The acquisition of Setswana phonology in children aged 3;0 – 6;0 years:

A cross-sectional study

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ABSTRACT

This study aimed to describe the typical development of speech in first language Setswana-speaking children. Thirty-six children, aged 3;0 – 6;0 years, attending preschools in Hebron in the North-West Province of South Africa, participated in the study. The objectives of the study were documenting the children's ability to produce consonants and vowels, different syllable structures, as well as the nature of phonological processes occurring at various ages. The study followed a cross-sectional design with six children grouped into each six month age band. Due to the preliminary and exploratory nature of the project, an assessment tool was developed and used to document speech development in Setswana-speaking children. This was done as none is currently available. Words and pictures selected for this assessment tool were culturally and linguistically appropriate for the study population, and an expert panel was used to ensure this. Assessments were transcribed online by a first language Setswana speaker using the IPA convention and were audio-recorded and re-transcribed by the same Setswana speaker to ensure reliability. Findings of this study indicate that the majority of Setswana consonants are acquired by 3;0 years. The rounded alveolar trill /rw/ is among the phonemes which continue to develop after 6;0 years, particularly in the penultimate syllable. Phonological processes found in the speech of younger children mainly occur in multisyllabic words and include deletion of marked and unmarked syllables, gliding of liquids, assimilation, as well as the simplification of -Cw- digraphs and words with five syllables. Older children (5;6 – 5;11 years) present with fewer phonological processes than the younger group of children (3;0 – 5;5 years). Findings of the study are discussed in relation to normative data from other languages, and in particular to those belonging to the same language group such as Sesotho. Knowledge of Setswana speech development will better equip Speech-Language Therapists working in Southern Africa to assess and manage speech difficulties in Setswana-speaking children. Future research may focus on developing a standardised Setswana speech assessment tool. The results contribute to an increasing body of locally relevant information about the typical development of children's speech.

Keywords: Setswana, speech sound development, phonological processes, syllable structures, stimulability

GLOSSARY OF TERMS

	Term	Definition
1.	**Affricate**	A single consonant that comprises of a stop, which is released gradually into a homorganic fricative (Brinton, 2000). For example, the "ch" sound in "cheese".
2.	**Allophone**	"An Allophone is a predictable variant of a phoneme" (Brinton, 2000: 48). Their distribution is often complementary (i.e. when one allophone occurs, the other does not) (Brinton, 2000). E.g. Using /t/ instead of /t^h/ in the word "top" will not result in a different word (Brinton, 2000).
3.	**Alveolar**	A single consonant sound that is produced when the tongue tip is brought into contact with the alveolar ridge (Brinton, 2000). For instance, the "d" sound in "door".
4.	**Approximant**	An approximant is a single consonant sound produced when one articulator approaches another. A turbulent airstream usually does not occur in the production of these sounds (Brinton, 2000). There are three types of approximants, namely; the glide, lateral, and the retroflex (Brinton, 2000).
5.	**Aspiration**	The puff of air that is sometimes released after production of a stop consonant (Brinton, 2000). For example, the "ph" sound heard in "pull".
6.	**Bilabial**	A single consonant sound that is produced when the lips are brought together (Brinton, 2000). The tongue is usually in the rest position during production of these sounds (Brinton, 2000). E.g. /p, b/.
7.	**Fricative**	A single consonant sound whose production involves a

		turbulent airflow occurring from a partially obstructed airstream. This results in a hissing or rubbing sound produced when two articulators are closely approximated (Brinton, 2000). For example, the "s" sound in "soak" and the "sh" sound in "shake".
8.	**Glottal**	A single consonant sound that is produced when the vocal folds momentarily close (Brinton, 2000). For example, the sound "h" in "home".
9.	**IPA**	The International Phonetic Alphabet is a system that is used to phonetically represent speech sounds in different languages (Brinton, 2000).
10.	**Labiodental**	A single consonant sound produced when the lower lip comes into contact with one's upper front teeth (Brinton, 2000). The tongue remains in the rest position during production of these sounds (Brinton, 2000). For example, the "f" sound in the word "food", and the "v" sound in "vase".
11.	**Liquid**	The lateral and retroflex approximants are classified as liquids (Brinton, 2000). The lateral approximant is a single consonant sound whose production occurs when the central portion of the vocal tract is completely obstructed, only allowing air to pass freely through the lateral passages (Brinton, 2000). For instance, the "l" sound in "loud". The retroflex approximant, on the other hand, is a single consonant sound that is produced by curling the underside of the tongue behind the alveolar ridge, as if moving it towards the palate (Brinton, 2000). For instance, the "r" sound in "roll".
12.	**Nasal**	A consonant sound that is produced with the soft palate in a lower position, allowing air to pass through the nose (Brinton, 2000). For example, the sound "ng" in "ring".
13.	**Palatal**	A consonant sound that is produced when the front of the tongue is raised up to make contact with the palate (Brinton, 2000). For example, the sound "y" in "you".

14.	**Phoneme**	A single distinctive or contrastive unit that is present in the sound system of a language (Brinton, 2000). This means that this unit can alter the meaning of a word (Brinton, 2000). For instance, "**n**ab, **l**ab, **t**ab".
15.	**Phonology**	The study of the structure and patterns of speech sounds of a specific language (Brinton, 2000).
16.	**Phonological processes**	These are also referred to as error patterns, and are defined as differences which occur consistently between a child's realisation of target words and that of an adult's (Dodd, Holm, Hua & Crosbie, 2003). E.g. cluster reduction ("table" for "stable").
17.	**Stimulability**	This refers to a child's ability to produce a sound s/he may have produced incorrectly, in the correct manner when provided with stimulation to do so (Bauman-Waengler, 2000 as cited in Glaspey & Stoel-Gammon, 2005).
18.	**Stop (plosive)**	A single consonant sound produced when the airflow is completely obstructed by two articulators (the velum is usually raised) (Brinton, 2000). Plosives occur when these consonants are released into a vowel (Brinton, 2000). For instance, the word "basin" begins with the plosive stop "b".
19.	**Syllable**	A phonological unit which consists mainly of a vowel and sometimes may consist of a consonant in the beginning and/or in the end (Brinton, 2000). E.g. "table" has two syllables; "ta - ble".
20.	**Trill**	A trill, also referred to as a roll, is a single consonant sound whose production occurs when an active articulator (the tongue) rapidly vibrates against a passive articulator (the alveolar ridge) (Brinton, 2000). This trill is not common in English phonology (Brinton, 2000).
21.	**Velar**	A consonant sound produced when the back of the tongue makes contact with the velum (Brinton, 2000). E.g. /g/

CONVENTIONS USED

1. 3;6 years = 3 years and 6 months
2. Setswana target word is recorded as '*ngwana*'
3. IPA transcription of the target word /ŋwana/
4. English translation of the target word (baby)
5. Changes affecting phonemes are shown in bold in both the target word a child's production, e.g. omission of phoneme /w/ in '***l****w**ala*' /**l**wala/ (to be sick) produced as '***l****ala*' /**l**ala/.

OUTLINE OF DISSERTATION

Chapter 1: Introduction

Challenges facing Speech Language Therapists in South Africa are highlighted in this chapter, followed by theoretical accounts of speech sound acquisition and their use in clinical practice. The chapter also gives a background of Setswana phonology.

Chapter 2: Literature review

Research studies on speech development are reviewed in this chapter. Studies which have investigated acquisition of speech in Southern Bantu languages, English and other languages spoken around the world and what this means in clinical practice are discussed.

Chapter 3: Methodology

The study design as well as methods of data collection and analysis are described in this chapter.

Chapter 4: Results

This chapter consists of a description of the findings of the study, which are reported according to the objectives formulated.

Chapter 5: Discussion and Conclusion

The study findings are discussed in detail and related to developmental studies carried out in other languages, as well as theoretical models and frameworks. The implications of the study findings for clinical practice and research are also discussed in this chapter, followed by a description of the study limitations and suggestions for future research.

CHAPTER 1: INTRODUCTION

This chapter aims to describe the challenges faced by Speech-Language Therapists (SLTs) working in Southern Africa and whose caseload consists of children from many different language and cultural backgrounds. An overview of speech acquisition in typically-developing children is provided in this Chapter as it is the main focus of this study. This is done to highlight some of the devastating effects that speech, language and communication difficulties may have on children, as well as how these will affect them into adulthood. Information on phonological assessment procedures and intervention is also provided in this chapter, and this will be related to clinical practice in South Africa. This is done so as to provide the rationale for the current study, as well as the context in which it was conducted. Setswana is then introduced, with a review of the literature that relates to the acquisition of this language.

1.1 Challenges faced by SLTs in South Africa

The prevalence of clinically significant speech difficulties in South Africa is not known. It has, however, been documented that approximately 7.5% of children who are between the ages of 3;0 and 11;0 years in the United States (US) experience developmental speech difficulties (Ruscello, 2008). A study conducted in the United Kingdom (UK) estimated that between 85 000 – 90 000 children would be referred with speech and language difficulties of an unknown aetiology annually (Broomfield & Dodd, 2004). These difficulties were mostly evident in children between the ages of 3;0 and 6;0 years (Broomfield & Dodd, 2004). When applied to the South African context, these estimates are likely an indication of the large number of children who require speech and language therapy services. Many of these children may not be appropriately identified or receive the services they require. The number of SLTs in the country is small and their role is not always well understood so that appropriate referral does not always occur (Pascoe & Norman, 2011).

Service delivery issues to the population aside, assessing and managing speech and language difficulties in these children may also be challenging for SLTs working in Southern Africa. This is because many of the assessment tools available to clinicians have been developed for and standardised on children in the US, UK and Australia, and often consist of materials not appropriate – both linguistically and/or culturally – for the Southern African context (Pascoe & Norman, 2011). This challenge may also be attributed to the linguistic diversity in the country, with little information available on speech acquisition in Bantu and other local languages. A further complicating factor is that the majority of South African SLTs are English- and/or Afrikaans-speaking and are often only able to provide services in

these languages, which are often acquired as a second or third language by most children (Naude, Louw & Weideman, 2007; Pascoe *et al*., 2010). This has ethical implications as clinicians are required to provide equitable services to these children to meet their needs (SASLHA, 2011). Clinicians may, however, not have sufficient skills to render effective services to these children (Pascoe & Norman, 2011).

In their survey of clinical practice of SLTs in the Western Cape, South Africa, Pascoe *et al*. (2010) found that some clinicians attempted to overcome difficulties which they experienced when working with children whose first language is not English. This was done by adapting formal assessment tools and intervention techniques. Adaptations made involved translating these assessment tools into other languages, changing visual stimuli used (by using pictures or objects which they felt were more appropriate for their clients), as well as making changes to prescribed methods of administering tests (repeating or rephrasing instructions (Pascoe *et al*., 2010). Results obtained from a recent national survey conducted by Van Dulm and Southwood (2013) suggest that few South African SLTs may have adequate language skills to serve bilingual children (in the case is less severe for English-Afrikaans speaking children than for those acquiring more than one indigenous language). They also reported that very few clinicians (6% of their participants) consider cultural and linguistic appropriateness of standardised assessment tools (Van Dulm & Southwood, 2013). A large number of SLTs who participated in this survey (84%) reported using assessment tools which they had developed, with 6% not supplementing these self-developed tools with any standardised tools.

Although translating assessment tools may seem a solution for many clinicians, several studies have shown that translated tools may not be suitable for use in different cultures (Barratt, Khoza-Shangase & Msimang, 2012). This may be due to differences in semantics, syntax and phonology between the languages involved (Barratt *et al*., 2012; De Lamo White & Jin, 2011). In addition, there is often a lack of evidence on which to base decisions made to adjust assessment procedures and intervention techniques (Pascoe *et al*., 2010; Van Dulm & Southwood, 2013). The validity and reliability of these adjusted tools is also questionable (Van Dulm & Southwood, 2013; Pascoe *et* al., 2010).

1.2 Speech sound acquisition

Speech sound acquisition, also referred to as phonological development, has been described as a child's ability to learn to produce speech sounds and to learn rules used in the sound system of adults speaking the same language (Gildersleeve-Neumann & Wright, 2010). Children's sound systems are thought to develop gradually before accuracy in speech

production is achieved (Gildersleeve-Neumann & Wright, 2010). A range of approaches aimed at understanding speech sound acquisition and the nature of difficulties which may arise during this process have been described in the literature. These include the medical, linguistic and psycholinguistic approaches. The medical approach is based on the notion that a child's speech sound difficulties are caused by an underlying medical condition (e.g. Cerebral Palsy, Down Syndrome) (Baker, Croot, McLeod & Paul, 2001; Stackhouse & Wells, 1997; Waring & Knight, 2013). One of the shortcomings of this approach is that it provides little information on the nature of speech difficulties a child presents with, how severe these difficulties may be, as well as the type of intervention approach which may be required (Waring & Knight, 2013). In addition, the medical approach fails to account for speech sound difficulties whose causes are not known (Baker *et al*., 2001; Stackhouse & Wells, 1997). The linguistic approach is aimed at identifying and describing ways in which a child's speech and language systems may be different to that of his/her typically-developing peers (Baker *et al*., 2001; Waring & Knight, 2013). The third approach to speech sound acquisition is the psycholinguistic approach and makes use of speech processing models to explain ways in which speech difficulties arise (Baker *et al*., 2001; Stackhouse & Wells, 1997; Waring & Knight, 2013). The psycholinguistic approach is based on the notion that a child's speech sound difficulties result from a breakdown in his/her speech processing system (Baker *et al*., 2001; Stackhouse, Pascoe & Gardner, 2006; Stackhouse & Wells, 1997; Waring & Knight, 2013). The key components of the speech processing system include the child's ability to process speech input (e.g. auditory discrimination), his/her lexical storage system (of word components, e.g. semantic, phonological), as well as his/her ability to process speech output (e.g. speech production) (Stackhouse *et al*., 2006; Stackhouse & Wells, 1997). One of the advantages of this approach is that it can be used to describe difficulties of a known and unknown cause (Stackhouse & Wells, 1997; Waring & Knight, 2013). It is useful in classifying speech sound disorders of an unknown aetiological cause in that it allows one to draw hypotheses on whether the difficulties a child presents with are perceptual, cognitive-linguistic or motoric in nature (Fox & Dodd, 2001).

For the purposes of this study, the developmental phase model, one of the components of Stackhouse and Wells' (1997, 2001) psycholinguistic framework, will be used to explain how children's speech sound systems change over time. Five phases of development were identified in this model, namely the pre-lexical, whole word, systematic simplification, assembly and metaphonological phases. The first phase is the pre-lexical phase and occurs in the child's first year of life. Although children are not yet producing recognisable speech during this phase, their babbling has taken on features of their native language (Stackhouse & Wells, 1997). The second phase is the whole word phase, which occurs when children are

roughly twelve months of age. The onset of this phase is characterised by the production of the first "real" word. In the third phase; the systematic simplification phase, the simplification of words is noted in children's speech and is characterised by the use of immature phonological processes. The fourth phase is the assembly phase and is characterised by an ability to produce consonantal sequences, as well as an attempt to produce sentences with a more complex structure (Stackhouse & Wells, 1997). The fifth phase is the metaphonological phase and occurs roughly in the child's fifth year of life. The development of pre-literacy skills (e.g. phonological awareness) is witnessed during this final phase (Stackhouse & Wells, 1997). Having passed successfully through each of these phases, the typical development of literacy is most likely to be attained. The Developmental Phase Model is depicted in Figure 1.

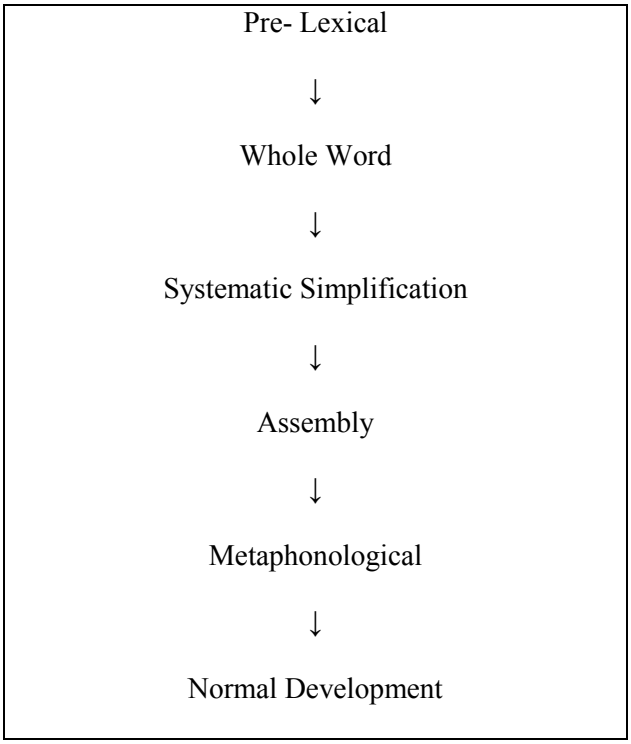


Figure 1.*The Developmental Phase Model (Stackhouse & Wells, 1997, as cited in Pascoe, Stackhouse and Wells, 2006:39).*

A breakdown at any of the levels described in this model may result in speech and later literacy difficulties (Stackhouse & Wells, 1997). This model of speech development can be related to Frith's (1985) model of literacy development in that difficulties experienced at any level of development account for literacy-related difficulties which may be experienced later on in life (Stackhouse & Wells, 1997). A large body of research conducted in the subsequent years has proven that a link exists between phonological difficulties in the early years and later literacy difficulties (Lewis, Freebairn & Taylor, 2000; Raitano, Pennington,

Tunick, Boada & Shriberg, 2004; Ruscello, 2008). In particular, literacy difficulties found in children with a history of speech sound disorders included poor phonological awareness skills, as well as difficulties in letter recognition, resulting in poor spelling abilities (Lewis *et al*., 2000; Raitano *et al*., 2004).

Stackhouse and Wells' (1997) Developmental Phase Model is most likely applicable to all languages in its description of the broad phases through which children progress. It has been applied to children developing a range of different languages, e.g. English (Pascoe, Stackhouse & Wells, 2005) and German (Fox & Dodd, 1999). Maphalala, Pascoe & Smouse (2014) related isiXhosa speech development to the Developmental Phase Model in a detailed way. In their study, they classified children aged 3;0 – 4;0 years as being in the systematic simplification phase. These children's speech was characterised by more phonological processes in comparison to the older ones (i.e. 5;0 – 6;0 years) (Maphalala *et al*., 2014). They were able to detail the nature of these processes which included gliding of liquids, stopping, deaffrication, depalatalisation, deaspiration, dentalisation and denasalisation. They further proposed that children between the ages of 5;0 and 6;0 years were likely in the assembly phase, and possibly progressing into the metaphonological phase (Maphalala *et al*., 2014). The classification of older children in these phases was based on the decreased use of phonological processes, as well as an indication of the presence of rhyming (a phonological awareness skill necessary for literacy development) in their speech (Maphalala *et al*., 2014).

Bearing in mind the ages of the children in the present study, it would be expected that they will be in the systematic simplification and assembly phases. It should be noted, however, that these phases as specific to Setswana phonology have not yet been documented, e.g. the phonological processes which characterise the systematic simplification phase in Setswana have not been documented to date.

When compared to typically-developing children, children with speech and language impairments have been reported to have poorer social skills, behavioural problems, and more difficulties forming friendships as they are often bullied and socially isolated (Broomfield & Dodd, 2004; McLeod & Bleile, 2007, Tempest & Wells, 2012). Other challenges these individuals may encounter include limited access to healthcare, education and difficulty finding jobs later on in life (McLeod & Bleile, 2007). These challenges may possibly be worse in Southern Africa, as McLeod and Bleile (2007) reported that difficulties experienced by individuals with communication difficulties may be exacerbated in countries with limited healthcare and education resources. Early identification of speech and other communication difficulties is therefore critical given the important role of speech and communication, as well as its relationship to later academic performance and psychosocial wellbeing (McLeod & Bleile, 2007; Ruscello, 2008).

A number of authors (McCormack, McLeod, Harrison & McAllister, 2010; McLeod, 2004; McLeod & Bleile, 2004; Threats, 2006) have proposed making use of the International Classification of Functioning, Health and Disability (ICF) framework (WHO, 2001) when assessing children with speech sound difficulties, as well as when planning for intervention. McCormack *et al*. (2010) and McLeod (2004) have further proposed that incorporating areas of the children's Activities and Participation (e.g. learning and applying knowledge, self-care and communication) into speech assessments and intervention programs may yield improved outcomes. McLeod (2004) explained that considering these areas as goals in intervention may help reduce poor social, emotional and educational outcomes, as well as poor occupational outcomes which they may experience later on in their lives (McLeod, 2004). McLeod and Bleile (2004) have highlighted the importance of facilitating these children's literacy skills in intervention as they often present with reading and spelling difficulties. They further emphasise the importance of targeting phonological awareness in intervention (McLeod & Bleile, 2004), since this has been proven to improve reading and spelling difficulties in children (Gillon, 2000).

1.3 Theories of speech sound acquisition

Children's sound systems are thought to follow a particular pattern of development before they are able to produce adult-like speech (Gildersleeve-Neumann & Wright, 2010). This developmental pattern is thought to follow a universal trend, with children acquiring unmarked features of a phonological or language system before marked features (Bernhardt & Stoel-Gammon, 1994; Zamuner, Gerken & Hammond, 2005). Unmarked features include properties of a language or phonological system which are common and occur frequently cross-linguistically, e.g. the CV syllable structure (Bernhardt & Stoel-Gammon, 1994; Zamuner *et al*., 2005). Marked features on the other hand, include properties which are specific to the language and phonological systems being acquired and are less common across languages (Bernhardt & Stoel-Gammon, 1994; Zamuner *et al*., 2005). According to Zamuner *et al*. (2005), markedness is not only linked to the frequency with which certain features occur across languages but that it is also determined by the frequency with which certain sound patterns occur in a language. The extent to which this theory applies can be considered in light of the studies reviewed in the following chapter. The unmarked features likely comprise vowels, nasals, glides and plosives as these are reported to be among the phonemes which are acquired early cross-linguistically. The marked features likely comprise of fricatives, affricates and clicks as these phonemes are among the last sounds to be acquired and are more language-specific (e.g. clicks appear in the isiXhosa phonological system and the interdental fricative /θ/ is more common in English than in other languages).

Four subgroups of speech disorders, each reflecting a breakdown in a child's speech processing system, were proposed by Dodd (1995). These include: (1) an articulation impairment, which is thought to occur as a result of difficulties in the motor programming system and speech production (Dodd, 1995); (2) delayed phonological skills, with no known deficit in the speech processing system (Dodd, 1995); (3) a consistent deviant disorder which occurs as a result of a breakdown at the internal organisational level of the system (Dodd, 1995); as well as (4) an inconsistent speech disorder which is caused by difficulties in phonological planning (Crosbie, Holm & Dodd, 2005). Phonological planning is reported to occur at the level at which programs of words are selected and sequenced to form an utterance (Stackhouse & Wells, 1997). An inability to carry this task out is thought to result in a lack of a stable phonological system (Crosbie *et al*., 2005).

Studies conducted with children who speak languages other than English have identified cross-linguistic similarities by using these subgroups to classify speech sound disorders in their languages. The languages on which these were applied include German (Fox & Dodd, 2001), Spanish (Goldstein, 1995; as cited in Crosbie *et al*., 2005), Cantonese (So & Dodd, 1994), Turkish (Topbas & Konrot, 1996) and Putonghua (Zhu & Dodd, 2000). Crosbie *et al*. (2005) have suggested that speech sound disorders do not appear to be dependent on the phonological system being acquired but that they are rather a reflection of deficits in children's speech processing systems.

Several research studies have examined the benefits of implementing the psycholinguistic approach in profiling speech development in managing speech sound disorders. In addition to illustrating that speech sound disorders reflect a deficit in the speech processing system, Dodd and Bradford (2000) have shown that more than one approach aimed at addressing these deficits may be beneficial for children with speech sound disorders. This was based on their findings of how their participants, children who presented with both consistent and inconsistent speech disorders, responded to different intervention programs. For instance, one child with consistent speech error patterns benefitted more from metaphonological therapy (which targets the cognitive-linguistic level) than he did from approaches which directly targeted articulation (e.g. PROMPT) and consistency of word production (core vocabulary approach) (Dodd & Bradford, 2000). This child's response to one therapy approach reflected the presence of only one deficit in his speech processing system (Dodd & Bradford, 2000). By contrast two children who presented with inconsistent speech errors benefitted more from an approach aimed at improving consistency of word production (i.e. core vocabulary approach), with one benefitting further from metaphonological therapy (Dodd & Bradford, 2000). The child for whom two therapy programs were effective may possibly have had a deficit at more than one level of the speech

processing system (Dodd & Bradford, 2000). Crosbie *et al*. (2005) have also shown that the various levels of the speech processing system respond differently to intervention approaches addressing different processing skills. For instance, they found that children with inconsistent speech error patterns present with deficits in phonological planning and not at the cognitive-linguistic level as core vocabulary therapy was more beneficial to them. Not only did they note an increase in the consistency with which the participants produced words, but an increase in the accuracy with which they were produced too (Crosbie *et al*., 2005). Crosbie *et al*. (2005) proposed that improving phonological planning in these children led to an improved ability to correct themselves, which further led to improved speech productions. They further proposed that children with atypical consistent speech errors benefit from phonological contrast therapy (an approach aimed at addressing deficits at the cognitive-linguistic level). This therapy approach is aimed at reorganising these children's phonological knowledge as their speech difficulties are thought to result from a deficit at the cognitive-linguistic level (i.e. the level at which lexical representations are stored) (Crosbie *et al*., 2005). These findings led them to suggest that a whole word approach is effective in addressing difficulties in phonological planning while a phonological contrast approach is effective for cognitive-linguistic difficulties.

Although contradictory results on the benefits of selecting therapy approaches to target underlying deficits in the speech processing system were reported by Hesketh, Adams, Nightingale and Hall (2000), it appears that a relation between the different levels of the speech processing system exists. Progress related to a specific type of therapy approach was not evident in children who participated in Hesketh *et al*.'s (2000) study. It was reported, however, that children's phonological awareness skills affected their response to intervention. For instance, they found that children with good metaphonological skills benefitted from therapy which targeted both cognitive-linguistic and speech production abilities (Hesketh *et al*., 2000).

1.4 Assessment and Intervention

A comprehensive assessment of a child's speech is the foundation on which intervention should be built. Carter *et al*. (2004) explain that results obtained from an assessment will not be accurate if the assessment fails to consider cultural differences of individuals being evaluated. This, in turn, will lead to inappropriate intervention being provided to the individuals involved (Carter *et al*., 2004). A comprehensive assessment tool, whether it be for language or speech sound development, is therefore essential as it will help with the early identification of children at risk for communication difficulties.

Many children in Southern Africa at risk for such difficulties may be missed as most assessment tools currently available have been designed for children from cultures different to theirs. The need to develop resources appropriate for children in the Southern African context can therefore not be overemphasised. Contextually relevant resources are explained as tools available to SLTs to use within a specific setting, which have been developed for use in that setting with the target population (Pascoe & Norman, 2011). These tools include scales on which to measure children's development, programs to use in intervention, as well as a set of normative data (Pascoe & Norman, 2011). This lack of contextually relevant assessment materials and associated normative data makes obtaining valid and reliable results during an assessment a challenge. This can then lead to a lack of evidence-based practice, as was noted in the survey by Pascoe *et al*. (2010). Although information reported in the survey was obtained from a small number of SLTs working in one region of the country (i.e. the Western Cape Province), this appears to be a nationwide problem (Van Dulm & Southwood, 2013). The need to develop assessment resources aimed at identifying children at risk of developing speech difficulties in South Africa is therefore an urgent one. However, in order to identify those children, SLTs must be able to differentiate between typical and atypical speech sound development. When assessing children for speech sound difficulties and planning for intervention, it is vital for SLTs to fully understand how children acquire speech in their home language (McLeod & Bleile, 2007), or languages, as is often the case for children from multilingual households. This may not be possible for a large number of SLTs in South Africa – the lack of information on speech acquisition in indigenous languages may be made more challenging by limited information on speech acquisition in children acquiring more than one language.

Extensive research on the assessment of children's speech sound acquisition has been conducted (Eisenberg & Hitchcock, 2010; Khan, 2002; Morrison & Shriberg, 1992; Williams, 2005), much of it focusing on assessment of monolingual, English-speaking children in developed contexts. There is an increasing body of literature that considers the speech acquisition and assessment of bi- and multilingual children (De Lamo White & Jin, 2011; Fabiano-Smith & Barlow, 2010; Gildersleeve-Neumann, Kester, Davis & Peña, 2008; Gildersleeve-Neumann & Wright, 2010; Gutiérrez-Clellen & Simon-Cereijido, 2009; Saenz & Huer, 2003), as well as children acquiring languages other than English (Hua & Dodd, 2000; Fox & Dodd, 2001; McLeod, 2007). This information provides clinicians with a guideline on the assessment and analysis of children's speech, especially those presenting with delayed phonological acquisition (Skahan, Watson & Lof, 2007). Information on children's articulation and phonological skills is usually obtained by administering norm-referenced standardised articulation and phonology assessment tools (Nelson, 2010; Skahan

et al., 2007). Clinicians are often able to measure children's articulatory and phonological skills as these tools provide information on phonemes (usually consonants) present in their phonetic inventories, phonemes produced accurately and consistently, information on phonological processes used, as well as information on other areas of development (e.g. literacy skills) (Skahan *et al*., 2007). This is mainly achieved by eliciting single word speech samples, although the value of using connected speech is also encouraged (Newton & Wells, 2002; Eisenberg & Hitchcock, 2010).

Assessment is typically followed by an analysis of results obtained and allows the clinician to make decisions on steps needed to be taken in managing speech sound difficulties noted in their clients (Baker, 2004). Information on whether or not a child's speech development is on par with his/her peers can be obtained from norm-referenced standardised tools (De Lamo White & Jin, 2011; Nelson, 2010). The clinician is often able to compare the child's performance to that of his/her typically-developing peers. These standardised tools are, however, culturally biased in that they assume that all children have had similar life experiences and that their knowledge of concepts and vocabulary is also the same (Saenz & Huer, 2003). In order to overcome this cultural bias, De Lamo White and Jin (2011), Laing and Kamhi (2003), and Nelson (2010) proposed that SLTs working with children from bilingual and/or different cultural backgrounds should familiarise themselves with the child's culture, as well as ways in which language is used by the child's family, including differences in dialects which may be spoken.

In addition, two other methods of analysing a child's speech acquisition are used widely. These are independent and relational analyses, which are used to describe a child's phonetic and phonemic inventories (Baker, 2004; Dodd, Holm, Hua & Crosbie, 2003). The independent analysis involves documenting consonants, vowels and syllable structures produced by a child (Baker, 2004; Dodd *et al*., 2003). Information on phonemes present and those not present in a child's phonetic inventory is obtained through the use of this method, regardless of the accuracy with which the child produced them (Baker, 2004; Dodd *et al*., 2003). Relational analysis, by contrast involves comparing the child's speech to the adult target. This method of analysis takes the child's ability to produce phonemes accurately and consistently into account (Baker, 2004; Dodd *et al*. 2003). It also considers the nature of phonological processes present in the child's speech. Measuring the number of phonemes the child has developed is achieved by calculating the percentage of phonemes the child produced correctly – i.e. the percentage of consonants correct (PCC) and percentage of vowels correct (PVC) (Baker, 2004; Dodd *et al*., 2003). Baker (2004) explains that these methods of phonological analysis will aid the clinician in selecting phonemes to target in therapy, as well as measuring progress made by the child.

It is clear that application of these assessment and analysis methods requires information on typical speech acquisition. For instance, an SLT needs information on what might be considered delayed speech acquisition even when using the PCC and PVC scores obtained from a speech sample which may have been elicited during an informal assessment. The PCC score of a typically-developing 3;0 year old isiXhosa-speaking child will likely be higher than that of an English-speaking child. This is hypothesised as speech acquisition studies on isiXhosa have reported that the majority of phonemes are acquired as early as 3;0 years in comparison to findings reported for English-speaking children.

An introduction to the Southern African language, Setswana, is now provided. This study has the acquisition of Setswana phonology as its focus.

1.5 Setswana

1.5.1 Regions and dialects

Setswana is one of South Africa's eleven official languages. It is a Southern Bantu language belonging to the Sotho group of languages (Cole, 1955; Mosaka, 2000; Zerbian, 2006). It ranks sixth on the list of commonly spoken languages in the country and is spoken as a first language by an estimated 4 million people, i.e. 8% of the country's population (Statistics S.A., 2011). Setswana is mainly spoken in the North West province, a region bordering Botswana (Statistics S.A., 2011) – Setswana is the national language of Botswana (Ethnologue, 2014). An estimated 53.8% of South Africa's Setswana-speaking citizens are found in the North West province. Two languages are spoken in the province: Setswana, which is spoken by 63.4% of the province's residents; as well as Afrikaans, which is spoken by only 9% of the province's population (Statistics S.A., 2011). Setswana is also spoken in other provinces in the country – the Northern Cape (by 33% of the provincial population), Gauteng (by 9%) and the Free State (by 5.2%) (Statistics S.A., 2011). Krüger (2006) has suggested that Setswana is spoken in the North-Western part of the Limpopo province. The estimated number of Setswana speakers in the province is, however, not known. In addition, Setswana is spoken by a small number of people in Namibia and Zimbabwe (Ethnologue, 2014).

A number of dialect clusters, all spoken in the aforementioned areas, are reported for Setswana. These are Hurutshe, Rôlông, Tlhaping, Tlharô, Kwêna (Eastern and Western), Ngwakêtse, Kgatla (Eastern and Western), as well as Kgatla of Hammanskraal and Bela-

Bela (Cole, 1955; Krüger, 2006). Figure 2 details the geographical areas in which Setswana is mainly spoken.

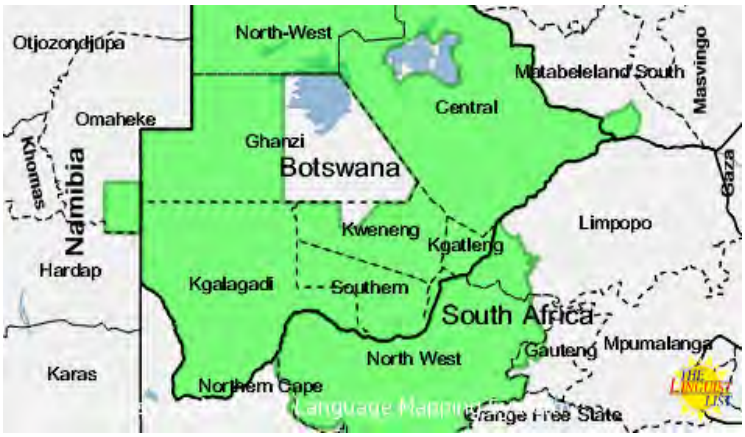


Figure 2. *Geographical regions in which Setswana is mainly spoken (shown by shaded areas) (Source: www.multitree.org, 2013).*

1.5.2 Research on Setswana phonology

Although there is information available on the sound system of Setswana, no information is available on the nature of speech development in Setswana speakers. This includes information on the ages at which different phonemes and syllables develop, as well as the nature of phonological processes expected to occur in typical Setswana speech sound development. This information is vital for SLTs working with children with delayed speech acquisition or speech sound disorders.

Research on Setswana phonology has focused mainly on the sound systems of adults with typical speech, as well as making comparisons between languages in the Sotho group of languages (i.e. Setswana, Sesotho and Sepedi). For instance, a study conducted by Coetzee and Pretorius (2010) reported the presence of post-nasal devoicing in some Setswana-speaking adults. Van der Pas, Wissing and Zonneveld (2000) studied ways in which native Setswana speakers acquired the stress system of English, which was their second language. Wissing (2010: 246) studied aspects of vowel raising in Setswana and Sesotho. He found similarities between these two languages, which led him to propose that Sotho languages (in this case Setswana and Sesotho) may be one "homogenously structured language". This statement is, however, debatable as these two languages are considered separate languages amongst others due to syntactic and semantic differences (Cole, 1955; Demuth, 2007). Gouskova, Zsiga and Boyer (2011) examined the post-nasal devoicing rule (which was reported in a study by Coetzee and Pretorius, 2010), as well as Setswana obstruents. They

reported that post-nasal devoicing which was reported to occur in Setswana speaking adults was in fact post-nasal ejectivisation. They also showed that the voiced alveolar explosive /d/ was derived from lateral non-fricative /l/ (Gouskova, Zsiga and Boyer, 2011).

A study conducted by Palai and O'Hanlon (2004) contributed a culturally appropriate resource for Audiologists working with Setswana speaking adults. They devised a word list which can be used during the speech discrimination part of an audiological assessment. The words included in this list were selected based on the frequency with which they occurred in speech samples obtained from their participants.

Only one developmental study on Setswana speaking children has been documented in the literature. Tsonope (1987; as cited in Demuth, 2003) conducted a longitudinal study to investigate the acquisition of the noun class system and agreement morphology of Setswana. This study was conducted more than two decades ago and included a sample of two children acquiring one dialect of Setswana. It, however, provides information that Setswana speaking children acquire tone on nouns earlier than on verbs (Tsonope, 1987; as cited in Demuth, 2003). No other developmental studies on Setswana speaking children followed.

1.5.3 Setswana phonology

Much of what is known about Setswana phonology was reported by Cole as far back as 1955. Some of this work on Setswana phonology has been supplemented by researchers in the past few decades. Cole's early work on Setswana phonology is, however, still referred to in current studies and will be referred to in this section. Like many Bantu languages, Setswana is an agglutinative language (Van Rooy & Pretorius, 2003), meaning that several morphemes can be joined together to form words, and that different prefixes and suffixes can be used to change the meaning of a root word (Pascoe & Smouse, 2012; Zerbian & Barnard, 2010). The Setswana phonetic inventory consists of seven vowels and twenty-nine consonants (Cole, 1955; Krüger & Snyman, 1988; Setshedi & Malope, 1978; Snyman *et al*., 1989).

1.5.3.1 Vowels

Four of the seven vowels (namely the mid vowels), have variants, each phonetically different from the other (Cole, 1955; Krüger & Snyman, 1988; Snyman *et al*., 1989). When compared to vowels of other languages (e.g. English), Setswana vowels have no diphthongal qualities and are often produced with some degree of tension (Cole, 1955; Krüger & Snyman, 1988). The Setswana vowel chart is illustrated in Figure 3.

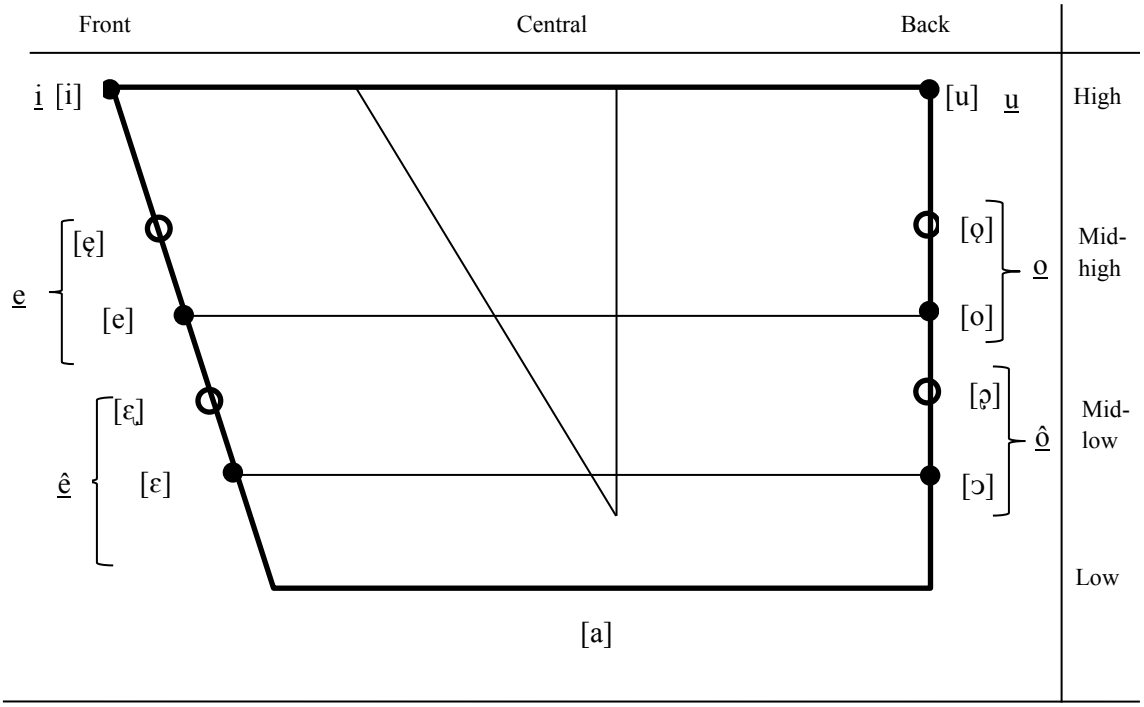


Figure 3. *Setswana vowel chart (adapted from Snyman et al., 1989; Krüger & Snyman, 1988).*

1.5.3.2 Consonants

Setswana consonants are classified as simple or compound (Cole, 1955). They can be classified further according to the manner in which they are produced, the direction in which air flows from the oral cavity, the presence or absence of voicing, as well as their places of articulation (Cole, 1955; Krüger & Snyman, 1988; Setshedi & Malope, 1978; Snyman *et al*., 1989). The classification of these phonemes is illustrated in Table 1 (Appendix A). A few of these consonant phonemes have allophones and variants. For instance, the bilabial fricative /ɸ/ occurs as a variant of the labio-dental fricative /f/, and bilabial fricative /β/ as a variant of the bilabial explosive /b/ (Cole, 1955; Krüger & Snyman, 1988; Setshedi & Malope, 1978). The voiced alveolar explosive /d/ occurs as an allophone of the non-fricative lateral alveolar /l/ before the high vowels /i, u/ (Coetzee & Pretorius, 2010; Cole, 1955; Krüger & Snyman, 1988).

In addition, there are two consonant phonemes which sometimes take on the features of the mid vowels (Cole, 1955; Krüger & Snyman, 1988; Setshedi & Malope, 1978). These

two phonemes, the medial labio-velar /w/ and the palatal /j/, are referred to as semi-vowels (Cole, 1955; Krüger & Snyman, 1988; Setshedi & Malope, 1978). Labialisation (also referred to as rounding) occurs in consonants occurring before the medial labio-velar /w/, e.g. '***ngwêdi***' (/**ŋw**ɛdi/ - a star) (Cole, 1955; Krüger & Snyman, 1988; Snyman *et al*., 1989). This consonant-/w/ combination forms a digraph as the medial labio-velar /w/ is no longer a separate phoneme, but forms a new phoneme with the consonant it merges with (i.e. the -Cw- combination) (Cole, 1955). Not all consonants, however, can combine with the medial labio-velar /w/. Exceptions include bilabials, the labio-dental /f/, the voiced alveolar explosive /d/, the glottal fricative /h/, as well as the non-fricative palatal /j/ (Cole, 1955; Krüger & Snyman, 1988). For instance, combination of /w/ with the velar nasal /ŋ/ is allowed, as seen in '***ngwana***' (/**ŋw**ana/ - a child). The voiced alveolar explosive-/w/combination, i.e. /dw/ is, however not permitted.

1.5.3.3 Syllables

Setswana employs an open syllable structure, with the majority of syllables ending with a vowel (Cole, 1955; Krüger & Snyman, 1988). Three main syllable structures have been documented in the Setswana literature: vowel only (V, e.g. '***a**pole*', /**a**p'ole/ - an apple), consonant and vowel (CV, e.g. '***se**tlhare*', /**se**tɬ^{h}are/ - a tree) and consonant only (C, e.g. '***m**phê*', /**m**p^{h}ɛ/ - give me) (Coetzee & Pretorius, 2010; Cole, 1955; Krüger & Snyman, 1988; Setshedi & Malope, 1978; Snyman *et al*., 1989). A fourth syllable structure – the consonant, consonant and vowel (CCV) syllable – is also reported for Setswana (Coetzee & Pretorius, 2010; Krüger & Snyman, 1988). This syllable is made up of a consonant diagraph (the -Cw-combination) and a vowel (i.e. CwV, e.g. '***kwêna***', /**kw'ɛ**na/ - a crocodile), with the vowel being either the low central /a/ or one of the front vowels /i, e, ɛ/ (Krüger & Snyman, 1988).

