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Phonological development of first language isiXhosa-speaking children aged 3;0- 6;0 years: a descriptive cross-sectional study.

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ABSTRACT

This descriptive cross-sectional study aimed to describe the phonological development of twenty-four typically-developing first language isiXhosa-speaking children aged 3; 0- 6; 0 years. Participants attended pre-schools in the Cape Flats region of Cape Town and were grouped into 6 age bands of 6 months each. There is no tool available to assess isiXhosa phonology and there is limited information about developmental norms and what is considered as typical as opposed to delayed or disordered speech. The study objectives were to describe the order and age at which isiXhosa consonants (including the clicks) and vowels are acquired; syllable development in isiXhosa, and the emergence and elimination of phonological processes. This was done using a set of culturally and linguistically appropriate pictures to elicit single word responses. Audio recordings of the participants were taken and transcribed using the IPA transcription convention. The findings suggest that acquisition of isiXhosa phonemes occurs relatively early: by age 3;0 most of the consonants were acquired although affricates, fricatives and clicks were still developing and may be refined after the age of 6;0. All five vowels were acquired by 3;0. Children within this sample were able to produce multisyllabic words by 3;0. Phonological processes were used and included mainly sound preference substitution and deaffrication. The study provides normative data on phonological development in isiXhosa speaking pre-school aged children, and is discussed in relation to the small body of work that has focused on isiXhosa phonology. Findings are related to theories of developmental universals and phonological acquisition. The study contributes to the development agenda of Speech Language Therapists in South Africa and may be used as a basis for a larger normative study and ultimately the development of a contextually relevant assessment of the phonology of isiXhosa-speaking children.

Keywords: isiXhosa, normative data, speech development, phonological processes, syllable structure

GLOSSARY OF TERMS

1. **Acquisition**: In this study refers to the presence or absence of a sound in the child's phonological system.

2. **Affricate**: This is a combination of speech sounds, beginning with the complete closure as when producing a plosive, followed by a slow release of friction (Roach, 2009).

3. **Fricative**: When these sounds are produced, there is incomplete closure at some point in the mouth. As a result, air escapes through the narrow opening, causing friction as the sound is produced (e.g. /f/) (Roach, 2000).

4. **Glide**: a vowel-like sound produced with very little obstruction of air and involves continued gliding motion of the articulators into the following vowel (e.g. /w/) (Fromkin & Rodman, 2003).

5. **IPA**: International Phonetic Alphabet which is used for the transcription of languages. It offers a set of symbols that can be used to represent consonants and vowels in all languages (IPA Handbook, 1999).

6. **Liquid**: to produce this sound, the tongue touches the alveolar ridge. There is some obstruction to the airflow but there is no significant friction (e.g. /l/) (Fromkin & Rodman, 2003).

7. **Nasal**: Sounds produced with the mouth completely closed, with a release of air through the nose (e.g. /m/) (Roach, 2000).

8. **Phoneme**: The smallest contrastive unit in a sound system (e.g. **r**ip- **d**ip) (De Lacy, 2007).

9. **Phonological processes**: normally occurring simplification processes (errors) used by children during the process of speech development (Hua & Dodd, 2000).

10. **Phonology**: The study of the representation, processing and production of speech sounds of specific language (Bernhardt, 2004).

11. **Plosive/stop:** Sounds produced with complete closure at some point in the mouth/vocal tract (e.g. /b/) (Roach, 2009).

12. **Stimulability**: The child's ability to correctly produce/articulate a sound that they had previously misarticulated by following specific instructions or modelling (Glaspey & Stoel-Gammon, 2005).

13. **Syllable**: segments of a word which are phonologically significant (e.g. mo-ney) (De Lacy, 2007).

CONVENTIONS USED

1. 4;6 in this study, refers to the child's chronological age (i.e. 4;6 = 4 years; 6 months)
2. isiXhosa target word *ibhola*
3. Translation of target word 'ball'
4. IPA transcription /ibʰɔla/
5. # C - number of consonants
6. # V- number of vowels
7. CV = Consonant Vowel syllable combination
8. Phonemes being discussed are shown in bold e.g. /uja**k'**aba/

OUTLINE OF DISSERTATION

This dissertation consists of seven chapters, outlined below:

Chapter One: Introduction

This chapter gives an introduction to Speech-Language Therapy (SLT) in the South African context and the implications this has for management of children with speech difficulties. Background information about isiXhosa is described to give further context for the study. The statement of the problem and rationale for this study are provided.

Chapter Two: Literature Review

Chapter two gives an overview of isiXhosa phonology and is dedicated to the review of previous studies into phonological development in isiXhosa, English and other languages.

Chapter Three: Phonological Theory

This chapter introduces phonological theories and frameworks that can be used to account for the nature and process of phonological development. Clinical assessment and management frameworks are also discussed, as these are typically derived from the theories and frameworks.

Chapter Four: Methodology

This chapter describes the design used to carry out the study and details the methods, procedures and materials used to collect data. A description of the methods of analysis used to arrive at the results is also provided.

Chapter Five: Study Findings

Chapter five uses tables and graphical representations to illustrate the results of this study in accordance with the aims and objectives of the study. Detailed profiles are given for each of the six age bands in turn, followed by a description of the developmental progression across the bands.

Chapter Six: Discussion of Findings

Results are discussed in relation to phonological theories and frameworks and related to what has previously been documented about phonological development in isiXhosa as well as other languages.

Chapter Seven: Clinical implications and Conclusion

This final chapter concludes by stating the main contributions of the study. A response to the research question will be given and the implications of the findings will be discussed. The research limitations will be explained and suggestions for future research will be provided.

CHAPTER ONE: INTRODUCTION

This chapter aims to describe the current state of Speech-Language Therapy (SLT) in South Africa, and to detail some of the challenges that arise within this culturally and linguistically diverse context. Background information about isiXhosa and other Bantu languages will be presented. The rationale for the study will be provided, particularly in light of the need for cultural sensitivity and evidence based practice when managing children with speech difficulties.

1.1 Speech- Language Therapy in South Africa

There are approximately 2000 Speech-Language Therapists registered in South Africa and a large number (approximately 85%) of them are either English- or Afrikaans-speaking (Gxilishe, 2008; Pascoe et al., 2010). There are 11 official languages spoken in South Africa, two of which are English and Afrikaans (Nation Master, 2012). This highlights the fact that those who speak languages other than English or Afrikaans are most likely not benefiting from the services of SLTs (Pascoe et al., 2010). This mismatch can be attributed to various factors, including that in the past, SLTs were found in more affluent areas and only available to those who could afford them (Kathard et al., 2011) as well as the way in which SLTs were trained prior to 1994 (i.e. pre-democracy). It is clear that the way in which SLT services are delivered needs to be addressed at a national level so as to not only devise strategies to bridge this gap, but also to find ways to ensure equitable services for all who need them.

In the Western Cape region of South Africa, Afrikaans, isiXhosa and English are the predominantly spoken languages (Nation Master, 2012) and SLTs working in this environment are likely to encounter children who are either monolingual isiXhosa speakers or bi-/multilingual speakers who have isiXhosa as their first language, and English or Afrikaans as other languages. This poses a challenge as there are no assessment materials which have been developed for use with these populations (Pascoe et al., 2010). This suggests that children with difficulties in other languages may be at a disadvantage. In their survey of clinical practice, Pascoe et al. (2010) reported that some clinicians adapt methods of administration of assessments and in some instances translate items. Stow and Dodd (2003) note that translation of assessments may alter what a test aims to assess- they expressed concern that this may lead to both linguistic changes and culturally inappropriate

assessments. Similar trends have been noted internationally, where SLTs increasingly have to assess and manage bilingual and/or multilingual children (Gildersleeve-Neumann & Wright, 2010). Working in such environments requires clinicians to have an in depth knowledge of both or all the languages used by the child. However, this is not always the case as there is often a lack of understanding and information about bilingual phonological representation (Goldstein & Fabiano, 2006) and there are limited resources for assessment and management of multilingual children. This pattern is evident in many places around the world (Stow & Dodd, 2003).

1.2 The role of the Speech-Language Therapist

Children with speech difficulties make up a considerable proportion of SLT caseloads (Broomfield & Dodd, 2004; Ruscello, 2008) and this is no different in South Africa (Pascoe et al., 2010). In South Africa clinicians frequently face challenges assessing and managing children with speech difficulties in a language that is different from their own. In this context many children are not being identified as having speech and/or language difficulties due to the fact that SLTs are not equipped to manage children with speech difficulties in languages that are different from English and Afrikaans (Pascoe et al., 2010). This has implications for access to appropriate services for children with speech difficulties in a language different from English.

Clinicians aim to understand a child's communication ability and then address areas of difficulty following a comprehensive assessment. The assessment process includes administering standardised single word speech production tests (if available), obtaining connected speech samples, and assessing other areas (e.g. reading) that influence communication as a whole (Skahan, Watson & Lof, 2007). Stow and Dodd (2003) outline the importance of formal testing within the field of SLT, relating specifically to the bilingual population. Many standardised assessments have been designed to give clinicians a sample of English consonants (Eisenberg & Hitchcock, 2010), that is, tests which focus on a child's production of speech sounds using the speech mechanism (e.g. lips, tongue, vocal folds) (Dodd, 1995). The Edinburgh Articulation Test (Anthony, Bogle, Ingram & McIsaac, 1971) is an example of this. Similarly, there are a number of standardised assessments created to assess phonology (e.g. Diagnostic Evaluation of Articulation and Phonology (DEAP) (Dodd, Zhu, Holm & Ozanne, 2002). Phonology focuses on the specific sounds of a language and

looks at how speech sounds are represented and processed, often taking into account the production of sounds, syllables, words and connected speech and using a phonological process analysis (Bernhardt, 2004).

During the assessment process, the clinician can either obtain a spontaneous speech sample or make use of a single word picture naming task to gather information about a child's speech (Edwards & Beckman, 2008; Eisenberg & Hitchcock, 2010). Edwards and Beckman (2008) note that eliciting spontaneous speech has long been a method used by SLTs to gather information about children's phonological development. This is a useful method as it occurs in a child's natural environment and children are more likely to speak more since they can focus on topics of interest them. However, it presents a disadvantage when children do not produce target sounds (Edwards & Beckman, 2008) and analysis may be less systematic. As a result, SLTs also make use of single word naming tests in order to have more control over the sounds that need to be assessed (Edwards & Beckman, 2008).

Naming tasks give SLTs information about children's stored phonological representations and their ability to articulate real words (Stackhouse & Wells, 1997). Eisenberg and Hitchcock (2010) outline some of the benefits of using such tests. These include the fact that they are easy to administer and children's responses can be transcribed and analysed to give a profile of their speech abilities. Such tests allow for the assessment of a full range of sounds (including vowels) in a variety of contexts. Skahan et al. (2007) note that there are often norms associated with single word tests that can be used to identify children with speech difficulties, although clearly this is only applicable to some languages. Even so, single word naming tests can be problematic in that they may not give a comprehensive picture of a child's speech difficulty (Skahan et al., 2007). Another alternative is repetition/imitation tasks which are often carried out in situations where a child is unable to name a particular picture. Picture naming and spontaneous speech elicitation are thought to be more cognitively and linguistically challenging for a child than mere imitation (Edwards & Beckman, 2008).

Following assessment, SLTs should be able to identify children with speech difficulties (Skahan et al., 2007). Baker (2004) and Cohen and Anderson (2011) note the

importance of carrying out both independent and relational analyses of a child's speech. Independent analysis aims to give information about the consonants, vowels and syllable shapes a child is able to produce at that particular point of speech development (Baker 2004; Cohen & Anderson, 2011). SLTs can then use relational analysis to compare the child's productions to the intended adult phonology. This should include a record of the percentage of consonants produced correctly by the child (PCC), percentage vowels correct (PVC) and an analysis of phonological processes used by the child (Baker 2004; Cohen & Anderson, 2011). This information can help a clinician describe the nature of a child's speech difficulties and subsequently plan appropriate goals for therapy (Khan, 2002). These findings also allow for the monitoring of the child's progress after intervention strategies have been implemented (Bleile, 2002). McLeod and Bleile (2004) emphasise that intervention goals should focus on more than just the speech difficulty. That is, SLTs should aim to improve a child's confidence and level of participation by engaging in practices that will reduce the negative attitudes of society when it comes to speech and other communication difficulties in general.

Although SLTs working in the South African context often obtain qualitative information from the use of standardised assessments developed in different environments and standardised on different populations, the norms cannot be applied to children in the local population. In their paper, Laing and Kamhi (2003) address some issues related to assessment in culturally and linguistically diverse populations. These include: content bias- where items of an assessment may not be familiar to children in a context different to where assessments are standardised; linguistic bias- where there are differences between the language or dialect of the child and the clinician administering the test and the response expected from the child; disproportionate representation in normative samples- because in the past standardised tests have not included culturally and linguistically diverse populations in the process of standardisation, there is the risk that these children may be misdiagnosed. This highlights the need for development of material for such populations, and the judicious use thereof.

To date, there is no tool available to comprehensively assess isiXhosa phonology in children. Linked to this, there is limited information about developmental norms and what is classified as typically developing speech as opposed to delayed or disordered speech.

Although standardised articulation tests, (e.g. Goldman-Fristoe Test of Articulation-2, Goldman & Fristoe, 2000) are helpful in providing some insight into a child's difficulties and can be used to provide qualitative information, it is necessary to have linguistically and culturally relevant assessments. Clinicians in the study by Pascoe et al. (2010) noted that an assessment tool in the dominant languages in the Western Cape (i.e. isiXhosa, Afrikaans and English) would be of value to them. This may even increase their level of confidence when working with multilingual children.

It is the responsibility of the SLT to ensure that they provide equitable, ethical and evidence based services for their clients. In some way these concepts are linked. For example, in the local context it could be argued that isiXhosa speaking children with speech difficulties are less likely to be identified and appropriately assessed and managed than their monolingual English counterparts, and much of this may be due to the lack of evidence on which to base assessment and interventions. Several authors have discussed evidence based practice (e.g. Kent, 2006; Ratner, 2006; Vallino-Napoli & Reilly, 2004) and related these to the standards set by the professional associations around the world (e.g. American Speech-Language-Hearing Association (ASHA); South African Speech Language and Hearing Association (SASLHA)). With this in mind, research into the phonological development of children who speak the indigenous languages (in this case isiXhosa) is urgently needed in order to delineate best practice. Stow and Dodd (2003) note that having undertaken such research, the next steps for clinicians could involve the development of assessments that are specific to the context in which they practice. With further research, the evidence base should increase. In the long run this will provide SLTs with norms that are relevant to their specific populations and that can be used effectively in the clinical setting.

A substantial amount of research into children's phonological development in English has been carried out in many developed countries (e.g. Dodd, 1995; Grunwell, 1981; Ingram, 1974; Preisser, Hodson & Paden, 1988). As a result, there is a considerable volume of normative data available to SLTs working in these countries. Such information is necessary for making clinical decisions relating to assessment and management of children with speech difficulties (Dodd, Holm, Hua & Crosbie, 2003). Speech is important for being an effective and intelligible communicator. Raitano, Pennington, Tunick, Boada and Shriberg (2004)

noted that children with speech sound disorders have less intelligible speech than their typically developing peers. Difficulties communicating can lead to other problems with reading and spelling (Larrivee & Catts, 1999), poor academic success and negative psychosocial experiences during the school years. Lindsay and Dockrell (2000) suggest that children with speech and language difficulties are likely to be bullied and that this may be directly linked to the difficulty itself or the behaviours exhibited by the child with the difficulty (e.g. lack of confidence) (Lindsay, Dockrell & Mackie, 2008).

In order to curb such effects, some authors have suggested use of the International Classification of Functioning, Disability and Health (ICF) (WHO, 2001) in their clinical practice. Threats (2008), in his discussion of how the ICF can be used in the clinical setting, highlights the fact that in general, SLTs (and Audiologists) are trained to assess, identify and manage the specific areas of breakdown or impairment when managing clients. He states that this may be to the disadvantage of the client as this approach does not take into account the social and environmental factors that may influence them. McCormack, McLeod, McAllister and Harrison (2010) carried out a study to gain some understanding about childrens' experiences when it comes to speech difficulties. They included various aspects that may affect the child, including personal factors, overall communication skills and issues around relationships with significant others- all of which are linked to the ICF. McCormack et al. (2010) noted that SLTs need to find ways in which to address the environmental factors (e.g. perceptions of listeners/communication partners) by suggesting strategies that can allow both the child and the listener to overcome the challenges related to having a speech difficulty. According to McLeod and Bleile (2004) the ICF can be used to set more holistic goals for children with speech difficulties in order to ensure that they are able to be effective communicators in the long term. This model considers not only the impairment, but also the social impact of the impairment and recognises that a speech difficulty is not only an impairment of body function, but also has repercussions on social activity and participation (McLeod & Bleile, 2004).

A number of studies (e.g. Bird, Bishop & Freeman, 1995; Bishop & Adams, 1990; Gallagher, Frith & Snowling, 2000; Nathan, Stackhouse, Goulandris & Snowling, 2004) have been carried out in an attempt to describe the effect of speech difficulties on later

literacy skills. Bird et al. (1995) found that children who had speech difficulties had delays not only with phonological awareness, but also with literacy. They reported that, when compared to their typically developing peers, spelling was most affected. Bishop and Adams (1990) put forward the critical age hypothesis which suggests that if children's speech difficulties have not been addressed by the time that formal literacy instruction begins, there is an increased risk of experiencing literacy difficulties, which in turn may lead to academic failure. This highlights the importance of appropriate management of children with speech difficulties.

This is especially important in South Africa where the level of literacy is a major concern (Kathard et al., 2011). Such difficulties may be exacerbated by challenges inherent in the current educational system. In their paper, Kathard et al. (2011) reported alarming figures relating to literacy in South Africa. Figures released by the National Department of Education revealed that 61% of grade 3 learners were not reaching the expected outcomes (Centre for Evaluation and Assessment, 2006). Other studies conducted internationally (e.g. Mullis, Martin, Kennedy & Foy, 2007) also revealed concerning results- specifically that when compared to grade 4 learners from other countries, South African grade five learners performed the worst (Scherman, van Staden, Venter & Howie, 2008). There are many possible reasons for these outcomes, such as past inequalities under the apartheid regime, language barriers and the different opportunities available to children in rural versus urban areas (Kathard et al., 2011). In order to give South African learners the best opportunity to achieve academic success, it is vital that SLTs working in these environments keep this in mind when planning intervention for children with speech difficulties and in so doing maximise their therapy outcomes.

While there is a considerable amount of research focused on the development of English phonology, fewer studies have been conducted in languages other than English. Gxilishe (2004) notes that there is limited research available on the acquisition of Southern African languages such as isiXhosa, although there have been more studies carried out in recent years. Although investigations into some of the Bantu languages have been carried out (e.g. Sesotho- Demuth, 1992; Siswati- Kunene, 1979; isiZulu- Naidoo et al., 2003) findings from these studies cannot be generalised to other Bantu languages (Tuomi et al., 2001).

While some common attributes are shared among this language family, each language has different phonological and morphological systems (Pascoe & Smouse, 2012). Information about isiXhosa phonological acquisition is important for SLTs as it can help identify the differences between typically developing and disordered/delayed speech development within this population (Tuomi, Gxilishe & Matomela, 2001). In order to appropriately assess child phonology, such information is vital.

1.3 IsiXhosa background

IsiXhosa is one of the eleven official languages spoken in South Africa. It is a Southern Bantu language which falls in the family of Nguni languages (Jessen & Roux, 2002). IsiXhosa is the mother tongue of approximately 7.9 million (18%) South Africans and it is estimated that (23.7%) of its speakers are found in the Western Cape (Nation Master, 2012). Within South Africa it is the second most spoken language (Nation Master, 2012). Similar to other Bantu languages, isiXhosa is a tonal language -with high and low surface tones (Niesler, Louw & Roux, 2005). A unique feature of African languages is the fact that some of them contain click sounds which have been incorporated into the family of Nguni languages (Nurse & Philippson, 2003). isiXhosa is one of these languages which contains approximately 16 click consonants. It has a rich, agglutinative morphology, where the verbs have a set of intricate affixes (Gxilishe, de Villiers & de Villiers, 2007). The language has 15 noun classes- 8 singular and 7 plural (Gxilishe, Smouse, Xhalisa & de Villiers, 2009). Similar to isiZulu, isiXhosa is said to have conjunctive orthography- that is, sentences can be represented by a single word (e.g. Ndiphilile - 'I am fine') (Niesler et al., 2005).

According to Mosaka (2000) many of the Bantu languages have a CVCV syllable structure, with CV being the most basic. As with most Bantu languages isiXhosa syllable structure is characterised by syllables that almost always end in a vowel (e.g. *iliso* 'eye') and contain syllabic consonants (e.g. *u**m**ntu* 'person') (Demuth, 2003; Mowrer & Burger, 1991). It is very unusual for isiXhosa consonants to occur in word final positions (Lewis, 1994), as they usually end with an open syllable structure. In the past it has been said that in isiXhosa the stressed syllable (often the longest) is always the penultimate syllable (e.g. *U-**bi**-si* 'milk') (Mowrer & Burger, 1991; Mosaka, 2000). However, this thinking may be related to how in

several of the Bantu languages, the penultimate syllable stands out due to vowel lengthening (Kisseberth & Odden, in Nurse & Philippson, 2003).

In more recent years it has been suggested that stress should rather be described in terms of intensity (i.e. tone). Demuth (2003) notes that in Sesotho (also a Bantu language), there is no 'stress' but rather, similar to isiXhosa there is lengthening of the penultimate syllable which provides the contrastive tones (high and low) found in both the languages. Approximately 97% of Bantu languages are tonal, with the distinction of high and low tones (Nurse & Philippson, 2003). In a tonal language, the meaning of a word can be altered by a change in tone (Pascoe & Smouse, 2012). According to Nurse and Philippson (2003) tone is as much an important element for a syllable or word, as is a consonant or vowel, but most research into isiXhosa phonology to date has focused on segmental rather than suprasegmental aspects of the language.

Some African languages, particularly Bantu languages have prenasal consonants which have been referred to as homorganic bi-segments (e.g. /nd/-> *iqa**nd**a* 'egg') (Webb & Kembo-Sure, 2000). When compared to other languages such prenasal consonants are found more frequently in Bantu languages (Mwita, 2007). These prenasal consonants are a sequence of sounds that begin with production of a nasal and end with an oral sound (Mwita, 2007). It has been suggested that isiXhosa has consonant clusters (e.g. Conradie et al., 2011; Mowrer & Burger, 1991), however, a number of authors dispute this, saying consonant clusters are rarely found in isiXhosa and only occur in the form of borrowed words (e.g. *i**br**ushi*- 'brush'; *i**gr**eyivi*- 'gravy') (Finlayson et al., 1994; Demuth, 2003; Mohammed, 2001).

In some Bantu languages, prenasal consonants are viewed as separate phonemes (e.g. Swahili, Kikongo, Kuria, see Mwita, 2007). Early research appears to support this notion and authors have given various reasons as to why these sound combinations should be considered as a single unit of sound. They include the fact that they are homorganic and they exhibit similar timing of simple consonant length (Herbert, 1975, Hubbard, 1995). Herbert (1975), further explains that in the same way as some affricates have delayed release (e.g. t + ʃ => tʃ,) which is a single unit of sound), the same can be applied to the combination of such prenasals

(e.g. m + b => mb). Hubbard (1995) also notes that these sound combinations are usually found in environments where clusters are not permitted, which suggests that they are not in fact consonant clusters. More recently Mohammed (2001), in his exploration of Swahili, suggests that if such prenasals are used with different combinations of sounds, they can change the meaning of a word, as with other phonemes. Another reason supporting this school of thought is that the components of prenasals are often in one syllable (e.g. syllabification in Swahili words- see Mwita, 2007). Mohammed (2001) also notes that consonant clusters are less likely to be present in the Bantu languages (e.g. Swahili) due to the fact that these languages have a CVCV structure. Although there are different views on this, there seems to be more evidence supporting the school of thought which follows that these prenasals are not in fact consonant clusters.

In Southern Africa, it is clear that there is increased awareness of the challenges that come with working in such a diverse population. These challenges are exacerbated by the fact that SLTs are faced with obstacles relating to their inability to provide equitable services – an issue which needs to be addressed at a higher level; their reduced confidence in treating children with difficulties in the indigenous languages because of the limited understanding of these languages as well as the lack of appropriate materials that can be used in the clinical setting. When considering the Western Cape, it is likely that SLTs will encounter children who are either monolingual isiXhosa speakers or bi-/multilingual isiXhosa speakers who have either English or Afrikaans as their second language. There is a great need for research, not only to provide further information about languages such as isiXhosa, but also to work toward developing tools that will enable SLTs to provide equitable, ethical and evidence based care.

1.4 Summary

This chapter has provided some insight into the current situation faced by SLTs working in South Africa, particularly when having to assess and manage children with speech difficulties. This was done in order to justify the need for further research within this area in order to develop culturally and linguistically appropriate materials for clinicians. As South Africa is a culturally and linguistically diverse population there is often a mismatch between the language of the child with a speech difficulty and that of the SLT and this is currently

exacerbated by historical inequalities. This presents a number of challenges mainly due to the fact that there are limited resources available for SLTs to appropriately assess and manage children with speech difficulties, thus making it difficult to provide effective and equitable services. The reasons for this mismatch were described in order to highlight the need for intervention at a national level. The impact of speech difficulties on a child's life has been outlined to show the importance of early identification and appropriate mamnagement of these difficulties to avoid long term psychosocial and educational sequelae.

CHAPTER TWO: LITERATURE REVIEW

The following chapter will give an overview of what is known about isiXhosa phonology and will explore the small set of previous research into the language. Studies undertaken into other languages including English will also be discussed. This will be done in order to show the disparity between isiXhosa and other languages such as English, in terms of the availability of normative data regarding phonological development.

2.1 Phonology of isiXhosa

There is contradictory information regarding the number of phonemes in isiXhosa. In general it is acknowledged that there are at least 38 consonants in the language (Mowrer & Burger, 1991). In addition to these there is a variation of the three basic clicks of the language (dental (/ǀ/), lateral (/ǁ/) and palatal (/!/)) which result from different combinations of aspiration, nasalisation and voicing (Gxilishe, 2004). Some authors have reported 15 click consonants (Gxilishe, 2004; Niesler et al., 2005) whereas others have reported that there are 18 (Finlayson, Jones, Podile & Snyman, 1994; Jessen & Roux, 2002) (see Appendix A1 for a chart showing isiXhosa consonants and A2 for isiXhosa clicks). The majority of the Bantu languages have either a five vowel (a, i, e, o, u) or a seven vowel system (a, i, e, o, u, ɔ, ɛ) (Nurse & Philippson, 2003).

A unique feature present in isiXhosa is the process of vowel raising (Nurse & Philippson, 2003). Finlayson et al. (1994) explain that where the mid-low vowels / ɛ / and / ɔ / are followed by high vowels in a word (e.g. /u/ and /i/), vowel assimilation occurs. This means that the higher vowels will raise the mid-low / ɛ / and / ɔ / to /e/ and /o/, respectively. However, it is only a phonetic change and the meaning of the word is not changed (Finlayson et al., 1994). Figure 1 shows the vowel chart of isiXhosa and illustrates the vowel assimilation process.

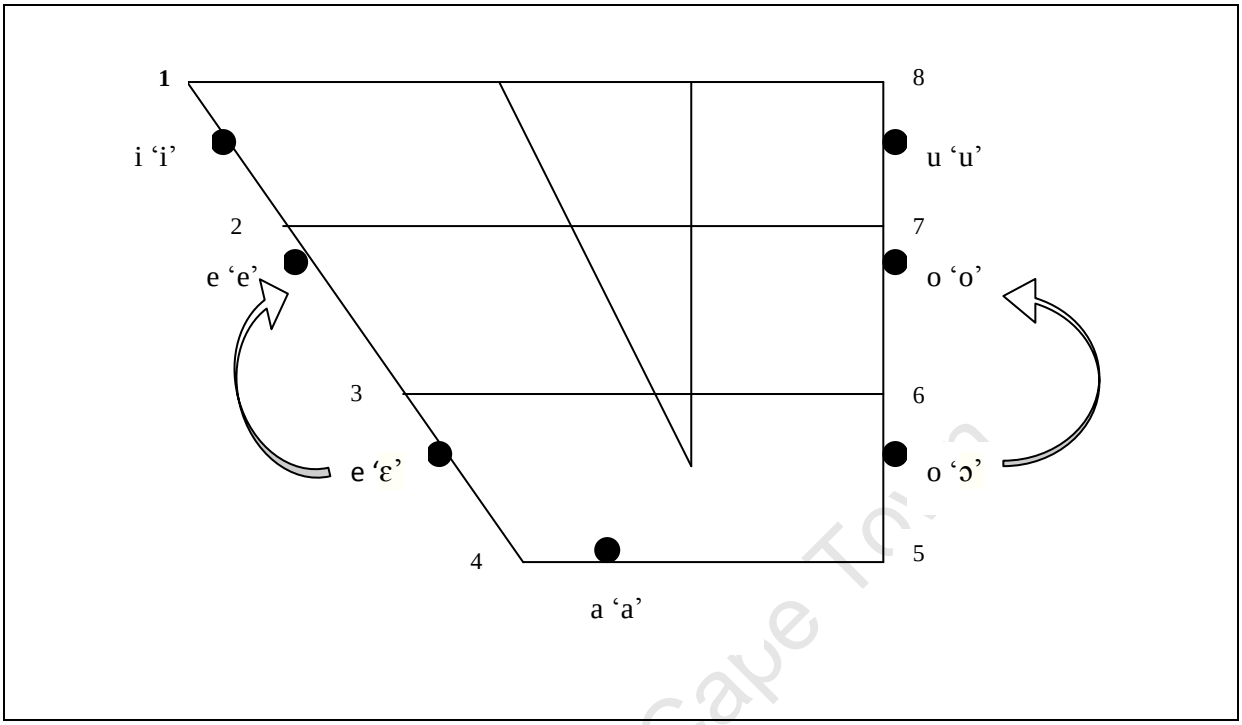

Figure 1. isiXhosa vowel chart *(adapted from Finlayson et al., 1994)*.

There are certain features thought to be unique to isiXhosa phonology. Mowrer and Burger (1991) outline some of these which include ejective plosives, rolled /r/ used in borrowed words and aspirate plosives (see Mowrer & Burger, 1991 for a review). There are, however, many consonants which are common to both English and isiXhosa (e.g. b, ɡ, v, s, z, m, n, ŋ).

2.2 Research into isiXhosa speech development

A number of studies of phonological acquisition in isiXhosa have been carried out in the last two decades. Research shows that isiXhosa speaking children acquire many of their phonemes early. This seems to be consistent in the few studies that have been done on isiXhosa (Gxilishe, 2004; Mowrer & Burger, 1991; Tuomi et al., 2001). As the majority of these studies have been longitudinal and/or single case studies focused mainly on the development of the click consonants, it is difficult to get a full understanding of the acquisition process in isiXhosa, including all the consonants, vowels, syllable structures and phonological processes of the language. Table 1 shows a summary of studies that have been carried out on isiXhosa speech development to date.

Table 1. Summary of studies of isiXhosa speech development

Authors	Participants	Investigated	Data collection	Main findings
Mowrer and Burger (1991)	70 isiXhosa speaking children, 70 English speaking children aged 2;6 – 6;0.	Order and age of acquisition of consonants, types of errors, substitutions.	Single word naming.	80% of the phonemes mastered by age of 3. Clicks are acquired between ages 2;5 and 3 years for /ǀ/; /!/ and between 3;5 and 4years for /ǁ/.
Lewis (1994)	41 isiXhosa-speaking children aged 1;6 -5;5.	Acquisition of isiXhosa clicks.	Imitation, sentence completion and sentence recall.	Clicks acquired later than other consonants. Use of clicks begins between 3;0 and 4;0, with /!/ appearing first.
Tuomi et al. (2001)	10 isiXhosa-speaking children aged between 1;0 – 3;0.	Order of emergence of consonants, development of consonant inventories and vowels.	Spontaneous speech samples.	Nasals, stops and glides emerged earlier, followed by fricatives and liquids. Clicks appear between 2;7 and 3;0 years. Vowels emerged early (at 1;6 years).
Gxilishe (2004)	10 isiXhosa-speaking children aged 1;0 -3;0 years.	Order of emergence of clicks.	Spontaneous connected speech samples in home environments.	First click to emerge is /ǀ /, then palatal /!/ and lateral / ǁ / between 1;0 and 1;6 years.
Conradie et al. (2011)	Longitudinal study of 1 isiXhosa-speaking child between 0;11 – 1;7.	Development of consonants, vowels, syllable structure, phonological processes and prosody.	Spontaneous connected speech samples in a naturalistic environment.	First consonants and clicks emerge between the 0;11 and 1;7 years. Vowels acquired by age 1;7 years.
Fish et al. (2012)	3 isiXhosa speaking children aged 2;8, 2;5, 2;7.	Speech input, stored phonological representations, and speech output.	Single word naming, repetition tasks and auditory discrimination tasks.	Majority of vowels and consonants already in use. Clicks and affricates still being acquired. Some phonological processes observed and variability in auditory discrimination.

With the exception of Mowrer and Burger's (1991) study, the remainder of the studies of isiXhosa phonology have made use of relatively small sample sizes. Even so, it can be seen that some valuable information regarding isiXhosa phonology has been gathered. These studies have looked at the phonological development of children as young as 1;0 (Conradie, Jeggo, Purchase, Rosewall & Winfield, 2011; Gxilishe, 2004; Lewis, 1994 and Tuomi et al., 2001) and thus some information can be obtained about the earliest stages of speech production. In general, the research focused on the order of development of consonants and vowels as well as clicks (Gxilishe, 2004; Lewis, 1994; Mowrer & Burger, 1991; Tuomi et al., 2001). The more recent studies (Conradie et al., 2011; Fish et al., 2012) are small scale, exploratory studies which have attempted to detail the development of a small number of children in terms of syllable structure development, phonological processes and overall speech processing.

