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The acquisition of Setswana phonology in children aged 2;0 – 6;5 years

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ABSTRACT

This study aimed to describe the phonological development of Setswana-speaking children between the ages of 2;0 and 6;5 years. The study objectives were to: 1) describe the acquisition of four aspects of phonology in these children, namely vowels, consonants, lexical tone and phonological processes; 2) contrast Setswana phonological development in monolingual vs multilingual children; and 3) contrast typical vs atypical Setswana speech acquisition and determine the occurrence and nature of speech sound disorders in children acquiring Setswana. The participant group comprised 81 children from the North-West Province of South Africa. All children were attending preschool and were acquiring one of two varieties of Setswana investigated in this study, namely Sekwêna and Setlhaping. Sixty-five participants were acquiring Sekwêna and were recruited from Hebron, and the remaining 16 participants were acquiring Setlhaping and were recruited from Dry-Harts village. The study used a cross-sectional design to detail the stages of phonological development in children aged 2;0–6;5 years. For each of the varieties studied, participants were assigned to groups of six-month age bands (e.g. 2;6–2;11 years).

Findings add to data from a preliminary pilot study on the acquisition of Setswana segmental phonology (Mahura, 2014; Mahura & Pascoe, 2020). Prior to obtaining speech samples from Setswana-speaking children, revisions were made to the assessment developed in the pilot study. This was done by addressing a number of limitations which had been documented following its use, including ensuring that all consonant phonemes were targeted in the initial word and penultimate syllable positions, as well as including syllabic consonants in these word positions. The picture stimuli were also changed, and an expert panel assessed the revised word list to ensure that all words were linguistically and culturally appropriate. Participants' speech was transcribed online using IPA symbols and audio recorded for later re-transcription to ensure reliability.

The findings indicate that children acquiring Setswana have a full set of vowels in their phonetic inventories as early as 2;6 years, and possibly earlier. A large number of consonant phonemes occurring in the Setswana phonological system had either been acquired or mastered by 2;6–2;11 years. This was seen word-initially and in the penultimate syllable position, with only three phonemes still to be acquired at this age word-initially: only two phonemes with rounding, velar plosive /kʷʼ/ and alveolar nasal /nʷ/, were still emerging at 2;6–2;11 years and seen to be acquired at 3;0–3;5 years in the initial word position and voiced palato-alveolar affricate /ʤ/ was absent at 2;6–2;11 years. This phoneme was, however, seen to emerge in the 3;0–3;5-year group. Heterorganic compounds in the initial word position mainly consisted of /fj/ and were only seen in the speech of children who speak the Sekwêna variety. Conclusions on the age at which heterorganic compound /fj/ is acquired could not be made as it was not used by all children acquiring the Sekwêna variety, but instead observed in the speech of several participants across the different age bands.

Although consonant clusters were not included in the consonant phonemes elicited as part of this study, they were noted in the inventories of children across the different age groups. A clear reduction in the occurrence of phonological processes was seen across age group, a pattern of development that can be expected in typically-developing children. Some of the phonological processes seen in Setswana-speaking children included assimilation (eliminated after 6;5 years), fronting (eliminated at 3;6 yeas), and stopping (eliminated at 4;0 years). Correct use of lexical tone was observed as early as 2;6–2;11 years. Furthermore, the speech sound skills of bi/multilingual children were found to be comparable to their monolingual peers, and sometimes slightly more advanced.

Findings are related to existing theoretical frameworks used to describe speech sound acquisition. While the findings from this study are not yet generalisable to all Setswana-speaking children, they indicate that theoretical frameworks such as Stackhouse and Wells' (1997) psycholinguistic approach and Dodd's (1995; 2005) diagnostic framework can be applied to Setswana. Language specific differences that should be taken into account are presented. This data adds to knowledge on speech sound acquisition in Setswana-speaking children, urgently needed for the early assessment and identification of children with speech difficulties, which has been lacking to date. When speech difficulties are identified and addressed early, children's academic, psychosocial and life outcomes can be improved, but Setswana-speaking children are often not well served by speech and language therapists in South Africa due to a lack of relevant information and resources. This study set out to redress this situation. Lines for future research include using a larger sample of participants to allow data to be more generalisable, developing assessments for speech input processing as well as production and considering aspects of tone more comprehensively.

Keywords: Setswana, speech sound development, intelligibility, lexical tone, phonological processes, speech sound disorder

GLOSSARY OF TERMS

Term	Definition
Affricate	A single consonant phoneme characterised by a complete obstruction of airflow, that is then gradually released into a homorganic fricative (Carr, 2015). Homorganic means that the phonemes are occurring in the same place of articulation (Carr, 2015) For instance, the sound 'j' in '**j**oy' is an affricate.
Allophone	"An allophone is a predictable variant of a phoneme" (Brinton, 2000, p. 48). Allophones always occur in complementary phonetic contexts, meaning that when a phoneme occurs, its allophonic variant will not. For instance, the unaspirated 't' in 's**t**op' and the aspirated 'th' in '**t**op' are allophones of the consonant phoneme 't'.
Alveolar	A consonant phoneme that is produced by bringing the tongue into contact with the alveolar ridge (Brinton, 2000; Rvachew & Brosseau-Lapré, 2017). For instance, the sound 't' in '**t**ool'.
Approximant	Approximants are speech sounds produced when articulators are in approximation (i.e. when one articulator approaches another), but not enough to result in audible friction (Carr, 2015). Approximants are produced with voicing and include glides (e.g. 'w' in '**w**ell' and 'y' in '**y**ellow'), laterals (e.g. 'l' in '**l**ogarithm') and retroflex phonemes (Brinton, 2000; Rvachew & Brosseau-Lapré, 2017).
Bantu	For many people in South Africa who equate term 'Bantu' with the Apartheid system and derogatory usage, it has negative connotations. In this dissertation, the term is used in a linguistic context to describe, in accordance with international usage, the language family to which many of the indigenous African languages belong.
Bilabial	A single consonant phoneme that is produced when the upper and lower lips are brought together (Brinton, 2000; Rvachew

	& Brosseau-Lapré, 2017). For instance, the sounds 'p' and 'b' in the words 'peach' and 'beach'. When bilabials are produced, the tongue is usually placed in the neutral position (Brinton, 2000).
Bilingualism	Bilingualism has been defined as having proficiency in two languages (Gn Wei En, Brebner & McCormack, 2014).
Dialect	A dialect has been defined as a form of language that is spoken by a specific group of people who are situated in the same geographical region, and share an ethnic group and/or social class (Rvachew & Brosseau-Lapré, 2017). No one dialect is superior to another. In this dissertation, the term 'variety' is used in place of 'dialect' since 'dialect' is no longer used in the linguistics literature because it diminishes the status of a particular variety.
Fricative	A single consonant phoneme that is produced with an audible friction. This audible friction is caused by a partially obstructed airstream, which occurs when articulators are in close approximation without sealing off airflow (Carr, 2015; Rvachew & Brosseau-Lapré, 2017). For instance, the sound 'f' in '**f**eline' is a fricative.
Glottal	A glottal fricative is a single consonant phoneme that is produced when the vocal cords are in close approximation (Carr, 2015). For instance, the sound 'h' in '**h**oneycomb'.
Intelligibility	Intelligibility refers to the degree to which one's speech is understood by others. It is important to note that speech intelligibility is different to speech accuracy, which refers to the correctness with which speech is produced (Rvachew & Brosseau-Lapré, 2017). Although speech accuracy is not the same as speech intelligibility, it is one of the factors that affect how well an individual's speech is understood by others.

IPA	The IPA is an International Phonetic Alphabet, which is a system that is widely used to represent the speech sounds of the world's languages phonetically (Brinton, 2000). This system includes segmental (i.e. consonant and vowel phonemes) and suprasegmental features, as well as diacritics (Rvachew & Brosseau-Lapré, 2017).
Labiodental	A single consonant phoneme that is produced when the upper front teeth are placed on the lower lip (Brinton, 2000; Rvachew & Brosseau-Lapré, 2017). For instance, the sound 'f' in '**f**uel'. When labiodentals are produced, the tongue is usually placed in the neutral position (Brinton, 2000).
Liquid	Liquids are consonant phonemes that are "more consonant-like than the glides but they are continuous in the manner of approximants. During their production there is some constriction in the vocal tract, but the oral cavity is fairly open, and the velopharynx closed" (Rvachew & Brosseau-Lapré, 2017, p. 8).
Monolingualism	Monolingualism has been described as being proficient in only one language (Soanes & Hawker, 2008).
Multilingualism	Multilingualism has been defined as being proficient in more than two languages (Soanes & Hawker, 2008).
Nasal	A single consonant phoneme sound that is produced with the velopharynx open, and air passing through the nasal cavity (Brinton, 2000; Rvachew & Brosseau-Lapré, 2017). For example, the sound 'm' in '**m**at'.
Palatal	A palatal speech sound is also sometimes referred to as a post-alveolar/palato-alveolar, and is a single consonant phoneme that is produced by raising the tongue blade to make contact with the hard palate and sometimes behind the alveolar ridge (Rvachew & Brosseau-Lapré, 2017), for instance, the sound 'ch' in '**ch**oice'.

Phone	The smallest unit of speech. A phone is a sound used in any of the world's languages, for speech (Rvachew & Brosseau-Lapré, 2017).
Phoneme	A single distinctive unit of sound 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, '**c**at, **m**at, **b**at'.
Phonetics	The study of speech sounds (Rvachew & Brosseau-Lapré, 2017).
Phonological processes	Phonological processes are also sometimes referred to as speech error patterns. They are variations that occur between the manner in which a child produces target words and adults' realisations of similar words (Dodd, Holm, Hua & Crosbie, 2003). For example, fronting of back sounds, where the word 'key' would be produced as 'tey'.
Phonology	The study of the speech sound systems of a specific language (Brinton, 2000; Rvachew & Brosseau-Lapré, 2017).
Phonotactics	Phonotactics is a description of consonant and vowel phoneme sequences that are allowed in a given language (Rvachew & Brosseau-Lapré, 2017). For example, a sequence of a consonant-vowel (CV-CV) is allowed in Setswana ('le-fa' – heir), but a sequence of a CCCCV is not.
Speech-Language Therapist	A Speech-Language Therapist is an expert who treats people who present with a feeding, swallowing and/or communication difficulties.
Stimulability	Stimulability is an assessment that is usually carried out to determine whether or not a child is able to produce target sounds when provided with cues to do so (Glaspey & Stoel-Gammon, 2005).

Stop	A stop, also referred to as a plosive, is a single consonant phoneme that is produced when airflow is completely sealed off by articulators (Carr, 2015; Rvachew & Brosseau-Lapré, 2017). Plosives come about when these consonants are released into vowel phonemes; for instance, the word '**p**en' has plosive 'p' in the initial position.
Tone sandhi	In Setswana, a difference in tone (High and Low tones) serves to distinguish the lexical and grammatical meaning of words (Zerbian & Barnard, 2010). According to Demuth (2007, p.530), "Verbs have either High or Low basic tone, and this tone may change in the context of certain grammatical morphemes (e.g., subject markers) and the tense/mood of the sentence to produce a specific tonal pattern or tonal melody". These processes involving changes in tone are referred to as tone sandhi.
Trill	A trill is a consonant phoneme produced when the tongue rapidly vibrates against the alveolar ridge or uvular (Brinton, 2000). For example, the sound 'r' in the Setswana word '**r**obala' (sleep).
Velar	A consonant phoneme produced when the back of the tongue is brought into contact with the velum (Brinton, 2000; Rvachew & Brosseau-Lapré, 2017).

CONVENTIONS USED

1. 2;6 years = 2 years and 6 months
2. Setswana target word is recorded as '*tafole*'
3. IPA transcription of the target word /t'afɔlɪ/
4. English translation of the target word (table)
5. Changes affecting phonemes are shown in bold in the target word and the child's production, e.g. substitution of phoneme /s/ in '***s****efatlhêgô*' /**s**ɪfat͡ɬʰɛxɔ/ face → '***t****efatlhêgô*' /**t'**ɪfat͡ɬʰɛxɔ/. Where a syllable has been omitted by a child, only the syllable in the target word is highlighted, e.g. omission of /sɪ/ in '***se****fatlhêgô*' /**sɪ**fat͡ɬʰɛxɔ/ face → '*fatlhêgô*' /fat͡ɬʰɛxɔ/.
6. v refers to a verb; n refers to a noun. For instance, '***s****efatlhêgô*' /sɪfat͡ɬʰɛxɔ/ face, n.

OUTLINE OF DISSERTATION

Chapter 1: Introduction

In this chapter, background information on the speech-language therapist's (SLT's) role in assessing and managing SSDs is given, followed by an account of the challenges faced by South African SLTs in carrying out these roles. Data on the prevalence of speech sound disorders (SSDs) and a description of theoretical frameworks used to describe these disorders is also provided in this chapter.

Chapter 2: Literature review

This chapter provides an overview of the Setswana speech sound system, followed by a summary of studies that have investigated phonological acquisition in this language, as well as several other Bantu languages and English.

Chapter 3: Methodology

In this chapter, a detailed description of the methods followed in obtaining data on the acquisition of the Setswana speech sound system, including the aims and objectives, is provided.

Chapter 4: Findings – Independent analysis

This is one of three chapters in which an account of the study findings are detailed. In this chapter, the acquisition of vowels and consonants are reported on. This is done for children aged 2;6–6;5 years and assigned to groups of six-month age bands (e.g. 3;0–3;5 years), for the two varieties of Setswana studied.

Chapter 5: Findings – Relational analysis

This chapter provides a detailed account of the accuracy with which children across various ages produced speech, as well as the error patterns noted in the speech of participants in the two Setswana varieties studied. Comments are also made on the acquisition of suprasegmental phonology, specifically use of lexical tone.

Chapter 6: Findings – Case studies of speech sound disorders and bi/multilingual speech development

This is the third chapter in which an account of study findings are detailed. In this chapter, a few selected cases of children acquiring more than one language and those with SSDs are explored. Findings from these selected cases are also related to existing literature, with some suggestions made regarding implications of these on the assessment and management of such children in clinical practice.

Chapter 7: Discussion

The findings of this research study are related to other phonological acquisition studies of various languages in this chapter. The implications of these findings on clinical practice are also discussed, together with limitations of the study and directions for future research.

CHAPTER 1: INTRODUCTION

This chapter describes the challenges facing South African Speech-Language Therapists (SLTs) in identifying and treating speech sound disorders in children, especially those acquiring indigenous Bantu languages. This is followed by an account of the negative outcomes of the long-term impact of speech disorders that are left unmanaged. Lastly, theoretical frameworks used to describe and classify speech disorders are discussed.

1.1 Introduction to the study

South Africa is a country rich in diversity, with eleven officially recognised languages and many more unofficial ones. Nine of these languages are indigenous Southern Bantu languages (viz. Xitsonga, Tshivenda, Setswana, Sepedi, Sesotho, isiNdebele, siSwati, isiXhosa and isiZulu), and two West Germanic languages (viz. Afrikaans and English). According to Statistics South Africa's 2018 General Household Survey, isiZulu was spoken by 25.3% of South Africa's population at home (Statistics S.A., 2019). This was followed by isiXhosa, which was spoken by 14.8% of the population in their homes; Afrikaans by 12.2%, Sepedi by 10.1%, Setswana by 9.1%, English by 8.1%, Sesotho by 7.9%, Xitsonga by 3.6%, siSwati by 2.8%, Tshivenda by 2.5%, as well as isiNdebele by 1.6%. Although Khoi, Nama and San languages are currently not recognised as official languages in South Africa, they are spoken by 0.1% of the country's population in their homes (Statistics S.A., 2019).

Despite South Africa's rich linguistic and cultural diversity, speech-language therapists (SLTs) working in this context face several challenges in providing equitable services to the country's population. These challenges are due, in part, to the country's past political policies and practices that excluded Black people (Southwood & Van Dulm, 2015) and consist of a lack of knowledge base required by SLTs to provide equitable services, barriers created by a language and cultural mismatch between SLTs and their clients, as well as a low priority given to the profession since many of the resources available in the national healthcare system are usually directed at managing the quadruple burden of disease in the country (Pascoe, Rogers & Norman, 2013). Research conducted in recent years has been aimed at bridging the gaps that exist in the current knowledge base and at addressing challenges faced by SLTs in clinical practice. The current challenges faced by SLTs in clinical practice, however, continue to perpetuate inequality: the majority of the population is unable to access services that are both linguistically and culturally appropriate (Khoza-Shangase & Mophosho, 2018; Southwood & Van Dulm, 2015).

In spite of the challenges experienced by South African SLTs, working in this environment brings great opportunities to study language diversity and support children acquiring all the languages. There are,

however, limited resources and information to support SLTs when working with clients who speak languages other than English and Afrikaans. The SLT's role is to support children to develop their communication so that negative psychosocial sequelae are prevented and academic success/life opportunities are enhanced. This can be difficult to do in an effective way when there is not enough information and resources available.