Only six consonants can be syllabic in Setswana (Cole, 1955; Krüger & Snyman, 1988; Setshedi & Malope, 1978; Snyman *et al*., 1989). These are the nasal consonants /m/, /n/, /ŋ/, /ɲ/, the alveolar trill /r/ and the lateral alveolar /l/ (Cole, 1955; Krüger & Snyman, 1988; Setshedi & Malope, 1978; Snyman *et al*., 1989). The syllabicity of these consonants is determined by the phonetic environment in which they occur. For example, the nasals /m/ and /n/ can be syllabic when followed by a number of consonants in the phonetic inventory ('***m**mê*', /**m**mɛ/ - mother, '***m**potsa*', /**m**p'otsa/ - ask me, '***n**na*', /**n**na/ - I/, '***n**tlo*', /**n**tɬ'o/ - a house), as compared to the others which are syllabic only when followed by consonants similar to them (e.g. '***r**rê*', /**r**rɛ/ - father, /mo**ll**ɔ/ - fire, /**ɲɲa:**ne/ - small, '***n**kgôga*', **ŋ**kx^{h}**ɔ:**xa - pull me) (Krüger & Snyman, 1988; Setshedi & Malope, 1978; Snyman *et al*., 1989). The nasal velar /ŋ/ is the only consonant phoneme that constitutes a syllable in the word-final

position, e.g. '*dikgo**ng***', /dikx^{h}o**:ŋ**/ (logs) (Krüger & Snyman, 1988). The syllabicity of the lateral alveolar /l/ is not accepted in orthography but is characteristic of the speech of some dialects (Krüger & Snyman, 1988; Setshedi & Malope, 1978). For example, the written forms of /mo**l**lɔ/ (fire) and /**l**la/ (to cry) are '*molelo*' and '*lela*', with a vowel in between the adjacent alveolar lateral consonants (Krüger & Snyman, 1988; Setshedi & Malope, 1978). No consonant clusters are found in Setswana phonology (Cole, 1955; Palai & O'Hanlon, 2004). As a result, loanwords from languages with clusters are often altered to follow the rules of Setswana phonology (Palai & O'Hanlon, 2004). This is achieved by inserting vowels between the adjacent consonants so as to follow the basic CV syllable structure of the language, e.g. '***se**kôlô*' /**s**ek'ɔ:lɔ/ (school – derived from the Afrikaans word 'skool') (Palai & O'Hanlon, 2004). Rose and Demuth (2006) have also reported on the occurrence of this phenomenon in Sesotho.

1.5.3.4 Tone

Setswana, like many Bantu languages, is described as a tonal language (Cole, 1955; Snyman *et al*., 1989). This means that differences in pitch convey differences in meaning of phonetically similar words (Cole, 1955; Krüger & Snyman, 1988; Snyman *et al*., 1989; Zerbian & Barnard, 2010). Two types of tonal values (i.e. tonemes), high [˗] and low [_] tonemes, are reported as the most significant in Setswana phonology (Cole, 1955; Krüger & Snyman, 1988; Snyman *et al*., 1989). Each of these tonemes has variants; raised, lowered, level and falling (Cole, 1955; Krüger & Snyman, 1988). Different syllables in words are therefore produced with a high or low tonal pattern (Cole, 1955; Krüger & Snyman, 1988; Snyman *et al*., 1989). For instance, '*tau*' (/t'au/ - a lion), has the low-high tone pattern [_ ˗]. Producing this word with a low-low ([_ _]), high-low ([˗ _]) or high-high ([˗ ˗]) tonal pattern would be incorrect, and the word would be meaningless (Cole, 1955). A change in the tonal pattern often results in a new word with a different meaning (Cole, 1955). For instance, the tonal pattern for the word '*gofitlha*' (/xoɸi**:**tɬ^{h}a/ - to arrive) is [_ _ _] and a rise in tone word-medially (as in this case [_ ˗ _]) results in a new word '*go**fi**tlha*' (/xo**ɸi:**tɬ^{h}a/ - to hide) (Cole, 1955). In addition, Zerbian and Barnard (2010) have reported that tone can be contrasted in every syllable in nouns, whereas such contrasts can only be made on stem-initial syllables of verbs.

1.5.3.5 Length

Production of single words and sentences is often characterised by an emphasis on a syllable or word (Cole, 1955). This is typically witnessed in the penultimate syllable of a

word produced in isolation or a word occurring at the end of a sentence (Cole, 1955). This prominence is reported as a marker of stress in a number of Bantu languages (Mosaka, 2000). Cole (1955), however, stated that this emphasis noted in the penultimate syllable marks the length of the syllable or word involved, as no significant function of stress is evident in Setswana. Similar findings on the absence of stress in Sesotho, which belongs to the same group of languages as Setswana, were reported by Demuth (2007), as well as in isiXhosa (also a Bantu language) (Van der Stouwe, 2009). Mosaka (2000) has suggested that this lengthening is also present in the initial syllable of words, as well as in syllabic consonants. Three degrees of length, involving both vowels and syllabic consonants, occur in Setswana. This includes normal or short length (often left unmarked); half length (marked as [ˑ]) and full length (marked as [:]) (Cole, 1955; Snyman *et al*., 1989). The prominence noted in the production of the penultimate syllable and final word in a sentence is marked by the full length.

1.6 Chapter summary

This chapter has introduced the study which focuses on detailing speech sound acquisition in Setswana-speaking children. Although Setswana is widely spoken in Southern Africa, there is limited research into the language and no formal assessments available for SLTs working with Setswana-speaking children. The available research into Setswana focuses on language rather than speech, and the work that has been done on speech focuses on adult phonetic inventories rather than acquisition of speech in children. The study aims to address this knowledge gap by collecting normative data from typically-developing children acquiring Setswana. This information is needed to assist SLTs working with this population in identifying children who may require intervention. Children whose speech does not develop typically are at risk for a range of difficulties, including but not limited to a communication impairment. In this chapter, a stage-based psycholinguistic model of speech development was presented which will provide a broad framework for understanding the data obtained by children of different ages. Efficacy studies which adopted the psycholinguistic approach in assessment and management were reviewed. The Setswana language and its context were introduced, together with a description of the phonology of the language. In the following chapter, I provide further detail about the research that has been carried into Sesotho speech development, a language related to Setswana, as well as speech development in Nguni languages and English.

CHAPTER 2: LITERATURE REVIEW

The previous chapter introduced Setswana and highlighted the lack of normative data available for Setswana-speaking children. This chapter aims to provide a review of research into speech acquisition in a range of other languages. Since relatively more research has been carried out with children acquiring Southern Bantu languages (Sesotho, isiXhosa and isiZulu in particular), the chapter starts with a focus on this work. Much research into children's speech development in English has taken place in many countries around the world. An overview of this work is presented, before consideration of other languages. There is much to learn from these studies of speech sound acquisition into related and other languages, both in terms of methodology and the findings as they relate to the specific languages.

2.1 Southern Bantu languages

Southern Bantu languages are a group of languages (spoken in the southern parts of the African continent) with some similarities in structure and vocabularies. They include the Shona, Venda, Sotho, Nguni, Tsonga and Chopi language families (Herbert & Bailey, 2002). A number of research studies on the acquisition of Bantu languages have been conducted in the past two decades. The main focus of this research is the morphological system, particularly nominal morphology (Gxilishe, 2008). In her review of these studies, Demuth (2003) noted similarities in how noun class prefixes, nominal agreement markers, as well as subject and object markers were acquired by children in different languages. These trends led her to propose that children speaking Bantu languages may progress through similar stages of development, specifically in the acquisition of nominal morphology. More research on speech and language acquisition has been conducted in Southern Bantu languages, in particular Sesotho, isiXhosa and isiZulu.

2.1.1 Sesotho speech sound acquisition

A number of developmental studies have been carried out in Sesotho and include investigations of both phonological and language development. The phonological studies examined segmental (e.g. consonants and vowels), as well as suprasegmental aspects (e.g. tone) of development. For the purposes of this project, only the studies reporting on phonological development will be described. The findings from these studies are summarised in Table 2.

Table 2. ***Speech sound acquisition studies in Sesotho-speaking children***

Author(s)	Study population	Areas investigated	Main findings
Demuth (1992)*	Four Sesotho-speaking children aged 2;1 – 4;7 years.	Consonant acquisition.	Most simple consonants and vowels acquired by 2;0 years. Affricates, consonant digraphs, and palatal alveolar click /!/ developing at 3;0 years. Trilled /r/ developing beyond 4;0 years.
Demuth (1993)*	One Sesotho-speaking child at ages 2;1, 2;6 and 3;0 years.	The acquisition of lexical and grammatical tone on verbs.	High and low lexical tones acquired at 2;1 years. Correct use of tone on verbs fully developed at 3;0 years.

*Longitudinal studies

Information on phonemes produced by these children was obtained from spontaneous speech samples. Research on Sesotho speech acquisition has shown that vowels and the majority of simple consonants are acquired by 2;0 years (Demuth, 1992; 2007). These findings are similar to those reported for children acquiring isiXhosa and isiZulu in that affricates and clicks are among the last sounds to be acquired by typically-developing children. These children are also able to distinguish voicing of labial and alveolar stops. Demuth (1992; 2007) has reported a full phonetic inventory at an early age of 2;6 years, with the exception of some consonants which develop at 3;0 years and beyond (e.g. the lateral affricates /tɬ/ and /ts/).

Phonological processes found in the speech of Sesotho-speaking children younger than 3;0 years include the omission of the glide /w/ when it occurs as part of a compound (e.g. /ŋw/) (Demuth, 1992; 2007). The lateral affricates /tɬ/ and /ts/ are often simplified to /t/, and the alveolar click /!/ is often produced as /k/ when occurring within a word. Aspiration is often preserved during this simplification process (Demuth, 1992; 2007). The alveolar plosive /d/ is often realised as the alveolar lateral approximant /l/ until 3;0 years (Demuth, 1992; 2007). Phonological processes occurring in children aged 3;0 years and above include the inconsistent use of labial palatalization (Demuth, 1992; 2007). The ages at which children produce speech free of phonological processes has not yet been documented. In addition, Sesotho-speaking children appear to have acquired fixed lexical tones (high and low) at 2;1 years (Demuth, 1993). They may, however, still present with overgeneralisation, using high tone on verbs with low tone. At 2;6 years, Sesotho-speaking children are often able to differentiate between high- and low-toned verbs. The correct use of tone on verbs develops fully at 3;0 years.

Setswana and Sesotho are considered mutually intelligible and share a basic vocabulary (Demuth, 2007). Setswana-speaking children are therefore likely to follow the same developmental patterns described for children acquiring Sesotho. Exceptions include the acquisition of the alveolar click /!/, which is not found in the Setswana phonetic inventory. This normative data regarding Sesotho-speaking children may therefore be used to identify speech sound difficulties in Setswana-speaking children as there are similarities between these two languages and no information is currently available on the development of Setswana phonology. Results obtained when applying this normative data to Setswana-speaking children must, however, be treated with caution. Gxilishe (2008) has emphasised that the normative data of one language cannot be used with children learning another language. This is especially important as Setswana and Sesotho are separate languages with tonal, morphophonological and syntactic differences (Demuth, 2007).

Most of the information obtained by Demuth regarding Sesotho speech development was from longitudinal studies with samples consisting of one to four children. Although the sample sizes were small, these studies provided essential information that can be used to identify children who may present with delayed speech acquisition. Longitudinal studies allow researchers to observe participants over a long period of time, thus aiding in providing a comprehensive description of the participants studied, as well as changes which may occur over time (Babbie & Mouton, 2006). Disadvantages to using this type of method of research is that participants may drop out before different phases of the study are completed, thereby leaving the researcher with inconclusive information (Babbie & Mouton, 2006). Because of the small number of children, results may not be generalisable to the entire population. Despite the shortcomings of this research method, it is clear that the studies described above provide comprehensive information on how a small set of typically-developing children acquire speech. This method of research has often been used to obtain information on the phonological skills of typically-developing children and is a useful approach in the early phases of research when very little is known about the developmental trajectory of the language (Newton & Wells, 2002; Saaristo-Helin, 2009; So & Dodd, 1995). In the longitudinal studies carried out by Demuth with Sesotho-speaking children, data on the children's phonological skills was collected by eliciting spontaneous speech samples over a ninety-eight hour period. Longitudinal studies may either elicit single words and/or connected spontaneous speech samples.

Single word samples are widely used in standardised assessment tools (e.g. the Hodson Assessment of Phonological Patterns, 3rd Edition (HAPP-3), Hodson 2004) as they offer a means of eliciting production of a large set of consonants in a relatively short space of time (Eisenberg & Hitchcock, 2010). In addition to being time-efficient, single word samples

allow the SLT to compare the child's speech production to target phonology (Hodson, Scherz & Strattman, 2002). In contrast, eliciting connected spontaneous speech samples may be time-consuming and a sufficient sample may not always be obtained as some children may be reluctant to talk (Eisenberg & Hitchcock, 2010). Some children's speech intelligibility may be severely affected, making it difficult for the clinician to identify and transcribe target words (Shriberg *et al*., 1997). Lastly, the series of phonemes, syllable structures and words may be limited as children may avoid producing words which they find challenging (Hodson *et al*., 2002). Apart from its shortcomings, this approach may be beneficial in collecting data on the speech of young children (e.g. 1;6 years) who do not yet have the vocabulary to name a set of pictures (as seen in Gxilishe, 2004; Newton & Wells, 2004; Tuomi, Gxilishe & Matomela, 2001). Both methods have been used to document the acquisition of speech in children from varying language backgrounds. For instance, studies by Dodd *et al*. (2003), Fabiano-Smith and Barlow (2010), Gangji, Pascoe & Smouse (in press), Gildersleeve-Neumann *et al*. (2008), Gildersleeve-Neumann and Wright (2010), Maphalala *et al*. (2014), and Vance, Stackhouse and Wells (2005) all used single word samples. Studies which have used connected speech samples to examine the speech of children of varying ages include those conducted by Gxilishe (2004), Newton and Wells (2002) and Tuomi *et al*. (2001). In some instances, however, both these methods are used in combination (as seen in Hua and Dodd, 2000).

Another widely used approach in phonological acquisition studies is the cross-sectional research design. This involves explaining a phenomenon (e.g. speech sound acquisition) by taking a cross-section of it (e.g. children aged 3;0 to 6;0 years) at one time (Babbie & Mouton, 2006). An advantage of using this approach is that it yields useful information in a short space of time (Cozby, 2005). Unlike a longitudinal study, however, a cross-sectional study does not allow the researcher to observe the same group of participants over an extended period of time (Cozby, 2005). Similar to longitudinal studies, sample sizes in cross-sectional studies range from a small study population (as seen in developmental studies by Bland-Stewart, 2003, whose sample consisted of 8 children, as well as Maphalala *et al*., 2014, who had 24 participants) to one with a large number of participants (e.g. studies by Dodd *et al*., 2003, with a sample of 684 participants and Hua & Dodd, 2000, with a sample of 129 children).

2.1.2 IsiXhosa and isiZulu speech sound acquisition

Research conducted on typically-developing isiXhosa- and isiZulu-speaking children has consisted of both longitudinal and cross-sectional studies. The majority of these studies

also made use of small sample sizes. They, however, provide preliminary information on phonological acquisition in these children. This information may be used as a guide by SLTs to identify isiXhosa- and isiZulu-speaking children who may have speech sound difficulties. IsiXhosa and isiZulu acquisition studies are summarised in Table 3.

Table 3. ***Speech acquisition studies in isiXhosa- (based on Pascoe and Smouse, 2012) and isiZulu-speaking children***

Author(s)	Participants	Areas investigated	Main Findings
Mowrer and Burger (1991)**	70 isiXhosa-speaking children aged 2;6 – 6;0 years.	Acquisition of consonants.	Majority of consonants acquired by 3;0 years, followed by a small set of phonemes (/j, ŋ, ʃ, s/) at 4;0 years. The last set of phonemes to emerge are clicks; the dental click /ǀ/ is the first to emerge, followed by the palatal click /ǃ/ at 2;6 years, as well as the lateral click /ǁ/ between the ages of 3;6 – 4;0 years.
Lewis (1994)**	41 isiXhosa-speaking children aged 1;6 – 5;5 years.	Acquisition of clicks.	Clicks are acquired around the ages of 3;6 – 4;0 years, with palatal clicks the first to be acquired at 3;6 years.
Tuomi *et al*. (2001)*	10 isiXhosa-speaking children aged 1;0 – 3;0 years.	Acquisition of consonant phonemes and vowels.	Vowels are acquired as early as 1;6 years. Sibilants /s/ and /z/ are acquired at 2;0 years, earlier than was previously reported. Findings are similar to Mowrer and Burger's study.
Gxilishe (2004)	10 isiXhosa-speaking children aged 1;0 – 3;0 years.	Acquisition of clicks.	Basic clicks in isiXhosa emerge between 1;0 and 1;6 years, earlier than previously reported: the dental click /ǀ/ is the first to emerge, followed by the palatal /ǃ/ and lateral /ǁ/ clicks.
Conradie, Jeggo, Purchase, Rosewall and Winfield (2011).	One isiXhosa-speaking child aged 0;11 – 1;7 years.	Acquisition of consonant phonemes and vowels.	A large set of consonants and all vowels acquired at 1;7 years. Some clicks and some of the consonants reported to be acquired after 1;7 years (e.g. /r/).
Maphalala *et al*. (2014)	24 isiXhosa-speaking children aged 3;0 – 6;0 years.	Acquisition of consonants, vowels and syllable structures.	Majority of consonants in isiXhosa phonetic inventory and all vowels acquired at 3;0 years. Large set of clicks used by 3;0 years; basic clicks /ǀ, ǃ, ǁ/ and complex articulatory combinations /ǃʰ, ǃg, ŋǃ, ŋk, ŋǁʱ/. Small set of clicks and affricates, as well as multisyllabic words (5 syllables and more) acquired after 6;0 years.
Naidoo, Van der Merwe, Groenewald and Naude (2005)	18 isiZulu-speaking children aged 3;0 – 6;2 years.	Acquisition of consonants, vowels and syllable structures.	Most consonants and all vowels acquired before 3;0 years, with the exception of consonants which continue to develop between 3;0 and 6;2 years (prenasalised plosive /nt/ and prenasalised affricate /nts/). Consistent use of words with 5 syllables and more at 4;0 years.

*Longitudinal studies **Cross-sectional studies

These studies indicate the early acquisition of vowels, a trend which has been reported for English-speaking children (Dodd *et al*., 2003). They also show that nasals, liquids, glides and plosives are among consonant phonemes which are acquired early (Maphalala *et al*.,

2014; Naidoo *et al*., 2005; Tuomi *et al*., 2001). In addition, they indicate that affricates and plosives are among the last consonants to develop in typically-developing isiXhosa- and isiZulu-speaking children (Maphalala *et al*., 2014; Naidoo *et al*., 2005). The plosives which appeared particularly difficult for these children to produce include the palatal plosive /ɟ/ and aspirated plosives /p^h, t^h, k^h, c^h/ (Maphalala *et al*., 2014), the prenasalised plosives /nt/ (Naidoo *et al*., 2005), the affricates /dʒ; $tʃ^h$/ for isiXhosa and the prenasalised affricate /nts/ for isiZulu. Although clicks were reported to be acquired late by Naidoo *et al*. (2005), they were not included in Maphalala *et al*.'s (2004) list of phonemes acquired last. This is likely the case as clicks are not used frequently in isiZulu (Naidoo *et al*., 2005) unlike in isiXhosa (Maphalala *et al*., 2014). A further difference reported to occur is that isiXhosa-speaking children acquire words with 5 syllables (e.g. *uyakrazula* – s/he is tearing) after 6;0 years while isiZulu-speaking children use words of the same length consistently at 4;0 years. These differences may be attributed to methods which were employed in eliciting speech samples. Maphalala *et al*.'s (2004) use of pictures to elicit single words provided the isiXhosa-speaking children with a limited opportunity to produce multisyllabic words. In comparison, the isiZulu-speaking children had more opportunities to produce longer words. Naidoo *et al*.'s (2005) use of connected spontaneous speech not only allowed their participants more opportunities to produce speech, but also allowed them to use words of their own choice. Although the same procedure was followed during each session (e.g. use of the same material to elicit speech), participants had control (to some extent) over the vocabulary they used during assessments. The method of eliciting spontaneous speech samples appear to be the most preferred as it was used by all (but one, Maphalala *et al*., 2014) studies documented in Table 3.

The differences noted between isiXhosa and isiZulu, although relatively minor, clearly indicate factors which SLTs need to consider when applying normative data of one language to children acquiring a different language. Furthermore, isiXhosa and isiZulu normative data can clearly not be applied to children acquiring Sotho languages (e.g. Setswana and Sesotho) due to the vast differences in the structures of these languages (e.g. frequent use of click consonants by isiXhosa speakers).

Although research into speech and language acquisition in children acquiring Sesotho, isiXhosa and isiZulu is still in its early stages, it is clear that more is known about how children acquire speech and language in these languages than in Setswana. This therefore puts these children at more of an advantage than their Setswana-speaking peers about whose typical speech acquisition very little is known. In contrast, there is a large body of research that has focused on development of English-speaking children, and this work is described in the section that follows.

2.2 English speech sound acquisition

A great deal of research has been conducted to obtain information on speech and language development in English-speaking children. SLTs working with English-speaking children with speech sound difficulties are therefore well-equipped in that information on typical and atypical development in these children is available. Access to appropriate norm-referenced standardised assessment tools allows them to conduct valid and reliable assessments. In addition to typical and atypical speech and language development, the efficacy and/or effectiveness of some intervention methods with children with speech sound delays and disorders has been investigated (e.g. Bernhardt & Major, 2005; Dodd & Bradford, 2000; Gillon, 2000; Hesketh *et al*., 2000; Pascoe *et al*., 2005). There is a fairly substantial body of work which provides evidence to support that intervention for children with speech sound difficulties works (see Williams, McLeod, & McCauley, 2010 for a review). Table 4 provides a summary of key phonological development studies conducted with children acquiring different dialects of English.

Table 4. ***Summary of studies on speech sound acquisition in English-speaking children***

Author(s)	Study population	Areas investigated	Main findings
Dodd *et al*. (2003)**	684 monolingual English-speaking British children aged 3;0 – 6;11 years.	Acquisition of consonant phonemes	Plosives /p, b, t, d, k, g/, nasals /m, n, ŋ/ and fricatives /f, v, s, z, h/ were present in children's inventories between 3;0 – 3;5 years. Last consonant phonemes acquired: /ɹ,θ,ð/. Error-free speech in children older than 6;0 years. Voicing distinctions during production of words made at 3;0 years. Stopping resolves at 3;6 years, weak syllable deletion and fronting present until 4;0 years. Deaffrication is suppressed at 4;11 years. Reduction of two consonant clusters is suppressed at 3;11 years while that of three consonant clusters persists until 4;11 years. Gliding seen until 6;0 years. Interdental fricatives /θ, ð/ mastered earlier by girls aged 5;6 years than boys of the same age.
Bland-Stewart (2003)**	8 African American English-speaking children between the ages of 2;0 and 2;11 years.	Phonetic and phonemic acquisition.	Consonants used by the study population included: all stops (/p, b, t, d, k, g/), nasals (/m, n, ŋ/), some fricatives (/s, f, v, h/) and glides (/w, j/). These phonemes; /l/, /θ/, /ʃ/, /ɟ/and /ʤ/ were frequently omitted. Phonological processes used by typically developing African American English-speaking children include deleting /m/, /n/, /ŋ/, /l/, stops and fricatives word-finally. Clusters were reduced word-initially (patterns include /sp, st, pl, gl, sl/) and word-finally (patterns include/rk, rt, rd, lz, rz/). Other clusters which were reduced are /nt, nd, nk/. Substitutions included producing interdental fricative /ð/ as alveolar plosive /d/.
Cohen and Anderson (2011)**	94 English-speaking Scottish children aged 3;1 – 4;11 years.	The nature of phonological processes in preschool-aged children.	Stopping of fricatives was absent in the children's speech. Stopping of affricates was present until 3;6 years, but occurred less frequently after 3;0 years. Palato-alveolar fronting occurred less frequently at 3;0 years, while velar fronting occurred less at 3;6 years. Reduction of obstruent+approximant clusters was seen less at 3;10 years and /s/ clusters were reduced until the age of 4;2 years.

*Longitudinal studies **Cross-linguistic studies

Although there are differences which have been documented in the speech systems of these dialects (e.g. substituting /ð/ with /d/, and deleting /ŋ/ word-finally in African American English (Bland-Stewart, 2003)), children seem to follow a similar pattern in acquiring articulatory and phonological skills. For instance, children acquire vowels early (Dodd *et al*., 2003). Plosives, nasals and glides appear earlier than fricatives, affricates, and liquids in children's speech (Bland-Stewart, 2003; Dodd *et al*., 2003). Some studies have

noted differences in typically-developing boys and girls (Dodd *et al*., 2003; Maclagan & Gillon, 2007), while others differ in their findings of the ages at which certain phonological processes may disappear. In their study, Dodd *et al*. (2003) found that children continue to reduce clusters until the age of 5;5 years while Cohen and Anderson (2011) reported cluster reduction to occur only until 4;2 years.

In her volume on speech acquisition in languages spoken globally, McLeod (2007) provides a review of studies which have investigated phonological acquisition in various dialects of English. The differences highlighted by McLeod (2007) help SLTs avoid misdiagnosing speech sound difficulties when using standardised assessment tools as children acquiring one dialect may present with some phonological patterns (e.g. African American children may continue to substitute /ð/ with /d/ (Bland-Stewart, 2003)) which may be indicative of a delay or disorder in another dialect.

Much research has focused on the acquisition of English in a range of dialects and contexts, and studies have often assumed that those children are monolingual speakers of English. However, Stow and Dodd (2003) suggest that monolingualism is rare and that many children who are acquiring English will be doing so while acquiring at least one or more languages. They have estimated that about 14.6% (177 600 of 1200 000) of children from ethnic minority groups under the age of 15 years living in the UK are likely to be referred for speech and language disorders (Stow & Dodd, 2003). This estimate is expected to be much higher in Southern Africa as multilingualism is reported to be more common than monolingualism (Mesthrie, 2002). It is therefore vital for SLTs working in this context to familiarise themselves with their clients' cultural and linguistic backgrounds (De Lamo White & Jin, 2011; Stow & Dodd, 2003). Adapting this approach in assessment may help reduce chances of misdiagnosing speech and language difficulties. It should be noted that these children may be missed or may be referred for help although they do not in actual fact require it. According to Winter (2001), lack of knowledge on multilingualism may lead to misrepresentation of children acquiring more than one language. She explained that children can either be under- or over-represented with those under-represented not receiving the therapy they need and over-represented ones receiving therapy unnecessarily (Winter, 2001). This information was taken into account during selection of target stimuli for the present study. This was achieved by employing an expert panel, which consisted of individuals who were familiar with the study population's culture and use of language (details in Chapter 3).

2.3 Speech sound acquisition in other languages

Speech sound acquisition has been investigated to varying degrees in a range of languages other than English and those described earlier in this chapter. For instance, Hua and Dodd (2000) investigated phonological acquisition in Putonghua, also known as Modern Standard Chinese. In their study, Hua and Dodd (2000) reported that the children acquired tone first, followed by syllable-final consonants, and then vowels. Consonants in the syllable-initial position are the last phonemes to be acquired (Hua & Dodd, 2000). Simple vowels are acquired as early as 1;6 years. Phonological processes affecting vowels were more evident in the youngest age groups (i.e. 1;6 – 2;0 and 2;1 – 2;6 years) than in older children (4;1 – 4;6 years). These include reducing tri- and diphthongs, as well as substitution patterns. All the twenty-one consonants occurring in the syllable-initial position were acquired by 75% of the study population by 3;6 years. Children acquiring Putonghua acquired nasals before oral phonemes, and stops were acquired before fricatives. The order in which these children acquire consonant phonemes was analysed further, with results indicating that front consonants (/p, p^h, m, f/) were acquired at roughly the same time as back consonants (/k, k^h, x, ŋ/). The three alveolo-palatal consonants were acquired as early as 2;6 years (these phonemes were used by 75% of children in this age group). Ten consonant phonemes, which are often the last to be acquired by Putonghua-speaking children, include the three retroflex sounds, the six affricates and two liquids. Lastly, Hua and Dodd (2000) reported on phonological processes which were indicative of universal tendencies (e.g. assimilation and gliding) and those which were specific to phonological characteristics of Putonghua (e.g. deaspiration processes and deletion of consonants occurring before vowels /i, u, y/ in the syllable-initial position). The Putonghua-specific phonological patterns are similar to those reported for children acquiring Cantonese (So & Dodd, 1995).

Other developmental research studies which have been documented in the literature include children acquiring one language. For example, Fox and Dodd (2001) looked into whether or not systems used to classify delayed and atypical speech sound acquisition in English-speaking children could be used in German-speaking children; Saaristo-Helin (2009) investigated phonological development in Finnish-speaking children; and So and Dodd (1995) examined phonological development in Cantonese-speaking children. Other developmental studies focused on children acquiring more than one language, e.g. Gildersleeve-Neumann *et al*. (2008) reported on phonetic and phonemic inventories of children acquiring English and Spanish; and Gildersleeve-Neumann and Wright (2010) investigated how the Russian sound system may affect English speech sound acquisition in bilingual Russian-English children.

Information on ways in which children in Africa from varying cultural backgrounds acquire speech and language is extremely limited. This is, however, slowly changing as studies by Gangji *et al*. (in press) and Saleh, Shoeib, Hegazi and Ali (2007) indicate an increased awareness of the usefulness of applying contextually relevant information to identify speech sound disorders in children. Gangji *et al*. (in press) investigated speech sound acquisition in children who speak Swahili, a Bantu language spoken in East Africa. They proposed that vowels are acquired earlier in this population as they were used accurately in children aged 3;0 years. They reported differences in acquisition of consonants between children whose first language is Swahili and those who speak English. These include acquisition of fricatives /v, ð/ and affricate /ʧ/ at 3;0 years in Swahili and between the ages of 5;0 and 7;0 years in English (Gangji *et al*., in press). Syllable simplification processes occurred less frequently in older children acquiring Swahili – children aged 3;0 years have acquired simple syllable structures while those aged 5;11 years and older continue to acquire complex syllable structures and multisyllabic words (Gangji *et al*., in press). Universal trends reported for Swahili-speaking children include reduction of clusters and deletion of weak syllables. This once again highlights the importance of treating results with caution when applying the norms of one language on individuals from a different population.

Research studies on phonological acquisition in children from varying cultural and linguistic backgrounds all indicate that the speech sound system of children is refined over time. Similarities in phoneme acquisition (e.g. early acquisition of vowels and the late acquisition of affricates) and the use of certain phonological processes across languages (e.g. gliding, reduction of clusters) is an illustration of trends which may be universal in speech acquisition processes. Cross-linguistic differences which need to be taken into account include the ages at which specific phonemes are acquired, e.g. a 5;0-year-old Swahili-speaking child's speech sound system may be considered delayed or atypical if he experiences difficulty producing the affricate /ʧ/, whereas his English-speaking peer with a similar difficulty would not. Other differences include considering whether or not the nature of phonological processes present in a child's speech are language-specific.

2.4 Summary

An overview of studies on the acquisition of Sesotho phonology was provided in this chapter. This was done as the findings of the present study may be more similar to those described in Sesotho than in other languages since they are in the same language family. Research on phonological acquisition in Nguni languages was also reviewed in order to highlight the need for similar studies in the Southern African context. This information is

important in making comparisons of speech acquisition across languages, as well as to contribute information to theories of developmental universals. The description provided on English acquisition studies, as well as speech acquisition in languages other than English, has highlighted the importance of not using norms of one population on another to make decisions on whether or not a child may have delayed or atypical speech acquisition. Similarities discussed in these studies have illustrated trends of universal developmental patterns e.g. an increase in speech intelligibility as children grow older, decrease in use of phonological processes, which results in more accurate articulation and fewer errors in their speech. The chapter that follows reviews additional models/approaches used in understanding speech sound acquisition, with a focus on applying them to classify speech sound disorders, as well as how their use in intervention programs may yield positive outcomes.

CHAPTER 3: METHODOLOGY

In this chapter, a description of the methods used in the study is provided, with an account of reasons for the selection of each. The study aims and objectives are included here. A brief explanation of the research design chosen will then follow. The selection of participants, materials used, procedures followed and analysis of data will also be described. Lastly, a discussion of how ethical considerations relevant to this study, as well as validity and reliability, were addressed will be included in this chapter.

3.1 Aim:

This study aimed to describe the speech development of typically-developing Setswana-speaking children between the ages of 3;0 and 6;0 years.

The following objectives were formulated in order to achieve the aim:

1. To describe the acquisition of consonants.
2. To describe the acquisition of vowels.
3. To describe the development of syllable structures.
4. To describe the nature of phonological processes.

3.2 Research Design

A cross-sectional research design was chosen for this study in order to explain speech acquisition in a cross-section of children during a single time frame (Babbie & Mouton, 2006). In this case, children aged 3;0 to 6;0 years were assessed. One of the advantages to using this method is that it produces useful results in a relatively short space of time (Cozby, 2005). It allowed the researcher to draw inferences regarding age as the main variable for differences in phoneme production, as noted among participants belonging to different age groups (Cozby, 2005). There are also limitations to using this method. For instance, the same age group cannot be observed over an extended period of time (Cozby, 2005). According to Dodd *et al*. (2003), normative data obtained using this method will only provide an estimation of the rate at which development occurs and the patterns it follows. This therefore means that the researcher will experience great difficulty in minimising individual differences, as this method does not allow one to keep track of each child's developmental patterns (Dodd *et al*., 2003). Despite its shortcomings, the cross-sectional research design has been widely used in developmental speech studies (Bland-Stewart, 2003; Dodd *et al*., 2003; Gangji *et al*., in press; Maphalala *et al*., 2014; Naidoo *et al*., 2005).

This study is also exploratory in nature as it was aimed at obtaining information on a relatively new subject (Babbie & Mouton, 2006): Setswana speech acquisition, which neccessitated development of a Setswana speech assessment tool to collect data since none has been developed to date.

3.3 Participants

3.3.1 Selection Criteria

The participant group consisted of thirty-six children from Hebron, in the North-West Province, South Africa. This village is situated 33.4 km outside Tshwane (Go Mapper, 2014), in the Gauteng Province. This village was specifically chosen for data collection as the researcher was acquainted with a well-respected member of the community. Kwêna is the dialect of Setswana spoken in this region. Although Setswana is the main language spoken in this area, residents are also exposed to other languages such as English, Afrikaans, Northern Sotho and isiNdebele. Exposure to English and Afrikaans is, however, limited as Hebron is considered a rural area and its residents have access to limited resources.

Participants selected were between the ages of 3;0 and 6;0 years, and had to speak Setswana as their first language. This particular age group was chosen as a substantial body of research has shown that most phonological development occurs during these preschool years (Dodd *et al*., 2003; Gildersleeve-Neumann *et al*., 2008). These participants were assigned to six groups covering different age bands of six months duration (3;0 – 3;5, 3;6 – 3;11, 4;0 – 4;5, 4;6 – 4;11, 5;0 – 5;5 and 5;6 – 5;11 years). The six monthly age bands were chosen as they follow the patterns used in other speech and language developmental studies (Dodd *et al*., 2003; Hua & Dodd, 2000; Saaristo-Helin, 2009; Tuomi *et al*., 2001). Dodd *et al*. (2003) have explained that the six monthly age bands help demonstrate the rate at which accuracy in speech production may be gradually achieved by participants of varying ages.

Children who presented with speech, language, learning and/or hearing difficulties were not included in the study group. This was done as this study was aimed at documenting the speech development of typically-developing children, and these factors would have confounded results obtained. Children who would have experienced difficulty recognising pictures as a result of visual difficulties and/or cognitive impairment were also not included in the study group. No assessments were conducted to determine the presence and/or absence of these factors. The researcher therefore relied solely on information provided by parents and educators.

3.3.2 Participant Selection Procedures

Permission to conduct the study was granted by the University of Cape Town, Faculty of Health Sciences Human Research Ethics Committee (HREC/REF: 364/2013). A request for permission to conduct research was sent to the heads of two preschools (Appendix C), both situated in Hebron. Educators were given information on the aims of the study, as well as about their roles in the research process (Appendix D). Educators at both schools helped identify potential participants, after which informed consent was obtained from their parents and legal guardians (Appendix E).

3.4 Sampling

A convenience sampling method was used for this study. This allowed the researcher to select participants who were available, willing to participate and met the selection criteria for the study group (Alasuutari, Bickman & Branen, 2009). Parents' and legal guardians' consent was regarded as their willingness to have their children take part in the study. Verbal assent (Appendix F) was obtained from all the children and used to indicate their willingness to participate in the study.

3.4.1 Sample Size

The educators at both schools identified a total of ninety potential participants, all of whom returned their informed consent forms. Twenty-two of these participants were excluded from the study as they were not Setswana first language speakers, and/or were below 3;0 years or above 6;0 years. Forty-two participants were then selected randomly from the list of those who met the criteria, ensuring an equal number of children in each age band. This was done in order to ensure a fair representation of participants of varying age groups. From these, six participants were randomly selected and assessed for the pilot study. The final number of participants who formed part of this study was therefore thirty-six. Of these thirty-six, four were excluded from the study after being assessed as they presented with either a language delay or speech difficulties. Decisions about the children's language skills were based on clinical observations, as well as guidelines provided in the literature, i.e. these children did not portray language skills similar to that of their peers at the schools. Some articulatory errors noted included a lisp, e.g. alveolar fricative /s/ was often produced as interdental /ɵ/ (a phoneme not present in the Setswana phonetic inventory). All participants excluded from the study were replaced with participants in similar age bands, therefore leaving the final number of participants unchanged. Figure 4 illustrates the different stages at

which participants were selected to form the study sample, as well as the number of potential participants remaining at each stage.

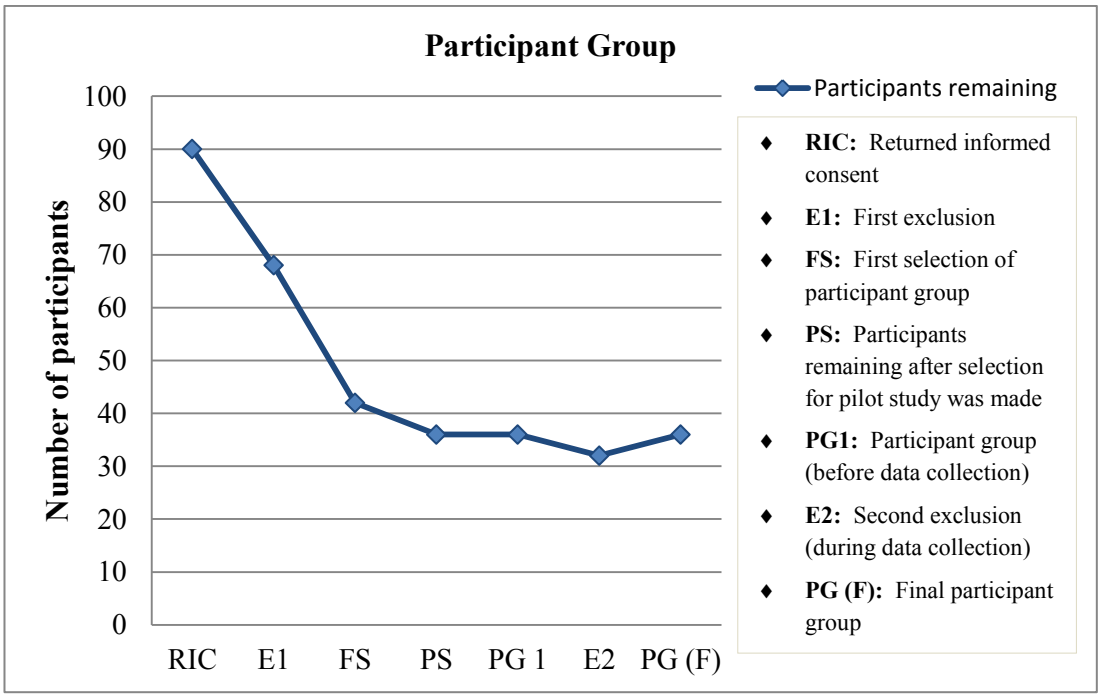


Figure 4. *The participant selection procedure.*

The sample size was small and only represented one dialect of Setswana. It was, however, affordable and practical for the researcher to carry out. Examples of research studies which have documented speech acquisition using small sample sizes were followed (Demuth, 2007; Gangji *et al*., in press; Gildersleeve-Neumann & Wright, 2010; Gildersleeve-Neumann *et al*., 2008; Maphalala *et al*., 2014; Naidoo *et al*., 2005; Saaristo-Helin, 2009; Tuomi *et al*., 2001). Results obtained from this study may produce valuable information on phonological development, as seen in studies with an even smaller sample (Demuth, 2007; Saaristo-Helin, 2009; Tuomi *et al*., 2001). This information can also be used as a starting point for collecting data, as well as for the development of a norm-referenced standardised tool to assess Setswana phonology.

3.4.2 Description of Participants

The study population consisted of fourteen (38.9%) females and twenty-two (61.1%) males. They were assigned to different age bands, with each group consisting of six participants. These groups only consisted of children for whom written consent had been obtained, who met the selection criteria, and who had given verbal assent. Gender was not

stratified, therefore girls and boys were randomly assigned to each age band. This was done as this preliminary study was not aimed at making deductions on gender as a variable for differences which may be present in the production of speech in typically-developing girls and boys. A summary of the participant group is illustrated in Figure 5.

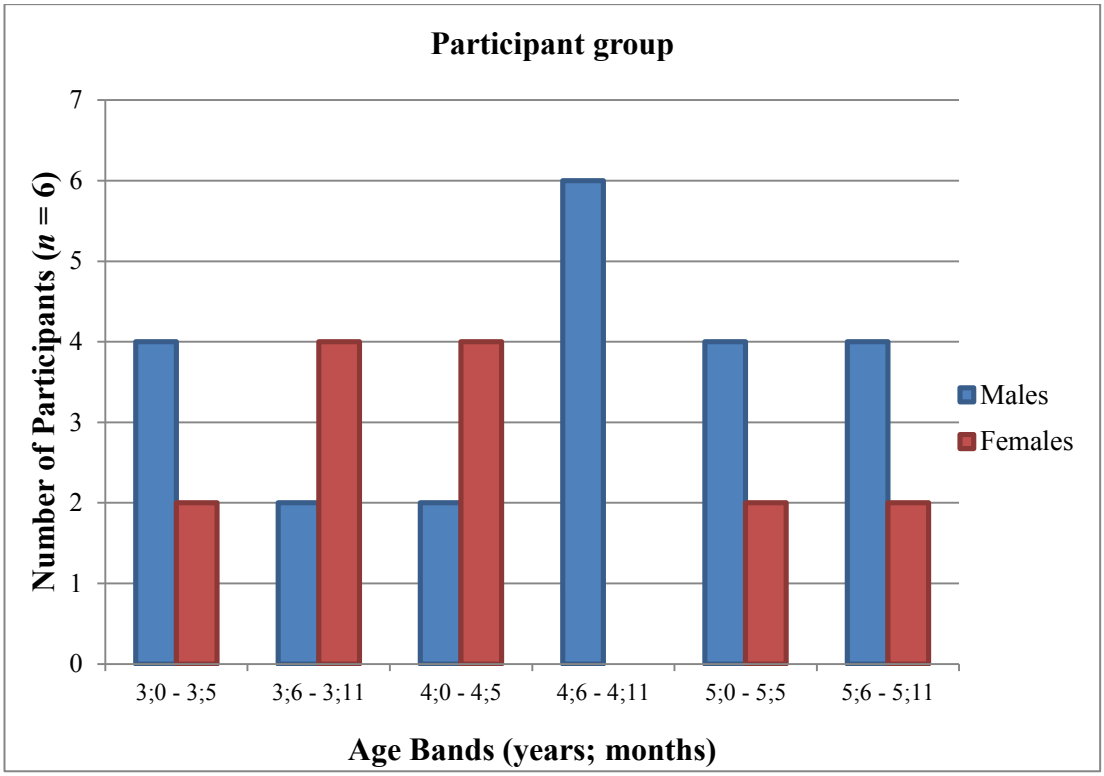


Figure 5. *The distribution of participants in different age groups.*

Table 5 consists of a list of group numbers which will be used when reporting on the findings of each age band, as well as the mean age of each group.

Table 5. ***Group numbers and mean ages, as adapted from Maphalala et al. (2014)***

Group number	**Age band (years; months)**	**Mean age (years; months)**
Group 1	3;0 – 3;5 Years	3;3 years
Group 2	3;6 – 3;11 Years	3;6 years
Group 3	4;0 – 4;5 Years	4;3 years
Group 4	4;6 – 4;11 Years	4;7 years
Group 5	5;0 – 5;5 Years	5;2 years
Group 6	5;6 – 5;11 Years	5;6 years

3.5 Materials

A case history form (Appendix G), which was adapted from Shipley and McAfee (2009), was sent to parents and legal guardians to obtain information on the participants' developmental history. This information was used to determine whether or not these participants were developing typically. This form was translated into Setswana to ensure that all parents and legal guardians understood the questions asked. A hearing assessment was not conducted and the researcher relied on information from the case history in order to make decisions on whether or not any of the children presented with hearing difficulties.