Mowrer and Burger (1991) reported that 80% of isiXhosa phonemes were acquired by the age of 3;0 (/ŋ,/ /j/, /ʃ/, /s/ are acquired between 3;5 -4;0). This corresponds to what was found by Tuomi et al. (2001) who noted that the order of acquisition of consonants was nasals, stops and glides, followed by fricatives and liquids. There was some inconsistency with /s/ and /z/. Tuomi et al. (2001) reported that these sounds may be acquired by age 2;0 years. This pattern of early emergence of consonants is also reported in the study by Conradie et al. (2011) and Fish et al. (2012). They reported that consonants emerged between 0;11 and 1;7 years (Conradie et al., 2011), and Fish et al. (2012) found that many of the consonants and vowels were already acquired by the children aged 2;5 -2;8 years. Acquisition of vowels was reported to occur by the age of 1;7 (Tuomi et al., 2001; Conradie et al., 2011). There is some consistency in terms of the age at which clicks are acquired. Mowrer and Burger (1991), Tuomi et al. (2001) and Lewis (1994) noted that clicks generally emerge between the ages of 2;6 and 4;0 years. However, Gxilishe (2004) and Conradie et al. (2011) reported that clicks emerge as early as 1;0 year.

These studies suggest that acquisition of isiXhosa phonemes begins relatively early (approximately 1;6 years) and continues up to the age of 4;0 years. While there is an increasing body of knowledge around isiXhosa phoneme acquisition, there are many

questions remaining. The majority of studies have focused primarily on the acquisition of the click sounds found in isiXhosa (Gxilishe, 2004; Lewis, 1994; Mowrer & Burger, 1991; Tuomi et al., 2001). Less is known about the development of consonants, vowels and syllable structure (the latter which is especially lacking) as well as the phonological simplification processes that may occur in isiXhosa. For example, recent studies suggest that processes such as lateralisation may be a process commonly found in isiXhosa (Fish et al., 2012) and due to the presence of lateral sounds in isiXhosa, delateralisation may also occur commonly in isiXhosa (Conradie et al., 2011; Odden, 1996). Acquisition of suprasegmental aspects such as tone and links between phonology and morphology need to be investigated further.

McLeod's (2007) 'International Guide to Speech Acquisition' outlines research that has been undertaken investigating speech acquisition in twelve English dialects around the world as well as an additional twenty-four chapters each detailing speech development of languages other than English. A survey of this text suggests two main methods of investigating children's speech acquisition, namely longitudinal and cross-sectional studies. Longitudinal studies (e.g. Sesotho studies by Connelly, 1984; Demuth, 1992) involve selecting a particular group (usually smaller samples) and carrying out observations over time. This allows for sequential mapping of changes seen in the sample. Cross-sectional studies (e.g. Hua & Dodd, 2000; Mowrer & Burger, 1991) involve having participants from different age groups and studying the differences between them (Irwin, Pannbacker & Lass, 2008). Dodd, Holm, Hua, Crosbie and Broomfield (2006) note that with this method of data collection, one is likely to obtain only probable data as a cross-sectional study does not allow for the identification of development patterns. However, it is also possible to yield the developmental progression of phonological acquisition with a large enough sample, and make generalisations about a particular population (Hua & Dodd, 2006).

2.3 Studies of phonological development in English

Speech development is an on-going process in which children are learning to produce the speech sounds of their language accurately (Gildersleeve-Neuman, Kester, Davis & Peña, 2008). It is widely accepted that children produce their first words at approximately age 1;0 and that between the ages of 1;0 and 2;0, they start to produce more complex words (Dodd & McIntosh, 2010). This developmental progression of phonological development is observed

in some English phonology acquisition studies. Table 2 gives a summary of studies of phonological development in various English dialects.

Table 2. Summary of studies of English speech development

Authors	**Participants**	**Investigated**	**Data collection**	**Main findings**
McLeod et al. (2001)	16 typically developing English speaking 2 year olds.	Consonant cluster production.	Spontaneous speech samples.	Consonant clusters were acquired word initially and word finally.
Bland-Stewart (2003)	8 African American English speaking children aged 2;0.	Phonetic inventory, phonological processes, and word shapes.	Spontaneous language samples.	Children used phonological patterns that were attributed to the development of the dialect.
Dodd et al. (2003)	684 British English speaking children aged 3;0 and 6;11.	Age of acquisition and the age when error patterns are eliminated.	Standardised phonology assessment.	The following sounds appear early /m, n, p, b, d, w/ and /r, h, ð/ were acquired later. /ʧ/ is one of the last sounds to be acquired. 90% of children over 6 years did not exhibit errors. Gliding continued after age 6.
Vance et al. (2005)	100 English speaking children age 3-7.	Effects of age and task length on speech processing.	Picture naming, repetition and non-word repetition.	Older children performed better on all three tasks. Significant improvements noted between 3 and 4 years and 4 and 5 years.
McIntosh & Dodd (2008)	62 typically developing English speaking 2year olds	Accuracy of spoken phonology.	Auditory-visual tasks, oro-motor movements, verbal and non-verbal rule abstraction.	Fricatives and affricates are acquired later than other sounds.
Cohen & Anderson (2011)	94 English speaking children aged 3;1- 4;11.	Identify and compare phonological processes in relation to existing norms.	Single word picture naming.	Velar fronting, stopping of affricates ‘s’ cluster reduction found to be in line with what has been documented.

In general, research has shown that as children get older their sound production becomes more precise and there are fewer phonological processes present in their speech (e.g. Dodd, Holm, Hua & Crosbie, 2003; Vance, Stackhouse & Wells, 2005). In these phoneme acquisition studies researchers appear to be in agreement regarding the fact that certain sound groups develop earlier than others. Sounds such as /m, n, p/ (which are produced anteriorly, thus believed to be easier to produce) are acquired earlier followed by sounds such as /θ, ð, z/ (which are more complex to produce) (Dodd et al., 2003; Dodd & McIntosh, 2010; Vance et al., 2005). Within the age range 2;0 – 7;0 years, a number of developmental phonological processes have been detailed and these are expected for typically developing speech. Cohen and Anderson (2011) reported on phonological processes used by pre-school aged children. They suggested that some of the processes used (e.g. fronting and stopping) mirror those that have been well documented for other languages and that presence of some processes reduced as the children became older.

The various dialects of English have also been explored (see McLeod, 2007). This is an advantage for SLTs working with English speaking children as they are provided with normative data that can aid in their management of children with speech difficulties with a range of English dialects. SLTs may use this information to determine where a given child's speech seems typical (albeit different from the standard) for the population from which he/she comes or may be delayed or disordered. It should be noted that in some instances, children may produce certain sounds in a way that may be viewed as disordered, when in fact, it has more to do with a dialectal difference (Laing & Kamhi, 2003). Thus it is important for the SLT to identify whether a child's speech is delayed (i.e. characterised by use of developmental phonological processes beyond the age of expected elimination) (Dodd & McCormack, 1995) or disordered (i.e. use of atypical processes, either consistently or inconsistently) (Crosbie, Holm & Dodd, 2005). Some of the studies have made use of large participant groups (e.g. Dodd et al., 2003; Vance et al., 2005) and as such the findings can be generalised to the wider population. There seem to be many changes that occur in phonological development between the ages of 1;0 and approximately 8;0 years and studies of English phonological development have aimed to record these changes in order to provide information about typical and atypical phonological development.

2.4 Research in other languages

Studies have been carried out to investigate phonological acquisition of children whose first language is not English. For example Demuth (1992) carried out a study to gain more information on speech acquisition in Sesotho, another Bantu language. She reported on the development of consonants, vowels, stress, tone and syllable structures of the language. According to the findings, the majority of the simple consonants were acquired by the age 2;0. As with other languages, it was reported that Sesotho speaking children acquired vowels at an early age. According to Demuth (1992), children appear to have a complete phonetic inventory by the age of 2;6 years. As Sesotho is also a Bantu language, these findings may give an indication of how a child developing speech in isiXhosa may follow a similar pattern of development. While there is extensive information on some languages (e.g. German acquisition studies by Berg, 1992; Elsen, 1991; Fox & Dodd, 1999), there are other languages that are being newly researched (e.g. Swahili studies by Mohammed, 2001 and Dutch studies by Beers, 1995; Fikkert, 1994; Jongstra, 2003). Phonological acquisition studies can be those of monolingual children (e.g. Finnish- Saaristo-Helin et al., 2011) as well as of children acquiring a particular language alongside another (e.g. Russian and English- Gildersleeve-Neumann & Wright, 2010). Studies of monolingual acquisition may reduce language interference however they may not always be possible or realistic in some contexts where monolingualism is rare.

Findings from studies carried out on languages different from English and isiXhosa reveal that vowel development occurs early in the process of phonological development (e.g. German- Fox & Dodd, 1999; Putonghua- Hua & Dodd, 2000). A number also report that most stops, nasals and some fricatives are acquired earlier than affricates, liquids and glides (Spanish- Goldstein & Cintrón, 2001; Arabic- Saleh, Shoeib, Hegazi & Ali, 2007; Finnish- Saaristo-Helin et al., 2011). This suggests that this may also be true across many other languages including isiXhosa. It should be kept in mind though, that all these languages have different consonant and vowel systems and interpretation should be made with caution as language specific differences do occur as seen in previous studies (Saaristo-Helin et al., 2011; Saleh et al., 2007). Phonological processes have been identified in a range of different

languages (German- Fox & Dodd, Arabic- Saleh, 2007; Finnish- Saaristo-Helin et al., 2011). Interestingly though, some authors (e.g. Hua & Dodd, 2000) found that some of the phonological processes used in one language would be considered atypical in another. This further highlights the differences in languages and the need to carry out research in order to identify language specific differences.

Cross-linguistic studies of phonology compare what occurs in languages during the period of phonological development. There is a strong suggestion of universal trends in phonological development- a theory which will be introduced and explored in the following chapter. Although there appear to be some common attributes across languages (e.g. acquisition of stops and nasals occurring earlier than affricates), SLTs should be mindful of the individual language factors which can strongly influence clinical and research findings. Even so, such data gives both researchers and clinicians a better understanding of what to possibly expect at certain ages in order to make judgments about what is typical versus atypical in a child's speech and allows for cross-linguistic comparisons to be made. Studies of typical development are important for two reasons. Firstly, they provide information that is of clinical value to SLTs in their assessments and interventions; secondly, to provide information against which theories of phonological development and cross-linguistic universals can be judged. The following chapter explores this second area futher.

2.5 Summary

This chapter first looked at studies of isiXhosa phonological development. It was found that in general vowels are acquired early by isiXhosa speaking children and that many of the consonants of the language are acquired by approximately age 3;0, however a great need for further research was identified to elucidate knowledge of other aspects of the language. A review of the studies on various English dialects suggested that children's accuracy of production increases with age and that there are fewer phonological processes present in their speech as they get older. Lastly, phonological acquisition in other languages (besides isiXhosa and English) was briefly discussed in order to show the importance of such research in order to be able to make cross-linguistic comparisons which can inform clinical practice. Together the studies reviewed highlight that although there may be some common

attributes in phonological development, it is important to pay attention to the language specific differences as well in order to make appropriate clinical judgements.

CHAPTER THREE: PHONOLOGICAL THEORIES AND FRAMEWORKS

This chapter aims to introduce key frameworks and theories used for understanding the development of children's phonology. This chapter will briefly explore the history of phonological theories and discuss how they have led to current research and clinical practice. Pertinent concepts about phonological development will be explored to provide a background to this study. Some well researched clinical assessment and management frameworks are discussed. The chapter will conclude by posing a question that the researcher will aim to answer by using the methods described in the following chapter.

3.1 Background to phonological theories

In the 1970's linguistic approaches to understanding child phonology suggested that phonological processes were at the core of child speech difficulties. Linguistic approaches, such as non-linear phonology (see Bernhardt & Stoel-Gammon, 1994) give a description of a child's phonological system in terms of their linguistic difficulties (Baker, Croot, McLeod & Paul, 2001). The non-linear generative phonological theory was introduced by Goldsmith in 1979. It is closely related to the notions of generative grammar and aims to describe children's 'errors' by considering the hierarchical relations between phonological units (Bernhardt, 1992). Some studies have been undertaken in order to illustrate how this approach may be used for assessment and management of children with speech difficulties (e.g. Bernhardt, 1990; Bernhardt & Gilbert, 1992). Medical/diagnostic approaches focus on identifying the structural problem contributing to a child's speech difficulty (Baker et al., 2001). Although these approaches are valuable, there is often still a lack of information about the underlying processes underpinning a child's phonological difficulty.

3.2 Phonological Processes

SLTs use phonological processes as a descriptive way of detailing children's speech immaturities. Phonological or simplification processes were described by Ingram (1989), as mental strategies used by children during development of speech. Dodd et al. (2003) note that children use these strategies (not consciously) due to the under development of their vocal and perceptual abilities- which is why phonological units are altered. Authors have described the phonological processes that occur in English (e.g. Grunwell, 1981; Ingram, 1989). Ingram (1989) divided phonological processes into 3 categories- syllable structure processes (where

the syllable shape is changed, e.g. weak syllable deletion), substitution processes (a certain sound is substituted for another, e.g. fronting) and assimilation processes (a particular sound becomes similar to another sound in that word). Authors such as Grunwell (1981) and Ingram (1989) have attempted to map out the unfolding of phonological development in terms of appearance and elimination of processes. Some authors have criticised phonological processes saying the functional explanations and psychological reality are lacking (for a review, see Bankson and Bernthal, 1998). However, it is generally accepted that different processes are suppressed at different ages, with most phonological processes thought to be eliminated by approximately age five (Bowen, 2009). For example depalatalisation is said to persist after the age of three (Stoel-Gammon & Dunn, 1985) and gliding of liquids is said to persist until the age of 5;0 years (Grunwell, 1997). At present phonological processes are one of the most efficient ways of relating children's speech to that of the adult targets and it can thus be assumed that similar principles could be applied to languages such as isiXhosa.

Research has shown that with age, these simplifications become less frequent in a child's speech as their speech accuracy increases. Phonological processes are thought to be universal and occur across all languages that have been researched in this way (Hua & Dodd, 2006). The exact nature of the processes will vary in accordance with the language structure. For example, English phonology includes consonant clusters such as ***sl****ip*, thus cluster reduction is a process that would be expected. On the contrary, this would not be expected for a language such as isiXhosa, as with other Bantu languages (e.g. Sesotho) it is reported to have few if any consonant clusters (Demuth, 1992). Recent studies (e.g. Conradie et al., 2011; Fish et al., 2012) have discussed some phonological processes used by isiXhosa speaking children. It appears that they are similar to those which have been well documented for other languages (e.g. gliding of liquids, assimilation). It was also suggested that some processes that may be typical for isiXhosa (e.g. lateralisation) (Fish et al., 2012) are less widely used in other languages (e.g. English), however, further research into this area is necessary. During the years of speech development, the simplifications or phonological processes are expected from children with typically developing speech (Gildersleeve-Neuman, 2001) and are a useful diagnostic indicator of typical versus disordered speech depending on the nature of the simplification process used. For example, in English it is widely acknowledged that stopping, velar fronting and weak syllable deletion are typical

(Bowen, 1998) whereas processes such as backing, initial consonant deletion and glottal replacement are thought to be unusual (Strand & McCauley, 2000) and are possibly indicative of a speech delay or disorder (Dodd et al., 2003).

3.3 Clinical frameworks

Theoretical frameworks give SLTs greater insight into child phonology. SLTs frameworks are likely to be reflected in both their assessment and management choices. Phonological development is a multi-layered process which is influenced by various factors such as gender, socio-economic status and language backgrounds (Dodd et al., 2003). SLTs have a variety of intervention methods at their disposal. Some of these include: a cognitive-linguistic approach which aims to make children aware of specific contrasts in their language for example through minimal pair therapy (e.g. Weiner, 1981); a metaphonological approach where the focus is on the child's ability to manipulate and reflect on sounds in their language (e.g. Bernhardt & Major, 2005; Howell & Dean, 1991); core vocabulary approaches which concentrate on increasing the child's consistency in a small set of high frequency words (e.g. Crosbie, Pine, Holm & Dodd, 2006; Dodd, McCormack & Woodyatt, 1994) and some therapies focused more on motor control e.g. PROMPT (Hayden, 2004). In contrast, psycholinguistic approaches aim to explain how children process speech and language by identifying the underlying level of breakdown in their mental processing (Baker et al., 2001; Stackhouse & Wells, 1997; 2001). In this approach, emphasis is placed on the concept of speech processing- that is, how words are perceived, stored and produced (Dodd, 1995; Fee, 1995). This approach will be discussed in further detail in the following section.

3.3.1. Psycholinguistic framework

The psycholinguistic approach of Stackhouse and Wells (1997; 2001) was developed with the intention of providing clinicians with a better understanding of child speech difficulties (Baker et al., 2001). Stackhouse, Pascoe and Gardner (2006) give a brief description of some of the main goals of the psycholinguistic approach. These include being able to pinpoint the exact area of breakdown within the speech processing 'chain', considering the effect this may have on other areas of development (e.g. phonological awareness); establishing the child's strengths and weaknesses; using this information to formulate the most appropriate intervention plan, and finally, monitoring whether selected

strategies are indeed effective. Figure 2 shows the simple speech processing 'chain' on which the framework is based.

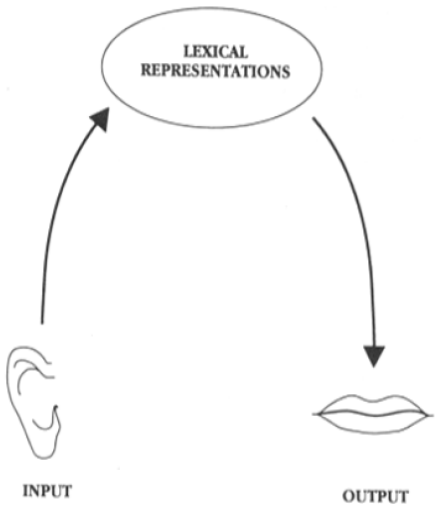

Figure 2. Simplified speech processing model *(based on Stackhouse & Wells, 1997)*

The simple speech processing chain depicts the three areas involved in speech processing as suggested by Stackhouse and Wells (1997; 2001), namely: speech input, the storage of words and lexical representations; the output of speech. The SLT who uses this approach will be aware that speech development is not only about observed output but is in fact a progression through which a child hears and processes speech, stores this knowledge in order to be able to produce speech (Stackhouse & Wells, 2001).

The psycholinguistic framework consists of three key components:

1. A speech processing profile which is a clinical tool that poses specific questions at each level of input and output processes. This helps clinicians to organise assessment data from a range of tasks.
2. A speech processing 'box and arrow' model which visually illustrates the authors' hypotheses about how speech processing and production occurs by charting the flow of information through a series of levels of processing.

3. A developmental phase model which adopts a longitudinal perspective of a child's development and suggests a series of stages through which all children must pass in order to master speech processing and production as well as linked literacy skills.

The developmental phase model has been informed by research (e.g. Frith, 1985; Stackhouse & Wells, 2001) and has been used effectively in clinical settings to provide a greater understanding of not only speech acquisition but also literacy development of children in English (see Frith, 1985; Pascoe, Stackhouse & Wells, 2004; Stackhouse, Pascoe & Gardner, 2006). This model is presented in Figure 3.

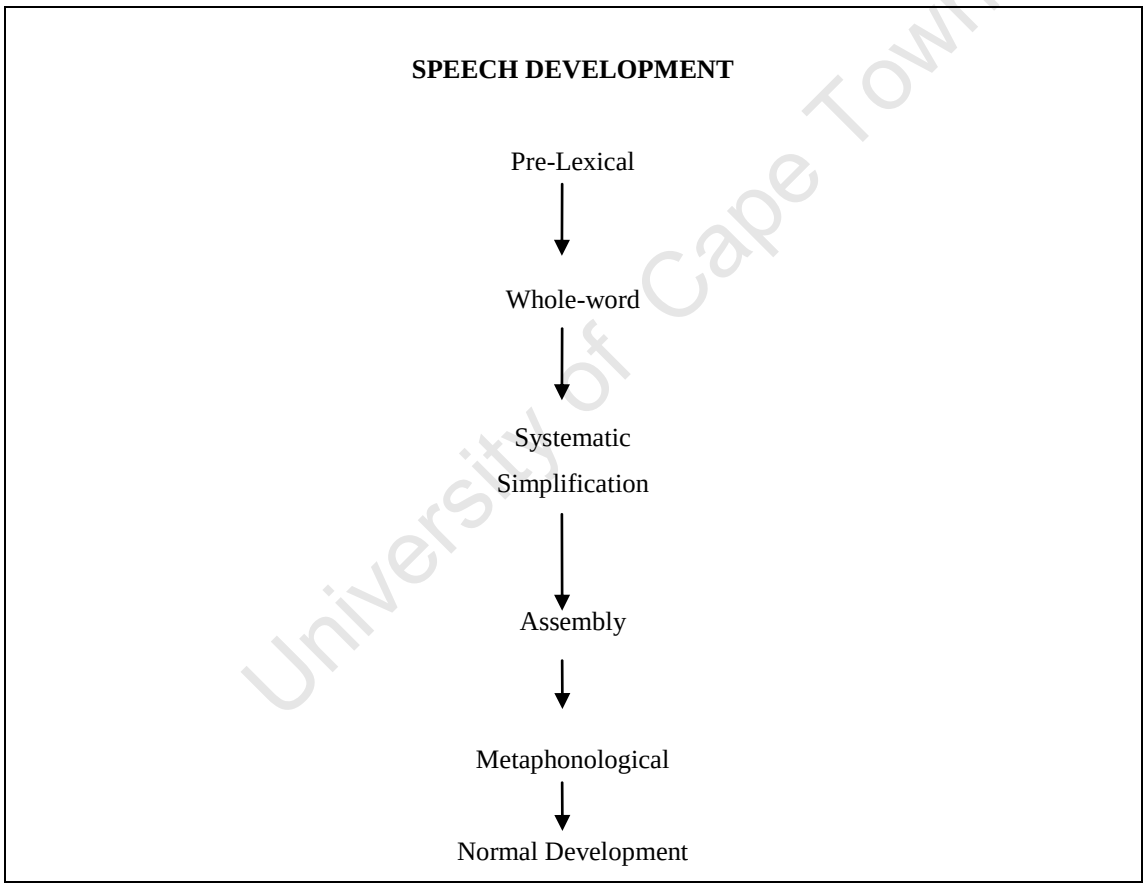

Figure 3. The developmental phase model *(Stackhouse & Wells, 1997 adapted from Pascoe et al., 2006).*

In the pre-lexical phase, often during the child's first year, children are not yet able to produce recognisable speech. This is followed by the whole-word phase in which the child begins to make use of single words, generally in the second year of life. Systematic simplification is the next phase in which children make use of phonological processes e.g.

gliding of liquids in English (Grunwell, 1997) or lateralisation which may be expected in isiXhosa (Fish et al., 2012). In the assembly phase children make use of connected speech and are believed to have increased intelligibility as they master connected speech and are able to combine segmental and suprasegmental aspects of phonology together with more advanced language and fluency skills. At early school-age children enter into the metaphonological phase where they are able to think about and use their language in a more abstract manner (Pascoe et al., 2006). This tool enables SLTs to understand and explain some aspects seen in child speech. If for example, a school age child is still in the pre-lexical phase, the clinician would be alerted to possible speech difficulties and would need to implement strategies to move them into the next phase of development.

3.4 Theory of Universals

It has been suggested that there are universal trends in the way that children's phonology develops (Hua & Dodd, 2000) even though there are individual as well as social factors that play a role in the acquisition process (Dodd et al., 2003). Languages are said to have ''unmarked'' features which are those that are common to a language, and ''marked'' features which refer to the properties that are rare and occur with less frequency (Zamuner, Gerken & Hammond, 2005). According to Gildersleeve-Neuman et al. (2008), although children may have different language environments, the sounds produced by children during the initial stages of speech development are similar. They cited a number of studies carried out with monolingual English speaking and bilingual English and Spanish speaking children (see Gildersleeve-Neuman et al., 2008 for review) which reported that in the early stages of acquisition, stops, nasals, glides and CV syllable shapes were present in their speech.

A universals theory was first suggested by Jakobson (1941/1968) who argued that sounds that were common to all languages, i.e. unmarked such as nasals, front consonants and stops, would be acquired earlier than sounds that were not as common or marked. In terms of cross-linguistic studies, this means that children would first develop sounds that are common across languages before using less common sounds (Zamuner et al., 2005). For the present study this would mean that children would acquire the sounds that occur more frequently across languages (e.g. plosives and nasals) and as phonological development continues, the less common sounds (e.g. isiXhosa clicks) would be acquired later.

It was proposed that during phonological development, children initially produce CV syllable structure and progressively start to use more complex syllable structures. (Jakobson (1968), as cited in Fee, (1995)). Further work was carried out in this area and authors appear to be in agreement with what was first suggested by Jakobson (1968). Demuth (1995) outlines four stages of prosodic development for English and Dutch, and suggested that this would be similar for children acquiring other languages. The stages she described included the core syllables (CV), minimal words (CVCV, CVC, CVV), prosodic words with longer binary roots and finally prosodic words which are the same as the adult form. Similar to the acquisition of phonemes, Demuth (1995), suggests that there are also unmarked syllables which are those in the first two stages (i.e. CV, CVCV). Thus, it can be said that children will acquire the unmarked syllable shapes first and then progress to the marked structures as is the case with phoneme acquisition (i.e. CV->CVC->CVCV). This further supports the findings of the research discussed in Chapter two. Therefore the assumption/hypothesis made here is that children learning to speak languages such as isiXhosa will develop unmarked sounds (e.g. /m/, /p/, /b/) and syllables (e.g. CV-> CVCV) before producing the less common sounds and syllable shapes unique to that language.

3.5 Research question

This study aimed to describe the phonological development of isiXhosa speaking children aged between 3;0 and 6;0 years, using a cross-sectional approach to answer the following question: How does phonology develop in typically developing isiXhosa speaking children between the ages of 3;0 and 6;0 years? The purpose of this study was twofold- to move forward the development agenda of South African SLTs in terms of assessment and the development of materials in all languages (in this case isiXhosa), as well as to contribute to the theoretical knowledge about developmental universals and phonological acquisition.

3.6 Summary

This chapter has given a brief description of the history of phonology and the influence it has had on the current assessment and management frameworks. Phonological processes are used by children during a period of speech development called the ‘systematic

simplification' phase by Stackhouse and Wells, (1997, 2001) in their developmental phase model and it is generally accepted that as children get older, these processes should be eliminated. Clinical frameworks were outlined to show that SLTs have a wide variety of clinical approaches available to them, for assessment and management of children with phonological difficulties. The psycholinguistic framework is used by SLTs to gain a better understanding of a child's speech difficulties. This framework was introduced and discussed, in particular the developmental phase model. Theories of universal trends in phonological development were also discussed. In general, it appears that there are some classes of sounds which develop ealier than others and that similar phonological processes occur across a range of languages.

CHAPTER FOUR : METHODOLOGY

This chapter sets out to detail the methods employed in this study and gives a rationale for all the choices made. Aims and objectives are described and an overview of the research design is given. The participants, materials used, procedures and data analysis are detailed. The chapter also provides an account of the ethical considerations pertinent to the study and ways in which these, as well as reliability and validity, were managed.

4.1 Aim

The aim of this study was to describe phonological development of typically developing first language isiXhosa speaking children aged between 3; 0 and 6 ;0 years.

4.2 Objectives

The objectives of this study were to describe the following aspects of phonology in typically developing first language isiXhosa speaking children aged between 3; 0 and 6; 0 years:

1. Consonant acquisition
2. Vowel acquisition
3. Development of syllable structure
4. Nature of phonological processes

4.3 Research design

A descriptive cross-sectional design was used to document the stages of phonological development of twenty-four isiXhosa speaking children at a single point in time. According to Durrheim (2006), descriptive studies can be used to accurately describe particular phenomena. For the present study, this was done in order to describe the changes seen in the participants' phonology between these ages. Cross-sectional designs are used to compare findings from a number of groups at a single point in time, and examine how much they differ (Burton, 2000). Using this design allowed the researcher to gain information about phonological development at different ages and make comparisons between the groups. With the objectives of the study in mind, this design was chosen to add to the information about what occurs in children's speech at each of the age intervals and to map out a proposed progression of phonological development for isiXhosa speaking children.

4.4 Participants

4.4.1 Selection criteria

The participants were twenty four first language isiXhosa speaking children (girls and boys) who were identified to be typically developing by parents/legal guardians as well as educators. Gender was not taken into account for this study. Although some cross-sectional studies have stratified their groups by gender (e.g. Dodd et al., 2006), this was not necessary due to the small sample size and the descriptive nature of this study. The participants were found at different schools and there was no equal distribution of boys and girls who met the study criteria. Thus it was more convenient to exclude gender for the present study. In the Western Cape, it is rare to find monolingual speakers of a specific language (e.g. isiXhosa) and there is bound to be a degree of exposure to the other main languages spoken in this region (i.e. English and Afrikaans). The participants were first language isiXhosa speaking children between the ages of 3;0 and 6;0 years, chosen as they have isiXhosa as their first language, although they were not necessarily monolingual speakers. This is similar to other speech acquisition studies (e.g. Dodd et al., 2003; Gildersleeve-Neumann & Wright, 2010; Mowrer & Burger, 1991). This age group was selected as it is well documented that much phonological development occurs in the pre-school years and single word assessments can be used with children between these ages. Children younger than three can pose a challenge in terms of picture naming tasks where vocabulary constrains their ability to name pictures (Edwards & Beckman, 2008; Fish et al., 2012). Children with hearing impairment, corrected vision that does not allow for recognition of pictures or other health conditions which may affect communication (e.g. cognitive impairment) were excluded from the participant group. A child who had in the past received speech-language therapy or was currently attending speech-language therapy was excluded from this study.

4.4.2 Recruitment

The participants were identified through personal contact – a Speech-Language Therapist working at a non-governmental organisation (NGO) based in Cape Town. A letter detailing the purpose of the study was sent to the director of the NGO (see Appendix B) and the educators at the pre-schools managed by the NGO (see Appendix C). Parents/legal guardians of the children received an information letter with a consent form attached (see

Appendix D1 and D2 for the translated letter). The letter was sent to the organisation via electronic mail and parent/legal guardian letters and consent forms were hand delivered to the pre-schools and sent home with the children. Children whose parents/legal guardians consented to their participation in the study and who met the criteria were considered for the participant group. Children were required to give their assent (see Appendix E1 and E2 for the translated letter) before any assessments were carried out. Figure 4 illustrates the methods of recruitment.

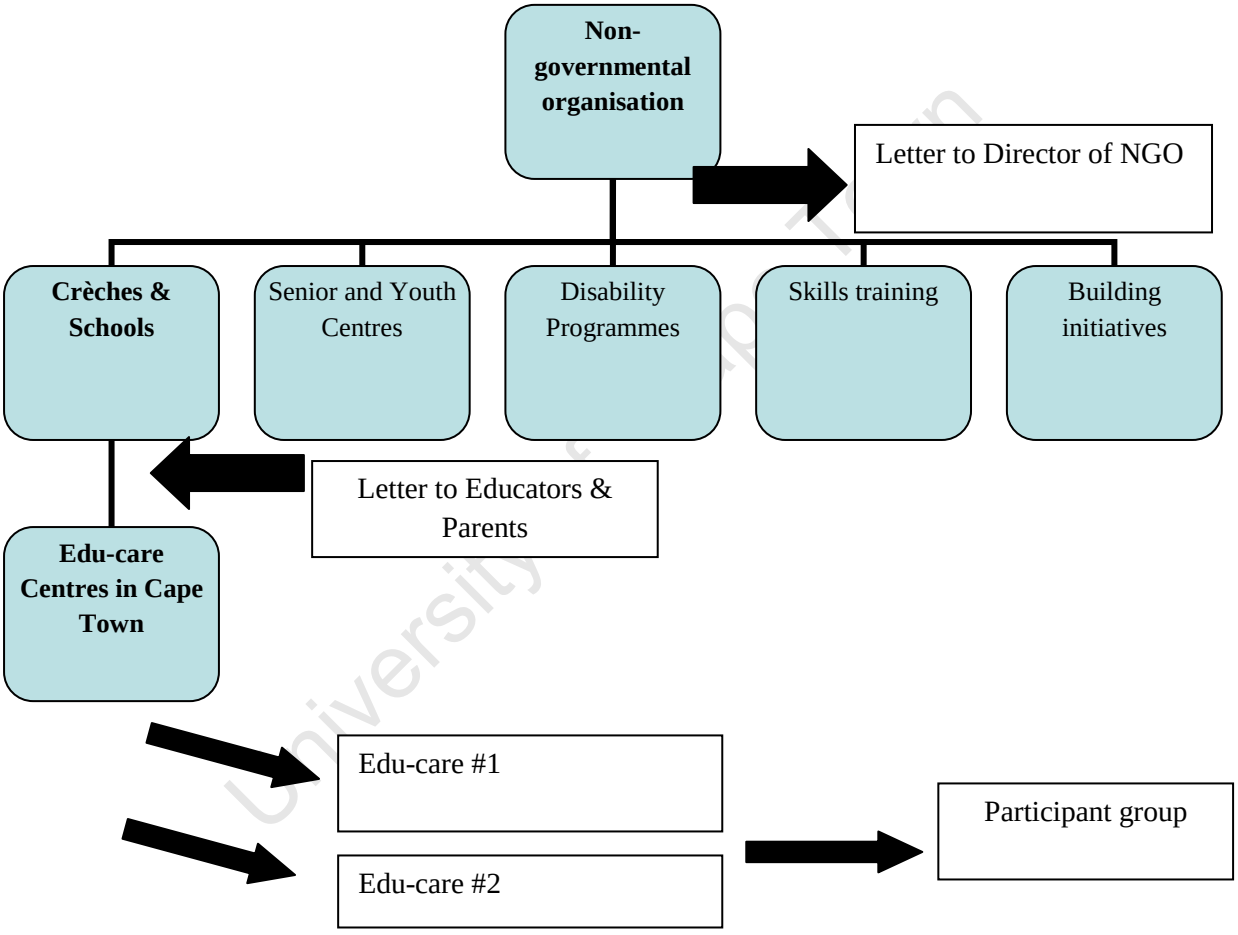

Figure 4. Flow chart illustrating methods of recruitment

4.4.3 Sampling method

This study made use of non-random convenience sampling. This method of sampling involves selecting participants who are available and willing to take part in the study (Irwin et al., 2008). Even though there were different sites for data collection, the number of potential

participants was limited due to the fact that many consent letters were not returned. Only those children whose parents had consented to participation were considered for this study. Parental consent was taken as an indication of their willingness to have their child take part in the study. This is a simple method of sampling and as such, it is less precise and does not fully represent the entire population (Teddlie & Yu, 2007). Children whose parents/legal guardians consented to their participation, met the selection criteria and gave their assent to participate in the study were grouped into age groups as follows:

- 3;0 -3;6 years (Group 1)
- 3;7 -4;0 years (Group 2)
- 4;1 -4;6 years (Group 3)
- 4;7 -5;0 years (Group 4)
- 5;1 -5;6 years (Group 5)
- 5;7 -6;0 years (Group 6)

Children were grouped into the age groups on a 'first-come first-served' basis and the categories were closed once they were full. There were four children per group which gave a total sample of twenty-four children. The groups were divided into six month intervals in order to be able to identify the changes in development within the six month interval, which has been done in other studies of phonological development (e.g. Hua & Dodd, 2000; Saaristo-Helin, 2009). Another reason is that as there was only one researcher collecting and analysing data, this was found to be a manageable number of participants. Although the sample was relatively small, it was affordable and manageable for the purposes of this study and followed examples of speech acquisition research cited in the literature (e.g. Gildersleeve-Neumann, et al., 2008; Gillon, 2000; Gxilishe, 2004). Within this area of research, even small samples can yield a wealth of information about phonological development, which this descriptive design allows. This can be seen from case studies which have samples of fewer than ten children (e.g. Saaristo-Helin, 2009; Salidis & Johnson, 1997). With a long term view towards future development and standardisation of an assessment tool, this study can be viewed as a preliminary stage of the development process.