As a first language Setswana-speaking SLT my clinical practice has been targeted at assessing and managing speech and language difficulties in children, many of whom are acquiring indigenous languages spoken in South Africa. Since the data I relied on to make clinical decisions had not been developed for the population I worked with, I was often not confident about the reliability and validity of findings from assessments conducted. This experience in clinical practice prompted the start of this research project, which is aimed at addressing some of the limitations I experienced in being able to provide evidence-based services to children acquiring indigenous languages spoken in South Africa. The research study described in this dissertation is a continuation of a preliminary pilot study of speech acquisition in Setswana-speaking children (Mahura, 2014; Mahura & Pascoe, 2016, see Chapter 2 section 2.1.3.2 for a summary). This study builds on the initial project aiming to develop what is known about speech sound acquisition in Setswana-speaking children with a view to supporting SLTs who work with Setswana-speaking families and the children themselves.

In this chapter, the prevalence of speech sound disorders (SSDs) across the world is highlighted. This is followed by a description of recommended procedures in assessing and managing phonological disorders and some of the challenges SLTs working in South Africa face in carrying out these procedures. This is done to bring attention to some of the negative consequences of developmental speech disorders on a child. Theoretical frameworks used to describe and classify SSDs are discussed, and given that the main focus of this research study is typical phonological development in children acquiring Setswana, an overview of the different phases of speech sound development is given using a developmental phase model.

1.2 Prevalence of Speech Sound Disorders

A large number of children with communication difficulties present with SSDs (Dodd, 2015), and reportedly form a large proportion of SLTs' caseloads globally. According to the International Expert Panel on Multilingual Children's Speech (2012, p.1), a child with SSD

> "can have any combination of difficulties with perception, articulation/motor production, and/or phonological representation of speech segments (consonants and vowels), phonotactics (syllable and word shapes), and prosody (lexical and grammatical tones, rhythm, stress, and intonation) that may impact speech intelligibility and acceptability".

In the United States (US), approximately 7.5% of children aged between 3;0 and 11;0 years experience SSDs (Ruscello, 2008); and a survey of 489 paediatric SLTs in the US revealed that as many as 52% of the survey respondents reported that children with SSDs comprised a large portion of their caseload (Brumbaugh & Smit, 2013). In the United Kingdom (UK), it has been estimated that between 85 000 and 90 000 children with SSDs of an unknown aetiology are likely referred to SLTs annually (Broomfield & Dodd, 2004). These difficulties were evident in children aged 3;0–6;0 years but were found in a small number of those aged 2;0–3;0 years too (Broomfield & Dodd, 2004). In a recent study by Pascoe, Mahura and Le Roux (2018), the prevalence of developmental SSDs in children aged 3;0–6;0 years acquiring South African English in Cape Town was estimated at approximately 9.09%. This study population mainly consisted of monolingual children acquiring South Afican English (spoken as a home language by only 9.6% of the country's population; Statistics S.A., 2011), residing in one region of the country (i.e. Western Cape Province). Although this study is not representative of the entire South African population, the prevalence rate recorded is in line with prevalence rates reported internationally. If considered within the diverse South African context, the number of children who require speech and language therapy services in the country is likely large.

1.3 Phonological assessment and management of SSDs

Although there are numerous theoretical approaches and frameworks to guide the SLT in giving a detailed account of SSDs, a reliable and valid assessment of the child's speech sound development must first be conducted. This can only be achieved when using a contextually appropriate tool during assessment; a contextually appropriate tool is a resource that has been developed for a specific target population, for use within a specific context (Pascoe & Norman, 2011). Such resources can include child developmental scales, therapy programmes and approaches and normative data (Pascoe & Norman, 2011). Making use of a contextually appropriate tool is important as appropriate assessment is the cornerstone for relevant and effective management of SSDs (Carter et al., 2005; Marshall, 2000; Rvachew & Brosseau-Lapré, 2017). The reliability and validity of assessment findings may be negatively impacted if the SLT does not make provision for any linguistic and cultural differences and how these differences may influence a client's performance during specific tasks (Carter et al., 2005; Marshall, 2000; Rvachew & Brosseau-Lapré, 2017). The significance of a linguistically and culturally appropriate assessment tool for the early identification of children at risk of communication difficulties (speech and language) can therefore not be disputed (HPCSA, 2019; Khoza-Shangase & Mophosho, 2018; Pascoe, Klop, Mdlalo & Ndhambi, 2018).

1.3.1 The SLT's role in identifying SSDs

In order to determine whether a child's development of the phonological system is typical, delayed or disordered, the SLT is required to carry out several procedures. Some of the recommended procedures include a single-word naming task that elicits production of speech sounds of a target language in various word positions. The single-word naming task is a key procedure in assessment and the most common means used in clinical practice to measure a child's speech sound development (Rvachew & Brosseau-Lapré, 2017). Words included in this task must also vary in length and structure (Eisenberg & Hitchcock, 2010; McLeod, Verdon & International Expert Panel on Multilingual Children's Speech, 2017; Skahan, Watson & Lof, 2007). Other procedures include obtaining a connected speech sample and may assist the SLT to identify developmental speech error patterns (i.e. phonological processes) not present in single word naming (Rvachew & Brosseau-Lapré, 2017; Skahan et al., 2007). It is recommended that the SLT assess the multilingual child in the languages s/he is acquiring using language-specific tools (International Expert Panel on Multilingual Children's Speech, 2012; McLeod et al., 2017). Norm-referenced, standardised assessment tools comprising single-word naming tasks are typically used in evaluating a child's phonological development (Rvachew & Brosseau-Lapré, 2017; Skahan et al., 2007). Such a test will likely limit the SLT's ability to obtain a comprehensive picture of the child's production of speech sounds as compared to a connected speech task (Rvachew & Brosseau-Lapré, 2017; Skahan et al., 2007). Despite this limitation, single-word naming tests are beneficial as they allow the SLT to examine a representative sample of speech sounds in a short space of time. In addition to being time-efficient, they also likely make transcription of a speech sample easier as the SLT is aware of the words the child is attempting to produce (Eisenberg & Hitchcock, 2010; Rvachew & Brosseau-Lapré, 2017).

The administration of a speech sound assessment (single-word naming and connected speech) is usually followed by an inventory analysis of all speech sounds that the child can produce in various word positions. An analysis of a child's phonetic inventory allows the SLT to identify the speech sounds that the child is able to produce, as well as those that the child does not yet produce (Eisenberg & Hitchcock, 2010). Furthermore, it allows the SLT to establish whether the speech sounds produced by a child are developmentally appropriate (Bleile, 2004; Rvachew & Brosseau-Lapré, 2017). Information obtained from the assessment also allows the SLT to describe the speech sample obtained during the single-word naming task in relation to adult targets. This involves a systematic description of the accuracy with which target phonemes are produced in varying word positions, as well as an analysis of the phonological processes noted in the child's production of certain words (Cohen & Anderson, 2011; Rvachew & Brosseau-Lapré, 2017). The accuracy with which a child produces speech sounds involves determining the percentage of vowels and consonants produced accurately (Baker, 2004; Rvachew, Marquis, Brosseau-Lapré, Paul, Royle

& Gonnerman 2013). This information forms the basis for selecting intervention goals, which should, in addition to improving speech production, focus on addressing the psychosocial impact that SSDs have on a child (Krueger, 2019).

Research has consistently revealed that children with SSDs (and other communication difficulties) often experience restrictions in participation in various daily life activities; for instance, a child's ability to access everyday social interactions may be limited (e.g., in a play group at school) as it may be difficult for her/his peers to easily understand her/his speech. This is likely to have a negative impact on the child's ability to take part in the educational setting (Krueger, 2019; Rvachew & Brosseau-Lapré, 2017). Many children with SSDs also experience difficulty forming relationships with their peers, as many have reported being bullied (Lyons & Roulstone, 2018). Furthermore, poor academic and social outcomes experienced by those with communication difficulties may result in a compromised health-related quality of life (specifically social and psychological functioning) in adolescence through to adulthood (Feeney, Desha, Khan & Ziviani, 2017).

SLTs working in South Africa reportedly follow these recommended procedures and attempt to use available standardised assessment tools (Pascoe et al., 2010; Southwood & Van Dulm, 2015). The tools available to SLTs have, however, for the most part been developed for and standardised on monolingual English-speaking children in countries such as the UK, US and Australia. These standardised tools have therefore been developed for populations whose cultures are different to those of the South African population, most of whom are bi/multilingual (Southwood & Van Dulm, 2015). This has implications for measuring the outcomes of an assessment as the normative data against which a child's performance on the assessment is measured assumes that the child comes from the population that normative data were derived (Pascoe & Norman, 2011). Since this is not the case, these tools may be linguistically and culturally biased as they likely include several test items that are unfamiliar to children in the South African context, and the words and concepts (in the case of a language assessment) targeted may be interpreted differently by children. Such interpretations may be influenced by cultural factors and not be considered fully by clinicians unfamiliar with the child's culture. Mdlalo, Flack and Joubert (2019) give an example of isiZulu-speaking children responding that a man 'is in danger' rather than 'rescuing a cat' (the target response for the picture) reflecting the common believe of their culture that black cats signify danger.

Several studies have shown that the use of tools normed on a population different to the target population may result in misidentifying those assessed as presenting with a difficulty as the norms are usually applied in the absence of linguistically and culturally appropriate data (Boivin, 1991; Pahl & Kara, 1992; Stanczak, Stanczak & Awadalla, 2001). The consequences of a misdiagnosis include pathologising children who are typically developing and not in need of intervention, as well as missing those who in fact

have an SSD and require intervention. SLTs have been advised to address these biases by familiarising themselves with the manner in which a child's family uses language, any differences due to the language variety spoken, as well as their client's cultures (De Lamo White & Jin, 2011; HPCSA, 2019; International Expert Panel on Multilingual Children's Speech, 2012; Laing & Kamhi, 2003; Mdlalo et al., 2019; Nelson, 2010). It is evident that reliable and valid application of procedures of assessment and analysis requires normative data on phonological development specific to the language/s the child is acquiring. There has been a growing awareness of the need to provide linguistically and culturally appropriate services in South Africa and in various parts of the world. A scoping review aimed at identifying resources that are in South Africa's official languages and available to health professionals reported a significant growth in availability of such resources between the years 2010 and 2019 (Pascoe, Mahura & Dean, 2020). Although there was a higher number of resources available in English and Afrikaans, an increase in the development of resources in South Africa's officially recognised languages is an indication of a growing understanding and acknowledgement of the importance of clients' languages in equitable service provision. This is especially encouraging since a relatively large number of these resources were in the speech and language therapy fields (Pascoe et al., 2020).

McLeod et al. (2017) have published a tutorial to guide SLTs in terms of factors to consider when working with multilingual children and those who speak a language different to theirs. Guidelines include many of the points already noted in this section: 1) Children should be assessed in the languages they are acquiring (assessing production of single words and connected speech, intelligibility, stimulability, perception of speech, language development, as well as the child's ability to participate in various contexts); and 2) obtaining a comprehensive case history that is sensitive to a child's culture and considers her/his linguistic environments (McLeod et al., 2017). The Health Professions Council of South Africa's professional board for speech, language and hearing professions (HPCSA, 2019) has also compiled guidelines for South African SLTs and audiologists practicing in this culturally and linguistically diverse context. Cultural humility is described in that document as an essential part of cultural competence and comprises the clinician's ability to commit to self-evaluation and the establishment of collaborations that are mutually beneficial with communities. For the clinician to achieve cultural humility, it is suggested that s/he move from being aware of clients' cultures to applying such knowledge to interactions with clients in daily clinical practice (HPCSA, 2019). Furthermore, much research has been conducted in South Africa to address the need for contextually appropriate resources. For instance, research projects (many of which are ongoing) undertaken by Child Language Africa (2018) are aimed at developing contextually appropriate tools, as well as translating and adapting existing tools to make them linguistically and culturally appropriate for the South African population. Others include data provided by Dowling and Whitelaw (2018), and Mdlalo et al. (2019). Dowling and Whitelaw (2018) conducted a pre-pilot study that adapted

the toddler form of the MacArthur Bates Communicative Developmental Inventory (MB-CDI) (a parent-based report) for use in assessing the language development of isiXhosa-speaking toddlers. They found the MB-CDI an appropriate tool to use in obtaining information on the language abilities of isiXhosa-speaking toddlers. There are, however, considerations that must be made when adapting this tool further to make it more appropriate as there are differences between isiXhosa children and the population for which the MB-CDI was originally developed. For instance, the MB-CDI assesses the child's ability to understand and expressively identify lexical items such as 'upstairs, downstairs, basement', but Dowling and Law (2018) found that these concepts were unfamiliar to their study population as they lived in single-storeyed houses. Other considerations included economic ones since some children, due to economic reasons, might not have been exposed to certain items included in the list of words in the MB-CDI (and possibly other tools). It is therefore important for the SLT to be aware of such factors when interpreting language results. Diemer, Van der Merwe and de Vos (2015) developed a phonological awareness assessment for isiXhosa-speaking children. In their study, they found that isiXhosa-speaking children obtained better scores on syllable awareness than they did on phoneme awareness. A likely reason for this is that isiXhosa has a consistent structure, which may have an impact on the child's awareness of it. For instance, isiXhosa-speaking learners were reported to do well on tasks that required them to blend and segment syllables (with syllable substitution being more difficult) as compared to blending and segmenting phonemes. The syllable blending and segmentation tasks are thought to be easy for this population due to the agglutinating nature of isiXhosa (Diemer et al., 2015). While these studies make an important contribution to the development of contextually appropriate data nationally, they have focused on early language development (e.g. Dowling & Whitelaw, 2018), and literacy-related issues in older children (e.g. Diemer et al., 2015). Despite all these attempts that have been made to address the lack of contextually relevant resources, a great deal more work is still required as such resources are still limited (Khoza-Shangase & Mophosho, 2018).

1.3.2 Speech-Language Therapy in South Africa: current practices

Due to the complexities of its multilingual and multicultural context, a large number of SLTs working in South Africa often experience challenges with appropriate identification of children with SSDs and providing equitable services to all their clients (Barratt, Khoza-Shangase & Msimang, 2012; Khoza-Shangase & Mophosho, 2018; Mdlalo et al., 2016, 2019; Southwood & Van Dulm, 2015). This is largely as a result of a lack of research into speech sound acquisition in indigenous languages spoken by the majority of the South African population (and consequently a lack of linguistically and culturally appropriate resources), as well as a mismatch between those who make up a large portion of the client base and the SLTs. Many of the SLTs working in this context are, at present, a homogeneous group comprising

White English- and/or Afrikaans-speaking females who are usually only able to provide services in these languages (Flack, Pahl & Mdlalo, 2015; Mdlalo et al., 2016, 2019; Pascoe et al., 2010; Van Dulm & Southwood, 2013). This has been attributed in part to the negative impact that past political policies and practices of South Africa have had on the professions of Speech-Language Therapy and Audiology (Southwood & Van Dulm, 2015). These include a discriminatory policy that limited access to tertiary education for Black South Africans, resulting in very few Black people who speak indigenous southern Bantu languages entering the profession (Evans, 1990; Southwood & Van Dulm, 2015). Factors such as these are therefore thought to have contributed to the current mismatch between SLTs and their clients. This has led to those who speak indigenous languages in South Africa to be under-served at most or all times since a large number of SLTs do not have a comprehensive understanding of the cultural practices of the majority of the country's population (Mdlalo et al., 2016; Southwood & Van Dulm, 2015).

The impact that an individual's cultural norms have on her/his communication abilities (e.g., asking and answering questions, eye contact etc.) has been widely acknowledged and documented (Awaad, 2003; Flack et al., 2015). It is therefore fundamental for the SLT to have a good understanding of the concept of culture and to be aware of her/his clients' cultural views (Awaad, 2003; Flack et al., 2015). An awareness of clients' cultural perspectives is key since cultural values affect how developmental disabilities are viewed by a group of people with common cultural values. This may in turn influence decisions that families may make regarding which approach to follow when managing these disabilities, as well as the outcomes they expect from intervention (Enderby, 1992; Flack et al., 2015). Such factors will have implications on how the SLT measures a client's progress, and the extent to which the client's family participates in intervention (Enderby, 1992). Recognition of clients' cultures will therefore likely be beneficial in helping SLTs achieve improved clinical outcomes (Flack et al., 2015; Helman, 1985 as cited in Marshall 2000; Mdlalo et al., 2016). The influence of culture on clinical outcomes is further supported by Harry and Kalyanpur (1994), who noted that successful participation of caregivers in the intervention process may be negatively affected if the clinician continues to make use of intervention practices that do not take their cultural views into consideration. It is equally important for the SLT to be aware of her/his own cultural values and to consider how these may potentially shape ways in which s/he interprets the communication behaviours of clients from a different cultural background (Awaad, 2003; Flack et al., 2015; Marshall, 2000; Mdlalo et al., 2019). Whilst the significance of being cognisant of clients' cultures and the impact that cultural values have on clinical outcomes cannot be refuted, it seems an impossible task for the SLT to interpret speech and/or language difficulties and ways in which these difficulties relate to a range of cultural practices in detail. Not only will such a task be time-consuming, but there are often differences that exist between individuals belonging to the same cultural group that need to be considered further (Marshall, 2000). This, however, does not mean that the SLT is not required to make an effort to ensure that services provided to clients are

culturally sensitive and to ensure that they develop cultural humility. Those working with clients from cultural backgrounds different to theirs are encouraged to have knowledge of areas in which differences exist so as to avoid using their own cultural values as a frame of reference and making assumptions about universal truths (HPCSA, 2019; Marshall, 2000; Mdlalo et al., 2016, 2019; Rvachew & Brosseau-Lapré, 2017).

