. These external factors seemed to have influenced probe performance negatively, although performance during shared storybook reading remained high. The fact that probes were conducted in a test format without contingent feedback may have made them appear more challenging and less motivating than the storybook reading activity, resulting in reduced performance.

Overall, the results suggest that behavioural measurements of a more formal nature may not fully tap the child's abilities evidenced in a more naturalistic environment. Furthermore, repeated formal testing may be prone to elicit reactivity from the child (boredom, fatigue), negatively affecting performance. In the current study, all three participants evidenced sudden

decreases in performance on intervention probes (i.e. Sessions 8 and 11 for Participant 1, Session 22 for Participant 2, and Sessions 10, 17 and 24 for Participant 3). Performance during shared storybook reading seemed more consistent overall. Repeated exposure to naturalistic activities may thus not be as prone to reactivity. Measurements that can take place within natural environments may therefore be more appropriate for designs that require repeated measurements. This also prevents the challenge of researchers spending much of the contact time with participants testing them rather than intervening. In the current study, a roughly equal amount of time was spent intervening (story reading) as was spent testing (probes). When intervention and measurement can be done within the same context, more time can potentially be spent on intervention.

5.2.2.2 Intervention

Setting a teaching criterion in addition to a learning criterion can help to prevent participants reacting negatively to extended repeated testing and intervention sessions (Gast & Ledford, 2010, p. 294; Schlosser, 2003b, p. 131). In the current study, a learning criterion was set, namely achievement of a score of at least 40% above the baseline average for two consecutive probes. A teaching criterion of nine sessions was set. Intervention ceased whenever one of these criteria was met.

Because of the teaching criterion of nine sessions, the number of intervention sessions conducted in the current study may have been too little in certain instances to enable stabilization of the targeted skills. Intervention may have ended prematurely in some instances—before a clear effect was evident and/or before the skill was established to the extent that it could be maintained after intervention ceased. Upon close inspection of Figure 4.2, it is clear that Participant 2's performance during shared storybook reading (grey bar graph) on the first type of relation only "took off" at Session 9, followed by the only increase in performance above baseline on the target items during the intervention probe. Although setting a teaching criterion can prevent the unnecessary continuation of an ineffective intervention (Schlosser, 2003b), it is typically not recommended (Gast & Ledford, 2010; Schlosser, 2003b), since less clear evidence of effectiveness and no evidence of efficacy is obtained. None of the other studies that

investigated graphic symbol combinations made use of a teaching criterion. This may have led to better effectiveness and better evidence of effectiveness.

Similarly, the learning criterion set in this study (a score of at least two correct answers above baseline average for two consecutive probes) may have been low, causing intervention to cease prematurely (e.g. on the second type of relation targeted for Participant 2, for which he did not show any maintenance postintervention). Furthermore, when intervention was introduced to a second or third tier, intervention on the previous tier ceased. Specifically in light of the fact that Participant 2 increased his performance over the consecutive types of relations that were targeted, extending intervention on the first and second type of relation may have had benefits for his performance.

Although Participant 3 clearly did not perform well on the intervention probes, extending the intervention may not have increased her performance. When inspecting Figure 4.3, it is evident that her performance during shared storybook reading was typically at maximum levels already during the second or third intervention session conducted per relation and was maintained relatively well throughout the following intervention sessions. Her performance on the probe test, however, remained variable, without any clear trends being evident. The incongruence between her performances during shared storybook reading and during the intervention probes is unlikely to have been resolved by an increased number of intervention sessions.

Other aspects of the intervention may have had an influence on the comparative effectiveness. Only the study by Nigam et al. (2006) also targeted the production of specific graphic symbol combinations during intervention. In that study, only three intervention items were targeted per set, whereas five were targeted at a time in the current study. In addition, each item was targeted three times during intervention in the study by Nigam et al., whereas in the current study items were only targeted twice during an intervention session. An average of 14 intervention sessions were conducted per set per participant in the study by Nigam et al., whereas an average of only seven sessions were conducted per type of relation per participant in the current study. In addition, only one type of relation (action-object) was targeted in the study by

Nigam et al. At the same time, the criterion for a correct response was stricter in the study by Nigam et al., since the combination had to be produced in the correct order, whereas any sequence was considered acceptable in the current study.