Participants were selected from two pre-schools affiliated with the NGO. The pre-schools were based in Cape Flats townships. A total of 50 letters were sent out to parents/legal

guardians. Of these, a total of 34 parents/legal guardians consented to the participation of their child. In order to ensure confidentiality, participants were given reference numbers. Table 3 illustrates the selection process and outlines the steps involved in the inclusion process that finally gave the sample of 24 children.

Table 3. Participant selection process

Step 1		**Step 2**	**Step 3**	**Step 4**	**Step 5**	
Parental consent		**Typically developing as judged by parents and educators**	**Child assent**	**Hearing screening**	**Include/Exclude**	**Assessment completed**
Participants						
Ref #	**CA**					
Group 1						
1	**(3;2)**	☑	☑	Pass	Include	☑
2	**(3;4)**	☑	☑	Pass	Include	☑
3	**(3;6)**	☑	☑	Pass	Include	☑
4	**(3;2)**	☑	☑	Pass	Include	☑
Group 2						
5	**(4;0)**	☑	☑	Pass	Include	☑
6	**(3;11)**	☑	☑	Pass	Include	☑
7	**(4;0)**	☑	☑	Fail	Referred and re-assessed after ENT & Audiology intervention	☑
8	**(3;8)**	☑	☑	Pass	Include	☑
Group 3						
9	**(4;2)**	☑	☑	Pass	Include	☑
10	**(4;1)**	☑	☑	Pass	Include	☑
11	**(4;4)**	☑	☑	Pass	Include	☑
12	**(4;2)**	☑	☑	Pass	Include	☑
Group 4						
13	**(4;8)**	☑	☑	Pass	Include	☑
14	**(4;7)**	☑	☑	Pass	Include	☑
15	**(4;8)**	☑	☑	Pass	Include	☑
16	**(4;7)**	☑	☑	Pass	Include	☑
Group 5						
17	**(5;2)**	☑	☑	Fail	Referred and reassessed after ENT & Audiology intervention	☑
18	**(5;1)**	☑	☑	Pass	Include	☑
19	**(5;3)**	☑	☑	Pass	Include	☑
20	**(5;5)**	☑	☑	Pass	Include	☑

Group 6						
21	**(5.9)**	☑	☑	Pass	Include	☑
22	**(5;9)**	☑	☑	Pass	Include	☑
23	**(6;0)**	☑	☑	Pass	Include	☑
24	**(5;10)**	☑	☑	Pass	Include	☑
Non-Participants						
Referrals						
25	**(4;0)**	☑	×	Could not condition	Exclude	×(referred to speech therapy)
26	**(4;5)**	Started talking at CA 4;0	☑	Unable to condition ; speech difficulties	Exclude	×(referred to speech therapy)
27	**(3;9)**	☑	☑	Unable to condition; receptive difficulties	Exclude	×(Referred to speech therapy)
Over 6; 0						
28	**(6;1)**	☑	☑	Pass	Exclude (over 6)	×
29	**(6;2)**	☑	☑	Pass	Exclude (over 6)	×
30	**(6;1)**	Started talking at CA 3;0	☑	Pass	Exclude (over 6)	×
Left schools						
31	**(5;6)**	☑	☑	Pass	Include	× (left school)
32	**(5;5)**	☑	☑	Pass	Include	×(left school)
33	**(5;1)**	☑	☑	Pass	Include	×(left school)
34	**(5;10)**	☑	☑	Pass	Include	× **(**left school)

Once parents/legal guardians had returned letters, they were reviewed to establish whether or not consent was given. Each child had to have parental consent in order to be considered for the participant group. Parents/legal guardians were required to fill out a developmental screener (see Appendix F1 and F2 for the translated form) in order to give an indication of whether the child was typically developing. If the child's developmental milestones, as reported by parents, were within the norm a tick was put in the 'typically developing' column. Children were required to give assent before any of the assessments were done. This was done by reading out the content of the assent letter (Appendix E2-the

translated letter) and having the child either agree or decline to carry out the tasks described. An educator was present for this to act as a witness.

The next stage of inclusion was hearing screening. Otoscopy and conditioned play audiometry (between 500 to 4000Hz at 20dB) was carried out by the researcher. A child who passed in each category was included in the participant group. Some children (Child 7 and Child 17, Table 4) required further audiological intervention and were referred to a children's hospital in Cape Town. Once their ear infections were managed and ear-wax removed, they were reassessed and then included in the sample. A further three children presented with difficulties with speech and language comprehension and upon discussion with educators, they were also referred for speech-language therapy and excluded from the sample. Three children whose parents/legal guardians had consented to their participation were excluded as they were over the age of 6;0 years and therefore did not meet the inclusion criteria. Four of the children who had met the criteria initially had to be excluded as they left the schools over the holiday period and were no longer contactable. The remaining 24 children made up the participant group for this study. Table 4 shows the participant information of the 24 children who met all the criteria and participated in the study.

Table 4. Participant information

Group	Age category (mean age) (years; months)	Girls *(n= 14)*	Boys *(n=10)*	Total
1	3;0 -3;6 (3;4)	1	3	4
2	3;7 – 4;0 (3;10)	2	2	4
3	4;1 – 4;6 (4;2)	3	1	4
4	4;7 – 5;0 (4;7)	3	1	4
5	5;1 – 5;6 (5;3)	2	2	4
6	5;7 – 6;0 (5;9)	3	1	4
	Sum			**24**

The selected sample does not fully represent the population of isiXhosa speaking children in South Africa. The participants of this study were from a predominantly isiXhosa region of the Cape Flats, an area of considerable social deprivation where unemployment is high. isiXhosa speaking children in other regions of the Western Cape (e.g. Southern suburbs) who would most likely have a higher socio-economic status and more exposure to English and Afrikaans were not represented in this sample. Studies of African languages have shown that children are often raised in rich verbal environments despite socio-economic challenges (Demuth, 1986; Golinkoff, 1983; Gxilishe, 2004).

4.5 Description of materials

An informal oral-peripheral evaluation (OPE) checklist (see Appendix G) was used by the researcher to identify or rule out any structural or functional abnormalities that may have caused articulatory errors (Shipley & McAfee, 2004).

As there is currently no tool available to assess isiXhosa phonology, an assessment was created for this study. A single-word picture naming test was developed in order to

assess the children's speech abilities. The assessment tool was devised based on existing assessments such as the Diagnostic Evaluation of Articulation and Phonology (DEAP) (Dodd et al., 2002). The assessment tool comprised of two parts, namely: a) A stimulus (picture) booklet with 48 coloured illustrations. Several measures were taken in order to ensure that illustrations were appropriate for pre-school childrens' vocabulary, culturally and linguistically appropriate for the children and that they adequately represented the targeted phonemes; b) Recording sheet- for inventory assessment and for evaluating phonological processes.

4.5.1 Test development

The following section will detail the steps involved in the development of the assessment.

An initial isiXhosa wordlist was developed by a Speech-Language Therapist for clinical use with children at Groote Schuur Hospital, Cape Town. This list contained common isiXhosa words that included consonants and vowels found in English and was used with the therapist's permission as a basis for the assessment tool. Following this, the wordlist was reviewed by a first language isiXhosa speaking pre-school educator who made some modifications to the list. In the first wordlist the target sounds were assessed in the word initial, word medial and word final positions- which is standard for English assessments. A review of literature about Bantu languages and isiXhosa in particular (e.g. Demuth, 1992; Gxilishe, 2004, 2008; Lewis, 1994; Nurse & Philippson, 2003) was undertaken in order to become familiar with isiXhosa phonology and apply this to the assessment tool. Using the information gathered from the literature, a list of isiXhosa consonants (including clicks) and vowels was put together resulting in a total of 55 consonants and five vowels. Drawing from the existing wordlist and from the study by Mowrer and Burger (1991), a pool of 64 words representing each of the consonants and vowels, was created. Each word contained a specific target consonant and in other cases a consonant and vowel were assessed in the same word (e.g. *ibhola* 'ball' -> /bh/ and /o/). The wordlist included both nouns and verbs. Target consonants were placed in the penultimate syllable as this is the syllable that carries the most tone in a word- due to the lengthening of that syllable (Demuth, 1992). Vowels were assessed word medially (e.g. *ibh**o**la* 'ball') and finally (e.g. *inj**a*** 'dog'). isiXhosa nouns are said to be

open (begin and end in vowels), thus assessment of consonants in the word medial and final positions was not applicable.

A checklist (Appendix H) consisting of the 64 words was created in order to evaluate the wordlist on four levels: their meaning, age appropriateness, cultural appropriateness and whether they assessed the phoneme they aimed to. This was done with the help of an 'expert panel' made up of two first language isiXhosa speaking pre-school educators, two lecturers from the School of Languages and Literatures at the University of Cape Town, one of whom has isiXhosa as a first language; the other a linguist and child language specialist who is proficient in isiXhosa and a final year Speech-Language Therapy undergraduate student proficient in isiXhosa.

The panel assembled for an hour long session. The purpose of the study was explained to the group members and checklists were distributed. An explanation of the 'word-checking' process was given. That is, that they were required to read all the words in the list and check them against the four criteria, all of which were defined by the researcher to avoid misunderstanding. Members were given the opportunity to ask questions before commencing with the activity. A total of 20 minutes was allocated for the word-checking process and members were urged not to discuss the words until all checklists were completed. During this time, no recordings were made.

Audio recording began when the group discussion was started and was undertaken with the consent of all members. The discussion was facilitated by the researcher. One of the first language isiXhosa speaking educators was asked to read out each word which gave a first language example of how the words should be produced. Once each word was read, members who had any comments or suggestions regarding that specific item stated these (e.g. inappropriate word due to low frequency use, culturally inappropriate or offensive). This means that for a word to be included in the final wordlist, it had to meet all the given criteria (i.e. a score of 4/4). Any words that scored less than this were discussed. Members who raised issues with words were asked to comment on what the exact problems were. If a word needed to be replaced, suggestions were made by the panelists and these too were checked

against the inclusion criteria. If they met the criteria, they were then included as part of the final wordlist.

Of the 64 words in the initial list, 54 were found appropriate in all four categories. Table 5 shows the words found inappropriate, the reasons for this and the resulting changes.

Table 5. Summary of 'expert panel' review

Consonant	Word	Problem identified	Comments	Changes
ɭ	*ulo**l**iwe* 'train'	Not age appropriate vocabulary	Children would recognise the picture of the train, however are more likely to use the English word as this is what most adults use.	Word removed and the verb *uya**l**ala* 'sleep' to be used instead.
Dz	*i**dz**edze* 'flea'	Not age appropriate vocabulary	Members felt that although children know this word and produce it in a well known song. When asked to name it in a picture, they would either be unable to name it or they would use a different word (i.e. intakumba). A suggestion was made that the children be asked to do song and then listen for their production. Attempts were made to come up with a new word, however this was unsuccessful.	The word was kept in the list and will be elicited using the song, however this may need to be reviewed if test is to be developed further.
cʰ	*i**ty**hefu* 'poison' *uku**ty**hafa* 'worn out'	Not age appropriate vocabulary	Children will not know or use these words at this age. A new word was suggested.	Word removed and replaced with *uya**ty**hala* 'pushing'.
ɟ	*i**dy**asi* 'coat'	Inaccurately defined	The members suggested that this should be illustrated as a long coat with a belt (i.e a 'trench coat') otherwise children would refer to it as a jacket.	Illustrators were informed of the necessary specifications.

kʰ	***kh**ala* ‘cry’	Not age appropriate vocabulary	Children may say *lila* which is another word for ‘cry’.	Word removed from list and the verb *uyakhaba* ‘kicking’ was used.
G	*uya**g**ula* ‘sick’	Not age appropriate vocabulary	Members suggested that children’s interpretation may be that a person is ‘sleeping’, thus suggested *igubu* ‘drum’ or *igadi* ‘garden’.	Word removed and replaced with *i**g**adi* ‘garden’.
ɣ	*gro**gr**isa* ‘to scare’	Not age appropriate vocabulary	Word is not generally used within this age group. The members suggested the use of a different word.	Word removed and replaced with *uya**gr**omba* ‘digging’.
kx’	*uku**kr**okra* ‘suspect’	Not age appropriate vocabulary	Word not generally used within this age group. Group suggested new word.	Word removed and replaced with *uya**kr**azula* ‘tearing’.
ǁ	*i**x**esha* ‘time’	Not age appropriate vocabulary	Members felt that the childrens’ interpretation of the word would be incorrect and that children would say ‘watch’ instead of time. Thus a new word was suggested.	Word removed and replace with *i**x**olo* ‘peel of a fruit’.
ǀʰ	***ch**eba* ‘shave’	Inaccurately defined and not age appropriate vocabulary	At this age, the word is used by the children to refer to cut/ cutting.	Word was kept, however will now represent cut as opposed to shave i.e *uya**ch**eba* ‘cutting’.
ŋǃʱ	*ingqele* ‘cold’	Not age appropriate vocabulary	Children will not be using this word within this age group, thus a new word was suggested.	Word removed and replaced with *i**ngq**iniba* ‘elbow’.
ǁʰ	*isi**Xh**osa* ‘the language’	Not adequately defined	One group member expressed that it should be clarified that this word could refer to the spoken language as well as the culture (i.e. *unxiba isiXhosa* ‘wear isiXhosa attire’.	No changes to word itself.

ǁg̊	***g**x**o**tha* ‘chase away’	Not age appropriate vocabulary	Not a word used by children at this age. They may also use a different word (e.g. hamba) or words that are not culturally/socially appropriate.	Word was removed and replaced with *ama**g**x**a*- ‘shoulders’.
ŋǁʱ	*in**g**x**o**lo* ‘noise’		Suggested that children may better interpret word in the verb form, thus it was suggested that word class be changed.	Word changed to **baya**-n**g**x**o**la ‘noisy’.

The main reason for inappropriate words was that they were not judged as age appropriate vocabulary. Following this, the wordlist was then revised- 44 words from the original list were used and nine replacement words were included. Thus, the final word list had a total of 53 words (The five vowels were assessed in words that were already in the list).

The wordlist was then submitted to a group of independent illustrators. They were given an outline of what was required for such an assessment tool; i.e. coloured drawings uniform in size, type and finish which had to take into account cultural factors as well as be appealing to young children. The illustrators had two weeks to produce the first set of illustrations, which they then submitted to the research team for review. Those that were found to meet the above criteria were selected for the final set of illustrations. A number of pictures required some editing before they were reviewed a second time and then included as part of the final assessment tool. Following this process, a total of 48 illustrations were put together to form the picture booklet for the assessment tool. Each of the illustrations corresponded with the words in the list. In some instances the same picture was used to assess more than one target sound, e.g. the picture of *ibhanana* ‘banana’ also represented *ixolo* ‘peel’. Here the two target sounds were /n/ in *ibha**n**ana* and /x/ in *i**x**olo*. The illustrations were similar to the clear and bright illustrations used in existing assessments such as the Diagnostic Evaluation of Articulation and Phonology (Dodd et al., 2002) and the Goldman-

Fristoe Test of Articulation-2 (Goldman & Fristoe, 2000). Figure 5 summarises the development process undertaken.

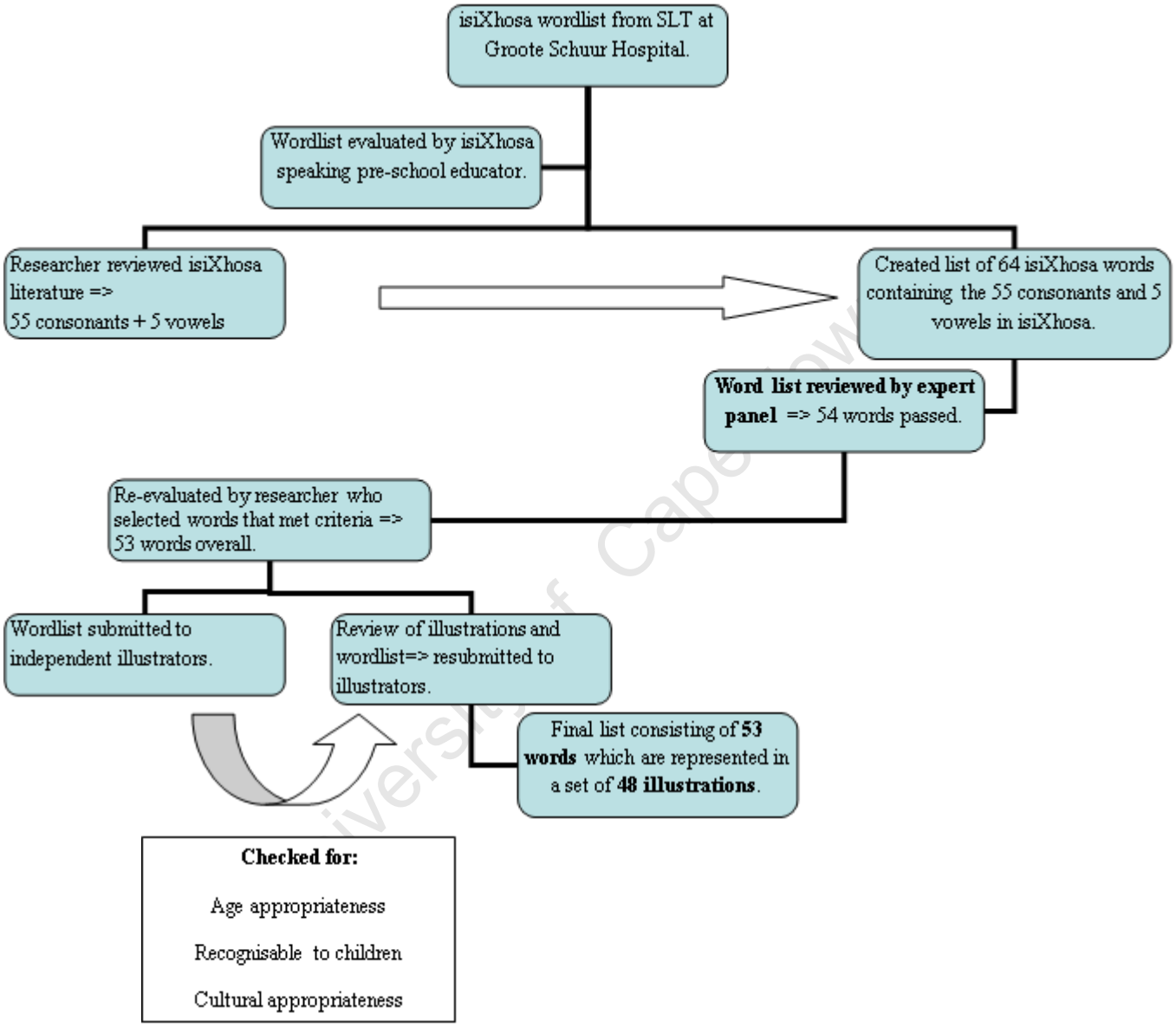

Figure 5. IsiXhosa single word naming assessment: Summary of the test development process

The recording sheet (Appendix I) was made up of a list of 53 isiXhosa words containing the target sounds. The wordlist was made up of nouns as well as verbs in the progressive present tense. Careful attention was paid to the selection of word and syllable structure as this is different to that of English. isiXhosa nouns always begin and end with a

vowel (e.g. ***i**langa* 'sun'), thus the researcher was not able to exclusively test for target sounds in the word initial, medial or final positions, as is standard in English assessments. As such, target sounds were tested within particular syllable positions. Eisenberg and Hitchcock (2010) note that placing target sounds in the stressed syllable is best when testing for consonants. In this case, target sounds (consonants) were tested in the penultimate syllable, which in isiXhosa is the syllable that carries the most tone- the equivalent of the so-called stressed syllable in English. The vowels were assessed word medially, e.g. *ibh**o**la* 'ball' and word finally, e.g. *inj**a*** 'dog'. The recording sheet was designed in a way that allowed the researcher to record which sounds the child was able to produce as well as those that were produced incorrectly as well as allow for the transcription of a child's responses. This transcription was then compared to the expected IPA transcription in order to note any phonological processes.

A Sony mini-disc digital audio recorder (MZ-R38) with an external microphone (ECM-MS907) was used to record all assessments to allow for later transcription and analysis of the data. A GSI38 audiometer was used to carry out hearing screening before the speech assessments were done.

The isiXhosa single word assessment was piloted on four (approximately 16% of the entire sample) pre-school aged children before conducting the research (an English speaking child and three isiXhosa speaking children). The purpose of the field test was to assess whether the selected words and illustrations were appropriate and recognisable to the children within this age range. The 5 year old English speaking child was able to identify most of the pictures. The picture depicting a *coat* was identified as a *dress.* In the expert panel discussion, it was highlighted that in order for isiXhosa speaking children to identify it as *idyasi* 'coat' and not *ijakheti* 'jacket', it had to be a long coat with a belt. This was relayed to the illustrators; however it was felt that there could be further modifications to the picture to make it look more like a coat and less like a dress to avoid confusing the children. This was done and the illustration was then included in the assessment. The three isiXhosa speaking children were aged between 3;0 and 4;0 years. They were able to identify most of the pictures correctly, and the only concern was the prompts used during the assessment, e.g. for *intloko* 'head' the children said *ubuso* 'face'. When the researcher prompted using the gestures from

the song '*intloko namagxa'* ''head, shoulders, knees and toes'', children were then able to produce the correct word. Following this pilot, the necessary changes were made, with special attention paid to the instructions/prompts that were to be given to the children.

4.6 Study personnel

The study personnel included the main researcher- a qualified SLT who is a first language siSwati speaker (also a Bantu language and within the Nguni group of languages), studied linguistics for two years and isiXhosa for one year and has functional use and understanding of the language; a linguist and child language specialist from the School of Languages and Literatures at the University of Cape Town who is proficient in isiXhosa and two first language isiXhosa speaking pre-school educators.

4.7 Procedures and Data Collection

Once permission was obtained from the University of Cape Town, Faculty of Health Sciences Human Research Ethics Committee (Ref # 284/2011, Appendix J), a letter detailing the purpose of the study and requesting consent to perform the assessments was forwarded to the Director of the NGO (see Appendix B). Following this, letters were sent to the educators and parents/legal guardians of the pre-school children in order to obtain informed consent (Appendices D1 and D2). Letters, screening checklists and consent forms were written in English and then translated into isiXhosa as the participants were first language isiXhosa speakers. Children whose parents/legal guardians consented to their participation formed part of the participant group.

Information regarding the children's development was obtained from school folders, educators and SLTs working with the children. This was done with the permission of the parents/legal guardians. A screening questionnaire (see Appendices F1 and F2 for the translated form) was also given to parents/legal guardians in order to obtain information concerning the child's general and communication development. The researcher conducted hearing screening of all participants before doing the assessment. Based on this information, the children who met the inclusion criteria and gave their assent participated in the study.

Both children and parents/legal guardians were informed that participation in the study was voluntary; that they were free to withdraw from the study at any time with no

repercussions and that confidentiality and anonymity would be ensured. Upon inclusion into the participant group, each child was given a reference number and all data concerning them carried only this reference number. All recordings made were labelled using the particular reference number of the child. Recordings were only listened to by members of the research team for transcription purposes. Parents/legal guardians and children were informed that they would receive feedback following the completion of the study.

Data collection was carried out over a period of four months. Every attempt was made to cause as little disruption to the children's learning as possible. Participants were all required to give assent before any assessments were done. This was done by reading the assent form (Appendices E1 and E2) with an educator present as a witness. The child was required to give assent or decline to carry out the tasks outlined in the letter. Hearing screening (otoscopy and conditioned play audiometry between 500 to 4000Hz at 20dB) was carried out by the researcher. Children who passed hearing screening were then assessed. Three of the children required further assessments and were thus referred to the appropriate professionals. As is the standard for any communication assessment, an oral-peripheral evaluation (OPE) was conducted to rule out any structural abnormalities that may have affected the child's speech. Children with a structurally and functionally normal oral cavity were included in the study.

Assessment took place in quiet rooms at the pre-schools. For the younger children an educator was asked to be present if the child appeared to be uncomfortable. It was explained to the children that we would look at some pictures and they would be required to name them. As the assessment did not include practice pictures, the researcher showed them five of the illustrations to allow the children to become familiar with the task. It was also explained to the children that the researcher would be making a recording in order to hear what they have said. Prompts given for nouns were different to those given for the verbs. For the nouns, children were asked *'yintoni le?'* ''what is this?'' and for the verbs the question was *'wenza ntoni?'* ''what is he/she doing?'' for the singular or *'benza ntoni?'* 'what are they doing?'' for plural. In some cases, e.g. *intloko* 'head', demonstrations were necessary. Where children were unable to name a picture, the researcher gave a model of the word and the participants were required to imitate. This was recorded as such. Assessments lasted between

30-45 minutes per child in which the researcher was able to administer the complete speech test. The researcher ensured that children did not miss out on any special school activities (e.g. school outings/functions, break-time). Throughout the administration process, children's responses were transcribed using the IPA transcription convention. Audio recordings were also made to allow the researcher to play back assessments and re-check field transcriptions.

4.8 Data analysis

For the present study, descriptive analysis was used, allowing for data to be organised and summarised in order to evaluate its attributes (Maxwell & Satake, 2006). Analysis was carried out at two levels (based on Baker 2004; Cohen & Anderson, 2011):

1. Independent analysis: where each participant's performance on single word naming was recorded. That is, their consonant, vowel and syllable productions were noted.

Following data collection, the researcher created a profile of each participant's responses and divided this according to consonants, vowels and syllable shapes produced by each child. Appendix K shows the consonants each child was able to produce and those they produced incorrectly. The table is further divided by age group (i.e. Group 1; Group 2) in order to show the consonants that are produced by children within that group. The same was done for the vowels (Appendix L). The words in the assessment were grouped by syllable shape and then the researcher evaluated all the participants (*n=24*) responses to establish which syllable shapes each child could produce and similar to the consonant and vowel analysis, the syllable structure development was analysed within each of the six age groups (Appendix M).

2. Relational analysis: where the percentage consonants correct (PCC) and percentage vowels correct (PVC) were calculated. This was done according to the formula given by Shriberg, Austin, Lewis, McSweeney and Wilson (1997):

$$PCC = \frac{\#\ C\text{'s correct}}{\#\ C\ \text{targeted}} \times 100$$

That is, the total number of consonants correctly produced as a percentage of the total number in the sample.

$$PVC = \frac{\#\ V\text{'s correct}}{\#\ V\ \text{targeted}} \times 100$$

That is, the total number of vowels correctly produced as a percentage of the total number in the sample.

Phonological simplifications made by each participant were described and detailed in terms of number of times used. Similarities and differences within each of the age groups and across all six age groups were noted in order to gain information about the common phonological processes used by children in this sample.

The profiles of all the children within each group were analysed to give information about phonological development at that age level (e.g. 3;0 -3;6 years). The profiles were then analysed across group (i.e. comparison of all twenty-four participants) to create a profile of phonological development between the ages of 3;0 -6;0years.

4.8.1 Criteria for acquisition of sounds

Decisions about acquisition of specific sounds were made based on the outline provided by Hua (2002).

4.8.1.1 Individual acquisition

Participants had at least two opportunities to produce each of the target sounds. Therefore, for the present study, if a child could produce the target sound correctly once, it was considered that the child has acquired that sound.

4.8.1.2 Group acquisition

According to Hua and Dodd (2006), when analysing group data, it is necessary to have a minimum percentage of children in a group who can correctly produce a sound. This is a specific criterion which allows the researcher to determine whether or not a sound has been acquired. A number of phonological development studies (e.g. Amayreh & Dyson 1998; Poole, 1934; Priester, Post & Goorhuis-Brouwer, 2011) have made use of three terms in order to describe speech development. They are: age of customary production- where at least half the group of children are able to correctly produce a sound in two positions; age of acquisition- where 75% of the group is able to produce the sound correctly in all required positions; age of mastery- where 90% of the group correctly produce the sound in all word positions.

For the present study, this was adapted to follow the phonological structure of isiXhosa. Thus in terms of age of customary production, it was not applicable to assess the sounds in two word positions as target sounds were only assessed in the penultimate syllable position. For age of acquisition, sounds had to be produced correctly in the penultimate syllable by 75% of the group. Therefore if three of the four children in a group were able to produce the target sound at least once, it was considered to be acquired. For the present study therefore, if all four children within a group could produce the target sound in the correct word position, it was considered to be mastered. Where a participant was able to produce a consonant or vowel (either spontaneously or by imitation) it was included in the phonetic inventory (Dodd et al., 2006).

4.9 Validity and reliability

Validity pertains to the accuracy and appropriateness of findings in a study (Durrheim & Painter, 2006), that is, whether the study is correctly measuring what it aims to (Mason, 2002). Criterion-related validity is the extent to which a measure correlates with some related criterion (Babbie, 2004). In order to achieve criterion-related validity, the researcher reviewed other studies that have been conducted in this area of Speech-Language Therapy (e.g. Gildersleeve-Neumann & Wright, 2010; Hua & Dodd, 2000; Saaristo-Helin, 2009), including those carried out in languages other than English (e.g. Goldstein & Cintrón, 2007; Saaristo-Helin et al., 2011) and especially those carried out in Bantu languages (e.g. Demuth, 2003; Tuomi et al., 2001). According to Babbie (2004), content validity is how much a measure covers all the areas that it claims to measure. In this study, it was ensured that the single word assessment contained words that are culturally appropriate and that reflect the correct word and syllable structure of the language. The researcher studied previous work that has been documented regarding isiXhosa word and syllable structure as well as the limited information about phonological processes of the language. All illustrations were reviewed a number of times in an attempt to ensure that they were standard and recognisable to children within this age group following the outline by Hua and Dodd (2006).

Reliability pertains to whether or not a certain strategy, if used repeatedly will lead to the same result (Babbie, 2004), that is, how dependable the measure is (Durrheim & Painter,

2006). In order to ensure reliability of this study, IPA transcription was used during the assessment and audio recordings of each assessment were made. This was done in order to allow the research team to listen to the recordings more than once in an attempt to make the transcriptions as accurate as possible. Babbie (2004) notes that in order to increase researcher reliability, training and practice are essential. Before the study was carried out, the researcher examined what has been documented regarding isiXhosa phonological inventories. This allowed the researcher to become familiar with the phonemes of the language and how to transcribe them using appropriate IPA symbols.

Irwin et al. (2008) note that in order to establish reliability of a study intra-rater and inter-rater reliability are important. Intra-rater reliability refers to where a researcher makes similar findings on repeated observations (Irwin et al., 2008). In this study, the researcher re-transcribed the entire sample to establish consistency. From these transcriptions, 50% (12 recordings) were selected at random to assess intra-reliability. The intra-rater reliability of this study was 93% which was judged as acceptable. Inter-rater reliability is the level of agreement between two (or more) different researchers about a particular participant (Irwin et al., 2008). For the present study, 10% of the entire speech data was played back and transcribed by a second researcher (a linguist and child language specialist who is proficient in isiXhosa) and then compared to the transcriptions made by the main researcher. Inter-rater reliability was also found to be 93%. The discrepencies between the two transcribers were discussed and resolved by a process of consensus.

4.10 Ethical Considerations

According to the revised Helsinki Declaration of 2008 (Williams, 2008) researchers should uphold various ethical considerations throughout the research process. These ethical considerations include:

4.10.1 Autonomy

Autonomy relates to the rights a participant has to make decisions without any negative repercussions (Wassenaar, 2006). The children who formed the participant group were young and within the vulnerable population. As such, their parents/legal guardians were required to give informed consent. All children were also required to assent to the activities

that were to be carried out by the researcher. Babbie (2004) notes that research can be an intrusion into the participants' lives. It is for this reason that those who took part in the study were made aware that participation was voluntary, and that they were free to withdraw from the study, at any time with no repercussions. The children's parents/legal guardians were informed that participation was not forced. Every effort was made to communicate this to the children as well. The protection of participants' identities is imperative (Maxwell & Satake, 2006). The researcher ensured that confidentiality and anonymity were upheld throughout the research process by assigning a reference number to each participant. No biographical information was used in this report and all audio recordings were listened to only by the research team.

4.10.2 Beneficence

This ethical principle compels the researcher to maximise the benefits of the participants who take part in the study (Wassenaar, 2006). Although there was no direct benefit to the children in the study, the researcher ensured that any children identified as having a speech or language difficulty were referred to the appropriate health professional(s).

4.10.3 Non-maleficence

Non-maleficence is concerned with the measures a researcher must take to ensure no harm comes to the participant (Babbie, 2004). In order to uphold this principle the researcher carried out all the assessments on the school premises, with an educator present upon the child's request. Children were also given frequent breaks and encouragement as needed.

4.10.4 Justice

Justice is a principle that obliges the researcher to ensure that all participants are treated fairly and that those who form a part of the sample should also be able to receive the benefits (Wassenaar, 2006). Participants of this study were selected using the already mentioned criteria. On completion of the study all the findings will be reported to all parents/legal guardians who consented to their child's participation. It is believed that the findings will ultimately benefit isiXhosa speaking children in the Western Cape region.