A few surveys exploring South African SLTs' clinical practices have been conducted in recent years. Most SLTs who participated in these surveys indicated that they were only able to provide services in English and/or Afrikaans and have limited competence in the indigenous languages spoken in the country (Mdlalo et al., 2016; Pascoe et al., 2010; Van Dulm & Southwood, 2015), as well as a poor understanding of the cultures linked to them (Mdlalo et al., 2016). This limited knowledge of their clients' languages and cultures has a significant impact on ways in which SLTs record children's performance during assessment and how they interpret these findings. This is an especially important factor to take into account as SLTs also often make decisions to assess children in English, which is usually acquired as a second or third language. According to Mdlalo et al. (2016), the SLT's poor understanding and consideration of clients' linguistic and cultural differences places her/him in a somewhat influential position as s/he is likely to apply her/his own cultural norms as a point of reference when interpreting assessment findings. This then allows her/him to place meaning on the assessment outcomes and set success criteria from her/his perspective. Mdlalo et al. (2016, p.3) have suggested that

> "this powerful position raises the question as to whether the meaning that the SLT attaches to their assessment, serves the interests of justice and equality as they relate to the client".

The implications of the SLT's poor understanding of a client's language and culture are further exacerbated by the lack of assessment tools and intervention approaches that are linguistically and culturally sensitive. The lack of contextually relevant resources has forced SLTs working in the South African context to rely on normative data and tools (assessment and intervention) developed for children acquiring English and living in countries such as Australia, the UK and US. This paucity of contextually relevant resources and the reliance on resources developed for a population different to the one living in South Africa is therefore likely to affect the SLT's ability to provide services that are always appropriate and efficient (Barratt et al., 2012; Khoza-Shangase & Mophosho, 2018; Mdlalo et al. 2016, 2019). For instance, the reliability and validity of assessment results may be questionable, which may in turn affect intervention plans negatively. This will likely result in the misidentification of children who require SLT services, especially since the languages in which SLTs working in South Africa offer services are often acquired as a second or third language by most children assessed. This has implications for ethical practice as the SLT

is required to ensure that all services provided meet the needs of individuals and their communities (HPCSA, 2019; SASLHA, 2019).

Surveys on South African SLTs' clinical practice have also found that a number of SLTs working in this context concur that current practices are flawed (Mdlalo et al., 2016), and have made efforts to address some of the challenges outlined above. This includes working through interpreters and making adaptations to standardised tests to better suit the population with whom they work. Adaptations made involved translating tests into languages spoken by clients, substituting test materials (e.g., pictures) with those they felt were culturally appropriate for their clients, as well as altering prescribed administration procedures (e.g., repeating instructions so as to encourage children to give a response) (Pascoe et al., 2010). Several SLTs were also reported to often only provide a qualitative analysis and interpretation of findings from formal tools instead of following procedures prescribed for scoring and analysing a child's performance on formal tests (Pascoe et al., 2010). Furthermore, findings indicate that several SLTs frequently use self-developed tools (Pascoe et al., 2010; Van Dulm & Southwood, 2013). These efforts indicate that SLTs are aware of the shortcomings of current clinical practices and how they may be biased towards their clients. While such attempts should be commended as they demonstrate the SLTs' proactive approach in addressing the challenges they face, the solutions offered have numerous limitations. Although working through interpreters is beneficial in ensuring that no communication breakdowns occur due to language differences between the SLT and clients, it has several drawbacks. The SLT's ability to provide an accurate diagnosis may be hampered when interpretations, especially those provided through informal consultations (as is usually the case in South Africa), are altered by an interpreter due to restrictions in vocabulary in English and/or her/his own language (Barratt et al., 2012). This is then likely to affect responses obtained from clients, which will in turn affect scoring of tests, the diagnosis given and consequently the provision of inappropriate intervention. Translating available tools is also not always appropriate and may not be applicable in various cultures as there are often structural differences between English and the languages involved (Barratt et al., 2012; De Lamo White & Jin, 2011; Southwood & Van Dulm, 2015). This includes differences in semantics, syntax and phonology. For instance, a study by Barratt et al. (2012) found that several syntactic and semantic errors were made during translation of a language assessment into isiZulu. Some of these include altering the word order (i.e., sentence structure) during translation of instructions, which changed the semantics of the command given and may ultimately have a negative impact on a client's ability to understand a given instruction (Barratt et al., 2012). Furthermore, translations and adaptations made to the resources and prescribed procedures, as well as the use of self-developed resources are usually informal in nature and not supported by research evidence. This therefore makes it challenging to ensure reliable and valid assessment findings, which is likely to result in a lack of evidence-based practice (Pascoe et al., 2010; Van Dulm & Southwood, 2013). The various challenges

facing South African SLTs highlight the urgent need to generate and validate tools to use in identifying SSDs in children in this context. This can, however, only be achieved once the stages of phonological development for the languages the children are acquiring have been established (McLeod & Bleile, 2007; Mdlalo et al., 2016).

1.4 Classification of developmental speech disorders

Phonological development refers to an individual's capacity to acquire production of the speech sounds of a language, as well as the rules governing this speech sound system (Gildersleeve-Neumann & Wright, 2010; Rvachew & Brosseau-Lapré, 2017). Research studies have shown that typically developing children can be expected to acquire the speech sound system of a language gradually before they are able to produce adult-like speech. In some cases, however, difficulties during speech sound acquisition may arise. Children who experience such difficulties often present with speech that is characterised by misarticulations (articulatory and phonological errors). These children are a heterogeneous group and all present with speech difficulties that vary in severity, the underlying cause/s and how they respond to the communication difficulties they experience as a result of their speech disorders (Dodd, 2005). The attributes of the developmental errors these children make during speech production, their response to intervention approaches, as well as the presence of associated language difficulties also vary (Dodd, 2005). Given the diversity of children who present with speech difficulties, the need to classify them according to the types of difficulties they present with seems apparent. Classification of SSDs is not only beneficial for differential diagnosis, but for selection of an appropriate intervention approach (Fox & Dodd, 2001; Rvachew & Brosseau-Lapré, 2017).

An array of theoretical approaches aimed at classifying SSDs in children have been proposed and documented in the literature since a universal classification system currently does not exist. These approaches all offer varying perspectives on the difficulties that children experience during speech acquisition. The medical, descriptive-linguistic and psycholinguistic approaches are the three main approaches that have been investigated and discussed in a large number of speech acquisition studies. According to the medical perspective, a speech difficulty occurs as a result of an underlying medical condition (Baker, Croot, McLeod & Paul, 2001; Stackhouse & Wells, 1997; Waring & Knight, 2013). For instance, speech errors noted in a child with cerebral palsy can be attributed to oral motor limitations associated with this neurological condition. The medical approach is beneficial when managing speech disorders caused by specific conditions (e.g., surgery for a cleft lip and palate repair) (Stackhouse & Wells, 1997). Another advantage of the medical approach is its ability to help the clinician determine the prognosis of a child's speech development (e.g., a case of a child diagnosed with a progressive neurological condition)

(Stackhouse & Wells, 1997). This approach is, however, not without some shortcomings. It provides limited data on the nature and severity of SSDs, as well as the most suitable therapy approach for addressing SSDs with different characteristics (Waring & Knight, 2013). This means that intervention provided within this framework is not necessarily centred around a child's medical diagnosis. This is due to the fact that although the medical approach allows the clinician to identify the condition causing a child's speech disorder, it limits her/him to accurately predict the types of speech difficulties the child will experience (Stackhouse & Wells, 1997). Lastly, the medical approach often fails to explain SSDs whose causes are unknown (Baker et al., 2001; Stackhouse & Wells, 1997; Waring & Knight, 2013), an issue that Shriberg's (2010) Speech Disorders Classification System (SDCS) attempts to address.

The SDCS (which uses the medical approach) comprises eight subgroups of SSDs (with three main types of SSDs proposed) that highlight the relationship between the errors found in a child's speech to an aetiology (Rvachew & Brosseau-Lapré, 2017; Waring & Knight, 2013). The three main types of SSDs proposed in the SDCS include: 1) Speech delay, 2) Speech errors, and 3) Motor speech disorders. Shriberg (2010) has argued that for each of the subgroups proposed in the SDCS, the aetiology can be linked to a combination of genetic anomalies and environmental factors (Rvachew & Brosseau-Lapré, 2017; Terband, Maassen & Maas, 2019; Waring & Knight, 2013). This, however, excludes persistent SSDs that are caused by environmental factors only.

The second approach that has been widely investigated in research to conceptualise speech and language development and difficulties that occur during this period is the descriptive-linguistic approach. The descriptive-linguistic approach is a developmental approach aimed at identifying error patterns in the speech of a child with SSD and detailing these in comparison to the speech of an age-matched typically developing child (Rvachew & Brosseau-Lapré, 2017; Waring & Knight, 2013). For instance, patterns in a child's speech are identified and described systematically using phonetic and phonological analyses (Dodd, 2005; Stackhouse & Wells, 1997). The advantage of such a systematic description is that it allows the clinician to form hypotheses on the nature of the speech difficulties a child experiences. One of the main limitations of this approach, however, is that the influence of non-linguistic factors such as cognitive functioning, as well as social and environmental factors on speech development are often missed since the approach only draws attention to the child's speech output (Stackhouse & Wells, 1997; Waring & Knight, 2013). The descriptive-linguistic approach therefore provides a means to describe a child's speech disorder but is not able to explain the disorder (Stackhouse & Wells, 1997; Waring & Knight, 2013).

Dodd's (1995; 2005) five-category model for differential diagnosis is an example of a classification model based on the descriptive-linguistic approach to classifying developmental SSDs. The key assumption of Dodd's (1995; 2005) model for differential diagnosis is that the surface-level error patterns noted in a

child's speech can be used to identify which one of the categories the child falls into. This can be done as the errors noted in the child's speech are thought to be reflective of processing deficits that are specific to each of the five categories (Rvachew & Brosseau-Lapré, 2017; Waring & Knight, 2013). This classification system is beneficial for clinicians working with a diverse group of children with SSDs as the surface-level error patterns they present with can be described as belonging to one of these subgroups, despite the language/s being acquired. This therefore means that Dodd's classification system can be applied cross-linguistically. A summary of these subgroups is provided in Table 1.

Table 1. Dodd's (1995; 2005) classification of subgroups of functional speech disorders

Subgroup	Description	Example
Articulation disorder	A child with an articulation disorder experiences difficulty producing certain phonemes, and substitutes error phonemes with the same sound each time s/he produces it.	A lisp, e.g. *'**s**un'* /**s**ʌn/ → *'**th**un'* /**θ**ʌn/
Phonological delay	A child with a phonological delay presents with typical developmental simplification error patterns common in the speech of children younger than her/him.	A 5-year-old child producing *'**s**ing'* /**s**ɪŋ/ as *'**t**ing'* /**t**ɪŋ/: stopping alveolar fricative /s/ beyond the age at which it is expected to have been eliminated.
Consistent phonological disorder	The speech of a child in this subgroup is characterised by a consistent use of atypical error patterns. A child with a consistent phonological disorder may also present with error patterns that are developmentally appropriate for her/his age or delayed.	Deleting all fricatives word-initially, e.g. *'**sh**ip'* /**ʃ**ɪp/ → *'ip'* /ɪp/.
Inconsistent phonological disorder	A child in this subgroup can be expected to produce the same lexical item in various ways. Contrary to the child with a consistent phonological disorder, the error patterns made by a child with an inconsistent phonological disorder are not predictable as they vary during each production of the same word.	*'**f**an'* /**f**æn/ produced as *'**s**an'* /**s**æn/, *'**k**a**p**'* /**k**æ**p**/ or *'**j**an'* /**dʒ**æn/
Childhood Apraxia of Speech (CAS)	The speech of children diagnosed with CAS is characterised by inconsistent speech errors, errors involving prosody, and oromotor difficulties (e.g., groping).	

The psycholinguistic approach is another approach used to give an account of phonological development. This approach attempts to address some of the limitations that the medical and descriptive-linguistic approaches have in describing speech acquisition and difficulties that some children may experience during this period. The psycholinguistic approach does this by proposing that speech difficulties arise when a child experiences a breakdown at the level of the input, stored linguistic knowledge, output or a combination of these levels (Baker et al., 2001; Rvachew & Brosseau-Lapré, 2017; Stackhouse, Pascoe & Gardner, 2006; Stackhouse & Wells, 1997; Waring and Knight, 2013). Frameworks that are based on the psycholinguistic approach make use of theoretical speech processing models, which allow the clinician to classify a child's speech disorder by forming and evaluating hypotheses on whether the difficulties the child experiences are a result of a breakdown in one or more of its essential components. These components include: 1) input (e.g., auditory discrimination, memory and/or sequencing); 2) stored linguistic knowledge (i.e., a child's lexical storage system); and 3) output (i.e., speech production) (Geronikou & Rees, 2016; Rvachew & Brosseau-Lapré, 2017; Stackhouse et al., 2006; Stackhouse & Wells, 1997). The speech processing and developmental phase models, both developed by Stackhouse and Wells (1997), are examples of theoretical models for describing speech development and speech difficulties within a psycholinguistic framework. These have been investigated in numerous research studies (e.g., Geronikou & Rees, 2016 used this psycholinguistic framework to profile Greek children with SSDs) and are used in this chapter to describe how word knowledge (e.g., novel words, each with a semantic and phonological representation) and skills (e.g., segmenting or blending phonemes) develop in children, as well as the ages at which these are acquired.

The speech processing model consists of three levels of processing, namely the input processing, the lexical representation and the output processing. Each of these levels consists of various components, as depicted in Figure 1. The input processing component of the model includes: a) the peripheral auditory processing, which represents the child's general auditory skills and is not related to her/his ability to process speech sounds heard; b) speech/non-speech discrimination, a level at which the child discriminates between speech sounds that are based on the sounds that s/he has heard before they are decoded further; and c) phonological recognition, which involves having the child determine whether the speech sounds belong to a language that s/he recognises (Stackhouse & Wells, 1997). Phonological recognition also involves having the child compare the speech sounds heard to patterns of speech sounds that s/he may have in her/his phonetic repertoire (Rvachew & Brosseau-Lapré, 2017). Phonetic discrimination, another element of the input level of processing, includes the child's ability to break down what s/he hears into smaller units (e.g., single words into syllables, syllables into individual phonemes, etc.), as well as identifying these

phonological units accurately (Stackhouse & Wells, 1997). When completing some of these input tasks (e.g., phonetic discrimination), the child is required to access her/his stored knowledge (i.e., her/his lexical representation), another level of her/his speech processing system. To complete such a task successfully, the child needs to not only have access to the phonological representations of the words heard, but the semantic representations too (i.e., what the words mean), as well as the motor program (i.e., the gestures needed in order to produce the words accurately) (Stackhouse & Wells, 1997). The child's stored knowledge also includes the grammatical and orthographic representations, and the orthographic program. The output processing (the last level of the speech processing model) involves motor planning and execution (Stackhouse & Wells, 1997). Processing at this level involves having the motor program (from a child's stored knowledge) to be sent to the motor planning element of the output processing. Here, planning of various features of utterances takes place, followed by messages sent to the articulators for accurate production of the target word/s (Stackhouse & Wells, 1997).