In the studies by Binger et al. (2008; 2010), parents or educational assistants provided a minimum of 12 models per intervention session and likely more. The average number of intervention sessions was seven and five per participant in the respective studies. However, because no specific types of relations were targeted, comparisons to the current study are complicated.

5.2.3 AAC system

The communication board used in the study by Nigam et al. (2006) consisted of 12 items arranged in two groups (actions and objects), whereas the board used in the current study consisted of 21 items arranged in four groups (agents and possessors, actions, attributes, as well as entities and possessions). This aspect may have contributed to better performance during the study by Nigam et al.

The communication boards or overlays used in the studies by Binger et al. (2008, 2010) consisted of 30-35 symbols. However, because the combinations that were modelled to the children and measured in children's productions were not specified, it is unclear whether all symbols were in fact used by parents and children.

In the study by Binger et al. (2008), it is interesting to note that participants making use of SGDs with graphic symbol overlays produced the combinations quicker than the one using nonelectronic communication boards. This finding was also observed in the study by Binger and Light (2007), where aided models provided during play scenarios were used to increase utterance length (in any modality) for children with severe congenital speech disorders. The additional auditory feedback from their selections may have reinforced learning and increased motivation. The use of multiple modalities may encourage the production of longer utterances (Loncke, 2008). All participants in the study by Binger et al. (2010) made use of an SGD, which might have advantaged their learning. In contrast, none of the participants in the current study had

access to an SGD, but made use of a communication board. This may have negatively influenced their learning.

5.2.4 Partner- and environment-related factors

Variables concerning the home environment, the family and the sociocultural context, may have influenced children's performance in the study directly or indirectly. These variables were not formally tested, but informal observations lead to some hypotheses regarding the possible influences of these factors. For all participants, intervention sessions were not only conducted in the school context, but also at home, necessitated by nonattendance (Participant 3) as well as school holidays (all participants). Participant 2 was also seen at the crèche where he often went during school holidays on days when his mother was working. For Participant 1, 11 sessions were conducted at school and an equal number were conducted at home. For Participant 2, 11 sessions were conducted at school, 4 at his grandmother's place of residence (she rented a room in a big residence, where she shared ablution and kitchen facilities with a few other families and individuals), and 9 at the crèche. For Participant 3, only 5 sessions were conducted at school, whereas 21 sessions were conducted at home. The influence of the home environment versus the school environment may have been different for each participant because the proportion of sessions conducted in different contexts varied.

Expectations by caregivers of children's performance (within the home context and in general) and interactions styles between caregivers and children may have been influenced by the family's cultural values and beliefs, family circumstances (e.g. socioeconomic variables and availability of formal and informal support), as well as child characteristics (e.g. skill levels, type and onset of disability). Some of these factors are summarized in Section 3.7.3 and in Table 3.4. The participants in this study all came from an African background, two from a Northern Sotho background and one from a Tshivenda background. However, with multiple cultures and a young democracy, individuals and families in South Africa often differ considerably in the extent to which they preserve their traditional cultural views or adapt according to influences such as a rapidly changing world and the influence of values and beliefs from other cultures. As a result, it is hard to generalize when speaking about typical cultural norms of different population groups.

Traditional African culture tends to regard learning as a process that takes place through observation, rather than through active engagement. Children are expected to learn by observing adults, rather than through engaging with adults or through adult-mediated interactive activities such as play (Bornman, 2001; Geiger & Alant, 2005; Sawadogo, 1995). Children typically also engage with other children, rather than with adults. Although all three participants were exposed to interactive storybook reading in group format during school, only Participant 1's parents read to him at home. However, Participant 2's grandmother, whom he often spent time with, read stories to him and told him traditional stories. Participant 3 was not read to at home but was mostly engaged in watching television. Her parents seemed to regard her mainly as a person in need of care and seemed to try to structure her life in such a way as to keep her content. During the cold winter months, for example, she was mostly kept at home so that she did not have to get up early for school. Of course, the role of strain on caregivers in having to care for a child with severe physical disabilities who did not have independent mobility in a home environment that was not wheelchair accessible as well as having two other children to care for should not be underestimated.

Because the majority of sessions were conducted at home, placing demands on Participant 3 within the home context may have been incongruent with the typical home routines. While this did not seem to affect the performance during shared storybook reading, it may have had an effect on the performance during the probe test. It is notable that the two sessions during which she performed best overall on the probe test (11/30 and 10/30 during Sessions 9 and 13 respectively) were conducted at school.