4.10.5 Risks and benefits of study for participants

Babbie (2004) notes that participants should be fully aware of any possible risks and benefits of a study. For the present study, there were no risks to the participants and there were no material gains for the researcher or participants.

4.10.6 Referral

Children who were identified as having any difficulties relating to speech, language or any other aspect of development were referred to the appropriate health professional(s).

4.11 Summary

This chapter has detailed the methods employed in the study with a view to ensuring that other researchers would be able to replicate the process. An overview of the research was provided and the motivation for the methods chosen was discussed in light of the scope of the study, its aims and the literature in the field. The aims and objectives, research design used and selection of participants were discussed. A cross-sectional approach was used with a sample of 24 children grouped into six different age groups. Given that there is no assessment of isiXhosa childrens' speech currently available, designing a linguistically and culturally appropriate assessment tool was an important component of the research. A considerable proportion of the chapter described that process. Data collection and analysis procedures were discussed, together with the way in which validity and reliability were maximised. This chapter concluded with the ethical considerations taken into account for the duration of the study. The following chapter presents the findings of the study.

CHAPTER FIVE: STUDY FINDINGS

This chapter will describe the findings of the study. Data is presented according to the research objectives. That is, systematic analysis of the participants' speech, relating specifically to the acquisition of consonants and vowels, the emergence or disappearance of phonological processes and the development of syllable structure between the ages of 3;0-6;0 years. Results are illustrated using graphical representation and tables together with a summary. Phonological profiles were created for each age group and are shown in Appendix K- N.

The first part of this chapter focuses on each of the six groups individually and in turn. For each group details of performance on the single word naming task are presented. The consonant and vowel acquisition of each group is described by detailing the phonetic inventory, followed by a description of the syllable structures produced by each group (i.e. independent analysis). PCC and PVC for each group will be presented and findings will be compared to adult phonology by establishing what phonological processes were used within this group (i.e. relational analysis).

The second part of the chapter details performance across all six groups, also following the objectives of the study. This section describes consonant and vowel acquisition, syllable struture development and phonological processes across the groups in order to determine patterns or trends from the younger through to the older children.

5.1 Individual group analysis

This section focuses on each of the six groups in turn, starting with the youngest group and moving to the eldest. Information is grouped under the following headings as per the objectives in order to yield a comprehensive description of the groups phonology.

5.1.1 Group 1 (3;0 -3;6)

5.1.1.1 Independent analysis

Table 6 shows the summary of the independent analysis of the four children in Group 1.

Table 6. ***Phonetic and syllable inventory: Group 1 (3;0 -3;6)***

Consonants	**Group 1**			
(Manner)	**Child 1**	**Child 2**	**Child 3**	**Child 4**
Plosives (voiced)	/d//ɡ/	/d/ /ɡ/	/d/ /ɡ/	/d/ /ɡ/
Plosives (ejectives)	/p’/, /t’/,/k’/	/p’/, /t’/,/k’/	/p’/, /t’/,/k’/	/p’/, /t’/,/k’/
Plosives (aspirated)	/bʰ/	/bʰ//pʰ/ /tʰ/ /kʰ/	/bʰ//pʰ/ /tʰ/ /kʰ/	/bʰ//pʰ/ /tʰ/ /kʰ/
Implosive	/ɓ/	/ɓ/	/ɓ/	/ɓ/
Fricatives	/f//v//ʃ/ /ɮ/ /ɦ/	/f//v//s//z//ʃ/ /x/ /ɣ/ /ɬ//ɮ/ /ɦ/	/f//v//s//ʃ/ /x/ /ɣ/ /ɬ/ /ɮ/ /ɦ/	/f//v//s//z//ʃ//x/ /ɣ/ /ɬ/ /ɮ//ɦ/
Affricates	/tɬ/ /c’/ /kx’/ / dʒ/	/ts’/ /tʃ’/ /c’/ /kx’/ /tsʰ/ /tʃʰ/ /cʰ/ /dz/ /ɟ/ /dʒ/	/tɬ//ts’/ /tʃ’/ /c’/ /kx’/ /tsʰ//tʃʰ/ /cʰ/ /dʒ/	/tɬ/ /ts’//c’/ /kx’/ /tsʰ/ /tʃʰ/ /cʰ/ /dz/
Nasals	/m/ /n/ /ɲ/ /ŋ/	/m/ /n/ /ɲ/ /ŋ/	/m/ /n/ /ɲ/ /ŋ/	/m/ /n/ /ɲ/ /ŋ/
Glides	/w/ /j/	/w/ /j/	/w/ /j/	/w/ /j/
Trill		/r/	/r/	
Lateral	/l/	/l/	/l/	/l/
Clicks	/ǀ/ /ŋǀ/ /ŋǁ/ /ǀg̊/ /!/ /ŋ!/ /ŋ!ǁ/ /!g̊/ /!ʰ/ /ǁg̊/ /ŋˀ/	/ǀ/ /ŋǀ/ /ŋǁ/ /ǀg̊/ /ǀʰ/ /!/ /ŋ!/ /ŋ!ǁ/ /!g̊/ /!ʰ/ /ǁ/ /ŋǁ/ /ŋǁǁ/ /ŋǁ//ŋˀ/	/ǀ/ /ŋǀ/ /ŋǁ/ /ǀg̊/ /ǀʰ/ /!/ /ŋ!/ /ŋ!ǁ/ /!g̊/ /!ʰ/ /ǁ/ /ŋǁ/ /ŋˀ/	/ǀ/ /ŋǀ/ /ŋǁ/ /ǀg̊/ /!/ /ŋ!ǁ/ /!g̊/ /!ʰ/ /ǁ/ /ŋǁ/ ŋǁǁ /ǁg̊/ /ǁʰ/ /ŋˀ/
Vowels	a, i, e, o, u	a, i, e, o, u	a, i, e, o, u	a, i, e, o, u
	****Example**			
Syllable type	*iti* ‘tea’ / it’i/	2 syllables	2 syllables	2 syllables	2 syllables
	ibhola ‘ball’ /ibʰɔla/	3 syllables	3 syllables	3 syllables	3 syllables
	bayangxola ‘noisy’ /ɓajaŋǁɦɔla/	4 syllables	4 syllables	4 syllables	4 syllables
	uyakrazula ‘tearing’ /ujakx’azula/	5 syllables	5 syllables	5 syllable	5 syllables

** Examples of syllable shapes assessed and produced by participants

5.1.1.1.1 Consonant acquisition

The children in this age group could produce all nasals, glides, the lateral approximant /l/ and the implosive /ɓ/. Aspirated plosives, /tʰ/ /pʰ/ /kʰ/ were produced correctly by three of the participants in Group 1 (child 1 produced the aspirated plosives as /t/, /p/ and /k/ respectively), i.e. unaspirated. Fricatives and affricates were more challenging for Group 1 with only five of the ten fricatives being produced correctly by all four children. Child 1 was unable to correctly produce /s/,/ɣ/,/x/,/ ɬ/ even after modelling. Child 1 and 3 both made distorted productions of /z/, where /z/ approximated /ʒ/ in both cases. One (/c'/) of the eleven affricates was produced correctly by all four participants in the group. Three of the four children produced /dʒ/, /tɬ/ /tsʰ/ /ts'/ /tʃʰ/ /cʰ/ and /kx'/. The following sounds were produced correctly by two of the children: /tʃ̋/ (Child 1's production approximated / ʃ/ and Child 4 produced it as / ts'/); /ɟ/ (Child 1 produced it as /g/ and Child 4 produced it as /dz/); /dz/ (Child 1 and 3 both produced it as /dʒ/). The trill /r/ was produced correctly by two of the four children within this group.

In terms of clicks, participants within this group produced the majority of the clicks (nine of sixteen) correctly. Clicks present in the phonetic inventory of all four children in Group 1 are: / ǀ , !, !ʰ, ŋǀ, ǀg̊, ǁg̊, ŋ!ʱ, ŋǀʱ, ŋk/ /. The only clicks that appeared to be more challenging were the aspirated clicks ǀʰ and ǁʰ, with only two of the children producing them correctly. There was no specific pattern observed, however, it was noted that where there were sound substitutions, children often used a more basic click in its place (e.g./ujaǀʰeɓa/ *uyacheba* 'cutting' -> 'ujaleɓa'; /ǀʰ/ -> /l/). As can be seen in Table 7, Child 1 seemed to have the most difficulty with clicks, producing ten of the sixteen correctly. This level of performance was observed in the other sound classes as well, suggesting that this child's performance was different to other children in the group and may have had a confounding influence on the findings of this group.

5.1.1.1.2 Vowel acquisition

All four children were able to produce the five vowels (a, ɛ, i, ɔ, u) assessed in the naming task.

5.1.1.1.3 Syllable structure development

All the participants in this group were able to produce words of 2 to 5 syllable. Child 1 was recorded to have made a number of substitution errors on words longer than 3 syllables as did Child 3 also with the 5 syllable word. Even so, these were included in their syllable inventory as they did produce the correct number of syllables.

5.1.1.2 Relational analysis

The participants' responses were also compared to the target adult phonology through relational analysis. Results are shown in Table 7.

Table 7. Relational analysis : Group 1 (3;0 -3;6)

		Group 1			
	Example	**Child 1**	**Child 2**	**Child 3**	**Child 4**
Percentage Consonants Correct (PCC)		78%	96%	96%	95%
Percentage Vowels Correct (PVC)		98%	97%	96%	98%
Phonological processes					
Gliding of liquids	/ujakx'azula/-> /ilaŋa/->	/ujakx'azu**j**a/	/i**j**aŋa/	/ujakx'azu**j**a/	
Stopping	/isele/-> /ujałeka/->	/i**t**ele/ /uja**t'**eka/	/i**t**ele/		
Deaffrication	/iwɔt**ʃ'**i/-> /intɬɔkɔ/->	/iwɔ**ʃ**i/	/in**ɬ**ɔkɔ/		
Depalatalisation	/iɟasi/->				/i**dz**asi/
Prevocalic voicing	/u!i**x**a/->	/u!i**ɣ**a/			

Postvocalic devoicing	/u!ǧiɣa/->	/u**!**iɣa/			
Deaspiration	/ujak^{h}aɓa/-> /uja^{l}^{h}eɓa/->	/uja**k**aɓa/			/ujaleɓa/
Dentalisation	/ama**z**iɲɔ/->			/ama**ð**iɲɔ/	
Palatalisation	/ujats'iɓa/->	/**tʃ'**iɓa/			
Backing	/i‖ɔlɔ/->	/i**k'**ɔlɔ/			
Glottal replacement	/ujaɣɔmba/->	/uja**ɦ**ɔmba/			
Lateralisation	/iɔ**r**endʒi/->				/ɔ**l**entsi/
Sound preference substitution	/i**dz**edze/->	/i**dʒ**edʒe/		/i**dʒ**edʒe/	
Idiosyncratic (insertion of consonant)	/isits^{h} aɓa/->		/iti's'ts^{h}aɓa		
Vowel substitution	/iɦaʃ**e**/->		/iɦaʃ**i**/		
Vowel assimilation	/iɦaʃ**e**/-> /iɔ**r**endʒi/-> /ib^{h}anana/->	/iɦaʃ/ /olen**dʒi**/		/iɦaʃ/ /b^{h}anana/	

* Examples of phonological processes are shown. Transcriptions show the substitution used (e.g. /isele/-> /i**t**ele/) in relation to the adult target

With the exception of Child 1, who had a PCC of 78%, the children within this group had high PCCs approximating adult levels. Velleman (2009) notes that PVC is usually higher than PCC. This was observed in this group with PVC above 95% for all four of the participants. This was higher for three of the four participants (Child 3 had an equal percentage for PCC and PVC). This suggests all the vowel productions were close to the adult targets. The findings for Group 1 suggest that some of the speech sounds are still developing and are not yet being produced. Child 1, in particular, had the fewest fricatives and affricates in her phonetic inventory and had a PCC considerably lower than her peers. In

the following section, phonological processes are described and give some explanation for Child 1's difficulties.

5.1.1.2.1 Phonological processes

Phonological processes that were common in this group include gliding of liquids (e.g. [ujakx'azu**j**a] for *uyakrazula* 'to tear' /l/->/j/); sound preference substitution (e.g. [idʒedʒe] for *idzedze* 'flea' /dz/->/dʒ/); stopping (e.g. [uja**t'**eka] for *uyahleka* 'laugh' /ɬ/-> /t/); deaspiration (e.g. [uja**k**'aɓa] for *uyakhaba* 'to kick' /kʰ/->/k/) and deaffrication (e.g. [inɬɔkɔ] for *intloko* 'head' /tɬ/->/ɬ/). There was also dentalisation of /z/ in the word *amazinyo* 'teeth' /ama**z**iɲɔ/ where Child 3 produced it as [ama**ð**iɲɔ]. This is of particular interest as /ð/ is not typically found in isiXhosa phonology, thus suggesting that this may be an influence of exposure to English, possibly an isolated idiosyncratic 'error' or phonological disorder.

Vowels were not consistently produced by children in this group although their overall PVC scores were high. Vowel substitution was noted for *ihashe* 'horse' /iɦaʃe/ which was often produced as [iɦaʃ**i**]; /e/->/i/. This was seen in a number of productions where children omitted either the initial (e.g. [bʰanana] for *ibhanana* 'banana' /i/->/ø/) or final vowel (e.g. [iɦaʃ] for *ihashe* 'horse' i/->/ø/). According to Edwards and Beckman (2008), there are covert contrasts which cannot be perceived without further analysis using spectrographic instruments (Edwards & Beckman, 2008). Assimilation may also account for the omission of vowels as this is a commonly occurring process in adult speakers of isiXhosa (Smouse, 2012, Personal Communication).

5.1.1.3 Summary: Group 1

Children in Group 1 were the youngest in the sample. They had a relatively well developed phonetic inventory although they still needed to develop fricatives, many of the affricates and some of the clicks. Vowels found in isiXhosa were all acquired by the children in this group, although some phonological processes were also used (e.g. vowel substitution and vowel assimilation). The children in this group were able to produce multisyllabic words (2 to 5 syllable words). The PCC and PVCs for Group 1 were high and approximated adults; however, Child 1 had a lower PCC. Overall, Child 1 made use of the most phonological processes in this group (e.g. backing, gliding of liquids). It was noted that she often had to imitate during the assessment, thus the lower PCC score and the presence of the phonological

processes suggest a possible delay or disorder. Some processes that were used include deaffrication, deaspiration and sound preference substitution.

5.1.2 Group 2 (3;7 -4;0)

5.1.2.1 Independent analysis

Table 8 shows the summary of the independent analysis of the four children in Group 2.

Table 8. Phonetic and syllable inventory: Group 2 (3;7 - 4;0)

Consonants	**Group 2**			
(Manner)	**Child 5**	**Child 6**	**Child 7**	**Child 8**
Plosives (voiced)	/d//ɡ/	/d/ /ɡ/	/d/ /ɡ/	/d/ /ɡ/
Plosives (ejectives)	/p'/, /t'/,/k'/	/p'/, /t'/,/k'/	/p'/, /t'/,/k'/	/p'/, /t'/,/k'/
Plosives (aspirated)	/bʰ//pʰ/ /tʰ/ /kʰ/	/bʰ//pʰ/ /tʰ/ /kʰ/	/bʰ//pʰ/ /tʰ/ /kʰ/	/bʰ//pʰ/ /kʰ/
Implosive	/ɓ/	/ɓ/	/ɓ/	/ɓ/
Fricatives	/f//v//s//z//ʃ//x/ /ɣ/ /ɬ/ /ɮ//ɦ/	/f//v//s//z//ʃ//x/ /ɣ/ /ɬ/ /ɮ//ɦ/	//f//v//s//z//ʃ//x/ /ɣ/ /ɬ/ /ɮ//ɦ/	/f//v//s//z//ʃ//x/ /ɣ/ /ɬ/ /ɮ//ɦ/
Affricates	/tɬ/ /ts'/ /tʃ'/ /c'/ /kx'/ /tsʰ/ /tʃʰ/ /cʰ/ /dz/ /dʒ/ /ɟ/	/tɬ/ /ts'/ /c'/ /kx'/ /tsʰ/ /tʃʰ/ /dz/ /ɟ/ /dʒ/	/tɬ/ /ts'/ /tʃ'/ /c'/ /tsʰ//tʃʰ/ /cʰ/ /dz/ /dʒ/	/tɬ/ /ts'/ /tʃ'/ /c'/ /kx'/ /tʃʰ/ /cʰ/ /dz/ /dʒ/ /ɟ/
Nasals	/m/ /n/ /ɲ/ /ŋ/	/m/ /n/ /ɲ/ /ŋ/	/m/ /n/ /ɲ/ /ŋ/	/m/ /n/ /ɲ/ /ŋ/
Glides	/w/ /j/	/w/ /j/	/w/ /j/	/w/ /j/
Trill	/r/		/r/	/r/
Lateral	/l/	/l/	/l/	/l/
Clicks	/ǀ/ /ŋǀ/ /ŋǀʱ/ /ǀg̊/ /ǀʰ/ /!/ /ŋ!/ /ŋ!ʱ/ /!g̊/ /!ʰ/ /ǁ/ /ŋǁ/ /ŋǁʱ/ /ǁg̊/ /ŋǀˀ/	/ǀ/ /ŋǀ/ /ŋǀʱ/ /ǀg̊/ /ǀʰ/ /!/ /ŋ!/ /ŋ!ʱ/ /!g̊/ /!ʰ/ /ǁ/ /ŋǁ/ /ŋǁʱ/ /ǁʰ/ /ŋǀˀ/	/ǀ/ /ŋǀ/ /ŋǀʱ/ /ǀg̊/ /ǀʰ/ /!/ /ŋ!/ /ŋ!ʱ/ /!g̊/ /!ʰ/ /ǁ/ /ŋǁ/ /ŋǁʱ/ /ǁg̊/ /ǁʰ/ /ŋǀˀ/	/ǀ/ /ŋǀ/ /ŋǀʱ/ /ǀg̊/ /!/ /ŋ!/ /ŋ!ʱ/ /!g̊/ /!ʰ/ /ŋǁ/ /ŋǁʱ /ǁg̊/ /ǁʰ/ /ŋǀˀ/
Vowels	a, i, e, o, u	a, i, e, o, u	a, i, e, o, u	a, i, e, o, u
****Example**				
Syllable type *iti* 'tea' / it'i/	2 syllables	2 syllables	2 syllables	2 syllables
ibhola 'ball' /ibʰɔla/	3 syllables	3 syllables	3 syllables	3 syllables
bayangxola 'noisy' /ɓajaŋǁʱɔla/	4 syllables	4 syllables	4 syllables	4 syllables
uyakrazula 'tearing' /ujakx'azula/	5 syllables	5 syllables	5 syllables	5 syllables

** Examples of syllable shapes assessed and produced by participants

5.1.2.1.1 Consonant acquisition

The children in this age group could produce implosive /ɓ/, nasals, lateral /l/, fricatives, glides, all the plosives (except Child 8 who produced /tʰ/ as /t/) and vowels. The trill /r/ was produced inaccurately by only one child (Child 7 produced /r/ as /l/). Again, affricatives were a more challenging class of sounds with only six of the eleven affricates present in all four of the childrens' phonetic inventories. Consonants that were produced inaccurately included /tʃʼ, cʰ, ɟ, kx/.

This group did particularly well at the production of the clicks. Child 7 was able to accurately produce all sixteen clicks assessed. For the remaining three children, clicks present in all their phonetic inventories include: /ǀ, ǃ, ǃʰ, ǁʰ, ŋǃ, ŋǀ ŋǁ ǃɠ̊, ǀɠ̊, ŋǃʱ, ŋǀʱ, ŋǁʱ, ŋk//.

5.1.2.1.2 Vowel acquisition

All four children were able to produce the five vowels (a, ɛ, i, ɔ, u) assessed in the naming task.

5.1.2.1.3 Syllable structure development

The participants in Group 2 produced words of two to five syllable words, although Child 7 produced the 5 syllable word *uyakrazula* 'tearing' inaccurately. This was however, a difficulty at the segmental level where Child 7 used a substitution process.

5.1.2.2 Relational analysis

Participants' responses were also compared to the target adult phonology through relational analysis. Results are shown in Table 9.

Table 9. Relational analysis: Group 2 (3;7 -4;0)

	Example	**Group 2** **Child 5**	**Child 6**	**Child 7**	**Child 8**
Percentage Consonants Correct (PCC)		98%	97%	98%	95%
Percentage Vowels Correct (PVC)		100%	99%	99%	100%
Phonological processes					
Stopping	/ujakx'azula//->	/uja**k'**zula/			
Deaffrication	/iwɔt**ʃ'**i/-> /isitsʰ aɓa/		/iwɔ**ʃ**i/		/isi**s**aɓa/
Deaspiration	/bajatʰetʰa/-> /ujaˡʰeɓa/->				/ɓaja**te**ta/ /ujaleɓa/
Dentalisation	/iˡˡɔlɔ/ /->				/iˡɔlɔ/
Denasalisation	/in**ɮ**eɓe/-> /iŋ!ᶯ**i**niɓa/->	/i**ɮ**eɓe/		/iŋ!ᶯ**il**iɓa/	
Sound preference substitution	/ujacʰala/-> /iɟasi/->		/uja**tʃ'**ala/	/i**dʒ**asi/	
Vowel substitution	/iɦaʃ**e**/->			/iɦaʃ**i**/	
Vowel assimilation	/isitsʰ aɓa/->		/sitsʰaɓa/		

* Examples of phonological processes are shown. Transcriptions show the substitution used (e.g. /isele/-> /i**t**ele/) in relation to the adult target.

Participants in Group 2 had higher PCCs than those in Group 1. All four scores suggest that the children's accuracy is close to that of the expected adult productions. PVC was also higher than each child's PCC. As mentioned, this is an expected result.

5.1.2.2.1 Phonological processes

This group made use of fewer phonological processes than Group 1. It was also noted that use of processes was more widely spread out across the group. That is, all four of the children in Group 2 made use of various phonological processes unlike in Group 1 where most of the processes were used by one child. The children in this group produced many of their sounds accurately, although affricates were still developing. This may account for the types of processes used by children in this group. Phonological processes commonly used within this group included: denasalisation (e.g. [i**ɮ**eɓe] for *indlebe* 'ear' /n/->/ø/); deaffrication (e.g. [iwɔ**ʃ**i] for *iwotshi* 'a watch' /tʃʾ/->/ʃ/) and sound preference substitution (e.g. [uja**tʃʾ**ala] for *uyatyhala* 'push' /cʰ/->/tʃʾ/). The children within this group seemed to substitute sounds with ones in the same sound class (i.e. same manner of articulation) (e.g. [uja**tʃʾ**ala] for *uyatyhala* 'push' /cʰ/->/tʃʾ/, both affricates). Less commonly documented processes used in this group include dentalisation, in this case, of a click. In Table 10 the example given shows that alveolar click /ǃ/ -> dental click /ǀ/ thus resulting in /iǀɔlɔ/ for *ixolo* 'peel'; deaspiration (e.g. [ɓaja**te**ta] for *bayathetha* 'talking' /tʰ/->/t/). Group 2 was found to make similar vowel substitutions and assimilations as Group 1.

5.1.2.3 Summary: Group 2

Group 2 was the second youngest group in the sample. Their inventories were found to have developed from that of children in Group 1, although they still needed to develop some of the affricates and clicks. Children in Group 2 were able to produce words of two to five syllables, suggesting that they were able to cope with more complex syllable shapes. PCC and PVC scores were high and approximated adult targets. Fewer phonological processes were used by children in this group when compared to Group 1 and those used were mainly deaffrication and deaspiration. It was noted that this Group also made use of similar vowel processes to those used by Group 1.

5.1.3 Group 3 (4;1 – 4;6)

5.1.3.1 Independent analysis

Table 10 shows the summary of the independent analysis of the four children in Group 3.

Table 10. Phonetic and syllable inventory: Group 3(4;1 -4;6)

Consonants		**Group 3**		
(Manner)	**Child 9**	**Child 10**	**Child 11**	**Child 12**
Plosives (voiced)	/d//ɡ/	/d/ /ɡ/	/d/ /ɡ/	/d/ /ɡ/
Plosives (ejectives)	/p'//k'/	/p'/, /t'/,/k'/	/p'/, /t'/,/k'/	/p'/, /t'/,/k'/
Plosives (aspirated)	/bʰ//pʰ/ /tʰ/ /kʰ/	/bʰ//pʰ/ /tʰ/ /kʰ/	/bʰ//pʰ/ /tʰ/ /kʰ/	/bʰ/ /pʰ/ /tʰ/ /kʰ/
Implosive	/ɓ/	/ɓ/	/ɓ/	/ɓ/
Fricatives	/f//v/ /z/ /x/ /ɣ/ /ʃ/ /ɬ/ /ɮ/ /ɦ/	/f//v//s//z//ʃ/ /x/ /ɣ/ /ɦ/	/f//v//s/ /z//ʃ/ /x//ɣ/ /ɬ/ /ɮ/ /ɦ/	f//v//s//z//ʃ/ /x/ /ɣ/ /ɬ/ /ɮ//ɦ/
Affricates	/tɬ/ /ts'/ /tʃ"/ /c'/ /tsʰ/ /tʃʰ/ /dz/ /dʒ/	/ts'/ tʃ" /c'/ /kx'/ /tʃʰ/ /cʰ/ /dz/ /dʒ/	/tɬ/ /tʃ"/ /c'/ /kx'/ /cʰ/ /dʒ/ /ɟ/	/ts'/ /tʃ"/ /c'/ /kx'/ /tʃʰ/ /cʰ/ /dz/ /dʒ/
Nasals	/m/ /n/ /ɲ/ /ŋ/	/m/ /n/ /ɲ/ /ŋ/	/m/ /n/ /ɲ/ /ŋ/	/m/ /n/ /ɲ/ /ŋ/
Glides	/w/ /j/	/w/ /j/	/w/ /j/	/w/ /j/
Trill	/r/	/r/	/r/	/r/
Lateral	/l/	/l/	/l/	/l/
Clicks	/ǀ/ /ŋǀ/ /ŋǀʱ/ /ǀɡ/ /ǀʰ/ /!/ /ŋ!/ /ŋ!ʱ/ /!ɡ/ /!ʰ/ /ǁ/ /ŋǁ/	/ǀ/ /ŋǀ/ /ǀɡ/ /ǀʰ/ /!/ /ŋ!/ /ŋ!ʱ/ /!ɡ/ /!ʰ/ /ǁ/ /ŋǁ/ /ŋǁʱ/ /ǁɡ/ /ǁʰ/	/ǀ/ /ŋǀ/ /ŋǀʱ/ /ǀɡ/ /ǀʰ/ /!/ /ŋ!/ /ŋ!ʱ/ /!ɡ/ /!ʰ/ /ǁ/ /ŋǁ/ /ŋǁʱ/ /ǁɡ/ /ǁʰ/	/ǀ/ /ŋǀ/ /ŋǀʱ/ ǀʰ/ /!/ /ŋ!/ /ŋ!ʱ/ /!ɡ/ /!ʰ/ /ǁ/ /ŋǁ/ /ŋǁʱ /ǁɡ/ /ǁʰ/ /ŋǀʔ/
Vowels	a, i, e, o, u	a, i, e, o, u	a, i, e, o, u	a, i, e, o, u
	****Example**			
Syllable type	*iti* 'tea' / it'i/	2 syllables	2 syllables	2 syllables	2 syllables
	ibhola 'ball' /ibʰɔla/	3 syllables	3 syllables	3 syllables	3 syllables
	bayangxola 'noisy' /ɓajaŋǁʱɔla/	4 syllables	4 syllables	4 syllables	4 syllables
	uyakrazula 'tearing' /ujakx'azula/	5 syllables	5 syllables	5 syllables	5 syllables

** Examples of syllable shapes assessed and produced by participants

5.1.3.1.1 Consonant acquisition

Group 3's consonant acquisition is in line with the previous two groups, in that many of the sound classes were already acquired by all four children in the group. The phonetic inventory of the four children within this group included implosive /ɓ/, nasals, lateral /l/, glides /w/ and /j/, and trill /r/. Three of the four children produced all their plosives accurately (Child 9 produced all but one, /t'/->/c'/). There was more variability in accuracy when it came to the production of fricatives and affricates. This is of interest as Group 2 (3;7 -4;0), had all the fricatives in their phonetic inventory. Possible explanations for this will be presented in the discussion. Fricatives inaccurately produced included: /s/ and /ɮ/. Fricatives present in all four children's phonetic inventories are: /f, v, z, ʃ, ɣ, x, ɦ, ɬ/. Only three affricates were present in all the children's inventories: /tʃ', dʒ, c'/. The least accurately produced affricate was the aspirated alveolar affricate /tsʰ/, with only one child producing it correctly. Sounds produced correctly by only two children include /ɻ/ and /tɬ/. The remaining affricates were produced accurately by at least three of the four children in the group.

In terms of clicks, Group 3 produced most of their clicks correctly. The group appeared to have most accuracy with the more basic clicks (e.g. /!, ǀ, ǁ/). There were clicks that were produced inaccurately by either one or two children. These were mainly the more complex articulatory combinations (e.g. voiced nasalized dental click /ŋǀʱ/ and voiced-nasalised alveolar-palatal click /ŋ!ʱ/).

5.1.3.1.2 Vowel acquisition

All four children were able to produce the five vowels (a, ɛ, i, ɔ, u) assessed in the naming task.

5.1.3.1.3 Syllable structure development

The participants in this group were able to produce words of two to five syllables, although Child 9 used a substitution process for the 5 syllable word.

5.1.3.2 Relational analysis

The participants' responses were also compared to the target adult phonology through relational analysis. Results are shown in Table 11.

Table 11. Relational analysis: Group 3(4;1 -4;6)

	Example	**Child 9**	**Group 3** **Child 10**	**Child 11**	**Child 12**
Percentage Consonants Correct (PCC)		92%	95%	94%	96%
Percentage Vowels Correct (PVC)		100%	98%	100%	98%
Phonological processes					
Stopping	/i**ɟ**asi/->		/i**d**asi/		
Deaffrication	/ujak**x'**azula/-> /isits^{h} aɓa/-> /in**tɬ**ɔkɔ/->	/uja**x**azula/	/si**s**aɓa/		/in**ɬ**ɔkɔ/
Postvocalic devoicing	/i**ŋ**|^{ɦ}a/->	/i**ŋ**|a/			
Deaspiration	/bajat^{h}et^{h}a/->/uja|^{h}eɓa/->				/ɓaja**t**e**t**a/ /ujaleɓa/
Dentalisation	/i**s**ele/->	/i**θ**ele/			/i|ɔlɔ/
Backing	/i**ɟ**asi/->				/i**g**asi/
Denasalisation	/in**ʒ**eɓe/->			/i**ʒ**eɓe/	
Lateralisation	/ŋk/e**ŋ**k/eʃela/->		/||el|eʃela/		
Sound preference substitution	/ujac^{h}ala/->/idzedze/->/uja**ɬ**eka/->	/uja**tʃ'**ala/	/uja**ʃ**eka/	/i**dʒ**e**dʒ**e/	
Idiosyncratic (insertion of consonant)	/ɓajaŋ||^{ɦ}ɔla/->	/ɓaja'ŋ'ŋ||^{ɦ}ɔla/			

	/imali/->				/’g’imali/
Vowel substitution	/iɲaʃ**e**/->		/iɲaʃ**i**/		
Vowel assimilation	/isele/-> /idada/->		/sele/		 /dada/

* Examples of phonological processes are shown. Transcriptions show the substitution used (e.g. /isele/-> /i**t**ele/) in relation to the adult target.

The PCC for Group 3 was slightly lower than it was for Group 2, however their scores still reflect a high level of accuracy. The PVC for this group was also high, with Child 9 and Child 11 having 100% accuracy when it came to vowel production. Overall, PVC scores were higher than individual PCC scores.

As noted, this group performed well on most sound classes, however there was decreased accuracy, with all four children, when it came to the production of affricates. This is reflected in their use of phonological processes.

5.1.3.2.1 Phonological processes

The most commonly seen processes within this group were: deaffrication (e.g. [uja**x**azula] for *uyakrazula* ‘to tear’ /kx’/-> /x/; [in**ɬ**kɔ] for *intloko* ‘head’ /tɬ/->/ɬ/); idiosyncratic insertion of consonants (e.g. [ɓaja’ŋ’ŋ||ʱɔla] for *bayangxola* ‘make noise’ add /ŋ/ and ‘ɡ’imali for imali, add /ɡ/) and sound preference substitution. Where there were inaccuracies in production, children seemed to substitute sounds in the same class (e.g. [uja**tʃ’**ala]for *ukutyhala* ‘to push’ /cʰ/->/tʃ’/ and [i**dʒ**ed**ʒ**e] for *idzedze* ‘flea’ /dz/->/dʒ/).

Children within this group also displayed some processes that affected vowel production. As with previous groups, there was substitution of the final vowel (e.g. [iɲaʃ**i]** for *ihashe* ‘horse’ /e/->/i/). Assimilation of some initial vowels was also noted (e.g. [sele] for *isele* ‘frog’ /i/->/ø/).

5.1.3.3 Summary: Group 3

The children in Group 3 had well developed phonetic inventories, with most sound classes acquired. They too had most difficulty when it came to the production of affricates and some of the more complex clicks, which are still developing. The vowels were acquired by all four children, although some phonological processes affecting vowels were also noted. Children in this group were able to produce words of up to five syllables. Although their average PCC score was lower than that of Group 2, the scores were still high enough to suggest that they are close to adult targets. Group 3 made use of more phonological processes than Group 2 and it was noted that there was variable use by all four children in the group. Similar processes used by previous groups were used by Group 3 with the most common being deaffrication, sound preference substitution and vowel assimilation.

5.1.4 Group 4 (4;7 -5;0)

5.1.4.1 Independent analysis

Table 12 shows the summary of the independent analysis of the four children in Group 4.