A short questionnaire (Appendix H) aimed at obtaining information on the participants' behavioural and learning patterns, was developed and given to educators. These areas were specifically targeted as they have been explained as being important when obtaining pre-assessment information from educators (Shipley & McAfee, 2009).

An oral mechanism examination form (Appendix I), which was also adapted from Shipley and McAfee (2009) was used to assess the participants' oral structures and oral motor function. This was done in order to rule out the presence of structural and/or functional factors which may influence the participants' abilities to produce intelligible speech (Shipley & McAfee, 2009).

A Setswana phonology assessment tool (Appendix J) was developed for the purposes of this study as there is no tool currently available to assess Setswana phonology. This was an important and time-consuming part of the research project, and is described in further detail in the section that follows.

3.5.1 Development of Assessment Tool

A single word picture naming assessment tool was devised for the purposes of this study. The researcher is a first language Setswana-speaker who has been working as a Speech and Language Therapist in the region and was therefore well equipped to know the types of words and pictures to select. The speech sample included single words as the majority of speech sound assessment tools target phonemes in single words and they can be used with the age group selected for this study (Goldman & Fristoe, 2000; Hodson, 2003). Single word picture naming tasks have also been widely used in research studies documenting phoneme acquisition (Dodd *et al*., 2003; Gildersleeve-Neumann & Wright, 2010; Gildersleeve-Neumann *et al*., 2008). This tool comprised one hundred and eleven target words. This was done so that forty-three consonants and one vowel were represented in the initial word position; and twenty-six consonants and six vowels were represented in

the penultimate syllable. Target phonemes were represented in the penultimate syllable as it is often lengthened during the production of single words. The word-initial position was selected as Mosaka (2000) proposed that initial syllables are also often lengthened during speech production.

The assessment tool was divided into two sections: the picture naming and word repetition tasks. Table 6 provides a summary of the structure of the target words.

Table 6. ***The structure of target words***

	Length of target words	**Syllable structures – Initial word position**	**Syllable structures – Penultimate syllable**
Picture Naming Task	• Monosyllabic = 2 (e.g. /nwa/ - drink) • Bisyllabic = 27 (e.g. /ba-la/ - read) • Tri-syllabic = 47 (e.g. /k'ɔ-lɔ-i/ - car) • 4 syllables = 14 (e.g. /se-fa-tɬ^{h}ɛ-xɔ/ - face) • 5 syllables = 2 (e.g. /se-k^{h}u-ru-mɛ-lɔ/ - lid)	• CV = 76 (e.g. /**le**xɔ:tɬ'ɔ/ - mouse) • V = 2 (e.g. /**a**p'a:ja/ - to cook) • C = 7 (e.g. /**ŋ**k'ɔ/ - nose) • CCV = 6 (e.g. /**ŋwa**na/ - baby)	• CV = 49 (e.g. /na**mɛ**:la/ - climb) • V = 5 (e.g. /dik'a**u**:su/ - socks) • C = 5 (e.g. /ts^{h}o**l**:la/ - spill) • CCV = 3 (e.g. /mo**nwa**:na/ - finger)
Word Repetition Task	• Monosyllabic = 0 • Bisyllabic = 10 • Tri-syllabic = 6 • 4 syllables = 1 • 5 syllables = 5	• CV = 9 • V = 0 • C = 2 • CCV = 11	• CV = 4 • V = 2 • C = 3 • CCV = 3

The words included in the assessment tool were ordered according to the manner in which they are produced. For the picture naming task, eighty-nine words were used to elicit phonemes in the initial word position. The word list included sixty-three nouns, twenty-two verbs and four adjectives. More than one word was used to elicit 55% of the target phonemes in the picture naming task. For instance, the words '***p**itsa*' /**p'**its'a/ (pot), '***p**anana*' /**p'**ana:na/ (banana) and '***p**ôtla*' /**p'**ɔtɬ'a/ (pocket) were used to elicit the ejective explosive /p'/ in the

word-initial position; and the words '*ta**m**ati*' /t'a**m**a:t'i/ (tomato), '*dina**m**ane*' /dina**m**a:ne/ (calves) and '*kô**m**iki*' /k'ɔ**m**i:k'i/ (cup) were used to elicit the nasal /m/ in the penultimate syllable. This was done in order to obtain a better sample of these phonemes. The multisyllabic words targeted two different phonemes, one in the initial position and one in the penultimate syllable. For instance, the word '***th**ubê**g**ile*' /**t^{h}**ubɛ**x**i:lɛ/ (broken) was used to elicit the aspirated explosive /t^{h}/ in the word-initial position, as well as the velar fricative /x/ in the penultimate syllable.

In addition to the picture naming task, a word repetition task was included. Half of the words included here are those with the CCV syllable structure in the word-initial position. The word repetition list included thirteen nouns, seven verbs and two adjectives. The phonemes targeted in this task were not included in the picture naming task as the words used to elicit them could not be represented in pictures. Some of these words were also often used by adults, rather than by children. The word repetition task was therefore compiled primarily as an attempt to determine whether or not the phonemes targeted in this task were present in the participants' consonant inventories.

A set of picture cards were used to elicit words which formed part of the picture naming task. Mayer-Johnson's Boardmaker, Windows v.6 (2011) was used to develop these pictures. This program was used as its pictures are all colourful and are specifically designed to be easily recognised by children (Rabiee, Sloper & Beresford, 2005). The size of these pictures was kept the same to ensure a standard format. Pictures selected were also checked for cultural appropriateness.

A table consisting of multisyllabic words (words with four syllables and more – Appendix K) was compiled in order to determine the accuracy with which participants of varying ages are able to produce longer words. These words were all elicited during the assessment. Information recorded in this table would therefore help clarify whether or not there is a trend in the production of long words becoming easier in older children, and whether certain phonological processes such as unmarked syllable deletion occur more in these types of words as compared to bi- and tri- syllabic words. The term '*marked*' and '*unmarked*' were used in the results section to distinguish between syllables reported to be lengthened in production of certain words and those not lengthened. This was done as '*stressed*' and '*weak syllable deletion*' could not be used since no stress occurs in Setswana phonology.

3.6 Validity of Assessment Tool

This section of the chapter focuses on the measures which were taken in an attempt to ensure that the developed assessment tool was valid.

The words selected were age appropriate for this study population. They could be visually represented in pictures and attempted to include all consonants of Setswana in the initial word position and penultimate syllable. A Setswana dictionary (Tsonope & Kgasa, 2012) was used to check the correct spelling and meaning of selected words. These words were then reviewed by an expert panel in order to determine whether or not the words chosen for the study population were appropriate. A checklist (Appendix L) was developed to ensure that words were reviewed in the same manner by the panel. More information on the review process and the panel is provided below.

3.6.1 Expert Panel Review

The panel comprised three members: two preschool educators, both of whom are Setswana first language speakers and speak the participants' dialect; and a Setswana lecturer at the Department of African Languages, University of South Africa. Although the third member is not a first language Setswana-speaker, he has a background in Linguistics, speaks Setswana fluently and is an expert in the field.

Information on the study and its aims was given to each member of the panel. The purpose and process of reviewing the selected words were then explained to the members of the panel. This was done on a one-to-one basis as the members were not all available at the same time for a group discussion. Another challenge was that the members were all in different regions, making meeting in one place difficult. All items of the checklist were explained to each member before the review process began. For instance, explaining what 'age appropriate' referred to in this context. Suggestions made by members were noted and were later compared to determine which words were deemed inappropriate by the expert panel and whether or not suggestions made were similar or related. All these comments were constantly reviewed and used as guidelines during the process of developing the assessment tool.

The list initially comprised one hundred and eighteen words. Only two words were removed from the list as all the members of the panel felt that they were not commonly used in the region's dialect and participants would therefore not be able to recognise them, as well as due to challenges encountered in representing one of the words visually. Table 7 consists of examples of comments and suggestions made by the panel, as well as steps taken.

Table 7. ***The expert panel review checklist***

Sounds Targeted	Word	Is this word appropriate for this age group?	Is this word culturally appropriate?	Is this word commonly used by Setswana speakers living in this region?	Comments	Alternative word(s)	Action taken
b	*Ôbola* (to peel)	✓	✓	✓	Some children use '*phôtlha*'	*Phôtlha*	'*Phôtlha*' was added so as to accommodate speakers who do not use '*ôbola*', as well as to determine which of the two words is used more frequently.
n, m	*Namêla* (to climb)	✓	✓	✓	Other children may use '*tana*' instead. The word need not change as it is used by the majority of speakers in the region.	Tana	'*Namêla*' was used in the assessment as it was reported to occur more frequently than '*tana*' in the region's vocabulary.
s	*Lesoba* (a hole)	✓	✓	X	Most speakers use '*phatlha*'.	*Phatlha*	'*Phatlha*' was chosen as it was the most preferred word.
j, tl	*Dijana*/ *Dikôtlôlô* (Dishes)	✓	✓	✓	Words are used interchangeably so both are accepted.		Both words were selected – they were later analysed to determine which one of them was used more frequently.
ny	*Monyakô* (a door)	✓	✓	X	Majority of the residents use the term '*mojakô*'.	*Mojakô*	'*Mojakô*' was selected as it was the term the children were likely more familiar with.
m	*Mosamêlô* (a pillow)	✓	✓	X		*Mosamô*	'*Mosamô*' was selected as it is commonly used in the dialect.
l, ngw	*Lengwalô* (a letter)	X	✓	✓		*Borifi*	'*Borifi*' was initially selected as it was the preferred term. It was later discarded due to challenges in finding a visual representation which would be easily recognised by children.
p	*Apeya* (to cook)	✓	✓	X		*Apaya*	'*Apeya*' was altered to '*apaya*'.
m	*Lemôta* (a wall)	✓	✓	X		*Lebôta*	'*Lebôta*' was selected. Although reports on the frequency

							with which it occurs in the region's dialect differed between members of the panel, the word was kept. Decisions on whether to continue using the word or to discard it would be based on responses obtained from the pilot study.
l, t	*Lepantinti* (a convict)	X	✓	X	Not able to think of alternative but certain that children will not be able to recognise the word. Not commonly used.		This word was discarded. Children would not have been familiar with this term as it is very rarely used by adults who speak the same dialect.

3.7 Procedure

3.7.1 Pilot Study

Six participants who met the selection criteria were randomly selected, from a list of children whose parents and legal guardians had given written consent, to form the pilot study group. The pilot study sample consisted of one participant from each age group. Information on the aims of the study (Appendix F) was read to participants before inviting them to participate in the study. Verbal assent was then obtained from each participant before conducting the assessments. Pictures not recognised by participants across all age groups (four to six participants) were removed from the list of target words. Words with four syllables and more which had been removed from the list of target words in the picture naming task were moved to the list that comprised the word repetition task. For instance, '*lemphorwana*' /lemp^{h}orwa:na/ (a chick) was moved to the word repetition task as all participants did not recognise the picture used to represent the word. Other words were changed (without changing their meaning) in order to match the region's dialect, e.g. '*borokgwê*' /boro:kx^{h}wɛ/ (a pair of trousers) was changed to '*borukhu*' /boru:k^{h}u/. Alternatives to some words were added as it had been noted that participants used particular words interchangeably. For instance, some participants used the word '*mogatla*' /moxa:tɬ'a/ while others used '*mosela*' /mose:la/ to refer to a tail. In addition, changes made to the stimulus sheet (Appendix M) were dependent on cues participants responded well to. It was observed that they responded to contextual cues better than they did when an initial phoneme or syllable of a word was used as a cue. For instance, all participants who experienced

difficulty identifying a picture of a boy closing the window (target word '*tswalêla*' /tsw'al:la/) responded well to: "*Pula e êtla nê, o êtsa eng ka lefenstere?*" (It's about to rain, what is he doing with the window?), as compared to: "*O a tswa-l-_*" (He is clo-_). In addition, most participants also responded to rhyming songs used in the classroom, e.g. when participants had difficulty identifying a picture of the sun, the researcher used a song sung every morning to teach them about the weather. The assessment tool was then refined accordingly.

3.8 Data Collection

Once ethics permission was obtained, and permission given by the heads of schools, educators assisted in the identification of potential participants. Informed written consent was then obtained from the participants' parents and legal guardians, who were later asked to complete case history forms. Participants' educators were asked to complete a short questionnaire. Information obtained from the children's parents and legal guardians, as well as their educators, was used to determine whether or not participants met the selection criteria.

Each participant was assigned a code to ensure that they remained anonymous (e.g. E1). The letters 'E' and 'L' each represent the first letter of the name of the schools and were used with each code as a systematic way of identifying the schools in which participants were based. The researcher read information on the study to the children in Setswana (Appendix F) before asking for their permission to take part in the study. The assessment was conducted once participants gave verbal assent. The participants' responses were all transcribed during each assessment, and audio recorded to enable the researcher to verify transcriptions made during each assessment. The researcher is a first language speaker of Setswana and an experienced Speech and Language Therapist.

A Speed-Link digital voice recorder, model PDR3, as well as a Panasonic Mini Cassette Recorder, Model RQ-L10, were used to record the assessments. The individual assessments were conducted over a period of three weeks on the school premises, and were thirty to forty-five minutes long. The assessments were carried out in a quiet classroom which had been made available to the researcher during the data collection period. Only the researcher and participant were present at each assessment. A table which was appropriate for the participants' height was used, making it easy for them to clearly see the stimulus book. The examiner explained to the participants that they would be shown pictures and asked questions relating to them. They were asked to indicate if they required help in identifying some of these pictures. It was later explained that they only needed to repeat the

words read to them in the word repetition task. They were encouraged to let the examiner know if some words were unclear and needed to be repeated. Assessments were kept short but participants were allowed to take breaks if they became distracted. Questions such as: "*Ê ke eng? Monna yô o dirang? Mama o tswallêtse pitsa ka eng fa?*" (What is this? What is this man doing? What did mom use to close the pot?") were asked to prompt participants during the picture naming task. Participants were encouraged to name these pictures spontaneously. If they were not able to do so after given cues, answers were provided to them. They were then asked to repeat the answer, following a short delay after production of these words by the researcher. Participants did not receive a reward for participating in the study, but verbal positive reinforcement was given throughout each assessment to keep them motivated.

3.9 Data Analysis

Results obtained were transcribed phonetically by the researcher and entered into tables for easy organisation of the data. These tables were later used to calculate frequencies at which different aspects of phonological acquisition in Setswana occurred. Evaluation of data made use of independent and relational analyses. Saaristo-Helin (2009) explained that these methods of analysis should be employed in a comprehensive assessment of young children's phonological skills as the variation noted in their speech production is often of significance.

In this study, independent analysis involved investigating participants' abilities to produce different target phonemes and syllable structures, irrespective of the accuracy with which participants were able to produce them (Baker, 2004). According to Saaristo-Helin (2009), information obtained using this method of analysis can be used to plan for intervention. For instance, one is often able to identify phonemes present in a child's phonetic inventory, even if these were produced in unintelligible utterances or non-real words (Saaristo-Helin, 2009). A descriptive method of analysis was employed to explain consonants according to their manner and place of production, vowels according to height and front/back dimensions, as well as syllable structures, as elicited in both the picture naming and word repetition tasks. Results obtained from the word repetition task were mainly used to determine which of the phonemes elicited are present in participants' phonetic inventories. Findings were analysed within each age group.

Relational analysis, on the other hand, involved comparing participants' production of phonemes and words to the target phonology (Baker, 2004). According to Saaristo-Helin (2009), relational analysis helps the SLT identify phonemes or syllable structures which have

been produced correctly and those produced incorrectly. She has emphasised that children's productions of words must be compared not to the standard versions but to their real targets (such as adult production), as it is what they are often exposed to (Saaristo-Helin, 2009). This method of analysis involved calculating the percentage of consonant and vowel phonemes, as well as syllable structures which were produced accurately (i.e. PCC, PVC and PPC) (Baker, 2004). This is a measurement used in clinical settings and aims to determine the degree to which a child's phonological development may be delayed (Saaristo-Helin, 2009). Phonemes were not considered errors if they were part of the dialectal variation. Information on phonological processes noted in the participants' speech was also obtained using this method.

An additional description of comparisons made across the different age groups is also provided. This was done in order to explain any developmental progression noted between the youngest and older participants.

A number of phonological acquisition studies were used as a guideline to interpret the assessment results since no information on the development of Setswana phonology is available. For instance, phonemes produced in imitation were recorded as part of participants' phonetic inventories. Dodd *et al*. (2003) describe children's abilities to imitate phonemes as an indication of their articulatory competence. A phoneme was recorded as being present in participants' consonant and vowel inventories when five of the six participants in an age group produced that phoneme at least once.

Phonemes were considered to have fully emerged when 83% of participants (i.e. 5 of 6) in a single age group were able to produce target phonemes at an accuracy rate of 66.7% (i.e. 2/3) and higher (Lewis, 1994 as cited in Tuomi *et al*., 2001). A criterion frequency is imperative when assessing the ages at which production of phonemes has stabilised since inconsistencies are often noted in children's production of speech (Hua & Dodd, 2000). Although the criterion used by Hua and Dodd (2000) differs from that used in similar studies, they also used an accuracy rating of 66.7% to determine the number of phonemes which had stabilised in their participants. A formula was applied to calculate the accuracy rate and involved dividing the number of times a phoneme or syllable was produced correctly by the number of opportunities provided for production of that phoneme (Hua & Dodd, 2000; Shriberg, Austin, Lewis, McSweeney & Wilson, 1997):

$$\text{Percentage accuracy} = \frac{\textit{the number of times a phoneme was produced accurately}}{\textit{the number of opportunities provided for production of a phoneme}}$$

(Hua & Dodd, 2000: 17)

Adaptations were made to the accuracy rate when determining which consonant phonemes had been acquired by the participants. This was done as not all consonant

phonemes could be elicited more than twice. In cases where a phoneme was sampled twice, five of the six participants in each age group had to produce the phoneme both times, and once when the phoneme was sampled only once. In addition, phonological processes present in the speech of all participants were recorded, regardless of the number of times these were produced. This was done in order to allow the researcher to hypothesise on which processes were likely to occur with a higher frequency in the speech of children younger than those who took part in this study.

3.10 Ethical Considerations

Ethics approval was obtained from the University of Cape Town, Faculty of Health Sciences Human Research Ethics Committee. Informed written consent was obtained from the heads of the two preschools. Ethical considerations pertinent to this study were upheld in a number of ways throughout the data collection process.

The principle of autonomy was upheld by informing participants, as well as their parents and legal guardians, about what the study was aimed at before speech assessments were conducted. They were also made aware that they could withdraw from the study at any stage (Declaration of Helsinki, 2008). Confidentiality and anonymity were ensured by assigning a code to each participant and keeping it separate from the list of participants' names.

In order to uphold beneficence, participants, their parents and legal guardians were made aware that they would not benefit from participating in the study (Declaration of Helsinki, 2008). Participants who presented with speech and language difficulties during the assessments were referred to an SLT at a healthcare clinic nearest to them. An information feedback session was held with educators, as well as parents of participants who had been referred for intervention.

Participants did not incur any harm while participating in the study (principle of non-maleficence; Declaration of Helsinki, 2008). All assessments were conducted on the school premises to ensure that participants were not removed from their safe environment.

Lastly, the principle of justice was adhered to as all participants who met the selection criteria were given equal opportunity to take part in this study (Cozby, 2005), and ultimately the study aims to develop resources which will benefit the population of children who speak Setswana.

3.11 Validity and Reliability

Materials used during the data collection period were adapted from a speech and language assessment manual (Shipley & McAfee, 2009). Although these materials (e.g. case history form and oral examination form) were not part of a standardised assessment tool, they have been adapted and used in other research studies of a similar nature (Gangji *et al*., in press; Maphalala *et al*., 2014). This was done in order to ensure validity of items included in these materials, since no standardised tools to assess Setswana phonology are currently available.

Two measures of validity, namely content and criterion-related validity, were applied in this study. Content validity refers to the extent to which a measure addresses all the aspects that comprise a particular concept (Babbie & Mouton, 2006). This was ensured by making use of words and pictures which are appropriate both culturally and for young children; including the majority of Setswana phonemes in a range of word positions; as well as using a standard set of pictures to elicit target words (see 3.5.1 for details on content validity as relating to this study). Criterion-related validity, also referred to as predictive validity, is explained as the degree to which a measure can be used to predict future behaviour (Cozby, 2005). In the present study, results obtained from related studies (e.g. those in Sesotho and isiXhosa) have been considered in light of findings obtained during the data collection period.

Reliability refers to the consistency of results obtained from a tool used to assess a particular subject (Babbie & Mouton, 2006). For the present study, the researcher improved reliability of phonetic transcriptions by transcribing responses three times on three separate occasions using the recordings that had been taken. This is known as intra-rater reliability (Cozby, 2005). Results were transcribed using the IPA and transcriptions were consistent on all three occasions. Edwards and Beckman (2008) mention the importance of having a first language speaker to collect and analyse data in a study of this nature. The researcher is a native Setswana speaker, thereby increasing the accuracy with which responses were transcribed. The reliability of observations made by a single individual is often questioned; therefore increasing the number of individuals during observations may improve the reliability of inferences made (Cozby, 2005). A second rater re-transcribed 25% of the data, for which an inter-rater agreement of 95% was reached. The second rater is a Speech-Language Therapist whose first language is Northern Sotho (Sepedi). The two raters re-evaluated and discussed the 5% of items for which there was disagreement. Consensus regarding which transcriptions to use was reached following this discussion. Although not a first language Setswana-speaker, the second rater is familiar with the dialect investigated in this study. This is known as inter-rater reliability (Cozby, 2005).

3.12 Summary

This chapter has focused on describing the methods that were used in the study and the rationale for their selection. The aims and objectives formulated, the research design used, as well as the process of selecting the study population were discussed. A cross-sectional research design was selected and used to document speech sound acquisition in a sample of thirty-six children who were assigned to six groups of varying age bands. This, however, could not be achieved without first compiling an assessment tool appropriate for the study population. A description of the development of the assessment tool and ensuring its validity was included as this was an important part of this research project. Procedures followed during the data collection and analysis process were discussed. In addition, this chapter focused on ways in which ethical considerations, as well as validity and reliability, were addressed during the study. Further, it is hoped that the information provided in this chapter will assist future researchers interested in this subject to replicate with ease the methods described. The findings of the study are presented in the chapter that follows.

CHAPTER 4: RESULTS

In this chapter, the findings of the study will be described and reported according to the study objectives. The study involved an analysis of the speech of Setswana-speaking children between the ages of 3;0 and 6;0 years with a focus on describing the children's acquisition of consonants, vowels, syllable structures and phonological processes in Setswana. The analysis focuses firstly on the acquisition of consonants. Each age group is considered in turn, with the second part of the section describing the changes noted across groups. Percentage Consonants Correct (PCC) data is also presented here for individual children and for each group. The second section focuses on vowels, again firstly looking at each group in turn before looking across the groups for any patterns that may be noted in acquisition. Percentage Vowels Correct (PVC) data is also provided here. Section three focuses on syllable structure development, firstly by group then for the entire sample. Data on Percentage Phonemes Correct (PPC) is documented in this section as it relates to the different syllable shapes. The final section considers phonological processes exhibited by each group and then the way in which these change over the sample from younger to older children.

4.1 Section 1: Consonants

4.1.1 Independent Analysis

Consonants produced spontaneously and in imitation were recorded as being in a child's inventory. A consonant was considered present if it was produced at least once by each of five of the six participants (i.e. 83%) in an age group. Consonants were evaluated in two different word positions, namely the word-initial position and penultimate syllable.

4.1.1.1 Group 1 (3;0 – 3;5 years)

The consonant inventory of each participant in Group 1 is summarised in Tables 8a and 8b.

Table 8a. ***Word-initial phonetic inventory: Group 1 (3;0 – 3;5 years)***

Consonants (Manner of articulation)	Child E2	Child L1	Child L2	Child L4	Child L5	Child L29
Explosives (ejective)	/pˈ/ /tˈ/ /twˈ/ /kˈ/ /kwˈ/ /tɬˈ/	/pˈ/ /tˈ/ /twˈ/ /kˈ/ /kwˈ/ /tɬˈ/	/pˈ/ /tˈ/ /kˈ/ /kwˈ/ /tɬˈ/	/pˈ/ /tˈ/ /twˈ/ /kˈ/ /kwˈ/ /tɬˈ/	/pˈ/ /tˈ/ /twˈ/ /kˈ/ /kwˈ/ /tɬˈ/	/pˈ/ /tˈ/ /twˈ/ /kˈ/ /kwˈ/ /tɬˈ/
Explosives (aspirated)	/p^h/ /t^h/ /t^{h}w/ /k^h/ /k^{h}w/ /tɬ^h/ /tɬ^{h}w/	/p^h/ /t^h/ /k^h/ /k^{h}w/ /tɬ^h/ /tɬ^{h}w/	/p^h/ /t^h/ /k^h/ /tɬ^h/	/p^h/ /t^h/ /t^{h}w/ /k^h/ /k^{h}w/ /tɬ^h/	/p^h/ /t^h/ /t^{h}w/ /k^h/ /k^{h}w/ /tɬ^h/	/p^h/ /t^h/ /k^h/ /k^{h}w/ /tɬ^h/
Explosives (voiced)	/b/ /d/	/b/ /d/	/b/ /d/	/b/ /d/	/b/ /d/	/b/ /d/
Fricatives	/s/ /sw/ /x/ /xw/ /h/ /ɸ/	/s/ /sw/ /ʃ/ /x/ /xw/ /h/ /ɸ/	/s/ /sw/ /x/ /h/ /ɸ/	/s/ /sw/ /x/ /xw/ /ɸ/	/s/ /sw/ /ʃ/ /x/ /xw/ /h/ /ɸ/	/s/ /sw/ /ʃ/ /x/ /h/ /ɸ/
Rolled vibrant/ trill						
Nasals	/m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/	/m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/	/m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/	/m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/	/m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/	/m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/
Non-fricatives (lateral)	/l/ /lw/	/l/ /lw/	/l/ /lw/	/l/ /lw/	/l/ /lw/	/l/ /lw/
Non-fricatives (medial)	/w/ /j/	/w/ /j/	/w/ /j/	/w/ /j/	/w/ /j/	/w/ /j/
Affricates (ejective)	/tsˈ/ /tswˈ/	/tsˈ/ /tswˈ/	/tsˈ/ /tswˈ/	/tsˈ/ /tswˈ/	/tsˈ/ /tswˈ/	/tsˈ/ /tswˈ/
Affricates (aspirated)	/ts^h/ /ts^{h}w/ /ʧ^h/ /kx^{h}w/	/ts^h/ /ts^{h}w/ /ʧ^h/ /kx^h/ /kx^{h}w/	/ts^h/ /ʧ^h/, /kx^{h}w/	/ts^h/ /ts^{h}w/ /ʧ^h/	/ts^h/ /ts^{h}w/ /ʧ^h/ /kxh/ /kx^{h}w/	/ts^h/ /ts^{h}w/ /ʧ^h/ /kx^{h}w/
Affricates (voiced)	/ʤ/ /ʤw/	/ʤ/ /ʤw/	/ʤ/	/ʤ/ /ʤw/	/ʤ/ /ʤw/	/ʤ/

The participants in this age group were able to produce all the voiced explosives, nasals, the lateral and medial non-fricatives (/l/ /lw/ /w/ and /j/), as well as the ejective affricates elicited. The six ejective explosives were produced by five of the participants in this age group (Child L2 produced the rounded ejective alveolar explosive /twˈ/ as rounded ejective velar explosive /kwˈ/, moving the place of articulation posteriorly). Five of the seven aspirated explosives are present in this group's inventory and were produced by five participants. The rounded aspirated phonemes (/t^{h}w/ /k^{h}w/ and /tɬ^{h}w/) appeared difficult for these participants, with only one participant, Child L2, experiencing difficulty with the rounded aspirated velar /k^{h}w/. The rounded aspirated explosives /t^{h}w/ /k^{h}w/ and /tɬ^{h}w/ were produced without rounding (i.e. /w/ was omitted). With the exception of Child E2, these

participants still omitted /w/ when models were provided to them. It was noted, however, that /w/ was produced when part of other sound class digraphs (e.g. aspirated affricates).

The fricatives /s/ /sw/ /x/ /h/ and /ɸ/ were present in the inventories of participants in Group 1 and produced by five participants (Child L4 often produced the glottal fricative /h/ as velar fricative /x/ - this substitution is a common feature in the region's dialect). Three participants (Child E2, L2 and L4) produced the pre-palatal fricative /ʃ/ as alveolar fricative /s/ and were stimulable for production of /ʃ/. The rounded velar fricative /xw/ was produced as the rounded glottal fricative /hw/ by Child L2 and L29. The aspirated affricates present in this group's inventory word-initially include the alveolar /ts^{h}/ and /ts^{h}w/, the pre-palatal /ʧ^{h}/, as well as the velar /kx^{h}w/ (Child L2 produced the alveolar /ts^{h}w/ without rounding, i.e. as /ts^{h}/, and Child L4 produced velar affricate /kx^{h}w/ as velar explosive /k^{h}w/). In addition, the voiced velar affricate /ʤ/ was produced by all participants. Only two of the participants experienced difficulties producing the rounded velar affricate /ʤw/ (e.g. Child L2 and L29 omitted the non-fricative labio-velar /w/ and produced this phoneme as /ʤ/). Both participants continued to find this phoneme challenging after models were provided to them. The trilled alveolar /r/ was not produced by participants in this age group in the word-initial position.

Table 8b. ***Penultimate syllable phonetic inventory: Group 1 (3;0 – 3;5 years)***

Consonants (Manner of articulation)	**Child E2**	**Child L1**	**Child L2**	**Child L4**	**Child L5**	**Child L29**
Explosives (ejective)	/p'/ /t'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /k'/ /tɬ'/	/p'/ /t'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /k'/ /tɬ'/
Explosives (aspirated)	/tɬ^{h}/	/tɬ^{h}/	/tɬ^{h}/	/tɬ^{h}/	/tɬ^{h}/	/tɬ^{h}/
Explosives (voiced)	/b/ /d/	/b/ /d/	/b/ /d/	/b/ /d/	/b/ /d/	/b/
Fricatives	/sw/ /x/ /ɸ/	/s/ /sw/ /x/ /ɸ/	/s/ /sw/ /x/ /ɸ/	/x/ /ɸ/	/sw/ /x/ /ɸ/	/s/ /sw/ /x/ /ɸ/
Rolled vibrant/ trill	/r/					
Nasals	/m/ /n/ /nw/ /ɲ/	/m/ /n/ /nw/ /ɲ/	/m/ /n/ /nw/ /ɲ/	/m/ /n/ /nw/ /ɲ/	/m/ /n/ /nw/ /ɲ/	/m/ /n/ /nw/ /ɲ/
Non-fricatives (lateral)	/l/	/l/	/l/	/l/	/l/	/l/
Non-fricatives (medial)	/w/	/w/	/w/	/w/	/w/	/w/
Affricates (ejective)	/ts'/ /tsw'/	/ts'/ /tsw'/	/ts'/ /tsw'/	/ts'/ /tsw'/	/ts'/ /tsw'/	/ts'/
Affricates (aspirated)	/ts^{h}w/	/ts^{h}w/ /ʧ^{h}/	/ʧ^{h}/	/ʧ^{h}/ /kx^{h}/	/ʧ^{h}/	/ʧ^{h}/

All participants produced the aspirated explosive /tɬ^{h}/, voiced explosives, nasals, lateral and medial non-fricatives /l/ /lw/ elicited in the penultimate syllable. The ejective explosives /p'/ /t'/ /k'/ and /tɬ'/ were produced by all participants in Group 1. Two participants, however, experienced difficulty producing the rounded velar ejective /kw'/ (both Child L2 and L29 produced this phoneme without rounding). The fricatives /sw/ /x/ and /ɸ/ were produced by all the participants. The alveolar fricative /s/ was not produced by three of the participants in this group as the words they produced did not match the target words, e.g. '*mo**s**ela*' /mo**s**e:la/ - a tail and '*mo**s**amô*'/mo**s**a:mɔ/ - a pillow, were sometimes produced as '*mogatla*' /moxa:tɬ'a/ and '*mosamêlô*' /mosamɛ:lɔ/ respectively. These participants' answers were recorded because the words they produced are often used by speakers of this dialect. These participants were, however, stimulable for production of the target words. In addition, the rounded alveolar fricative /sw/ was produced as velar ejective affricate /tsw'/ (rounding and place of articulation was maintained). The ejective alveolar affricates /ts'/ and /tsw'/ were both present in the group's inventory in the penultimate syllable (only one participant, Child L29, produced the alveolar affricate /tsw'/ without rounding). The aspirated pre-palatal affricate /ʧ^{h}/ is present in the inventory of this group in the penultimate syllable. Neither the

rounded aspirated alveolar /ts^{h}w/ nor the velar /kx^{h}/ affricates were present in this group's inventory. The aspirated alveolar affricate /ts^{h}w/ was often produced as the ejective alveolar affricate /tsw'/ (i.e. without aspiration), as is the case for many speakers of this dialect. The aspirated velar affricate /kx^{h}/, by contrast, was produced without any friction (i.e. as aspirated velar explosive /k^{h}/) and is also seen in the speech of many adult speakers in the region. In addition, the alveolar trill /r/ was not present in participants' inventories, Child E2 being the axception.

4.1.1.2 Group 2 (3;6 – 3;11 years)

The word-initial consonant inventory of each participant in Group 2 is summarised in Table 9a.

Table 9a. ***Word-initial phonetic inventory: Group 2 (3;6 – 3;11 years)***

Consonants (Manner of articulation)	Child E4	Child E5	Child E6	Child E7	Child L6	Child L7
Explosives (ejective)	/p'/ /t'/ /tw'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /tw'/ /k'/ /kw'/	/p'/ /t'/ /tw'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /tw'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /tw'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /tw'/ /k'/ /kw'/ /tɬ'/
Explosives (aspirated)	/p^h/ /t^h/ /t^{h}w/ /k^h/ /k^{h}w/ /tɬ^h/ /tɬ^{h}w/	/p^h/ /t^h/ /t^{h}w/ /k^h/ /k^{h}w/ /tɬ^h/ /tɬ^{h}w/	/p^h/ /t^h/ /t^{h}w/ /k^h/ /k^{h}w/ /tɬ^h/ /tɬ^{h}w/	/p^h/ /t^h/ /t^{h}w/ /k^h/ /k^{h}w//tɬ^h/	/p^h/ /t^h/ /k^h/ /k^{h}w/ /tɬ^h/ /tɬ^{h}w/	/p^h/ /t^h/ /t^{h}w/ /k^h/ /k^{h}w/ /tɬ^h/ /tɬ^{h}w/
Explosives (voiced)	/b/ /d/	/b/ /d/	/b/ /d/	/b/ /d/	/b/ /d/	/b/ /d/
Fricatives	/s/ /sw/ /x/ /xw/ /ɸ/	/s/ /sw/ /ʃ/ /x/ /xw/ /h/ /ɸ/	/s/ /sw/ /ʃ/ /x/ /xw/ /ɸ/	/s/ /sw/ /ʃ/ /x/ /ɸ/	/s/ /sw/ /ʃ/ /x/ /xw/ /h/ /ɸ/	/s/ /sw/ /ʃ/ /x/ /xw/ /h/ /ɸ/
Rolled vibrant/ trill		/r/				/r/ /rw/
Nasals	/m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/	/m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/	/m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/	/m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/	/m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/	/m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/
Non-fricatives (lateral)	/l/ /lw/	/l/ /lw/	/l/ /lw/	/l/ /lw/	/l/ /lw/	/l/ /lw/
Non-fricatives (medial)	/w/ /j/	/w/ /j/	/w/ /j/	/w/ /j/	/w/ /j/	/w/ /j/
Affricates (ejective)	/ts'/ /tsw'/	/ts'/ /tsw'/	/ts'/ /tsw'/	/ts'/ /tsw'/	/ts'/ /tsw'/	/ts'/ /tsw'/
Affricates (aspirated)	/ts^h/ ts^{h}w/ /ʧ^h/ /kx^h/ /kx^{h}w/	/ts^h/ /ts^{h}w/ /ʧ^h/ /kx^{h}w/	/ts^h/ /ts^{h}w/ /ʧ^h/ /kx^h/	/ts^h/ /ts^{h}w/ /ʧ^h/ /kx^h/ /kx^{h}w/	/ts^h/ /ts^{h}w/ /ʧ^h/ /kx^{h}w/	/ts^h/ /ts^{h}w/ /ʧ^h/ /kx^h/
Affricates (voiced)	/ʤ/ /ʤw/	/ʤ/ /ʤw/	/ʤ/ /ʤw/	/ʤ/ /ʤw/	/ʤ/ /ʤw/	/ʤ/ /ʤw/

The ejective explosives are present in the inventory of this age group. The ejective lateral alveolar explosive /tɬ'/ was not produced by Child E5, not because the participant was not able to produce it, but because his answer did not match the target word (e.g. the picture used to elicit '***tl****ola*' /**tɬ'**ola/ - to jump, was produced as '*shiana*' /ʃia:na/ - to run). This participant was stimulable for the correct production of the target word and phoneme. The aspirated lateral alveolar explosive /tɬ^{h}w/ was produced as aspirated medial alveolar explosive /t^{h}w/ by Child E5, who was able to produce the target phoneme when prompted. The voiced explosives, fricatives, nasals, lateral and medial non-fricatives, ejective affricates and voiced affricates are all present in this group's inventory. The glottal fricative /h/ was produced as velar fricative /x/ by two participants (Child E4 and E7). Only two participants (Child E5 and L7) produced the alveolar trill /r/, and Child L7 produced the rounded trill

/rw/. The aspirated velar affricates /kx^{h}/ and /kx^{h}w/ were the only phonemes absent in all the participants' inventories. As mentioned earlier, these phonemes are often produced without friction (i.e. they are produced as aspirated velar explosive /k^{h}/ and /k^{h}w/ respectively).

The penultimate syllable consonant inventory of each participant in Group 2 is summarised in Table 9b.

Table 9b. ***Penultimate syllable phonetic inventory: Group 2 (3;6 – 3;11 years)***

Consonants (Manner of articulation)	**Child E4**	**Child E5**	**Child E6**	**Child E7**	**Child L6**	**Child L7**
Explosives (ejective)	/p'/ /t'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /k'/ /tɬ'/	/p'/ /t'/ /k'/ /kw'/ /tɬ'/
Explosives (aspirated)	/tɬ^{h}/	/tɬ^{h}/	/tɬ^{h}/	/tɬ^{h}/	/tɬ^{h}/	/tɬ^{h}/
Explosives (voiced)	/b/ /d/	/b/ /d/	/b/ /d/	/b/ /d/	/b/ /d/	/b/ /d/
Fricatives	/s/ /sw/ /x/ /ɸ/	/sw/ /x/ /ɸ/	/sw/ /x/ /ɸ/	/sw/ /x/ /ɸ/	/s/ /sw/ /x/ /ɸ/	/sw/ /x/ /ɸ/
Rolled vibrant/ trill		/r/ /rw/				/r/
Nasals	/m/ /n/ /nw/ /ɲ/	/m/ /n/ /nw/ /ɲ/	/m/ /n/ /nw/ /ɲ/	/m/ /n/ /nw/ /ɲ/	/m/ /n/ /nw/ /ɲ/	/m/ /n/ /nw/ /ɲ/
Non-fricatives (lateral)	/l/	/l/	/l/	/l/	/l/	/l/
Non-fricatives (medial)	/w/	/w/	/w/	/w/	/w/	/w/
Affricates (ejective)	/ts'/ /tsw'/	/ts'/ /tsw'/	/ts'/	/ts'/ /tsw'/	/ts'/ /tsw'/	/ts'/ /tsw'/
Affricates (aspirated)	/ʧ^{h}/ /kx^{h}/	/ʧ^{h}/	/ts^{h}w/ /ʧ^{h}/	/ʧ^{h}/	/ʧ^{h}/	/ʧ^{h}/

All phonemes elicited in the assessment in the penultimate syllable are present in Group 2's inventory. Although Child L6 does not have the round velar ejective /kw'/ in his inventory, he was stimulable for correct production. The word used to sample /kw'/ in the penultimate syllable was not present in this participant's vocabulary (e.g. while most participants produced '*dikwae**kw**ae*' /dikw'ae**kw**'a:e/ - a type of shoe, Child L6 used the word '*ditlhako*' /ditɬha:k'o/ - shoes/). The alveolar fricative /s/ was not produced by some of these participants as the words which they produced, although part of their dialect, did not have the target phoneme in the penultimate syllable. This was highlighted in the description of Group 1's phonetic inventory. The alveolar trill /r/ was produced by Child E5 and L7, with Child E5 producing the rounded alveolar trill /rw/ too. Participants in Group 2 also produced the

aspirated alveolar affricate /ts^{h}w/ with no aspiration (i.e. as ejective alveolar /tsw'), and the aspirated velar affricate was produced with no friction (i.e. as aspirated velar explosive /k^{h}/).

4.1.1.3 Group 3 (4;0 – 4;5 years)

The word-initial consonant inventory of each participant in Group 3 is summarised in Table 10a.

Table 10a. ***Word-initial phonetic inventory: Group 3 (4;0 – 4;5 years)***

Consonants (Manner of articulation)	**Child E10**	**Child E11**	**Child L8**	**Child L9**	**Child L10**	**Child L32**
Explosives (ejective)	/p'/ /t'/ /tw'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /tw'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /tw'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /tw'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /tw'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /tw'/ /k'/ /kw'/ /tɬ'/
Explosives (aspirated)	/p^{h}/ /t^{h}/ /t^{h}w/ /k^{h}/ /k^{h}w/ /tɬ^{h}/ /tɬ^{h}w/	/p^{h}/ /t^{h}/ /t^{h}w/ /k^{h}/ /k^{h}w/ /tɬ^{h}/ /tɬ^{h}w/	/p^{h}/ /t^{h}/ /k^{h}/ /k^{h}w/ /tɬ^{h}/ /tɬ^{h}w/	/p^{h}/ /t^{h}/ /t^{h}w/ /k^{h}/ /k^{h}w/ /tɬ^{h}/ /tɬ^{h}w/	/p^{h}/ /t^{h}/ /t^{h}w/ /k^{h}/ /k^{h}w/ /tɬ^{h}/ /tɬ^{h}w/	/p^{h}/ /t^{h}/ /t^{h}w/ /k^{h}/ /k^{h}w/ /tɬ^{h}/ /tɬ^{h}w/
Explosives (voiced)	/b/ /d/	/b/ /d/	/b/ /d/	/b/ /d/	/b/ /d/	/b/ /d/
Fricatives	/s/ /sw/ /ʃ/ /x/ /xw/ /h/ /ɸ/	/s/ /sw/ /ʃ/ /x/ /xw/ /h/ /ɸ/	/s/ /sw/ /ʃ/ /x/ /xw/ /h/ /ɸ/	/s/ /sw/ /ʃ/ /x/ /xw/ /h/ /ɸ/	/s/ /sw/ /ʃ/ /xw/ /h/ /ɸ/	/s/ /sw/ /ʃ/ /xw/ /h/ /ɸ/
Rolled vibrant/ trill	/r/	/r/ /rw/		/r/		
Nasals	/m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/	/m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/	/m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/	/m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/	/m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/	/m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/
Non-fricatives (lateral)	/l/ /lw/	/l/ /lw/	/l/ /lw/	/l/ /lw/	/l/ /lw/	/l/ /lw/
Non-fricatives (medial)	/w/ /j/	/w/ /j/	/w/ /j/	/w/ /j/	/w/ /j/	/w/ /j/
Affricates (ejective)	/ts'/ /tsw'/	/ts'/ /tsw'/	/ts'/ /tsw'/	/ts'/ /tsw'/	/ts'/ /tsw'/	/ts'/ /tsw'/
Affricates (aspirated)	/ts^{h}/ /ts^{h}w/ /ʧ^{h}/ /kx^{h}w/	/ts^{h}/ /ts^{h}w/ /ʧ^{h}/ /kx^{h}/ /kx^{h}w/	/ts^{h}/ /ts^{h}w/ /ʧ^{h}/ /kx^{h}/	/ts^{h}/ /ts^{h}w/ /ʧ^{h}/ /kx^{h}/ /kx^{h}w/	/ts^{h}/ /ts^{h}w/ /ʧ^{h}/ /kx^{h}/ /kx^{h}w/	/ts^{h}/ /ts^{h}w/ /ʧ^{h}/ /kx^{h}w/
Affricates (voiced)	/ʤ/ /ʤw/	/ʤ/ /ʤw/	/ʤ/ /ʤw/	/ʤ/ /ʤw/	/ʤ/ /ʤw/	/ʤ/ /ʤw/

All consonant phonemes (except the alveolar trills /r/ and /rw/) elicited in the word-initial position were present in this age group's inventory. One participant (Child L8) produced the rounded alveolar explosive /t^{h}w/ as /t^{h}/ (i.e. unrounded) and was not stimulable for correct production of the target phoneme. The velar fricative /x/ was produced as glottal fricative /h/ by Child L10 and L32. The alveolar trill /r/ was produced by three participants,

and only one participant (Child E11) produced the rounded alveolar trill /rw/. Similar to other age groups and those still to be discussed, the velar affricates /kx^{h}/ and /kx^{h}w/ were produced as velar explosives /k^{h}/ and /k^{h}w/.