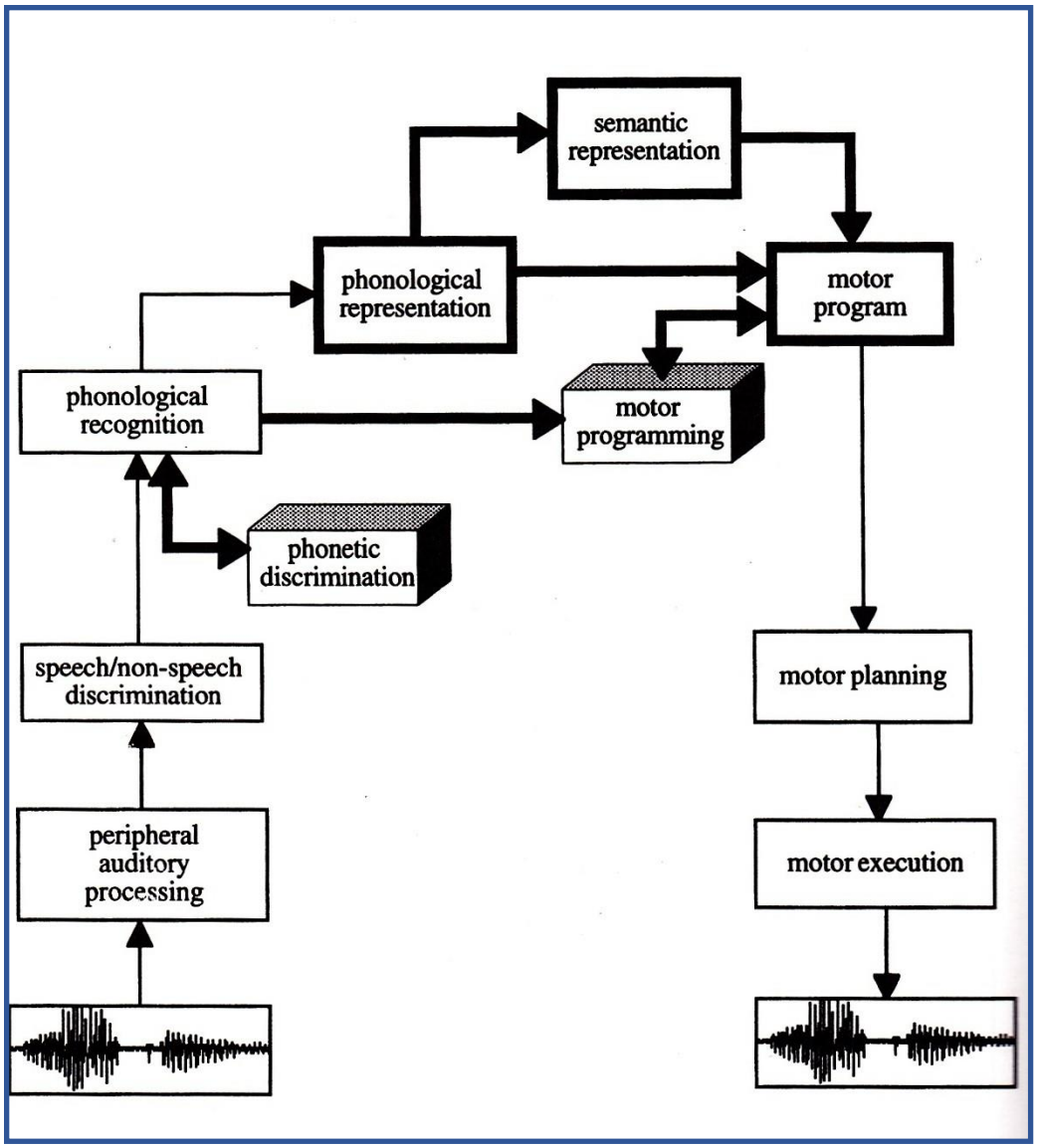

Figure 1. Speech Processing Model (Stackhouse & Wells, 1997:350)

Making use of the psycholinguistic framework in planning a speech assessment requires the SLT to consider including different tasks that would allow for examination of the three levels of processing. For instance, an auditory discrimination task for the assessment of the child's input and a single word production task for assessing output. A picture naming task, which was used to collect speech samples in the current research study, therefore allowed the researcher to tap into more than one component of each participant's stored knowledge. For instance, each participant not only needed to access her/his motor program when asked to spontaneously produce a target word by verbally identifying visual stimuli but was also required to access her/his phonological representation/s of the target words. Participants who required cues to assist

them in retrieving target words likely required help to access their semantic representations of these words. It is for this reason that the importance of making a clear distinction between children who have difficulty accessing the name of the picture shown (i.e., due to expressive language difficulties), as well as those who are able to access the name but have difficulty accessing the phonological representations during naming tasks (i.e., due to speech sound difficulties), has been highlighted (Stackhouse & Wells, 1997). This is vital as it has been shown that a direct relationship between phonological and lexical development exists (Rvachew & Brosseau-Lapré, 2017). In addition to semantic and pragmatic factors, words comprising a child's early vocabulary are determined by the child's phonological abilities (Stoel-Gammon, 2011). This is in support of Stoel-Gammon's (2011) suggestion that children who produce their first words later than their peers will not only have a limited vocabulary, but a limited phonological repertoire too. A study conducted by Girolametto, Steig, Pearce and Weitzman (1997) has shown an increase in the acquisition of various complex syllable shapes, speech sound inventories, as well as, an increase in the production of word-initial and final consonants in a group of toddlers who received lexical intervention after being diagnosed as late talkers.

The developmental phase model, which is another theoretical model of the psycholinguistic framework, comprises five phases of speech sound development. This model outlines the main stages of phonological development through the five phases proposed. It allows the clinician to b able to track a child's development (in turn identifying if a delay exists), and this is done according to the types of simplification errors that are characteristic of the child's speech production. The pre-lexical phase is the first of the developmental phases and occurs during the initial year of life (Stackhouse & Wells, 1997). A number of skills involving various levels of speech processing develop during this period. These skills range from the child's ability to distinguish between speech and non-speech sounds in infancy (Rvachew & Brosseau-Lapré, 2017; Stackhouse & Wells, 1997); being able to recognise a few words at six months (an indication that the child has a phonological representation, although it still needs to develop further), as well as her/his ability to compare patterns of speech sounds s/he has heard to those in her/his existing repertoire; and a more developed motor program (this is evident in the child's use of a more varied range of sound patterns in babbling) (Rvachew & Brosseau-Lapré, 2017; Stackhouse & Wells, 1997). It has been proposed that the child's output skills are not linked to her/his input level of processing during this phase as s/he does not need to have heard other people speaking in order to babble (Stackhouse & Wells, 1997). The whole word phase is the second developmental phase; it occurs around the time children reach their first birthday and is marked when they produce their first 'real' word. During this phase, the child's output skills are linked to her/his input skills since the words produced are dependent on the words the child has heard spoken (Rvachew & Brosseau-Lapré, 2017; Stackhouse & Wells, 1997). The lexical representation of the words uttered by the child consists of a semantic representation, phonological representation and a

motor program at this phase of speech sound development. Since the child's vocabulary is still small at this phase of development, it is unlikely that segmentation or simplification of words occurs (Stackhouse & Wells, 1997). The systematic simplification phase is the third phase of speech development and is characterised by the presence of immature phonological processes, which result when children simplify certain words that they are unable to produce accurately (Stackhouse & Wells, 1997). This is likely because the child's phonological representation, as well as her/his motor program has to be refined as her/his vocabulary increases. The child therefore needs to accurately update existing motor programs and lexical representations in order to move onto the assembly phase, which is the fourth phase of speech development (Stackhouse & Wells, 1997). The assembly phase is characterised by an attempt to produce consonantal sequences and sentences with a more complex structure in spite of immature phonological skills. This phase occurs around the fourth year of life and children in this phase continue to have challenges producing affricates and consonantal sequences. The challenges noted during this phase of development are evidence that the child's motor planning skills are still developing (Stackhouse & Wells, 1997). The metaphonological phase is the final phase of speech development; it occurs around the child's fifth birthday (i.e., early school-age), a period during which s/he develops pre-literacy skills (e.g., phonological awareness) (Rvachew & Brosseau-Lapré, 2017; Stackhouse & Wells, 1997). Most children at this phase are beginning to segment words (e.g., identify that 'window' has two syllables, the initial phoneme in 'cat' as /k/, etc.). Identification of word-final phonemes is often very challenging for children in this phase of phonological development, and segmentation into phones only occurs once the child has been exposed to an alphabetic script (Rvachew & Brosseau-Lapré, 2017; Stackhouse & Wells, 1997). A child who progresses through this phase without challenges or limitations during development can therefore be expected to acquire literacy skills in a typical manner. Stackhouse and Wells' (1997) Developmental Phase Model is depicted in Figure 2.

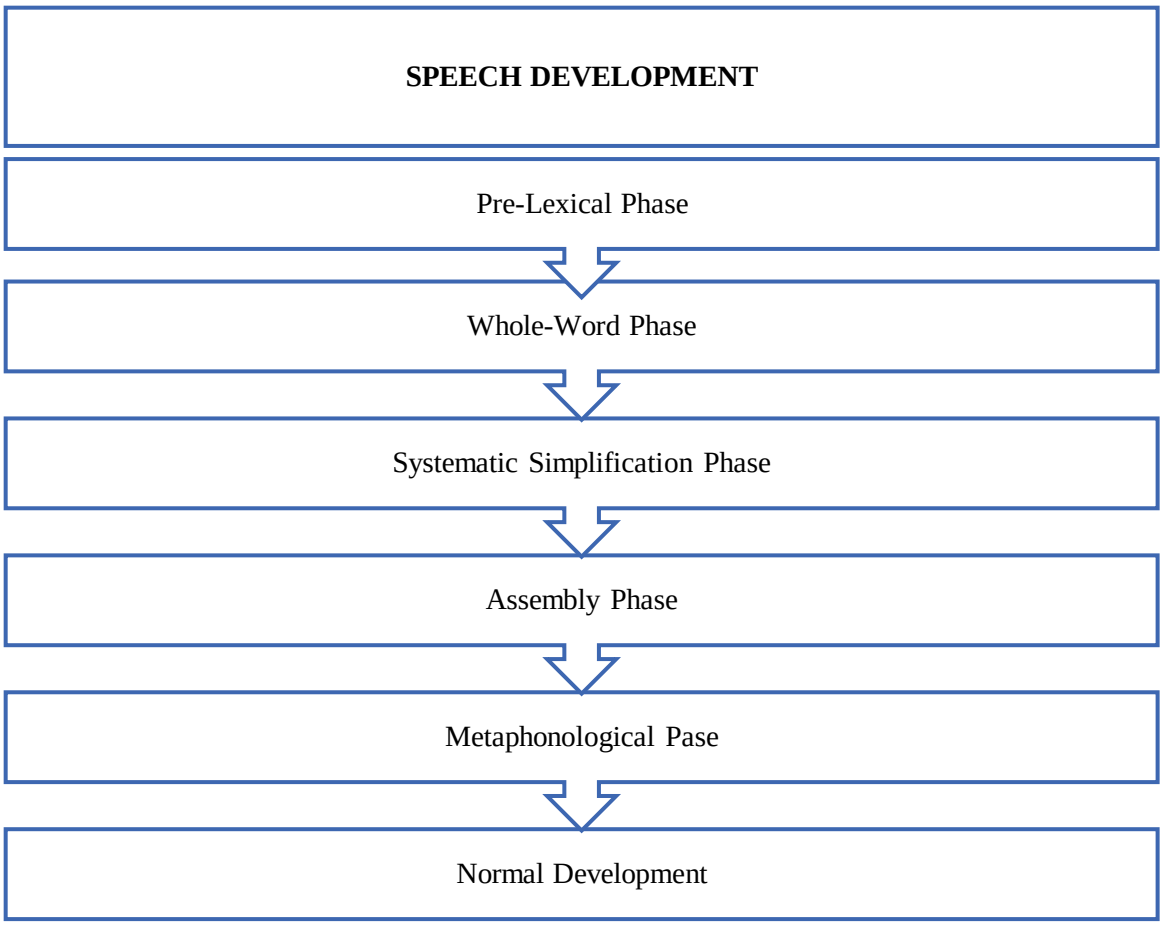

Figure 2. The Developmental Phase Model (Stackhouse & Wells, 1997, as cited in Pascoe, Stackhouse and Wells, 2006:39)

A child who experiences a breakdown at one or more of the levels in these speech processing models (Figures 1 and 2) will likely present with SSDs (Geronikou & Rees, 2016; Waring & Knight, 2013). S/he is in turn, at a greater risk of experiencing challenges in developing literacy skills at age-appropriate times (Stackhouse & Wells, 1997; Waring & Knight, 2013). This relationship between SSDs experienced in early years and difficulties with literacy development in later years has been illustrated by a large body of research. Research studies that have explored this relationship have found that children who had a history of SSD presented with poor spelling abilities, which occurred as a result of poor phonological awareness and letter recognition skills (Hayiou-Thomas, Caroll, Leavett, Hulme & Snowling, 2016; Law, Dennis & Charlton, 2017; Terband, Maassen & Maas, 2019).

The application of the developmental phase model has been investigated in research focused on a range of languages, including English (Pascoe, Stackhouse & Wells, 2005), German (Fox & Dodd, 1999)

and Greek (Geronikou & Rees, 2016). The relevance of this speech processing model in some Southern Bantu languages has recently been explored as well. In their study of isiXhosa phonological development, Maphalala, Pascoe and Smouse (2014) gave a detailed account of the various stages of speech acquisition that isiXhosa-speaking children likely reach at certain ages. This was done by relating these stages to Stackhouse and Wells' (1997) developmental phase model. Children aged 3;0–4;0 years presented with more phonological processes than the older ones and were therefore described as being in the systematic simplification phase of the developmental phase model (Maphalala et al., 2014). Given that the younger children's speech was characterised by the presence of an increased number of phonological processes, one can propose that refinement of motor programs and phonological representations mainly occurs between 3;0 and 4;0 years in children acquiring isiXhosa. Findings from this study also suggested that older children (aged 5;0–6;0 years) were in the assembly phase and likely advancing to the metaphonological phase as they used fewer simplification error patterns and were noted to use rhyming (a skill crucial for literacy development) (Maphalala et al., 2014).

Pascoe et al. (2016) also investigated the application of Stackhouse and Wells' psycholinguistic approach for describing the speech skills of children acquiring isiXhosa. This involved exploring procedures for assessing the speech processing and production skills of two children aged 2;5 and 2;8 years, which allowed them to give an account of each of their speech input skills, stored phonological representations, as well as output skills. Using the speech processing model of the psycholinguistic approach, Pascoe et al. (2016) proposed the following in interpreting the two children's performance in tasks evaluating their speech processing skills:

- Difficulty producing certain words accurately – this is likely due to one of two reasons namely articulatory problems in producing target sounds (i.e., limited motor programming skills) or erroneous stored phonological representations.
- Inaccurately producing words during spontaneous naming and accurately producing target words during repetition – this likely illustrates that a child has good motor programming skills for accurate production of words, but poor phonological skills. This means that children at this age have developed gestures needed to produce words accurately (i.e., there are no structural and motor programming difficulties), but are not yet able to always retrieve the correct phonological units.
- Inaccurate production of target words, accurate production during repetition and difficulty distinguishing between minimal pairs accurately – this is likely because the child has an inaccurate storage of the phonological representation of these words.

- Accurate production of words in spontaneous naming and repetition and an ability to discriminate between the target word and its similar sounding pair – this is an indication that a child has an accurate lexical representation of the target word.

Another recent preliminary developmental study attempted to apply the psycholinguistic framework to speech sound development in Setswana (Mahura, 2014). It was proposed that Setswana-speaking children aged 3;0–3;11 years were in the systematic simplification phase (e.g., *'sekhurumêlô'* /sɪkʰurumɛlɔ/ lid → *'khurumêlô'* /kʰurumɛlɔ/); those aged 4;0–4;5 years in the assembly phase, and those between the ages of 4;6 and 5;11 years in the metaphonological phase of development. Although these findings were not conclusive, there seemed to be a considerable overlap between these phases (Mahura, 2014). For instance, children aged 3;6–3;11 years were in the systematic simplification phase but progressing into the assembly phase, while those aged 4;0–4;5 years were in the assembly phase but making their way into the metaphonological phase. Although motor planning appears to continue to develop at 4;5 years in children acquiring Setswana, children in this age group are likely starting to segment words they hear. The youngest group of children (2;6–2;11 years) in the current study are expected to be in the systematic simplification phase since it has been suggested that this age group is likely to present with more simplification error patterns during speech production (Mahura & Pascoe, 2016).

The psycholinguistic framework was used to describe speech sound development in children acquiring Setswana. This may be beneficial to clinicians as they will likely be able to explain the cause(s) of a child's SSD (i.e., the level of breakdown in a child's speech processing model). For example, a child who continues to produce *'**n**ônyane'* /**n**ɔɲanɪ/ (bird) as *'**ny**ônyane'* /**ɲ**ɔɲanɪ/ after 5;0 years may have difficulty discriminating between alveolar nasal /n/ and palatal nasal /ɲ/ word-initially. Using this framework is especially important since there is currently no information describing possible causes of SSDs in Setswana.