Table 12. Phonetic and syllable inventory: Group 4 (4;7 -5;0)

Consonants		**Group 4**		
(Manner)	**Child 13**	**Child 14**	**Child 15**	**Child 16**
Plosives (voiced)	/d//ɡ/	/d/ /ɡ/	/d/ /ɡ/	/d/ /ɡ/
Plosives (ejectives)	/p'/ /t'/ /k'/	/p'/, /t'/,/k'/	/p'/, /t'/,/k'/	/p'/, /t'/,/k'/
Plosives (aspirated)	/bʰ//pʰ/ /tʰ/ /kʰ/	/bʰ//pʰ/ /tʰ/ /kʰ/	/bʰ//pʰ/ /tʰ/ /kʰ/	/bʰ/ /pʰ/ /tʰ/ /kʰ/
Implosive	/ɓ/	/ɓ/	/ɓ/	/ɓ/
Fricatives	/f//v/ s/ /z/ /ʃ/ /x/ /ɣ/ /ɬ/ /ɮ/ /ɦ/	/f//v//s//z/ /ʃ/ /x/ /ɣ/ /ɬ//ɮ/ /ɦ/	/f/ /v/ /s/ /z/ /ʃ/ /x/ /ɣ/ /ɬ/ /ɮ/ /ɦ/	/f/ /v/ /s/ /z/ /ʃ/ /x/ /ɣ/ /ɬ/ /ɮ//ɦ/
Affricates	/tɬ/ /ts'/ /tʃ'/ /c'/ /tsʰ/ /kx'/ /dz/ /dʒ/ /ɟ/	/tɬ/ /tʃ'/ /c'/ /kx'/ /tʃʰ/ /cʰ/ /ɟ/ /dʒ/	/tɬ//ts'// tʃ'/ /c'/ /kx'/ /tʃʰ/ /cʰ/ /dʒ/ /ɟ/	/tɬ/ /ts'/ /tʃ'/ /c'/ /kx'/ /tsʰ/ /tʃʰ/ /dz/ /dʒ/ /ɟ/
Nasals	/m/ /n/ /ɲ/ /ŋ/	/m/ /n/ /ɲ/ /ŋ/	/m/ /n/ /ɲ/ /ŋ/	/m/ /n/ /ɲ/ /ŋ/
Glides	/w/ /j/	/w/ /j/	/w/ /j/	/w/ /j/
Trill	/r/	/r/	/r/	
Lateral	/l/	/l/	/l/	/l/

Clicks		/ǀ/ /ŋǀ/ /ŋǀʱ/ /ǀg̊/ /ǀʰ/ /!/ /ŋ!/ /ŋ!ʱ/ /!g̊/ /!ʰ/ /ǁ/ /ŋǁ/ /ŋǁʱ//ǁʰ/ /ŋǃʔ/	/ǀ/ /ŋǀ/ /ŋǀʱ/ /ǀg̊/ /!/ /ŋ!/ /ŋ!ʱ/ /!g̊/ /!ʰ/ /ǁ/ /ŋǁ/ /ŋǁʱ/ /ǁg̊//ǁʰ/ /ŋǃʔ/	/ǀ/ /ŋǀ/ /ŋǀʱ/ /ǀg̊/ /ǀʰ/ /!/ /ŋ!/ /ŋ!ʱ/ /!g̊/ /!ʰ/ /ǁ/ /ŋǁ/ /ŋǁʱ/ /ǁg̊/ /ǁʰ/ /ŋǃʔ/	/ǀ/ /ŋǀ/ /ŋǀʱ/ /ǀg̊/ /!/ /ŋ!/ /ŋ!ʱ/ /!g̊/ /ǁ/ /ŋǁ/ ŋǁʱ /ǁg̊/ /ǁʰ/ /ŋǃʔ/
Vowels		a, i, e, o, u	a, i, e, o, u	a, i, e, o, u	a, i, e, o, u
	**Example				
Syllable type	*iti* ‘tea’ / it’i/	2 syllables	2 syllables	2 syllables	2 syllables
	ibhola ‘ball’ /ibʰɔla/	3 syllables	3 syllables	3 syllables	3 syllables
	bayangxola ‘noisy’ /ɓajaŋǁʱɔla/	4 syllables	4 syllables	4 syllables	4 syllables
	uyakrazula ‘tearing’ /ujakx’azula/	5 syllables	5 syllables	5 syllables	5 syllables

** Examples of syllable shapes assessed and produced by participants

5.1.4.1.1 Consonant acquisition

Group 4 (4;7-5;0) did particularly well on the naming task, with all four children producing all the plosives, nasals, glides, fricatives, implosive /ɓ/ and lateral /l/ accurately. The trill /r/ was produced correctly by three of the four participants in this group. For Group 4, affricates presented a challenge with /tɬ, tʃʼ, ɟ, dʒ, cʼ and kxʼ/ being the only affricates produced accurately by the whole group. The remaining affricates were produced correctly by at least two of the children in the group. In general, the inaccuracies were observed across the group (i.e. incorrect productions were not specific to one child).

Clicks were produced accurately most of the time. Clicks present in all four of the children’s phonetic inventories include / ǀ, !, ǁ, ǁʰ, ŋ!, ŋǀ, ŋǁ, !g̊, ǀg̊, ŋ!ʱ, ŋǀʱ, ŋǁʱ, ŋk/ /. Some inaccuracies were noted for the aspirated clicks, with two of the children (Child 14 and Child 16), producing /ǀʰ/ as /ǀ/ and Child 16 producing /!ʰ/ as /!/. The voiced alveolar-lateral /ǀg̊/ was inaccurately produced by only one child in the group. In general, it can be seen that the children in Group 4 had acquired the majority of the clicks.

5.1.4.1.2 Vowel acquisition

All four children were able to produce the five vowels (a, ɛ, i, ɔ, u) assessed in the naming task.

5.1.4.1.3 Syllable structure development

Children in this group were able to produce the different syllable shapes assessed with all four children in this group able to produce words of two to five syllables.

5.1.4.2 Relational analysis

The participants' responses were also compared to the target adult phonology through relational analysis. Results are shown in Table 13.

Table 13. Relational analysis: Group 4 (4;7 -5;0)

	Example	Child 13	Group 4 Child 14	Child 15	Child 16
Percentage Consonants Correct (PCC)		97%	96%	95%	95%
Percentage Vowels Correct (PVC)		100%	99%	100%	98%
Phonological processes					
Postvocalic devoicing	/amall**g̊**a/->	/amalla/			
Deaspiration	/ujaleɓa/-> /isi**ts**^{h}aɓa/-> /uja**!**^{h}uɓa/->		/ujaleɓa/	/sisi**ts**aɓa/	/uja**!**uɓa/
Palatalisation	/en**tʃ**^{h}a/->	/en**c'**a/			
Denasalisation	/indʒa/->	/idʒa/			
Lateralisation	/io**r**endʒi/->				/o**l**endʒi/
Sound preference substitution	/ujac^{h}ala/-> /idzedze/->	/uja**tʃ'**ala/	/i**ð**eðe/		
Idiosyncratic (insertion of consonant)	/isi**ts**^{h}aɓa/ ->	/'s'isits'aɓa/			

Vowel substitution	/iɲaʃ**e**/->		/iɲaʃ**i**/		
Vowel assimilation	/io**r**endʒi/->				/o**l**endʒi/

* Examples of phonological processes are shown. Transcriptions show the substitution used (e.g. /isele/-> /i**t**ele/) in relation to the adult target.

The PCC scores for Group 4 are all 95% and above, and when compared to their PVC, these scores were higher. The assumption for this group is that in general, the children within this age group were able to produce speech that closely approximated adult phonology.

5.1.4.2.1 Phonological processes

A process used by three children in this group, was that of deaspiration (e.g. [sis**ts**aɓa] for *isithsaba* 'crown' /tsʰ/->/ts/). Interestingly, there was also sound preference substitution seen in this group, and a child produced a sound that is not typically used in isiXhosa (e.g [i**ð**eðe] for *idzedze* 'flea' /dz/->/ð/). This is similar to the example from Child 3 in Group 1 and is possibly due to the influence of another language such as English. One instance of idiosyncratic insertion of a consonant was noted where Child 13 produced [s'isits'aɓa] for /isitsʰaɓa/ 'crown' where /s/ was added word initially- also something which is not typically found in isiXhosa phonology. Vowel substitution and assimilation were used in this group. These simplifications were similar to those described in previous groups. Overall, fewer phonological processes were seen in this group than in the younger groups. This is suggestive of improved accuracy of production with age.

5.1.4.3 Summary: Group 4

Children in Group 4 had well developed phonetic inventories with most of the sound classes, including the majority of clicks, present in their inventories. There was reduced accuracy when it came to the production of affricates, as with previous groups. Children in this group had acquired all the vowels and similar to the previous groups, there was use of phonological processes which affected vowels. Group 4 was able to produce words of two to five syllables. PCC and PVC scores were high suggesting that Group 4's productions are close to the adult target. There were fewer phonological processes used by the children in this

group than in Group 3, with the most common processes being deaspiration and sound preference substitution.

5.1.5 Group 5 (5;1 -5;6)

5.1.5.1 Independent analysis

Table 14 shows the summary of the independent analysis of the four children in Group 5.

Table 14. Phonetic and syllable inventory: Group 5 (5;1 -5;6)

Consonants	**Group 5**			
(Manner)	**Child 17**	**Child 18**	**Child 19**	**Child 20**
Plosives (voiced)	/d//ɡ/	/d/ /ɡ/	/d/ /ɡ/	/d/ /ɡ/
Plosives (ejectives)	/p'/ /t'/ /k'/	/p'/, /t'/,/k'/	/p'/, /t'/,/k'/	/p'/, /t'/,/k'/
Plosives (aspirated)	/bʰ/ /pʰ/ /kʰ/ /tʰ/	/bʰ//pʰ/ /tʰ/ /kʰ/	/bʰ//pʰ/ /tʰ/ /kʰ/	/bʰ/ /pʰ/ /tʰ/ /kʰ/
Implosive	/ɓ/	/ɓ/	/ɓ/	/ɓ/
Fricatives	/f//v/ s/ /z/ /ʃ/ /x/ /ɣ/ /ɬ/ /ɮ/ /ɦ/	/f//v//s//z/ /ʃ/ /x/ /ɣ/ /ɬ//ɮ/ /ɦ/	/f/ /v/ /s/ /z/ /ʃ/ /x/ /ɣ/ /ɬ/ /ɮ/ /ɦ/	/f/ /v/ /s/ /z/ /ʃ/ /x/ /ɣ/ /ɬ/ /ɮ//ɦ/
Affricates	/tɬ/ /tʃ'/ /c'/ /kx'/ /tʃʰ/ /dz/ /dʒ/ /ɟ/	/tɬ/ /ts'/ /tʃ'/ /c'/ /kx'/ /tsʰ/ /cʰ/ /ɟ/ /dz//dʒ/	/tɬ//ts'// tʃ'/ /c'/ /kx'/ /tʃʰ/ /cʰ/ /dz/ /dʒ/	/tɬ/ /ts'/ /c'/ /kx'/ /tsʰ/ /tʃʰ/ /dʒ/ /ɟ/
Nasals	/m/ /n/ /ɲ/ /ŋ/	/m/ /n/ /ɲ/ /ŋ/	/m/ /n/ /ɲ/ /ŋ/	/m/ /n/ /ɲ/ /ŋ/
Glides	/w/ /j/	/w/ /j/	/w/ /j/	/w/ /j/
Trill	/r/	/r/	/r/	/r/
Lateral	/l/	/l/	/l/	/l/
Clicks	/ǀ/ /ŋǀ/ /ŋǀʱ/ /ǀɡ̊/ /ǀʰ/ /!/ /ŋ!/ /ŋ!ʱ/ /!ɡ̊/ /!ʰ/ /ǁ/ /ŋǁ/ /ŋǁʱ/ /ǁɡ̊/ /ǁʰ/ /ŋǀˀ/	/ǀ/ /ŋǀ/ /ŋǀʱ/ /ǀɡ̊/ /ǀʰ/ /!/ /ŋ!/ /ŋ!ʱ/ /!ɡ̊/ /!ʰ/ /ǁ/ /ŋǁ/ /ŋǁʱ/ /ǁɡ̊/ /ǁʰ/ /ŋǀˀ/	/ǀ/ /ŋǀ/ /ŋǀʱ/ /ǀɡ̊/ /ǀʰ/ /!/ /ŋ!/ /ŋ!ʱ/ /!ɡ̊/ /!ʰ/ /ǁ/ /ŋǁ/ /ŋǁʱ/ /ǁɡ̊/ /ǁʰ/ /ŋǀˀ/	/ǀ/ /ŋǀ/ /ŋǀʱ/ /ǀɡ̊/ /ǀʰ/ /!/ /ŋ!ʱ/ /!ɡ̊/ /!ʰ/ /ǁ/ / ŋǁʱ /ǁɡ̊/ /ǁʰ/ /ŋǀˀ/
Vowels	a, i, e, o, u	a, i, e, o, u	a, i, e, o, u	a, i, e, o, u
****Example**				
Syllable type *iti* 'tea' / it'i/	2 syllables	2 syllables	2 syllables	2 syllables
ibhola 'ball' /ibʰɔla/	3 syllables	3 syllables	3 syllables	3 syllables
bayangxola 'noisy' /ɓajaŋǁʱɔla/	4 syllables	4 syllables	4 syllables	4 syllables
uyakrazula 'tearing' /ujakx'azula/	5 syllables	5 syllables	5 syllables	5 syllables

** Examples of syllable shapes assessed and produced by participants

5.1.5.1.1 Consonant acquisition

Participants in Group 5 produced the majority of consonants accurately, including plosives (although Child 17 produced /tʰ/ as / θ/), implosive /ɓ/ , nasals, fricatives, lateral /l/, glides and the trill /r/. Of the eleven affricates assessed, five /tɬ, dʒ, cʼ, kxʼ, tsʼ/ were present in the phonetic inventory of all four children. The remaining sounds were produced correctly by either two or three of the children. This suggests that these sounds are still developing.

All four children produced 14 of the 16 clicks correctly. In fact, apart from one child (Child 20) who produced /ŋǀ / and /ŋǁ/ inaccurately, these findings suggest that most of the clicks sounds are acquired by this age.

5.1.5.1.2 Vowel acquisition

All four children were able to produce the five vowels (a, ɛ, i, ɔ, u) assessed in the naming task.

5.1.5.1.3 Syllable structure development

Child 17 and 18 produced the 5 syllable word incorrectly, both making use of a substitution process. This was not observed to be a difficulty with syllables but rather with the segments comprising the word. The remaining two children in this group produced it accurately. This syllable shape may still be developing.

5.1.5.2 Relational analysis

The participants' responses were also compared to the target adult phonology through relational analysis. Results are shown in Table 15.

Table 15. Relational analysis: Group 5 (5;1 -5;6)

	Example	Group 5 Child 17	Child 18	Child 19	Child 20
Percentage Consonants Correct (PCC)		95%	98%	98%	96%
Percentage Vowels Correct (PVC)		100%	97%	98%	100%

Phonological processes					
Gliding of liquids	/ujakx'azu**l**a/->	/ujakx'azu**j**a/	/ujakx'azu**j**a/		
Postvocalic devoicing	/amaje**z**a/->			/amaje**s**/	
Deaffrication	/isi**ts**^{h}aɓa/-> /iwɔ**tʃ'**i/->	/isi**s**aɓa/			/iwɔ**ʃ**i/
Deaspiration	/isi**ts**^{h}aɓa/->			/isis**ts'**aɓa/	
Dentalisation	/iŋ!ina/->				/iŋ|ina/
Denasalisation	/in**ɮ**eɓe/->		/i**ɮ**eɓe/		/i**ɮ**eɓe/
Sound preference substitution	/i**ɟ**asi/-> /uja**ts**iɓa/-> /iɓi**s**i/-> /i**dz**edze/->	/uja**θ**iɓa/	/i**dʒ**asi/	/iɓi**θ**i/	/i**dʒ**edʒe/
Idiosyncratic (insertion of consonant)	/imali/-> /isi**ts**^{h}aɓa/-> /iɲagu/->	/'g'mali/ /'ŋg'iɲagu/		/isi's'ts'aɓa/	
Vowel substitution	/iɲaʃ**e**/->	/iɲaʃ**i**/	/iɲaʃ**i**/	/iɲaʃ**i**/	/iɲaʃ**i**/
Vowel assimilation	/isi||^{h}ɔsa/-> /amaje**z**a/->	/is||^{h}ɔsa/		/amaje**s**/	

* Examples of phonological processes are shown. Transcriptions show the substitution used (e.g. /isele/-> /i**t**ele/) in relation to the adult target.

The average PCC for Group 5 was high, as with children in previous groups. The children in this group produced most of the consonants accurately, and thus it is assumed that their speech production was close to the expected adult targets. PVC scores were also high, and at 100% for two of the children in this group.

5.1.5.2.1 Phonological processes

Phonological processes used by the children in Group 5 are similar to those used by the younger children. They also included sound preference substitution and the preferred sounds were ones that are not present in isiXhosa phonology. It was also observed that three of the four children in this group used denasalisation for the same word. They all produced [iɮeɓe] for *indlebe* 'ear' /n/-> /ø/. Two of the children also made use of idiosyncratic insertion of consonants, both word initially and word medially (see Table 14). Phonological processes affecting vowels were also similar to those used in Groups 1 through 4. There were some vowel substitutions seen as well as assimilation of vowels either word initially or word finally.

5.1.5.3 Summary: Group 5

Overall, Group 5 had most of the consonants in their phonetic inventories, including the majority of the clicks. It was noted that the children in this group also had some difficulty with affricates as seen in previous groups. The children in Group 5 had acquired all the vowels, however they did make use of phonological processes which affected vowels. The children in this group were able to produce words of two to five syllables. Average PCC and PVC scores were higher than those of Group 4, suggesting increased accuracy in this age group. It was found that although phonological processes were used, it was with less frequency and a smaller range of processes was observed.

5.1.6 Group 6 (5;7- 6;0)

5.1.6.1 Independent analysis

Table 16 shows the summary of the independent analysis of the four children in Group 6.

Table 16. Phonetic and syllable inventory: Group 6 (5;7 -6;0)

Consonants	**Group 6**			
(Manner)	**Child 21**	**Child 22**	**Child 23**	**Child 24**
Plosives (voiced)	/d//ɡ/	/d/ /ɡ/	/d/ /ɡ/	/d/ /ɡ/
Plosives (ejectives)	/p'/ /t'/ /k'/	/p'/, /t'/,/k'/	/p'/, /t'/,/k'/	/p'/, /t'/,/k'/
Plosives (aspirated)	/bʰ//pʰ/ /tʰ/ /kʰ/	/bʰ//pʰ/ /tʰ/ /kʰ/	/bʰ//pʰ/ /tʰ/ /kʰ/	/bʰ/ /pʰ/ /tʰ/ /kʰ/

Implosive	/ɓ/	/ɓ/	/ɓ/	/ɓ/
Fricatives	/f//v/ /z/ /ʃ/ /x/ /ɣ/ /ɬ/ /ɮ/ /ɦ/	/f//v//s//z/ /ʃ/ /x/ /ɣ/ /ɬ//ɮ/ /ɦ/	/f/ /v/ /s/ /z/ /ʃ/ /x/ /ɣ/ /ɬ/ /ɮ/ /ɦ/	/f/ /v/ /s/ /z/ /ʃ/ /x/ /ɣ/ /ɬ/ /ɮ//ɦ/
Affricates	/tɬ/ /tʃ'/ /c'/ /kx'/ /tʃʰ/ /cʰ/ /dʒ/ /ɟ/	/tɬ/ /ts'/ /tʃ'/ /c'/ /kx'/ /tsʰ/ /tʃʰ/ /cʰ/ /ɟ/ /dʒ/	/tɬ/ /ts'/ / tʃ'/ /c'/ /kx'/ tsʰ/ /tʃʰ/ /dz/ /dʒ/ /ɟ/	/tɬ/ /ts'/ / tʃ'/ /c'/ /kx'/ /tsʰ/ /tʃʰ/ /dz/ /dʒ/ /ɟ/
Nasals	/m/ /n/ /ɲ/ /ŋ/	/m/ /n/ /ɲ/ /ŋ/	/m/ /n/ /ɲ/ /ŋ/	/m/ /n/ /ɲ/ /ŋ/
Glides	/w/ /j/	/w/ /j/	/w/ /j/	/w/ /j/
Trill	/r/	/r/	/r/	/r/
Lateral	/l/	/l/	/l/	/l/
Clicks	/ǀ/ /ŋǀ/ /ŋǀʱ/ /ǀg̊/ /ǀʰ/ /!/ /ŋ!/ /ŋ!ʱ/ /!g̊/ /!ʰ/ /ǁ/ /ŋǁ/ /ŋǁʱ/ /ǁg̊/ /ǁʰ/ /ŋǀˀ/	/ǀ/ /ŋǀ/ /ŋǀʱ/ /ǀg̊/ /ǀʰ/ /!/ /ŋ!/ /ŋ!ʱ/ /!g̊/ /!ʰ/ /ǁ/ /ŋǁ/ /ŋǁʱ/ /ǁg̊/ /ǁʰ/ /ŋǀˀ/	/ǀ/ /ŋǀ/ /ŋǀʱ/ /ǀg̊/ /ǀʰ/ /!/ /ŋ!/ /ŋ!ʱ/ /!g̊/ /!ʰ/ /ǁ/ /ŋǁ/ /ŋǁʱ/ /ǁg̊/ /ǁʰ/ /ŋǀˀ/	/ǀ/ /ŋǀ/ /ŋǀʱ/ /ǀg̊/ /ǀʰ/ /!/ /ŋ!/ /ŋ!ʱ/ /!g̊/ /!ʰ/ /ǁ/ /ŋǁ/ / ŋǁʱ /ǁg̊/ /ǁʰ/ /ŋǀˀ/
Vowels	a, i, e, o, u	A, i, e, o, u	a, i, e, o, u	a, i, e, o, u
****Example**				
Syllable type *iti* 'tea' / it'i/	2 syllables	2 syllables	2 syllables	2 syllables
ibhola 'ball' /ibʰɔla/	3 syllables	3 syllables	3 syllables	3 syllables
bayangxola 'noisy' /ɓajaŋǁʱɔla/	4 syllables	4 syllables	4 syllables	4 syllables
Uyakrazula 'tearing' /ujakx'azula/	5 syllables	5 syllables	5 syllables	5 syllables

** Examples of syllable shapes assessed and produced by participants

5.1.6.1.1 *Consonant acquisition*

In general, Group 6 had the highest number of accurate productions across all sound classes. The phonetic inventory of the four children in this group consisted of all the plosives, nasals, fricatives, glides, implosive /ɓ/, lateral /l/ and trill /r/. There was improvement noted in the production of affricates in this group, with seven of the eleven affricates being produced accurately.

The children in this group produced all the sixteen clicks correctly.

5.1.6.1.2 Vowel acquisition

All four children were able to produce the five vowels (a, ɛ, i, ɔ, u) assessed in the naming task.

5.1.6.1.3 Syllable structure development

The children in this group were able to produce all the different syllable types assessed.

5.1.6.2 Relational analysis

The participants' responses were also compared to the target adult phonology through relational analysis. Results are shown in Table 17

.

Table 17. Relational analysis: Group 6 (5;7 -6;0)

	Example	**Group 6** **Child 21**	**Child 22**	**Child 23**	**Child 24**
Percentage Consonants Correct (PCC)		95%	98%	99%	99%
Percentage Vowels Correct (PVC)		99%	98%	100%	99%
Phonological processes					
Deaffrication	/i**dz**edze/->	/i**ð**eðe/	/i**ð**eðe/		
Sound preference substitution	/isi**ts^{h}**aɓa/-> /uja**c^{h}**ala/->	/isiθaɓa/	/i**dʒ**asi/	/uja**tʃ'**ala/	/uja**tʃ'**ala/
Idiosyncratic (insertion of a vowel)	/um**l**ga/	/um'u'**l**ga/			
Vowel substitution	/iɲaʃ**e**/->	/iɲaʃ**i**/	/iɲaʃ**i**/	/iɲaʃ**i**/	/iɲaʃ**i**/

Vowel assimilation	/isi$\|\|^{h}$ɔsa/-> /amaje**za**/-> /ilaŋa/		/is$\|\|^{h}$ɔsa/ /laŋa/	 /amaje**s**/	/is$\|\|^{h}$ɔsa/

* Examples of phonological processes are shown. Transcriptions show the substitution used (e.g. /isele/-> /i**t**ele/) in relation to the adult target.

Group 6 had the highest average PCC of all the groups, suggesting improved accuracy from previous groups. PCC scores were close to ceiling and PVC was the same or higher than PCC which is expected for older children.

5.1.6.2.1 Phonological processes

Researchers have suggested that as children get older, there are fewer phonological processes used in their productions (Dodd et al., 2003). This is true for Group 6 where few phonological processes were used. There were two children who used deaffrication, although this was only on one occasion each (e.g. [iðeðe] for *idzedze* 'flea' /dz/->/ð/). This type of substitution was seen in previous groups, where the children produced a sound that is not found in isiXhosa (in this case /ð/). This is likely due to some influence of English whether in school or at home. This will be discussed further in the following chapter. One child was observed to insert a vowel producing [um'u'ǀǧa] for *umgca* 'line', essentially adding a syllable to this word. The vowel simplifications for this group also include vowel substitutions (e.g. [iɲaʃi] for *ihashe* 'horse' /e/->/i/) and vowel assimilation (e.g. [is$\|\|^{h}$ɔsa] for *isiXhosa* /i/->/ø/). A possible explanation for this is that this is often done by adult speakers of isiXhosa, and thus the older children may be modelling what they hear in their environment.

5.1.6.3 Summary: Group 6

The children in Group 6 had the largest phonetic inventories of all the groups, with only a small number of affricates still to be acquired. The children in this group produced all clicks and vowels accurately, and were able to produce words of up to 5 syllables. The high PCC and PVC scores suggest that the children's production closely approximated the adult

targets and this is in line with the fact that Group 6 used the smallest range of phonological processes.

5.1.6.4 Summary of Groups 1- 6

Overall, Groups 2 and 6 had the highest accuracy of all the groups, that is, the highest average PCC of 97.75% for both groups. There appears to be a developmental trend in the accuracy of production of consonants and vowels, shown by increases in the PCC and PVC scores for all six groups. The phonetic inventories of the twenty-four children, show that many of the sound classes are already acquired as early as 3;0, and for those that are not, there is some development occurring across the group. It was also noted that although some phonological processes were present in all six of the groups (e.g. sound preference substitution and vowel assimilation) a smaller range was used as the children got older, and these were used with reduced frequency in the older groups. From these findings, the assumption of improved accuracy with age seems to hold true.

5.2 Across group analysis

In the following section, the findings will be described in terms of the entire sample in order to show the changes, if any, which may occur from group to group as children get older. The findings will be presented following the objectives of this study. The phonetic inventories for consonants and vowels will be presented, followed by a description of the development of syllable shape, and finally a relational analysis to describe the changes in PCC, PVC and the types of phonological processes used by isiXhosa speaking children between the ages of 3;0-6;0.

5.2.1 Independent analysis

5.2.1.1 Consonant Acquisition

In general, it seems that children within this sample had acquired many of their consonants as early as age 3;0. There were individual cases, where a child appeared to struggle with all the consonants (e.g. Child 1), however in most cases this did not affect group performance. Table 18 shows the progression of the phonetic inventory for isiXhosa speaking children aged 3;0-6;0.

Table 18 has been broken up into the inventory for each group. Where three of the four children were able to produce a sound it was considered to be in the inventory for that group. Where a participant was able to produce a consonant or vowel (either spontaneously or by imitation) it was included in the phonetic inventory (Dodd et al., 2006).

Table 18. * The phonetic inventory of children across the groups

Consonants	**Age category**					
	Group 1	**Group 2**	**Group 3**	**Group 4**	**Group 5**	**Group 6**
	3;0 -3;6	**3;7 -4;0**	**4;1 – 4;6**	**4;7– 5;0**	**5;1 – 5;6**	**5;7- 6;0**
Plosives	p, t ,d, k, ɡ, bʰ, pʰ, tʰ, kʰ	p, t , d, k, ɡ, bʰ, pʰ, kʰ, tʰ	p,d, k, ɡ, bʰ,pʰ,kʰ, tʰ, t	p, t , d, k, ɡ, bʰ,pʰ,kʰ, tʰ	p, t , d, k, ɡ, bʰ,pʰ,kʰ,tʰ	p, t, d, k, ɡ, bʰ,pʰ,kʰ,tʰ
Nasals	m, n, ŋ, ɲ	m, n, ŋ, ɲ	m, n, ŋ, ɲ	m, n, ŋ, ɲ	m, n, ŋ, ɲ	m, n, ŋ, ɲ
Implosive / ɓ/	ɓ	ɓ	ɓ	ɓ	ɓ	ɓ
Fricatives	f, v, ʃ, ɦ, ɮ, s, x, ɣ, ɬ	f, v, s, z, ʃ, ɣ, x, ɦ, ɬ, ɮ,	f, v, z, ʃ, ɣ, x, ɦ, ɬ , s, ɮ	f, v, z, ʃ, ɣ, x, ɦ, ɬ, ɮ, s	f, v, s, z, ʃ, ɣ, x, ɦ, ɬ, ɮ,	f, v, s, z, ʃ, ɣ, x, ɦ, ɬ, ɮ,
Affricates	c’, tsʰ, ts’, tʃʰ, dʒ, kx’, cʰ	ts’, tʃʰ, dʒ, dz, c’ tsʰ, cʰ, ɟ, tʃ’ ,kx’, tɬ	tʃ’, dʒ, c’ ts’, tʃʰ, dz, kx’, cʰ	tʃ’, ɟ, dʒ, c’ ts’, tʃʰ ,kx’, tɬ	ts’, dʒ, c’, tʃ’, tʃʰ, ɟ, dz, kx’, tɬ	tʃ’, tʃʰ, ɟ, dʒ, c’, tsʰ, ts’, kx’, tɬ
Trill	*r*	*r*	*r*	*r*	*r*	*r*
Lateral	l	l	l	l	l	l
Glides	w, j	w, j	w, j	w,j	w,j	w,j
Clicks	!, ǀ, !ʰ, ŋǀ, ǀg̊, ǁg̊, ŋ!ʱ, ŋǀʱ, ŋk/, ǁ, ŋ!, ŋǁ, !g̊, ŋǁʱ, ǀʰ	!, ǀ, !ʰ, ŋǀ, ǀg̊, ǁg̊, ŋ!ʱ, ŋǀʱ, ŋk/, ǁ, ŋ!, ŋǁ,!g̊, ŋǁʱ, ǀʰ	!, ǀ, !ʰ, ŋǀ, ǀg̊, ǁg̊, ŋ!ʱ, ŋǀʱ, ǁ, ŋ!, ŋǁ, !g̊, ŋǁʱ, ǀʰ, ǁʰ	!, ǀ, !ʰ, ŋǀ, ǀg̊, ǁg̊, ŋ!ʱ, ŋǀʱ, ŋk/, ǁ, ŋ!, ŋǁ, !g̊, ŋǁʱ, ǁʰ	!ʰ, !, ǀ, ŋǀ, ǀg̊, ǁg̊, ŋ!ʱ, ŋǀʱ, ŋk/, ǁ ,ŋ!, ŋǁ, !g̊, ŋǁʱ, ǀʰ, ǁʰ	!, ǀ, !ʰ, ŋǀ, ǀg̊, ǁg̊, ŋ!ʱ, ŋǀʱ, ŋk/, ǁ, ŋ!, ŋǁ, !g̊, ŋǁʱ, ǀʰ, ǁʰ

* Where 3/4 children in a group (75%) produced a sound at least once, it was considered to be in the inventory for the group.

Table 18 shows that a majority of the plosives are acquired as early as age 3;0, with at least three of the four children within each group producing them accurately. The only plosives that appear to still be developing are the aspirated plosives /pʰ, kʰ, tʰ/. Implosive / ɓ/, nasals, lateral /l/ and glides are produced accurately by the children in this sample, suggesting that they are some of the earliest sounds to develop. Although some children in this sample produced /r/ inaccurately, most of them produced it correctly, thus it was assumed that this sound is acquired, although some individual children may still be developing it.

The findings show that fricatives and affricates presented the biggest challenge for the children in this sample, although on the whole the children seemed to fare better with fricatives. All the children produced /f/ and /v/ correctly. It was noted that most of the children (95.8% *n*= 23) in this sample could produce /ɣ/, /x/, /ɬ/ and/ɮ/ correctly. Previous studies have reported inconsistent findings on the acquisition of /s/ and /z/ (Mowrer & Burger, 1991; Tuomi et al., 2001). Interestingly, /s/ and /z/ also had a high number of accurate productions with 91.6% *(n=22)* of the participants producing /z/ correctly and 87.5% *(n=21)* producing /s/ accurately, including children in Group 1 (3;0 -3;6).

The affricates showed most variance across the sample and were found to be produced inaccurately even by children in Group 6 (5;7-6;0). Even so, the majority of the affricates found in isiXhosa were developing even though they may not have been fully acquired yet. The only affricate produced correctly by all twenty-four children was /cʼ/. Other sounds with high accuracy of production included /dʒ/ (95.8%, *n=23*); /kxʼ/ (87.5%, *n= 21*); /tsʼ/,/tʃʰ/ and /tʃʼ/ *(n=20)*. The more challenging sounds were found to be /tɬ/ / ɻ/, /dz/, / tsʰ/ and /cʰ/, with fewer than 20 children producing them correctly.

In terms of clicks, it was found that the majority of the sixteen clicks were present in the phonetic inventory of the children within this sample. Of the 16 clicks assessed /!, ŋǃʱ, ǀ, ŋǀ/ were the only clicks produced correctly by all the children. It was found that for the remaining clicks /!ʰ, ǃ, ǃg̊, ǀg̊, ŋǀʱ, ŋǁʱ, ŋǃ, /ŋk/, ǁ, ǁʰ, ŋǁ , ǁg̊, ǀʰ /, at least 20 of the children were able to produce them accurately. This suggests that although they are less commonly

found in other languages, these sounds begin to develop early although it seems that the children produce them more accurately as they get older and possibly refine them beyond the age of 6;0.

Figure 6 is an illustration of the percentage of children who produced the assessed consonants correctly. This is a representation of findings already discussed and shows the developmental progression of consonant acquisition.

Figure 6. Percentage of children who produced consonants correctly.