The penultimate syllable consonant inventory of each participant in Group 3 is summarised in Table 10b.

Table 10b. ***Penultimate syllable phonetic inventory: Group 3 (4;0 – 4;5) years***

Consonants (Manner of articulation)	**Child E10**	**Child E11**	**Child L8**	**Child L9**	**Child L10**	**Child L32**
Explosives (ejective)	/p'/ /t'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /k'/ /tɬ'/	/p'/ /t'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /k'/ /kw'/ /tɬ'/
Explosives (aspirated)	/tɬ^{h}/	/tɬ^{h}/	/tɬ^{h}/	/tɬ^{h}/	/tɬ^{h}/	/tɬ^{h}/
Explosives (voiced)	/b/ /d/	/b/ /d/	/b/ /d/	/b/ /d/	/b/ /d/	/b/ /d/
Fricatives	/s/ /x/ /ɸ/	/s/ /x/ /ɸ/	/s/ /sw/ /x/ /ɸ/	/s/ /sw/ /x/ /ɸ/	/s/ /sw/ /x/ /ɸ/	/s/ /sw/ /ɸ/
Rolled vibrant/ trill	/r/ /rw/	/r/ /rw/		/r/		
Nasals	/m/ /n/ /nw/ /ɲ/	/m/ /n/ /nw/ /ɲ/	/m/ /n/ /nw/ /ɲ/	/m/ /n/ /nw/ /ɲ/	/m/ /n/ /nw/ /ɲ/	/m/ /n/ /nw/ /ɲ/
Non-fricatives (lateral)	/l/	/l/	/l/	/l/	/l/	/l/
Non-fricatives (medial)	/w/	/w/	/w/	/w/	/w/	/w/
Affricates (ejective)	/ts'/ /tsw'/	/ts'/ /tsw'/	/ts'/ /tsw'/	/ts'/ /tsw'/	/ts'/ /tsw'/	/ts'/ /tsw'/
Affricates (aspirated)	/ʧ^{h}/	/ʧ^{h}/	/ts^{h}w/ /ʧ^{h}/	/ts^{h}w/ /ʧ^{h}/	/ts^{h}w/ /ʧ^{h}/	/ʧ^{h}/

The velar fricative /x/ was produced as glottal fricative /h/ by Child L32, and round alveolar fricative /sw/ was not present in the inventories of two participants, who both produced words different to the target. E.g. the target word was '*le**sw**ana*' /le**sw**a:na/ - a spoon, and Child E10 and E11 labelled the picture as '*lêpola*' /lɛp'o:la/, which has the same meaning. Both these participants were stimulable for production of this phoneme. Three participants produced the alveolar trill /r/ and two produced the round trill /rw/. The round aspirated alveolar affricate /ts^{h}w/ was produced as an ejective affricate /tsw'/ (place of articulation was maintained). The aspirated velar affricates /kx^{h}/ and /kx^{h}w/ were produced without friction (i.e. as aspirated velar explosives /k^{h}/ and /k^{h}w/), even when participants

were prompted to produce the target phonemes. In addition to those discussed above, all consonants are present in this group's inventory.

4.1.1.4 Group 4 (4;6 – 4;11 years)

The word-initial consonant inventory of each participant in Group 4 is summarised in Table 11a.

Table 11a. ***Word-initial phonetic inventory: Group 4(4;6 – 4;11 years)***

Consonants (Manner of articulation)	**Child E13**	**Child L11**	**Child L12**	**Child L13**	**Child L14**	**Child L30**
Explosives (ejective)	/p'/ /t'/ /tw'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /tw'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /tw'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /tw'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /tw'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /tw'/ /k'/ /kw'/ /tɬ'/
Explosives (aspirated)	/p^h/ /t^h/ /t^{h}w/ /k^h/ /k^{h}w/ /tɬ^h/ /tɬ^{h}w/	/p^h/ /t^h/ /t^{h}w/ /k^h/ /k^{h}w/ /tɬ^h/ /tɬ^{h}w/	/p^h/ /t^h/ /t^{h}w/ /k^h/ /k^{h}w/ /tɬ^h/	/p^h/ /t^h/ /t^{h}w/ /k^h/ /k^{h}w/ /tɬ^h/ /tɬ^{h}w/	/p^h/ /t^h/ /t^{h}w/ /k^h/ /k^{h}w/ /tɬ^h/ /tɬ^{h}w/	/p^h/ /t^h/ /t^{h}w/ /k^h/ /k^{h}w/ /tɬ^h/ /tɬ^{h}w/
Explosives (voiced)	/b/ /d/	/b/ /d/	/b/ /d/	/b/ /d/	/b/ /d/	/b/ /d/
Fricatives	/s/ /sw/ /ʃ/ /x/ /xw/ /ɸ/	/s/ /sw/ /ʃ/ /x/ /xw/ /h/ /ɸ/	/s/ /sw/ /ʃ/ /x/ /xw/ /ɸ/	/s/ /sw/ /ʃ/ /x/ /xw/ /h/ /ɸ/	/s/ /sw/ /ʃ/ /x/ /xw/ /h/ /ɸ/	/s/ /sw/ /ʃ/ /x/ /xw/ /h/ /ɸ/
Rolled vibrant/ trill	/r/	/r/ /rw/		/r/ /rw/	/r/ /rw/	/r/ /rw/
Nasals	/m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/	/m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/	/m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/	/m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/	/m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/	/m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/
Non-fricatives (lateral)	/l/ /lw/	/l/ /lw/	/l/ /lw/	/l/ /lw/	/l/ /lw/	/l/ /lw/
Non-fricatives (medial)	/w/ /j/	/w/ /j/	/w/ /j/	/w/ /j/	/w/ /j/	/w/ /j/
Affricates (ejective)	/ts'/ tsw'/	/ts'/ tsw'/	/ts'/ tsw'/	/ts'/ tsw'/	/ts'/ tsw'/	/ts'/ tsw'/
Affricates (aspirated)	/ts^h/ /ts^{h}w/ /ʧ^h/ /kx^h/ /kx^{h}w/	/ts^h/ /ts^{h}w/ /ʧ^h/	/ts^h/ /ts^{h}w/ /ʧ^h/ /kx^{h}w/	/ts^h/ /ts^{h}w/ /ʧ^h/ /kx^h/ /kx^{h}w/	/ts^h/ /ts^{h}w/ /ʧ^h/ /kx^h/	/ts^h/ /ts^{h}w/ /ʧ^h/ /kx^h/
Affricates (voiced)	/ʤ/ /ʤw/	/ʤ/ /ʤw/	/ʤ/ /ʤw/	/ʤ/ /ʤw/	/ʤ/ /ʤw/	/ʤ/ /ʤw/

All consonants, except the rounded alveolar trill /rw/ were present in the inventory of this age group. Phonemes missing in Group 4's inventory are those which occur as features of the region's dialect. For instance, the velar affricate /x/ was produced as glottal fricative /h/ by some participants, while the velar affricates /kx^h/ and /kx^{h}w/ were produced as

aspirated velar explosives /k^{h}/ and k^{h}w/. The aspirated lateral alveolar explosive /tɬ^{h}w/ was produced as the medial alveolar explosive /t^{h}w/ by Child L12, who was not able to produce the correct target when prompted. In addition, only four participants in this age group had the round alveolar trill /rw/ in their inventories.

The penultimate syllable consonant inventory of each participant in Group 4 is summarised in Table 11b.

Table 11b. ***Penultimate syllable phonetic inventory: Group 4 (4;6 – 4;11 years)***

Consonants (Manner of articulation)	**Child E13**	**Child L11**	**Child L12**	**Child L13**	**Child L14**	**Child L30**
Explosives (ejective)	/p'/ /t'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /k'/ /tɬ'/	/p'/ /t'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /k'/ /kw'/ /tɬ'/
Explosives (aspirated)	/tɬ^{h}/	/tɬ^{h}/	/tɬ^{h}/	/tɬ^{h}/	/tɬ^{h}/	/tɬ^{h}/
Explosives (voiced)	/b/ /d/	/b/ /d/	/b/ /d/	/b/	/b/ /d/	/b/ /d/
Fricatives	/s/ /x/ /ɸ/	/s/ /sw/ /x/ /ɸ/	/s/ /sw/ /x/ /ɸ/	/s/ /sw/ /x/ /ɸ/	/s/ /sw/ /x/ /ɸ/	/s/ /sw/ /x/ /ɸ/
Rolled vibrant/ trill	/rw/	/r/ /rw/		/r/ /rw/	/r/ /rw	/r/ /rw/
Nasals	/m/ /n/ /nw/ /ɲ/	/m/ /n/ /nw/ /ɲ/	/m/ /n/ /nw/ /ɲ/	/m/ /n/ /nw/ /ɲ/	/m/ /n/ /nw/ /ɲ/	/m/ /n/ /nw/ /ɲ/
Non-fricatives (lateral)	/l/	/l/	/l/	/l/	/l/	/l/
Non-fricatives (medial)	/w/	/w/	/w/	/w/	/w/	/w/
Affricates (ejective)	/ts'/ /tsw'/	/ts'/ /tsw'/	/ts'/ /tsw'/	/ts'/ /tsw'/	/ts'/ /tsw'/	/ts'/ /tsw'/
Affricates (aspirated)	/ts^{h}w/ /ʧ^{h}/	/ʧ^{h}/	/ʧ^{h}/ /kx^{h}/	/ʧ^{h}/	/ts^{h}w/ /ʧ^{h}/	/ts^{h}w/ /ʧ^{h}/

The majority of consonants were produced in the penultimate syllable by participants in Group 4. The alveolar trill /r/ is not in this group's inventory and was produced by four participants. Only one participant, Child L12, did not produce the round alveolar trill /rw/. The round alveolar fricative /sw/ was produced as /fj/ by Child E11. Child L12 was stimulable for production of the round velar ejective /kw'/ and produced a word which did not match the target (e.g. the child produced '*ditlhako*' /ditɬ^{h}a:k'o/ - shoes and the target was '*dikwae**kw**ae*' /dikw'ae**kw'**a:e/ - a type of shoe). In addition, three participants produced the aspirated alveolar affricate /ts^{h}w/ and the velar affricates /kx^{h}/ and /kx^{h}w/ were produced without friction (i.e. as /k^{h}/ and /k^{h}w/).

4.1.1.5 Group 5 (5;0 – 5;5 years)

The word-initial consonant inventory of each participant in Group5 is summarised in Table 12a.

Table 12a. ***Word-initial phonetic inventory: Group 5 (5;0 – 5;5 years)***

Consonants (Manner of articulation)	Child L15	Child L17	Child L18	Child L20	Child L21	Child L33
Explosives (ejective)	/p'/ /t'/ /tw'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /tw'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /tw'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /tw'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /tw'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /tw'/ /k'/ /kw'/ /tɬ'/
Explosives (aspirated)	/pʰ/ /tʰ/ /tʰw/ /kʰ/ /kʰw/ /tɬʰ/ /tɬʰw/	/pʰ/ /tʰ/ /tʰw/ /kʰ/ /kʰw/ /tɬʰ/ /tɬʰw/	/pʰ/ /tʰ/ /tʰw/ /kʰ/ /kʰw/ /tɬʰ/ /tɬʰw/	/pʰ/ /tʰ/ /tʰw/ /kʰ/ /kʰw/ /tɬʰ/ /tɬʰw/	/pʰ/ /tʰ/ /tʰw/ /kʰ/ /kʰw/ /tɬʰ/ /tɬʰw/	/pʰ/ /tʰ/ /tʰw/ /kʰ/ /kʰw/ /tɬʰ/ /tɬʰw/
Explosives (voiced)	/b/ /d/	/b/ /d/	/b/ /d/	/b/ /d/	/b/ /d/	/b/ /d/
Fricatives	/s/ /sw/ /ʃ/ /x/ /xw/ /h/ /ɸ/	/s/ /sw/ /ʃ/ /x/ /xw/ /h/ /ɸ/	/s/ /sw/ /ʃ/ /x/ /xw/ /h/ /ɸ/	/s/ /sw/ /ʃ/ /x/ /xw/ /h/ /ɸ/	/s/ /sw/ /ʃ/ /xw/ /h/ /ɸ/	/s/ /sw/ /x/ /xw/ /h/ /ɸ/
Rolled vibrant/ trill		/r/ /rw/				/r/
Nasals	/m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/	/m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/	/m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/	/m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/	/m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/	/m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/
Non-fricatives (lateral)	/l/ /lw/	/l/ /lw/	/l/ /lw/	/l/ /lw/	/l/ /lw/	/l/ /lw/
Non-fricatives (medial)	/w/ /j/	/w/ /j/	/w/ /j/	/w/ /j/	/w/ /j/	/w/ /j/
Affricates (ejective)	/ts'/ /tsw'/	/ts'/ /tsw'/	/ts'/	/ts'/ /tsw'/	/ts'/ /tsw'/	/ts'/ /tsw'/
Affricates (aspirated)	/tsʰ/ /tsʰw/ /ʧʰ/	/tsʰ/ /tsʰw/ /ʧʰ/ /kxʰ/ /kxʰw/	/tsʰ/ /tsʰw/ /ʧʰ/	/tsʰ/ /tsʰw/ /ʧʰ/ /kxʰ/ /kxʰw/	/tsʰ/ /tsʰw/ /ʧʰ/	/tsʰ/ /tsʰw/ /ʧʰ/
Affricates (voiced)	/ʤ/ /ʤw/	/ʤ/ /ʤw/	/ʤ/ /ʤw/	/ʤ/ /ʤw/	/ʤ/ /ʤw/	/ʤ/ /ʤw/

Participants in this age group collectively have all the consonants in their word-initial inventory. Exceptions include the trilled alveolar /r/, which was produced by two participants and the round trill /rw/, which was produced by one participant (Child L17). The palatal fricative /ʃ/ was produced as alveolar fricative /s/ by Child L33. Child L21 produced the velar fricative /x/ as glottal fricative /h/. In addition, the aspirated affricates /kxʰ/ and /kxʰw/ were produced with no friction (i.e. as aspirated velar explosive /kʰ/ and /kʰw/ respectively).

The penultimate syllable consonant inventory of each participant in Group 5 is summarised in Table 12b.

Table 12b. ***Penultimate syllable phonetic inventory: Group 5 (5;0 – 5;5 years)***

Consonants (Manner of articulation)	**Child L15**	**Child L17**	**Child L18**	**Child L20**	**Child L21**	**Child L33**
Explosives (ejective)	/p'/ /t'/ /k'/ /tɬ'/	/p'/ /t'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /k'/ /kw'/ /tɬ'/	/p'/ /k'/ /tɬ'/	/p'/ /t'/ /k'/ /kw'/ /tɬ'/
Explosives (aspirated)	/tɬ^{h}/	/tɬ^{h}/	/tɬ^{h}/	/tɬ^{h}/	/tɬ^{h}/	/tɬ^{h}/
Explosives (voiced)	/b/ /d/	/b/ /d/	/b/ /d/	/b/ /d/	/b/ /d/	/b/ /d/
Fricatives	/s/ /sw/ /x/ /ɸ/	/s/ /sw/ /x/ /ɸ/	/s/ /sw/ /x/ /ɸ/	/s/ /sw/ /x/ /ɸ/	/s/ /sw/ /ɸ/	/s/ /sw/ /x/ /ɸ/
Rolled vibrant/ trill		/r/				/r/
Nasals	/m/ /n/ /nw/ /ɲ/	/m/ /n/ /nw/ /ɲ/	/m/ /n/ /nw/ /ɲ/	/m/ /n/ /nw/ /ɲ/	/m/ /n/ /nw/ /ɲ/	/m/ /n/ /nw/ /ɲ/
Non-fricatives (lateral)	/l/	/l/	/l/	/l/	/l/	/l/
Non-fricatives (medial)	/w/	/w/	/w/	/w/	/w/	/w/
Affricates (ejective)	/ts'/ /tsw'/	/ts'/ /tsw'/	/ts'/ /tsw'/	/ts'/ /tsw'/	/ts'/ /tsw'/	/ts'/ /tsw'/
Affricates (aspirated)	/ʧ^{h}/	/ʧ^{h}/	/ʧ^{h}/	/ʧ^{h}/	/ts^{h}w/ /ʧ^{h}/	/ts^{h}w/ /ʧ^{h}/

Participants in this age group appear to have most phonemes in their inventories. Exceptions include the round velar ejective /kw'/, which was not produced by Child L15 and L21 as their production did not match the target word. Child L15 was stimulable for correct production of the target phoneme and word. The velar fricative /x/ was produced as glottal fricative /h/ by Child L21. Only two participants, Child L17 and L33, produced the alveolar trill /r/ and none of the participants produced the round alveolar trill /rw/. The aspirated alveolar affricate /ts^{h}w/ was produced as ejective alveolar /tsw'/ by four of the participants. In addition, the velar affricates /kx^{h}/ and /kx^{h}w/ were produced as aspirated velar explosives /k^{h}/ and /k^{h}w/.

4.1.1.6 Group 6 (5;6 – 5;11 years)

The word-initial consonant inventory of each participant in Group 6 is summarised in Table 13a.

Table 13a. ***Word-initial phonetic inventory: Group 6 (5;6 – 5;11 years)***

Consonants (Manner of articulation)	**Child L23**	**Child L24**	**Child L26**	**Child L27**	**Child L28**	**Child L31**
Explosives (ejective)	/p'/ /t'/ /tw'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /tw'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /tw'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /tw'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /tw'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /tw'/ /k'/ /kw'/ /tɬ'/
Explosives (aspirated)	/p^h/ /t^h/ /t^{h}w/ /k^h/ /k^{h}w/ /tɬ^h/ /tɬ^{h}w/	/p^h/ /t^h/ /t^{h}w/ /k^h/ /k^{h}w/ /tɬ^h/ /tɬ^{h}w/	/p^h/ /t^h/ /t^{h}w/ /k^h/ /k^{h}w/ /tɬ^h/ /tɬ^{h}w/	/p^h/ /t^h/ /t^{h}w/ /k^h/ /k^{h}w/ /tɬ^h/ /tɬ^{h}w/	/p^h/ /t^h/ /t^{h}w/ /k^h/ /k^{h}w/ /tɬ^h/ /tɬ^{h}w/	/p^h/ /t^h/ /t^{h}w/ /k^h/ /k^{h}w/ /tɬ^h/ /tɬ^{h}w/
Explosives (voiced)	/b/ /d/	/b/ /d/	/b/ /d/	/b/ /d/	/b/ /d/	/b/ /d/
Fricatives	/s/ /sw/ /ʃ/ /xw/ /h/ /ɸ/	/s/ /sw/ /ʃ/ /x/ /xw/ /ɸ/	/s/ /sw/ /ʃ/ /xw/ /h/ /ɸ/	/s/ /sw/ /ʃ/ /x/ /xw/ /h/ /ɸ/	/s/ /sw/ /ʃ/ /x/ /xw/ /h/ /ɸ/	/s/ /sw/ /ʃ/ /x/ /xw/ /h/ /ɸ/
Rolled vibrant/ trill	/r/ /rw/	/r/ /rw/	/r/ /rw/	/r/ /rw/	/r/ /rw/	/r/ /rw/
Nasals	/m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/	/m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/	/m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/	/m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/	/m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/	/m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/
Non-fricatives (lateral)	/l/ /lw/	/l/ /lw/	/l/ /lw/	/l/ /lw/	/l/ /lw/	/l/ /lw/
Non-fricatives (medial)	/w/ /j/	/w/ /j/	/w/ /j/	/w/ /j/	/w/ /j/	/w/ /j/
Affricates (ejective)	/ts'/ /tsw'/	/ts'/	/ts'/ /tsw'/	/ts'/ /tsw'/	/ts'/ /tsw'/	/ts'/ /tsw'/
Affricates (aspirated)	/ts^h/ /ts^{h}w/ /ʧ^h/ /kx^h/	/ts^h/ /ts^{h}w/ /ʧ^h/ /kx^h/ /kx^{h}w/	/ts^h/ /ts^{h}w/ /ʧ^h/ /kx^h/	/ts^h/ /ts^{h}w/ /ʧ^h/ /kx^h/	/ts^h/ /ts^{h}w/ /ʧ^h/	/ts^h/ /ts^{h}w/ /ʧ^h/
Affricates (voiced)	/ʤ/ /ʤw/	/ʤ/ /ʤw/	/ʤ/ /ʤw/	/ʤ/ /ʤw/	/ʤ/ /ʤw/	/ʤ/ /ʤw/

All the consonants elicited in the word-initial position are present in this group's inventory. Phonemes not produced by some participants include the velar fricative /x/, which was produced as glottal fricative /h/ by Child L23 and the ejective alveolar affricate /tsw'/ was produced as ejective velar /kw'/ by Child L24.

The penultimate syllable consonant inventory of each participant in Group 6 is summarised in Table 13b.

Table 13b. ***Penultimate syllable phonetic inventory: Group 6 (5;6 – 5;11 years)***

Consonants (Manner of articulation)	**Child L23**	**Child L24**	**Child L26**	**Child L27**	**Child L28**	**Child L31**
Explosives (ejective)	/p'/ /t'/ /k'/ /tɬ'/	/p'/ /t'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /k'/ /kw'/ /tɬ'/	/p'/ /t'/ /k'/ /tɬ'/
Explosives (aspirated)	/tɬ^{h}/	/tɬ^{h}/	/tɬ^{h}/	/tɬ^{h}/	/tɬ^{h}/	/tɬ^{h}/
Explosives (voiced)	/b/ /d/	/b/ /d/	/b/ /d/	/b/ /d/	/b/ /d/	/b/ /d/
Fricatives	/s/ /sw/ /x/ /ɸ/	/s/ /sw/ /x/ /ɸ/	/s/ /sw/ /x/ /ɸ/	/s/ /sw/ /x/ /ɸ/	/s/ /sw/ /x/ /ɸ/	/s/ /sw/ /x/ /ɸ/
Rolled vibrant/ trill	/r/ /rw/	/r/ /rw/	/r/ /rw/	/r/	/r/ /rw/	/r/
Nasals	/m/ /n/ /nw/ /ɲ/	/m/ /n/ /nw/ /ɲ/	/m/ /n/ /nw/ /ɲ/	/m/ /n/ /nw/ /ɲ/	/m/ /n/ /nw/ /ɲ/	/m/ /n/ /nw/ /ɲ/
Non-fricatives (lateral)	/l/	/l/	/l/	/l/	/l/	/l/
Non-fricatives (medial)	/w/	/w/	/w/	/w/	/w/	/w/
Affricates (ejective)	/ts'/ /tsw'/	/ts'/ /tsw'/	/ts'/ /tsw'/	/ts'/ /tsw'/	/ts'/ /tsw'/	/ts'/ /tsw'/
Affricates (aspirated)	/ts^{h}w/ /ʧ^{h}/ /kx^{h}/	/ʧ^{h}/	/ʧ^{h}/	/ʧ^{h}/	/ts^{h}w/ /ʧ^{h}/	/ʧ^{h}/

The participants in this age group used most consonants in the penultimate syllable. Two participants, Child L23 and L31, did not produce the round velar ejective /kw'/ as it occurred in words that were not in their vocabulary and they produced a word which was accepted as an alternative. They were stimulable for correct production of the target word and phoneme. The round alveolar trill /rw/ was produced by four of the participants in this group. The aspirated alveolar affricate /ts^{h}w/ was produced without aspiration (i.e. as ejective alveolar explosive /tsw'/) by four participants. The aspirated velar affricates /kx^{h}/ and /kx^{h}w/ were produced without friction (i.e. as /k^{h}/ and /k^{h}w/).

A comparison of the different age groups is provided next.

4.1.1.7 Across age groups

The word-initial consonant inventory of all age groups is summarised in Table 14a.

Table 14a. ***Word-initial phonetic inventory: across the age groups***

	Group 1	**Group 2**	**Group 3**	**Group 4**	**Group 5**	**Group 6**
Age (years; months)	**3;0 – 3;5**	**3;6 – 3;11**	**4;0 – 4;5**	**4;6 – 4;11**	**5;0 – 5;5**	**5;6 – 5;11**
Explosives (ejective)	Complete /p'/ /t'/ /tw'/ /k'/ /kw'/ /tɬ'/	Complete /p'/ /t'/ /tw'/ /k'/ /kw'/ /tɬ'/	Complete /p'/ /t'/ /tw'/ /k'/ /kw'/ /tɬ'/	Complete /p'/ /t'/ /tw'/ /k'/ /kw'/ /tɬ'/	Complete /p'/ /t'/ /tw'/ /k'/ /kw'/ /tɬ'/	Complete /p'/ /t'/ /tw'/ /k'/ /kw'/ /tɬ'/
Explosives (aspirated)	Incomplete /pʰ/ /tʰ/ /kʰ/ /kʰw/ /tɬʰ/	Complete /pʰ/ /tʰ/ /tʰw/ /kʰ/ /kʰw/ /tɬʰ/ /tɬʰw/	Complete /pʰ/ /tʰ/ /tʰw/ /kʰ/ /kʰw/ /tɬʰ/ /tɬʰw/	Complete /pʰ/ /tʰ/ /tʰw/ /kʰ/ /kʰw/ /tɬʰ/ /tɬʰw/	Complete /pʰ/ /tʰ/ /tʰw/ /kʰ/ /kʰw/ /tɬʰ/ /tɬʰw/	Complete /pʰ/ /tʰ/ /tʰw/ /kʰ/ /kʰw/ /tɬʰ/ /tɬʰw/
Explosives (voiced)	Complete /b/ /d/	Complete /b/ /d/	Complete /b/ /d/	Complete /b/ /d/	Complete /b/ /d/	Complete /b/ /d/
Fricatives	Incomplete /s/ /sw/ /x/ /h/ /ɸ/	Complete /s/ /sw/ /ʃ/ /x/ /xw/ /ɸ/	Complete /s/ /sw/ /ʃ/ /xw/ /h/ /ɸ/	Complete /s/ /sw/ /ʃ/ /x/ /xw/ /ɸ/	Complete /s/ /sw/ /ʃ/ /x/ /xw/ /h/ /ɸ/	Complete /s/ /sw/ /ʃ/ /xw/ /h/ /ɸ/
Rolled vibrant/ trill	Incomplete	Incomplete	Incomplete	Incomplete /r/	Incomplete	Complete /r/ /rw/
Nasals	Complete /m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/	Complete /m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/	Complete /m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/	Complete /m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/	Complete /m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/	Complete /m/ /n/ /nw/ /ɲ/ /ŋ/ /ŋw/
Non-fricatives (lateral)	Complete /l/ /lw/	Complete /l/ /lw/	Complete /l/ /lw/	Complete /l/ /lw/	Complete /l/ /lw/	Complete /l/ /lw/
Non-fricatives (medial)	Complete /w/ /j/	Complete /w/ /j/	Complete /w/ /j/	Complete /w/ /j/	Complete /w/ /j/	Complete /w/ /j/
Affricates (ejective)	Complete /ts'/ /tsw'/	Complete /ts'/ /tsw'/	Complete /ts'/ /tsw'/	Complete /ts'/ /tsw'/	Complete /ts'/ /tsw'/	Complete /ts'/ /tsw'/
Affricates (aspirated)	Complete /tsʰ/ /tsʰw/ /ʧʰ/ /kxʰw/	Complete /tsʰ/ /tsʰw/ /ʧʰ/	Complete /tsʰ/ /tsʰw/ /ʧʰ/ /kxʰw/	Complete /tsʰ/ /tsʰw/ /ʧʰ/	Complete /tsʰ/ /tsʰw/ /ʧʰ/	Complete /tsʰ/ /tsʰw/ /ʧʰ/
Affricates (voiced)	Incomplete /ʤ/	Complete /ʤ/ /ʤw/	Complete /ʤ/ /ʤw/	Complete /ʤ/ /ʤw/	Complete /ʤ/ /ʤw/	Complete /ʤ/ /ʤw/

The majority of consonants were present in the inventories of the youngest group of children (i.e. 3;0 – 3;5 years). While the older children (Group 6) have a complete phonetic inventory, a number of consonants are yet to emerge in the younger children (Group 1). Consonants still to be acquired by Group 1 include the aspirated explosives (mainly those

with rounding, e.g. '***th****wala*' /**t^{h}w**ala/ - to find an item which had been lost or misplaced), the pre-palatal fricative /ʃ/, the alveolar trill /r/ and the round voiced pre-palatal affricate /ʤw/ ('***j****wala*' /**ʤw**ala/ - to plant a seed). Only the alveolar trill /r/ was not present in the inventories of Groups 2, 3 and 5. Although this phoneme is present in Group 4's inventory, the round alveolar trill /rw/ (e.g. '***rw****ala*' /**rw**ala/ - to put one's shoe or hat on) is yet to develop for this age group. Some participants' inventories were not considered incomplete when certain phonemes were not produced. These phonemes include the velar fricative /x/, the glottal fricative /h/, as well as the velar affricates /kx^{h}/ and /kx^{h}w/. This was done as velar fricative /x/ is often produced as glottal fricative /h/ (e.g. '***gô****ga*' /**x**ɔ**x**a/ - to pull, is produced as /**h**ɔ**h**a/), and glottal fricative /h/ is produced as velar fricative /x/ by some speakers (e.g. '***h****êmpê*' /**h**ɛm:p'ɛ/ - a shirt, is produced as /**x**ɛm:p'ɛ/). The velar affricates /kx^{h}/ and /kx^{h}w/ are often produced without friction (e.g. '***kg****ômo*' /**kx^{h}**ɔmo/ - a cow, is produced as /**k^{h}**ɔmo/ and '***kgw****êdi*' /**kx^{h}w**ɛdi/ - month, is produced as /**k^{h}w**ɛdi/. These occurrences are due to dialectal differences.

The penultimate syllable consonant inventory of each age group is summarised in Table 14b.

Table 14b. ***Penultimate syllable phonetic inventory: Across the age groups***

	Group 1	**Group 2**	**Group 3**	**Group 4**	**Group 5**	**Group 6**
Age (years; months)	**3;0 – 3;5**	**3;6 – 3;11**	**4;0 – 4;5**	**4;6 – 4;11**	**5;0 – 5;5**	**5;6 – 5;11**
Explosives (ejective)	Complete /p'/ /t'/ /k'/ /tɬ'/	Complete /p'/ /t'/ /k'/ /kw'/ /tɬ'/	Complete /p'/ /t'/ /k'/ /kw'/ /tɬ'/	Complete /p'/ /t'/ /k'/ /kw'/ /tɬ'/	Complete /p'/ /t'/ /k'/ /tɬ'/	Complete /p'/ /t'/ /k'/ /tɬ'/
Explosives (aspirated)	Complete /tɬ^{h}/	Complete /tɬ^{h}/	Complete /tɬ^{h}/	Complete /tɬ^{h}/	Complete /tɬ^{h}/	Complete /tɬ^{h}/
Explosives (voiced)	Complete /b/ /d/	Complete /b/ /d/	Complete /b/ /d/	Complete /b/ /d/	Complete /b/ /d/	Complete /b/ /d/
Fricatives	Complete /sw/ /x/ /ɸ/	Complete /sw/ /x/ /ɸ/	Complete /s/ /x/ /ɸ/	Complete /s/ /sw/ /x/ /ɸ/	Complete /s/ /sw/ /x/ /ɸ/	Complete /s/ /sw/ /x/ /ɸ/
Rolled vibrant/ trill	Incomplete	Incomplete	Incomplete	Incomplete /rw/	Incomplete	Incomplete /r/
Nasals	Complete /m/ /n/ /nw/ /ɲ/	Complete /m/ /n/ /nw/ /ɲ/	Complete /m/ /n/ /nw/ /ɲ/	Complete /m/ /n/ /nw/ /ɲ/	Complete /m/ /n/ /nw/ /ɲ/	Complete /m/ /n/ /nw/ /ɲ/
Non-fricatives (lateral)	Complete /l/	Complete /l/	Complete /l/	Complete /l/	Complete /l/	Complete /l/
Non-fricatives (medial)	Complete /w/	Complete /w/	Complete /w/	Complete /w/	Complete /w/	Complete /w/
Affricates (ejective)	Complete /ts'/ /tsw'/	Complete /ts'/ /tsw'/	Complete /ts'/ /tsw'/	Complete /ts'/ /tsw'/	Complete /ts'/ /tsw'/	Complete /ts'/ /tsw'/
Affricates (aspirated)	Complete /ʧ^{h}/	Complete /ʧ^{h}/	Complete /ʧ^{h}/	Complete /ʧ^{h}/	Complete /ʧ^{h}/	Complete /ʧ^{h}/

Although the number of phonemes sampled in the penultimate syllable is limited, all consonants (except one) appear to be present in the inventories of participants across the different age groups. The alveolar trill /r/ has been noted to be more challenging for Groups 1, 2, 3 and 5. The round alveolar trill /rw/ has emerged in participants in Group 4, while the same phoneme without rounding (i.e. /r/) is present in Group 5's inventory. The ejective velar explosive /kw'/ was not produced by all participants. It is, however, not considered absent from participants' inventories as the word used to target this phoneme is not in some participants' vocabularies. Differences observed between phonemes in the word-initial position, as well as the penultimate syllable, include production of the alveolar trills /r/ and /rw/. In the word-initial position, Group 4 has the alveolar trill /r/ in their inventory. This

phoneme is not present in the penultimate syllable and this age group has the round alveolar trill /rw/ instead. Both alveolar trill /r/ and round trill /rw/ are present word-initially in Group 6's inventory. In the penultimate syllable, however, only the trill /r/ is present in this group's inventory.

Although only sampled word-initially, the syllabic alveolar nasal /ŋ/ was present in the penultimate syllable and the final position, in the inventories of all participants. This phoneme was recorded as present as it was produced at least once by all participants in various age groups. This is seen in words such as '*di**n**ku*' /di**ŋ**:k'u/ (sheep), '*ditô**n**ki*' /dit'ɔ**ŋ**:k'i/ (donkeys), '*dikgo**ng***' /dik^{h}o:**ŋ**/ (logs), '*lethêkê**ng***' /let^{h}ɛk'ɛ:**ŋ**/ (on the waist), and '*tlinikiⁿg*' /tɬ'inik'i:**ŋ**/ (at the clinic), which were all produced by participants in different age groups. In addition, heterorganic compounds were present in these participants' consonant inventories, as seen in words such as '***fy**a*' /**fj**a/ (to burn), '*m**py**a*' /m**p'j**a/ (a dog), '*m**pts**a*' /m**p'ts'**a/ (a dog), '*ma**by**ang*' /ma**bj**a:ŋ/ (grass) and '*le**fy**ana*' /le**fj**a:na/ (a spoon).

4.1.2 Relational Analysis

The individual age groups' speech production in relation to adult phonology is described below. A comparison of the different groups is also provided in this part of the section.

4.1.2.1 Group 1 (3;0 – 3;5 years)

Percentage Consonant Correct (PCC) scores obtained by participants in Group 1 are documented in Table 15.

Table 15. ***Percentage consonants correct: Group 1(3;0 – 3;5 years)***

Percentage Consonant Correct (PCC)	**Child E2**	**Child L1**	**Child L2**	**Child L4**	**Child L5**	**Child L29**
Word-initial position	96%	96%	87%	93%	90%	89%
Penultimate Syllable	91%	89%	85%	84%	87%	82%

Children in this age group had a high PCC score, both word-initially and in the penultimate syllable. This suggests that consonants are acquired early. Only two children (Child L2 and L29) had a PCC of less than 90% word-initially. When compared to her peers, Child L2 did not produce a complete set of ejective and aspirated explosives and voiced affricates. Similarly, Child L29 did not have a full set of aspirated explosives and affricates. Five children in this age group had a PCC of less than 90% in the penultimate syllable. This may be attributed to production of fewer phonemes in the penultimate syllable. These

findings indicate that some consonant phonemes are still developing as they have not yet been produced by some children in this age group. The PCC scores obtained by other age groups are discussed next.

4.1.2.2 Group 2 (3;6 – 3;11 years)

Table 16 provides data on PCC scores for participants in Group 2.

Table 16. ***Percentage consonants correct: Group 2 (3;6 – 311 years)***

Percentage Consonant Correct (PCC)	**Child E4**	**Child E5**	**Child E6**	**Child E7**	**Child L6**	**Child L7**
Word-initial position	93%	95%	91%	94%	94%	98%
Penultimate Syllable	85%	87%	87%	87%	89%	93%

Participants in Group 2 also obtained high PCC scores in both word positions, more so in the word-initial position. These participants' scores are similar to those obtained by participants in Group 1. PCC in the penultimate syllable is lower than in the word-initial position, suggesting that more consonants are yet to be acquired in the penultimate syllable.

4.1.2.3 Group 3 (4;0 – 4;5 years)

The PCC scores for Group 3 are summarised in Table 17.

Table 17. ***Percentage consonants correct: Group 3 (4;0 – 4;5 years)***

Percentage Consonant Correct (PCC)	**Child E10**	**Child E11**	**Child L8**	**Child L9**	**Child L10**	**Child L32**
Word-initial position	97%	100%	95%	100%	99%	95%
Penultimate Syllable	95%	95%	93%	93%	87%	93%

The children in Group 3 had very high PCC scores, with accuracy in the word-initial position approximating adult productions. Two participants (Child E11 and L9) appear to have fully developed consonants word-initially, while others (in particular Child E10 and L10) will likely not take long before they also develop all consonants in the initial position.

PCC scores in the penultimate syllable are also high, with only one participant (Child L10) with a score of less than 90%. Child L10's score is likely less than that of his peers as he did not have the aspirated pre-palatal fricative /ʧʰ/ in his inventory.

4.1.2.4 Group 4 (4;6 – 4;11 years)

The PCC score for Group 4 are summarised in Table 18.

Table 18. ***Percentage consonants correct: Group 4 (4;6 – 4;11 years)***

Percentage Consonant Correct (PCC)	**Child E13**	**Child L11**	**Child L12**	**Child L13**	**Child L14**	**Child L30**
Word-initial position	94%	97%	90%	98%	98%	98%
Penultimate Syllable	89%	95%	80%	96%	98%	98%

Participants in this age group also had high PCC scores, in both the word-initial position and penultimate syllable. None of the participants in this group obtained a score of 100%, in contrast to those in Group 3. Child L12 obtained the lowest score in the penultimate syllable. This may be attributed to his limited set of affricates, as well as an incomplete set of trilled phonemes. Similar to the other age groups, this incomplete PCC seen in all participants indicate that some consonants are not yet being produced at 4;11 years and are still developing. More consonants are still to be acquired in the penultimate syllable, a pattern observed in the previous age groups.

4.1.2.5 Group 5 (5;0 – 5;5 years)

Table 19 is a summary of PCC scores obtained by participants in Group 5.

Table 19. ***Percentage consonants correct: Group 5 (5;0 – 5;5 years)***

Percentage Consonant Correct (PCC)	**Child L15**	**Child L17**	**Child L18**	**Child L20**	**Child L21**	**Child L33**
Word-initial position	93%	99%	90%	91%	94%	98%
Penultimate Syllable	87%	95%	87%	89%	85%	96%

Although PCC scores obtained by participants in Group 5 are high, there is little different when compared to younger age groups. As already mentioned, more consonants are still to develop in the penultimate syllable.

4.1.2.6 Group 6 (5;6 – 5;11 years)

Table 20 is a summary of the PCC scores obtained by participants in Group 6.

Table 20. ***Percentage consonants correct: Group 6 (5;6 – 5;11 years)***

Percentage Consonant Correct (PCC)	**Child L23**	**Child L24**	**Child L26**	**Child L27**	**Child L28**	**Child L31**
Word-initial position	97%	95%	100%	98%	98%	98%
Penultimate Syllable	96%	96%	95%	93%	96%	93%

The high PCC scores obtained by participants in Group 6 indicate that the accuracy with which children in this age group produce words is approximating adult production. Scores obtained by this group are slightly higher than for the other age groups. An increase in correct production of consonants in the penultimate syllable is also observed. The incomplete scores are an indication that consonants are still being acquired in this age group and beyond.

A comparison of PCC scores across the different age bands is provided in the next part of this section.

4.1.2.7 Across the age groups

A summary of PCC scores obtained across the different age groups is provided in Table 21.

Table 21. ***Percentage consonants correct: Across the age groups***

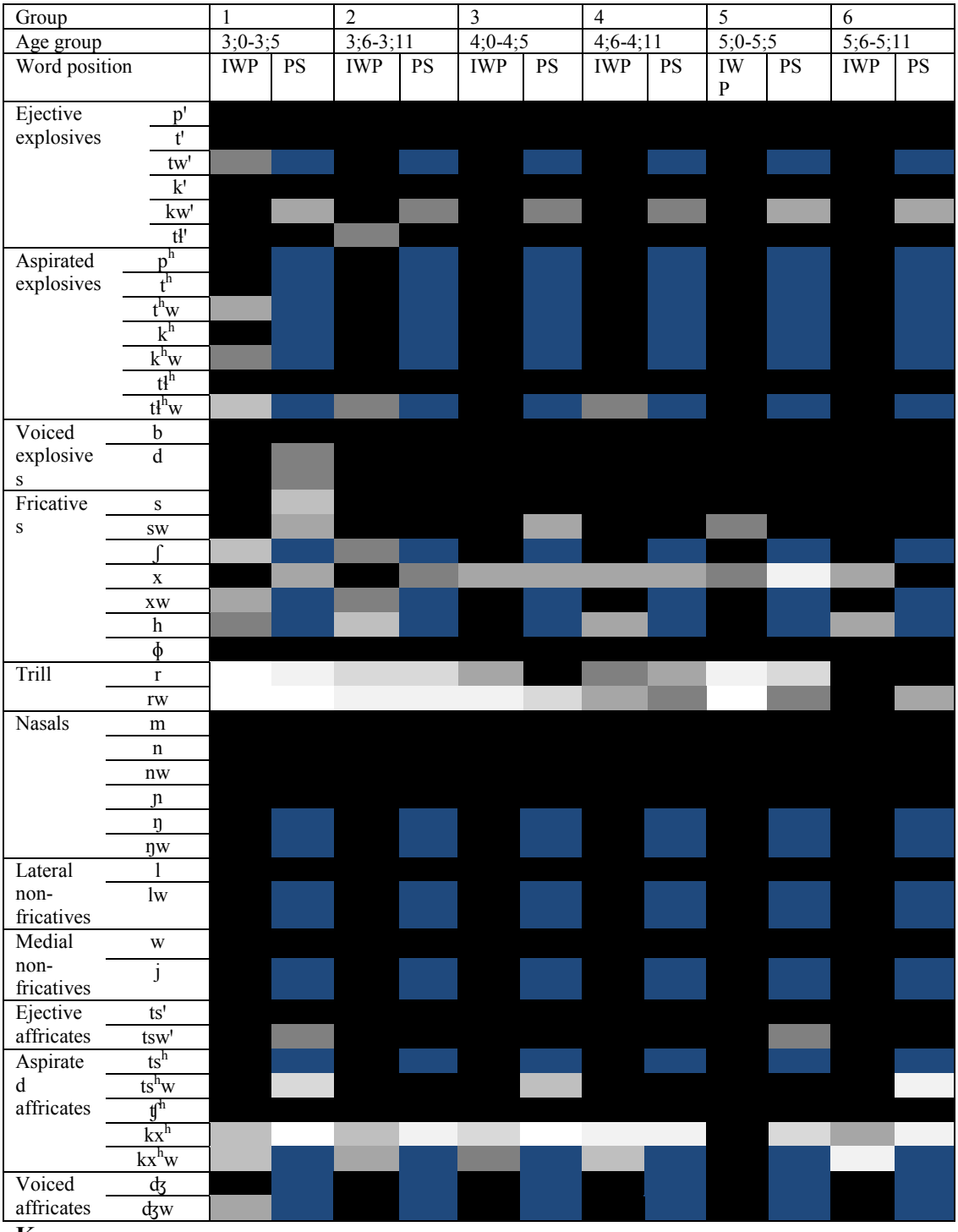
Percentage Consonant Correct (PCC)	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Word-initial position	92%	94%	98%	96%	94%	97%
Penultimate Syllable	86%	88%	93%	93%	90%	95%

More consonants were produced accurately by participants in Group 2 than those in Group 1. Group 2 obtained a PCC of 94% in the word-initial position and 88% in the penultimate syllable. Group 1, by contrast, had a PCC of 92% word-initially and 86% in the penultimate syllable. A further increase in PCC scores obtained by Group 3 is observed in both word positions – both scores were higher than those reported for Groups 1 and 2. Group 4 obtained a slightly lower PCC score in the word-initial position than Group 3. Consonant acquisition in the penultimate syllable appears to have stabilised between 4;0 – 4;11 years as the PCC scores obtained by Groups 3 and 4 remain unchanged. PCC scores in both the word-initial and penultimate syllable decrease further, as seen in Group 5. This group's PCC word-initially is similar to that of Group 2, with a slight difference in scores in the penultimate syllable. An increase in PCC scores is observed in Group 6, following the dip described in Group 5. These findings indicate a progressive pattern in the acquisition of consonants observed in Setswana-speaking children. It can be noted from these findings (PCC of Group 3 and 5) that children are likely to "lose" some of the consonants they have acquired before being able to master them later as they grow older. It can also be hypothesised that this decrease in scores with an increase in ages may be due to one or two of the six children in an age group presenting with speech skills that fall in the low normal range for their age. It is also likely that one or two participants in the younger age groups may have had speech abilities in the high range. The link between speech, language and other cognitive domains is well-known (Stackhouse & Wells, 2002) and difficulties in one of these domains may have knock-on effects in the other areas. In addition, none of the age groups had obtained a PCC score of 100% in both word positions, suggesting that children continue to acquire consonants beyond 6;0 years. Groups 1, 5 and 6 were predominantly male (with 4 boys and 2 girls in each group), while Group 4 was a male only group. The decrease in PCC mainly occurred in groups with more boys than girls. This decrease in PCCs obtained in Groups 4 and 5 may be attributed to gender differences in phonological development, with girls acquiring speech earlier than boys.