One of the benefits of Stackhouse and Wells' (1997) psycholinguistic framework is that it provides clinicians with a theoretical base that they can use when planning for individual therapy programmes (Pascoe et al., 2005; Rvachew & Brosseau-Lapré, 2017). Although this framework does not give exact information on the types of stimuli appropriate for each child assessed, it provides the clinician with suggestions of modalities (e.g., input and/or output) which may be appropriate to use in intervention (Pascoe et al., 2005). This psycholinguistic framework is reported to have high construct validity and can be used reliably as a tool to describe differences in the speech processing of children with and without SSDs (Rvachew & Brosseau-Lapré, 2017; Waring & Knight, 2013). Clinicians are encouraged to take a holistic approach when using this framework in their assessments, therefore giving it high face validity.

Stackhouse and Wells' (1997) framework is, however, not without any shortcomings. SSDs are often attributed to the occurrence of a breakdown at one or more levels of a child's speech processing system. This may not always be the case as the SSD a child presents with might be a co-morbid symptom of an underlying deficit (Waring & Knight, 2013). Although it is important to consider that the strengths and weaknesses of each child with SSD are unique, doing so has a negative impact on the framework's predictive validity (Waring & Knight, 2013). This therefore makes it challenging for one to predict the improvement a child might make during a period of intervention. This psycholinguistic framework is used to describe the way in which the current study population acquires speech. In addition, Dodd's (1995, 2005) diagnostic framework is used to classify children who may present with SSDs since Stackhouse and Wells' (1997) framework is not a classification system (Rvachew & Brosseau-Lapré, 2017; Waring & Knight, 2013). Dodd's classification system proposes that surface-level error patterns can be used to classify subgroups since these error patterns reflect underlying subgroup-specific processing deficits (Rvachew & Brosseau-Lapré, 2017; Waring & Knight, 2013). The validity and use of this classification system in clinical settings is supported by a range of empirical evidence. Research around Dodd's (1995, 2005) classification system has demonstrated that all children whose SSDs are of an unknown aetiology can also be classified into four subgroups (Waring & Knight, 2013). These subgroups have been matched to various intervention techniques, thereby increasing the efficacy of the intervention provided (Waring & Knight, 2013). Unlike the psycholinguistic framework, Dodd's (1995, 2005) classification system is said to have a high predictive validity as the speech sound profiles which are characteristic of the subgroups can be used to make recommendations for therapy (Waring & Knight, 2013). Dodd's (1995, 2005) classification system has become easier for clinicians to use since the *Diagnostic Evaluation of Articulation and Phonology* (DEAP) (Dodd, Hua, Crosbie, Holm & Ozanne, 2002) was based on this specific system of classifying children's SSDs.

In addition to being at risk of poor academic success, studies have shown that children with SSDs often experience limitations taking part in social situations. Such limited opportunities mean that these children are more likely to be bullied and isolated from social situations than typically developing children (Feeney et al., 2017; Krueger, 2019; Lyons & Roulstone, 2018; Rvachew & Brosseau-Lapré, 2017). This often occurs as children with communication impairments (speech and language) may have poorer social skills, behavioural difficulties and experience more challenges forming friendships than their peers with typical communication skills (Feeney et al., 2017; Krueger, 2019; Lewis et al., 2016; McCormack, Harrison, McLeod, & McAllister, 2011; McLeod & Bleile, 2007; Rvachew & Brosseau-Lapré, 2017; Tempest & Wells, 2012). These individuals may experience further challenges at a later stage in their lives, especially if they continue to experience communication difficulties and poor literacy development. These

additional challenges include limited access to healthcare and occupational opportunities (Feeney et al., 2017; McLeod & Bleile, 2007). Since South Africa has limited resources, one can expect these challenges to be worse for individuals with communication difficulties living in this context, and other countries with challenges similar to those of South Africa.

Given the far-reaching impact of speech and other communication difficulties on an individual's educational success and psychosocial well-being, the need to promptly identify such difficulties cannot be overemphasised. It is equally important to give a comprehensive account of how a child's speech difficulties impact her/his participation in various contexts, as well as how this may in turn be affected by her/his communication partners and/or other factors within the environment. A framework that allows the clinician to consider the child in such a holistic manner is the World Health Organisation's (WHO, 2007) International Classification of Functioning, Health and Disability (ICF). Not only will the use of the ICF framework (WHO, 2007) assist in identifying limitations experienced by a child with SSD, it will help the clinician address the child's impairment/s, as well as various factors impeding her/his participation too (Krueger, 2019; McCormack, McLeod, Harrison & McAllister, 2010; McLeod, 2004; McLeod & Bleile, 2004; Rvachew & Brosseau-Lapré, 2017; Threats, 2006). The use of the ICF in clinical practice is likely to yield improved developmental outcomes since this framework allows the clinician to incorporate a child's ability to learn, apply knowledge acquired, care for her-/himself and communicate (i.e. Activities and Participation component of the framework) during assessment of her/his development and management of developmental difficulties, as well as contextual influences on Activities and Participation (e.g. language and cultural environments).

1.5 Theories of phonological acquisition

Evidence from cross-linguistic studies has demonstrated that children follow a particular trajectory before being able to produce adult-like speech. While differences in patterns of speech sound acquisition can be expected in most of the world's languages, studies have highlighted developmental trends that are common in how speech is acquired across the various languages documented. Several theories of phonological acquisition have been developed in an attempt to account for developmental trends common across languages and those that are unique to given languages. One of these theories is Jakobson's (1941/1968) 'laws of irreversible solidarity', which proposes that phonological acquisition follows a universal trend. According to Jakobson (1941/1968), certain phonemes and phonological features are common to almost all languages and can be expected to be acquired earlier than those that are specific or unique to a given language. For instance, nasals, front consonants and stops are acquired earlier than oral

and back consonants, as well as fricatives (Jakobson, 1941/1968). This claim of developmental universals has, however, been disputed as it does not account for certain individual differences in speech acquisition within a language, as well as differences in the acquisition of the same phonemes and features across languages (Hua & Dodd, 2006). Other developmental studies have also provided evidence that challenges Jakobson's (1941/1968) theory on developmental universals: findings from languages such as English, German, Putonghua, Cantonese, Maltese, Egyptian Arabic and Turkish have demonstrated that while sounds common in all these languages (e.g. nasals /m, n/ and plosives /p, b, t, d, k, g/) are developed earlier than other sounds, the ages at which they are acquired varies across the different languages, thereby suggesting that speech acquisition can be influenced by language-specific factors (Hua & Dodd, 2006).

Another theoretical account of phonological acquisition is that of markedness (Edwards, 1974). It has been suggested that languages have features that are 'marked' and 'unmarked': unmarked features consist of properties that are common to a given language and occur with a high frequency, while marked features include unique properties that are rare and occur less frequently (Zamuner, Gerken & Hammond, 2005). According to this theory, early acquired sounds can be considered unmarked while those acquired later are marked. Children can therefore be expected to produce unmarked phonemes (and phonological features) in place of marked ones during speech sound acquisition (Anderson, 1983; as cited in Hua, 2002; Hua & Dodd, 2006). This hypothesis was supported by a number of cross-linguistic studies documented in Hua and Dodd (2006), which have found that children acquiring most of the languages largely presented with stopping and fronting during speech production, likely due to the early acquisition of stops (unmarked sounds) across these languages. They have, however, noted that although this tendency was common in the languages studied, it does not mean that children are unlikely to produce marked features in place of unmarked ones. For the present study on Setswana speech sound acquisition, marked features likely include alveolar trill /r/, affricates, as well as phonemes or syllables with aspiration and rounding (e.g., *'t**h**uba'* /tʰuba/ break; *'rôj**w**a'* /rɔʤʷa/ to be broken). Children acquiring Setswana are therefore expected to acquire these features later than others, as was suggested by a recent preliminary study (Mahura & Pascoe, 2016).

1.6 Summary

Data on studies that have documented the prevalence of SSDs globally, including preliminary figures for the South African context, were outlined in this chapter. This was done to highlight the potentially large number of South African children who require speech and language therapy services. This was followed by a description of several frameworks used to classify children who present with SSDs of known and unknown aetiologies. Some of these helped to highlight some of the negative consequences of SSDs on a child's academic success. Since there is a scarcity of contextually relevant resources in South Africa, some of the challenges faced by SLTs working in this context and the impact of these on evidence-based practice were focused on. This highlighted the great need for developing contextually relevant resources that are based on research evidence. The next chapter gives a description of the Setswana speech sound system as it is the focus of this research study. This will be followed by an overview of related studies carried out in South Africa, specifically those of children acquiring other indigenous Bantu languages and South African English (including children who are bi/multilingual).

CHAPTER 2: LITERATURE REVIEW

This research study aims to outline the stages of speech sound development in children acquiring Setswana. This outline includes describing speech acquisition in monolingual and multilingual children, as well as the speech of those with SSDs. This was done to contribute evidence for SLTs working with children acquiring Setswana in Southern Africa. In this chapter, the Setswana speech sound system is introduced as this is the focus of this study, and related research is summarised. This will be followed by a review of literature on speech sound acquisition of a number of Bantu languages and South African English. Literature on South Afican English was summarised here so as to make comparisons to children acquiring South Afican English and to note any universals in speech development between those acquiring English in South Africa and those acquiring indigenous Bantu languages.

2.1 Setswana

2.1.1 Regions and varieties

Setswana is a Southern Bantu language belonging to the Sotho branch of the language family (Cole, 1955; Greenberg, 1963; Mosaka, 2000; Zerbian, 2006). It is one of South Africa's officially recognised languages; it forms the fifth largest language group in the country and is spoken by 8% of the population (an estimated 4 million people) (Statistics, S.A., 2011), with recent data estimating that it is spoken by 9.1% of the population in their homes (Statistics, S.A., 2019). The majority of Setswana speakers can be found in the north-western parts of South Africa (Statistics S.A., 2011), a region of the country that borders Botswana. More than half (53.8%) of the Setswana-speaking population in South Africa live in the North-West province, with others living in Northern Cape (33%), Gauteng (9%) and the Free State (5.2%) (Statistics S.A., 2011). Setswana is a cross-border language and is spoken in Botswana, Namibia and Zimbabwe. It is the national language of Botswana, where it is spoken by 76.6% of Batswana (Statistics Botswana, 2017). In Namibia, Setswana constitutes a small language group and is spoken in 0.3% of the country's households (Namibia Statistics Agency, 2011). Setswana speakers in Namibia are mainly found in Gobabis, a city in the eastern part of the country that is situated close to the Botswana border (Arebbusch, 2019). Official data on the number of Setswana speakers in Zimbabwe is not available, but some reports have indicated that they only form a small group of the Zimbabwean population (Makoni, Dube & Mashiri, 2006). The geographical areas in which Setswana is mainly spoken are illustrated in Figure 3.

In South Africa, there are several Setswana varieties spoken by the diverse groups of Batswana. These have been classified into four divisions, namely Central, Northern, Southern and Eastern (Cole, 1955). The varieties of Setswana per division include:

- Central – Serôlông, Sehurutshe and Sengwakêtse
- Northern – Sekwêna (often referred to as Western Sekwêna), Sengwatô and Setawana
- Southern – Setlhaping and Setlharô
- Eastern – Sekgatla and Eastern Sekwêna (Cole, 1955; Krüger, 2006)

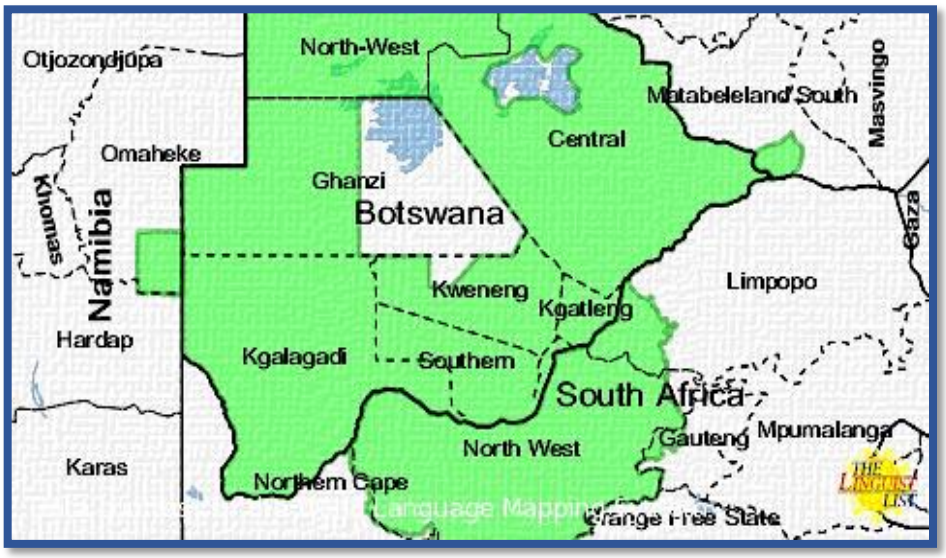

Figure 3. Geographical areas where Setswana is mainly spoken (shown by the green shaded areas) (Source: www.multitree.org, 2013)

Setswana is largely uniform amongst the different groups, but some variations in pronunciation and vocabulary have been reported. According to Cole (1955), speakers of the southern variety invariably substitute voiceless labio-dental fricative /f/ with glottal fricative /h/ (e.g., *'**f**o**f**a'* /**f**ʊ**f**a/ fly is pronounced as *'**h**o**h**a'* /**h**ʊ**h**a/). Those who speak the northern dialects are likely to substitute latero-alveolar affricates /t͡ɬʼ/ and /t͡ɬʰ/ with interdental /t̪/ and /t̪ʰ/, as well as use heterorganic compounds *'fs, fš, bj, ps, pš, psh, pšh'* in place of *'š(w), j(w), tš(w), tšh(w)'*. Lastly, hormorganic compounds are used extensively in the eastern varieties, where the process of vowel elision is typical (e.g., *'mo**l**e**l**ô'* /mʊ**l**ɪ**l**ɔ/ (fire) is usually produced as *'mo**ll**ô'* /mʊ**l̪l**ɔ/). In this study, speech sound acquisition in children acquiring two varieties of Setswana, namely Setlhaping and Sekwêna, was investigated.

2.1.2 Setswana phonology

Setswana, like many Bantu languages, is an agglutinative language, which means that words can be formed by joining several morphemes, and that the meaning of root words can be changed using various noun class prefixes, as well as suffixes (Van Rooy & Pretorius, 2003; Zerbian & Barnard, 2010). For instance, the root *'tswana'* /t͡sʷ'ana/ can take several meanings with the addition of different noun class prefixes, such as *'**Se**tswana'* /**sɪ**t͡sʷ'ana/ (the language), *'**Mo**tswana'* /**mʊ**t͡sʷ'ana/ (singular – a speaker of Setswana and/or a native of Botswana) and *'**Ba**tswana'* /**ba**t͡sʷ'ana/ (plural – speakers of Setswana and/or natives of Botswana). Twenty-eight consonants and seven vowels are widely reported in the literature on Setswana phonology (Cole, 1955; Krüger & Snyman, 1988; Setshedi & Malope, 1978; Snyman et al., 1989; University of Botswana (UB) Department of African Languages and Literature, 2001).

2.1.2.1 Consonants

Setswana consonant phonemes can be distinguished according to: a) their place of articulation; b) their manner of articulation; c) whether or not they are voiced; and d) their direction of airflow from the oral cavity during production (Cole, 1955; Krüger & Snyman, 1988; Setshedi & Malope, 1978; Snyman et al., 1989). Similar distinctions are made in recent literature, although slightly different terminology is used. For instance, voicing is referred to as 'position of vocal cords' and airflow direction from the oral cavity is referred to as 'position of the velum' (UB Department of African Languages and Literature, 2001, p.7). The voiced alveolar plosive /d/ is an allophone of lateral sonorant /l/ and only occurs before close vowels /i/ and /u/ (Coetzee & Pretorius, 2010; UB Department of African Languages and Literature, 2001). Medial labio-velar /w/ and palatal /j/ are classified as semi-vowels since they sometimes take on features of back close-mid /ʊ/ and front close-mid /ɪ/ respectively. Three of the ejective plosives and three ejective affricates in the Setswana phonetic inventory have an aspirated pair each (e.g., /p' – pʰ/; /t' – tʰ/; /k' – kʰ/; /t͡s' – /t͡sʰ/; /t͡ɬ' – t͡ɬʰ/; /t͡ʃ'/ – /t͡ʃʰ/) (Cole, 1955; UB Department of African Languages and Literature, 2001). Additionally, a number of Setswana consonants become rounded/labialised when occurring before medial labio-velar /w/. However, not all consonants can take on the rounding feature and exceptions include bilabials, labio-dental fricative /f/, voiced alveolar plosive /d/ and medial palatal sonorant /j/ (Cole, 1955; Krüger & Snyman, 1988). For instance, /sʷ/ is permissible (as seen in the word *'**sw**aba'* /**sʷ**aba/ to be disappointed) but /jʷ/ is not. It has also been suggested that glottal fricative /h/ cannot be rounded (Cole, 1955; Krüger & Snyman, 1988). Setswana consonant phonemes are included in Table 2.