Key:

	100% (i.e. 4/4 children in each category produce the sound correctly)
	75% (i.e. 3/4 children in each category produce the sound correctly)
	<50% (i.e. 2 or less children in each category produce the sound correctly)

5.2.1.2 *Vowel acquisition*

Table 19 shows that all children across the six age groups were able to produce the five vowels found in isiXhosa at least once during the assessment. These findings indicate that vowel acquisition occurs early in isiXhosa and that all children in the sample aged between 3;0 -6;0 wera able to produce all the vowels.

Table 19. Vowel inventory of isiXhosa speaking children aged 3;0 -6;0

	Age category					
	3;0 -3;6	**3;7 -4;0**	**4;1 – 4;6**	**4;7– 5;0**	**5;1 – 5;6**	**5;7- 6;0**
Vowels	a, e, i, o, u	a, e, i, o, u	a, e, i, o, u	a, e, i, o, u	a, e, i, o, u	a, e, i, o, u

5.2.1.3 Syllable structure development

Information about the development of syllable structure was obtained by identifying the words with the highest percentage of error (i.e. bisyllabic versus multisyllabic). The word list was made up of bisyllabic and multisyllabic words as isiXhosa does not contain monosyllabic words. The different syllable shapes assessed were VCV (e.g. *iti* 'tea'), VCCV (bisyllabic) (e.g. *umgca* 'line'); VCVCV (e.g. *ibhola* 'ball'), VCVCVCV (e.g. *uyanxiba* 'dressing', CVCVCVCV (e.g. *bayathetha* 'talking', VVCVCV (e.g. *iorenji* 'orange') and VCVCVCVCV (multisyllabic) (e.g. *uyakrazula* 'to tear').

Participants were given a different number of opportunitites to produce the different syllable shapes. It should be noted though that there was only one opportunity to produce VVCVCV (e.g. *iorenji* 'orange'), a word borrowed from English and VCVCVCVCV (multisyllabic) (e.g. *uyakrazula* 'to tear'). If three of the four participants in each group, could produce at least 50% of the words with the specific syllable shape, it was assumed that the group had developed that particular syllable shape (i.e. if three children in Group 1 (3;0-3;6) produced

2/4 of the CVCVCVCV words, it was assumed that the syllable shape had developed for that group). However, the researcher also had to make note of whether errors on words affected syllables or if they were at a segmental level (i.e. substitution processes). Where the latter was observed, it was taken that a child was able to produce that syllable shape and the error was recorded as a phonological process.

Table 20 shows the number of children who produced the given syllable shapes correctly.

Table 20. Syllable shapes produced by children across the age categories.

	Syllable Shape	# of syllables	Example	Number of children					
				Group 1	**Group 2**	**Group 3**	**Group 4**	**Group 5**	**Group 6**
Age				**3;0 -3;6**	**3;7 – 4;0**	**4;1 – 4;6**	**4;7 – 5;0**	**5;1 – 5;6**	**5;7 -6;0**
	VCV	**2**	*iti* 'tea'						
	VCCV	**2**	*umgca* 'line'						
	VCVCV	**3**	*ibhola* 'ball'						
	VCVCVCV	**4**	*uyagromba* 'digging'						
	CVCVCVCV	**4**	*bayangxola* 'noisy'						
	VVCVCV	**4**	*iorenji* 'orange'						
	VCVCVCVCV	**5**	*uyakrazula* 'to tear'						

Key:		4/4 (100%) children in a group produce syllable shape
		3/4 (75%) children in a group produce syllable shape
		2/4 (50%) children in a group produce syllable shape

Findings suggest that children within this sample were able to produce 2 syllable and 3 syllable words, with at least three children in each group able to produce these words. Group 1 (3;0 -3;6) appear to still be developing the more complex 4 syllable words (VCVCVCV e.g. *uyagromba* 'digging' and VVCVCV e.g. *bayangxola* 'noisy'). Groups 2 through 6 were able to produce these combinations. The 4 (VVCVCV (e.g. *iorenji* 'orange') and 5 syllable words (VCVCVCVCV e.g. *uyakrazula* 'tearing'), were a challenge across the group, in that children often used substitution for segments of the words. It was taken that children were able to produce that syllable shape and their use of a phonological process was also recorded. Thus it can be said that although some of the children were able to produce these syllable shapes, they are still developing.

The VVCVCV syllable combination in the word *iorenji* 'orange' was produced correctly by fourteen participants, however this was only assessed in one word. This inaccuracy could therefore be due to a word specific difficulty or the fact that this type of syllable shape only occurs in borrowed words and is thus less frequently used in isiXhosa. Only three participants within Groups 1 through 4 produced this syllable shape correctly and only two in Groups 5 and 6. It should be noted that the inaccuracies on this word were recorded as phonological processes and careful attention was paid to whether the process affected the syllable shape or if it was simply a segmental error. In general, participants were able to produce both short and longer syllable words.

5.2.2 Relational analysis

This type of analysis is carried out in order to compare a child's production to that of an adult target (Baker, 2004). This is done by carrying out an analysis of the child's percentage of consonants and vowels produced correctly and establishing what phonological processes are used by the child (Cohen & Anderson, 2011).

5.2.2.1 Quantitative analysis

The following section shows the quantitative analysis of the participants' responses. The percentage of consonants correct was calculated by dividing the number of a child's correct responses (spontaneously or by imitation) by the total number of consonants assessed. The formula used is outlined by Shriberg et al. (1997):

PCC= # C's correct x 100

C targets

Similar calculations were done for vowels.

PVC= # V's correct x100

V targets

Table 21 shows the children's scores, the mean and standard deviation for each of the groups.

Table 21. Percentage consonants and vowels correct

	Group 1				Group 2				Group 3				Group 4				Group 5				Group 6			
Child	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
PCC %	78	96	96	95	98	97	98	98	92	95	94	96	97	96	95	95	95	98	98	96	95	98	99	99
Mean PCC (SD)	**91.25 (8.85)**				**97.75 (0.5)**				**94.25 (1.71)**				**95.75 (0.96)**				**96.75 (1.5)**				**97.75 (1.89)**			
	Group 1				**Group 2**				**Group 3**				**Group 4**				**Group 5**				**Group 6**			
PVC %	98	97	96	98	100	99	99	100	100	98	100	98	100	99	100	98	100	97	98	100	99	98	100	99
Mean PVC (SD)	**97.25 (0.96)**				**99.5 (0.58)**				**99 (1.15)**				**99.25 (0.96)**				**98.75 (1.5)**				**99 (0.82)**			

In general children within this sample had high PCCs and PVCs. PVCs were high across the group showing that children produced vowels more accurately from a younger age. The trend observed here seems to be a developmental improvement with age. The following sections will discuss the scores of the group in more depth.

5.2.2.1.1 Percentage consonants correct

The results show an inconsistency in accuracy of production of consonants. Percentage consonants correct (PCC) for participants in Group 1 (3;0 -3;6) was 91.25%. Group 2 (3;7; - 4;0) had PCC of 97.75%, as did Group 6 (5;7 – 6;0). It is interesting to note that Group 2 had an equal average PCC to the oldest children in the sample (Group 6). This is difficult to explain as this group had an equal girl/boy split, thus it can not be explained by gender differences. PCC for Group 3 (4;1- 4;6) was 94.25%, a decrease from the previous group. PCC for Group 4 (4;7- 5;0) was 95.75% and 96.75% for Group 5 (5;1 -5;7). The results show that there was some variance between the children's scores in Group 1 (3;0-3;6). Child 1 had a lower PCC of 78%, and looking at his responses in the naming task, this seems to be an accurate reflection of his performance. It is suggestive of some individual difficulty which warrants further review and possibly further assessment. This score accounts for the large standard deviation of 8.85% for Group 1(3;0 -3;6) when compared to those of the other five groups. For the remainder of the group, scores ranged between 92%- 99%. Looking at the average scores of the remaining groups, it is likely, that if child one had obtained a higher score, Group 1 would also have had a higher score.

5.2.2.1.2 Percentage vowels correct

The percentage vowels correct (PVC) increased from 97.25% in Group 1 (3;0 -3;6) to 99.5% for Group 2 (3;7- 4;0). Children in Groups 3,4 and 6 maintained an average score of approximately 99%. It was noted that PVC was slightly lower for Group 5 at 98.75%. There was no notable variation for these scores. Children across all six groups scored between 96% - 100% and the standard deviation for all groups is small, indicating that all these children are approaching the ceiling, thus the high PVC scores.

5.2.2.2 Phonological processes

Children's simplification patterns (phonological processes) were identified and described based on what is known about phonological processes in English and in other languages. Children's productions are compared to the adult target, and thus for this section, relational analysis is used (see Baker, 2004; Cohen & Anderson, 2011).

The three categories of phonological processes- syllable structure processes (such as consonant cluster reduction and weak-syllable deletion); substitution processes (such as stopping, gliding, fronting and voicing); and assimilation processes (such as consonant harmony)- will be used to describe processes used by the participants in the study.

The following criteria were used for this section of analysis: If two of the four children within a group used the same simplifications, it was taken as a process for that age group. The phonological processes observed in this sample are shown in Table 22.

Table 22. Percentage of children using phonological processes.

Phonological processes	Target	Examples	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Gliding of liquids	ujakx'azu**l**a	uyakx'azu**j**a						
Stopping	i**s**ele	i**t**ele						
Deaffrication	in**tɬ**oko	in**ɬ**ɔkɔ						
Depalatalisation	i**ɟ**asi	i**dz**asi						
Prevocalic voicing	u!ǧi**x**a	u!i**ɣ**a						
Postvocalic devoicing	u!ǧi**ɣ**a	u**!**iɣa						
Deaspiration	ujayk^{h}aɓa	uja**k**aɓa						
Dentalisation	ama**z**iɲɔ	ama**ð**iɲɔ						
Palatalisation	uja**ts'**iɓa	**tʃ'**iɓa						
Backing	i**l**olo	i**k'**ɔlɔ						
Denasalisation	i**nɮ**eɓe	iɮeɓe						
Glottal replacement	uja**ɣ**ɔmba	uja**ɦ**ɔmba						
Lateralisation	iɔ**r**endʒi	ɔ**l**entsi						
Sound preference substitution	i**dz**edze	i**dʒ**edʒe						
Idiosyncratic	isits^{h}aɓa	iti's'ts^{h}aɓa						
Vowel assimilation	isi^{l}^{h}ɔsa	is^{l}^{h}ɔsa/						
Vowel substitution	iɲa ʃ**i**	iɲa ʃ**i**						

Key:

	4/4 (100%) children in a group used process
	3/4 (75%) children in a group used process
	2/4 (50%) children in a group used process
	1< children in a group used process

Table 22 shows that the most common processes used by isiXhosa speaking children in this sample were: sound preference substitution, vowel assimilation, vowel substitution and idiosyncratic processes (e.g. insertion of consonants and vowels). As expected, Group 1 (3;0-3;6) made use of the most phonological processes and Group 6 (5;7 – 6;0) made use of the least. It appears that there is a decrease in the use of phonological processes as the children get older, with children using between four and six different processes. This is a notable decrease from the ten used by Group 1 (3;0 -3;6). This could be evidence for the improvement in accuracy with age, which has been suggested by other authors.

5.2.2.2.1 Substitution processes

Children within this sample mostly made use of substitution processes. This occurs when one class of sounds is replaced by another. Figure 7 illustrates the substitution processes used the most within this sample.

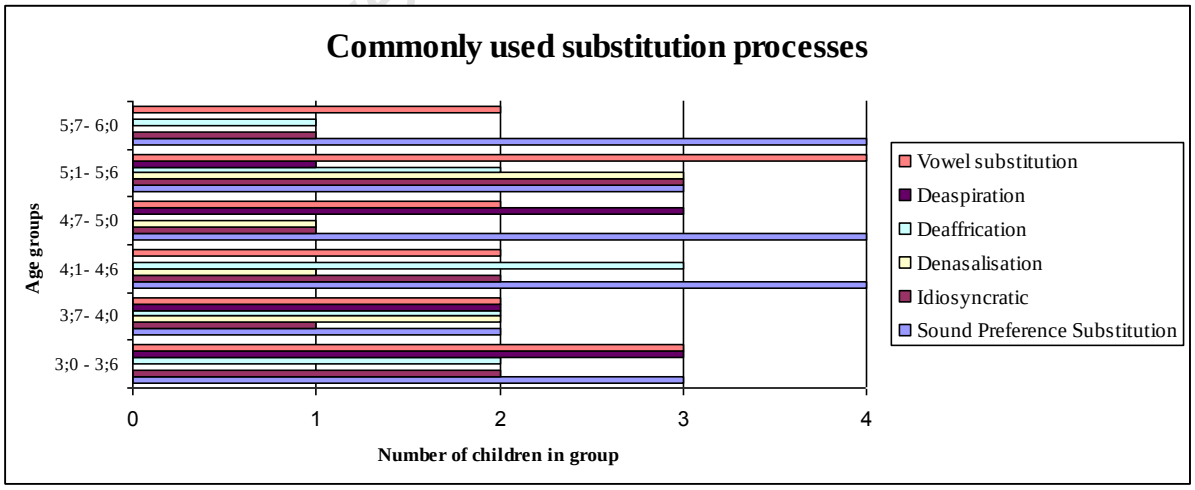

Figure 7. Substitution processes used by children across the group

It is apparent that the simplification processes used by the children in this sample, are not specific to any group. Interestingly, some of them occur from age 3;0 through 6;0 (e.g.

vowel assimilation, sound preference substitution). This suggests that for isiXhosa speaking children, these processes may be ones that persist even after the age of 6;0. Some of the commonly used processes across the group were: deaspiration- used by nine of the twenty four children, particularly when it came to the aspirated plosives and click consonants; deaffrication was used by ten of the children in the sample; denasalisation - used by seven of the twenty-four children and the most commonly observed simplification was with the word in *indlebe* 'ear' /i**n**ɮeɓe/-> [i**d**leɓe] /n/->/ø/; sound preference substitution – used by twenty of the twenty-four children. Children seemed to either substitute the correct sound with a sound from the same class (i.e. affricate for affricate) for example, *uyatyhala* 'to push' being produced as [ujatʃ'ala]; /cʰ/->/ tʃ'/or, they used some sounds that are not commonly found in isiXhosa (e.g. *isithsaba* 'crown' produced as [isiθaɓa]; /tsʰ/->/θ/). The latter suggests some type of exposure to other languages (e.g. English). Idiosyncratic processes were used by ten of the children in this sample with children either inserting consonants or vowels; vowel substitution-a number of the children in this sample substituted word final vowels, particularly in the word *ihashe* 'horse' which was produced as [iɦaʃi] /e/->/i/. This may have had to do with difficulty in perceiving what is known as covert contrasts (Edwards & Beckman, 2008), an area which will be discussed further in the following chapter. There were other processes used within this sample, although it was to a lesser degree. These are presented in Figure 8.

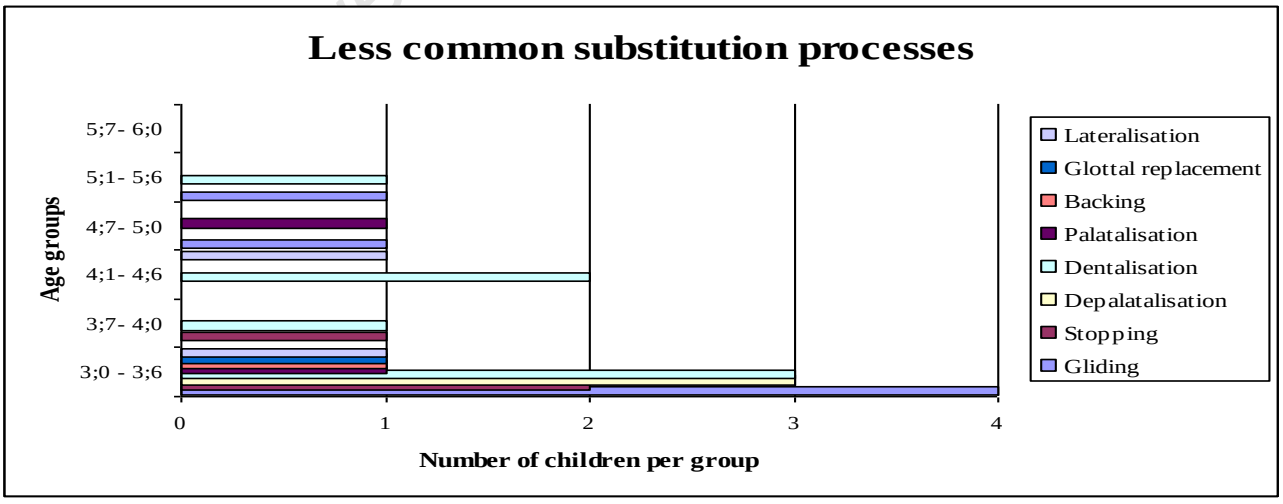

Figure 8. Substitution processes less commonly used by the children

Some of the less frequently used phonological processes were mainly used by the younger children (i.e. Group 1). There is a decrease in the use of some of the processes and it

appears that by the age of approximately 5;7 years onward these processes are being eliminated. Some of these included: gliding of liquids (e.g. [i**j**anga] for *ilanga* 'sun' and [uyakx'azu**j**a] for *uyakrazula* 'tearing' /l/-> /j/); stopping (e.g. *isele* 'frog' being produced as [i**t**ele] /s/->/t/) and depalatalisation (e.g. producing *idyasi* 'coat' as [idzasi] /ɟ/->/dz/).

There were other simplification processes observed within the sample, however little has been documented in the literature about their presence in other languages and when they are expected to appear and be eliminated from children's speech. The following section relates to these processes. Dentalisation was observed particularly when children were attempting to produce certain click consonants found in isiXhosa. Many of the children produced a dental click in place of the alveolar lateral (e.g. *isiXhosa* 'the language' was produced as /isiǀosa/ /ǁʰ/-> /ǀ/). Palatalisation occurred where e.g. *iti* 'tea' was produced as [ic'i] /t'/-> /c'/ and lateralisation where e.g. *io**r**enji* 'orange' was produced as [iɔ**l**endʒi]; /r/->/l/. Palatalisation and lateralisation were only used by two children and backing was used by one child, once.

5.2.2.2.2 Assimilation processes

There were some cases of assimilation processes which occur when the features of a sound change and sound more like another sound in that word context. Assimilation processes used by children in this sample are presented in Figure 9.

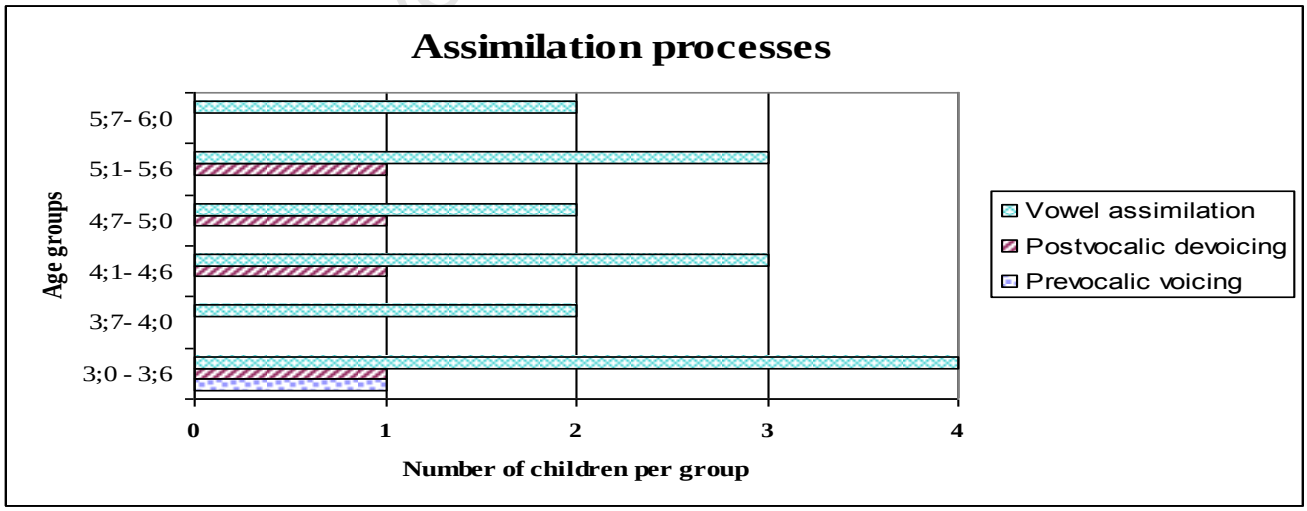

Figure 9. Assimilation processes used across the group

Vowel assimilation was the most commonly used assimilation process across the sample, used by children in all six groups. It was used for words such as /*iorenji*/ 'orange', where children omitted /i/ so that they produced the word as [*orenji*] 'orange'. Another example was with the word /isiXhosa/ where children produced it as [isXhosa]. It has been noted that assimilation is a normal process in isiXhosa adult speech (Blevins, 2005; Munnik, 2010). Other assimilation processes observed were prevocalic voicing (e.g. *ugqirha* 'doctor' produced as [u!iɣa] /x/-> / ɣ/) used by one child and postvocalic devoicing (e.g. *ugqirha* 'doctor' was produced as [u**!**iɣa]; /!ǧ/->/!/) used by four children in the sample.

The results show that the children within this sample produced many of the consonants, vowels and syllable shapes present in isiXhosa. The high PCC and PVC scores are evidence of this. Although there were individual cases where one child had difficulty with a set of sounds, it did not seem to confound the overall findings. The children in this sample made use of mainly substitution processes and the most frequently occurring processes were deaffrication, sound preference substitution and vowel assimilation. It was noted that some phonological processes may persist even after the age of 6;0 (e.g. vowel assimilation).

5.3 Summary

This chapter has presented the findings of the study and has described some of the most outstanding attributes of the data collected from the 24 participants. This was done following the objectives set out in Chapter four. In general, it was found that the children had acquired most sound classes by the age of 3;0, although the clicks and affricates showed the most variability across the six groups and are evidently the last consonants to be fully acquired. Vowel acquisition occurred early, with the children in Group 1 already able to produce all the vowels in isiXhosa. Syllable structure development appears to be under way early for isiXhosa speaking children, with the youngest children able to produce some multisyllabic words. It was noted that although some of the children made segmental errors for some of the more complex syllable shapes, they were able to produce the correct syllable number, suggesting that these too were well developed by the children in this sample. The average PCC and PVC scores for this sample were high and ranged between 90% and 100%. This suggests that many of the isiXhosa speaking children in this sample had high levels of

accuracy and their productions were closely approximating the adult targets. Phonological processes were identified. Deaffrication, sound preference substitution and vowel assimilation were the most commonly used. There was a developmental trend noted in the use of processes, with children's speech becoming more accurate as they got older and process use decreasing in terms of frequency and range of processes used. The following chapter will include in-depth interpretation and discussion of the findings.

CHAPTER SIX: DISCUSSION OF FINDINGS

The aim of the study was to describe the progression of phonological development in typically developing isiXhosa speaking children between the ages of of 3;0 – 6;0. This was done with a view of providing a preliminary set of normative data for this population and with this in mind, to contribute to the evidence base for clinicians and researchers. Chapter One highlighted the fact that there is limited data available on phonological development in isiXhosa and emphasised the need for more culturally and linguistically appropriate materials. This study therefore also aims to provide a foundation on which further research may be done in order to develop such materials. The current research involved 24 pre-school aged isiXhosa speaking children from the Cape Flats area of Cape Town. Their phonological development was evaluated by using a single word picture naming task, designed for the purposes of this study. This chapter aims to provide a detailed interpretation of the findings of the study and discuss the implications in relation to the theoretical concepts that were presented in Chapters One - Three.

Findings show that consonant and vowel acquisition occurs early for isiXhosa speaking children, with nasals, glides, trill /r/ and lateral /l/, some clicks and plosives being the earliest sounds to develop (at approximately 3;0 years), followed by fricatives and affricates which appear to continue developing through the pre-school years and even beyond the age of 6;0. This confirms the findings of previous research which suggested early acquisition (e.g. Gxilishe, 2004; Mowrer & Burger, 1991; Tuomi et al., 2001). Children within the present sample were able to produce complex syllable shapes and words of up to five syllables. Some phonological processes that have been well documented for other languages were used by children in this sample (e.g. deaffrication, stopping, gliding of liquids). However there was also use of some processes that are considered atypical in some other languages. These included sound preference substitution and idiosyncratic processes (e.g. insertion of consonants/vowels).

The following section will discuss the performance of the children in the sample following the four objectives of the study and will consider these in light of theories of phonological development introduced in Chapter Three.

6.1 Consonant acquisition

Nasals, liquids and glides were sound classes all acquired by 3;0 years by children in this study. Many of the plosive sounds were also acquired by the age of 4;1 years, although not all the younger children in the 3;0 -3;6 age group were able to produce the aspirated plosives /pʰ/, /kʰ/ and /tʰ/ correctly. The trill /r/ was also acquired by the majority of the children, with two of the children in the first two groups producing it correctly. It should be noted though that this sound is found only in borrowed words, thus it occurs with low frequency in isiXhosa and this may be an explanation for why some of the children did not produce it accurately. For the remaining sound classes: fricatives, affricates and clicks, there was considerable variation across the entire group and the following sections focus on these sound classes which were later acquired by all the children in the group.

6.1.1 Fricatives

The first fricatives to appear were /f, v, ʃ, ɦ/. These were produced correctly by the entire sample, including Group 1 (3;0 -3;6). Although one child in Group 3 (4;1 -4;6) produced the lateral fricative /ɮ/ incorrectly, it was assumed that this sound is also acquired early, as children in younger groups were able to produce it. By the age of approximately 3;7, it was found that children were producing a further three fricatives (/z, ɣ, x and ɬ/), suggesting that these sounds were beginning to develop at this age. While /s/ was produced by some children in the younger age groups, it was found that accuracy increased to 100% for the older children in Groups 5 and 6 (5;1 -5;6 and 5;7 -6;0). This provides support for what was found by Mowrer and Burger (1991) and Tuomi et al. (2001) who reported that /s/ was acquired between the ages of 2;0 and 3;0 but suggests that differences between studies may be due to to how acquisition is actually defined and that the refinement of /s/ may continue for some time. In English /s/ acquisition is thought to have a long range of typical emergence (Bleile, 2009). Looking at the children's performance on the production of fricatives, there is a clear developmental progression; with children producing this class of sounds with more accuracy in the older age groups. In terms of phonological development, the results support the view that children's accuracy improves as they get older (Dodd et al., 2003).

6.1.2 Affricates

There were ten affricates assessed in this study. This class of sounds was the most challenging for the children in this sample. This is likely due to the complex nature of articulation required to produce them. Minor changes to articulatory features change the sound completely and thus, this may make it more difficult for younger children to perceive these differences (e.g. many children produced voiced palato-alveolar /dʒ/ (e.g. *inja* 'dog' /in**dʒ**a/) in place of the voiced palatal /ɟ/ (e.g. *idyasi* 'coat' /i**ɟ**asi/). To the untrained ear or young speaker, these may be perceived as the same sound. Groups 1 through 6 exhibited some inaccuracies in the production of many of the affricates. For the present study, /cʼ/ (e.g. *ukutya* 'food' /uku**cʼ**a/) and /dʒ/ were present in over 90% of the children's inventories. This suggests that, for the children in this sample, these are some of the first affricates produced. The sound /kxʼ/ (e.g. *uyakrazula* 'tearing' /uja**kxʼ**azula/) was also accurately produced by the majority of children and appears to be acquired by approximately age 4;7 years. There was considerable variability in terms of the acquisition of the remaining affricates. There was no clear pattern of improvement in accuracy with age and it was noted that even children in group 6 (5;7 -6;0), struggled with some of these sounds. Fish et al. (2012) also flagged affricates as a set of sounds that proved difficult for the 2 year old participants in their study. The implication here is that affricates may continue developing even after the age of 6;0 years. It is possible that isiXhosa also has a set of sounds that develop later than others, similar to "The Late Eight" English phonemes as described by Bleile (2009). Mowrer and Burger (1991) also noted that affricates were some of the last sounds to develop in their study. These findings lend credence to the fact that affricates may form part of these later developing sounds together with some of the more complex clicks as suggested by Gxilishe (2004) and discussed in the following section.

6.1.3 Clicks

Clicks are some of the most unique sounds in isiXhosa. In many of the studies of isiXhosa, these have been of particular interest because of their distinctive nature (e.g Gxilishe, 2004; Lewis, 1994). This was also true for the present study. As clicks have not been extensively researched, part of the purpose of this study was to describe the order of acquistion for the children within this sample and to compare this to what has been previously reported (e.g. Conradie et al., 2011; Fish et al., 2012; Gxilishe, 2004; Lewis, 1994;

Mowrer & Burger, 1991; Tuomi et al., 2001). The results show that /!/ (e.g. *iqanda* 'egg' /i**!**anda/) , /ǀ/ (e.g. *icici* 'earring' /iǀiǀi/ , /ŋǃʱ/ (e.g. *ingqiniba* 'elbow' /i**ŋǃʱ**iniɓa) and /ŋǀ/ (e.g. *ncinci* 'small' /**ŋ**ǀiŋǀi) were some of the first clicks to appear within this sample. It is accepted that the first clicks to be acquired are the three basic clicks /!, ǀ, ǁ/. Earlier research by Lewis (1994), Mowrer and Burger (1991) and Tuomi et al. (2001) revealed that clicks were acquired early, between the ages of 2;5 and 3;0. Interestingly, Gxilishe (2004) reported on slightly earlier development of clicks, stating that these three basic clicks are already present in isiXhosa speaking children's speech between the ages of 1;0 and 1;6 years. This is supported by the findings of Conradie et al. (2011) who also reported that the participant in their longitudinal study had started to use clicks at approximately 0;11.

Children within this sample produced two of the more basic clicks early, thus providing further evidence for what has already been documented. It is interesting though, that the children in this study also produced some of what are considered the more complex clicks at an early age. This finding contradicts, to some extent, the theory of a universal trend in phonological development. It is possible that isiXhosa speaking children are in fact capable of producing these complex sounds perhaps due to their high frequency of use in everyday speech. Other clicks produced accurately by more than 90% (*n=21*) of the group included /ǁ/ (e.g. *isiXhosa* 'the language' /isiǁɔsa/), /!ʰ/ (e.g. *uyaqhuba* 'driving' /uja**!ʰ**uɓa/), /ŋǁʱ/ (e.g. *bayangxola* 'noisy' /ɓaja**ŋ**ǁ**ʱ**ɔla/), /!ǧ/ (e.g. *ugqirha* 'doctor' /u**!ǧ**ixa/), /ŋǃ/ (e.g. *inqina* 'chicken feet' /i**ŋǃ**ina/) and /ŋk// (e.g. nkcenkceshela 'watering' /**ŋk**/eŋk/eʃela/). This accounts for more than half of the clicks assessed, which provides some evidence that by approximately age 3;0 isiXhosa speaking children are using a relatively large proportion of the total click inventory of their language.

There were instances where individual children had some challenges when it came to certain sounds. For example, one child in Group 3 (4;1-4;6) was the only one in the entire sample to produce /ǀǧ/ (e.g. *umgca* 'line' /umǀ**ǧ**a/), /ŋǀ/ (e.g. *ncinci* 'small' /**ŋ**ǀiŋǀi) and /ŋǀʱ/ (e.g. *ingca* 'grass' /i**ŋ**ǀ**ʱ**a/) inaccurately. Considering that the younger children in Groups 1 and 2 (3;0 -3;6 and 3;7 -4;0 respectively), were able to produce these sounds this is suggestive of an individual difficulty for this child and warrants further investigation as no

definite conclusions can be made from this single instance. Child 1 in Group 1 (3;0 -3;6) was also found to have low scores and the disadvantage here is that these types of differences may affect the entire group. However, having a smaller sample can also be an advantage as it allows the researcher to discern and discuss individual differences and anomalies.

It seems that some of the last clicks to be acquired may be /ŋǁ/ (e.g. *uyanxiba* 'dressing' /ujaŋǁiɓa/) and /ǁg̊/ (e.g. *amagxa* 'shoulders' /amaǁg̊a/) as there was no clear pattern in terms of improved accuracy with age, with the youngest and oldest children producing them some of the time. Again, there is a possibility that such sounds could fit into the specific set of sounds that isiXhosa speaking children develop later. Thus in terms of Bleile's 'late eight' idea, it may be that there is a specific set of consonants that could be included in the 'late' category. A tentative suggestion is that these would include /ʄ, ts^{h}, c^{h}, ŋǁ, ŋǀ, ŋǀ^{ɦ} /

The findings of the study allow for a tentative description of the order of consonant acquisition of pre-school aged isiXhosa speaking children. For the present study, it can be said that nasals, liquids, glides, lateral /l/ and trill /r/ were some of the first sounds to appear in the majority of the children's phonetic inventories. These were followed by plosives, although aspirated plosives were found to still be developing for children in Groups 1 and 2 (3;0 -3;6 and 3;7 -4;0 respectively). The variation in findings when it comes to this samples' production of fricatives, affricates and some clicks is evidence that although these sounds are being used by the children, they may require ongoing development and refinement beyond age 6;0.

Results from this study concur with the findings of Mowrer and Burger (1991), who reported that the isiXhosa speaking children in their sample had acquired the majority of phonemes by the age of 3;0 years. Tuomi et al. (2001) reported that nasals, stops and glides emerged earlier followed by liquids and fricatives. This is also similar to the findings of this study. When compared to other studies of phonological development in a range of other languages, it can be said that there are similarities between the sounds acquired earlier and those that are last to be acquired. In the study of German by Fox and Dodd (1999), they

reported that /p, b, m, n/ are acquired as early as 1;6 – 1;11 and that by 3;0 to 3;5 the majority of phones are acquired. Dodd et al. (2003) reported on the phonological development of British English speaking children and found that /m, n, p, b, d, w/ appear early and /r, h, ð/ were acquired later, with /tʃ/ being one of the last sounds to be acquired. In their study of Arabic, Saleh et al. (2007) reported stops, nasals, fricatives, glides, and a liquid at 24 months.

These findings confirm, in part, some of the theories of universals first suggested by Jakobson (1941/1968). In terms of the order of acquisition, children within this sample acquired nasals, glides and plosives early which supports this theory. However, there were some further contradictions found in the results: It was noted that isiXhosa speaking children were already using more than 50% of the clicks by age 3;0. Following the theory of universals, this would mean that these sounds would be acquired at a later age, as clicks do not occur commonly across other languages. It should also be noted, that although these sounds are not common across languages, they occur frequently in isiXhosa, which may explain their early use. This highlights the fact that, although universal theories do have some predictive value, the individual factors/external influences specific to the language under discussion will also play an important role.