4.1.3 Summary

This section has discussed consonant acquisition in children of varying ages. This was achieved by describing data for individual children. This section has also discussed the consonant inventories of each of the six groups of children in turn. Profiles of consonant acquisition in the various age groups were detailed. This was done by making comparisons between the different age groups and through reporting on the participants' PCC. A progression in the development of consonants was noted in the number of phonemes produced accurately in both the word-initial position and penultimate syllable. More consonants were acquired and produced accurately by the older children (5;6 – 5;11 years) than the youngest group (3;0 – 3;5 years). Consistencies in the acquisition of consonants were observed in other groups, e.g. the PCC score obtained by Group 3 (4;0 – 4;5 years) in the penultimate syllable was equal to that of Group 4 (4;6 – 4;11 years). Fluctuations were also noted, e.g. there was a slight decrease in the PCC score obtained by Group 5 (5;0 – 5;5 years) as compared to Groups 3 (4;0 – 4;5 years) and 4 (4;6 – 4;11 years). This may be attributed to gender differences, with girls acquiring speech earlier than boys. In addition, more consonants are acquired in the word-initial position than in the penultimate syllable. An overall consistency was noted in higher accuracy scores in the word-initial position than the penultimate syllable. Table 22 summarises the acquisition of consonants across the different age groups. The section that follows focuses on vowel acquisition across the different age groups.

Table 22. ***Consonants produced correctly in the word-initial and penultimate syllable***



Key:

IWP	Initial word position
PS	Penultimate syllable
	6 participants (100%) produced the phonemes correctly
	5 participants (83%) produced the phonemes correctly
	4 participants (67%) produced the phonemes correctly
	3 participants (50%) produced the phonemes correctly
	2 participants (33%) produced the phonemes correctly
	1 participant (17%) produced the phonemes correctly
	0 participants produced the phoneme
	Not sampled in the assessment

4.2 Section 2: Vowels

4.2.1 Independent Analysis

Vowels produced spontaneously and in imitation were recorded as being in a child's inventory. Similar to the consonant inventory, a vowel was considered present if it was produced at least once by each of five of the six participants in each age group. Vowels present in the inventories of the various age groups in the word-medial and final positions are described below.

4.2.1.1 Group Analysis

A summary of the vowel inventory of the different age groups is provided in Table 23.

Table 23. ***Vowel inventory in the word-medial position: Across the age groups***

	Age Group					
Vowels	**Group 1**	**Group 2**	**Group 3**	**Group 4**	**Group 5**	**Group 6**
High	Complete /i/ /u/	Complete /i/ /u/	Complete /i/ /u/	Complete /i/ /u/	Complete /i/ /u/	Complete /i/ /u/
Mid-high	Complete /e/ /o/	Complete /e/ /o/	Complete /e/ /o/	Complete /e/ /o/	Complete /e/ /o/	Complete /e/ /o/
Mid-low	Complete /ɛ/ /ɔ/	Complete /ɛ/ /ɔ/	Complete /ɛ/ /ɔ/	Complete /ɛ/ /ɔ/	Complete /ɛ/ /ɔ/	Complete /ɛ/ /ɔ/
Low	Complete /a/	Complete /a/	Complete /a/	Complete /a/	Complete /a/	Complete /a/

All the seven vowels of the Setswana phonetic inventory appear to develop early, as the youngest group (i.e. 3;0 – 3;5 years) already had a complete inventory. The central low /a/, front mid-low /ɛ/ /ɔ/, back mid-high /e/ /o/, as well as front and back high /i/ /u/ were present in the inventories of all participants in all age groups, in both the word-medial and final positions. The raised variants of the four mid vowels /ɛ̝/ /ɔ̝ /e̝/ and /o̝/ were also present in their inventories.

The second part of this section focuses on the Percentage Vowel Correct (PVC) for each age group, followed by a comparison of the different age groups.

4.2.2 Relational Analysis

The individual age groups' speech production in relation to the adult phonology is described below. The accuracy with which vowels were produced by participants is described here. Comparisons relating to vowel accuracy are made across age groups.

4.2.2.1 Group 1 (3;0 – 3;5 years)

The PVC score obtained by individual participants in Group 1 is documented in Table 24.

Table 24. ***Percentage Vowels Correct: Group 1 (3;0 – 3;5 years)***

	Group 1					
Percentage Vowels Correct (PVC)	**Child E2**	**Child L1**	**Child L2**	**Child L4**	**Child L5**	**Child L29**
Word-medial	92%	92%	73%	84%	88%	70%
Word-final	87%	95%	75%	81%	87%	65%

The PVC scores obtained by participants in this age group were lower than their PCC scores. Two participants (Child L2 and L29) obtained PVCs of less than 80% in both word positions. Two other participants (Child L4 and L5) obtained scores lower than 90% in both word positions, while one participant (Child E2) only obtained a PVC of less than 90% in the word-final position. Participants sometimes substituted vowels, which included producing the central low /a/ as the front mid-low /ɔ/. E.g. '*din**a**mane*' /din**a**maːne/ (calves) was produced as '*din**ô**mane*' /din**ɔ**maːne/ by some participants. These findings indicate that vowels are still being acquired in this age group (i.e. from 3;0 – 3;5 years).

4.2.2.2 Group 2 (3;6 – 3;11 years)

The PVC scores obtained by participants in Group 2 are summarised in Table 25.

Table 25. ***Percentage Vowels Correct: Group 2 (3;6 – 3;11 years)***

	Group 2					
Percentage Vowels Correct (PVC)	**Child E4**	**Child E5**	**Child E6**	**Child E7**	**Child L6**	**Child L7**
Word-medial	95%	98%	92%	91%	96%	88%
Word-final	92%	91%	87%	95%	92%	88%

Group 2's PVC scores in both word positions were higher than those obtained by Group 1. Only two participants obtained a score of less than 90% - Child E6 only scored lower than his peers in the word-final position while Child L7 scored lower in both word positions. Vowel substitutions were also noted in this group and included substituting the back high /u/ with the front high /i/. E.g. '*sekh**u**r**u**mêlô*' /sek^{h}**u**r**u**mɛːlɔ/ (a lid) was produced

as '*skh**i**r**i**mêlô*' /sk^{h}**i**r**i**mɛ:lɔ/. Vowels may still be developing in this age group, but it can be noted from these findings that accuracy is almost approximating adult levels.

4.2.2.3 Group 3 (4;0 – 4;5 years)

Table 26 shows a summary of PVC scores obtained by participants in Group 3.

Table 26. ***Percentage Vowels Correct: Group 3 (4;0 – 4;5 years)***

	Group 3					
Percentage Vowels Correct (PVC)	**Child E10**	**Child E11**	**Child L8**	**Child L9**	**Child L10**	**Child L32**
Word-medial	99%	94%	98%	93%	91%	92%
Word-final	99%	94%	95%	92%	87%	95%

High PVC scores were obtained by participants in this age group. Two participants (Child E10 and L8) obtained PVCs higher than 95% in the word-medial position and three participants' (E10, L8 and L32) PVCs were 95% and more in the word-final position. Only one participant's (Child L10) PVC was slightly lower than that of his peers. Substitutions which occurred in this group included producing the back mid-high /o/ as mid-low /ɔ/, e.g. '*mafofa*' /maɸo:ɸa/ (feathers) was produced as '*mafɔfa*' /maɸɔ:ɸa/. The findings reported for this age group indicate that children's productions of vowels word-medially and finally are more adult-like.

4.2.2.4 Group 4 (4;6 – 4;11 years)

Table 27 is a summary of PVC scores obtained by Group 4.

Table 27. ***Percentage Vowels Correct: Group 4 (4;6 – 4;11 years)***

	Group 4					
Percentage Vowels Correct (PVC)	**Child E13**	**Child L11**	**Child L12**	**Child L13**	**Child L14**	**Child L30**
Word-medial	100%	100%	88%	93%	98%	97%
Word-final	95%	92%	85%	89%	92%	96%

PVCs were greater than 95% in the word-medial position and greater than 90% word-finally. Two participants (Child L12 and L13) obtained scores lower than their peers. Substitutions noted in the word-final position included producing the central low /a/ as the

mid-low /ɔ/, e.g. '*kgomagantsh**a***' /kx^{h}omaxan:ts^{h}a/ (to assemble pieces together) was produced as '*khomahants**ô***' /k^{h}omahan:ts'**ɔ**/. As reported for the previous age group, the accuracy with which participants in Group 4 produce vowels is approximating adult productions. These findings suggest that this is more the case in the word-medial position than the word-final position.

4.2.2.5 Group 5 (5;0 – 5;5 years)

A summary of PVC scores obtained by participants in Group 5 is documented in Table 28.

Table 28. ***Percentage Vowels Correct: Group 5 (5;0 – 5;5 years)***

	Group 5					
Percentage Vowels Correct (PVC)	**Child L15**	**Child L17**	**Child L18**	**Child L20**	**Child L21**	**Child L33**
Word-medial	96%	94%	100%	99%	93%	100%
Word-final	93%	91%	89%	95%	86%	89%

These participants' production of vowels is more adult-like, more so in the word-medial position than in the final position. It can be noted that the word-medial PVC scores are higher than those obtained word-finally. These results also indicate that correct production of vowels in words is still developing, particularly in the word-final position. Substitution patterns are similar to those described in the previous age group, e.g. three participants (Child L18, L21 and L33) had PVCs of less than 90%, which were lower than those of their peers.

4.2.2.6 Group 6 (5;6 – 5;11 years)

A summary of Group 6's PVC scores is documented in Table 29.

Table 29. ***Percentage Vowels Correct: Group 6 (5;6 – 5;11 years)***

	Group 6					
Percentage Vowels Correct (PVC)	**Child L23**	**Child L24**	**Child L26**	**Child L27**	**Child L28**	**Child L31**
Word-medial	99%	100%	96%	96%	97%	93%
Word-final	96%	89%	95%	95%	92%	93%

With the exception of one participant (Child L24), PVC scores obtained by Group 6 in both word positions are high. Child L24 obtained the highest PVC score in the word-medial position but the lowest in the word-final position. The low PVC word-finally is not reflective of Child L24's limited ability to produce vowels accurately. He produced vowels accurately but sometimes produced the syllabic palatal nasal /ŋ/ in the final position. This was not considered an error as his productions were accurate, although they did not match the target, e.g. he produced '*pôtla*' /pˈɔtɬˈa/ (a pocket) as '*pôtlê**ng***' /pˈɔtɬˈɛːŋ/ (in the pocket). His responses were likely influenced by the verbal cues given by the reasearcher, e.g. when he did not recognise the picture shown, Child L24 was given the functional cue: "Re lôkêla tšhêlêtê mo go yôna, ke eng?" ('We use it to put money in, what is it?'). Although this cue clearly required the child to name the object, he might have focused more on the first part of the cue. Based on these findings, it can be said that the accuracy with which vowels are produced by participants in this age group, word-medially and finally, is adult-like.

The findings reported for each individual age group are compared in the following sub-section. This will be done in order to determine whether or not a progressive change occurs in the acquisition of vowels in the word-medial and final positions.

4.2.2.7 Across age groups

Table 30 is a summary of mean PVC scores obtained by the different age groups.

Table 30. ***Percentage Vowels Correct: Across age groups***

	Age Groups					
Percentage Vowels Correct (PVC)	**Group 1**	**Group 2**	**Group 3**	**Group 4**	**Group 5**	**Group 6**
Word-medial	83%	93%	95%	96%	97%	97%
Word-final	82%	91%	94%	92%	91%	93%

A progressive change in the acquisition of vowel accuracy can be seen in the above table, more so in the word-medial position. These findings indicate that the older children produce vowels more accurately than the younger ones, e.g. Groups 5 and 6 had higher PVCs than Group 1 in both word positions. While this progressive change is also seen in the word-final position, a decrease in accuracy is observed between the ages of 4;6 and 5;5 years before an increase is seen again. Similar findings have been documented for consonant acquisition, whereby the accuracy with which phonemes are produced increases in older children. This was followed by a decrease in accuracy rates before an increase occurred again. Differences noted in these age groups may be attributed to gender differences. This is

proposed as decrease in PVC occurred in groups made up of more boys than girls. Findings reported for the accuracy with which vowels are produced in Setswana-speaking children differ from those of other phonological studies in that accuracy in vowel production does not seem to be adult-like. This is seen more in the youngest group of children (3;0 – 3;5 years), whose PVC scores were lower than 90%.

4.2.3 Summary

This section focused on describing the acquisition of vowels in the word-medial and word-final positions. Findings for six individual age groups were discussed, followed by a comparison of all the age groups. This was done in order to document vowels present in participants' inventories (i.e. independent analysis), as well as the accuracy with which they were produced in relation to adult phonology (i.e. relational analysis). All seven Setswana vowels, as well as four raised variants of the mid vowels were present in the inventories of the youngest group of children (i.e. 3;0 – 3;5 years). This group (3;0 – 3;5 years), however, produced fewer vowels accurately as their PVC score was lower than that of the older children (i.e. 5;6 – 5;11 years). Similar to findings of consonant acquisition, PVC scores indicate a progressive change across the age groups, in the word-medial position in particular. Another similarity in consonant and vowel acquisition is the decrease in accuracy scores in older children, before increasing again. This has been attributed to gender differences. E.g. the PCC for Group 5 (a group consisting of more boys) was slightly less than that reported for Group 3 (a group consisting of more girls) and PVCs for Group 5 were also less in comparison to Groups 3 and 4 word-finally.

In the section that follows, the development of syllable structures is discussed.

4.3 Section 3: Syllable structures

4.3.1 Independent Analysis

The criteria set to determine consonants and vowels present in the inventories of study participants were used to determine which syllable structures were present in the word-initial and penultimate position. Syllable structures were considered present when produced at least once by 83% (i.e. 5 of 6) participants in each age group. Data on syllable structures was first analysed for each individual group and this was then followed by a comparison of all six groups.

4.3.1.1 Group Analysis

It was found that each age band had a complete syllable structure inventory in both the word-initial and penultimate positions. These include the vowel only (V), consonant and

vowel (CV), consonant only (C), as well as the consonant, consonant and vowel (CCV) syllables. Group 4 is, however an exception as the V syllable was not present in this group's inventory in the word-initial position. Some participants in this age group presented with vowel alternation, e.g. '***a**paya*' /**a**p'a:ja/ (to cook) was produced as '***ya**peja*' /**ja**p'e:ja/. These participants were stimulable for correct production of this syllable. A summary of the syllable structures present word-initially and in the penultimate position in the inventory of participants in each age group is presented in Appendix N.

A description of syllable structure inventories across age groups is provided next.

4.3.1.2 Across age groups

Syllable structure inventories of all six age groups are summarised in Table 31, followed by a description of differences noted across these groups.

Table 31. ***Syllable structure inventory: Across age groups***

	Group 1	**Group 2**	**Group 3**	**Group 4**	**Group 5**	**Group 6**
Word-initial	Complete V CV C CCV	Complete V CV C CCV	Complete V CV C CCV	Incomplete CV C CCV	Complete V CV C CCV	Complete V CV C CCV
Penultimate syllable	Complete V CV C CCV	Complete V CV C CCV	Complete V CV C CCV	Complete V CV C CCV	Complete V CV C CCV	Complete V CV C CCV

The four syllable structures found in the Setswana inventory appear to be present in children as young as 3;0 years. These were present in both the word-initial and penultimate syllables. With the exception of Group 4 (4;6 – 4;11 years), all syllable structures were present in the inventories of all participants. The V only syllable is not present in Group 4's inventory as two participants in this group inserted the medial non-fricative /j/ before the low vowel /a/, e.g. '***a**paya*' /**a**p'a:ja/ (to cook) was produced as '***ya**peja*' /**ja**p'e:ja/.

A discussion on the accuracy with which these syllable structures were produced follows in the next section.

4.3.2 Relational Analysis

The individual age groups' speech production in relation to the adult phonology is described below. The accuracy with which syllable structures were produced by participants is described here. Comparisons relating to vowel accuracy are made across age groups in section4.3.2.7.

4.3.2.1 Group 1 (3;0 – 3;5 years)

Data on the PPC scores obtained by participants in Group 1 word-initially is summarised in Table 32a.

Table 32a. Percentage of Phonemes Correct in the word-initial position: Group 1 (3;0 – 3;5 years)

Syllable structure	Child E2	Child L1	Child L2	Child L4	Child L5	Child L29
V	100%	100%	100%	100%	100%	100%
CV	99%	93%	92%	84%	93%	97%
C	100%	100%	100%	100%	100%	100%
CCV	80%	100%	60%	100%	100%	73%

The findings documented in the table above indicate that the four syllable structures found in the Setswana inventory are produced accurately in the word-initial position as early as 3;0 years, possibly earlier. The CCV syllable, however, appears to be the last syllable that is not yet produced accurately in this age group. Three participants (Child E2, L2 and L29) had PPCs less than 90% and their scores were lower than those obtained by their peers. These participants often reduced the -Cw- digraphs, e.g. producing '***tlhware***' /**tɬ**^{h}ware/ (a type of snake) as '***tlhale***' /**tɬ**^{h}ale/. The CCV syllable structure therefore continues to develop word-initially beyond 3;5 years.

Table 32b is a summary of PPC scores obtained by Group 1 in the penultimate syllable.

Table 32b. ***Percentage of Phonemes Correct in the penultimate syllable: Group 1 (3;0 – 3;5 years)***

Syllable structure	Child E2	Child L1	Child L2	Child L4	Child L5	Child L29
V	100%	100%	100%	100%	100%	100%
CV	94%	96%	94%	94%	100%	91%
C	100%	100%	100%	100%	100%	100%
CCV	100%	100%	60%	100%	100%	40%

Participants in this age group had high PPCs, with the accuracy with which syllable structures produced in the penultimate position matching adult productions. Two participants (Child L2 and L29), however, had lower PPCs as compared to their peers. The -Cw- digraphs were simplified here too, e.g. '*le**tsw**ai*' /le**tsw'**a:i/ (salt) was produced as '*le**ts**ai*' /le**ts'**a:i/. These findings indicate that the CCV syllable occurring in the penultimate position continues to develop after 3;5 years.

4.3.2.2 Group 2 (3;6 – 3;11 years)

PPCs obtained by participants in Group 2 in the word-initial position are summarised in Table 33a.

Table 33a. ***Percentage of Phonemes Correct in the word-initial position: Group 2 (3;6 – 3;11 years)***

Syllable Structure	Child E4	Child E5	Child E6	Child E7	Child L6	Child L7
V	100%	100%	100%	100%	100%	100%
CV	91%	94%	88%	93%	93%	92%
C	100%	88%	88%	100%	100%	100%
CCV	100%	100%	100%	100%	100%	93%

High PPCs in the word-initial position were obtained by participants in Group 2, indicating that children aged 3;6 – 3;11 years produce the different syllable structures with the same accuracy as adults. One participant (Child E6) had a PPC less than 90% for the CV syllable and two (Child E5 and E6) had PPCs less than 90% for the C syllable. These participants' scores were slightly lower than those obtained by their peers. This is likely the case as the first syllable was sometimes omitted, e.g. '***se****fapanô*' /**se**fap'a:nɔ/ (a cross), was produced as '*fapanô*' /fap'a:nɔ/ by some participants. It can therefore be said that the accuracy with which syllable structures are produced word-initially continue to develop.

Table 33b is a summary of PPC scores obtained by participants in Group 2 in the penultimate syllable.

Table 33b. ***Percentage of Phonemes Correct in the penultimate syllable: Group 2 (3;6 – 3;11 years)***

Syllable Structure	Child E4	Child E5	Child E6	Child E7	Child L6	Child L7
V	100%	100%	100%	100%	100%	100%
CV	94%	100%	92%	96%	100%	100%
C	100%	100%	100%	100%	100%	100%
CCV	100%	100%	100%	100%	100%	80%

PCCs obtained in the penultimate position by participants in this age group were higher than those reported for the word-initial position. Only one participant (Child L7) had a PCC less than 90% for the CCV syllable. Simplification of the -Cw- digraph, as reported

for Group 1, was noted in this participant's speech. Although syllable structures in the penultimate position are produced accurately by more children, they continue to develop (the CV and CCV in particular).

4.3.2.3 Group 3 (4;0 – 4;5 years)

Group 3's PPCs in the word-initial position are summarised in Table 34a.

Table 34a. ***Percentage of Phonemes Correct in the word-initial position: Group 3 (4;0 – 4;5 years)***

Syllable Structure	Child E10	Child E11	Child L8	Child L9	Child L10	ChildL32
V	100%	100%	100%	100%	100%	100%
CV	89%	92%	91%	93%	93%	92%
C	100%	100%	100%	100%	100%	100%
CCV	100%	100%	93%	100%	100%	100%

High PPCs in the word-initial position were obtained by participants between the ages of 4;0 and 4;5 years. Only one participant (Child E10) had a PPC of less than 90% for the CV syllable. Similar to findings reported in Group 1, deletion of the initial syllable was noted. Participants in this age group therefore produced the four syllable structures documented word-initially with accuracy approximating adult productions.

Data on the PPC scores obtained by participants in Group 3 in the penultimate syllable is documented in Table 34b.

Table 34b. ***Percentage of Phonemes Correct in the penultimate syllable: Group 3 (4;0 – 4;5 years)***

Syllable Structure	Child E10	Child E11	Child L8	Child L9	Child L10	Child L32
V	100%	100%	100%	100%	100%	100%
CV	100%	100%	98%	92%	96%	94%
C	88%	100%	100%	100%	100%	100%
CCV	100%	100%	100%	100%	100%	100%

Similar to results documented in the word-initial position, PPCs were high in the penultimate syllable. Children therefore continue to produce syllable structures with the same accuracy as adults.

4.3.2.4 Group 4 (4;6 – 4;11 years)

Table 35a is a summary of Group 4's PPCs in the word-initial position.

Table 35a. ***Percentage of Phonemes Correct in the word-initial position: Group 4 (4;6 – 4;11 years)***

Syllable Structure	Child E13	Child L11	Child L12	Child L13	Child L14	Child L30
V	100%	100%	0%	0%	100%	100%
CV	94%	95%	91%	93%	91%	89%
C	100%	88%	100%	100%	100%	100%
CCV	100%	100%	100%	100%	100%	100%

With the exception of the V syllable, all other syllables were produced with a high accuracy word-initially. Child L12 and L13, in particular, had low PPCs for the V syllable. It was found that children often added a consonant in the initial position when producing the V syllable, e.g. '***a****paya*' /**a**p'a:ja/ (to cook) was produced as '***ya****peja*' /**ja**p'e:ja/.

Table 35b is a summary of Group 4's PPCs in the penultimate syllable.

Table 35b. ***Percentage of Phonemes Correct in the penultimate syllable: Group 4 (4;6 – 4;11 years)***

Syllable Structure	Child E13	Child L11	Child L12	Child L13	Child L14	Child L30
V	100%	100%	100%	100%	100%	100%
CV	96%	96%	96%	100%	94%	94%
C	88%	88%	100%	88%	100%	100%
CCV	100%	100%	100%	100%	100%	100%

PCCs obtained by Group 4 in the penultimate syllable were higher than those reported for the initial position. This suggests that more syllable structures are produced accurately in the penultimate syllable. The scores obtained by two participants (Child E13 and L11) for production of the C syllable are slightly lower than those of their peers. The accuracy with which syllable structures are produced in the penultimate syllable, particularly the C syllable, appears to continue to develop in children older than 4;11 years.

4.3.2.5 Group 5 (5;0 – 5;5 years)

Table 36a summarises PPCs of Group 5 word-initially.

Table 36a. ***Percentage of Phonemes Correct in the word-initial position: Group 5 (5;0 – 5;5 years)***

Syllable Structure	Child L15	Child L17	Child L18	Child L20	Child L21	Child L33
V	100%	100%	100%	100%	100%	100%
CV	92%	89%	89%	93%	94%	89%
C	100%	100%	100%	100%	100%	100%
CCV	100%	100%	100%	100%	100%	100%

Participants in this age group have very high PPCs in the word-initial position. Only three participants (Child L17, L18, L33) have PPCs less than 90% for the CV syllable. This syllable structure is expected to be produced with adult-like accuracy in older children as it is reported to be acquired early in most languages. The data documented in the above table indicates that participants in this age group have adult-like productions of syllable structures, more so for the V, C and CCV syllables.

Table 36b summarises PPCs of Group 5 in the penultimate syllable.

Table 36b. ***Percentage of Phonemes Correct in the penultimate syllable: Group 5 (5;0 – 5;5 years)***

Syllable Structure	Child L15	Child L17	Child L18	Child L20	Child L21	Child L33
V	100%	100%	100%	100%	100%	100%
CV	100%	98%	98%	96%	100%	100%
C	100%	100%	100%	100%	88%	100%
CCV	100%	100%	100%	100%	100%	100%

Findings recorded in Table 36b indicate that syllables in the penultimate position are produced more accurately than in the word-initial position. The accuracy with which syllables are produced in the penultimate position by participants in this age group can be considered adult-like.

4.3.2.6 Group 6 (5;6 – 5;11 years)

Data on PPCs obtained by participants in Group 6 in the word-initial position is documented in Table 37a.

Table 37a. ***Percentage of Phonemes Correct in the word-initial position: Group 6 (5;6 – 5;11 years)***

Syllable Structure	Child L23	Child L24	Child L26	Child L27	Child L28	Child L31
V	100%	100%	100%	100%	100%	100%
CV	93%	92%	93%	92%	93%	93%
C	100%	88%	100%	100%	100%	88%
CCV	100%	100%	100%	100%	100%	100%

High PPCs in the word-initial position were recorded for participants in Group 6. The accuracy with which the C syllable is produced may still be developing in children aged 6;0 years or older. This is likely the case as two participants in this age group obtained scores lower than 90% for the C syllable. Other syllable structures are, however, produced with accuracy approximating adult productions.

Data on PPCs obtained by participants in Group 6 in the penultimate syllable is documented in Table 37b.

Table 37b. ***Percentage of Phonemes Correct in the penultimate syllable: Group 6 (5;6 – 5;11 years)***

Syllable Structure	Child L23	Child L24	Child L26	Child L27	Child L28	Child L31
V	100%	100%	100%	100%	100%	100%
CV	100%	98%	98%	96%	96%	100%
C	100%	100%	100%	100%	88%	100%
CCV	100%	100%	100%	100%	100%	100%

The high PPCs documented in the penultimate position for Group 6 indicate that syllables are produced with adult-like accuracy. This is seen for all four syllable structures.

A comparison of the data described above for each individual group is discussed next.

4.3.2.7 Across age groups

Data on PPCs obtained by participants in different age groups in the word-initial position is documented in Table 38a.

Table 38a. ***Percentage of Phonemes Correct in the word-initial position: Across age groups***

Syllable Structure	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
V	100%	100%	100%	67%	100%	100%
CV	93%	92%	92%	92%	91%	93%
C	100%	96%	100%	98%	100%	96%
CCV	86%	99%	99%	100%	100%	100%

A progressive change in the acquisition of syllable structures is seen more in the development of the CCV syllable, with the older children (Group 6) producing it more accurately than the younger ones (Group 1). In the other syllable structures, however, fluctuations have been noted to occur across the age groups. For instance, high PPCs were recorded for Groups 1 and 2 for the V syllable and a significant decrease was noted in Group 4 before accuracy levels increased again in Groups 5 and 6. A similar pattern has been described in consonant acquisition and was attributed to gender differences. In addition, these findings indicate that children produce syllable structures with an accuracy approximating adult-like productions as early as 3;0 years.

Data on PPCs obtained by participants in the different age groups in the penultimate syllable is documented in Table 38b.

Table 38b. ***Percentage of Phonemes Correct in the penultimate syllable: Across age groups***

Syllable Structure	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
V	100%	100%	100%	100%	100%	100%
CV	95%	97%	97%	96%	99%	98%
C	100%	100%	98%	94%	98%	98%
CCV	83%	97%	100%	100%	100%	100%

Similar to findings reported for the word-initial position, the only progressive change in syllable acquisition is seen in the CCV syllable. There appears to be a consistency in the acquisition of the V syllable, as scores obtained in different age groups were similar. An increase was noted in the production of the CV syllable, followed by a decrease in accuracy

(as seen in Group 4) before an increase is noted again. The younger age groups (Groups 1 and 2) obtained the highest PPC scores for the C syllable. Group 4 obtained the lowest scores and this was followed by an increase in PPCs by participants in Groups 5 and 6. It should be noted that Group 4 consisted of boys only and this decrease in PPCs may be attributed to gender differences, suggesting that girls acquire speech earlier than boys. These findings are also similar to those reported for the word-initial position, as well as for the acquisition of consonants, in that an increase in accuracy seems to always be followed by a decrease before an increase is observed again.

4.3.3 Summary

This section has focused on describing patterns observed in the acquisition of syllable structures. Syllables present in the inventories of participants (i.e. independent analysis), as well as the accuracy with which they were produced (i.e. relational analysis), were discussed in this section. All syllable structures appear to be present in the participants' inventories, with the exception of the V syllable in children between the ages of 4;6 – 4;11 years in the word-initial position. The CCV syllable seems to continue to develop after 3;5 years in both the word-initial and penultimate syllables. Findings on syllable acquisition also indicate that an increase in accuracy may be seen in groups of increasing age, followed by a decrease in older groups, before an increase is seen again in the oldest groups. It was noted that a decrease often occurs in groups consisting of more males than females, suggesting that girls acquired speech ealier than boys. The section that follows describes the phonological processes noted in the speech of children of various age groups.

4.4 Section 4: Phonological processes

4.4.1 Relational Analysis: Consonants and Syllables

This section focuses on describing participants' speech in relation to the target phonology. Phonological processes occurring at the syllable- and segmental-levels are described for each age group and will be followed by a comparison of all six groups. This will be done in order to determine the nature of phonological processes occurring across various age bands, as well as to describe any patterns in elimination of these.

4.4.1.1 Group 1 (3;0 – 3;5 years)

Phonological processes noted in the speech of participants in this age group are summarised in Table 39.

Table 39. ***Phonological processes: Group 1 (3;0 – 3;5 years)***

Phonological process	Example	Child E2	Child L1	Child L2	Child L4	Child L5	Child L29
Vowel elision	set'i:lɔ	**st**'i:lɔ	**st**'i:lɔ				
Deletion of marked syllable	sefatɬhɛ:xɔ	fatɬ^{h}ɛ:xɔ		fatɬhɛ:hɔ		tɬ^{h}atɬ^{h}ɛ:xɔ	fatɬhɛ:xɔ
Deletion of unmarked syllable	sek^{h}urumɛ:lɔ kx^{h}omaxan:ts^{h}a		kx^{h}oman:t^{h}ɔ	sek^{h}umɛ:lɔ k^{h}oman:ts^{h}a		sk^{h}umɛ:lɔ	
Gliding of liquids	raxa lla xwai:la mori:ri set'i:lɔ	**j**axa			**jj**a xwai:**j**a	st'i:**w**ɔ	**j**axa mo**j**i:**j**i
Assimilation	sefatɬhɛ:xɔ lwala nɔŋa:ne			ŋɔ**ŋ**a:ne	lwa**l**wa	**tɬ^{h}**atɬ^{h}ɛ:xɔ	ŋɔ**ŋ**a:ne
Simplification of Cw digraphs	leswa:na letsw'a:i			le**s**a:na			le**ts**'a:i
Simplification of multisyllabic words	lemp^{h}orwa:na sek^{h}urumɛ:lɔ			p^{h}orwa:na			k^{h}imɛ:lɔ
Deaspiration	t^{h}wala		**tw'**ala				
Specific phoneme substitution	rɔbɛ:ts'e diap'a:rɔ rɔbɛ:ts'e dik'ɔtɬ'ɔ:lɔ	**ʀ**oba:la	**ʀ**obɛts'e diap'a:**ʀ**ɔ	**l**obɛts'e	**ʀ**ɔbɛ:ts'e	**ʀ**obɛts'e	**l**ɔbɛts'e **l**ik'ɔtɬ'ɔ:lɔ
Palatalisation	lexadi:ma kx^{h}wɛdi			lehadi:**j**a			kx^{h}wɛ**j**i
Plosivation	sefap'a:nɔ xwai:la			**kx^{h}w**ɛi:la		sefa**p^{h}**a:nɔ	
Occlusivation/ Stopping	maswɛ sefatɬ^{h}ɛ:xɔ				ma**tw'**ɛ se**p'**atɬ^{h}ɛ:xɔ		
Backing front sounds	tw'atsi			**kw'**ats'i			

Note: Syllables sampled in the word-initial and penultimate positions are referred to here as 'marked' and those occurring in the word-medial position are referred to as 'unmarked'.

Participants in Group 1 used 13 different phonological proceses. The most widely used ones included vowel elision, deletion of marked and unmarked syllables, gliding of liquids, assimilation, as well as specific phoneme substitution. Vowel elision occurred in different word positions. This process, however, almost always occurred in CV syllables consisting of the alveolar fricative /s/ and mid-high vowel /e/ and results in the formation of an /s/C cluster (e.g. '***se**tilô*' /**se**t'i:lɔ/ - a chair, is often produced as '***st**ilô*' /**st**'ilɔ/ and an /**st'**/ cluster is formed). This often occurs in loanwords (e.g. '*setilô*' is derived from the Afrikaans word '**st**oel'), as well as non-loanwords (e.g. '***se**tlhare*' /**se**tɬ^{h}a:re/ - a tree, is often produced as '***stlh**are*' /**stɬ^{h}**a:re/). Although recorded here vowel elision is not considered a developmental process as it occurs in adult speech too. This occurrence can be considered to illustrate the children's adult-like phonological skills.

Syllables sampled in the word-initial and penultimate positions are referred to here as 'marked' and those occurring in the word-medial position are referred to as 'unmarked'. These two terms were used as these processes cannot be referred to as 'stressed' and 'weak' syllable deletion since no stress is reported to occur in Setswana. Participants in this age group omitted both marked and unmarked syllables. Deletion of the marked syllable always occurred in the word-initial position and never in the penultimate position. Although this occurred in tri-syllabic words, marked syllables were omitted more in words made up of four and five syllables, e.g. '*sefapanô*' /sefap'a:nɔ/ (a cross) was produced as '*fapanô*' /fap'a:nɔ/. Syllabic consonants in the word-initial position were not affected, and the one participant who had omitted a syllabic consonant in the word-initial position was able to produce other syllable consonants word-initially, e.g. Child L2 produced '***m**pôpô*' /mp'ɔ:p'ɔ/ (a doll) as '*pôpô*' /p'ɔp'ɔ/ and produced '*lela*' /**l**la/ (to cry) accurately. Deletion of unmarked syllables affected multisyllabic words only (i.e. words with more than three syllables), e.g. '*kgomagantsha*' /kx^{h}omaxan:ts^{h}a/ (to glue things together) was produced as '*kgomanthô*' /kx^{h}oman:t^{h}ɔ/ by one of the participants and as '*khomantsha*' /k^{h}oman:ts^{h}a/ by another. '*Baesekela*' /baesek'e:la/ (a bicycle) was produced as '*baekela*' /baek'e:la/ by two participants (Child L1 and L4). Gliding of liquids appears to have occurred in short words only (i.e. bi- and tri-syllabic words) and was noted in different word positions. Both syllabic and non-syllabic consonants were affected, e.g. '***lel**a*' /**ll**a/ was produced as '***yy**a*' /**jj**a/ by Child L4, '*seti**l**ô*' /set'i:**l**ɔ/ (a chair) was produced as '*sti**w**ô*' /st'i:**w**ɔ/ by Child L5, and Child L29 produced '*mo**r**i**r**i*' /mo**r**i:**r**i/ (hair) as '*mo**y**i**y**i*' /mo**j**i:**j**i/. Assimilation was noted to have occurred in bi- and tri- syllabic words only, e.g. '***n**amêla*' /**n**amɛ:la/ (to climb) was often produced as '***m**amêla*' /**m**amɛ:la/, '*monwa**n**a*' /monwa:**n**a/ (a finger) was produced as

‘*monwa**nw**a*’ /monwa:**nw**a/ and ‘*lwa**l**a*’ /lwa**l**a/ (to be sick) was produced as ‘*lwa**lw**a*’ /lwa**lw**a/. This process appears common in the speech of young children (i.e. between 3;0 – 3;5 years) and was used by four participants in this age group.

Lastly, specific phoneme substitution occurred in all word positions, with the alveolar trill /r/ the most frequently substituted consonant. This phoneme was often produced posteriorly and substituted with the uvular trill /ʀ/. It was also often substituted with the non-fricative lateral alveolar /l/. For instance, ‘***r**ôbêtse*’ /**r**ɔbɛ:ts'e/ (asleep) was produced as ‘***g**ôbêtse*’ /**ʀ**ɔbɛ:ts'e/ by some participants while others produced it as ‘***l**ôbêtse*’ /**l**ɔbɛ:ts'e/. Other instances include producing ‘*mo**r**i**r**i*’ /mo**r**i:**r**i/ (hair) as ‘*mo**g**i**g**i*’ /mo**ʀ**i:**ʀ**i/ or ‘*mo**l**i**l**i*’ /mo**l**i:**l**i/, and ‘*setlha**r**e*’ /setɬʰa:**r**e/ (a tree) as ‘*setlha**g**e*’ /setɬʰa:**ʀ**e/ or ‘*setlha**l**e*’ /setɬʰa:**l**e/. Although the simplification of -Cw- and multisyllabic words were not used as frequently as the processes described above, they are interesting to make note of. Simplification of -Cw- digraphs in the word-initial position and penultimate syllable involved omitting the semi-vowel /w/, thereby reducing the CCV syllable to the simple CV structure. This occurred in words of varying length. For instance, ‘***nw**a*’ /**nw**a/ (to drink) was produced as ‘***n**a*’ /**n**a/, ‘***jw**ala*’ /**ʤw**ala/ (to plant a seed) as ‘***j**ala*’ /ʤala/, ‘***tshw**aragantsha*’ /**ts**ʰ**w**araxan:tsʰa/ (to assemble pieces together) as ‘***tsh**alagantsha*’ /**ts**ʰalaxan:tsʰa/. The -Cw- digraphs occurring in other word positions were also simplified, e.g. ‘*se**tshw**antshô*’ /se**ts**ʰ**w**an:tsʰɔ/ (a picture) was produced as ‘*se**tsh**antshô*’ /se**ts**ʰan:tsʰɔ/ by some of the participants in this age group. These findings likely indicate that the CCV syllable is being produced more accurately, even though adult targets may not be reached yet. This process is also likely used frequently in children younger than 3;0 years. This also corresponds to this group’s PPC scores for the CCV syllable structure, which indicate that this syllable is used accurately by this age group but continues to develop in children older than 3;5 years. Simplification of multisyllabic words involved words with five syllables. Two participants (Child L2 and L29) reduced the five syllable words to tri-syllabic words so as to produce them with ease, e.g. ‘*lemphorwana*’ /lempʰorwa:na/ (5 syllables - a chick) was produced as ‘*phorwana*’ /pʰorwa:na/ (3 syllables) and ‘*sekhurumêlô*’ /sekʰurumɛ:lɔ/ (5 syllables - a lid) was produced as ‘*khimê:lô*’ /kʰimɛ:lɔ/ (3 syllables).

4.4.1.2 Group 2 (3;6 – 3;11 years)

Phonological processes noted in the speech of participants in this age group are summarised in Table 40.

Table 40. ***Phonological processes: Group 2 (3;6 – 3;11 years)***

Phonological Process	Example	Child E4	Child E5	Child E6	Child E7	Child L6	Child L7
Vowel elision	setɬʰa:re	**stɬʰ**a:re	**stɬʰ**a:re	**stɬʰ**a:re	**stɬʰ**a:re	**stɬʰ**a:re	**stɬʰ**a:re
Deletion of marked syllables	letsw'a:i sefatɬʰɛ:xɔ			tsw'ai	fatɬʰɛ:xɔ		
Deletion of unmarked syllables	tsʰwaraxa n:tsʰa					tsʰwahan: tsʰa	
Gliding of liquids	raxa tɬʰware					**j**axa tɬʰwa**j**e	
Assimilation	lempʰorw a:na nɔɲa:ne	lempʰoʀw a:**ʀ**a ɲɔ**ɲ**wa:ne	 ɲɔ**ɲ**a:ne	 ɲɔ**ɲ**a:ne		 ɲɔ**ɲ**a:ne	lempʰo**l**a:**l** a
Simplification of Cw digraphs	nwa setsʰwant sʰɔ			**w**a	se**ts**ʰan:tsʰ ɔ		
Simplification of multisyllabic words	kxʰomaxa n:tsʰa						xan:tsʰa
Specific phoneme substitution	boru:kʰu lepʰɔdi:sa mori:ri	bo**ʀ**u:kʰu mo**ʀ**i:**ʀ**i	 lepʰ**ɔ**li:sa mo**l**i:**l**i	bo**l**ukʰu mo**l**i:**l**i	bo**ʀ**u:kʰu mo**ʀ**i:**ʀ**i	bo**ʀ**u:kʰu mo**l**i:**l**i	bo**l**u:kʰu
Plosivation	kxʰomaxa n:tsʰa xwai:la			kxʰoma**kx** ʰan:tsʰa	 **kx**ʰ**w**ai:la		
Occlusivation/ Stopping	sefatɬʰɛ:xɔ		se**p'**atɬʰɛ: xɔ				
Secondary labialisation	nɔɲa:ne	ɲɔ**ɲw**a:ne					

Participants in this age group used 11 processes. The most widely used processes in Group 2 are vowel elision, assimilation and specific phoneme substitution (with the alveolar trill /r/ the most substituted). Examples of these are illustrated in Table 40. Fewer processes were used by Group 2, indicating that some processes are eliminated early.

4.4.1.3 Group 3 (4;0 – 4;5 years)

Phonological processes noted in the speech of participants in this age group are summarised in Table 41.

Table 41. ***Phonological processes: Group 3 (4;0 – 4;5 years)***

Phonological process	Example	Child E10	Child E11	Child L8	Child L9	Child L10	Child L32
Vowel elision	baesek'e:la	bae**sk'**ela	bae**sk'**ela	bae**sk'**ela		bae**sk'**ela	bae**sk'**ela
Deletion of marked syllable	sets^{h}wan:ts^{h}ɔ mp'ɔ:p'ɔ	ts^{h}wan:ts^{h}ɔ		ts^{h}wan:ts^{h}ɔ	p'ɔp'ɔ		
Assimilation	ts^{h}asa mose:la nɔŋa:ne	ts^{h}a**ts^{h}**a ɲɔ**ŋ**a:ne	mose:**s**e		ɲɔ**ŋ**a:ne	ɲɔ**ŋ**wa:ne	
Simplification of Cw digraphs	sets^{h}wan:ts^{h}ɔ t^{h}wala		se**ts^{h}**an:ts^{h}ɔ	**t^{h}**ala			
Specific phoneme substitution	raxa k^{h}wae:re	khwae:**l**e		**ʀ**aha k^{h}wae:**ʀ**e	**ʀ**axa k^{h}wae:**ʀ**e	**ʀ**aha k^{h}wae:**ʀ**e	**ʀ**aha k^{h}wae:**ʀ**e
Secondary labialisation	nɔŋa:ne					ɲɔ**ŋ**wa:ne	

Participants in Group 3 used fewer processes than Groups 1 and 2. They only used 6 processes and the most frequently used ones included vowel elision, assimilation, as well as specific phoneme substitution (which often involved the alveolar trill /r/). Examples of these processes are documented in Table 41. Processes eliminated include deleting the unmarked syllable, gliding of liquids, simplifying multisyllabic words, deaspiration, palatalization, plosivation, occlusivation/stopping, as well as, backing front stops.