Table 2. Setswana consonant chart (adapted from Cole, 1955; Setshedi & Malope, 1978; Snyman et al., 1989; Krüger & Snyman, 1988; UB Department of African Languages and Literature, 2001)

Manner		Place of articulation								
		Bilabial	**Labio-dental**	**Alveolar**	**Latero-alveolar**	**Palato-alveolar**	**Palatal**	**Glottal**	**Velar**	**Labio-velar**
Plosives	Ejective	p’		t’					k’	
	Aspirated	pʰ		tʰ					kʰ	
	Voiced	b		(d)						
	Fricatives		f	s		ʃ		h	x	
	Nasals	m		n			ɲ		ŋ	
Sonorants	Lateral				l					
	Medial						j			w
	Trill			r						
Affricates	Ejective			t͡s’	t͡ɬ’	t͡ʃˀ				
	Aspirated			t͡sʰ	t͡ɬʰ	t͡ʃʰ			kx͡ʰ	
	Voiced					ʤ				

Variants and allophones:		Syllabic consonants:
/b/ = [b~β]	/ʤ/ = [ʤ~bj, βj]	/ɾ̩/ /l̩/
/l/ = [l~d]	/tʃˀ/ = [t͡ʃˀ~ps’, pʃˀ, p’j]	/m̩/ /n̩/
/f/ = [f~ɸ]	/t͡ʃʰ/ = [t͡ʃʰ~pʰs, pʰʃ]	/ŋ̩/ /ɲ̩/
/ʃ/ = [ʃ~ɸʃ, fs, fʃ, ɸj, fj]		

From Mahura & Pascoe (2016, p.547)

2.1.2.2 Vowels

Earlier authors have reported the Setswana phonetic inventory as consisting of eight vowels, represented phonetically as /i/, /ɪ/, /e/, /ɛ/, /a/, /ɔ/, /o/, /ʊ/ and /u/. Each of the four mid vowels have a variant, resulting in eleven vowel phones in Setswana (Chebanne, Creissels & Nkhwa,1997; Cole, 1955). None of the Setswana vowels have diphthongal qualities (Cole, 1955; Krüger & Snyman, 1988). Although Setswana has eight vowels, these are represented using the seven symbols in orthography: *i, e, ê, a, o, ô, u*. Recent literature on Setswana phonology has suggested a seven-vowel system (UB Department of African Languages and Literature, 2001). The authors argue that despite the scientific and historical basis of reports of an eight-vowel system for Setswana, it is not reflective of the language's current vocalic system (UB Department of African Languages and Literature, 2001). The Setswana seven vowel system is illustrated in Figure 4.

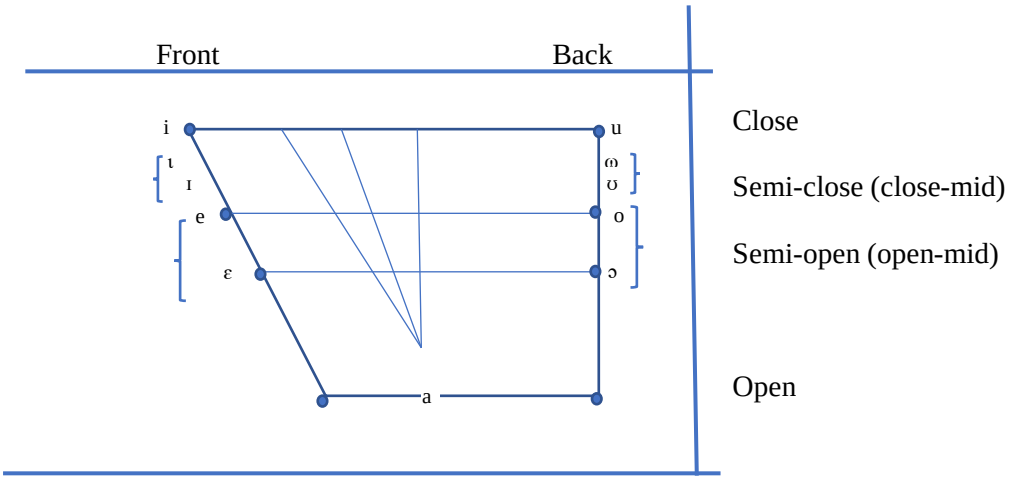

Figure 4. The Setswana vowel system (adapted from Cole, 1955; Krüger & Snyman, 1988)

The close-mid vowels /ɪ/ and /ʊ/ can only occur in specific contexts: a) when the syllable that follows them has vowels other than close /i/ and /u/; and b) when it is in the final word position. Distinguishing close-mid vowels /ɪ/ and /ʊ/ from close /i/ and /u/ can sometimes be challenging; this is mainly seen in a limited number of words requiring for lateral /l/ to be replaced with its allophone /d/ and is mainly prevalent in the southern varieties of Setswana (Cole, 1955; UB Department of African Languages and Literature, 2001).

2.1.2.3 Syllables

Setswana has an open syllable structure, which means that the majority of its syllables end in a vowel (Cole, 1955; Krüger & Snyman, 1988; UB Department of African Languages and Literature, 2001). The literature has mainly documented three syllable structures for Setswana: 1) consonant and vowel (CV, e.g., *'**bu**ka'* /**bu**k'a/ book); 2) vowel only (V, e.g., *'**ê**pa'* /**ɛ̨**p'a/ dig); and 3) consonant only (C, e.g., *'**m**pa'* /**m̩**p'a/ stomach). Nasals, trills and lateral sonorant /l/ are the only consonant phonemes that can be syllabic in Setswana (Coetzee & Pretorius, 2010; Cole, 1955; Krüger & Snyman, 1988; Setshedi & Malope, 1978; Snyman et al., 1989; UB Department of African Languages and Literature, 2001). The syllabicity of some of these phonemes is dependent on the phonetic context in which they occur. The nasals /m/, /n/ and /ŋ/ can be syllabic when followed by various consonants (e.g. *'pê**n**tê'* /p'ɛ**n̩**t'ɛ/ paint, *'**m**pitsa'* /**m̩**p'it͡s'a/ call me), while the lateral sonorant /l/, trills as well as palatal nasal /ɲ/ can only be syllabic when followed by identical consonants (e.g. *'nnyê'* /**n̪̩n̪**ɛ/ small; *'molelô'* /mʊ**l̩l**ɔ/ fire; *'rrê'* /**r̩r**ɛ/ father) (Krüger & Snyman, 1988; Setshedi & Malope, 1978; Snyman *et al*., 1989). Only the velar nasal /ŋ/ can occur as a syllable in the final position of a word, e.g., *'dikgong'* /dik͡x^{h}ʊ**ŋ̩**/ (logs) (Krüger & Snyman, 1988). Syllabic lateral alveolar /l/ is a feature in the speech of a few varieties but is not part of the standard Setswana orthography. For instance, when spelling /bʊfʊ**l̩**la/ (untie), a vowel is added between the adjacent laterals to make it *'bofol**o**la'* /bʊfʊl**ʊ**la/ (Krüger & Snyman, 1988; Setshedi & Malope, 1978). Although much of the literature on Setswana phonology has generally reported on three types of syllable structures, some authors have proposed that a fourth one exists. This fourth syllable consists of a consonant, medial labio-velar /w/ and a vowel (C^{w}V, e.g., *'**kwê**na'* /**k^{w}'ɛ**na/ crocodile) (Coetzee & Pretorius, 2010; Krüger & Snyman, 1988). Since labio-velar /w/ adds a rounding feature when combined with certain consonant phonemes (Cole, 1955; Krüger & Snyman, 1988), the suggestion of round syllables forming a fourth syllable structure in Setswana is somewhat questionable.

No consonant clusters have been reported in Setswana phonology, and native speakers often alter the syllable structures of loanwords with consonant clusters by adding a vowel between the adjacent consonants (e.g., CCV → CV-CV; *'**st**oel'* /**st**ul/ Afrikaans word for 'chair' → *'**seti**lô'* /**sɪt'i**lɔ/) (Palai & O'Hanlon, 2004). A similar occurrence has been reported for Sesotho by Rose and Demuth (2006). A recent preliminary study investigating the acquisition of segmental Setswana phonology proposed that consonant clusters likely form an additional syllable structure (Mahura & Pascoe, 2016). This proposition was made following observations of participants producing clusters when using loanwords (e.g., *'**se**tilô'* /**sɪ**t'ilɔ/ chair → *'**st**ilô'* /**st'**ilɔ/; *'bae**se**kele'* /baɪ**sɪ**k'ɪlɪ/ bicycle → *'ba**sk**ele'* /ba**sk'**ɪlɪ/), as well as when they omitted vowels in non-loan words so as to form consonant clusters (e.g., *'**se**tlhare'* /**sɪ**tl^{h}arɪ/ tree → *'**stlh**are'* /**st͡l^{h}**arɪ/).

In addition, Setswana syllables, with the exception of those in the penultimate syllable position, have been described as typically being short. This means that length cannot be used to distinguish between two words (UB Department of African Languages and Literature, 2001). Mosaka (2000) has, however, proposed that the syllable

occurring in the initial position also receives some lengthening during production of single words. It is for this reason that production of target phonemes occurring word-initially was investigated in this study.

2.1.2.4 Tone

Tone is semantically significant in the majority of Bantu languages, i.e., differences in tone serve to distinguish meaning in phonetically identical words (Cole, 1955; Krüger & Snyman, 1988; Snyman *et al*., 1989; Zerbian & Barnard, 2010). Setswana uses High (H) and Low (L) tones; each is thought to have raised, lowered, level and falling varieties, although they are not as significant as the two main ones. A H or L is thus used when producing each syllable in a word (Cole, 1955). For instance, *'pitsa'* /pʼit͡sʼa/ (pot) has a LL tonal pattern and producing the word with a HL (/pˈ**ít͡s**ˈ**à**/) or a HH (/pˈ**ít͡s**ˈ**á**/) tonal pattern would be inaccurate and meaningless. It should be noted, however, that such a change in the tonal pattern is acceptable in numerous cases and often results in production of a new word. For example, *'bua'* /bùạ̀/ (to flay) is produced with a LL tonal pattern, and a rise in tone in the first syllable (i.e., LL → HL) results in production of a new word (/b**úạ**̀/ to speak) (Cole, 1955). According to the UB Department of African Languages and Literature (2001), only about 20%–25% of syllables in most Bantu languages (including Setswana) have a high tone, which can displace, be spread out or deleted. Setswana is suggested to have a tone rule requiring the spreading out of a High tone on a verb stem to syllables on the right, except on the final syllable (UB Department of African Languages and Literature, 2001). Furthermore, it has been reported that tone can only be contrasted on stem-initial syllables of verbs, but that such contrasts can be made on all syllables of nouns (Zerbian & Barnard, 2010).

There is currently very limited data on how children acquiring Bantu languages develop tone. Chimombo and Mtenje (1989), who studied the acquisition of tone in Chichewa-speaking children found the use of the regular HL tonal pattern during production of a variety of negative forms, despite the absence of a H tone in some of these constructs in the initial position. In her study of one Sesotho-speaking child, Demuth (1993) reported an overextension of H tone to verbs with a L tone at 2;1 years, followed by an accurate use of tones on verbs at 3;0 years. Similar findings were made for Setswana (Tsonope, 1987), as well as isiZulu (Suzman, 1991). More data on the acquisition of tone in tonal languages is vital since words produced with an inaccurate tonal pattern at specific ages may indicate an SSD. In their study of Setswana- and isiZulu-speaking adults, Van der Merwe and Le Roux (2014) found that those who presented with a motor speech disorder such as apraxia of speech omitted syllabic tone used to distinguish meaning in words.

2.1.2.5 Stress and intonation

Stress refers to a prominence that is assigned to specific syllables during production of single words and sentences (Peppe, 2012). In Setswana, as in a number of Bantu languages, this prominence is characterised by a

penultimate syllable lengthening phenomenon. This means that during speech production, the penultimate syllable is often lengthened, thereby making it bimoraic (Cole, 1955; Mosaka, 2000; UB Department of African Languages and Literature, 2001). There is some controversy around whether or not the penultimate syllable lengthening phenomenon is a marker of stress. Some authors have proposed that lengthening of the penultimate syllable in Setswana and several southern Bantu languages is indicative of stress (Mosaka, 2000; UB Department of African Languages and Literature, 2001). These authors further suggested that since stress is always marked on the penultimate syllable, Setswana can be considered a fixed stress language (UB Department of African Languages and Literature, 2001). Other authors have, however, argued against the penultimate syllable lengthening phenomenon as a stress marker in certain Bantu languages, including Setswana (Cole, 1955), Sesotho (Demuth, 2007) and isiXhosa (Van der Stouwe, 2009). Cole (1955) argued that the prominence noted in the penultimate syllable only marks its length and has no semantic function in Setswana (and other southern Bantu languages) as it does in a stress language such as English. This was supported by Zerbian and Barnard (2008), who indicated that southern Bantu languages have characteristics of syllable-timed languages and not of stress-timed languages. Syllable-timed languages are characterised by simple syllable structures while stress-timed ones phonemically discern between short and long vowels and are characterised by complex syllable margins and nuclei (Zerbian & Barbard, 2008). In Setswana, lengthening of syllables occurs at three varying degrees, namely: a) normal or short length, which is typically not marked; b) half length, which is marked as [ˑ]; and c) full length, which is marked as [ː] and occurs in the penultimate syllable of a word (Cole, 1955; Snyman et al., 1989).

2.1.3 Research on Setswana phonology

The Setswana speech sound system is a widely researched field; much of this research has focused on the phonological systems of typical adults (i.e., with no cognitive, language and/or hearing difficulties), as well as investigating relationships between Setswana and other languages belonging to the Sotho group of languages (i.e., Sesotho and Sepedi). Despite the plethora of research data on Setswana phonology (Coetzee & Pretorius, 2010; Gouskova, Zsiga & Boyer, 2011; Van der Pas, Wissing & Zonneveld, 2000; Wissing, 2010), research on the acquisition of the Setswana speech sound system is lacking. This includes information on the ages at which typically developing children acquiring Setswana are expected to develop various segments (i.e., consonants, vowels and phonotactic structures) of Setswana phonology, as well as the nature of developmental errors expected in their speech at different ages. Such data is vital for accurate identification of children with developmental SSDs and to help plan for management of these difficulties. Palai and O'Hanlon (2004) conducted a study in which they obtained speech samples from Setswana-speaking adults. They then used data obtained from their study to select frequently occurring words in developing a linguistically and culturally relevant word list for a speech discrimination sub-test

of a diagnostic audiological assessment for this population. So far, only two developmental studies on Setswana have been documented in the literature and are summarised below.

2.1.3.1 Acquisition of noun class prefixes

Tsonope (1987; 1993) investigated the acquisition of the Setswana noun class system and agreement morphology. He conducted a study in which two monolingual children (a girl and boy aged 29 months and 23 months respectively) living in rural Botswana and acquiring one variety of Setswana participated. Data was collected over a period of seven months and consisted of recording the children's spontaneous speech in their natural contexts (Tsonope, 1987). This study revealed that Setswana noun class prefixes are acquired in three stages between 2 and 3 years. Children produced word units (noun stems) resembling the last two syllables of adult nouns in the first stage of noun class prefix acquisition (e.g. '***mo****togo'* soft porridge → '*togo'*); in the second stage, noun forms from the first stage are pre-posed by a vowel (specifically 'e', e.g. '***mo****togo'* → '***e****togo'*); and the third stage is characterised by nouns identical to those of adult forms (Tsonope, 1987, 1993). There is partial overlap between these stages, with little over-generalisation; these findings were similar to those reported for other Bantu languages, including Sesotho (Connelly, 1984; Demuth, 1984, as cited in Demuth, 2003), siSwati (Kunene, 1979, as cited in Demuth, 2003) and isiZulu (Suzman, 1980, as cited in Demuth, 2003).

It has been suggested that noun stems are acquired before prefixes as they have content, while prefixes do not since they are mere grammatical forms (Connelly, 1984; Demuth, 1988; Kunene, 1979, as cited in Tsonope, 1993). Tsonope (1987; 1993) has however, disputed the distinction between form and content to account for why noun stems are acquired before prefixes by children who speak Southern Bantu languages. He suggested that despite the implication that prefixes have no meaning (as according to the form/content distinction), they are able to convey significant changes in word meaning when affixed to noun stems (Tsonope, 1987;1993). He further highlighted that the form/content distinction does not offer an adequate explanation for the acquisition of noun stems before prefixes as children appear to acquire monosyllabic stems with their prefixes (e.g., '***me****tsi' (water)* ≠ '*tsi'*) (Tsonope, 1987; 1993). He has offered an alternative interpretation of the processes involved when children acquiring Southern Bantu languages develop noun class prefixes in the three stages documented in these studies. He argues that since adults tend to use simplified language forms (which include bisyllabic nouns) when interacting with children, they develop a CVCV bisyllabic template that they extract from models of adult language. Such a structure is characteristic of noun forms used during the first stage of noun class prefix acquisition (e.g., '***mo****togo'* (soft porridge) → '*togo'*). These simplified adult registers consist of bisyllabic noun forms that generally have a LH tonal pattern, as well as notable lengthening on the penultimate syllable (e.g., *'tôgô'* /t'ɔ̀xɔ́/). Children are thought to use these templates to filter even words which adults do not simplify (Tsonope, 1987; 1993).