Beliefs of parents' about the permanence and course of their children's disabilities could affect their expectations of and involvement in intervention and it may be influenced by the onset and severity of the disability. Participant 1 had developed typically up until age 3, when he had suffered a near-drowning incident. His parents expressed the hope on numerous occasions that he would regain more of his skills, such as more intelligible speech and motor skills. This may have been occasioned by their experience of him as a typically developing child prior to the accident, as well as by his recovery from a comatose child to one that was alert, independently mobile with his electric wheelchair and attending the academic stream at a special school. Furthermore, his

speech was more intelligible than that of the other two participants, which may have also fuelled their hope of progress. Participant 2's grandmother also expressed her hope of improved speech for her grandson. Both his speech intelligibility and mobility skills were better than those of Participant 3, whose mother did not express hopes for improvement for her daughter. The severity of her daughter's impairment may have had an influence on her expectations. Parents of Participants 1 and 2 seemed more intent on seeing their children progress, as evidenced by their active interest in schoolwork and therapy, and their requests for ideas on educational activities and games that they could perform with their children at home.

Higher parental expectations have been linked to better school achievement of children (Barnard, 2004; Fan, 2001). It seems plausible that parental expectations may foster perseverance and motivation in their children, resulting in achievements that matched potential to a larger degree. It has been suggested that lack of expectations, in turn, could be linked to increased passivity in children with physical disabilities (Basil, 1992). This may result in achievements that are lower than the child's potential.

5.3 Structure of the combinations produced

From Table 4.5 it is evident that only a proportion of the participants' multisymbol productions conformed to the word order that was modelled during shared storybook reading. Participant 1 produced the highest percentage (60%) while Participant 3 produced the lowest percentage (14%). These differences amongst participants may have been influenced by the speech abilities of the participants—Participant 1 had the most intelligible speech and, according to parent report, produced the most clearly articulated words, while Participant 3's speech was least intelligible and she produced the smallest number of clearly articulated words. Experience with spoken words as an expressive mode may have predisposed Participant 1 (and Participant 2 to an extent) to produce the graphic symbol combinations in the same order as they were modelled during the stories, conforming to spoken output.

Home language may also have had a role to play. In Northern Sotho and Tshivenda, agent-action combinations have the same word order as in English. However, possessor-possession and attribute-entity combinations have the reverse order (e.g. *katse ya Thandi,*

directly translated from Northern Sotho as *the cat of Thandi,* thus *Thandi's cat; gebisi ntswu,* directly translated from Tshivenda as *cap black*, thus *the black cap*). The extent to which characteristics of the first language can negatively interfere with learning of a second language is debated in the literature. Some authors propose that common expressive errors observed in second language learners are similar to those observed in first language learners and do not result from interference from the first language (e.g. Dulay & Burt, 1974), while others propose that negative transfer from the first language can cause word order problems in the second language (e.g. Håkasson & Nettelbladt, 1996). An analysis of expressive syntactic errors made by second language English learners aged 2;9 to 6;2 who had an African language as their first language, revealed that word order errors occurred relatively seldom when compared to other syntactic and morphological errors (Preston, 1992). In the current study, Participant 3 clearly showed a greater percentage of reverse order responses for the attribute-entity and possessor-possession combinations, with a greater percentage of conforming word order responses for the agent-action combinations. The influence of home language on the ordering of the elements within the graphic symbol constructions can thus not be ruled out. The other two participants, however, did not show such a pattern, suggesting that home language structure did not necessarily influence their graphic symbol constructions.

Although reversal of elements in early two-word semantic combinations does occur in children with typical speech development, such reversals are relatively rare (Brown, 1973). However, deviations from spoken word order has been found more frequently than expected in the graphic symbol productions of children with limited speech as well as in young typically developing children (preschoolers) (Kaul, 2003; Smith, 1996; Sutton & Morford, 1998; Sutton et al., 2010; Udwin & Yule, 1990). Such deviations have also been found amongst hearing children using manual signs for expression (Grove, Dockrell, & Woll, 1996; Udwin & Yule, 1990). The percentages of conforming output, as opposed to reversing spoken word order found in the current study (49% and 26%), seem to correlate reasonably well with findings by Iacono, Mirenda, and Beukelman (1993). These authors found that 52% of word combinations produced by their participants (two children with intellectual impairments aged 3;6 and 4;6) in sign and/or graphic symbol output using an SGD, conformed to the order of spoken output, while elements were reversed in 43% of responses.