4.4.1.4 Group 4 (4;6 – 4;11 years)

Phonological processes noted in the speech of participants in this age group are summarised in Table 42.

Table 42. ***Phonological processes: Group 4 (4;6 – 4;11 years)***

Phonological process	Example	Child E13	Child L11	Child L12	Child L13	Child L14	Child L30
Vowel elision	set'i:lɔ	**st'**i:lɔ	**st'**i:lɔ	**st'**i:lɔ	**st'**i:lɔ	**st'**i:lɔ	**st'**i:lɔ
Assimilation	nɔɲa:ne namɛ:la	ɲɔ**ɲ**wa:ne	ɲɔ**ɲ**a:ne	ɲɔ**ɲ**wa:ne **m**amɛ:la	ɲɔ**ɲ**a:ne **m**amɛ:la	ɲɔ**ɲ**a:ne	
Deaspiration	kx^{h}oxo			**x**oxo			
Specific phoneme substitution	borɔ:t^{h}ɔ diap'a:rɔ lexadi:ma	bo**ʀ**ɔ:t^{h}ɔ diap'a:**ʀ**ɔ		bo**l**ɔ:t^{h}ɔ diap'a:**l**ɔ lexa**l**i:ma	bo**ʀ**ɔ:t^{h}ɔ		diap'a:**l**ɔ
Secondary labialisation	nɔɲa:ne	nɔ**ɲw**a:ne		nɔ**ɲw**a:ne			
Vowel alternation	ap'a:ja ap'a:ra			**j**ap'e:ja **j**ap'a:la	**j**ap'e:ja		

Participants in Group 4 used five processes (excluding the elision of vowels). Similar to Group 3, the most frequently used processes were vowel elision, assimilation, as well as specific phoneme substitution which almost always involved the alveolar trill /r/.

4.4.1.5 Group 5 (5;0 – 5;5 years)

Phonological processes noted in the speech of participants in this age group are summarised in Table 43.

Table 43. ***Phonological processes: Group 5 (5;0 – 5;5 years)***

Phonological process	Example	Child L15	Child L17	Child L18	Child L20	Child L21	Child L33
Vowel elision	sek'ɔtɬ'ɔ:lɔ	**sk'**ɔtɬ'ɔ:lɔ	**sk'**ɔtɬ'ɔ:lɔ	**sk'**ɔtɬ'ɔ:lɔ	**sk'**ɔtɬ'ɔ:lɔ		bae**sk'**e:la
Deletion of marked syllable	set'i:lɔ sefatɬ^{h}ɛ:xɔ					t'ilɔ fatɬ^{h}ɛ:xɔ	
Deletion of unmarked syllable	baesek'e:la					baek'e:la	
Gliding of liquids	ts^{h}waraxan :ts^{h}a		ts^{h}wa**j**ahan :ts^{h}a				
Assimilation	sefap'a:nɔ nɔɲa:ne	ɲɔ**ɲ**a:ne				sefa**f**a:nɔ	
Specific phoneme substitution	lemp^{h}orwa :na	lemp^{h}o**R**wa :na	lemp^{h}o**R**wa :na	lemp^{h}o**R**wa :na	lemp^{h}o**R**wa :na	lemp^{h}o**R**wa :na	lemp^{h}o**R**wa :na
Occlusivation/ Stopping	seha ts^{h}asa					**ts'**eha ts^{h}a**ts'**a	
Vowel alternation	ap'a:ja		**j**ap'e:ja				

Participants in Group 5 presented with eight phonological processes. Vowel elision and specific phoneme substitution were the most widely used processes. Participants in Group 5 used more processes than reported for Groups 3 and 4. This correlates with findings reported for acquisition of consonant, vowel and syllable structures, where participants in this age group produced phonemes with less accuracy in comparison to those in younger groups. The findings reported here, however, cannot be attributed to gender differences as the male only group (Group 4) produced fewer processes than Groups 1 – 3.

4.4.1.6 Group 6 (5;6 – 5;11 years)

Phonological processes noted in the speech of participants in this age group are summarised in Table 44.

Table 44. ***Phonological processes: Group 6 (5;6 – 5;11 years)***

Phonological process	Example	Child L23	Child L24	Child L26	Child L27	Child L28	Child L31
Vowel elision	sek^{h}urumɛ:lɔ	**sk^{h}**urumɛ:lɔ	**sk^{h}**urumɛ:lɔ	**sk^{h}**urumɛ:lɔ	**sk^{h}**urumɛ:lɔ	**sk^{h}**urumɛ:lɔ	**sk^{h}**urumɛ:lɔ
Assimilation	nɔɲa:ne lemp^{h}orwa:na				ɲɔ**ɲ**a:ne	ɲɔ**ɲ**a:ne **m**emp^{h}orwa:na	ɲɔ**ɲ**a:ne
Deaspiration	t^{h}wala	**tw'**ala					
Specific phoneme substitution	mori:ri borɔ:t^{h}ɔ				mo**ʀ**i**ʀ**i	bo**ʀ**ɔ:t^{h}ɔ	
Metathesis	lemp^{h}orwa:na				**r**emp^{h}o**l**wa:na		**r**emp^{h}o**l**wa:na

Participants in Group 6 presented with five processes and frequently used vowel elision and specific phoneme substitution. The alveolar trill /r/ was substituted with the velar trill /ʀ/ only. Although not widely used by participants in this group, it is interesting to note this group presented with metathesis in their speech. This process was used by two participants and only one word was involved: Child L27 and L31 produced '***l****emphor****w****ana***' /**l**emp^{h}o**r**wa:na' (a chick) as '***remphol****w****ana***' /**r**emp^{h}o**lw**a:na/, thereby swapping the phonemes of the first and fourth syllables.

4.4.1.7 Across age groups

The younger participants (3;0 – 3;5 years) presented with more phonological processes than those in the other age groups. Syllable-level phonological processes are seen in all groups, more so in the youngest groups (Groups 1 and 2). These participants presented with deletion of marked and unmarked syllables, gliding of liquids, assimilation, simplifying the -Cw- digraphs, as well as simplifying words with five syllables. The older age group (Group 6) only presented with assimilation and metathesis at the syllable level. Fewer participants in Group 1 (4 of 6) presented with assimilation as compared to those in Group 2 (5 participants). This number is seen to decrease in Group 3 (with 4 participants presenting with assimilation) before it increases again in the next group (with 5 participants in Group 4). Fewer participants in Groups 5 and 6 had this process in their speech. Assimilation is likely eliminated after 6;0 years. Participants in Group 5 produced more syllable-level

processes than those in Group 4. This pattern is also described for consonant and syllable acquisition.

It can be noted that participants in Group 2 presented with fewer phonological processes than those in Group 1. This may be an indication of increasing accuracy in speech production. Unlike the other groups, assimilation occurring in the speech of participants in Groups 4 and 6 appears to affect only a specific group of words – those with nasals word-initially and medially.

All participants presented with specific phoneme substitution, with the alveolar trill /r/ the one consonant phoneme frequently substituted with other consonants. This phoneme is substituted with two consonants, namely the non-fricative lateral alveolar /l/ and the uvular trill /ʀ/, in all word positions by Groups 1 up to 4. It is, however, only substituted with the uvular trill /ʀ/ by participants in Groups 5 and 6. This is likely because the older participants are able to consciously differentiate between the non-fricative lateral alveolar /l/ and the rolled vibrant /r/, hence substituting it with a phoneme which sounds similar to it (i.e. the uvular trill /ʀ/). The voiced alveolar explosive /d/ was also sometimes substituted with its allophonic variant /l/ in the word-medial position.

Other phonological processes which occurred with less frequency include reducing five syllable words to three syllables. This occurred more in the youngest group of children (Group 1) and is likely a strategy used to help them produce the multisyllabic words with ease. Some participants omitted aspiration in words, while others sometimes produced non-aspirated phonemes with aspiration. Although recorded as a phonological process, vowel elision is also present in adult speech, and occurs in both loanwords and non-loanwords. These findings therefore suggest that children use adult-like speech in their earliest years. Table 45 is a summary of phonological processes used by the children of varying ages.

Table 45. ***Number of participants using phonological processes across the age groups***

Group			1	2	3	4	5	6
Phonological process	**Target**	**Example**						
Vowel elision	**se**t'i:lɔ	**st'**i:lɔ						
Deletion of marked syllable	**se**fatɬhɛ:xɔ	fatɬ^{h}ɛ:xɔ						
Deletion of unmarked syllable	sek^{h}**u**r**u**mɛ:lɔ	sek^{h}umɛ:lɔ						
Gliding of liquids	**ll**a set'i:**l**ɔ	**jj**a st'i:**w**ɔ						
Assimilation	lwa**l**a	lwa**l**wa						
Simplification of Cw digraphs	le**sw**a:na	le**s**a:na						
Simplification of multisyllabic words	**lem**p^{h}orwa:na	p^{h}orwa:na						
Deaspiration	**t^{h}**wala	**tw'**ala						
Specific phoneme substitution	**ʀ**ɔbɛ:ts'e	**ʀ**obɛts'e						
Palatalisation	lexadi:**m**a	lehadi:**j**a						
Plosivation	sefap'a:nɔ	sefa**p^{h}**a:nɔ						
Occlusivation/ Stopping	ma**sw**ɛ	ma**tw'**ɛ						
Backing front sound	**tw'**atsi	**kw'**ats'i						
Secondary labialisation	nɔ**ɲ**a:ne	nɔ**ɲw**a:ne						
Metathesis	**l**emp^{h}o**r**wa:na	**r**emp^{h}o**l**wa:na						
Vowel alternation	ap'a:ja	**j**ap'a:ja						

Key:

	6 participants (100%) used the process
	5 participants (83%) used the process
	4 participants (67%) used the process
	3 participants (50%) used the process
	2 participants (33%) used the process
	1 participant (17%) used the process
	0 participants used the processes

4.4.2 Summary

Phonological processes used by children of varying ages were discussed. The youngest group of children (3;0 – 3;5 years) were noted to use more phonological processes than the older children (5;6 – 5;11 years). A decrease in the number of processes used is seen more in Groups 3 and 4, followed by an increase again before more processes are eliminated in Group 6. This same developmental pattern is seen in the acquisition of consonants and syllable structures and was attributed to gender differences. This is, however not a satisfactory explanation in the case for phonological processes as the male only group (Group 4) used fewer phonological processes than Group 5. Processes used by participants included assimilation, gliding of liquids, plosivation and occlusivation/stopping, specific phoneme substitution, as well as metathesis in the older group of children (Group 6). Phonological processes occurring in production of vowels are described next.

4.4.3 Relational Analysis: Vowels

In this part of the section, an overview of participants' production of vowels in comparison to the target phonology is provided. Each individual age group is discussed, followed by a comparison of all age groups.

4.4.3.1 Group 1 (3;0 – 3;5 years)

Vowels of varying heights were substituted by participants in this age group. The central low /a/ was substituted with the front mid-high /e/ in the word-final position, e.g. '*lemphorwan**a***' /lemp^{h}orwa:n**a**/ (a chick) was produced as '*lempholwan**e***' /lemp^{h}olwa:n**e**/.

The central low /a/ was also substituted with the back mid-low /ɔ/, e.g. '*kgomagantsh**a***' /kx^{h}omaxan:ts^{h}**a**/ (to glue things together) was produced as '*kgomagants**ô***' /kx^{h}omahan:ts**ɔ**/. The back high vowel /u/ was substituted with the front high vowel /i/ by some participants, e.g. '*sekh**u**r**u**mêlô*'/sek^{h}**u**r**u**mɛ:lɔ/ (a lid) was produced as 'skh**i**r**i**mêlô' /sk^{h}**iʁi**mɛ:lɔ/. Participants were stimulable for correct production of these vowels in words.

4.4.3.2 Group 2 (3;6 – 3;11 years)

Fewer substitutions were made by participants in this age group. The low central /a/ was substituted with the back mid-low /ɔ/, e.g. '*din**a**mane*' /din**a**ma:ne/ (calves) was produced as '*din**ô**mane*' /din**ɔ**ma:ne/. Similar to participants in Group 1, the back high vowel /u/ was substituted with the front high /i/, e.g. '*sekh**u**r**u**mêlô*'/sek^{h}**u**r**u**mɛ:lɔ/ (a lid) was produced as 'skh**i**r**i**mêlô' /sk^{h}**iʁi**mɛ:lɔ/.

4.4.3.3 Group 3 (4;0 – 4;5 years)

Only one vowel substitution was noted in this group. The low central /a/ was substituted with the back mid-low /ɔ/ in the word-final position, e.g. '*kgomagantsh**a***' /kx^{h}omaxan:ts^{h}**a**/ (to glue things together) was produced as '*kgomagants**ô***' /kx^{h}omahan:ts**ɔ**/.

4.4.3.4 Group 4 (4;6 – 4;11 years)

Children in the age group continue to substitute the low central /a/ with the back mid-low /ɔ/, e.g. '*lebôt**a***' /lebɔ:t'**a**/ (a wall) was produced as '*lebôt**ô***' /lebɔ:t'**ɔ**/ by some participants.

4.4.3.5 Group 5 (5;0 – 5;5 years)

The low central /a/ was substituted with the back mid-low /ɔ/, e.g. '*dit**a**mati*' /dit'**a**ma:t'i/ (tomatoes) was produced as '*dit**ô**mati*' /dit'**ɔ**ma:t'i/.

4.4.3.6 Group 6 (5;6 – 5;11 years)

No vowel substitution patterns were noted in participants in this age group.

4.4.3.7 Across age groups

The vowel substitutions appeared to occur more in younger children than in the older group. A decrease in substitutions was observed with an increase in age, e.g. fewer

substitutions were used by children in Group 2 than in Group 1. This pattern continued and vowel substitutions were eliminated in the speech of older children.

4.4.4 Summary

In this section, profiles of the phonological skills of children in various age groups were detailed. This was achieved by making a comparison across all groups. Developmental changes were noted in immature vowel-related phonological processes, as children in the oldest group (Group 6) had no vowel substitution patterns. The younger group, on the other hand, presented with more vowel substitutions.

4.4.5 Stimulability

Stimulability was assessed in order to determine whether participants would be able to produce consonant phonemes and words they experienced difficulty producing, when prompted. They were asked to repeat words, then syllables in isolation if words still appeared difficult and lastly single phonemes if syllables also posed a challenge for them.

4.4.5.1 Group 1 (3;0 – 3;5 years)

Most participants in Group 1 were able to produce the marked syllables omitted in the spontaneous picture naming task, e.g. '*sefatlhêgô*' /sefatɬʰɛːxɔ/ (a face), which had been produced as '*fatlhêgô*' /fatɬʰɛːxɔ/ by some participants, was produced in its correct form. They, however, continued to omit the unmarked syllables, e.g. '*baesekela*' /baesek'ela/ (a bicycle) was still produced as '*baekela*' /baek'eːla/. All syllables were produced in isolation and the participants were prompted to repeat these each time. For example, producing all these syllables in isolation; /ba/, /e/, /se/, /k'e/, /la/. Target words were then segmented into their different syllables (e.g. /ba-e-se-k'e-la/), all of which participants were able to produce accurately. Difficulties were only noted when participants were prompted to blend these syllables. Not all participants in Group 1 were stimulable when prompted to produce words in which assimilation occurred, e.g. 'namêla' /namɛːla/ (to climb) was still produced as '*mamêla*' /mamɛːla/ by some participants while others produced it correctly. Those who were not stimulable for the correct production were able to produce the syllables of these words in isolation. In addition, none of these participants were stimulable for the word '*nônyane*' /nɔŋaːne/ (a bird). Participants in this age group were able to produce the -Cw- digraphs, although not consistently. They were also not stimulable for the CCV syllable as they omitted the semi-vowel /w/, reducing this syllable to the simple CV structure. Finally, these participants were not stimulable for production of the alveolar trill /r/. They continued

to substitute it with the non-fricative lateral alveolar /l/ or, more commonly, with the uvular trill /ʀ/. This occurred at both the syllable and single phoneme levels, e.g. /ra/ was produced as /la/ and /ʁa/ while /r/ was produced as either /l/ or /ʀ/.

4.4.5.2 Group 2 (3;6 – 3;11 years)

Participants in this age group were stimulable when prompted to produce words in which assimilation occurred. As was the case for Group 1, correct productions were inconsistent. For instance, participants who produced '*namune*' /namu:ne/ (an orange) as '*mamune*' /mamu:ne/ were stimulable for correct production of the word but not for correct production of '*nônyane*' /nɔŋa:ne/ (a bird – which they continued producing as '*nyônyane*'/ɲɔŋa:ne/). Similar to the previous group, these participants were not stimulable for correct production of the alveolar trill /ɾ/.

4.4.5.3 Group 3 (4;0 – 4;5 years)

These participants were stimulable for correct production of words in which assimilation occurred. Production of these words were consistent and participants only experienced difficulty with producing '*nônyane*' /nɔŋa:ne/ (a bird), which was often produced as '*nyônyane*' /ɲɔŋa:ne/. In addition, some of these participants were stimulable for the production of the alveolar trill /r/ (e.g. '*moriri*' /mori:ri/ – hair, which was often produced as either '*molili*' /moli:li/ or '*mogigi*' /moʁi:ʁi/, was produced accurately). Most participants, however, continued substituting this phoneme with the non-fricative lateral alveolar /l/ and the uvular trill /ʀ/.

4.4.5.4 Group 4 (4;6 – 4;11 years)

All the participants in this group were stimulable for correct production of most words. For instance, 'nônyane' /nɔŋa:ne/ (a bird), which was sometimes produced as 'nyônyane' /ɲɔŋa:ne/, was produced accurately by all participants. Some participants were able to produce the word without extra cues while others produced it after segmenting it into different syllables. Similar to the previous age group, some participants were stimulable for correct production of the alveolar trill /r/. This occurred more in words than in syllables or in isolation, e.g. some participants were able to produce '*rôbêtse*' /rɔbɛ:ts'e/ (asleep) accurately but substituted this phoneme with either the non-fricative lateral alveolar /l/ or uvular trill /ʀ/ when producing it at a syllable or phoneme level (e.g. /ra/ was produced as /la/ or /ʁa/). It was, however, noted that these participants used the uvular trill /ʀ/ more often than the lateral alveolar /l/ to replace the alveolar trill /r/.

4.4.5.5 Group 5 (5;0 – 5;5 years)

More participants in this age group were stimulable for correct production of the alveolar trill /r/, although some continued to substitute it with the uvular trill /ʀ/.

4.4.5.6 Group 6 (5;6 – 5;11 years)

Although most participants in the older age group (5;6 – 5;11 years) often substituted the alveolar trill /r/ with the uvular trill /ʀ/, all participants were stimulable for correct production of /r/. This was seen in words, as well as syllables and phonemes produced in isolation.

4.4.6 Chapter Summary

In this chapter, profiles of the phonological and phonetic skills of children in various age groups were detailed. This was achieved by making a comparison across all groups. A progression in the development of consonant phonemes was noted in the number of phonemes produced accurately in both the initial word position and in the penultimate syllable. More consonants were acquired by the older children (5;6 – 5;11 years) than the youngest group (3;0 – 3;5 years).

Consistencies in the acquisition of consonant phonemes were observed in other groups, e.g. the number of phonemes produced accurately in Group 2 (3;6 – 3;11 years) was similar to those produced by participants in Group 3 (4;0 – 4;5 years). Fluctuations were also noted, e.g. there was a slight decrease in the number of consonants acquired in Group 5 (5;0 – 5;5 years) in the penultimate syllable as compared to Group 4 (4;6 – 4;11 years). This slight dip seen in Group 5 was noted particularly in the acquisition of the alveolar trills /r/ and /rw/, as well as the aspirated alveolar affricate /ts^{h}w/. These fluctuations not only occurred in Group 5, but were seen in the acquisition of the vowel only syllable (V) in Group 3. Although acquired by children in younger groups (Groups 1 and 2), this syllable was not acquired by those in Group 3, with vowel alternation occurring here.

Developmental changes were also noted in the nature of phonological processes used – the youngest group (3;0 – 3;5 years) presented with more processes in their speech than all the other age groups. The older groups (5;0 – 5;5 and 5;6 – 5;11 years) were more stimulable for correct production of target words than the youngest group (3;0 – 3;5 years). In addition, all participants used all the seven vowels, as well as the four raised variants of the semi-open and semi-close vowels, accurately.

In the chapter that follows, results detailed above will be used to make cross-linguistic comparisons. The limitations of this study and its implications for clinical practice will also be discussed.

CHAPTER 5: DISCUSSION

This study aimed to describe speech sound acquisition in typically developing Setswana-speaking children between the ages of 3;0 and 6;0 years. This study was carried out to contribute information on typical speech development in Setswana as such information is currently not available. It also aimed to contribute to the evidence base for clinical practice in Southern Africa. This was done as SLTs working in the Southern African context may often experience difficulties identifying, classifying and managing speech sound disorders in this population. A Setswana single word assessment tool was developed for the purposes of this study and was used to collect information on the speech of thirty-six preschool aged Setswana-speaking children from Hebron, in the North-West province of South Africa. In this chapter, the findings of the study are interpreted and discussed in detail.

The study makes contributions at two levels: that of basic research in which it adds new knowledge to the fields of study (phonology, linguistics, African languages) and that of applied research in which the findings have particular bearing on the clinical work of SLTs working in Southern Africa. In this chapter, I return to the research that has been carried out in the related language of Sesotho and relate findings for Setswana to this, and other languages. The chapter also focuses on relating the findings of this study to established frameworks and models of speech development, thereby contributing to theoretical knowledge in the field. More practically, clinical implications and future development of this work are discussed.

5.1 Consonant acquisition

The majority of Setswana consonants appear to develop early. In the word-initial position, all ejective and voiced explosives, nasals, approximants (lateral and medial non-fricatives), as well as ejective and aspirated affricates were acquired by children aged 3;0 years in the current study. The aspirated explosives, fricatives and voiced affricates are all acquired by 4;0 years. These findings are in agreement with findings reported for isiXhosa in that ejectives (explosives), nasals and approximants are acquired early (Maphalala *et al*., 2014; Pascoe & Smouse, 2012). Setswana-speaking children appear to acquire aspirated explosives earlier than isiXhosa-speaking children. This may be the case in Sesotho too as Demuth (2007) reported that children younger than 3;0 years often preserve aspiration when producing aspirated phonemes. Affricates are also acquired earlier in Setswana than in isiXhosa. Affricates are reported to pose challenges for Sesotho-speaking children too, with affricates /tɬ'/ and /ts'/ often simplified to /t'/. Unlike isiXhosa, conclusive remarks on Setswana-speaking children acquiring affricates earlier than their Sesotho-speaking peers

cannot be made as simplification of affricates was reported to occur in children aged 2;6 years. It is likely that affricates are acquired in 3;0 year olds, with the acquisition of this sound class occurring earlier than reported for isiXhosa. This is supported by findings from Demuth (1992), who reported the acquisition of the alveolar affricate /ts'/ and /ts^{h}/ as early as 2;6 years. Affricates are likely acquired later by isiXhosa-speaking children as the language has a larger set of affricates in comparison to the Sotho group of languages. Sesotho is reported to have four affricates (Demuth, 2007), Setswana has six (Cole, 1955, with only four used by the study group) and isiXhosa has eight affricates (Maphalala *et al*., 2014). Early acquisition of aspirated explosives and affricates was also reported for isiZulu (Naidoo *et al*., 2005), a language belonging to the same group as isiXhosa. These differences in acquisition of Southern Bantu phonological systems should be explored further in future.

The alveolar trill /r/ was the last consonant to be acquired by the Setswana-speaking children in the study. It is, however, acquired early (at 4;0 years) in isiXhosa (Maphalala *et al*., 2014), and even earlier in Sesotho (at 3;0 years) (Demuth, 1992). This early acquisition of the trill /r/ in isiXhosa is surprising as it is reported to be one of the less frequently occurring phonemes in the language (Maphalala *et al*., 2014), likely less than in Setswana. In the current study, variations in the acquisition of the alveolar trill /r/ were noted. Children between the ages of 4;6 – 4;11 years had acquired the trill /r/ but not with rounding (i.e. /rw/). This phoneme, however, had not yet been acquired by children aged 5;0 – 5;5 years but acquisition appears complete between 5;6 – 5;11 years.

In the penultimate syllable, the majority of consonants were acquired by the 3;0 year old children. Exceptions include the alveolar fricative /s/, which was acquired at 4;0 years, as well as the aspirated affricate /ts^{h}w/. Similar to the findings reported for word-initial acquisition, children continue experiencing difficulties producing the alveolar trill /r/. The rounded trill /rw/ has developed in children between the ages of 4;6 – 4;11 years. It does not appear to be acquired at 5;0 – 5;5 years. By 6;0 years, children had acquired the trill /r/ but the rounded trill /rw/ appears to develop beyond 6;0 years.

These findings indicate that the accuracy with which consonants are produced increases with age. The older children (i.e. 5;5 – 5;11 years) had acquired more consonants than the younger ones (i.e. 3;0 – 3;5 years), in both the word-initial position and the penultimate syllable. This is in agreement with research studies which have investigated phonological acquisition in other languages and have reported that phonological skills develop with age (Demuth, 2007; Dodd *et al*., 2003; Hua & Dodd, 2000; Maphalala *et al*., 2014; Saaristo-Helin, 2009; Tuomi *et al*, 2001). Sound classes not acquired by 3;0 years by the children in the study are discussed in further detail below.

5.1.1 Aspirated explosives

The aspirated explosives were acquired by 4;0 years but were challenging for participants in the youngest group (i.e. 3;0 – 3;5 years). Although five of the participants in this youngest age group had acquired five of the seven aspirated explosives assessed in the word-initial position, they often produced the other two phonemes with no aspiration (i.e. they produced them as ejective explosives). The aspirated alveolar explosive /t^{h}w/ was sometimes produced as ejective alveolar explosive /tw'/, e.g. '***th****wala*' /**t^{h}w**ala/ (to find an item which had been lost or misplaced) was produced as '***tw****ala*' /**tw'**ala/. Production of aspirated explosives as ejectives is reported for children acquiring isiXhosa (Maphalala *et al*., 2014), even though it appears to occur less frequently in Setswana. Sesotho-speaking children are reported to preserve aspiration even when simplifying certain phonemes, e.g. producing aspirated alveolar affricate /ts^{h}/ as aspirated alveolar explosive /t^{h}/ (Demuth, 2007). One participant in particular experienced difficulty producing the velar /k^{h}w/. These phonemes were also sometimes produced with no rounding, e.g. '***kh****waere*' /**k^{h}w**ae:re/ (a choir) was produced as '***kh****aele*' /**k^{h}**ae:le/. It can be noted in this instance that participants preserved aspiration. One aspirated explosive was sampled in the penultimate syllable and was acquired at 3;0 years.

Although the acquisition of phonemes in Setswana occurs relatively early, some features of Setswana phonology, like rounding, appear to develop later. This is seen in the examples provided above, with children initially producing rounded phonemes with no rounding. These findings concur with Demuth's (2007), who reported that /w/ is often omitted when it occurs as part of a complex syllable onset. This occurs more frequently when /w/ occurs after a nasal velar (e.g. /ŋw/) and is reported to occur until the age of 3;0 years in Sesotho-speaking children (Demuth, 2007). Sesotho-speaking children may be more advanced than their Setswana-speaking peers as this process is seen to occur in Setswana-speaking children older than 3;5 years. This is supported by the early acquisition of the alveolar trill /r/ too, as well as their ability to preserve aspiration when producing phonemes with a complex structure.

5.1.2 Fricatives

All fricatives were acquired by 3;0 years. Some differences were observed in production of the pre-palatal /ʃ/ and alveolar /s/ in children aged 3;0 – 3;5 years. The pre-palatal /ʃ/ was substituted with alveolar /s/ by some children, e.g. '***sh****iana*' /**ʃ**ia:na/ (to run) was produced as '***s****iana*' /**s**ia:na/. Although not common in this dialect, this substitution is often seen in speakers of other Setswana dialects. It was not considered an error as it is found

in the speech of some adults in this region. The alveolar fricative /s/ was not present in some participants' speech as the words used to sample this phoneme in the penultimate syllable were not present in their vocabularies, e.g. '*mosamô*' /mosa:mɔ/ (a pillow) was produced as '*mosamêlɔ*' /mosamɛ:lɔ/ (which also means a pillow) by some participants. When asked to repeat the target words, however, these participants were able to do so accurately.

The use of alternative words by participants made it challenging for the researcher to target all phonemes. This also occurred for production of the ejective velar explosive /kw'/ in the penultimate syllable, e.g. while the majority of participants identified a pair of shoes as '*dikwae**kw**ae*' /dikw'ae**kw'**a:e/ (a pair of high heel shoes), a few used the term '*ditlhako*' /ditɬha:k'o/ (general term used for any type of shoe). The picture stimuli was a pair of high heeled shoes as it was more recognisable than other options provided by the Boardmaker program used to develop pictures.

5.1.3 Voiced affricates

Of the voiced affricates, only the pre-palatal voiced affricate /ʤ/ was assessed in the word-initial position. This phoneme developed as early as 3;0 years. The youngest group of children (3;0 – 3;5 years), however, experienced difficulty producing this phoneme with rounding (i.e. /ʤw/). They often omitted the labio-velar non-fricative /w/, e.g. '***j**wala*' /**ʤw**ala/ (to plant a seed) was produced as '***j**ala*' /**ʤ**ala/. This phoneme was acquired at 4;0 years and was used accurately throughout the older age groups. Simplification of phonemes with rounding occurs later than was reported for Sesotho-speaking children and in various environments (Demuth, 2007). This process occurred in /ŋw/ digraphs and was seen in children younger than 3;0 years. It also appears to be a unique feature of the Sotho group of languages as it was not reported for children acquiring isiXhosa and isiZulu. Cross-linguistic research into these languages may give a better picture of whether or not this statement is true.

5.1.4 Alveolar trill

The alveolar trill /r/ is the only consonant which posed challenges across all six age groups. Although this phoneme is acquired at 3;0 years in Sesotho (Demuth, 2007), it appeared to be acquired between the ages of 4;6 – 4;11 years in Setswana, in both the word-initial and penultimate syllable. Similar to other phonemes, the alveolar trill /r/ would be expected to follow a progressive pattern of development typically described in developmental research. Instead, the trill was not acquired in either of the word positions by

participants aged 5;0 – 5;5 years. This phoneme is, however, fully acquired in the word-initial position by 6;0 years. Participants in the oldest group (i.e. 5;6 – 5;11 years) produced both /r/ and /rw/ accurately. More differences in the acquisition of this phoneme were noted in the penultimate syllable were noted. Participants aged 4;6 – 4;11 years had acquired the rounded trill /rw/ and those in the older group (5;6 – 5;11 years) had acquired /r/ with no rounding. Participants aged 5;0 – 5;5 years continued to experience difficulties producing the trill as it is not acquired by this group in the penultimate syllable. These differences cannot be attributed to gender as all three groups discussed here consist of more boys than girls. These differences may, however, be attributed to the children's linguistic backgrounds, with some children encouraged to produce words and phonemes more accurately by adults around them. Another hypothesis that accounts for these differences is that while children are developing, some phonemes may be acquired and then not used accurately for a certain period before being mastered again later on in life.

Similar to Bleile's (2009) 'Late Eight' category of later-acquired English consonants, the alveolar trill /r/ and rounded trill /rw/ are phonemes which may fall into that category for Setswana. In Setswana, the 'late eight' concept may not only be applicable to particular phonemes but also to the acquisition of phonological features, rounding in particular. Although the trill /r/ and production of rounded phonemes is acquired by 3;0 year old Sesotho-speaking children, these continue to pose challenges for Setswana-speaking children and are only mastered by older children.

5.1.5 Aspirated affricates

The aspirated alveolar affricate /ts^{h}w/ was often produced as ejective alveolar affricate /tsw'/ in the penultimate syllable, e.g. '*khu**tshw**ane*' /k^{h}u**ts^{h}w**a:ne/ (short) was produced as '*khu**tsw**ane*' /k^{h}u**tsw'**a:ne/. This is true for adult speech and is not an articulatory error. This also occurs in Sesotho (Demuth, 2007). Children in the youngest age group, however, often preserved the aspiration and omitted the labio-velar non-fricative /w/, e.g. '*khu**tshw**ane*' /k^{h}u**ts^{h}w**a:ne/ (short) was produced as '*khu**tsh**ane*' /k^{h}u**ts^{h}**a:ne/.

5.1.6 Velar affricates

Velar affricates /kx^{h}/ and /kx^{h}w/ were not always produced accurately by participants. These two phonemes were often produced with no friction, i.e. they were produced as aspirated velar explosives /k^{h}/ and /k^{h}w/. For instance, '***kg**ogo*' /**k^{h}**oxo/ (a chicken) was produced as '***kh**oho*' /**k^{h}**oho/ and '***kgw**êdi*' /**k^{h}xw**ɛdi/ (a month) as '***khw**êdi*' /**k^{h}w**ɛdi/ by a

large number of participants. Similar to the aspirated affricate /ts^{h}w/, these productions were not considered errors or developmental patterns as adults who speak the same dialects produce these phonemes with no friction.

Findings of this study indicate that the ejective and voiced explosives, nasals, approximants (lateral and medial non-fricatives), as well as the ejective and aspirated affricates were some of the phonemes acquired at 3;0 years in the word-initial position. These were followed by the aspirated explosives, fricatives and voiced affricates at 4;0 years. In the penultimate syllable, the majority of consonants are also acquired at 3;0 years, followed by the alveolar fricative /s/ at 4;0 years. The alveolar trill /r/ appears to be the phoneme acquired last (by 6;0 years) in both the word-initial and penultimate syllable. These findings (with the exception of the alveolar trill /r/) are in agreement with findings reported by Demuth (2007) for Sesotho-speaking children. She reported acquisition of consonants as early as 2;0 years. There were also differences noted in the acquisition of phonemes by isiXhosa-speaking children. Although belonging to a language group different to Setswana, isiXhosa like Setswana is also a Southern Bantu language.

Although there were differences in the consonants acquired by the older children, findings regarding sounds acquired early concur with those reported in studies conducted in a range of languages. For instance, Maphalala *et al*. (2014) reported that nasals, liquids and glides are acquired early by isiXhosa-speaking children. Dodd *et al*. (2003) reported that nasals /m, n/ and plosives /p, b, d/, as well as approximant /w/ were some of the phonemes acquired early by British English-speaking children. Gangji *et al*. (in press) have also reported that plosives /p, b, t, d, k/, nasals /m, n, ɲ, ŋ/, approximants /w, j/, affricates /ts'/, lateral /l/, as well as fricatives /f, s/ were among the consonants acquired early.

Although the theory of universals (Zamuner *et al*., 2005) is confirmed by the findings of this study, it only holds true to some degree. The theory of universals hypothesises that during phonological development children acquire features which are common and occur frequently in different languages. On this theory, nasals, plosives and approximants are among the first phonemes to be acquired. This theory would predict that fricatives and affricates would be acquired in older children. In this study, fricatives and affricates were, however, acquired early. The only phoneme still to be acquired in the older children was the alveolar trill /r/. It can therefore be said that these findings are more in keeping with the Specific Language Grammar Hypothesis (SLGH) (Zamuner *et al*., 2005) than the theory of universals. The SLGH predicts that children are likely to acquire phonemes which occur

with more frequency in their native language before acquiring the less frequently occurring phonemes (Zamuner *et al*., 2005).

While there are similarities in the acquisition of consonants across languages (e.g. nasal /m, n/ and plosive /p, b, d/) (Sesotho, Demuth, 2007; English, Dodd *et al*., 2003; Swahili, Gangji *et al*., in press; isiXhosa, Maphalala *et al*., 2014; isiZulu, Naidoo *et al*., 2005), more differences were noted in that almost all consonants were acquired early by Setswana-speaking children. This is a clear indication that normative data from one language cannot be applied to children acquiring a different language. This was highlighted in Chapter 2, which reviewed phonological development in various languages. The differences noted in the acquisition of phonemes in various languages may be influenced by languages (other than those investigated) these children may be exposed to. Given the diverse linguistic setting in South Africa, multilingualism is more common than monolingualism (Mesthrie, 2002). The children who participated in the current study are likely to have some influence from Afrikaans, English, isiNdebele and/or Northern Sotho. Similarly, when the other studies are examined, they may not have detailed and explicitly considered the influence of other languages on the children. This may mean that every child the SLT comes into contact with has a unique history of language exposure and influence. As part of assessment procedures, clinicians are urged to familiarise themselves with the child's culture, how language is used in his/her household, as well as variations in dialects used (De Lamo White & Jin, 2011; Laing & Kamhi, 2003). This information may be useful in setting guidelines for the assessment of multilingual children. The International Expert Panel on Multilingual Children's Speech (2012) suggested that in addition to familiarising themselves with a child's culture, the SLT needs to conduct an assessment and provide therapy in the child's native language. This can be achieved by collaborating with family members, as well as community members. The information obtained in this manner can be used to develop culturally and linguistically appropriate tools (International Expert Panel on Multilingual Children's Speech, 2012). Clinicians are, however, reminded of the need to apply evidence based procedures (International Expert Panel on Multilingual Children's Speech, 2012). This method of developing appropriate assessment and intervention tools can be adopted by SLTs in South Africa as a first step to providing equitable and effective services to children acquiring local indigenous languages. This, however, starts with collecting normative data for the different languages as the importance of applying evidence based procedures cannot be overemphasised.

5.2 Vowel acquisition

There are seven vowels documented in the Setswana inventory. All these were acquired early by the children in the study. The four variants of the mid-vowels are also used accurately as early as 3;0 years. Vowels are also acquired early in Sesotho, although Demuth (2007) has suggested that Sesotho-speaking children may experience difficulties producing the finer distinctions in vowel height. This may be the case for Sesotho-speaking children as Sesotho consists of more vowels than Setswana (i.e. nine vowels with three variants of the mid-vowels). The early acquisition of vowels has also been reported for many other languages, for instance in English-speaking children (Stoel-Gammon & Herrington, 1990), isiXhosa (Maphalala *et al*., 2014; Tuomi et al., 2001), isiZulu (Naidoo *et al*., 2005) and Swahili (Gangji *et al*., in press). While vowels seem to be acquired early across languages, difficulties with vowel production can occur in children with speech difficulties and have a major impact on a child's intelligibility (Speake, Stackhouse & Pascoe, 2012). It is therefore important for SLTs to include vowels in their assessments, as well as to know what is to be expected (i.e. what might be considered typical or disordered).

Different to other languages, the younger participants in this study did not always produce certain vowels accurately. When using this data to determine whether or not children acquiring Setswana may have a motor speech disorder (e.g. Childhood Apraxia of Speech), clinicians should note that there are a few substitutions used by typical Setswana-speaking children. Nelson (2010) has reported that some of the main indicators of Childhood Apraxia of Speech are omissions and errors involving vowels. These are more present in younger children (i.e. 3;0 – 3;5 years) and are used less frequently by children between the ages of 3;6 – 4;6 years. These substitutions included producing the back mid-low /ɔ/ in place of the low central /a/ in the word-final position, e.g. '*kgomagantsh**a***' /kx^{h}omaxan:ts^{h}**a**/ (to glue things together) was produced as '*kgomagantsô*' /kx^{h}omaxan:ts'**ɔ**/ by some participants. Similar developmental patterns were not reported for Sesotho-speaking children. This may therefore be a feature unique in Setswana phonological development and further studies with a large sample size will be needed to investigate it further.

5.3 Syllable structures

Four syllable structures were assessed in the word-initial and penultimate positions. All syllable structures are acquired word-initially as early as 3;0 years, with the exception of the vowel only syllable (V) in Groups 3 and 4 (4;0 – 4;5 and 4;6 – 4;11 years respectively). Participants in these two age groups inserted the palatal non-fricative /j/ before vowels, converting the V syllable to CV. For instance, they produced '***a**paya*' /**a**p'a:ya/ (to cook) as

‘***y****apeya*’ /**j**ap'e:ja/ and ‘***a****para*’ /**a**p'a:ra/ (to get dressed) as ‘***y****apara*’ /**j**ap'a:ra/. This may be attributed to individual differences in development as Group 3 consisted of more girls than boys while Group 4 consisted of boys only. All participants, except those in Group 1, have acquired all four syllable structures in the penultimate syllable. The CCV syllable structure appears to develop after 3;5 years and was found challenging in the youngest group of children. This is seen as they sometimes produce certain phonemes with no rounding (i.e. they omit the labio-velar non-fricative /w/ when producing -Cw- digraphs), e.g. ‘*le****tsw****ai*’ /le**tsw'**a:i/ (salt) was produced as ‘*le****ts****ai*’ /le**ts'**a:i by some participants in the youngest group (3;0 – 3;5 years). This concurs with findings reported by Demuth (2007), who reported that Sesotho-speaking children often simplify co-articulated phonemes. The consonant only syllable (C) was not sampled in the word-final position. Assumptions that it is acquired at 3;0 years were made as all participants produced this syllable accurately and used it consistently in their connected speech utterances not recorded as part of the assessment.

5.4 Percentage of consonants, vowels and phonemes correct

The accuracy with which consonants, vowels and syllable structures were produced was calculated using a formula described by Shriberg *et al*. (1997). This was done in order to determine the accuracy with which children produce speech in relation to the adult target. The average PCC scores for the different age groups show a progressive pattern of consonant acquisition in both the word-initial position and penultimate syllable. This sequential development, however, appears to stop in Group 4. In the word-initial position, Group 3 has a higher PCC average than the remaining groups. Although this warrants further investigation, the high PCC score obtained by Group 3 may be attributed to gender differences. Group 3 consisted of more girls than boys while Groups 4, 5 and 6 comprised more boys than girls. If this is the case, it can be tentatively hypothesised that Setswana-speaking girls acquire accuracy earlier than boys. Scores obtained by Group 5 are similar to those obtained by an even younger group than Group 3 (i.e. Group 2). This finding further supports the hypothesis that girls may acquire speech earlier than boys as Group 2 (3;6 – 3;11 years) consisted mainly of girls. Data on gender as a variable in speech acquisition is limited. In a study investigating phonological development in British English-speaking children, Dodd et al. (2003) found that girls between the ages of 5;6 – 6;11 years were more accurate in their speech than boys. The present study was not aimed at investigating differences in speech acquisition in boys and girls, but this could be investigated in future studies as the data here seems to suggest that boys may lag behind girls. However, it should be remembered that the sample size was very small and a larger sample would be needed to investigate this hypothesis more specifically.

Although PCC scores are seen to increase again in the oldest group (Group 6), accuracy levels are still slightly lower than those obtained by Group 3 (4;0 – 4;5 years). After a progression in accuracy levels is seen in the penultimate syllable, these appear to decrease again at 5;0 – 5;5 years. PCCs obtained by Group 4 are similar to those obtained by Group 3, while those obtained by Group 5 are lower than Group 3's. This may be in support of the hypothesis that girls acquire accuracy earlier than boys. In comparison to findings reported for PCCs in the word-initial position, the older children (5;6 – 5;11 years) obtained the highest PCCs.

The PVC appears to follow a progressive pattern of development, with PVCs increasing with age. This is, however, not the case for vowels occurring in the word-final position. The same pattern described for consonants is seen in vowels. An increase in accuracy is seen between Groups 1 – 3, before a decrease in PVC scores is observed in the groups that follow (i.e. Groups 4 – 6). Group 3 (which consists mainly of girls) has the highest PVCs in the word-final position. Group 5 has a score equal to that obtained by Group 2 (another group consisting mainly of girls). Although an increase in PVCs is seen in Group 6, it is slightly lower than that obtained by Group 3. These differences may again be attributed to gender differences, with girls acquiring accuracy before boys. The low PVCs obtained by the youngest group may be due to more vowel substitution patterns observed in this group.

A progressive change in the acquisition of syllable structures is seen more in the development of the CCV syllable, with the older children (Group 6) producing it more accurately than the younger ones (Group 1). In the other syllable structures, however, fluctuations have been noted to occur across the age groups. For instance, high PPCs were recorded for Groups 1 and 2 for the V syllable and a significant decrease was noted in Group 4 before accuracy levels increased again in Groups 5 and 6. A similar pattern has been described in consonant acquisition and was attributed to gender differences. In addition, these findings indicate that children produce syllable structures with an accuracy approximating adult-like productions as early as 3;0 years. Similar to findings reported for the word-initial position, the only progressive change in syllable acquisition is seen in the CCV syllable. There appears to be a consistency in the acquisition of the V syllable, as scores obtained in different age groups were similar. An increase was noted in the production of the CV syllable, followed by a decrease in accuracy (as seen in Group 4) before an increase was noted again. The younger age groups (Groups 1 and 2) obtained the highest PPC scores for the C syllable. Group 4 obtained the lowest scores and this was followed by an increase in PPCs by participants in Groups 5 and 6. It should be noted that Group 4

consisted of boys only and this decrease in PPCs may be attributed to gender differences, suggesting that girls acquire speech earlier than boys. These findings are also similar to those reported for the word-initial position, as well as for the acquisition of consonants in that an increase in accuracy seems to always be followed by a decrease before an increase is observed again.