In his study, Tsonope (1987; 1993) proposed that noun class prefixes were not acquired as separate units, but as part of the whole noun form. He found that children in his research study consistently produced bisyllabic word forms. He goes on to suggest that the prefixal vowel characteristic of the second stage of noun class prefix acquisition is an expansion of the children's bisyllabic templates. This occurs as the children are exposed to noun forms that deviate from their CVCV bisyllabic templates (Tsonope, 1987; 1993). Although this study was conducted three decades ago and only included two participants acquiring one variety of Setswana, it provides crucial information on the development of Setswana nouns and gives an idea of the developmental pattern that children acquiring Setswana can be expected to follow. In addition, this study has also documented the early acquisition of lexical tone.

2.1.3.2 Acquisition of segmental phonology

Mahura (2014) and Mahura and Pascoe (2016) detailed the development of segmental phonology in thirty-six children, aged 3;0–5;11 years acquiring Setswana, specifically the Sekwêna dialect. This study described the acquisition of consonants, vowels, syllable structures, as well as the nature of phonological processes found in the speech of these children. The accuracy with which Setswana consonants, vowels and syllable structures are produced follows a progressive pattern, a trend that can be expected. The majority of consonants and vowels had developed at 3;0–3;5 years, with only a few consonants missing from this age group's phonetic inventory (round aspirated plosives, /ʃ/, /r/ and /ʤʷ/). Alveolar trill /r/ (including round /rʷ/) is thought to continue to develop after 6;0 years; it was the only consonant missing from the inventories of children aged 3;6–4;5 and 5;0–5;5 years in the word-initial position, while those aged 4;6–4;11 years were missing /rʷ/ word-initially. This phoneme also appeared challenging for most children in the penultimate syllable position; children aged 4;6–4;11 years had /rʷ/ in their inventory, while the oldest age group (5;6–5;11 years) only had /r/ (without rounding) in the penultimate syllable position. Data from Mahura (2014) showed that girls in the older age groups (4;6–4;11 and 5;0–5;5 years) obtained higher accuracy scores when producing consonants, vowels and various syllable structures as compared to boys in the same age groups. Based on these findings, it was suggested that speech accuracy is likely acquired earlier in girls than in boys.

In Mahura (2014) the youngest group of children (3;0–3;5 years) presented with more phonological processes than other age groups, a developmental trend that can be expected in typically developing children. Phonological processes found in the speech of all children included syllable-level processes (e.g., gliding of liquids), as well as specific phoneme substitution. Alveolar trill /r/ was the most frequently substituted consonant; most children in the younger age groups (3;0–4;11 years) substituted it with lateral /l/, while the older group of children (5;0–5;11 years) substituted it with a similar-sounding /ʁ/ (i.e., the uvular trill). It was proposed that the older children substituted /r/ with a similar-sounding phoneme as they could consciously differentiate between /r/ and /l/.

Although this occurred less frequently, the youngest group of children reduced five syllable words to three syllables and produced round consonants without their rounding feature (e.g., *'le**sw**ana'* /lɪ**sʷ**ana/ spoon → *'le**s**ana'* /lɪ**s**ana/). It was therefore suggested that simplification of such words is likely to occur more frequently in children younger than 3;0 years. In addition, vowel substitution was present in the speech of all participants. This was seen more in younger children and was eliminated at 4;0–4;5 years. Vowel elision was also seen in the speech of all participants, e.g., *'**se**tilô'* /**sɪ**t'ilɔ/ *chair* → /**st'**ilɔ/. This was, however, recorded as the children's abilities to use adult-like speech in the early years, as vowel elision is commonly found in adult speech (Mahura & Pascoe, 2016).

These findings, although important for clinical practice and research on speech sound development in Southern Africa, cannot be applied to all children acquiring Setswana as a first language. The size of the sample included in this study was small and could have included children in the 2;6–2;11 years age range since the youngest group (3;0–3;5 years) had acquired much of their phonology. This preliminary pilot study investigated one variety of Setswana; therefore, little is known about the extent to which findings from this study can be applied to other varieties of Setswana since there are some differences that have been suggested between them (see section 2.1.1, Regions and varieties). Furthermore, the language backgrounds of participants were not profiled, data of those who presented with an SSD were not included and the development of suprasegmental phonology, specifically tone, was not considered in analysis of findings. Profiling of participants' language backgrounds is beneficial as some research studies have suggested that the phonological system of one language may influence that of another language in bi/multilingual children and that those acquiring more than one language are likely to present with phonological processes found in those younger than them and acquiring one language (Gildersleeve-Neumann & Wright, 2010). In addition, the inclusion of children with SSDs is beneficial as it will allow for an estimation of the occurrence of SSDs in Setswana children, as well as a detailed account of speech errors that are typical at different ages and those that are atypical for this population.

There is currently very limited information on phonological development in children acquiring various Bantu languages. This lack of normative data and resources which are culturally and linguistically relevant often poses a challenge for SLTs to reliably identify children with SSDs. The present study therefore aimed to contribute information on the typical acquisition of Setswana phonology and describe the characteristics of SSDs in this population. This information will be useful in helping SLTs identify children who may have SSDs. This will ultimately decrease the number of children who may be misdiagnosed as a result of a lack of information on speech sound development in children acquiring Setswana. The need for SLTs to identify children with and at risk for SSDs is urgent since these difficulties will greatly impact on the children's academic success and participation in

social contexts. In addition, the findings of this study will contribute towards the development of a norm-referenced standardised assessment of Setswana phonology.

A review of research studies that have documented phonological acquisition of various languages is provided in the next section, with a main focus on Southern Bantu languages, as well as South African English.

2.2 Speech sound acquisition: Review of the literature

In the previous section (2.1, Setswana), an overview of the Setswana speech sound system was provided, and data from two small-scale studies that explored the acquisition of noun class prefixes and segmental phonology in Setswana-speaking children were summarised. In this section, research studies which have documented speech sound acquisition in other Bantu languages and South African English are reviewed. Much of the research that has explored development of various Bantu languages has focused on how children acquire nominal morphology in these languages (Demuth, 2003). In a review of siSwati, isiZulu, isiXhosa, Setswana, Sesotho, Chichewa and Sangu, Demuth (2003) reported that children follow three overlapping stages when developing noun class prefixes. In the first stage, noun stems are produced without prefixes (e.g., *'**mo**tôgô'* soft porridge → *'tôgô'*), followed by insertion of a shadow vowel or nasal prefix in the second stage (e.g., *'**mo**tôgô'* → *'**e**tôgô'*). In the final stage, children produce noun class prefixes, which are also phonologically accurate. A small set of studies with a focus on describing speech sound acquisition in Bantu languages has been conducted in the past 29 years.

2.2.1 Phonological acquisition in Bantu languages

Table 3 provides a summary of studies that have described speech sound acquisition in various Bantu languages, specifically Sesotho, isiXhosa, isiZulu and Kiswahili.

Table 3. Acquisition of phonology in Bantu languages

Sesotho			
Author(s)	**Participants**	**Areas investigated**	**Main findings**
Demuth (1992) [L]	Four children aged 2;1–4;7 years	Consonants	Majority of simple consonants are acquired at 2;0 years, including nasals, as well as voicing distinction on labial and alveolar stops. Alveolar trill /r/ is usually produced posteriorly (i.e., as a uvular). Allophone [d] is sometimes realised as lateral sonorant /l/, and medial labio-velar /w/ may be omitted when part of a complex syllable onset (especially after velar nasal /ŋ/) until 3 years. At 2;6 years, the palatal alveolar click /!/ is produced accurately in isolation but realised as /k/ in lexical items until 3;0 years. Some evidence suggests challenges producing variations in vowel height. Word-final vowels are sometimes devoiced or omitted. Children aged 3 years seldom use labial palatalisation accurately.
Demuth (1993) [L]	One child at ages 2;1, 2;6 and 3;0 years.	Tone	Correct tone used when producing most H-toned verb roots at 2;1–3;0 years. Inconsistent use of L-tone when producing Ø-toned verbs: i) most H- and Ø-toned verb roots were produced as H at 2;1 years; and ii) a significant development in marking of Ø-toned verb roots at 3;0 years. Child likely used a Default High Strategy (DHS) when marking lexical tone, i.e., he used H-tone in producing all verb roots until he learns that a L-tone should be used when producing some. A DHS was not used in marking subject markers – at 2;1 years, H- and Ø-toned Sesotho subject markers were produced with 80% accuracy. A regression in the appropriate marking of H-toned subject markers occurred at 3;0. The acquisition of tone sandhi rules involving the obligatory contour principle occurs around 3;0 years.
isiXhosa			
Author(s)	**Participants**	**Areas investigated**	**Main findings**
Mowrer & Burger (1991) [CS]	70 children aged 2;6–6;0 years	Consonants	Eighty percent of isiXhosa phonemes were mastered before 3;0 years of age. Plosives and most nasals were mastered before 3;0 years; velar /ŋ/ was only mastered at 4;0 years. Trilled /r/ was mastered between 4;0 and 4;6 years. Fricatives /x, ɣ, f, v, z/ were mastered at or before 2;6–3;0 years; /s/ at 3;0–3;6 and /ʃ/ at 3;6–4;0 years. Only 2 of the 10 affricates (/cʰ, ɟ/) had not been mastered before 3;0 years. Seventy percent of errors

			occurred in the speech of children under 4 years. Interdental fricative similar to /θ, ð/ was frequently used to substitute fricatives, especially /s/, as well as affricates.
Tuomi, Gxilishe & Matomela (2001) [L]	10 children aged 1;0–3;0 years	Consonants and vowels	A noticeable increase in accurate production of clicks occurred at 2;7–3;0 years. All 5 isiXhosa vowels emerged by 1;6 years. Nasals, stops and glide /j/ were acquired earlier than fricatives and liquids. Sibilants /s/ & /z/ were acquired at 1;6–2;0 years.
Gxilishe (2004) [L]	10 children aged 1;0–3;0 years	Clicks	Three basic clicks used at speech onset (age 1;0 years). The dental click /ǀ/ was acquired first, followed by palatal /ǃ/, with lateral /ǁ/ acquired last. A trend in the early acquisition of basic voiceless clicks, followed by voiced and nasalised click combinations. Acquisition continues beyond 3;0 years.
Conradie, Jeggo, Purchase, Rosewall & Winfield (2011) [L]	1 child aged 1;0–1;7 years	Consonants and vowels	All vowels and a large number of consonants (e.g., clicks and lateral /ɬ/) acquired by 1;7 years.
Maphalala et al. (2014) [CS]	24 children, 3;0–6;0 years old	Consonants, vowels and word shapes	Most consonants were acquired at 3;0 years. Only one plosive (/cʰ/) and two affricates (/ʤ/ & /tsʰ/) were yet to be acquired at 5;1–6;0 years. At 3;0–3;6 years, aspirated plosives were produced unaspirated and had all emerged at 4;1–5;0 years. Fricatives were only acquired at 3;7–4;0 years and trill /r/ was acquired at 4;1–5;0 years. Affricates and clicks were the most challenging sound classes. No pattern observed in acquisition of clicks – nasal clicks were found more challenging than dental and lateral clicks, with alveolar clicks the least challenging. Multisyllabic words (5 & 6 syllables) were not always produced accurately at 5;0–5;11 years. Deaffrication and denasalisation were occasionally used at 4;1–5;0 years. Vowels were produced with high accuracy rates from a young age.
Pascoe et al. (2016)	2 children aged 2;5 and 2;8 years	Speech processing and production	Most vowels and consonants were used accurately, with affricates still developing. Some variability noted in production of four-syllable words and auditory discrimination skills (i.e., phonological representations).

isiZulu			
Author(s)	**Participants**	**Areas investigated**	**Main findings**
Naidoo, Van der Merwe, Groenewald and Naude (2005)	18 children aged 3;0–6;2 years	Consonants, vowels and word shapes	All 7 vowels had been acquired at 3;0–4;0 years. Children aged 3;0–4;0 years had 54% of consonants in their phonetic inventory, including all plosives, 7 fricatives, 3 approximants, 3 nasals, 2 prenasalised consonants and implosive /ɓ/. Consonant /nt/ appeared at 4;1–5;1 years, while 'nts' only appeared at 5;2–6;2 years. Five-syllable words were used as early as 3;0–4;0 years, while longer words were acquired after 6;2 years.
Pascoe & Jeggo (2019) [CS]	32 children aged 2;6–6;5 years	Consonants, vowels and word shapes	Vowels were acquired earlier than 2;6 years. Early acquired consonants include the implosive, plosives, affricates and nasals. Prenasalised /ᶯtʃ/ & /ᵐɸpf/ were acquired at 3;0 years. Dental /ǀ/, palatal /ǃ/, aspirated /ǃʰ/ and lateral clicks /ǁ/ were mastered around 4;0 years; and /ǁg/ was mastered at 4;6 years. Fricative /ɦ/ continues to develop after 4;0 years. Approximants /w/ was mastered as early as 2;6 years. Bisyllabic words were mastered at 2;6 years and tri-syllabic words at 3;6 years. Longer words continued to develop beyond 6;5 years. Denasalisation was present until 4;0–4;5 years and co-articulated phonemes continue to be simplified beyond 6;5 years. No clear developmental trend established for deaspiration, dentalisation and postvocalic devoicing.
Kiswahili			
Author(s)	**Participants**	**Areas investigated**	**Main findings**
Gangji, Pascoe and Smouse (2015) [CS]	24 children aged 3;0–5;11 years	Consonants, vowels and word shapes	All vowels were produced at 3;0 years. A large number of consonants were produced word-initially and medially at 3;0 years, including plosives, nasals, approximants, affricates /ʧ, ʝ/, lateral /l/ and 4 fricatives. Fricatives /z, s, h/ were present at 4;0–4;5 years, with /θ/ and /r/ only acquired last at 5;6–5;11 years. Four syllable words were produced as early as 3;0 years.

[CS] Cross-sectional studies [L] Longitudinal studies

Sesotho-speaking children have been reported to make voicing distinctions on labial and alveolar stops as early as 2 years. At this age, most simple consonants (such as nasals) and vowels had been acquired, findings which have also been documented for other Southern Bantu languages. Affricates are some of the phonemes that appear to develop last, a finding that has been documented for isiXhosa- and isiZulu-speaking children. Some of the phonological processes noted in the speech of children acquiring Sesotho include omission of medial labio-velar /w/ when it is part of a complex syllable onset and occurred until 3 years of age. Round syllables were therefore produced unrounded. Children aged 3 years also realised the palato-alveolar click /!/ as velar /k/ in words and hardly used labial palatalisation accurately. The ages at which we can expect no speech errors in children acquiring Sesotho has, however, not yet been documented. The correct use of tone was noted at 2;1–3;0 years during production of high-toned verb roots. Although the majority of high and low-toned verb roots were produced with a high tone at 2;1 years, high and low-toned subject markers were produced accurately 80% of the time. Although these data on the development of segmental and suprasegmental phonology are beneficial for clinical practice, the children who participated in both studies mentioned were from rural Lesotho and speak a variety of Sesotho which is likely different to that spoken in some parts of South Africa. An SLT who is not familiar with Sesotho might therefore fail to take this factor into consideration when making use of such data to make a decision about a child's speech sound development. Both studies on phonological development in Sesotho are longitudinal studies and allowed for the participants to be observed over an extended period. This allowed for a reduction in any individual differences between participants (Babbie & Mouton, 2006). The size of samples in both studies were, however, very small and consisted of one and four participants each, which means that data from both studies cannot be generalised to the Sesotho-speaking population.

While data on isiXhosa phonological development are still preliminary, much more has been documented on how isiXhosa-speaking children acquire speech sounds in comparison to other Bantu languages spoken in South Africa. One of the earlier studies was conducted by Mowrer and Burger (1991), who investigated the order in which isiXhosa consonants were acquired in 70 monolingual children aged 2;6–6;0 years. These authors also explored the acquisition of consonants in an age-matched group of children acquiring South African English, following which a comparative analysis between the two language groups was carried out. They reported that 80% of isiXhosa phonemes were mastered before 3 years and that isiXhosa-speaking children acquired a large number of consonants earlier than their English-speaking peers. Similar findings were reported by Conradie et al. (2010), Maphalala et al. (2014), Pascoe et al. (2016) and Tuomi et al. (2001), who all found that majority of isiXhosa phonemes were acquired by 3;0 years. Some of the earlier acquired consonant phonemes include plosives, liquids, nasals and glides. Affricates are some of the later acquired consonants (Maphalala et al., 2014; Mowrer & Burger, 1991), but some differences in the ages at which fricatives

were acquired have been reported by the two studies. In addition, isiXhosa-speaking children were found to acquire all vowels and basic clicks at an early age (Conradie et al., 2011; Gxilishe, 2004; Pascoe et al., 2016; Tuomi et al., 2001).