While it is apparent that there are indeed some similarities in the way phonological development occurs across languages, language specific differences should be kept in mind when doing such research. It was found that some of the front sounds and nasals (sounds that are common to all languages (e.g. p, b, m, n) were acquired early by the children in this sample and some of the sounds more unique to isiXhosa (e.g. ɟ, ts^h, c^h) seemed to only be acquired later. This supports the universals theory, however, it should be noted that the children in this sample also performed better than what might be predicted, particularly when it came to clicks. As these sounds are not commonly found in other languages, it would be expected that they would be acquired much later. This was not so for the children in this sample. A likely explanation for this is that isiXhosa clicks occur in high frequency in isiXhosa words used for everyday conversation and thus children are exposed to these sounds early on. It has also been reported that children in this background grow up in a highly verbal environment (Demuth, 1986; Golinkoff, 1983; Gxilishe, 2004) and thus are likely to start

using these sounds early in their phonological development. Thus conforming to a universals theory exclusively would limit the children in this sample for example.

6.2 Vowel acquisition

It was noted that isiXhosa has seven vowels; however, due to the vowel raising process (Finlayson et al., 1994) described in Chapter Two , only five were considered for this study. The children within this sample were all able to produce all the five vowels that were assessed. Studies carried out with isiXhosa speaking children (e.g. Conradie et al., 2011; Fish et al., 2012; Tuomi et al., 2001) have all reported that vowels are acquired early, beginning at 0;11 and being developed by approximately 1;6 -2;0 years. It appears that the children in this sample acquired vowels early and this is in line with previous studies carried out with the population. It is generally accepted that vowels are acquired earlier than the consonants of English (Stoel- Gammon & Herrington, 1990) and the results of the present study, suggest that this is possibly true for isiXhosa.

Early vowel acquisition has implications for SLTs managing children with speech difficulties. If a clinician is presented with an isiXhosa speaking child who has difficulties with vowels (i.e does not yet use all five vowels by age 3;0) it may be an indication of a more serious speech difficulty such as Childhood Apraxia of Speech (CAS) (Speake, Stackhouse & Pascoe, 2012 in press). Such disorders have not been considered in languages such as isiXhosa and there is little language specific data available that would inform clinicians of markers that could be used to identify problems.

6.3 Syllable structure development

The different syllable combinations assessed in this study were bisyllabic: VCV (e.g. *iti* ‘tea’ /it’i/) and VCCV (e.g. *umgca* ‘line’ /um|ǧa/) and multisyllabic: V.CV.CV (e.g. *ibhola* ‘ball’ /ibʰɔla/), V.CV.CV.CV (e.g. *uyanxiba* ‘dressing’ /ujaŋǁiɓa/), CVCVCVCV (e.g. *bayangxola* ‘noisy’ /ɓajaŋǁʱɔla/), V.V.CV.CV (e.g. *iorenji* ‘orange’ /iɔrendʒi/) and VCVCVCVCV (e.g. *uyakrazula* ‘tearing’ /ujakx’azula/). The majority of children were able to produce words of two to three syllables. The most simple syllable shape in Buntu languages such as isiXhosa is CV (Demuth, 1992). A study by Conradie et al. (2011)

revealed this CV structure is observed in the early babbling stages. Therefore the assumption was made that by age 3;0 children within this sample would be able to produce this syllable shape and no CV words were included in this assessment. Furthermore it is important to note that monosyllabic words rarely occur in isiXhosa. This is a possible explanation for why children in this sample were able to produce some of the more complex syllable shapes, which occur more frequently in isiXhosa: It is likely that they will hear many words of two or more syllables in their environments and thus may start to produce these shapes early on.

It was noted that when it came to words of four syllables, children in Group 1 (3;0 - 3;6) had some difficulties with specific structures (e.g. V.CV.CV.CV e.g. *uyagromba* 'digging' and V.V.CV.CV e.g. *bayangxola* 'noisy'). As the children in Groups 2 through 6 (i.e. children between 3;7 – 6;0) were able to produce these syllable shapes, it appears that they begin to develop at approximately 3;7 years onward. Another word that produced interesting findings is the four syllable word *iorenji* 'orange' (V.V.CV.CV). It was noted that the majority of the children in this sample omitted the initial vowel and some even produced the word in English. As this word is borrowed from English it is possible that such a V.V.CV.CV combination is rare in isiXhosa. This could be the reason why it was challenging for the children within this sample and therefore this was not considered a difficulty with phonology per se, but rather a word specific difficulty related to limited exposure to this syllable combination.

For the children in this sample the five syllable word *uyakrazula* 'tearing' (V.CV.CV.CV.CV) presented a challenge across the group. Various processes were used during the production of this word (e.g. gliding of liquids and deaffrication)-discussed further in the following section. This suggests that children may still be developing words of more than five syllables beyond the age of 6;0 years. Although this syllable shape was assessed in only one word, the level of inaccuracy in production highlights that it may in fact be a more challenging syllable shape. James (2009) compiled a set of multisyllabic words which are complex to articulate and thought to be useful in identifying children with speech difficulties in English. Fish et al. (2012) highlighted the possibility of compiling a similar set of words in isiXhosa. Looking at this word (*uyakrazula* 'tearing') in particular, it could be said that this

word could be 'clinically useful' for the assessment of isiXhosa speaking children, that is, it could be useful in identifying those children with speech difficulties. Further investigation is warranted in this respect since effective assessment and screening protocols for isiXhosa speech are urgently needed.

Demuth (1995) discusses the stages of prosodic development of syllables and suggested that they may be applicable to languages other than English and Dutch. These stages include core syllables (CV), minimal words (CVCV, CVC, CVV), prosodic words with longer binary roots as well as prosodic words which are the same as the adult productions. She suggested that children are likely to acquire unmarked syllable shapes before producing the marked syllable combinations. However, because children within this sample were able to produce the bisyllabic and multisyllabic words with different shapes, it is difficult to comment on the developmental aspect of syllable structure for this population. That is, the progression can not be mapped out from the findings of this study. There is a need to do research with younger children (e.g. 2;0 year olds) in order to gain information about what they are capable of doing at that age, although this may be a challenge due to limited vocabulary at this age (Edwards & Beckman, 2008).

6.4 Percent consonants and vowels correct

The PCC and PVC were calculated to give an indication of accuracy within this sample when producing consonants and vowels. This was done using the formula suggested by Shriberg et al. (1997), to establish whether there was a pattern of chronological development and increased accuracy with age, as has been found in other studies (e.g. Dodd et al., 2003). The results showed a variation in PCC. Children in Group 1 (3;0 -3;6) had an average PCC of 91.25%. The results showed that one child had a PCC of 78%, suggesting that this child may have some type of difficulty. In the absence of other PCC data and the fact that a small sample was used it was difficult to know whether this score represents the low average range or should be treated as an indication of a difficulty. Using the PCC norms outlined for English by Shriberg et al. (1997) this child, although not within the 90% range, did not have a low enough score to be considered to have a speech delay. This score brought down the average for this group and if this child had had a PCC of 90% or more, the overall group performance would have been better. Group 2 (3;7 -4;0) was recorded as having a PCC of 97.75%, a 6.5% increase from Group 1. Interestingly, this score was the same as that of

Group 6 (5;7 -6;0), the oldest children in the group. This is an exceptionally high score considering the age of these children and it is difficult to explain why this occurred: this group had two boys and two girls in it, thus gender may not account for this performance. PCC for Group 3 (4;1 -4;6) then decreased to 94.25%, but was not considered problematic. From Groups 3 through 5 (4;1 -4;6; 4;7 -5;0 and 5;1 -5;6) there was gradual increase in PCC scores, which is to be expected as it is believed that children's accuracy increases with age. Thus it was assumed that there is a developmental progression of consonant acquisition for children within this sample. Given the small sample, this variation is not unexpected and having a bigger sample would allow the researcher to show the progression more, as outliers tend to cancel each other out.

The results show that children had high scores when it came to the production of vowels. This is not surprising as it has been noted that PVC is usually higher than PCC (Velleman, 2009) and for the majority of the children within this group, this was true (including Child 1 who had the lowest PCC score). There was no significant variability for these scores with children either having reached or approaching ceiling scores (i.e. scores were between 96- 100%). This suggests that in terms of vowel production, children within this sample closely approximated adult productions. The findings regarding vowel acquisition are clear and PVC may be used as a clinical marker to suggest typical or atypical speech development.

6.5 Phonological processes

Phonological processes are simplifications used by children as they develop speech (Dodd et al., 2003; Ingram, 1989). They are divided into three categories (substitution processes, syllable structure processes and assimilation processes). The same categories were used for analysis within this sample and for the present study, it was noted that children made use of mostly substitution processes- including sound preference substitution and deaffrication. There is agreement that phonological processes are found across languages (see Hua & Dodd, 2006 for cross-linguistic comparisons) and that they should be suppressed by approximately age 6;0 years (Saleh et al., 2007). It should be noted though that the phonological processes found in a specific language are influenced by the structure of that language. At first glance, it is clear that children within this sample made use of substitution

processes more than the other two categories. It was observed that some of the phonological processes used by children in this sample have been well documented for a range of languages (e.g. English- Dodd et al., 2003; Arabic- Saleh et al., 2007; German- Fox & Dodd, 1999). The results show that Group 1 (3;0 –3;6) used most of the phonological processes when compared to the rest of the group. The children in Group 6 (5;7 -6;0) used the least phonological processes, a finding which seems in line with the notion that children use fewer phonological processes as they get older and therefore their productions become more accurate.

6.5.1 The Developmental Phase Model

The Developmental Phase Model of Stackhouse and Wells (1997; 2001) was used to outline the different phases of speech development based on their work mainly with English speaking children. It has been used effectively in some intervention studies and is a valuable tool for SLTs working with children who have speech difficulties. The developmental phase model forms a part of the psycholinguistic framework (Stackhouse & Wells, 1997; 2001) which has been widely used by SLTs as it allows clinicians to identify specific areas of breakdown and the possible reasons for this and then using this information, plan intervention tailored for the individual child (Stackhouse, Pascoe & Gardner, 2006). Since this type of research has not been carried out on languages such as isiXhosa, it is difficult to say whether these phases could be directly applicable to children developing isiXhosa. As mentioned, little is known about phonological development in isiXhosa and this model may be useful in explaining what is seen in the speech of typically developing isiXhosa speaking children.

Children in this sample may be progressing from the whole-word phase into the systematic simplification phase (approximately age 3;0 – 4;0 years) a phase where children's speech is characterised by the use of phonological processes. For the older children aged between 5;0 and 6;0, it was assumed that although they may still be using phonological simplifications, it was likely that there were fewer and these were used less. Therefore, they would be entering into the assembly and possibly metaphonological phases. The findings suggest that the children within this sample seem to advance through similar phases, although possibly earlier than what has been suggested for English. Conradie et al. (2011) also noted

that the participant in their study entered the whole-word phase before the age of 2;0, thus providing further support for the earlier development within this population. If this is the case, it has implications for intervention as this would mean, for isiXhosa speaking children, difficulties in speech development may occur earlier than what has been documented for other languages. Thus a child with a difficulty would need to be identified as early as 2;0 years in order for early intervention to be most effective. It is well documented that persisting speech difficulties are linked to possible literacy and psychosocial difficulties for the school-aged child (Bird, Bishop & Freeman, 1995; Gallagher, Frith, & Snowling, 2000; Nathan et al., 2004). For this reason, information regarding typical phonological development for children acquiring isiXhosa is vital. For the child presenting with phonological difficulties, intervention is likely to have an effect on his/her performance in the school environment. The link that can be made here, is that within the developmental phase model, the metaphonological phase is most closely related to literacy. For the present study there was limited data available for there to be any conclusions drawn about the metaphonological phase although some children of the older groups (5;0 – 6;0 years) were observed to be 'playing' with sounds of their language or rhyming (e.g. during the song used to elicit the response for 'head'). Figure 10 represents the Developmental Phase Model as it could be applied to the isiXhosa children within this sample.

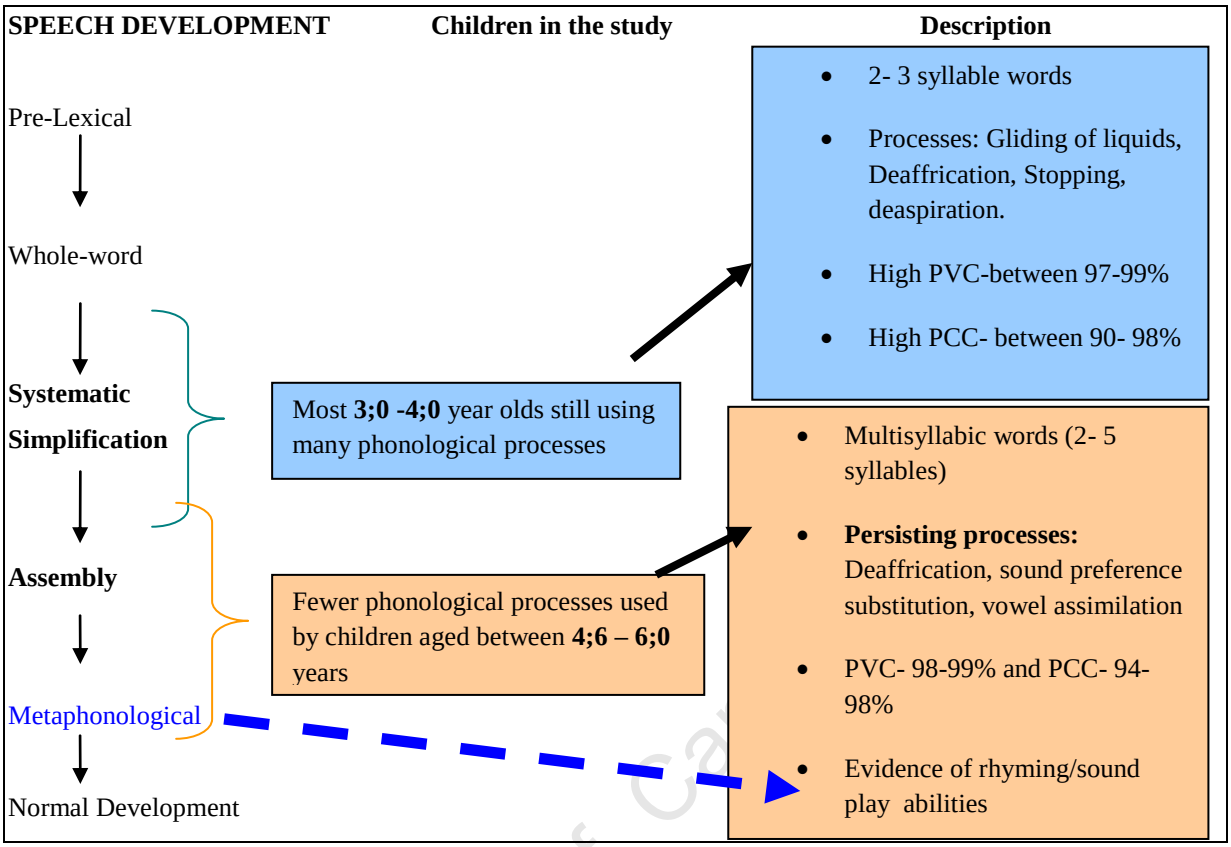

Figure 10. A developmental phase model specific to isiXhosa speech development *(based on Stackhouse & Wells, 1997; 2001).*

Figure 10 represents tentative suggestions about the unfolding of isiXhosa speech development in relation to the model of Stackhouse and Wells (1997; 2001). It is difficult to apply a 'cut-off' as to when a child moves from one phase to another and given the small sample of children investigated, these are preliminary conclusions. The model would need to be refined further in future studies exploring the age range and nature of tasks.

The phonological simplifications observed in this sample are described in the following section. Some of the processes used by the children in this sample are similar to those reported by Conradie et al. (2011) and Fish et al. (2012). The most predominant processes were:

Gliding of liquids (where /l/ -> /j/) was included as a developmental process in the 3;0 -3;6 age group as all four of the children used this process. This result suggests that this process is eliminated after the age of 3;7 as older children in this sample did not exhibit consistent use of this process. According to Grunwell (1997), this process generally persists until the age of 5;0 years in English speaking children's speech. Again, there is a suggestion here, that isiXhosa speaking children achieve accuracy of production relatively early.

Deaffrication was used by ten children in this sample. Fish et al. (2012) reported that the participants in their study also made use of this process. For the present study, it was observed that five of the six groups used deaffrication. This is not surprising as affricates seemed to be the most challenging sounds for the children in this sample. It is possible that for this population, this process persists even after the age 6;0 years. It has been suggested that this process should be eliminated by the age of 5;5 years for English (see Dodd et al., 2003). However, as there is limited information in this regard and as there are more many affricates in isiXhosa than in English, it is difficult to make any firm conclusions.

Deaspiration was used by a total of nine children in this group (three children in the group 1 (3;0-3;6) used this process, three in group 4 (4;7-5;0), two in group 2 (3;7-4;0) and one child in group 5 (5;1-5;6)). Again, there is variation in the distribution of use of this process. In isiXhosa there are a number of aspirated consonants (e.g. aspirated plosives and clicks), thus the fact that the children deaspirated is not surprising as they were developing mastery of the aspiration process. Based on the fact that this process was seen across the sample, it may be assumed that this is a typical process for isiXhosa speaking children and that perhaps it is suppressed after the age of 5;6 years.

Sound preference substitution was the most commonly used process for the children in this sample. It was noted that all 6 groups used this simplification process. Often children either substituted the correct sound with one in the same class (i.e. affricate for affricate) (e.g. *uyathyala* 'pushing' [ujatʃʼala] /cʰ/->/ tʃʼ/) and in some instances, they would substitute a particular sound with sounds which do not occur in isiXhosa phonology (e.g. *isithsaba* 'crown' produced as [isiθaɓa] /tsʰ/->/θ/. In an environment such as the Western Cape, there is bound to be some interaction between the languages spoken by the children in this sample.

Although they had isiXhosa as their first language, it is likely that they were exposed to English (and possibly even Afrikaans) at school and/or at home. This is a possible explanation for the use of a consonant which does not occur in their own language. It is difficult to determine what effect this type of exposure has on the speech development of isiXhosa speaking children and this is an area that requires further systematic investigation.

A number of children used some processes which are not extensively described in literature, that is, idiosyncratic processes. In this sample, children either inserted a consonant word initially (e.g. *imali* 'money' /imali/->[ɡ'mali]) or word medially (e.g. *isithsaba* 'crown' /isitsʰaɓa/-> [isi's'ts'aɓa] or a vowel word medially (e.g. *umgca* 'line' /um|ǧa/ -> [um'u'|ǧa]). Conradie et al. (2011) reported on early speech development in isiXhosa. They found that their participant also used this type of insertion of consonants. As there is limited information about this type of systematic simplification it is difficult to provide an explanation for why this was present for the children in this sample and further investigations of a greater number of children may be able to confirm whether it is in fact idiosyncratic or typical.

Similar to the findings of Fish et al. (2012), the children in this sample also exhibited some simplifications when it came to the production of vowels. In many cases this was assumed to be assimilation, which is thought to be a normal occurrence in isiXhosa adult speech (Blevins, 2005; Munnik, 2010). In general, children either assimilated the vowel or did not produce some initial and final vowels. Examples of this seen across the group were on the words *iorenji* 'orange' where /iɔrendʒi/ -> [ɔrendʒi] /i/-> /ø/, *isiXhosa* 'the language' where /isi||ʰɔsa/-> [is||ʰɔsa] /i/-> /ø/ and *ihashe* 'horse' where /iɦaʃe/ -> [iɦaʃ] /e/ -> /ø/ or /iɦaʃi/ /e/ -> /i/. The present study made use of IPA transcriptions for data collection. Edwards and Beckman (2008) explored different methods used in phoneme acquisition studies and noted that it is possible that certain sounds are not easy to perceive, which they termed covert contrasts. This is a possible explanation for the vowel processes used by the children in this sample. Perhaps closer auditory analysis and use of spectrograms would yield different findings (Edwards & Beckman, 2008). For this reason, no definite conclusions can be drawn about whether this is a developmental simplification used by isiXhosa speaking children, or

in fact an indicator of some speech difficulty or simply not perceived accurately by the researcher. An alternative view could be that this type of production mirrors what children hear in adult speech. That is, this may be a common occurrence in adult conversational speech (Smouse, 2012, Personal communication). This again presents an area which requires further research in order to gain a better understanding of the nature of isiXhosa speaking children's speech and environmental influences.

Overall, the isiXhosa speaking children in this sample used many of the phonological processes typically used in a range of the world's languages. Some of the previous studies on isiXhosa (e.g. Conradie et al., 2011; Fish et al., 2012) reported that children made use of phonological processes similar to those used by the children in this sample. The children who participated in these studies were between the ages of 0;11 – 2;8 years. This suggests that speech development is well under way by the age of 3;0 and looking at this sample, it appears that the children's speech is more accurate than younger isiXhosa speaking children. This is supported by the fact that many of the older children in this sample used fewer phonological processes (with the exception of the sound preference substitution, idiosyncratic processes and vowel assimilation). The findings suggest that phonological processes are resolved earlier for isiXhosa speaking children than for English, for example. If this is true, then SLTs working with children in this population could assume that children presenting with phonological processes after the age of approximately 4;0 years have phonological difficulties requiring intervention. These are tentative conclusions and it is clear that further research should be carried out in order to allow for generalisations to be made.

Stackhouse and Wells (1997; 2001) use a simple speech processing chain to characterise speech development (see Figure 2). The model depicts three key areas involved in speech processing (derived from a more complex representation) as suggested by Stackhouse and Wells' (1997; 2001), namely: speech input, storage of words and lexical representations; speech output. The naming task used in the present study meant that children were required to access their own lexical representation and then produce output. Imitation is a different process, although in this study both were used as a means of obtaining data. Future

studies might compare naming versus repetition and input processing (e.g. through auditory discrimination tasks) in order to understand how a child processes what they hear, stores this knowledge and then uses it to produce speech (Stackhouse & Wells, 2001). It was noted earlier that phonological development is a multi-faceted process influenced by a variety of factors (e.g. age, gender). It is important for this type of research to consider these factors as far as possible in order to produce findings that can be used effectively within the clinical setting. This was the focus of the study carried out by Fish et al. (2012) and it seems to have been an effective method of gathering data on isiXhosa speaking children.

6.6 Phonological assessment materials for isiXhosa speaking children

Using single word picture naming tests has long been the practice of SLTs and the various advantages of this have been noted (Eisenburg & Hitchcock, 2010; Edwards & Beckman, 2008). At present, there are no standardised tools available for the assessment of isiXhosa speech, although it has been reported that clinicians make adaptations to already existing materials in an attempt to make them more culturally appropriate (Pascoe et al., 2010). The drawbacks of altering standardised assessments have been discussed by Stow and Dodd (2003) and Laing and Khami (2003). For the purposes of this study, a set of pictures was created in order to elicit single word responses from the children. Every attempt was made to ensure that the final set of pictures and wordlist were both culturally and linguistically appropriate and preliminary validation work was carried out. This was done by means of assembling an expert review panel who evaluated the words used in the list and provided suggestions where changes were needed. Hua and Dodd (2006) outline some important factors to consider when creating words for a picture naming task. These factors include ensuring that children have an opportunity to produce all phonological features, phonemes should be assessed in all word and syllable positions allowed for that language, the phonemes assessed should have balanced frequency, vocabulary should be appropriate for that age and assessment should not be long as young children struggle to concentrate for extended periods (Hua & Dodd, 2006). These were applied as closely as possible for the present study.

The children in this study were able to cope with the activity presented to them. It did seem though that some of the illustrations were abstract for them and prompting was a challenge. A notable example was *isithsaba* 'crown', where children either could not name the picture, or would refer to it as 'party' as it is customary for them to wear crown-like hats during class parties. This type of difficulty could not have been anticipated, thus at times the researcher had to provide a model for the children. In other instances, it was found that children used the English equivalent of the item presented (e.g. '**uya-pusha**' for *uyathyala* 'push') and the reason provided for this was that adults in their environments also used this in conversation. There were words in the original word list that were flagged for this reason and had been removed. This suggests that further validation sessions need to take place and should include a more rigourous review of both words as well as the pictures used for the assessment material. In all likelihood, some of the test items would have to be discarded if used in future research or for clinical purposes. This material was effective for the purposes of this study, however it was noted that it could be developed further for use as a clinical assessment tool. Doing this would involve re-evaluation of the specific items in the test and further engagement with speakers of the language to enhance the tool's content validity. A further step that could be taken is to administer this assessment to a much larger sample of children (e.g. approximately 600) and focus on exploring both the rural and urban settings in order to document possible differences in speech development as well as take into consideration gender differences. This would allow for generalisations to be made and provide normative data for isiXhosa speaking children within this environment. As it stands, this single word isiXhosa speech assessment tool developed for this study, provides a good starting point for a larger scale study and is a clinical tool that is much needed together with some preliminary normative data.

6.7 Summary

This chapter has explored and described the findings of the study in order to interpret what they mean for isiXhosa speaking children in this context. An attempt was made to draw conclusions about phonological development within this population in relation to the phonological theories and frameworks discussed earlier in this dissertation. There is some evidence supporting the theory of universal development in acquisition of speech sounds, however there were also some differences noted, particularly when it came to the clicks found in isiXhosa. The order of acquisition was tentatively suggested to be that vowels,

nasals, liquids, glides and trill /r/ are some of the first sounds to be acquired, followed by the plosive sounds. In general the fricatives, affricates and some of the more complex clicks were observed to still be developing and being refined after the age of 6;0 years. A developmental phase model was adapted for this population in order to provide a preliminary map of how isiXhosa speech development unfolds between these ages. For the present study, it was found that the younger children were in the systematic simplification phase and progressing to the assembly phase and the older children were thought to be in the assembly phase, and starting to move into the metaphonological phase. The results provide preliminary normative data which can be used clinically as markers of what is typical versus disordered, for children in this population.

CHAPTER SEVEN: CLINICAL IMPLICATIONS AND CONCLUSION

This final chapter seeks to provide an answer to the questions posed by the researcher. The clinical implications of the findings for SLTs working in South Africa will also be discussed as well as the limitations of the research. The chapter concludes with suggestions for the way forward and possible lines of future research.

7.1 Clinical implications

It has been emphasised that SLTs have the important but often challenging role of assessing and managing children with speech and other communication difficulties (Skahan et al., 2007). In order to do this, clinicians require normative data to allow them to draw accurate conclusions about whether a given child has a delay, disorder or simply a 'difference' in speech (Dodd & McCormack, 1995). The present study contributes to what is known about isiXhosa speech development, not only in terms of consonant and vowel acquisition, but also in providing preliminary normative data on syllable structure development and the phonological processes found in isiXhosa pre-schoolers. It may form the start of an evidence base from which clinicians can begin to adapt their practices in order to provide the best service for isiXhosa speaking children who present with speech difficulties in this region.

The isiXhosa single word speech assessment tool was devised for the purposes of this study and it was found that with some further modifications, it could be an effective clinical assessment tool. The step-by-step test development process could serve as a 'working guideline' for not only experienced SLTs but, as is noted by Fish et al. (2012), by SLTs in their community service year who have been placed in culturally and linguistically diverse environments likely to have little or no assessments at their disposal. Fish et al. (2012) noted that the vocabulary in the wordlist used for the present study, was challenging for the 2;0 year olds in their study. Thus it may be valuable for this tool to be adapted into a screener of simpler pictures that could be used with children younger than 3;0 years. Given that this study and others into isiXhosa (e.g. Gxilishe, 2004; Tuomi et al., 2001) strongly suggest that development occurs early for isiXhosa speaking children, a screening tool would be effective for the early identification of children with speech difficulties. Also of clinical value would

be a checklist for the early identification of speech difficulties in isiXhosa which may include a range of 'red flags' or clinical markers (see Table23).

It has been highlighted that SLTs should carry out evidence based practice (Kent, 2006; Ratner, 2006) and should ensure that their clients receive equitable and accessible services. The checklist in Table 23, together with the adapted Developmental Phase Model (Figure 10) are a contribution to the evidence base and also provide some practical materials for clinicians in this context where they could use these to guide their evaluation of isiXhosa speaking children. These are tentative suggestions which may be further refined. The current study contributes to the early evidence base on which SLTs can develop their knowledge and understanding of the typical progression of isiXhosa speech development. Furthermore, the findings of this study contribute to the development agenda of SLTs in South Africa and may be used as the starting point of a larger study which could yield normative data, with the ultimate goal of developing a contextually relevant standardised speech assessment for isiXhosa-speaking children.

Table23. Developmental checklist for isiXhosa speaking children

Approximate Age	**By age 3;0 – 4;0**
Consonants	Nasals ☑
	Glides ☑
	Liquids ☑
	Plosives ☑
	Trill /r/ ☑
	Basic clicks ☑
	Some fricative and affricates ☑
Vowels	All vowels present ☑
Syllable structure	Multisyllabic words, 2 – 3 syllable words ☑
Phonological processes	Gliding of liquids, lateralisation, deaspiration, deaffrication ☑
	By age 4;0 - 5;0
Consonants	As with 3;0 – 4;0
	More clicks ☑
	More fricatives and affricates ☑
Vowels	All vowels present ☑
Syllable structure	Multisyllabic words 2-4 syllable words ☑
Phonological processes	Fewer processes, may be some sound preference substitution, vowel assimilation and substitution ☑
	By age 5;0 - 6;0
Consonants	As with 3;0 -4;0 ☑
	All/most clicks ☑
	Fricatives ☑
	Most affricates ☑
Vowels	All vowels present ☑
Syllable structure	Multisyllabic words, 2- 5 syllable words ☑
Phonological processes	Most processes should be eliminated, may still find sound preference substitution and vowel assimilation ☑

7.2 Limitations

Due to the small sample size, conclusions drawn from this study have been made with caution. Twenty-four children is a relatively small number and may not be representative of this population, thus generalisations to the entire population cannot be made. It is highly likely that isiXhosa spoken in the Western Cape region may be slightly different to that spoken in the Eastern Cape for example. Thus an entirely different sample of children would be required to develop normative data for that population.

Some of the test items presented some difficulty during the assessment of the children in this sample. As a result, prompts and instructions given had to be adapted during the assessments, often leading to children having to imitate. Repetition and spontaneous naming tap into different areas of speech processing- repetition provides a child with a model of what they should say and it has been noted that it is less of a cognitive challenge (Edwards & Beckman, 2008); whereas spontaneous naming requires a child to access their stored representations in order to produce the required target (Stackhouse & Wells, 1997). Imitation was accepted for the present study as the goal was to establish whether children were able to produce a target sound. This short-coming should be addressed in future research in order to yield more accurate results.

Edwards and Beckman (2008) noted that transcription of children's responses should be carried out by a native speaker of the language. This was not possible for the entire data set of this study, although every attempt was made to ensure that transcribers had sufficient practice and a good reliability measure. Future studies could make use of a team of transcribers that could include people who are experienced phoneticians and speakers of the language in addition to speakers of other languages who have been trained to transcribe the language in question.

As there is limited research carried out on syllable structure development and phonological processes in particular, it was difficult to make comparisons with other studies and to come to conclusions about whether or not what was recorded was typical for this population. It was noted in the previous chapter that some of the speech behaviours recorded in this sample may be influenced by adult conversational speech, that is, what is heard in the

environment. Examples included some of the vowel assimilation processes used and the way in which children produced the English word for certain stimuli. In this context, where a minimum of three languages is spoken, there is bound to be some kind of interaction and exposure to English and Afrikaans, either in school or at home. The influence of exposure to different languages should also be explored as it may have some bearing on the speech development process.

7.3 Future research

Future studies should focus on the same areas of phonological development, although on a larger scale, with the intention of generalising the results and standardising the assessment. This could include a larger sample of children (approximately 600) (e.g. Dodd et al., 2003) which would allow for a sample stratified by age, gender and possibly environment (e.g. urban versus rural) and noting the influence of these factors. Similar to the study by Fish et al. (2012), it may be useful to include the various elements of speech processing in order to obtain a larger body of data. That is, distinguish between spontaneous naming and repetition and evaluate input processing. It may also be beneficial to carry out a more detailed investigation into the development of affricates in particular as this class of sounds presented the most difficulty for the children in this sample. The focus of the present study was speech production, however, normative data for language development in isiXhosa is also lacking. Thus it would be beneficial for researchers to extend this type of research to language acquisition not only for isiXhosa but also for the wide variety of languages spoken in South Africa.

In general, isiXhosa studies have concluded that speech development occurs early for this population and a majority of the consonants and vowels have been acquired by age 3;0 (Gxilishe, 2004; Tuomi et al., 2001). Therefore, further studies should pay attention to the suprasegmental development (e.g. tone) in the language and describe in detail some of the phonological processes that are used by children in this age group.

7.4 Conclusion

The present study aimed to describe the speech development of typically developing isiXhosa speaking children between the ages of 3;0 and 6;0. This was done by focusing on four areas of phonological development, namely: consonant and vowel acquisition, syllable development (all of which were analysed using independent analysis) and the emergence and elimination of phonological processes (analysed by means of relational analysis). Findings suggested that a majority of the consonants and all of the vowels were acquired by 3;0 although it was found that affricates and some of the clicks were still being developed. There was a developmental trend seen in the acquisition of affricates, with children in Group 6 producing them with greater accuracy. In terms of clicks, the findings concur with what has been documented by previous studies (e.g. Conradie et al., 2011; Lewis, 1994; Tuomi, et al, 2001) in that the basic clicks are already present in children's speech as early as 1;6 years. Children in this sample were able to produce complex syllable shapes relatively early. It was noted that the children were able to produce words of up to five syllables. Phonological processes were identified and some were the same as those used across languages (e.g. gliding of liquids), a finding which supports the theory of universals. However, there were some processes that were present across the sample in all the age groups suggesting that they are possibly specific to isiXhosa (e.g. vowel assimilation), a notion suggested by other studies as well (e.g. Conradie et al., 2011; Fish et al., 2012). Thus, it is important to consider that while evidence does exist in support of universal trends, there are language specific differences to be considered as can be seen in the present study. This is of importance as it can inform SLTs working with this population as to what phonological features can be expected at certain points during phonological development and having this information can allow clinicians to make clinical decisions based on research evidence. To contribute to this, a developmental phase model specific to isiXhosa, together with a checklist/ 'red flag' list have been proposed for possible use by SLTs and General Practitioners. Although these are only tentative norms in the preliminary phase of development, they can be used as a practical starting point and are open to refinement and modification through future research. This preliminary set of normative data provides a platform from which further studies of this nature can be carried out in order to develop more culturally and linguistically appropriate speech assessments much needed for clinical use by SLTs in the South African context.