5.5 Phonological processes

According to Dodd *et al*. (2003), phonological processes are patterns used by children in order to simplify adult productions. These can be classified into syllable and substitution patterns. Syllable patterns are those which involve the syllable structures of the target words and substitution patterns involve substitution of one or more phoneme for another (Dodd *et al*., 2003). In the present study, both these phonological process patterns were seen across the age groups. The youngest group of children (3;0 – 3;5 years) used more phonological processes than the oldest group (5;6 – 5;11 years). Phonological processes reported for English-speaking children were found to occur in Setswana-speaking children too.

The most widely used processes were the deletion of the marked and unmarked syllables (referred to as stressed and weak syllable deletion in English phonology). Marked syllables were always omitted in the word-initial position and never in the penultimate position. The omission of both marked and unmarked syllables occurred in words with three or more syllables. This process, however, occurred more in words longer than three syllables, e.g. '*sefapanô*' /sefap'a:nɔ/ (a cross) has four syllables, and was produced as '*fapanô*' /fap'a:nɔ/, which has three syllables. The syllabic consonants were also almost never omitted by these children and this was only seen in the speech of one child in Group 1 (3;0 – 3;5 years). Other frequently used phonological processes used by the youngest group of children included gliding of liquids, assimilation, as well as specific phoneme substitutions.

Although the simplification of both the -Cw- digraphs and multisyllabic words appear to be in the process of being eliminated, it is interesting to note that the labio-velar non-fricative /w/ is often omitted when part of a consonant digraph. This leads to the CCV syllable being reduced to the simple CV structure and was seen in monosyllabic through to multisyllabic words in the word-initial and penultimate syllable. For instance '***nwa***' /**nw**a/ (to drink) was produced as '**na**' /**na**/, '***lwala***' /**lw**ala/ (to be sick) was produced as '***la***la' /**la**la/, '*mo**nw**ana*' /mo**nw**a:na/ (a finger) was produced as '*mo**na**na*' /mo**na**:na/ and '*lempho**rw**ana*' /lemp^{h}o**rw**a:na/ (a chick) was sometimes produced as '*lempho**la**la*' /lemp^{h}o**la**:la/. The

simplification of -Cw- digraphs is likely more frequent in children younger than 3;0 years as this was reported frequently in the speech of 2;0 year old Sesotho-speaking children (Demuth, 2007). Simplification of multisyllabic words occurred when words with five syllables were reduced to three syllables. This is likely a strategy used by young children to produce these long words with ease, e.g. '*sekhurumêlô*' /sek^{h}urumɛ:lɔ/ (a lid) was produced as '*khimêlô*' /k^{h}imɛ:lɔ/.

A decrease in the number of phonological processes used by children was observed to occur with age. The oldest group of children (5;6 – 5;11 years) used the least number of processes in their speech. Group 5 (5;0 – 5;5 years) used more processes than Groups 3 and 4. As described earlier, differences between Groups 3 and 5 may be attributed to gender differences. It has been proposed that Setswana-speaking girls are more accurate than boys, as was described in differences noted in PCC, PVS and PPC scores. One consonant phoneme, the alveolar trill /r/, was substituted the most, with this process observed across all ages. This is not surprising as it is the only phoneme which was challenging for participants to produce. It was substituted with both the alveolar non-fricative /l/, as well as the uvular trill /ʀ/. Children in Groups 1 – 3 substituted /r/ with /l/ more than they did with /ʀ/, thereby maintaining the place of articulation. Children in Group 4 substituted the alveolar trill /r/ more with the uvular trill /ʀ/ than with the alveolar non-fricative /l/, therefore maintaining the manner of articulation more than they did the place of articulation. These children may be starting to consciously perceive that the uvular trill sounds more similar to the alveolar trill, hence they use it more than the alveolar non-fricative /l/. This was observed more in children in Groups 5 and 6 (5;0 – 5;5 and 5;6 – 5;11 years respectively), who substituted the alveolar trill /r/ with the uvular trill /ʀ/ only, This substitution pattern has also been reported to occur in Sesotho-speaking children (Demuth, 2007).

Assimilation was found in all age groups but occurred more frequently in Groups 1 – 3. In Group 2 (3;6 – 3;11 years), assimilation occurred mostly in two words, '***n**ônyane*' /**n**ɔɲa:ne/ (a bird) as produced as '***ny**ônyane*' /**ɲ**ɔɲa:ne/ and '***l**emphorwana*' /**l**emp^{h}orwa:na/ (a chick) was produced as '***m**emphorwana*' /**m**emp^{h}orwa:na/. In Group 3, no specific group of words was affected. In Group 4, however, assimilation occurred in tri-syllabic words consisting of nasals in the word-initial positions. For instance '***n**ônyane*' /**n**ɔɲa:ne/ (a bird), which has the palatal /ɲ/ in the penultimate syllable was produced as '***ny**ônyane*' /**ɲ**ɔɲa:ne/, and '***n**amêla*' /**n**amɛ:la/, which has the bilabial nasal /m/ in the penultimate syllable was produced as '***m**amêla*' /**m**amɛ:la/. No specific set of words was involved in Groups 5 and 6 and assimilation was used with the least frequency in comparison to the youngest age groups (Groups 1 – 3, children aged 3;0 – 3;5, 3;6 – 3;11 and 4;0 – 4;5 years). Demuth (2007) has also reported the use of assimilation by children acquiring Sesotho.

In addition, the oldest group of children (5;6 – 5;11 years) were the only ones using metathesis in their speech, e.g. '***l****emphor**r**wana*' /**l**emp^{h}o**r**wa:na/ (a chick) was produced as '***r****emphol**l**wana*' /**r**emp^{h}o**l**wa:na/, swapping phonemes in the first and fourth syllables.

Vowel elision, although included as a phonological process, is not a developmental pattern but an indication of adult-like phonological skills by children. This process is used in adult speech and almost always occurred in CV syllables consisting of the alveolar fricative /s/ and the front mid-high vowel /e/. Elision of this vowel results in the formation of /s/C clusters, e.g. '***se****tilô*' /**se**t'i:lɔ/ (a chair) is often produced as '***st****ilô*' /**st'**i:lɔ/; an /st'/ cluster is formed. This process often occurs in loanwords, as reported for Sesotho too (Demuth, 2007), e.g. '*setilɔ*' is derived from the Afrikaans word '***st****oel*'. This, however, also occurred in non-loanwords, e.g. '***se****khurumêlɔ*' /**se**k^{h}urumɛ:lɔ/ (a lid) was produced as '***skh****urumêlɔ*' /**sk^{h}**urumɛ:lɔ/, thereby forming an /sk^{h}/ cluster. This was noted in other word positions too, e.g. '*bae****se****kela*' /bae**se**k'e:la/ (a bicycle) was produced as '*bae****sk****ela*' /bae**sk'**e:la/. This process is likely an indication of some changes which may affect the structure of Setswana, with consonant clusters possibly a fifth syllable structure to be considered in the literature on Setswana phonology. This proposition is based on the finding that Setswana speakers are adhering less to the rule of inserting a vowel in-between clusters when using words borrowed from other languages. This was explained to occur in both Setswana (Palai & O'Hanlon, 2004) and Sesotho (Rose & Demuth, 2006).

Another process indicating children's adult-like speech is the omission of aspiration when producing the aspirated alveolar affricate /ts^{h}w/. This phoneme is often produced as the ejective /tsw'/ . For instance, producing 'khu**tshw**ane' /k^{h}u**ts^{h}w**a:ne/ (short) as '*khu****tsw****ane*' /khutsw'a:ne/ would be considered accurate. Production of /ts^{h}w/ as an ejective is, however, not accepted in other instances, e.g. production of '***tshw****ara*' /**ts^{h}w**ara/ (to hold) as '***tsw****ara*' /**tsw'**ara/ would be considered incorrect. Further research foused on identifying substitutions which are accepted and those considered errors in Setswana-speaking children is therefore necessary. This information may be beneficial to SLTs working with this population as it may help them differentiate typical, delayed or disordered speech acquisition, as proposed by Maphalala *et al*. (2014).

In her diagnostic framework, Dodd (1995) describes children with speech difficulties as falling into one of four categories. The nature of 'errors' made by the children in each group are important – diagnostically and for intervention. Children with delayed speech will exhibit typical phonological processes of the language, but use these beyond the age at which they are expected to occur. Children with disordered speech will use processes that are not usual in the language. This kind of classification presupposes a knowledge of typical and unusual processes, and one of the contributions of the present study is to start developing this

type of knowledge. Work has been carried using Dodd's framework in a range of languages (German - Fox & Dodd, 2001; Spanish - Goldstein, 1995; as cited in Crosbie *et al*., 2005; Cantonese - So & Dodd, 1994; Turkish - Tophas & Konrot, 1991; Putonghua - Zhu & Dodd, 2000) and it appears that it can be applied to a range of languages. Future work may involve more explicit application of Dodd's framework to Setswana.

5.6 The Developmental Phase Model

Typical speech sound acquisition was described in the introductory chapter where Stackhouse and Wells' (1997; 2001) Developmental Phase Model was used to describe the different phases of speech acquisition. This model derives from their psycholinguistic framework, which highlights that a breakdown at one of the developmental phases is likely to result in later literacy difficulties (Stackhouse & Wells, 1997; 2001). Such an approach is useful in identifying difficulties a child presents with, planning for management, as well as in monitoring progress (Pascoe *et al*., 2005). This model has been applied to children acquiring English (Pascoe *et al*., 2005), German (Fox & Dodd, 1999) and more recently to those acquiring isiXhosa (Maphalala *et al*., 2014).

Findings of this study indicate that the youngest children (3;0 – 3;5 and 3;6 – 3;11 years) are in the systematic simplification phase. This is likely the case as their speech was characterised by the highest number of phonological processes in comparison to the other children. Children in Group 2 (3;6 – 3;11 years) are likely progressing from the systematic simplification phase into the assembly phase. They were able to produce the complex CCV syllable structures with accuracy, approximating adult production. Those in Group 3 (4;0 – 4;5 years) may soon be progressing into the metaphonological phase. Children in Groups 4 – 6 (4;6 – 4;11, 5;0 – 5;5 and 5;6 – 5;11 years) are likely more in the final phase, i.e. the metaphonological phase, which is reported to occur in the fifth year in typically developing English-speaking children.

Similar to Maphalala *et al*.'s (2014) findings for isiXhosa, Setswana-speaking children may be progressing through these stages earlier than their English-speaking peers. These children may also be advancing into the metaphonological phase earlier than isiXhosa-speaking children as fewer phonological processes were noted between the ages of 4;6 – 4;11 years for Setswana-speaking children and 5;0 years for those acquiring isiXhosa. Differences observed in the use of phonological processes suggested that children in Group 5 (5;0 – 5;5 years) may be more in the systematic simplification phase as they presented with more phonological processes than Group 4 (4;6 – 4;11 years). Similar to Group 3 (4;0 – 4;5

years), children in Group 5 are still in the simplification phase but making their way into the metaphonological phase.

Setswana-speaking children between the ages of 4;6 – 4;11 years were classified in the metaphonological phase as they appeared to be able to consciously identify similar-sounding phonemes from those which sound different, e.g. children aged 4;6 – 4;11 years substituted the alveolar trill /r/ with the uvular trill /ʀ/ more than they did with the alveolar non-fricative /l/ (as seen in younger children in Groups 1 – 3). This ability to consciously identify similar-sounding phonemes was seen more in Groups 5 and 6 (5;0 – 5;5 and 5;6 – 5;11 years) as the alveolar trill /r/ was substituted with the uvular trill /ʀ/ only. These participants also responded well to a rhyming cue (to elicit response for '*letsatsi*' /lets'a:ts'i/ - the sun) which was often used in classrooms to teach them about the weather. It should be noted, however, that some children as young as 3;0 years also responded to this cue, suggestive of early emergence of pre-literacy skills.

Speech sound disorders are reported to be more evident in children aged 3;0 years and older (Broomfield & Dodd, 2004; Ruscello, 2008). The case may be different in Southern Africa where, based on the findings of the children acquiring Setswana, as well as other Bantu languages, children are reported to develop their phonology earlier than their English-speaking peers. This is true for Sesotho, a language related to Setswana (Demuth, 2007), isiXhosa (Maphalala *et al*., 2014; Tuomi *et al*., 2001), isiZulu (Naidoo *et al*., 2005) and Swahili (Gangji *et al*., in press). These findings have important clinical implications for both the SLTs working in the Southern African context and researchers, in that identification and phonological intervention may begin earlier than 3;0 years. In addition to normative data, research aimed at determining the incidence and prevalence of speech sound difficulties in children acquiring indigenous languages in South Africa is also needed in order to describe and distinguish between younger children, and those with delayed and/or disordered speech. Dodd's (1995) Diagnostic framework may be a useful theoretical framework to apply to such a study.

Maphalala *et al*.'s (2014) illustration of isiXhosa speech development in relation to the Developmental Phase Model has been adapted for the current study. Figure 4 illustrates Setswana-speech development in light of that model.

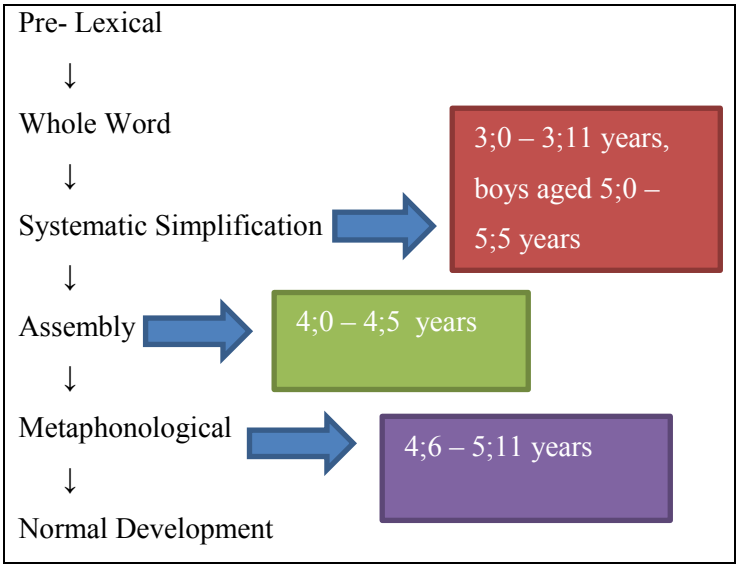


Figure 6. *Stackhouse and Wells' (1997; 2001) developmental phase model applied to Setswana-speaking children (adapted from Maphalala et al., 2014).*

Key:

	• Children between the ages of 3;0 – 3;11 years used a range of phonological processes, including deletion of marked and unmarked syllables (occurring more in words with more than three syllables). • Simplification of -Cw- digraphs and words with five syllables. • Substitution patterns involving vowels. • PCCs of between 92 – 94% word-initially and 86 – 88% in the penultimate syllable. • PVCs of between 83 – 93% word-medially and 82 – 93% word-finally.
	• Fewer phonological processes used between 4;0 – 4;5 years. • Accurate production of co-articulated phonemes (i.e. -Cw- digraphs) and multisyllabic words
	• Fewer phonological processes used (with the exception of those aged 5;0 – 5;5 years). • PPC scores high – between 96 – 97% in the word-initial position and 93 – 95% in the penultimate syllable. • PVC scores high – between 96 – 97% in the word-initial position and 93 – 95% in the word-final position. • Children aged 4;0 – 4;5 years able to consciously identify similar sounding phonemes and manipulating them in production of words.

Although the application of these findings must be treated with caution, it can be noted that children do not progress through these phases in a systematic manner. For instance, children aged 3;6 – 3;11 years were in the systematic simplification phase but

progressing onto the assembly phase, while those aged 4;0 – 4;5 years were in the assembly phase but making their way into the metaphonological phase.

5.7 Clinical implications

This study makes two main contributions to clinicians working with children who are acquiring Setswana. Firstly, the study provides a small, preliminary set of normative data regarding the nature of speech development in Setswana. This was achieved by providing a description of typically developing children's phonology at different ages. This normative data provides information on acquisition of consonants, vowels, syllable structures, as well as phonological processes used by typically developing Setswana-speaking children. To date there is no published normative data about speech acquisition in this language. Since there was no assessment available for assessing children's Setswana speech production, it was necessary to devise one for the study. This was done using principles for assessment development from Edwards and Beckman (2008), and Eisenberg and Hitchcock (2011), and based on studies of a similar nature (Maphalala *et al*., 2014; Gangji *et al*., in press). Although the assessment will require some further modification, it could be used as an assessment tool by clinicians since it covers all sounds of the language, was found to be appropriate for children as young as 3;0 years and had colourful pictures which could be easily recognised by children.

Secondly the study findings were related to the Developmental Phase Model (Stackhouse & Wells, 1997; 2001) and it was found that Setswana-speaking children advance through all the stages described in this model, although possibly at earlier ages than children acquiring English. This may mean that Setswana-speaking children are underdiagnosed, as normative data on English-speaking children are often applied in clinical practice by South African SLTs (Pascoe *et al*., 2010; Van Dulm & Southwood, 2013). This early acquisition of Setswana speech likely indicates that speech sound delays in this population may occur in children younger than 3;0 years and children acquiring this language need to be assessed with the appropriate norms in mind.

Another important factor SLTs need to consider when working with this population is that girls may possibly acquire speech earlier than boys. This is suggested by the speech literature for other languages (Dodd *et al*., 2003) and may well be the case for Setswana too.

5.8 Limitations

This study has several limitations which need to be considered when evaluating the findings and implications thereof. These include the small sample size, the nature of the participants (e.g. gender, language profile, age ranges) and the assessment tool itself.

5.8.1 Sample size

The sample size used in this study was relatively small and represented just one dialect of Setswana. Findings can therefore not be generalised to all children acquiring Setswana. In the absence of any other norms, they may aid clinicians to better understand the process of typical speech acquisition in Setswana and identify atypical speech development in this population. However, clinicians should use the norms with caution since the small number of children, gender imbalance in some of the groups and specific dialect and location of the participants mean that the results may have been rather different if these factors were varied. Having a larger sample of children can mean that these differences are less noticeable than when in a small group.

Children between the ages of 3;0 and 6;0 were the participants. It was found that the youngest participants in the study had already acquired much of their phonology, and therefore it would have been useful to consider even younger children in the sample. This would however bring about other challenges, since 2 year olds may not neccesarily have the vocabulary to be able to name all the pictures, nor the attention to sit through the duration of the assessment. To evaluate the phonology of younger children might require a different methodology, e.g. naturalistic sampling.

5.8.2 Participant profiling

Development of speech mapped out in this study did not always follow a progressive pattern, and skills found in younger children were not always present in the older ones, as would be expected. One of the explanations for this may be gender. Gender was not stratified during the sampling process and Group 4 (4;6 – 4;11 years) may not be a true representative of this age band as it consisted of boys only. Girls and boys were not equally distributed in each group, and groups consisting mainly of girls were noted to acquire speech earlier than those consisting mainly of boys. These findings were not conclusive and need to be investigated further.

The study focused on children with Setswana as their home language. Information was gathered about the children's other languages from their files at the school, but such

information was not always available, and for many of the children it was difficult to gauge what other languages they were exposed to, could speak and understand. Future studies may wish to profile participants' languages backgrounds more carefully since the influences of a child's languages on each other are well documented (Gildersleeve-Neumann & Wright, 2010; Gildersleeve-Neumann *et al*., 2008). De Lamo White & Jin (2011) describe approaches which need to be used in clinical practice to efficiently assess the specific needs of multilingual children. They have suggested integrating the sociocultural approach into standardised assessment procedures and intervention (De Lamo White & Jin, 2011). When used in conjunction with normative data, SLTs working with children acquiring indigenous languages in South Africa may provide more effective services to these children.

In a cross-sectional design such as this one, children from a range of different age groups are sampled and together the information gathered gives a picture of development over time. Since it is not actually the same children developing over time, it must be considered that the composition of the groups could affect the results, and future studies could control more tightly for gender and other factors. Longitudinal studies of the development of Setswana in one cohort of children would also complement studies like the present one.

5.8.3 Assessment materials

Case history forms and educator questionnaires were not standardised but were adapted from the literature (Shipley & McAfee, 2009). They have been used in studies of a similar nature (Gangji *et al*., in press; Maphalala *et al*., 2014). The assessment tool used to collect information on speech acquisition in Setswana-speaking children is also not standardised and was developed specifically for this study. There were, however, measures which were taken to increase its validity and reliability, as well as the reliability of results obtained. An expert panel review was used to determine whether the words selected were appropriate for the dialect under investigation and whether they would be familiar to preschool aged children, and queries which the panel had were addressed. Assessments were transcribed online and audio-recorded. The researcher used the recordings to check for accuracy of transcriptions; this was done on three separate occasions and no inconsistencies were noted. A second rater re-transcribed 25% of the data, for which an inter-rater agreement of 95% was reached. Five percent of items for which there was disagreement was discussed, followed by decisions regarding which transcriptions would be used. The second rater was a qualified SLT familiar with the participants' dialect.

Some difficulties were noted with the assessment tool. Not all syllabic consonants were sampled in various word positions, e.g. the rolled vibrant /r/ in '***rr**ê*' /**r**rɛ/ (father), the velar nasal /ŋ/ in '*di**n**ku*' /di**ŋ**:k'u/ (sheep) and '*dikgo**ng***' /dik^{h}xo:ŋ/ (logs). There were limited opportunities for production of some phonemes. For instance, the absence of six vowels in the word-initial position, as well as a limited number of both consonant and vowel phonemes in the penultimate syllable. Vowels were not well-represented as the majority of words with vowels in the word-initial position are difficult to represent in pictures and are not frequently found in children's speech, e.g. 'ikêtla' /ik'ɛ:tɬa/ (to relax). The ejective velar explosive /kw'/ was not produced by all participants in the penultimate syllable, e.g. while the majority of participants identified a pair of shoes as '*dikwae**kw**ae*' /dikw'ae**kw'**a:e/ (a pair of high heel shoes), a few used the term '*ditlhako*' /ditɬha:k'o/ (general term used for any type of shoe). The stimulus was a clear picture of a pair of high heeled shoes as it was more recognisable than other options provided by the Boardmaker program used to develop pictures.

This tool may be used as a basis for developing a norm-referenced standardised assessment tool for this population. Research on determining which words are commonly used by children may be helpful to achieve this. During the study, children were often observed to use alternative words (e.g. for the target word '*mosamô*' /mosa:ɔ/ - a pillow, some participants produced '*mosamêlô*' /mosamɛ:lɔ/), thereby making it difficult for the researcher to always sample the target phoneme. In the present study, the alternative words were accepted and participants were sometimes asked for a different word with the same meaning. This was done more with older participants as it was assumed that they would understand better and that they had a larger vocabulary than the younger ones. Prompts including "*re e bitsa eng gape*?" ('what else is it called') were used in an attempt to elicit the target word. In cases where this prompt could not be used and when children did not understand, they were asked to repeat the target word. It would be helpful to have a specific approach for dealing with this in future, e.g. to detail the various possible options (i.e. the correct dialectal forms of a word that may be produced), and factor this in to the overall design of the assessment to ensure that no matter which word a child chooses, all speech sounds will be adequately sampled.

The pictures used to collect data from the children in this study were from a published program (Mayer-Johnson's Boardmaker Windows v.6, 2011) with copyright limitations on their distribution. They worked well for this preliminary work and provided a cost-effective solution for the researcher. For future and larger scale studies, a different set of visual stimuli would need to be commissioned, i.e. employing an illustrator to develop pictures. This would

also mean that pictures could be adapted and made more culturally appropriate where needed.

5.9 Future Research

This preliminary study of Setswana speech development in children opens up several promising lines of future research. These are discussed below in terms of 1) a larger scale study; 2) a different study design, 3) using standard cues, and 4) action research with clinicians.

1. A larger scale study should be carried out to build on the work started here. A study by Dodd *et al*. (2003) used 684 children and stratefied them into groups according to gender and age. Following this approach for Setswana is likely to yield data that will be more generalisable to the Setswana-speaking population. Children could be further grouped by dialect, region, and other languages spoken and socio-economic status. Such a study might also use a larger sample of words, investigate the acquisition of tone in the language, and consider children in the 2,6 – 3;0 years age range.

2. The cross sectional design was an appropriate choice for this preliminary study, the first of its kind in Setswana. Future studies could build on the knowledge gained here by documenting the longitudinal development of a small number of Setswana-speaking children over time. Conradie *et al*. (2011) documented the spontaneous isiXhosa speech produced by one child aged 11 months at the start of the study, until she was 1;7. The naturalistic data obtained in a home environment gave a rich source for understanding early speech development in isiXhosa. Undertaking something similar in Setswana would be valuable, especially in providing information about the very early period before more formal picture naming tasks can be carried out.

3. Cues should be given in a more standardised and structured way in order to avoid eliciting untargeted words. For instance, one of the participants produced '*pôtla*' /pˈɔtɬˈa/ (a pocket) as '*pôtlê**ng***' /pˈɔtɬˈɛːŋ/ (in the pocket). His responses were likely influenced by the verbal cues given by the researcher, as he was given a functional cue ("Re lôkêla tšhêlêtê mo go yôna, ke eng?" – 'We use it to put money in, what is it?') when he did not recognise the picture shown. Although this cue clearly required the child to name the

object, he might have focused more on the first part of the cue. Having a set of cues associated with the word elicited may therefore be helpful in that a set of carefully thought out cues will be given when a child has difficulty naming an item.

Speech and language therapists working in Southern Africa are in urgent need of more resources that will enable them to appropriately assess and manage Setswana-speaking children. It would be helpful to develop the assessment used in this study in partnership with them. Getting feedback from a group of clinicians who use the assessment in their practice would help to identify the strengths and weaknesses of the tool. The isiXhosa speech assessment ('Masincokoleni') designed by Maphalala *et al*. (2012) has been designed specifically for use by both SLTs proficient in isiXhosa and those who may only have minimal knowledge of the language. Adapting the Setswana speech assessment used in this project so that it is user-friendly for both Setswana and non-Setswana speakers may be a helpful next step. The Intelligibility in Context Scale (Mcleod, Harrison & McCormack, 2012; International Expert Panel on Multilingual Children's Speech, 2012) has now been translated into all of South Africa's official languages including Setswana. This is a screening tool for children with speech difficulties and together with the assessment developed for this study, the availability of these instruments may cause South African SLTs to feel better equipped to assess the speech of Setswana-speaking children.

5.10 Conclusion

This study investigated speech sound acquisition in Setswana-speaking children aged 3;0 – 6;0 years. The research makes both basic and applied contributions. Firstly, it contributes basic knowledge about Setswana speech development which had not yet been documented in this way. The data has been related to similar data collected for a range of other languages including the related languages of Sesotho and isiXhosa. It has been related to theories and frameworks that are used to aid in understanding of speech development in general. The results cannot be generalised to all children acquiring Setswana as the study sample was small.

The findings indicate that all ejective and voiced explosives, nasals, approximants (lateral and medial non-fricatives), as well as ejective and aspirated affricates were acquired as early as 3;0 years. The aspirated explosives, fricatives and voiced affricates are all acquired by 4;0 years. Variations in the acquisition of the alveolar trill /r/ were noted. Children between the ages of 4;6 – 4;11 years had acquired the trill /r/ but not with rounding

(i.e. /rw/) which is acquired between 4;6 – 4;11 years. This phoneme, however, had not yet been acquired by children aged 5;0 – 5;11 years and acquisition appears complete between 5;6 – 5;11 years. In the penultimate syllable, the majority of consonants are acquired at 3;0 years. Exceptions include the alveolar fricative /s/, which is acquired at 4;0 years, as well as the aspirated affricate /ts^{h}w/. Children continue experiencing difficulties producing the alveolar trill /r/. The rounded trill /rw/ develops between the ages of 4;6 – 4;11 years. It does not appear to be acquired at 5;0 – 5;5 years. At 6;0 years, children have acquired the trill /r/ but the rounded trill /rw/ appears to develop beyond 6;0 years. These findings indicate that the accuracy with which consonant phonemes are produced increases with age. The older children (i.e. 5;5 – 5;11 years) have acquired more consonants than the younger ones (i.e. 3;0 – 3;5 years), in both the word-initial position and the penultimate syllable. This is in agreement with research studies which have investigated phonological acquisition in other languages and have all reported that phonological skills develop with age (Demuth, 2007; Dodd *et al*., 2003; Hua & Dodd, 2000; Maphalala *et al*., 2014; Saaristo-Helin, 2009; Tuomi *et al*, 2001). Children acquiring Setswana appear to develop speech earlier than those acquiring English; this was indicated when findings of the study were related to the Developmental Phase Model of Stackhouse and Wells (1997; 2001).

Secondly, it is applied research that has important implications for SLTs working in the Southern African region. SLTs have an ethical duty to serve all their clients irrespective of the language spoken. In South Africa this has long been a challenge and much has been written about the need for more research into the local languages (Pascoe & Norman, 2011; Pascoe & Smouse, 2012, Pascoe *et al*., 2010; Van Dulm & Southwood, 2013), as well as development of linguistically and culturally appropriate assessment and therapy resources. This small scale project contributes to this development agenda for the profession in Southern Africa, and may be a starting point for better provision of services for Setswana-speaking children with speech difficulties.

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Appendix A: Setswana Consonant Chart

Table 1. *Setswana consonant chart (adapted from Cole, 1955; Setshedi & Malope, 1978; Snyman et al., 1989; Krüger & Snyman, 1988)*

Manner of Articulation		Channel		Place of Articulation						
				Bilabial	**Alveolar**	**Pre-palatal & Palatal**	**Velar**	**Glottal**	**Labio-dental**	**Labio-velar**
Stop Consonants	Explosives	Medial	Ejective	p'	t'		k'	(ʔ)		
			Aspirated	p^h	t^h		k^h			
			Voiced	b	(d)	(ɟ)				
		Lateral	Ejective		tɬ′					
			Aspirated		$tɬ^h$					
Continuant Consonants	Fricatives	Medial	Voiceless		s	ʃ	x	h	f	
			Voiced	(β)						
	Rolled Vibrant	Medial	Voiced		r					
	Flapped Vibrant	Medial	Voiced		{ɾ}					
	Non-Fricative (Semi-vowels)	Lateral	Voiced		{l}					
		Nasal	Voiced	m	n	ɲ	ŋ			
		Medial	Voiced			j				w
Compound Consonants	Affricates	Medial	Ejective		ts′	tʃ′				
			Aspirated		ts^h	$tʃ^h$	kx^h			
			Voiced			dʒ				

Appendix B: Ethical clearance

UNIVERSITY OF CAPE TOWN

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29 July 2013

HREC REF: 364/2013

Miss O Mahura
c/o Dr M Pascoe
Occupational Therapy
Health & Rehab
OMB

Dear Miss Mahura

PROJECT TITLE: THE ACQUISITION OF SETSWANA PHONOLOGY IN CHILDREN AGED 3;0 -6;0 YEARS: A CROSS-SECTIONAL STUDY

Thank you for your letter dated 21 July 2013, addressing the issues raised by the Human Research Ethics Committee.

It is a pleasure to inform you that the HREC has **formally approved** the above mentioned study.

Approval is granted for one year till the 28 August 2014.

Please submit a progress form, using the standardised Annual Report Form, if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.

Please note that the on-going ethical conduct of the study remains the responsibility of the principal investigator.

Please quote the REC. REF in all your correspondence.

Yours sincerely

PROFESSOR M BLOCKMAN
CHAIRPERSON, HSF HUMAN ETHICS

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

sAriefdien

Appendix C1: Information letter to the Head of the school

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
Internet: www.uct.ac.za

To: The Head, L/ E Preschool

RE: Permission to conduct a research study at your preschool.

I am currently registered as a Speech-Language Therapy Master's student at the University of Cape Town. I am expected to conduct a research study so as to fulfill the requirements of my degree. I wish to conduct a study aimed at exploring the development of the speech sound system (phonology) of first language Setswana-speaking children aged 3 - 6 years.

There is currently no information on the nature of Setswana development, and such information is beneficial to Speech-Language Therapists working with children with speech difficulties.

The aim of this study is to describe the nature of speech sound development in first language Setswana-speaking children aged 3 - 6 years. This will be done in order to gain information on the Setswana sound system, as well as to help Speech-Language Therapists to develop their knowledge about Setswana speech development and to ultimately help Setswana-speaking children with speech difficulties. The study will be conducted between the months of September and October 2013. It will entail conducting a speech sound developmental assessment, as well as, asking the educators questions related to the pupils' behaviour and learning patterns. The assessment comprises of showing the learners a set of pictures, asking them to name the pictures, and recording their responses. Results obtained from this study will be used to outline the development of Setswana phonology from the age of three years up to six years.

The learners will form part of the study once permission has been obtained from you (the Head of the school), the educators, parents and legal guardians, as well as, the learners. Forty-two children who meet the criteria will be used. These criteria include; first language

Setswana-speaking children aged 3-6 years, as well as, children with no speech, language, hearing and learning difficulties.

Appropriate times for data collection will be arranged with the relevant staff members. The children will be assessed individually over a period of two-to-three weeks (10-15 school days) and assessments will be conducted on the school premises, in an empty room available. A quiet space on the school premises will be used if all the rooms are occupied. All children assessed will only be assessed once. Referrals of children who present with some form of developmental delay will be made to appropriate health professionals. All ethical guidelines will be adhered to.

The results obtained from the research study will be shared with you and your staff. Feedback will be provided throughout the research process. Concerns which may arise during the research process will be addressed.

I hereby request permission to conduct my research project at your preschool as a large number of your pupils are first language Setswana speakers.

Individuals taking part in this study do so voluntarily. They may withdraw from the study at any stage during the research process. There will be no financial costs and rewards for the participants and the school. Ethics approval has been obtained from the University of Cape Town Faculty of Health Sciences Human Research Ethics Committee (HREC/REF: 364/2013).

Yours Sincerely

Olebeng Mahura	Dr Michelle Pascoe
(Researcher)	(Research supervisor)
Tel : 071 XXX XXXX	Tel: 021 XXX XXXX
Email : xxxxxx@yahoo.com	Email: xxxxxx@uct.ac.za

You may contact Professor Marc Blockman, the chairperson of the Faculty of Health Sciences Human Research Ethics Committee on 021 406 6496 if you have any queries about you or your child's rights and welfare as a participant in this study.

Appendix C2: Lekwalo la tshedimosetsô go Prinsipala

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
Internet: www.uct.ac.za

Go: Prinsipala wa sekolo

MABAPI LE: Tetlêlelo ya go dira dipatlisiso mo sekolong sa gago

Ke moithuti wa Master's wa Speech-Language Therapy kwa Unibesithing ya Motse Kapa. Ke tshwanetse go dira dipatlisiso go netefatsa maemo a digarata tsa me. Ke eletsa go batlisisa ka mokgwa o puo ya bana ba Batswana, ba ba nang le dingwaga tse tharo go fitlha go tse thataro, e golang ka ona.

Ga go na tshedimosetso ka ga mokgwa o puo ya bana ba Batswana e golang ka ona. Tshedimosetso e e botlhokwa thata go di Speech-Language Therapist ba ba thusang bana ba ba nang le mathata a go bua.

Maikaelelo a dipatlisiso tse ke go tlhalosa ka mokgwa o bana ba Batswana ba dingwaga tse tharo go fitlhelela go tse thataro, ba ba buang ka gone. Dipatlisiso tse di tla diragala magareng ga dikwedi tsa Loetse le Phalane, mme di tla akaretsa tlhatlhobo ya puo ya baithuti, le go botsa barutabana dipotso ka ga maitseo le mokgwa o ban aba ba ithutang. Tlhatlhobo yona e tla akaretsa go bontsha baithuti ditshwantsho, go ba botsa gore ba bona eng mo ditshwantshong tse, le go recorder dikarabo tsa bona. Ditlamorago tsa dipatlisiso tse di tla diriswa go tlhagisa thuto ya fonotiki ya Setswana go tswa ka dingwaga tse tharo go fitlhelela ka tse thataro.

Baithuti ba tla nna karolo ya dipatlisiso tse morago ga gore wena (prinsipala), barutabana, batswadi le baithuti ba ntetlelele go dira dipatlisiso tse. Baithuti ba le masome a le mane le bobedi ba ba maleba le lenaane kgetho ba tla tlhopiwa go tsaya karolo. Lenaane kgetho le le akaretsa; bana ba Batswana ba ba nang le dingwaga tse tharo go fitlhelela go tse thataro, mme ba se na mathata a go tlhaloganya, go bolela, go utlwa le go ithuta.

Dinako tse di tshwanetseng go kgobokanya tshedimosetso di tla rulaganngwa le barutabana ba ba rileng. Bana ba tla tlhatlhobiwa mo nakong ya dibeke tse pedi go ya go tse tharo

(matsatsi a le 10-15), mme ditlhatlhobo di tla direlwa ko sekolong. Go tla kopiwa phaphosi e e sa dirisiweng, mme fa e seo go tla batliwa lofelo longwe lo lo didimetseng ko sekolong go dira ditlhatlhobo tse. Bana ba ba belaelwang ba na le mathata a developmente (e.g. mathata a go ithuta kgotsa go bua), ba tla romelwa ko bathong ba ba rileng ba ba tla kgonang go ba thusang. Tsepamo ya melaotlhomo yotlhe e tla tsewa.

Ditlamorago tsa dipatlisiso tse di tla abelwa go wena le barutabana ba gago. Lo tla fiwa tshedimosetso mo tsamaong ya nako ya dipatlisiso. Ditletlebo tse di leng gone di tla rarabololwa mo go kgonegang.

Ke kopa tetlelelo ya go dira dipatlisiso tse mo sekolong sa gago ka gonne bana ba bantsi mo ke Batswana.

Baithuti ba ba tsayang karolo ba dira jalo ka boithaopo. Ba lelteletswe go fetola menagano ya bona ebile ba ikgoge ka nako nngwe le nngwe ka nako e dipatlisiso di dirwang ka gona. Baithuti ba ba tsayang karolo le sekolo se ka se patedisiwe. Tetlelelo ya melaotlhomo e bonwe go tswa go Komiti ya Dipatlisiso tsa Batho, Faculty of Health Sciences ko Unibesithing ya Motse Kapa (HREC/REF: 364/2013).

Weno

Olebeng Mahura

(Mobatlisisi)

Tel : 071 XXX XXXX

Email : xxxxxx@yahoo.com

Dr Michelle Pascoe

(Supervisora ya mobatlisisi)

Tel: 021 406 6043

Email: xxxxxx@uct.ac.za

O ka leletsa Professor Marc Blockman, modula setilo wa Komiti ya Dipatlisiso tsa Batho ko Faculty ya Health Sciences mo 021 406 6496 fa o na le ditletlebo mabapi le ditshwanelo tsa baithuti ba gago jaaka batsayakarolo mo dipatlisisong tse.

Appendix C3: Permission from the Head of the school

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
Internet: www.uct.ac.za

RE: The acquisition of Setswana phonology in children aged 3:0 – 6:0 years: a cross-sectional study.

I, _____, hereby give permission for the study to be conducted at _____ pre-school. The purpose of this study and what it entails have been explained to me. I understand that this study will involve asking educators questions regarding the identified learners' behaviour and learning patterns, as well as, assessing the speech sound development of these learners.

I understand that the learners' and educators' identities will be kept anonymous and that their confidentiality will be maintained throughout the research study. I am aware that learners' and educators' participation is completely voluntary and that they may withdraw from the study at any time without penalty and without giving a reason.

_____ _____

(Name) (Signature)

Yours Sincerely

Olebeng Mahura
(Researcher)
Cellphone no.: 071 XXX XXXX
Email : xxxxxx@yahoo.com

Dr Michelle Pascoe
(Research supervisor)
Tel: 021 XXX XXX
Email: xxxxxx@uct.ac.za

You may contact Professor Marc Blockman, the chairperson of the Faculty of Health Sciences Human Research Ethics Committee on 021 406 6496 if you have any queries about you or your child's rights and welfare as a participant in this study.

Appendix C4: Tetlelelo go tswa go Prinsipala

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
Internet: www.uct.ac.za

MABAPI LE: Tetlelelo ya go dira dipatlisiso mo sekolong sa gago

Nna, _____, ke fa tetlelelo ya gore dipatlisis tse di dirwe mo sekolong sa _____.
Ke tlhaloseditswe maikaelelo a dipatlisiso tse le gore di akaretsa eng. Ke tlhaloganya gore barutabana ba tla botsisiwa dipotso ka ga maitseo a baithuti, le ka mokgwa o ba ithutang ka gone. Ke tlhaloganya gape gore go tlilwe go tlhatlhobiwa puo modumo e e tlhômameng mo kgolong ya baithuti ba ba tlhopilweng.

Ke tlhaloganya gore maina a baithuti le barutabana ga a na go itsiwe. Ke a itse gore baithuti le barutabana ba tsaya karolo ka boithaopo, ebile ba letleletswe go fetola menagano ya bona ka go tsaya karolo nako nngwe le nngwe ntle ga go tlhalosa.

_____ _____ _____
(Leina) (Signature) (Letlha)

Fa o na le dipotso o ka leletsa nna kgotsa supervisora ya me.

Weno

Olebeng Mahura
(Researcher)
Tel : 071 XXX XXXX
Email : xxxxxx@yahoo.com

Dr Michelle Pascoe
(Research supervisor)
Tel: 021 XXX XXXX
Email: xxxxxx@uct.ac.za

O ka leletsa Professor Marc Blockman, modula setilo wa Komiti ya Dipatlisiso tsa Batho ko Faculty ya Health Sciences mo 021 406 6496 fa o na le ditletlebo mabapi le ditshwanelo tsa baithuti ba gago jaaka batsayakarolo mo dipatlisisong tse.

Appendix D1: Information letter to the 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
Internet: www.uct.ac.za

To: The Educator

RE: Research study information and permission for your learners to participate in the study

I am currently registered as a Speech-Language Therapy Master's student at the University of Cape Town. I am expected to conduct a research study so as to fulfill the requirements of my degree. I wish to conduct a study aimed at exploring the development of the speech sound system (phonology) of first language Setswana speaking children aged 3 - 6 years.

There is currently no information on the nature of Setswana development, and such information is beneficial to Speech-Language Therapists working with children with speech difficulties.

The aim of this study is to describe the nature of speech sound development in first language Setswana speaking children aged 3 - 6 years. This will be done in order to gain information on the Setswana speech system. The study will be conducted between the months of September and October 2013. It will entail conducting a speech sound developmental assessment, as well as, asking you, the educators questions related to the pupils' behaviour and learning patterns. The assessment comprises of showing the learners a set of pictures, asking them to name the pictures, and recording their responses. Results obtained from this study will be used to outline the development of Setswana phonology from the age of three years up to six years.

The learners will form part of the study once permission has been obtained from the Head of the school, the parents and legal guardians, as well as, the learners. Forty-two children who meet the criteria will be selected for this study. These criteria include; first language Setswana-speaking children aged 3-6 years, as well as, children with no speech, language, hearing and learning difficulties.

Your assistance is required in identifying learners who meet the above-mentioned criteria and providing information on the learners learning abilities. Appropriate times for data collection will be arranged with you so as to minimise disruption to your learners' schedules. The children will be assessed individually over a period of two-to-three weeks (10-15 school days) and assessments will be conducted on the school premises, in an empty room available. A quiet space on the school premises will be used if all the rooms are occupied. Each child will be assessed once. Referrals of children who present with some form of developmental delay will be made to appropriate health professionals. All ethical guidelines will be adhered to.

The results obtained from the research study will be shared with you and your colleagues. Feedback will be provided throughout the research process. The researcher will address any concerns which may arise.

I hereby request permission to assess the identified learners in your classroom.

Individuals taking part in this study do so voluntarily. They may withdraw from the study at any stage during the research process. There will be no financial costs or rewards for the participants and the school. Ethics approval has been obtained from the University of Cape Town Faculty of Health Sciences Human Research Ethics Committee (HREC/REF: 364/2013).

Yours Sincerely

Olebeng Mahura
(Researcher)
Tel : 071 XXX XXXX
Email : xxxxxx@yahoo.com

Dr Michelle Pascoe
(Research supervisor)
Tel: 021 XXX XXXX
Email: xxxxxx@uct.ac.za

You may contact Professor Marc Blockman, the chairperson of the Faculty of Health Sciences Human Research Ethics Committee on 021 406 6496 if you have any queries about you or your child's rights and welfare as a participant in this study.

Appendix D2: Lekwalo la tshedimosetso go Barutabana

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
Internet: www.uct.ac.za

MABAPI LE: Tshedimosetso ya dipatlisiso le tetlelelo ya gore baithuti bag ago ba tseye karolo

Ke moithuti wa Master's wa Speech-Language Therapy kwa Unibesithing ya Motse Kapa, mme ke tshwanetse go dira dipatlisiso go netefatsa maemo a digarata tsa me. Ke eletsa go batlisisa ka mokgwa o puo ya bana ba Batswana, ba ba nang le dingwaga tse tharo go fitlha go tse thataro, e golang ka ona.