Researchers have suggested that inherent characteristics of the graphic modality play a role in the lack of conformity of the structure of graphic symbol output compared to that of spoken output (Smith, 1996; Sutton & Morford, 1998, Sutton et al., 2010). It was suggested in Section 2.4.4.1.1 that graphic symbols may predispose toward global rather than sequential processing. This may contribute to conforming and nonconforming order patterns being used interchangeably. On the communication board used, constructing two-symbol combinations conforming to the order of spoken language was accomplished by selecting symbols in a left-to-right progression (e.g. *DOG* appeared to the left of *RUN*). Ordering symbols on a communication board according to word classes in a fashion that promotes left-to-right sentence production has been suggested as a method to simplify the task of producing output structured according to spoken language. However, in a study by Alant et al. (2007) ordering of elements on a display did not influence the order in which symbols were selected to construct symbol sequences aimed at expressing SVO constructions. The current study corroborates these findings. Participants in the current study may not have had extensive exposure to literacy activities where a visual left-to-right progression is reinforced. Participants in the study by Alant et al. were typically developing and aged from 7;5 to 8;5 and presumably had at least a fair amount of exposure. Sequencing letters in a left-to-right fashion may still be quite different from selecting symbols in a left-to-right fashion from a board. In the current study, participants also did not see their sequenced productions, since the symbols were only pointed to rather than selected and placed on a sentence strip, which is used, for example, in the Picture Exchange Communication System (PECS) (Bondy & Frost, 1994) or in a message window, as is used in various dynamic display SGDs.

In the current study, reversing the elements within a particular target item did not inherently change the meaning of the item (e.g. *RUN DOG* essentially conveys the same idea as *DOG RUN*). Thus, participants may not have deemed it necessary to preserve the order within which the items were modelled. Research by Trudeau et al. (2007) suggested that speaking individuals may modify the sequence of complex graphic symbol output (in this case even in a way that output differs from the sequence of spoken output) to avoid ambiguity. Adults and teens

tend to do this more than school-aged children do; however, increased demands for clarity can induce children to use such sequencing strategies more.

In summary, the sequencing patterns of graphic output produced by the participants in this study confirm the patterns observed in previous investigations. These results once again underline that output in spoken and graphic modalities is not necessarily constructed according to the same patterns.

5.4 Summary

The results of the study were discussed in this chapter. Possible influences on the differential performance on the production of symbol combinations by each of the three participants were discussed with reference to relevant literature. Possible influences on the structure of graphic symbol combinations were also discussed. The results were compared to other relevant intervention and descriptive studies.

CHAPTER 6
CONCLUSION

6.1 Introduction

The main aim of the study was to determine the effect of a prompting hierarchy used together with a matrix strategy incorporated into shared storybook reading on the production of graphic symbol combinations (representing three types of semantic relations) by children with limited speech. The effect of the intervention was measured using the probe test.

In this chapter, the most important conclusions regarding the effectiveness of the intervention are presented. Furthermore, clinical implications of the results are discussed. The strengths and limitations of the study are summarized and recommendations for further research are provided.

6.2 Summary of findings

Based on the results from the probe test, a clear effect of the intervention on the production of targeted symbol combinations and generalization to untrained exemplars could only be shown for Participant 1. The probes only showed a low overall effect for Participants 2 and 3. An analysis of performance during shared storybook reading seems to suggest that all participants performed better in this context. The nature of the probe test may have masked the abilities that seemed to be evident during shared storybook reading. Participant 1 seemed to derive enough benefit from the intervention to make this effect measurable by the probe test. His higher receptive language skills may have contributed to his good performance (c.f. also the pilot participant). For Participant 2, probe test results show more effective and efficient learning with each new type of relation. Participant 2 had the lowest receptive language skills and no experience in the expressive use of graphic symbols. The intervention may not have continued long enough in order for a clear overall gain in skills to be demonstrated by him. Participant 3 showed a particular discrepancy between performance during shared storybook reading versus performance during the intervention probes, suggesting that she was unable and/or not motivated to transfer her skills to the probe test situation. Specific factors related to her skills and characteristics were suggested as possible reasons that exacerbated the limited congruence

between performance during intervention and during measurement (probes). Overall, the results suggest that formal testing of specific skills may mask participant ability. Measurements conducted within natural environments may be less prone to inhibit participants' performance.