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Appendices

Appendix A1: IsiXhosa consonant chart

Manner		Place									
		Bilabial	**Labiodental**	**Dental**	**Alveolar**	**Palato-alveolar**	**Palatal**	**Velar**	**Uvular**	**Phanryngeal**	**Glottal**
Plosive	*Ejective*	pʼ			tʼ			kʼ			
	Aspirated	pʰ			tʰ			kʰ			
	Voiced				d			g			
Implosive	*Voiced*	ɓ									
Nasal	*Voiced*	m			n		ɲ	ŋ			
Fricative	*Unvoiced*		f		s	ʃ		x			
	Voiced		v		z			ɣ			ɦ
	Lateral				ɬ ɮ						
Affricate	*Ejective*				tsʼ	tʃʼ	cʼ	kxʼ			
	Aspirated				tsʰ	tʃʰ	cʰ				
	Voiced				dz	dʒ	ɟ				
	Lateral				tɬ						
Lateral	*Approximant*				l						
Approximant	*Voiced*	w			j						
Trill					r						

(adapted from Mowrer & Burger, 1991)

Appendix A2: IsiXhosa clicks

Clicks			
Manner	**Place**		
	Dental	**Alveo-palatal**	**Alveolar-lateral**
	ǀ	ǃ	ǁ
Nasalised	ŋǀ	ŋǃ	ŋǁ
Voiced Nasalised	ŋǀʱ	ŋǃʱ	ŋǁʱ
Voiced	ǀg̊	ǃg̊	ǁg̊
Aspirated	ǀʰ	ǃʰ	ǁʰ
	*ŋk/		

Appendix B: Permission from Director of Ikamva Labantu

School of Health and Rehabilitation Sciences

Faculty of Health Sciences

Divisions of Communications Sciences and Disorders,
Nursing and Midwifery, Occupational Therapy, Physiotherapy

F45 Old Main Building, Groote Schuur Hospital,

Observatory 7925

Tel: +27 (0) 21 406 6401 Fax: +27 (0) 21 406 6323

The Director

Ikamva Labantu

P.O. Box 165

Cape Town

8000

Dear Sir/Madam

Re: Permission to conduct research at Ikamva Labantu

I am currently registered as a Master's student in the Department of Communication Sciences and Disorders at the University of Cape Town. In order to fulfil the requirements of my degree I am expected to conduct a research project. I am interested in researching the phonological (speech) development of first language IsiXhosa speaking children aged between 3 and 6 years.

There is very limited information regarding the process of speech development in IsiXhosa. Such information is vital for Speech and Language Therapists working with children with speech difficulties

This study intends to describe and document the speech sound development of pre-school children to gain a better understanding of the IsiXhosa phonological system. The study will involve showing a set of pictures to the children and recording the children's naming of them.

Findings from the study will be used to profile the progression of IsiXhosa speech sound development between 3 and 6 years. The detailed research proposal is attached.

The inclusion of specific children will depend on informed consent from yourself (the Director of the organisation), Pre-school principal, educators, parents/legal guardians and learners. The twenty four typically developing pre-school aged children will be selected using a list of inclusion criteria outlined in the proposal. The researcher will assess the children over a period of approximately 14 days, on the school premises. Each child will be individually assessed. This will be done in an attempt to minimise disruption for the educators and learners. Should the researcher discover any difficulties relating to speech or language development, the child will be referred to the appropriate health professional(s). The researcher will comply with all of the ethical guidelines outlined in the proposal.

You will receive feedback during the research process. The researcher is available to discuss any concerns that may arise. On completion of the study, findings will be shared with your organisation and results will be disseminated through academic publications.

I hereby request permission to conduct this study in the pre-school at your organisation.

Thank you for considering this request. The researcher(s) will be in contact with you for your response. Should you have any questions, please contact me or my supervisor (details below).

This project has received Ethical clearance through the University of Cape Town, Faculty of Health Sciences Human Research Ethics Committee (Ref #284/2011).

Yours faithfully

Zinhle Maphalala

_____

(Researcher)

Mobile: 076 729 1742

E-mail: zinhle.maphalala@uct.ac.za

Dr. Michelle Pascoe

_____

(Research Supervisor)

Tel: 021 406 6043

Email: michelle.pascoe@uct.ac.za

Appendix C: Information Letter and Informed Consent: Educators

School of Health and Rehabilitation Sciences

Faculty of Health Sciences

Divisions of Communications Sciences and Disorders, Nursing and Midwifery, Occupational Therapy, Physiotherapy

F45 Old Main Building, Groote Schuur Hospital,

Observatory 7925

Tel: +27 (0) 21 406 6401 Fax: +27 (0) 21 406 6323

Ikamva Labantu

P.O. Box 165

Cape Town

8000

Dear Educator

RE: Information about research study and consent to assess learners

This study intends to describe and document the speech sound development of pre-school children to gain a better understanding of the IsiXhosa phonological system. The study will involve showing a set of pictures to the children and recording the children's naming of the items. To date, there is very limited information regarding the process of speech development in IsiXhosa. Such information is important in order for Speech Language Therapists to improve their assessment and intervention methods when treating children with speech difficulties in IsiXhosa.

We would need to assess twenty-four children using a IsiXhosa speech test. In order for the process to run smoothly, the researcher will require some assistance from the educators, in terms of identifying learners, providing some information about the learners' general development and helping to make learners feel more comfortable during the assessment. The researcher will assess the learners over a period of approximately 14 days, on the school premises. This will be done in an attempt to minimise disruption for the educators and learners.

Each child will be individually assessed. Assessments should take place in a quiet room and should last between 30-45minutes in which time the researcher aims to administer the entire test. A teaching assistant may be asked to be present in the room, for the benefit of the learner. All the assessments will be audio recorded for the purposes of the study, however they will only be listened to by the research team and no portions of the recordings will be included in the report. Should the researcher discover any difficulties relating to speech or language development, the child will be referred to the appropriate health professional(s) and this will be communicated to the educator.

I hereby request your permission to assess the selected learners in your class. The assessment time will be negotiated and every effort will be made to reduce disruptions to the pre-school schedule.

Thank you for considering this request. Please find consent form attached. Should you have any questions, please contact me or my supervisor (details below).

Ethical approval for this study has been granted by the University of Cape Town, Faculty of Health Sciences Human Research Ethics Committee (Ref # 284/2011)

Yours faithfully

Zinhle Maphalala — Dr. Michelle Pascoe

_____ _____

(Researcher) (Research Supervisor)

Mobile: 076 729 1742 Tel: 021 406 6043

E-mail: zinhle.maphalala@uct.ac.za Email: michelle.pascoe@uct.ac.za

Response Form: Educators

I have read the letter and understand the nature of the research study.

I **do**/**do not** grant permission for the assessment of the selected learners in my class (delete which is not applicable) and I consent to providing only relevant information about the learners' development.

Name: (in block letters) _____

Signature: _____

Date: _____

Contact Number: _____ School:_____

Appendix D1: Information Letter and informed consent: Parents of leaners

School of Health and Rehabilitation Sciences

Faculty of Health Sciences

Divisions of Communications Sciences and Disorders,
Nursing and Midwifery, Occupational Therapy, Physiotherapy

F45 Old Main Building, Groote Schuur Hospital,

Observatory 7925

Tel: +27 (0) 21 406 6401 Fax: +27 (0) 21 406 6323

Ikamva Labantu

P.O. Box 165

Cape Town

8000

Dear Mr. and Mrs_____

RE: Information about research study and invitation to consent to your child's participation in a research project.

I am a Master's student in the Department of Communication Sciences and Disorders at the University of Cape Town. In order to obtain my Master's degree in Speech Language Therapy I need to do a research project. I am interested in researching the changes in speech of first language Xhosa speaking children aged between 3 and 6 years.

There is very limited information about normal speech progress in Xhosa. Such information is important in order for Speech Language Therapists to improve the way in which they help children with speech difficulties in Xhosa.

I am inviting your child to participate in this study because he/she speaks Xhosa at home and is at pre-school age. The study requires twenty-four first language Xhosa speaking children aged between 3 and 6 years.

I am asking for permission to visit the pre-school and go through information about your child's progress from the school folder. In addition, I am asking for permission to assess your

child's speech by showing your child a set of pictures and asking him/her to name them. The findings of the study will be analysed and used by the research team to write the report. The assessments will be carried out on the school premises during school-hours and should take no longer than 45 minutes. The researcher may need to contact you for more information about your child's progress.

Participation in this study is voluntary. If you, or your child, wish to withdraw from the study, you may do so without having to provide a reason. I will ensure that all identifying information (e.g. your child's name, address) is known only to the researcher and will not be included in any research reports, presentations or discussions that arise from the study. Each learner will be given a coded name in order to ensure confidentiality.

There are no risks in taking part in this study and there will not be any rewards for taking part in the study. You will receive feedback once the study has been completed and if the researcher discovers that your child has a speech or language difficulty, they will be referred to the relevant health professional.

Thank you for considering this request. Please find the consent form attached. Should you have any questions, please contact me or my supervisor (details below).

Yours faithfully

Zinhle Maphalala

_____

(Researcher)

Response Form: Educators

I have read the letter and understand the nature of the research study.

I **do**/**do not** grant permission for the assessment of the selected learners in my class (delete which is not applicable) and I consent to providing only relevant information about the learners' development.

Name & School: (in block letters) _____

Signature: _____

Date: _____ Contact number:_____

Appendix D2: Incwadi yenkcukacha nemvume: Abazali babafundi

School of Health and Rehabilitation Sciences

Faculty of Health Sciences

Divisions of Communications Sciences and Disorders, Nursing and Midwifery, Occupational Therapy, Physiotherapy

F45 Old Main Building, Groote Schuur Hospital,

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Mnumzana noNkosikazi

Le yincwadi equlathe iinkcukacha malungana nophando kwaye sisimemo sokunika imvume ekuthatheni inxaxheba komntwana wakho kolu phando.

Ndingumfundi weMasters kwisebe lonxibelelwano kwezenzululwazi kwiYunivesithi yaseKapa. Olu phando lolwezifundo zam zeMasters kwiSpeech Language Therapy. Ndizama ukufumana ulwazi olunzulu mayelana nexesha abaqala ngalo abantwana ukusebenzisa ezinye izandi okanye indlela abathetha ngayo.

Luncinci ulwazi ngendlela abantwana baqala uthetha ngolwimi lwesiIsiXhosa. Olu lwazi lunganceda iSpeech Language Therapists xa basebenza nabantwana abanengxaki ngokuthetha isiIsiXhosa.

Ndimema umntwana wakho ukuba athathe inxaxheba kolu phando ngoba uthetha isiIsiXhosa ekhaya. Olu phando ludinga abantwana abathetha isiIsiXhosa ekhaya abangamashumi amabini anesine abaphakathi kweminyaka emithathu nesithandathu.

Ndicela imvume eyokuya e-pre-school ndiyo kuhlola iinkcukacha ezimalunga nokuphuhla komntwana wakho. Ndicela ukuhlola ukuthetha komntwana wakho ngokuba ajonge ii-foto andixelele ukuba ubona ntoni. Andizi kuxelela mntu ngento andixelele yona umntwna wakho. Iimpendulo ndiza kuzigcina kwindawo ekhusekileyo apho zingazi kubonwa ngumntu. Uhlolo ndiza kulwenza e pre-school. Aluzi kuthabatha ixesha elide. Ndiza kunxibelelana nawe ngemininingwane yomntwana wakho.

Akunyanzelekanga ukuba uthathe inxaxheba kolu phando. Xa wena okanye umntwana wakho, uthe watshintsha ingqondo, ungakwenza oko ngaphandle kokunika isizathu. Ndiza kwenza isiqiniseko sokuba imininingwane yomntwana wakho (njengegama lomntwana nedilesi) zaziwa ngumntu ophandayo kuphela kwaye asizi kusebenzisa le mininingwane ekubhalweni kwengxelo okanye kwingxoxo eziya kuthi zivele malunga nolu phando.

Ayikho ingozi ekuthabatheni inxaxheba kolu phando. Ayikho nenkokhelo ngokuthabatha inxaxheba kolu phando. Uza kufumana inkcazelo yemiphumela xa sele uphando lugqityiwe. Xa ndifumanisa ukuba umntwana wakho unengxaki ngokuthetha uza kuthunyelwa koogqihra abafanelekileyo.

Ndiyabulela ngokucinga ngesisicelo sam. Incwadi yemvume ifakelwe. Ukuba unemibuzo unganxibelelana nam okanye umphathi wam ngezinombolo zingezantsi

Owakho ozithobileyo

Zinhle Maphalala

_____

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_____

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Tel: 021 406 6043

Email: michelle.pascoe@uct.ac.za

Isihloko: Uphando ngexesha abaqala ngalo abantwana ukusebenzisa izandi okanye indlela abathetha ngayo.

Mna,_____ndiyifundile (okanye ndifundelwe ngu_____) incwadi equlathe iinkcukacha malungana nophando. Ndiyaqonda ukuba umntwana wam uza kwenza ntoni. **Ndiyavuma/andivumi** ukuba umntwana wam athathe inxaxheba kolu phando.Yonke imibuzo yam iphenduliwe. Akukho ondibophelelayo ukuba mna nomtwana wam sithathe inxaxheba kolu phando, ndizikhethele. Ndiyazi ukuba ndingatshintsha ingqondo nanini kwaye akukho mntu ziphumo ziza kuchaphazela umntwana wam.

Signed:_____ _____

Umzali 1 Umhla nendawo

Usihlalo weFakalthi Health Sciences Human Research Ethics Committee angafumaneka ukuba unemibuzo ngamalungelo nokhuseleko lwakho njengomzali womntwana oza kuthabatha inxaxheba: Prof Marc Blockman: 021 406 6496.

Appendix E1: Information Letter and informed assent: Learner

School of Health and Rehabilitation Sciences

Faculty of Health Sciences

Divisions of Communications Sciences and Disorders, Nursing and Midwifery, Occupational Therapy, Physiotherapy

F45 Old Main Building, Groote Schuur Hospital,

Observatory 7925

Tel: +27 (0) 21 406 6401 Fax: +27 (0) 21 406 6323

Dear learner

Information about research study: invitation and consent to participate

My name is Zinhle Maphalala. I am trying to find out more about when children start to use some sounds/ how they speak. If you would like to, you can be part of my study.

I have to ask your parents if they will let you help me with my study. If they allow you to, then it is up to you to let me know if you would like to do it or not.

If you would like to join, all you would have to do is look at some pictures and tell me what they are. All I am going to do is listen to you and record what you say on my recorder. If you change your mind and do not want to be in the study anymore, no one will be upset with you.

It won't hurt. You will not get into trouble if you do not know what the picture is. When you need a break just let me know and you can take one at any time.

I will not tell anyone about what you say. I will put all your answers away in a safe place and no one will know it what you said.

My cellphone number is 076 729 1742. You can ask me any questions that you have about the study.

Assent

I would like to be a part of the study. I know what I have to do and Zinhle Maphalala has told me that I can change my mind if I want to.

Signature of Study Participant Date:

Appendix E2: Incwadi yenkcukacha nemvume: Umfundi

School of Health and Rehabilitation Sciences

Faculty of Health Sciences

Divisions of Communications Sciences and Disorders, Nursing and Midwifery, Occupational Therapy, Physiotherapy

F45 Old Main Building, Groote Schuur Hospital,

Observatory 7925

Tel: +27 (0) 21 406 6401 Fax: +27 (0) 21 406 6323

Mfundi othandekayo

Isisimemo sokunika imvume ekuthatheni inxaxheba koluphando.

Igama lam ndinguZinhle Maphalala. Ndizama ukufumana ulwazi olunzulu mayelana nexesha abaqala ngalo abantwana ukusebenzisa izandi okanye indlela abathetha ngayo. Ukuba uyafuna ungaba yinxalenye yophando lwam.

Kuza kufuneka ndicele imvume kubazali bakho phambi kokuba ndenze olu phando. Ukuba bayavuma kukuwe ukuba ufuna ukuthatha inxaxheba kolu phando. Ukuba ufuna ukuthatha inxaxheba kuza kufuneka nje ujonge imifanekiso ukwenzela uzondixelela ukuba ubona ntoni. Mna ndizakumamela ndi-rekhode iimpendulo yakho. Xa uthe watshintsha ingqondo akakho umntu oza kukuqumbela.

Ayizi kuba buhlungu kwaye awuzi kungena engxakini ukuba awazi ukuba imifanekiso ingantoni na. Xa ufuna ukuthatha ikhefu uza kundixelela kwaye unglithatha naninina.

Andizi kuxelela mntu ngento ondixelele yona. Iimpendulo zakho ndiza kuzigcina kwindawo ekhusekileyo apho zingazi kubonwa ngumntu.

Inombolo yam yomnxeba nantsi: 076 729 1742. Ungandibuza nantoni na malunga nolu phando.

Imvume

Ndingathanda ukuba yinxalenye yolu phando. Ndiyazi into ekufuneka ndiyenzile kwaye uZinhle Maphalala undixelele ukuba ndingatshintsha ingqondo xa ndifuna.

Igama lomfundi_____

Zinhle Maphalala_____ **Usuku**_____

Appendix F1:Biographical Information Sheet

Thank you for allowing your child to participate.

This information sheet will take only take up five minutes of your time. When you have completed it, please submit it to the class teacher, together with your consent form.

Please answer the following questions:

Biographical details

Name of child:…….

Date of birth:……

Age:……years……..months

First language:……

Developmental information

At what age did your child start:

- Sitting…….
- Standing……
- Walking……
- Talking (first words)…….

General health (please circle the appropriate response)

Does your child have any problems with vision? **YES/NO**

Does your child have any hearing problems? **YES/NO**

Is your child's speaking ability similar to that of other children his/her age? **YES/NO**

Does your child have any medical or health problems? If yes, please specify **YES/NO**

…….

Has your child attended or been referred for speech-language therapy? **YES/NO**

Thank-you for taking the time to answer these questions. All information is strictly confidential.

Appendix F2: Iinkcukacha Ezibhekiswe Ebazalini

Ndiyabulela ngokumvumela umntwnana wakho ukuba athabathe inxaxheba

Eli phepha leenkcukacha liza kuthatha nje imizuzu emihlanu. Xa ugqibile ndicela ulithathe kunye nephepha lemvume uwanikele utishala .

Ndicela uphendule le mibuzo ilandelayo

Imininingwane ngomtwana

Igama lomntwana:

Umhla wokuzalwa:

(iminyaka)…….. (iinyanga)

(ulwimi lokuqala)……

Ukukhula komntwana

umntwana wakho waqala nini :

- Ukuhlala…….
- Ukuma……
- Ukuhamba……
- Ukuthetha……

Impilo

Ingaba umntwana wakho unayo ingxaki yokubona? **Ewe/Hayi**

Ingaba umntwana wakho unayo ingxaki yokuva ngeendlebe? **Ewe/Hayi**

Ingaba indlela umntwana wakho athetha ngayo iyafana neyabanye abantwana abalingana naye?
Ewe/Hayi

Ingaba zikhona na izigulo anazo umntwana wakho? Ukuba zikhona ndiyacela unabe?

Ewe/Hayi

…….

Ingaba umntwana wakho wake wafumana uncedo ngokuthetha? **Ewe/hayi**

Enkosi ngokuthatha ixesha ekuphenduleni le mibuzo. Ezi nkcukacha azizi kudizwa kwabanye abantu.

Appendix G: Oral-Peripheral Evaluation

Name:_____ Chronological Age:_____

Date:_____

Structure	Evaluation	Comments
Lips	At rest (symmetrical/ asymmetrical) Lip closure Lip rounding Lip spreading	
Dentition	Occlusion Hygiene Missing teeth	
Tongue	Size Mobility (lateralisation, elevation, backing)	
Hard palate	Arch Cleft	
Velum	Symmetry Movement on phonation	
Diadochokinesis (DDK rate)	Production of /puh/; /tuh/; /kuh/	

Appendix H: Xhosa Word List for Expert panel review

Consonant	Word		Culturally appropriate Y/N	Age appropriate vocabulary Y/N	Correct (meaning) Y/N	Comments/Suggestions
p’	i**p**apa (porridge)					
p^h	i**ph**epha (paper) **ph**eka (cook)					
b^h	i**bh**ola (ball)					
ɓ	u**b**isi (milk)					
m	u**m**ama (mother) i**m**ali (money)					
w	i**w**otshi (watch)					
f	**f**unda (read)					
v	**v**ala (close)					
t’	**t**ata (father) i**t**i (tea)					
t^h	**th**etha (talking) um**th**i (tree)					
d	i**d**ada (duck)					
n	ubha**n**ana (banana)					
s	i**s**ele (frog)					
z	ama**z**inyo (teeth)					

ɭ	**l**ala (sleep) ulo**l**iwe (train)					
ɬ	**hl**ala (sit) **hl**eka (laugh)					
ɮ	in**dl**ebe (ear)					
r	i**r**ula (ruler) io**r**enji (orange)					
ts’	**ts**ala (pull) **ts**iba (jump)					
tsʰ	isi**tsh**ixo (key) in**tsh**ebe (beard)					
dz	i**dz**edze (flea)					
j	i**y**eza (pill/medicine)					
ɲ	m**ny**ama (black) i**ny**ama (meat)					
tʃ’	iwo**tsh**i (watch)					
tʃʰ	in**tsh**a (new)					
dʒ	in**j**a (dog)					
ʃ	ihashe (horse)					
c’	uku**ty**a (food) uya**ty**a (eating)					

cʰ	i**tyh**efu (poison) uku**tyh**afa (tired/worn out)					
ɟ	i**dy**asi (coat)					
k’	i**k**ati (cat)					
kʰ	**kh**ala (cry) **kh**aba (kick)					
ɡ	uya**g**ula (sick)					
ŋ	ila**ng**a (sun)					
x	ugqi**rh**a (doctor)					
ɣ	**gr**ogrisa (to scare)					
kx’	ukukrokra (suspect)					
ɦ	i**h**agu (pig) **h**amba (go/walk)					
Click consonants						
ǀ	i**c**ici (earring)					
ǁ	i**x**esha (time)					
ǃ	i**q**anda (egg)					
ŋǀ	i**nc**inci (small)					
ǀʰ	**ch**eba (shave)					
ǀɡ̊	um**gc**a (line)					
ŋǀʱ	i**ngc**a					

	(grass)					
ŋǃ	i**nq**ina (chicken feet)					
ǃʰ	**qh**uba (drive)					
ǃg̊	U**gq**irha (doctor)					
ŋǃʱ	i**ngq**ele (cold)					
ŋǁ	**nx**iba (dress up)					
ǁʰ	isi**xh**osa (‘the’language)					
ǁg̊	**gx**otha (chase away)					
ŋǁʱ	i**ngx**olo (noise)					
Vowels						
a	inj**a** (dog)					
e	is**e**le (frog)					
i	**i**dada (duck)					
o	ibh**o**la (ball)					
u	Ihag**u** (pig)					

Appendix I: Recording sheet for articulaltion and phonology

Instructions: Ask the child *'**Yintoni le**?'* for picture 1-25. Where the target word is a verb (25-40), instruction will change to **Wenza ntoni?** Phonetic cues may be used if child is having difficulty. Should a child continue to have difficulties, they should imitate the word. This should be recorded as (I) next to the word. Circle consonants and vowels produced incorrectly.

Word	Target consonant	Target vowel	IPA	Transcription
i**p**apa (porridge)	p'		ipʌpʌ	
u**b**isi (milk)	ɓ	i	uɓisi	
i**t**i (tea)	t'		iti	
ibha**n**ana (banana)	n		ibʰʌnʌnʌ	
i**x**olo (peel)	ǁ		iǁɔlɔ	
io**r**enji (orange)	*r*		iɔrɛndʒi	
isi**thsa**ba (crown)	tsʰ	ʌ	isitsʰʌɓʌ	
i**bh**ola (ball)	bʰ	ɔ	i bʰɔlʌ	
i**m**ali (money)	m		imʌli	
i**w**otshi (watch)	w		iwɔtʃ'i	
i**w**otshi (watch)	tʃ'		iwɔtʃ'i	
ama**y**eza (pills/medicine)	j	ɛ	ʌmʌjɛzʌ	
i**q**anda (egg)	!		i!ʌndʌ	
i**nq**ina (chicken feet)	ŋ!		iŋ!inʌ	
i**s**ele (frog)	s		isɛlɛ	
i**d**ada (duck)	d		idʌdʌ	
in**j**a (dog)	dʒ		indʒʌ	
i**dz**edze (flea)	dz		idzɛdzɛ	
i**k**ati (cat)	k'		ikʌt'i	
i**h**agu (pig)	ɦ		iɦʌgu	
um**gc**a (line)	ǀɠ̊		umǀɠ̊ʌ	
ila**ng**a (sun)	ŋ		ilʌŋʌ	
i**dy**asi (coat)	ɟ		iɟʌsi	
ugqi**rh**a	x		u!ɠ̊ixʌ	

(doctor)				
u**gq**irha (doctor)	!ǧ		u!ǧixʌ	
(v) uya**ph**eka (cook)	pʰ		uyʌpʰɛkʌ	
uku**ty**a (eating)	c’	u	ukuc’ʌ	
(v) uya**nx**iba (dress up)	ŋǁ		ujʌŋǁ ibʌ	
(v) baya**th**etha (talking)	tʰ		ɓʌjʌtʰɛtʰʌ	
isi**isixhosa** ([the]language)	ǁʰ		isiǁʰ ɔsʌ	
(v) uya**f**unda (read)	f		ujʌfundʌ	
baya**ngx**ola (noise)	ŋǁɦ		ɓʌjʌŋǁɦɔlʌ	
(v) u**l**ele (sleeping)	l		ulɛlɛ	
(v) uya**hl**eka (laugh)	ɬ		ujʌɬɛkʌ	
(v) uya**ts**iba (jump)	ts’		ujʌts’iɓʌ	
uya**tyh**ala (push)	cʰ		ujʌcʰʌlʌ	
(v) uya**kra**zula (tear)	kx’		ujʌkx’ʌzulʌ	
(v) uya**gr**omba (digging)	ɣ		ujʌɣɔmbʌ	
nkcenkceshela (watering)	ŋk/		ŋk/ɛŋk/ɛʃɛlʌ	
nkcenkceshela (watering)	ʃ		ŋk/ɛŋk/ɛʃɛlʌ	
intoni? i**g**adi (garden)	ɡ		iɡʌdi	
(v) uya**ch**eba (cutting)	ǀʰ		ujʌǀʰ ɛɓʌ	
intoni? i**ngc**a (grass)	ŋǀɦ		iŋǀɦʌ	
(v) uya**qh**uba (driving)	!ʰ		ujʌ!ʰubʌ	
(v) uya**kh**aba (kicking)	kʰ		ujʌkʰʌɓʌ	
u**c**ango (door)	ǀ		uǀʌŋɔ	
livuliwe….. (v) li**v**aliwe (close)	v		livʌliwɛ	
enkulu… i**nc**inci (small)	ŋǀ		iŋǀiŋǀi	
endala/egugile… en**tsh**a (new)	tʃʰ		entʃʰʌ	
in**tl**oko (head)	tl		intlɔkɔ	

in**dl**ebe (ear)	ɮ		inɮɛɓɛ	
ama**z**inyo (teeth)	ɲ		ʌmʌziɲɔ	
ama**zi**n**y**o (teeth)	z		ʌmʌziɲɔ	
ama**gx**a (shoulders)	ǁg̊		ʌmʌǁg̊ʌ	
i**ngq**iniba (elbow)	ŋǃᵑ̊		iŋǃᵑ̊iniɓʌ	

Appendix J: Approval letter from Human Reasearch Ethics Committee, Faculty of Health Sciences University of Cape Town

UNIVERSITY OF CAPE TOWN

Faculty of Health Sciences
Human Research Ethics Committee
Room E52-24 Groote Schuur Hospital Old Main Building
Observatory 7925
Telephone [021] 406 6626 • Facsimile [021] 406 6411
e-mail: shuretta.thomas@uct.ac.za

23 June 2011

Sent via Internal mail & Email

HREC REF: 284/2011

Miss Z Maphalala,
Division of Communication Sciences & Disorders
Health & Rehab Sciences
OMB

Dear Miss Maphalala,

PROTOCOL NUMBER 284/2011

PROJECT TITLE: PHONOLOGICAL DEVELOPMENT OF FIRST LANGUAGE XHOSA-SPEAKING CHILDREN AGED 3:6-6;0 YEARS:A DESCRIPTIVE CROSS-SECTIONAL STUDY

Thank you for submitting your new study to the Faculty of Health Sciences Human Research Ethics Committee

It is a pleasure to inform you that the Ethics Committee has formally approved the above-mentioned study.

Approval is granted until 28 June 2012

Please submit an annual progress report (FHS016) if the research continues beyond the expiry date. Please submit a brief summary of findings if you complete the study within the approval period so that we can close our file.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please quote the HREC. REF in all your correspondence.

Yours sincerely

A/PROF MARC BLOCKMAN
CHAIRPERSON, FHS HUMAN ETHICS

Federal Wide Assurance Number: FWA00001637.
Institutional Review Board (IRB) number: IRB00001938

This serves to confirm that the University of Cape Town Human Research Ethics Committee complies to the Ethics Standards for Clinical Research with a new drug in patients, based on the Medical Research Council (MRC-SA), Food and Drug Administration (FDA-USA), International Convention on Harmonisation Good Clinical Practice (ICH GCP) and Declaration of Helsinki guidelines.

The Human Research Ethics Committee granting this approval is in compliance with the ICH Harmonised Tripartite Guidelines E6: Note for Guidance on Good Clinical Practice (CPMP/ICH/135/95) and FDA Code Federal Regulation Part 50, 56 and 312.

Appendix K: Table of consonants produced by children ages between 3;0- 6;0

Sound	Age groups																							
	3;0- 3;6				3;7-4;0				4;1-4;6				4;7-5;0				5;1-5;6				5;7-6;0			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
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tsʼ	×	☑	☑	☑	☑	☑	☑	☑	☑	☑	×	☑	☑	×	☑	☑	☑	☑	☑	☑	×	☑	☑	☑
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ʄ	×	☑	☑	×	☑	☑	×	☑	×	☑	☑	×	☑	☑	☑	☑	☑	☑	×	☑	☑	☑	☑	☑
dʒ	☑	☑	☑	×	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
dz	×	☑	×	☑	☑	☑	☑	☑	☑	☑	×	☑	☑	×	×	☑	☑	☑	×	×	×	☑	☑	☑
cʼ	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
cʰ	×	☑	☑	☑	☑	×	☑	☑	×	☑	☑	☑	×	☑	☑	×	×	☑	×	☑	☑	☑	×	×
r	×	☑	☑	×	☑	×	☑	☑	☑	☑	☑	☑	☑	☑	☑	×	☑	☑	☑	☑	☑	☑	☑	☑
l	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
w	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
j	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
!	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
ǀ	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
ǁ	×	☑	☑	☑	☑	☑	☑	×	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
!ʰ	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	×	☑	☑	☑	☑	☑	☑	☑	☑
ǀʰ	×	☑	☑	×	☑	☑	☑	×	☑	☑	☑	☑	☑	×	☑	×	☑	☑	☑	☑	☑	☑	☑	☑
ǁʰ	×	×	☑	☑	☑	☑	☑	☑	×	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
ŋ!	☑	☑	☑	×	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	×	☑	☑	☑	☑
ŋǀ	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
ŋǁ	×	☑	☑	☑	☑	☑	☑	☑	×	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	×	☑	☑	☑	☑
!ǧ	×	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
ǀǧ	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	×	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
ǁǧ	☑	☑	☑	☑	☑	×	☑	☑	×	☑	☑	☑	×	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
ŋ!ʱ	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
ŋǀʱ	☑	☑	☑	☑	☑	☑	☑	☑	×	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
ŋǁʱ	×	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
ŋk/	☑	☑	☑	☑	☑	☑	☑	☑	☑	×	×	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑

Appendix L: Table showing vowels produced by participants

Vowels	Age groups																							
	3;0- 3;6				3;7-4;0				4;1-4;6				4;7-5;0				5;1-5;6				5;7-6;0			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	16	19	20	21	22	23	24
a	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
e	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
i	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
o	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
u	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑

Appendix M: Syllable development

Syllable structure	Examples	Ages																							
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
VCV	*iti*	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
VCCV	*umgca*	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
VCVCV	*ibhola*	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	×	☑	☑	☑	☑	☑
VCVCVCV	*uyagromba*	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	×	☑	☑	☑	☑	☑	☑
CVCVCVCV	*bayangxola*	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
VVCVCV	*iorenji*	☑	☑	☑	×	☑	☑	×	☑	☑	☑	☑	×	☑	×	☑	×	☑	☑	☑	☑	☑	☑	☑	☑
VCVCVCVCV	*uyakrazula*	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑

** Syllables were counted as correct even when children used substitution errors during production.*

Appendix N: Phonological processes used by participants

Phonological process	Ages																						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Gliding of liquids	+	+	+	+		+										+		+						
Stopping	+	+					+			+														
Deaffrication	+	+				+		+	+	+		+					+			+	+			
Depalatalisation	+	+	+	+																				
Prevocalic voicing	+																							
Postvocalic devoicing	+								+				+						+					
Backing	+																							
Glottal replacement	+																							
Lateralisation	+									+														
Sound Preference substitution	+		+	+		+	+		+	+	+	+	+	+	+	+	+		+	+	+	+	+	+
Idiosyncratic process		+	+		+				+			+			+		+	+	+		+			
Denasalisation				+	+		+				+		+				+	+		+				
Deaspiration	+				+						+			+	+				+					
Deaspiration of clicks	+	+		+				+								+								
Dentalisation	+		+	+			+		+		+									+				
Palatalisation	+								+				+											
Vowel substitution		+					+			+				+		+	+	+	+	+	+		+	
Vowel assimilation	+		+			+				+	+	+					+		+			+	+	

***** *Cluster reduction was not included in the list there are no clusters found in IsiXhosa.*

+ - This illustrates that a participant made use of a phonological process.