Ga go na tshedimosetso ka ga mokgwa o puo ya bana ba Batswana e golang ka ona. Tshedimosetso e e botlhokwa thata go di Speech-Language Therapist ba ba thusang bana ba ba nang le mathata a go bua.

Maikaelelo a dipatlisiso tse ke go tlhalosa ka mokgwa o bana ba Batswana ba dingwaga tse tharo go fitlhelela go tse thataro, ba ba buang ka gone. Dipatlisiso tse di tla diragala magareng ga dikwedi tsa Loetse le Phalane, mme di tla akaretsa tlhatlhobo ya puo ya baithuti, le go botsa barutabana dipotso ka ga maitseo le mokgwa o bana ba ba ithutang. Tlhatlhobo yona e tla akaretsa go bontsha baithuti ditshwantsho, go ba botsa gore ba bona eng mo ditshwantshong tse, le go recorder dikarabo tsa bona. Ditlamorago tsa dipatlisiso tse di tla diriswa go tlhagisa thuto ya fonotiki ya Setswana go tswa ka dingwaga tse tharo go fitlhelela ka tse thataro.

Baithuti ba tla nna karolo ya dipatlisiso tse fa tetlelelo e bonwe go tswa go prinsipala, baithuti le batswadi ba bona. Baithuti ba le masome a le mane le bobedi, ba ba maleba le lenaane kgetho ba tla tlhopiwa go tsaya karolo. Lenaane kgetho le le akaretsa; bana ba Batswana ba ba nang le dingwaga tse tharo go fitlhelela go tse thataro, mme ba se na mathata a go tlhaloganya, go bolela, go utlwa le go ithuta.

Thuso ya gago e tlhokwa mo go supêng baithuti ba ba mabapi le lenaane kgetho le go fa tshedimosetso ka ga maitseo a baithuti ba le ka mokgwa o ba ithutang ka ona. Dinako tse di

tshwanetseng go tla go dira ditlhatlhobo di tla rulaganngwa le wena, go leka go fokotsa pheretlhô mo mananêông a baithuti ba gago. Baithuti ba ba tlhophilweng ba tla tlhatlhobiwa mo nakong ya dibeke tse pedi go ya go tse tharo (malatsi a le 10-15), mme ditlhatlhobo di tla direlwa ko sekolong. Go tla kopiwa phaphosi e e sa dirisiweng, mme fa e seo go tla batliwa lofelo longwe lo lo didimetseng ko sekolong go dira ditlhatlhobo tse. Bana ba ba belaelwang ba na le mathata a developmente (jaaka mathata a go ithuta kgotsa a go bua), ba tla romelwa ko bathong ba ba rileng ba ba tla kgonang go ba thusang. Tsepamo ya melaotlhomo yotlhe e tla tsewa.

Ditlamorago tsa dipatlisiso tse di tla abelwa go wena le le badirimmogo go wena. Lo tla fiwa tshedimosetso mo tsamaong ya nako ya dipatlisiso. Ditletlebo tse di leng gone di tla rarabololwa mo go kgonegang.

Ke kopa tetlelelo ya go tlhatlhoba baithuti ba ba tlhophilweng mo phaphosing ya gago.

Baithuti ba ba tsayang karolo ba dira jalo ka boithaopo. Ba letleletswe go fetola menagano ya bona ebile ba ikgoge ka nako nngwe le nngwe ka nako e dipatlisiso di dirwang ka gona. Baithuti ba ba tsayang karolo le sekolo se ka se patedisiwe. Tetlelelo ya melaotlhomo e bonwe go tswa go Komiti ya Dipatlisiso tsa Batho, Faculty of Health Sciences ko Unibesithing ya Motse Kapa (HREC/REF: 364/2013). Fa o na le dipotso o ka leletsa nna kgotsa supervisora ya me.

Weno

Olebeng Mahura

(Mobatlisisi)

Tel : 071 XXX XXXX

Email : xxxxxx@yahoo.com

Dr Michelle Pascoe

(Supervisora ya mobatlisisi)

Tel: 021 XXX XXXX

Email: xxxxxx@uct.ac.za

O ka leletsa Professor Marc Blockman, modula setilo wa Komiti ya Dipatlisiso tsa Batho ko Faculty ya Health Sciences mo 021 406 6496 fa o na le ditletlebo mabapi le ditshwanelo tsa gago kgotsa tsa baithuti ba gago jaaka batsayakarolo mo dipatlisisong tse.

Appendix D3: Consent from 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
Internet: www.uct.ac.za

RE: The acquisition of Setswana phonology in children aged 3:0 – 6:0 years: a cross-sectional study.

I, _____, hereby give permission for the selected learners in my classroom to be assessed for the purposes of the mentioned research study. The purpose of this study and what it entails have been explained to me. I understand that participation in this study will involve asking me questions regarding the selected learners' behaviour and learning patterns, as well as, a speech development assessment.

_____ _____

(Name) (Signature)

Should you have any queries, please feel free to contact me or my supervisor. See contact details below.

Yours Sincerely

Olebeng Mahura
(Researcher)
Tel : 071 XXX XXXX
Email : xxxxxx@yahoo.com

Dr Michelle Pascoe
(Research supervisor)
Tel: 021 XXX XXXX
Email: xxxxxx@uct.ac.za

You may contact Professor Marc Blockman, the chairperson of the Faculty of Health Sciences Human Research Ethics Committee on 021 406 6496 if you have any queries about you or your child's rights and welfare as a participant in this study.

Appendix D4: Tetlelelo go tswa go Morutabana

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
Internet: www.uct.ac.za

MABAPI LE: Tetlelelo ya go dira dipatlisiso le baithuti ba gago

Nna, _____, ke fa tetlelelo ya gore baithuti ba ba tlhophilweng mo phaposing ya me ba tlhatlhobiwe mabapi le maikaêlêlô a dipatlisisô tsê. Ke tlhaloseditswe maikaelelo a dipatlisiso tse, le gore di akaretsa eng. Ke tlhaloganya gore go tsaya karolo go akaretsa go araba dipotso ka ga maitseo a baithuti le ka mokgwa o ba ithutang ka gone. Ke tlhaloganya gape gore go tlilwe go tlhatlhobiwa puo modumo ya baithuti ba ba tlhophilweng.

_____ _____

(Leina) (Signature)

Fa o na le dipotso o ka leletsa nna kgotsa supervisor ya me.

Weno

Olebeng Mahura

(Mobatlisisi)

Tel : 071 XXX XXXX

Email : xxxxxx@yahoo.com

Dr Michelle Pascoe

(Supervisora ya mobatlisis)

Tel: 021 XXX XXXX

Email: xxxxxx@uct.ac.za

O ka leletsa Professor Marc Blockman, modula setilo wa Komiti ya Dipatlisiso tsa Batho ko Faculty ya Health Sciences mo 021 406 6496 fa o na le ditletlebo mabapi le ditshwanelo tsa gago kgotsa tsa baithuti ba gago jaaka batsakarolo mo dipatlisisong tse.

Appendix E1: Letter to the parents and legal guardians

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
Internet: www.uct.ac.za

Research Information Sheet

Dear Parent/Legal Guardian

RE: Research study information and permission for your child to participate in the study

I am currently registered as a Speech-Language Therapy Master's student at the University of Cape Town. I am expected to conduct a research study so as to fulfill the requirements of my degree. I wish to conduct a study aimed at exploring the development of the speech sound system (phonology) of first language Setswana-speaking children aged 3 - 6 years.

There is currently no information on the nature of Setswana development, and such information is beneficial to Speech-Language Therapists working with children with speech difficulties. This study aims to help Speech-Language Therapists to develop their knowledge about Setswana speech development, and ultimately to help Setswana-speaking children with developmental speech difficulties.

Forty-two children are required for this study, and your child is requested to take part as s/he speaks Setswana as a first language and is between the ages of three and six years. I hereby request for permission to have your child participate in the research study.

The research project will entail:

1. Asking educators questions related to the pupils' behaviour and learning patterns.
2. Conducting a speech developmental assessment.
3. Asking you to complete a form regarding your child's development.

This will only be done once you have agreed to have your child take part in the study. Your child will be assessed individually during school hours on the school premises, in an empty room available. A quiet space on the school premises will be used if all the rooms are occupied. The assessment will be 30 – 45 minutes long; s/he will only be assessed once. S/he will be shown a set of pictures which s/he will be asked to name and describe while responses are audio recorded. The assessment of your child will be of no cost to you.

Participation is entirely voluntary and you and your child's identities will be kept anonymous. Recorded responses will be kept in a locked cupboard, and only the researchers and supervisors will have access to these. Should you wish for your child to withdraw, you may do so at any stage without having to provide an explanation.

There are no risks anticipated for participation in this study, and your child will receive no rewards for taking part. Your child will be referred to an appropriate health professional if s/he presents with developmental delay and feedback will be given on completion of the study.

Attached to this letter is a consent form. Kindly complete it should you wish your child to participate in this study. For any queries, please contact me or my supervisor. HREC/REF: 364/2013. See contact details below.

Yours Sincerely

Olebeng Mahura

(Researcher)

Cellphone no.: 071 XXX XXXX

Email : xxxxxx@yahoo.com

Dr Michelle Pascoe

(Research supervisor)

Tel: 021 XXX XXXX

Email: xxxxxx@uct.ac.za

You may contact Professor Marc Blockman, the chairperson of the Faculty of Health Sciences Human Research Ethics Committee on 021 406 6496 if you have any queries about you or your child's rights and welfare as a participant in this study.

Appendix E2: Lekwalo la tshedimosetso go Motswadi

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
Internet: www.uct.ac.za

Go Motswadi

MABAPI LE: Tshedimosetso ya dipatlisiso le tetlelelo ya go letla ngwana wa gago go tsaya karolo

Ke moithuti wa Master's wa Speech-Language Therapy kwa Unibesithing ya Motse Kapa. Ke tshwanetse go dira dipatlisiso go netefatsa maemo a digarata tsa me. Ke eletsa go batlisisa ka mokgwa o puo ya bana ba Batswana, ba ba nang le dingwaga tse tharo go fitlha go tse thataro, e golang ka ona.

Ga go na tshedimosetso ka ga mokgwa o puo ya bana ba Batswana e golang ka ona. Tshedimosetso e e botlhokwa thata go di Speech-Language Therapist ba ba thusang bana ba ba nang le mathata a go bua. Maikaelelo a patlisiso e ke go thusa di Speech-Language Therapist go tlhaloganya mokgwa o bana ba ba golang ba ba buang Setswana ba buang ka gona gore ko mafelelong bana ba ba nang le mathata a go bua ba kgone go bona thuso e e lebaganeng.

Bana ba le somenne le bobedi ba a tlhokega mo dipatlisisong tse, mme o kopiwa gore ngwana wa gago a tseye karolo ka gonne o bua Setswana. Dipatlisiso tse di akarêtsa:

1. Go botsa barutabana dipotsô mabapi le maitseô a baithuti le mokgwa ô ba ithutang ka ôna.
2. Go tlhatlhoba mokgwa o baithuti ba buang ka ôna.
3. Go go kopa go araba dipotsô mabapi le kgolô ya ngwana wa gago.

Se se tla dirwa fela fa o dumela gore ngwana wa gago a tseye karolo mo dipatlisisong tse. Ngwana wa gago o tla tlhatlhobiwa a le mongwe ko dikagong tsa sekolo mo phaphosing e e lolea. Fa go se na phaphosi, go tla batlwa lefelo lo lo didimetseng gona ko sekolong. Ditlhatlhobo tse di tla tsaya metsotso e le 30 go fitlha go le e 45, ebile o tla tlhatlhobiwa

gangwe fela. O tla bontshwa ditshwantsho, a kopiwe go bolela maina a dilo tse di mo ditshwantshong tse kgotsa go di tlhalosa, mme dikarabo tsa gagwe di tla recordiwa. Ga o kitla o patedisiwa gore ngwana wa gago a tlhatlhobiwe.

Go tsaya karolo go dirwa jalo ka boithaopo, ebile leina la gago le la ngwana wa gago ga lo kitla lo rerebololwa. Dikarabo tse di recordilweng di tla bewa mo rakeng e e lotletsweng, mme di tla bonwa fela ke mobatlisisi le disupervisora fêla. O letleletswe go goga ngwana wa gago mo dipatlisisong tse nako nngwe le nngwe e o eletsang, ebile o ka dira jalo kwa ntle le go tlhalosa.

Ga gona kotsi e e lebeletsweng mo dipatlisisông tse, mme ngwana wa gago ga a kitla a duelwa go tsaya karolô. Fa ngwana wa gago a belaelwa a na le mathata a developmente(e.g. mathata a go ithuta kgotsa go bua), o tla romelwa ko bathong ba ba rileng ba ba tla kgonang go mo thusa. O tla fiwa tshedimosetso ka ditlamorago tsa dipatlisiso tse ko mafelong a tsona

Foromo ya go fa tetlelelo e tsamaya mmogo le lengwalo le, mme o kopiwa go e tlatsa fo o eletsa gore ngwana wa gago a tseye karolo mo dipatlisisong tse. Tetlelelo ya melaotlhomo e bonwe go tswa go Komiti ya Dipatlisiso tsa Batho, Faculty of Health Sciences ko Unibesithing ya Motse Kapa (HREC/REF: 364/2013). Fa o na le dipotso o ka leletsa nna kgotsa supervisor ya me.

Weno

Olebeng Mahura

(Researcher)

Tel : 071 XXX XXXX

Email : xxxxxx@yahoo.com

Dr Michelle Pascoe

(Research supervisor)

Tel: 021 XXX XXXX

Email: xxxxxx@uct.ac.za

O ka leletsa Professor Marc Blockman, modula setilo wa Komiti ya Dipatlisiso tsa Batho ko Faculty ya Health Sciences mo 021 406 6496 fa o na le ditletlebo mabapi le ditshwanelo tsa gago kgotsa tsa ngwana wa gago jaaka motsakarolo mo dipatlisisong tse.

Appendix E3: Consent from parents & legal guardians

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
Internet: www.uct.ac.za

RE: The acquisition of Setswana phonology in children aged 3:0 – 6:0 years: a cross-sectional study.

I,_____, hereby give permission for my child, _____, to take part in this research study. The purpose of this study and what it entails have been explained to me. I understand that participation in this study will involve asking my child's educator questions regarding his/her behaviour and learning patterns, as well as, a speech development assessment.

I understand that my child's identity will be kept anonymous and that his/her confidentiality will be maintained throughout the research study. I am aware that my child's participation is completely voluntary and that we may withdraw at any time without penalty and without giving a reason.

_____ _____

(Name) (Signature)

Should you have any queries, please feel free to contact me or my supervisor. See contact details below.

Yours Sincerely

Olebeng Mahura
(Researcher)
Tel : 071 XXX XXXX
Email : xxxxxx@yahoo.com

Dr Michelle Pascoe
(Research supervisor)
Tel: 021 XXX XXXX
Email: xxxxxxx@uct.ac.za

You may contact Professor Marc Blockman, the chairperson of the Faculty of Health Sciences Human Research Ethics Committee on 021 406 6496 if you have any queries about you or your child's rights and welfare as a participant in this study.

Appendix E4: Tetlêlêlô go tswa go Motswadi

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
Internet: www.uct.ac.za

MABAPI LE: Tshedimosetso ya dipatlisiso le tetlelelo ya go letla ngwana wa gago go tsaya karolo

Nna, _____, ke fa tetlelelo ya gore ngwana wa me _____ a tseye karolo mo dipatlisisong tse. Ke tlhaloseditswe maikaelelo a dipatlisiso tse le gore di akaretsa eng. Ke tlhaloganya gore go tsaya karolo go akaretsa go botsa morutabana wa ngwana wa me dipotso mabapi le maitseo a gagwe, le ka mokgwa o a ithutang ka gone. Ke tlhaloganya gape gore go tlilwe go tlhatlhobiwa puo modumo ya ngwana wa me.

Ke tlhaloganya gore leina la ngwana wa me ga le kitla le rarabololwa, ebile ke tlhaloganya gore ke ithaopa go tsaya karolo le gore re dumeletswe go fetola menagano ya rona nako nngwe le nngwe ntle ga go tlhalosa.

_____ _____

(Leina) (Signature)

Fa o na le dipotso o ka leletsa nna kgotsa supervisora ya me.

Weno

Olebeng Mahura
(Mobatlisisi)
Tel : 071 XXX XXXX
Email : xxxxxx@yahoo.com

Dr Michelle Pascoe
(Supervisora ya mobatlisisi)
Tel: 021 XXX XXXX
Email: xxxxxx@uct.ac.za

O ka leletsa Professor Marc Blockman, modula setilo wa Komiti ya Dipatlisiso tsa Batho ko Faculty ya Health Sciences mo 021 406 6496 fa o na le ditletlebo mabapi le ditshwanelo tsa gago kgotsa tsa ngwana wa gago jaaka motsakarolo mo dipatlisisong tse.

Appendix F1: Informed verbal assent from participants

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
Internet: www.uct.ac.za

Dear Learner

RE: Invitation to participate in a study

My name is Olebeng Mahura and I am trying to find out how children in pre-school speak. Finding out how children in pre-school speak will help me to better understand how to help children who sometimes find it difficult to say some words. I would like for you to take part in my study. I will ask your parents if it is alright.

If you agree to take part then I will show you some pictures and ask you to tell me what you see. I will record you when you speak so that I can listen to you again to make sure that I have not forgotten anything you and I spoke about. The only people who will be allowed to listen to the recordings are my supervisors and I. I will put these away in a locked cupboard so that no one else can take them. I will delete these recordings at the end of my study when I am able to better understand how children in preschool speak. We will work in an empty room available. A quiet space on the school premises will be used if all the rooms are occupied. You are allowed to change your mind if you do not want to take part in the study anymore. No one will be upset with you.

You will not get into trouble if you do not know some of the pictures shown to you. You can let me know when you are tired and want to rest. You will only be asked to name the pictures shown once and this will not be repeated on another day.

No one will know what you said during the test. You can ask me questions if you have any.

Yours Sincerely

Olebeng Mahura

Informed assent from the participants

I agree to take part in Olebeng's study. I know that I have to do what she has explained to me. I also know that I can change my mind at any time.

Name of participant : _____

Name of researcher : _____

Date : _____

Appendix F2: Tetlelelo ya Batsayakarolo

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
Internet: www.uct.ac.za

Go moithuti: O laletswa go tsaya karolo mo dipatlisisong

Leina la me ke Olebeng Mahura. Ke leka go bona gore bana ba ba tsenang crèche ba bua jang, ebile ke tla itumela fa o ka tsa karolo mo dipatlisisong tsa me.

Fa o dumela go tsaya karolo mo dipatlisisong tse, ke tla go bontsha ditshwantsho ke be ke go botsa gore di o bona eng mo ditshwantshong tse. Ke tla go recorder fa o bua gore ke kgone go go reetsa gape ka nako e nngwe go netefatsa gore ga ke a lebala gore nna le wena re ne re bua ka eng. Batho ba ba letleletsweng go reetsa di polêlô tse ke nna le barutabana ba me fêla. Ke tlile go di baya mo rakeng e e lotlelwang gore ope a seka a di tsaya. Ke tlile go di sutlha fa ke fetsa ka dipatlisiso tsa me ebile ke kgona go tlhaloganya gore bana ba crèche ba bua jang. O leltleletswe go fetola mogopolo wa gago fa o sa tlhole o batla go tsaya karolo. Ga go na motho yo o tla kwatang kgotsa yo o tla go ngalelang.

Ga o kitla o tsena mo mathateng fa o sa itse maina a dingwe tsa ditshwantsho tse o di bontshiwang. O ka nna wa mpolelela fa o lapile ebile o batla go ikhutsa.

Ga gona ope yo o tla itseng gore o rileng mo tekong e, ebile o ka botsa dipotso fa o sa tlhaloganye sengwe.

Weno

Olebeng Mahura

Tetlelelo ya Batsayakarolo

Ke dumela go tsaya karolo mo dipatlisisong tsa ga Olebeng. Ke a tlhaloganya gore ke thwanetse go dira se a se ntlhalosetsang. Ke a itse gore ke kgona go fetola monagano wa me ka nako nngwe le nngwe.

Leina la motsayakarolo : _____

Leina la mobatlisisi : _____

Letlha : _____

Appendix G1: Case History form

Child's name: _____ Date of birth: _____

Receptive and Expressive Language abilities

- How does your child communicate with you or other people? E.g. expressing his needs.

  _____

  _____

- How well do you and others understand your child's speech:

  _____

  _____

- How well is your child able to understand you and others (during conversation or when given instructions)? Do you often have to repeat yourself?

  _____

  _____

Pregnancy and Birth

- How was the mother's general health during the pregnancy?

  _____

- Were there any complications during pregnancy? If so, please explain.

  _____

  _____

- Are there factors which may have affected the pregnancy? E.g. smoking

  _____

- Was the child healthy at birth?

  _____

Developmental History

At what age was the child able to do the following?

- Sit : _____
- Crawl : _____
- Stand : _____
- Walk : _____

- Say first word : _____

Medical History

- How would you describe your child's current health?

  _____

- Does your child suffer from ear infections?

  _____

- Does your child appear to hear well? If not, please explain.

  _____

Appendix G2: Case History Form (Setswana)

Leina la ngwana: _____ Letsatsi la matsalo: _____

Receptive and Expressive Language abilities

- Ngwana wag ago o buisana jang le wena kgotsa le batho ba bangwe? Jaaka go abelana ka maikutlo mabapi le ditlhokego tsa gagwe?

  _____
  _____

- Wena le batho ba bangwe lo tlhaloganya polelo ya ngwana wa gago go le go kae?

  _____
  _____

- Ngwana wa gago o tlhaloganya wena le batho ba bangwe go le go kae (fa lo tlotla kgotsa fa o mo roma)? A o tlhoka go ipoeletsa gantsi pele ga a tlhaloganya?

  _____
  _____

Boimana le Pelego

- Boemo jwa mme fa a ne a imile bo ne bo le jwang?

  _____

- A go ne go na le mathata ka nako e o neng o imile? Fa go le jwalo, ke kopa o tlhalose.

  _____
  _____

- A go na le dilo tse di amileng boimana jwa gago? Jaaka motsoko kgotsa bojalwa.

  _____

- A ngwana o ne a itekanetse fa a ne a tsalwa?

  _____

Developmental History

Ngwana wa gago o ne a na le dikgwedi kgotsa dingwaga tse kae fa a ne a:

- Dula : _____
- Gagaba/khasa : _____
- Emelela : _____
- Tsamaya : _____

- Bolela (lefoko la ntlha) : _____

Medical History

- O ka tlhalosa jwang maemo a ngwana wa gago?
  _____
  _____
- A ngwana wa gago o tshwenngwa ke bolwetse jwa ditsebe?
  _____
- A ngwana wa gago o utlwa sentle? Fa go se jwalo, ke kopa o tlhalose.
  _____
  _____

Appendix H: Short Questionnaire for Educators

Child's Name: _____

1. Do you think that _____ understands verbal instructions well in the classroom? If not, please elaborate. E.g. Do you often need to repeat instructions, give demonstrations, speak loudly, etc?
   _____
   _____

2. When _____ tries to communicate with you, do you often have difficulty understanding him/her? If yes, briefly explain.

_____
_____

3. How does _____ interact with other children? (Is s/he shy, aggressive, etc.)?

_____
_____

4. When teaching new concepts in the classroom, do you feel that _____ needs more time, compared to other learners, to understand these? If yes, please provide an example.

_____
_____

5. General Comments:

_____
_____
_____

Appendix I: Oral Motor Exam

Participant code: _____ **Date of evaluation: _____**

Face:

Symmetry: Symmetrical_____ Asymmetrical_____

Open mouth posture: Yes_____ No_____

Comments: _____

Lips:

Closure: Present_____ Absent_____

ROM: WNL_____ Reduced_____ (Rounding)

ROM: WNL_____ Reduced_____ (Spreading)

Comments: _____

Dentition:

Occlusion: Class I_____ Class II_____ Class III_____

Hygiene: _____

Comments: _____

Tongue:

ROM: Elevation: WNL_____ Reduced_____

Lateralisation: WNL_____ Reduced_____

Depression: WNL_____ Reduced_____

Strength: WNL_____ Reduced_____

Comments: _____

Appendix J: Setswana Speech Assessment

Code: _____ **Date of Assessment:** _____

Target Sound	Initial Word Position	Target Sound	Penultimate Syllable	IPA Transcription	Response
/p'/	**P**itsa			/p'its'a/	
	Panana	/n/	Pa**n**ana	/p'ana**:**na/	
	Pôtla	/tɬ′/		/p′ɔtɬa/	
/p^{h}/	**Ph**efô			/p^{h}efɔ/	
/b/	**B**ala			/bala/	
	Baesekele	/k'/	Baese**k**ele	/baesek'e**:**le/	
	Borôthô	/r/	Bo**r**ôthô	/borɔ**:**t^{h}ɔ/	
	Borukhu	/r/	Bo**r**ukhu	/boru**:**k^{h}u/	
/t'/	**T**afola	/f/	Ta**f**ola	/t'afo**:**la/	
	Tamati	/m/	Ta**m**ati	/t'ama**:**t'i/	
/t^{h}/	**Th**ipa			/t^{h}ip'a/	
	Thubêgilê	/x/	Thubê**g**ilê	/t^{h}ubɛxi**:**lɛ/	
/d/	**D**itlhako/ **D**ikwaekwae	/tɬ^{h}/; /kw′/	Di**tlh**ako/ Dikwae**kw**ae	/ditɬ^{h}a**:**k'o/; /dikw′ae**:**kw′ae/	
	Diaparô	/p'/	Dia**p**arô	/diap'a**:**rɔ/	
	Dikôtlôlô/ **D**ijana	/tɬ′/; /dʒ/	Dikô**tl**ôlô; Di**j**ana	/dik′ɔtɬ′ɔ**:**lɔ/; /didʒa**:**na/	
	Ditamati			/dit′am**:**at′i/	
	Dikgômo	/kx^{h}/	Di**kg**ômo	/dikx^{h}ɔ**:**mo/	
	Dinamane	/m/	Dina**m**ane	/dinama**:**ne/	
	Dikausu	/u/	Dika**u**su	/dik′au**:**su/	
/k'/	**K**ôlôi			/k'ɔlɔ**:**i/	
	Katse			/k'ats'e/	
	Kômiki	/m/	Kô**m**iki	/k'ɔmi**:**k'i/	
	Kêtlêlê	/tɬ'/	Kê**tl**êlê	/k'ɛtɬ'ɛ**:**lɛ/	

	Kuwane	/w/	Ku**w**ane	/kʼuwa**:**ne/	
/kw′/	**Kw**ala/ **Ngw**ala			/kwʼala/; /ŋwala/	
/tɬ'/	**Tl**ôu			/tɬ'ɔu/	
/tɬ^{h}/	**Tlh**aba			/tɬ^{h}aba/	
	Tlhapa			/tɬ^{h}apʼa/	
	Tlhagola	/x/	Tlha**g**ola	/tɬ^{h}axo**:**la/	
/f/	**F**ôuno			/fɔu**:**no/	
	Fisa			/fisa/	
/s/	**S**ega			/sexa/	
	Setilô	/tʼ/	Se**t**ilô	/set'i**:**lɔ/	
	Sefatlhêgô	/tɬ^{h}/	Sefa**tlh**êgô	/sefatɬ^{h}ɛxɔ/	
	Sekhurumêlô	/m/	Sekhuru**m**êlô	/sek^{h}urumɛ**:**lɔ/	
	Sefapaanô	/p'/	Sefa**p**aanô	/sefap'a**:**nɔ/	
	Setlhare	/tɬ^{h}/	Se**tlh**are	/setɬ^{h}a**:**re/	
/ʃ/	**Sh**iana	/a/	Shi**a**na	/ʃia**:**na/	
/x/	**G**ôga			/xɔxa/	
/r/	**R**ôbêtse	/b/	Rô**b**êtse	/rɔbɛ**:**ts'e/	
	Raga			/raxa/	
/h/	**H**êmpê	/m/	Hê**m**pê	/hɛm**:**p'ɛ/	
/w/	**W**atšhe			/wat^{h}e/	
/l/	**L**ela			/l**:**la/	
	Loma			/loma/	
	Letsôgô	/ts'/	Le**ts**ôgô	/lets'ɔ**:**xɔ/	
	Lephôdisa	/d/	Lephô**d**isa	/lep^{h}ɔdi**:**sa/	
	Lebôtlôlô	/tɬ'/	Lebô**tl**ôlô	/lebɔtɬ'ɔ**:**lɔ/	
	Lebôta/ **L**ebôtana	/tʼ/	Le**b**ôta/ Lebô**t**ana	/lebɔ**:**ta/; /lebɔta**:**na/	
	Leswana	/sw/	Le**sw**ana	/leswa**:**na/	
	Lebônê	/b/	Le**b**ônê	/lebɔ**:**nɛ/	

	Letsatsi	/ts'/	Le**ts**atsi	/lets'a**:**tsi/	
	Legadima	/d/	Le**g**adima	/lexadi**:**ma/	
	Lepanta	/n/	Lepa**n**ta	/lepan**:**ta/	
	Lebati/ **M**onyakô	/b/; /ɲ/	Le**b**ati/ Mo**ny**akô	/leba**:**tʹi/; /moⁿa**:**kɔ/	
	Lefêêlô	/ɛ/	Lefêêlo	/lefiɛ**:**lɔ/	
	Legôtlô	/x/	Le**g**ôtlô	/lexɔ**:**tɬ'ɔ/	
/lw/	**Lw**ala			/lwala/	
/m/	**M**aswê/ **D**itšhila	/tʲʰ/	Di**tšh**ila	/maswɛ/; /ditʲʰi**:**la/	
	Moriri	/r/	Mo**r**iri	/mori**:**ri/	
	Maoto	/o/	Ma**o**to	/mao**:**tʹo/	
	Mogatla/ **M**osela	/x/; /s/	Mo**g**atla; Mo**s**ela	/moxa**:**tɬ'a/; /mose**:**la/	
	Mafuka/ Ma**f**ofa	/f/	Ma**f**uka/ Ma**f**ofa	/mafu**:**k'a/; /mafo**:**fa/	
	Mosamô/**M**osa mêlô	/s/; /m/	Mo**s**amô;Mosa **m**êlô	/mosa**:**mɔ/;/mosamɛ**:**lɔ/	
	Mpôpô	/p'/	M**p**ôpô	/mp'ɔ**:**p'ɔ/	
	Molelô	/l/	Mo**l**elô	/mol**:**lɔ/	
	Monwana	/nw/	Mo**nw**ana	/monwa**:**na/	
/n/	**N**amêla	/m/	Na**m**êla	/namɛ**:**la/	
	Nônyane	/ɲ/	Nô**ny**ane	/nɔⁿa**:**ne/	
	Nôga			/nnɔ**:**xa/	
	Ntšwa/ **M**pya			/ntsw'a/; /mpja/	
	Namune	/m/	Na**m**une	/namu**:**ne/	
/nw/	**Nw**a			/nwa/	
/ɲ/	**Ny**enyane	/ɲ/	Nye**ny**ane	/ɲɲa**:**ne/	
/ŋ/	**N**kô			/ŋkɔ/	
/ŋw/	**Ngw**ana			/ŋwana/	
/ts'/	**Ts**êbê			/ts'ɛbɛ/	

	Tsamaya			/ts'ama**:**ja/	
/tsw′/	**Tsw**alêla	/l/	Tswa**l**êla	/tsw′al**:**la/	
/ts^{h}/	**Tsh**olola	/l/	Tsho**l**ola	/ts^{h}ol**:**la/	
	Tshasa			/ts^{h}asa/	
/ts^{h}w/	**Tshw**êne			/ts^{h}wɛne/	
/tɬ^{h}/	**Tšh**êlêtê	/l/	Tšhê**l**êtê	/tɬ^{h}ɛlɛ**:**t'ɛ/	
/ʤ/	**J**a			/ʤa/	
	Jêrêsi/ **J**êsi	/r/	Jê**r**êsi	/ʤɛrɛ**:**si/ /ʤɛsi/	
/kx^{h}/	**Kg**ogo			/kx^{h}oxo/	
	Kgômo			/kx^{h}ɔmo/	
/a/	**A**para/ **A**pola **Tlh**obola	/p'/ /b/	A**p**ara/ A**p**ola Tlho**b**ola	/ap'a**:**ra/; /ap′o**:**la/ /tɬ^{h}obo**:**la/	
	Apaya/ **A**peya	/p'/	A**p**aya/ A**p**eya	/ap'a**:**ja/; /ape**:**ja/	

Appendix K: Multisyllabic word table

Code: _____ **Date of Assessment: _____**

Words with more than three syllables:

Target Words	**Was child able to say word?**
Baesekele	
Monnamogolo	
Sekhurumêlô	
Lebôtlôlô	
Sefatlhêgô	
Setshwantshô	
Ditamati	
Lephôdisa	
Dinamane	
Mosadimogolo	
Tshwaragantsha	
Dikgômo	
Dikausu	
Sefapaanô	
Legadima	
Thubêgilê	
Lemphorwana	
Diaparô	

Appendix L: Expert panel review checklist

Sounds Targeted	Word	Is this word appropriate for this age group?	Is this word culturally appropriate?	Is this word commonly used by Setswana speakers living in this region	Comments	Alternative word/s
p	**P**itsa					
p	**P**aka					
p	E**p**a					
ph	**Ph**efô					
ph	**Ph**ala					
b	**B**ala					
b	ô**b**ola					
m	**M**ae					
n, m	Na**m**êla					
t, r	**T**e**r**ena					
s, t	**S**e**t**ulô					
tl	**Tl**ola					

tl	**Tl**ôla					
tl	Pô**tl**a					
th	**Th**ipa					
th, b	**Th**a**b**a					
r, th	Bo**r**ô**th**ô					
tlh, tsw	**Tlh**a**tsw**a					
tlh	**Tlh**aba					
d, tlh	**D**i**tlh**ako					
d, p	**D**ia**p**arô					
l, s	**L**e**s**oba					
ts	**Ts**êbê					
ts	Le**ts**ôgô					
tsh	**Tsh**olla					
tsh	Nô**tsh**i					
r, b	**R**ô**b**êtse					

r	Ma**r**u					
r	Mo**r**iri					
l	Le**l**a					
l	**L**oma					
ng, kg	N**kg**a					
n	Di**n**ala					
j	**J**êrêsi					
d, j & tl	**Dij**ana/ **D**ikô**tl**ôlô					
sw	**šw**a					
sh	Mo**š**i					
tšh	**Tšh**êlêtê					
tšh	Wa**tšh**e					
ny	**Ny**enyane					
ny	Nô**ny**ane					
ny	Mo**ny**akô					

k	**K**ôlôi					
b, k	**B**aese**k**ela					
kh, tshw	**Kh**u**tshw**a ne					
kh	Boru**kh**u					
g	**G**alase					
g, tl	Le**g**o**tl**ô					
g	Se**g**a					
kg	**Kg**ômo					
tlh	Se**tlh**arê					
n	**N**ôga					
ng, k	**Nk**ô					
ng, kg	**Nkg**a					
ngwa	Le**ngw**alô					
ngwa, n	**Ngwa**n**a**					
ngwa, l	**Ngwa**l**a**					

f, n	**F**ou**n**o					
f	Ta**f**ole					
sw	Le**sw**ê					
sw	Le**sw**ana					
lw, l	**Lwal**a					
w	**W**a					
w	**W**elê					
wa, n	Ku**wan**e					
wa, tl	Le**watl**ê					
tshw	**Tshw**êne					
tsw	Le**tsw**ai					
nw	**Nw**a					
nw	Mo**nw**ana					
k & s	Di**k**ausu & Ma**s**ôkisi					

ts	Ka**ts**e					
d	Lega**d**ima					
d, l	**D**ipi**l**isi					
s, m	Mo**s**a**m**êlô					
a, y	**A**pe**y**a					
tšw	N**tšw**a					
tl	**Tl**ola					
p	M**p**ôpô					
l, b	**L**e**b**ônê					
m, t	Le**m**ô**t**a					
k	**K**ômi**k**i					
t, m	Di**t**a**m**ati					
tl	Kê**tl**êlê					
a, r	**A**pa**r**a					
tl	Lebô**tl**ôlô					

s, tlh	**S**efa**tlh**êgô					
s	**Se**sepa					
ts	Le**ts**atsi					
tsh	**Tsh**asa					
ph, n	Le**ph**ô**n**isa					
u	Nam**u**ne					
n	Pa**n**ana					
h	**H**êmpê					
g	Mo**g**atla					
ng	Mona**ng**					
f	Ma**f**ofa					
tshw	Se**tshw**ants hô					
kg, g	**Kg**o**g**o					
l	Mo**ll**ô					
sh, m	Mo**sh**i**m**an e					

n, t	Lepa**nt**iti					
l, rw	**L**emphor**w**ana					
s, p	**S**ei**p**ône					
m, g	**M**alamo**g**ôdu					
d, kw	**D**ikôn**kw**ane					
m, g	**M**onnamo**g**olo					
g, m	**G**aga**m**ala					
ê, m	**Ê**di**m**ola					
d	**D**inamane					
m, g	**M**osadimo**g**olo					
y	Tsama**y**a					
tshw, n	**Tshw**aragan**t**sha					
r	Mama**r**êtsa					
n, wa	Di**n**a**w**a					
f	Le**f**êlô					

s, m	**S**ekhuru**m**ê lô					
th, g	**Th**ubê**g**ilê					
s, p	**S**efa**p**anô					

Appendix M: Stimulus sheet

Setswana Speech Assessment – Stimulus Sheet

Spontaneous naming task

Ke tlile go go bôntsha ditshwantshô. Ke batla o mpolêlêlê gore o bôna eng mo ditshwantshông tse ke go bôntshang tsôna. Fa o sa itse, ke batla o lekê fela mme ke tla go thusa mô go gongwe.

Target Word	**Stimulus**
Pitsa	Ke eng ê?
Panana	Ke eng ê?
Pôtla	Re lôkêla tšhêlêtê mo go yôna.

Phefô	O bona eng fa? Setlhare se butswêlwa ke eng?

Bala	Yô o dira eng?
Baesekele	Ke eng ê?
Borôthô	
Borokgwê	Bo na le eng?

Tafole	Ke eng ê?
Tamati	

Thipa	Ke eng ê?
Thubêgilê	Ke kômiki. Go diragetse eng ka yônê?

Ditlhako	Tsê ke eng tsê?
Diaparô	
Dikôtlôlô	Tsa go jêla kana re di bitsa eng?
Ditamati	Tsê ke eng? Fa di le dintsi kana re di bitsa eng? Mama o dira gravy ka tsôna.
Dikgômo	Ke êng tsê?

Dinamane	Dikgômô tse di nnyê di bitswa eng?

Kôlôi	Ke eng ê?
Katse	
Kômiki	
Kêtlêlê	

Shiana	Yô o dira eng?
Tlhaba	Ba dirang ka yôna ko tlinking?
Tlhapa	Yô o dira eng?

Fôuno	Ke eng ê?

Sega	Mô ba dira eng?
Setilô	Ke eng sê?
Sekhurumêlô	Ke eng sê?
Sefapaanô	
Sefatlhêgô	O iphimola eng?
Setlhare	Ke eng sê?

Fisa	Molelô o dirang ditlhare fa?

Gôga	Yô o dira eng?
Rôbêtse	Yô o dira eng?
Raga	

Hêmpê	Ke eng ê?
Hutshê	

Watšhe	Ke eng ê?

Lela	Yô o dira eng?
Loma	
Letsôgô	Ke eng ê?
Letswai	Ke eng ê? Re tshêla eng mo dijông?
Lephôdisa	Yô ke mang?
Lebôtlôlô	Ke eng ê?
Leswê	Sekipa sê se sekono. Sê se jwang?
Lebôta	Ke eng ê?
Leswana	
Lebônê	
Letsatsi	Le tlhabilê.
Legadima	Ke eng ê? Pula fa e na go nna le eng?
Lemphorwana	Ke eng ê?
Lefêêlô	
Legôtlô	
Lwala	Yô o ntse jwang?
Lapanta	Ke eng ê? Re e bôfa mo lethêkêng.

Moriri	O kama eng fa?
Mogatla	
Mafuka	
Mosamô	
Mpôpi	Ke eng ê?
Mosimane	
Molelô	Dikgong di fiswa ke eng?
Monwana	
Monyakô	Ke eng ê? Ba tswalêtse eng mô?

Namêla	Yô o dira eng?
Nônyane	Ke eng ê?

Nôga	Ke eng ê?
Ntšwa	
Namune	Yô o dira eng?
Nwa	

Nyenyane	Ke eng ê? Ê ke ê e kgolo. Ê yônê e ntse jwang?

Nkô	Ke eng ê?
Ngwana	Yô ke mang?
Ngwala	Yô o dira eng?

Tsêbê	Ke eng ê?
Tsamaya	Yô o dira eng? A o a tlola kgôtsa o a tsamaya?
Tswalêla	Yô o dira eng? Mama o dirang fa pula e na?
Tsholola	Yô o dira eng?
Tshasa	Ba tlilê go dira eng fa?
Tshwêne	Ke eng ê?
Tshwaragantsha	Yô o dira eng?

Tšhêlêtê	Ke eng ê? Re rêka ka eng ko shôpông?

Ja	Yô o dira eng?
Jêrêsi	Ke eng ê?

Kgogo	Ke eng ê?
Kgômo	Ke eng ê?

Apara	Yô o dira eng?
Apaya	Yô o dira eng?

Word repetition task

Ke tlilê go bala mafoko, mme ke batla o boêlêtsê mafoko a ke a balang. Mo go gongwe ke tla bala mafoko ke be ke go bôntsha ditshwantshô. Fa o sa utlwa sentle, o mpolêlêlê gore ke boelêtse mafoko gape.

Target Word	**Stimulus**
Twatsi	
Kwêna	
Khwaere	
Botlhale	

Thwala	A o utlwilê? A o batla ke boêlêtsa lefoko lê?
Tlhware	
Swaba	
Gwaila	
Rwala	
Yôno	
Setšhaba	
Tšhôkô	
Jwala	
Kgwêdi	

Appendix N: Syllable structures present in participants' inventories

Syllable structures: Group 1 (3;0 – 3;5 years)

	E 2	**L 1**	**L 2**	**L 4**	**L5**	**L 29**
Word-initial	V CV C CCV	V CV C CCV	V CV C CCV	V CV C CCV	V CV C CCV	V CV C CCV
Penultimate	V CV C CCV	V CV C CCV	V CV C CCV	V CV C CCV	V CV C CCV	V CV C CCV

Syllable structures: Group 2 (3;6 – 3;11 years)

	E 4	**E 5**	**E 6**	**E 7**	**L 6**	**L 7**
Word-initial	V CV C CCV	V CV C CCV	V CV C CCV	V CV C CCV	V CV C CCV	V CV C CCV
Penultimate syllable	V CV C CCV	V CV C CCV	V CV C CCV	V CV C CCV	V CV C CCV	V CV C CCV

Syllable structures: Group 3 (4;0 – 4;5 years)

	E 10	**E 11**	**L 8**	**L 9**	**L 10**	**L 32**
Word-initial	V CV C CCV	V CV C CCV	V CV C CCV	V CV C CCV	V CV C CCV	V CV C CCV
Penultimate syllable	V CV C CCV	V CV C CCV	V CV C CCV	V CV C CCV	V CV C CCV	V CV C CCV

Syllable structures: Group 4 (4;6 – 4;11 years)

	E 13	**L 11**	**L 12**	**L 13**	**L 14**	**L 30**
Word-initial	V CV C CCV	V CV C CCV	CV C CCV	CV C CCV	V CV C CCV	V CV C CCV
Penultimate syllable	V CV C CCV	V CV C CCV	V CV C CCV	V CV C CCV	V CV C CCV	V CV C CCV

Syllable structures: Group 5 (5;0 – 5;5 years)

	L 15	**L 17**	**L 18**	**L 20**	**L 21**	**L 33**
Word-initial	V CV C CCV	V CV C CCV	V CV C CCV	V CV C CCV	V CV C CCV	V CV C CCV
Penultimate syllable	V CV C CCV	V CV C CCV	V CV C CCV	V CV C CCV	V CV C CCV	V CV C CCV

Syllable structures: Group 6 (5;6 – 5;11 years)

	L 23	**L 24**	**L 26**	**L 27**	**L 28**	**L 31**
Word-initial	V CV C CCV	V CV C CCV	V CV C CCV	V CV C CCV	V CV C CCV	V CV C CCV
Penultimate syllable	V CV C CCV	V CV C CCV	V CV C CCV	V CV C CCV	V CV C CCV	V CV C CCV