6.3 Clinical implications

Incorporating specific graphic symbol combinations generated from a matrix into a storybook reading activity can be a successful way of prompting children using AAC to produce specific symbol combinations and may promote generalization to untrained exemplars, as evidenced by the results of Participant 1. However, the effectiveness and efficiency of this method may be influenced by child characteristics. Children with no previous experience in graphic symbol use for expression and/or those with receptive language skills below 3 years may take longer to learn. Furthermore, the gains made in expressing symbol combinations during storybook reading may not automatically reflect in more formalized test situations. All formalized language assessments run the risk of reduced validity, because a skill is tested outside of the natural context within which it is typically used. Lack of authenticity may lead to reduced motivation to perform (Coombe, 2007). The goal of communicating during shared storybook reading is to jointly tell and enjoy a narrative. However, in a testing situation, the child's contributions (i.e. answering questions posed by an examiner who already knows the answers) serve no true communicative goal, but are rather used to evaluate the child's skills. Children with lower motivation and those who are generally more passive may respond particularly poorly in such situations where there is little reward intrinsic to the activity.

Clinical situations generally differ from research situations in that methods are more flexible and testing is not conducted as regularly. The risk of reactivity to repeated testing is thus considerably reduced. Clinically, the use of storybook reading as a context for prompting specific combinations may be very useful. The research by Binger et al. (2008; 2010) showed that parents and educational assistants can be taught to engage in interactive reading that can promote graphic symbol combination skills in general, without targeting specific combinations.

The fact that no behavioural covariation occurred in untreated baselines when intervention was introduced to a specific tier, suggests that combination skills may not readily

generalize across different types of semantic combinations. At the same time, generalization to some of the untrained exemplars within a matrix did occur. There may therefore be a need to target specific types of semantic relations in intervention. The use of a matrix approach can furthermore promote productive new combinations, ensuring that productions are not merely learnt by rote imitation and produced as unanalysed chunks.

The three matrices used in the current study did not contain the same number of items per semantic category (e.g. same number of agents as actions). While this reduced the number of items available to test generalization, it made the incorporation of the items into a story relatively easy. Any storybook with a simple storyline involving two similar characters who do or have the same things or have similar characteristics could potentially be used to create similar matrices of agent-action, possessor-possession and attribute-entity combinations.

Performance during shared storybook reading corroborates the findings of Binger et al. (2008, 2010) that shared storybook reading is a context within which graphic symbol combinations can be relatively easily fostered. The usefulness of this context for targeting specific AAC skills was thus once again demonstrated.

6.4 Evaluation of the study

6.4.1 Strengths

This study was the first targeting specific graphic symbol combinations (agent-action, attribute-entity and possessor-possession combinations) within a shared storybook reading context, thereby attempting to retain a high level of control over the intervention while using a naturalistic context. The prompting hierarchy allowed some flexibility to respond at a level appropriate to the participant's response, and yet followed a closely scripted procedure. The performance of the participants during the storybook reading activity seems to suggest that this was a motivating and enjoyable activity for them. The fact that the applicability of the stories to young children was determined beforehand can also be regarded as a strength of the study. The equivalence of the three stories was also ensured in terms of story grammar, number of words and number of illustrations.

Furthermore, although only a small number of participants took part in the study, the multiple probe design across behaviours (three types of semantic relations) allowed for replicating the intervention three times per participant. No response generalization across types of relations occurred, thus indicating that the behaviours were indeed independent of each other as is required by this type of design.

The matrix strategy allowed for targeting five combinations per type of relation, while generalization to five untrained combinations (the elements of which had been targeted in other combinations) could be tested. Generalization could be monitored continuously throughout all the phases of the study (baseline, intervention and postintervention). According to Schlosser (2003b), the only way of adequately measuring generalization to untrained exemplars is by measuring target and nontarget responses with the same frequency (p. 114). Generalization was observed in all three participants, although the degree to which this occurred differed.

Use of the probe test to measure the effect of the intervention had the advantage that participants' abilities were tested beyond rote, context-bound skills. Participants needed to produce symbol combinations they acquired in response to a different task (picture description) and different material. Furthermore, use of the probe test allowed testing of all 30 items (generalization and intervention items) in random order across all three types of relations. Items from the baseline, and/or intervention and/or postintervention phases could thus be tested using one test procedure. In this way, generalization items could be easily monitored, with the same frequency as intervention items across all three phases of the study (baseline, intervention and postintervention). This is preferable to monitoring generalization in the baseline phase and in a separate generalization phase after the completion of intervention only, as has been done in some previous studies targeting graphic symbol combinations (e.g. Binger et al., 2008; 2010; Binger & Light, 2007; Iacono et al.; 1993).

A further strength is the high level of procedural integrity obtained for both the procedure employed during the shared storybook reading activities as well as the probe test. Good interrater

reliability for the transcription and data collected (percentage correct responses) was also obtained.

The use of IRD calculations to supplement visual analysis can be regarded as a further strength of the study. Relying on visual analysis only has limitations, since no universal decision rules exist and the interpretation of the graphs remains subjective (Campbell & Herzinger, 2010). IRD can provide an indication of effect size, which allows for a standardized method of expressing the amount of behaviour change between phases (Parker et al., 2009).

Lastly, the children participating in the study all had physical challenges and all came from multilingual backgrounds. The study thus involved children with a profile that differed from that of children participating in previous studies targeting symbol combination skills.

6.4.2 Limitations

Two participants from whom data was collected already combined symbols to produce the agent-action combinations before intervention commenced. A different type of relation may have been used to substitute the agent-action combinations in order to allow three opportunities to demonstrate the effect of the intervention. As it is, the effect of the intervention could only be clearly measured twice for each of these participants. A combination of purposive and convenience sampling was used to select participants, because participants were recruited who had a specific profile and who were accessible to the researcher for daily sessions. Together with the fact that the data of only three participants was analysed, this limits the external validity of the study.

Results of the study are complicated by the fact that only a weak effect could be detected for two of the three participants according to the probe test measures. Although responses during the shared storybook reading suggest that participants acquired the relations within that context, lack of baseline data regarding the performance during this context prevents drawing any definite conclusions. It seems, though, that the performance during the probe test did not reflect the gain in skills that took place during shared storybook reading fully. The fact that the context within which intervention took place differed from the context within which the measurements were

taken may have played a significant role. The validity of the measurements may well have been affected by reactivity from the participants, since the repeated probes may have had an inhibitive effect due to lack of contingent reinforcement and lack of clarity of task requirements (Gast & Ledford, 2010; p. 294). In the current study, roughly as much time was spent on intervention as was spent on testing. Although regular and repeated testing is needed for a multiple probe design, testing that can be incorporated into the intervention procedure may allow more active intervention time to be spent with participants.

Setting a teaching criterion of nine sessions may have prematurely ended the intervention sessions before participants benefited adequately from the intervention. This may have contributed to the fact that only one participant showed good maintenance of the skills postintervention.

The CIs calculated for the majority of IRD values obtained were wide. This may in part be attributed to the limited number of data points from which the IRD values were calculated. The limited number of data points obtained per phase also precluded the use of other statistics, such as mean difference effect size methods and regression-based effect size measures, because these methods require correction of serial dependency through the calculation of autocorrelation. Autocorrelation can only be calculated reliably when sufficient data points are available (Wolery, Busick, Reichow, & Barton, 2010).

Only one instructor (the author) provided the intervention to all participants. Although physical location varied, intervention was only conducted within the shared storybook reading context. This limits the external validity of the intervention.

6.5 Recommendations for further research

Recommendations for future research emanating from this study are as follows:

- A replication of the study may be considered using a different format of measurement. Limited evidence of effectiveness of the intervention in the current study may have been partly attributable to testing. In future studies, instead of measuring by a test in a context that differs from the intervention, measurements could be taken within the storybook reading

context. Higher levels of congruence between the intervention and measurement contexts may help to reflect the participants' learning more genuinely. Use of different yet equivalent material during baseline and intervention may be useful to help prevent threats of repeated testing (which may have a facilitative or inhibitive effect) due to repeated exposure to the same story during baseline.

- With reference to factors influencing aided language development (see Figure 2.1), it is clear that many issues around the acquisition of graphic symbol combinations are still unexplored. Future studies may systematically attempt to determine the influence of these factors. These may include:
  - ***Child factors***:
    - Studies may aim to determine the contributions of specific skills (such as expressive vocabulary, expressive graphic symbol vocabulary, receptive language skills, motor skills and motivation) towards the acquisition of symbol combinations. Intervention procedures could be replicated while systematically varying child characteristics in order to gain a better understanding of prerequisite skills, if indeed they do exist. At the same time, cognizance needs to be taken of the challenges of such studies in populations that are typically small and highly diverse.
    - The influence of multilingualism on the acquisition of graphic symbol combinations and alternative modalities as such has not yet been adequately explored. In general, few intervention studies in the field of AAC have specifically involved participants with limited speech from multilingual backgrounds. So far, only one intervention study involving South African children from multilingual backgrounds is known of (Dada & Alant, 2009), focusing on the use of aided language stimulation to teach receptive vocabulary. In view of the significant influence of cultural issues on communication in general, and specifically on graphic symbol understanding and use (Alant, 2005a; Alant, 2005b), more intervention studies with participants from multicultural and multilingual backgrounds are needed.

- ***Partner, environment and task:*** In the current study, the researcher implemented the intervention, making use of a matrix of target and intervention items within a shared storybook reading context. The extent to which the matrix strategy can be used in different contexts (e.g. daily routines) and/or be implemented by the child's natural communication partners (e.g. caregivers, assistants, teachers) may be worthwhile to determine, as the use of natural contexts and partners may enhance the external validity of the intervention.

- ***AAC system***: Future studies may attempt to determine the influence of the use of an SGD versus a communication board on the acquisition of graphic symbol combinations. Although it has been suggested that the presence of voice output may facilitate learning graphic symbol combinations, this has not been investigated. Other factors, such as visual feedback of the sequence composed (e.g. in a message window of the device) and the visual lay-out of the symbols on a communication board, page or overlay and overall vocabulary organization of a communication aid may also be systematically varied in future studies to determine their influence on this process. The influence of the total amount of vocabulary items available to the child might also be investigated. Furthermore, the extent to which the specific symbol system or set used and/or the vocabulary items chosen influence acquisition of early symbol combinations is a question that is not yet answered. What, for example, would be the influence of the use of a less iconic, but more linguistic symbol system like Bliss versus the use of a more iconic, less linguistic set like PCS on the acquisition of symbol combinations? How are symbol combinations learnt when the child is provided with activity-specific overlays or boards versus core vocabulary boards? What is an ideal weighting of different parts of speech (e.g. nouns, verbs, adjectives and closed-class words) to foster the transition to graphic symbol combinations?

- Longitudinal descriptive studies documenting the development of expressive language through graphic symbols could shed more light on the transition from single to multisymbol utterances, and place this skill in the context of the overall trajectory of aided language development. When searching for evidence-based intervention strategies, interventionists and

researchers need to keep perspective of long-term goals. Early symbol combinations skills are typically a stepping-stone towards the development of linguistic competence. The influence of intervention strategies aimed at fostering early graphic symbol combinations skills on later aided language development need to be more fully researched, since relatively few studies exist that targeted syntactic and morphological skills beyond early symbol combinations (Binger & Light, 2008; Binger, Maguire-Marshall, & Kent-Walsh, 2011; Blockberger & Johnston, 2003; Lund & Light, 2003). Factors that can facilitate the development of these skills have yet to be adequately researched. In order to plan for the language development of a child using graphic symbols to communicate, interventionists need to be aware of the facilitators and inhibitors for each phase of the process. In the same way as certain strategies that prove helpful in acquiring symbolization skills (e.g. higher degree of iconicity of the graphic symbols) may actually prove inhibitive in progressing to symbol combination skills, factors that facilitate the latter process may not necessarily be helpful for the development of more complex syntactic production. Decisions regarding choice of AAC systems and intervention strategies, as well as regarding when to phase out or change these, need to be informed by a long-term perspective of language development through aided means.

6.6 Summary

The current chapter presented conclusions regarding the results of the study. The influence of testing on the validity of the results was specifically highlighted. Clinical implications of the results were also discussed, with reference to skills that may indicate readiness for learning graphic symbol combinations, as well as the usefulness of shared storybook reading as an intervention context. The strengths and limitations of the study were presented in an effort to evaluate all aspects of the study. Lastly, recommendations were made as to how future studies could further expand our knowledge on the acquisition of graphic symbol combinations skills, while also placing this skill within the developmental progression of children learning to communicate through graphic symbols.