Like isiXhosa, isiZulu-speaking children have been reported to acquire vowels and a fairly large range of consonants early. Earlier acquired consonants include plosives, nasals and some affricates (Naidoo et al., 2005; Pascoe & Jeggo, 2019). While there are similarities between the order in which phonemes are acquired in isiXhosa and isiZulu, it is important to note the differences in the ages at which these phonemes are acquired in the two languages. Some of these differences include the ages at which basic clicks are acquired; isiXhosa-speaking children are noted to acquire these earlier (by 3 years) (Conradie et al., 2011; Gxilishe, 2004; Mowrer & Burger, 1991; Tuomi et al., 2001) than isiZulu-speaking children (at 4 years) (Pascoe & Jeggo, 2019). Differences in the acquisition of clicks may be due to the fact that these are used more in isiXhosa than isiZulu. These findings also indicate that although isiXhosa and isiZulu both belong to the Nguni language group and are mutually intelligible, applying isiXhosa normative data to a child acquiring isiZulu or vice versa would be inaccurate and will likely yield unreliable and invalid assessment conclusions.

Research that has documented phonological development in Kiswahili has also reported early acquisition of vowels and a large number of consonants. Although Kiswahili is a North-Eastern Bantu language and differs from Southern Bantu languages (such as those spoken in South Africa) in that it is not a tonal language, there are similarities in the order in which Kiswahili-speaking children and those who speak Setswana, Sesotho, isiXhosa and isiZulu acquire phonemes. Whilst the differences in speech acquisition of these languages highlight the need to apply language specific normative data, the similarities noted across them give some support to Jakobson's (1941/1968) proposition that phonological development follows a universal trend. Data from these studies was obtained using cross-sectional and longitudinal studies, each of which has its advantages and disadvantages. Despite the limitations of the study designs of each of the studies mentioned, the contributions they have made to the local knowledge base is significant. The data from these research studies are, however, not generalisable since many of them included a limited sample size, assumed that the participants were monolingual speakers and did not take the varieties of the languages studied into consideration. Such information is important for the SLT to take note of when making use of this data to guide clinical decisions.

2.2.2 Acquisition of South African English phonology

A summary of studies that have documented speech sound acquisition in children acquiring South African English is provided in Table 4. The structure of English is different from that of South Africa's indigenous languages, and data on phonological acquisition in South Afican English cannot be

used as a guideline in clinical practice to make decisions about speech sound acquisition in children acquiring these languages. Studies that have detailed phonological acquisition in South African English have been included in this section to highlight other studies that have contributed to local research data. Additionally, the study by Pascoe et al. (2018) included bi/multilingual children and was included in this review as many children in South Africa acquire English as an additional language. It was therefore important to highlight certain factors that should be considered when assessing those acquiring more than one language, especially since English is used as the lingua franca in the country. Lastly, South African English is different to other varieties of English that are well-documented in the literature and such differences are worth noting so that they are not mistaken for errors.

Table 4. Acquisition of English segmental phonology

Authors	Participants	Areas investigated	Main findings
Mowrer & Burger (1991) [CS]	70 monolingual children aged 2;6–6;0 years acquiring South African English	Consonants	Only 48% of phonemes were mastered before 3 years. Several phonemes were mastered at 2;6–3;0 years, including nasals, liquid /l/, plosives (with the exception of /t/ and /d/), as well as fricative /v/. Fricatives /f, s/ and glide /j/ were mastered at 3;0–3;6 years. Palato-alveolar /ʃ/ was mastered later than alveolar /s/ at 3;0–4;0 years. Some of the consonants that were mastered last include fricatives /θ/ and /ð/ (between 4;0 and 6;0 years), and affricates /tʃ/ and /dʒ/. Most speech errors affected fricatives and were produced by children aged 2;6–3;0 years.
Pascoe et al. (2018) [CS]	308 children (mono- & multilingual) aged 3;0–5;11 years acquiring South African English	Consonants and vowels	Trilingual 3-year-olds had the greatest speech accuracy, as was seen by their high PCC scores. Interdental fricatives /θ, ð/ are the only consonants that continue to be acquired after 5;11 years. The 3-year-old isiXhosa-English bilingual children had the largest consonant inventory, with no differences seen between the groups at 4;0 years and after. The impact of the phonological systems of other languages (isiXhosa and Afrikaans) was observed when bilingual children produced English phonemes. Majority of the phonological processes were eliminated after 3;11 years, and gliding occurred past 5;11 years and was used frequently by both monolingual and bilingual children. Bilingual isiXhosa-English and trilingual children aged 5;0–5;11 years reduced clusters. Monolingual children made up the largest portion of children with SSDs.

[CS] Cross-sectional studies

Normative data on speech sound acquisition in English-speaking children is well-established, and there is substantial evidence of the differences that exist in different English varieties (McLeod, 2007). It is therefore no surprise that, due to the substantial evidence on English speech sound acquisition, SLTs working in South Africa and in other parts of the world often rely on English

normative data. This data is used as a guide when determining whether a child presents with an SSD and the severity thereof, even when working with children acquiring other languages. This is problematic as there are differences between the sound systems of English and other languages spoken in South Africa (specifically Bantu languages and Afrikaans). The studies summarised in Table 4 have reported similar patterns in the acquisition of segmental phonology in South African English and in children who are acquiring one or more languages. Vowels, plosives, nasals and glides are some of the earlier acquired sounds by children acquiring South Afican English (Mowrer & Burger, 1991; Pascoe et al., 2018) and British English (Dodd et al., 2003). South Afican English-speaking children continue to develop interdental fricatives /θ/ and /ð/ beyond 5;11 years (Pascoe et al., 2018), although these sounds were reported to be mastered at 4;0–6;0 years by an earlier study on South Afican English phonology (Mowrer & Burger, 1991). The reason for this difference is likely due to the fact that Mowrer and Burger (1991) only included monolingual children with no SSDs, while Pascoe et al.'s (2018) study was more inclusive of the general population of children and consisted of bi/multilingual children and those with SSDs. These factors might also account for differences in the frequency at which phonological processes occurred; for instance, Mowrer and Burger (1991) reported that most speech errors were noted at 2;6–3;0 years, while Pascoe et al. (2018) noted that the majority of phonological processes in their participants occurred up until 3;11 years.

2.2.3 Phonological development in bi/multilingual children

Some differences between monolingual and multilingual children were reported in children acquiring South Afican English. According to Pascoe et al. (2018), bilingual isiXhosa-English children had the largest consonant inventory as compared to the monolingual group, bilingual Afrikaans-English, as well as those acquiring all three languages. This was, however, only noted at 3;0–3;11 years and no further differences seemed apparent at 4 years and above (Pascoe et al., 2018). In their comparison of speech sound acquisition between isiXhosa- and South Afican English-speaking children, Mowrer and Burger (1991) reported that isiXhosa-speaking children made fewer errors than did their English peers during production of the twenty consonant phonemes common to both languages. This therefore suggests that children acquiring isiXhosa likely acquire speech accuracy earlier than those acquiring English. Pascoe et al. (2018) documented the acquisition of consonant and vowel phonemes and phonological processes in 33 isiXhosa-English bilingual children aged 3;0–3;11 years. A description of the phonetic inventories and phonological processes was provided for each of the languages the children were acquiring. The participants produced isiXhosa consonants more accurately than English ones, suggesting that isiXhosa-English bilingual children aged 3;0–3;11 years have higher accuracy levels in isiXhosa as compared to English (Pascoe et al., 2018). Data for English acquisition in these children was found to be comparable to what has been reported for monolingual English speakers. Those aged 3;0–3;11 years had acquired all English phonemes except /θ, ð, ʒ, r, ʤ/,

and voiced palato-alveolar affricate /ʤ/was the only one of these phonemes that developed at 3;6–3;11 years. It was suggested that this indicates the possibility of advanced speech acquisition by 3-year-old isiXhosa-English bilingual children compared to their monolingual peers. The data presented by Pascoe at al. (2018) relied retrospectively on data from two different projects and was not obtained from the same bilingual children.

Given that the application of English norms on children acquiring various languages in South Africa is common practice amongst SLTs in this context, the differences in speech sound development of these languages and English (including differences in bi/multilingual children) highlight the risks that SLTs face in misidentifying SSDs. The consequences of a misdiagnosis include 'pathologising' children who are typically developing and not in need of intervention, as well as missing those who in fact have an SSD and require intervention. Providing intervention to children with no SSDs means that resources that are already limited are wasted, and those who are missed are at a great risk of continuing to experience SSDs, which may lead to academic difficulties and negative social consequences (Krueger, 2019).

2.2.4 Intervention approaches for bilingual isiXhosa-English children

In addition to studies documenting speech sound development, more data is available on the efficacy of numerous approaches for managing SSDs in monolingual English-speaking children. Some work has explored the efficacy of these intervention approaches on two bilingual isiXhosa-English children (Rossouw, Pascoe & Mahura, 2019). The first study reported on a 3-year-old boy who presented with inconsistent errors and described changes that occurred in his speech, in both languages, following seven hours of intervention. The core vocabulary approach was used, and intervention was provided in English. Following intervention, an improvement in some aspects of the child's isiXhosa speech was noted even though therapy focused on his English speech. These changes include an increase in his PCC, use of fewer phonological processes and improved intelligibility, as reported by his parent and teacher. Similar changes were seen in the child's English speech, with the addition of more consistent errors (i.e., greater consistency in existing errors) (Rossouw et al., 2019).

Although these findings are preliminary and should be conducted on a larger sample acquiring various language combinations, they suggest that intervention aimed at improving speech in one language may result in improved speech in the untreated language (Rossouw et al., 2019). This is supported by findings from a second study, which has provided a description of changes in the speech of a 4;2-year-old girl in isiXhosa and English following eight hours of intervention (Rossouw & Pascoe, 2019). The child presented with a mild phonological delay in both isiXhosa and English; intervention was provided in isiXhosa, using the minimal pairs approach. Although this child continued to present with a mild phonological delay following the period of intervention, an improvement in PCC scores in

both languages were noted. Other changes included generalisation of improved production of target sounds in isiXhosa to English. This suggests that targeting a phonological process common to both languages being acquired in intervention will likely lead to an indirect improvement of speech production in the untreated language (Rossouw & Pascoe, 2019).

2.3 Summary

Given that the current study aims to describe speech sound acquisition in Setswana-speaking children, a summary of previous Setswana acquisition studies has been provided in this chapter. To date there is limited research that pertains specifically to phonological acquisition by Setswana-speaking children. For this reason, in this chapter, phonological development in other languages, specifically Bantu languages and South African English, was also reviewed. Similarities in the order in which speech sounds are acquired in these languages are demonstrative of universal trends in phonological development. Differences noted across these languages, on the other hand, are indicative of the need to develop language specific norms to avoid misidentification of SSDs in children.

The chapter that follows provides a detailed description of the methods followed in obtaining data on the acquisition of the Setswana speech sound system, including the aims and objectives of the study.

CHAPTER 3: METHODOLOGY

This chapter gives an account of the methods used in this study and a rationale for the selections made. The aim and objectives of the study are listed here, followed by an overview of the research design. A description of the selection of participants, materials used, procedures followed, and analysis of data is also provided. Lastly, the chapter details ways in which ethical considerations relevant to this study, as well as validity and reliability, were addressed.

3.1.1 Aim

This study aimed to describe the phonological development of Setswana-speaking children between the ages of 2;0 and 6;5 years.

3.1.2 Objectives

The study objectives were:

1. Describe the following aspects of speech sound acquisition in Setswana-speaking children aged 2;0 to 6;5 years:
    a) The acquisition of vowels.
    b) The acquisition of consonants.
    c) The nature of phonological processes.
    d) The acquisition of lexical tone.
2. Contrast Setswana phonology development in monolingual vs multilingual children.
3. Contrast typical vs atypical Setswana speech acquisition, determine the occurrence of speech sound disorders (SSDs) in children acquiring Setswana and describe the nature of these difficulties.

3.2 Research Design

This research study used a cross-sectional design to detail the stages of speech sound acquisition in a cross-section of children in a single time frame (Babbie & Mouton, 2006). The cross-sectional research design was selected as there is currently very limited information on the acquisition of Setswana phonology, and the cross-sectional approach allowed for the collection and analysis of data from a fairly wide age range in a relatively short time frame (Babbie & Mouton, 2006; Cozby, 2005). This method also allowed the researcher to make comparisons on findings from the participant groups and make deductions regarding age as the main variable for differences in speech sound acquisition between children of differing age ranges (Cozby, 2005). Although this method has

numerous advantages, it has a number of shortcomings too. A cross-sectional research design does not allow one to observe the same group over an extended period of time (Babbie & Mouton, 2006; Cozby, 2005). This poses challenges for the researcher as an inability to track the developmental patterns of each child makes it difficult to reduce any individual differences (Dodd et al., 2003). This therefore means that data obtained from this study only provides an estimation of the rate at which Setswana speech sound acquisition occurs and the patterns it follows. Many studies on the acquisition of phonology have, however, used the cross-sectional research design to provide valuable information on phonological development in various languages despite these shortcomings (Dodd et al., 2003; Gangji et al., 2015; Mahura & Pascoe, 2016; Pascoe et al., 2018).

3.3 Participants

3.3.1 Selection Criteria

To be included in the study, participants had to be between the ages of 2;0 and 6;5 years and speak Setswana (either on its own or in addition to other languages). Children who were acquiring Setswana in addition to other languages were included since they were attending creches and preschools where Setswana was the language of instruction. They were therefore exposed to Setswana for five to eight hours a day during the school term. The reason for this is because of the multilingual composition of the communities from which participants were recruited; and since one of the study objectives was to investigate and identify any differences in phonological development in monolingual and bi/multilingual children, making Setswana as a first language a criterion for selection would have excluded bi/multilingual children whose first language is not Setswana, despite acquiring it.

The 2;0–6;5 years age group was chosen as it has been documented that phonological development occurs very early in life (Gildersleeve-Neumann, Kester, Davis & Peña, 2008; Rvachew & Brosseau-Lapré, 2017). Broomfield and Dodd (2004) found that many children who were referred for Speech and Language Therapy were in their preschool years, and that the majority of their participants who presented with SSDs were between 3;0 and 6;0 years of age. The 2;0-year age group was chosen as the preliminary study conducted by Mahura and Pascoe (2016) indicated that most Setswana phonemes develop before 3;0 years. These findings were in agreement with research conducted by Demuth (2007) with Sesotho-speaking children. Although phonological delays at 2;0 years cannot yet be detected, children at high risk for SSDs can be identified reliably at this age (Dodd, 2015). The speech sample obtained from the youngest group of participants (2;0–2;11 years) in the study therefore gives an indication of whether or not there is a sequence in which the majority of Setswana phonemes are acquired. This information will be beneficial in identifying children at a high risk for SSDs.

Participants were assigned to groups of six-month age bands (i.e. 2;0–2;5, 2;6–2;11, 3;0–3;5 years etc.) for each of the Setswana varieties studied. The selection of the six-month age bands follows a method used in studies of a similar nature (Dodd et al., 2003; Gangji et al., 2015; Maphalala et al., 2014; McLeod, 2007) and allows one to systematically map out how accurate speech production is mastered gradually across the different age ranges.

Children who presented with speech, language, learning and/or hearing difficulties were included in the participant group as the study aimed at contributing to the standardisation of normative data on speech development in this population, and aimed to describe the nature of errors found in Setswana-speaking children with SSDs (Dodd et al., 2003). Information obtained from this group of children will also be beneficial in understanding differences in the speech of children with typical phonological systems, those with delayed phonological development, as well as those with disordered phonological systems. Information on the children's development (speech, language, etc.) was obtained from caregivers via case history forms, as well as through reports from educators. Additionally, data from children who were identified as having speech difficulties following the speech assessments by the researcher were not excluded from the study.

Children who would not have been able to recognise pictures as a result of visual difficulties and children who were not able to take part in the assessment because they required help engaging with given activities (i.e., those with an established disability) were not included in the study. Information provided by the children's parents and legal guardians as well as their educators was used to determine whether or not they met the selection criteria. This information was obtained by means of a case history form, which was completed by parents and legal guardians. The questions asked were based on published forms (Shipley & McAfee, 2009) and were used in a previous study on Setswana speech acquisition (Mahura & Pascoe, 2016). A Setswana version of the Intelligibility in Context Scale (ICS: Set) (Mahura et al., 2012), translated from the original English Intelligibility in Context Scale (ICS) developed by McLeod, Harrison and McCormack (2012) was used in addition to the case history form to obtain information on the participants' speech production. The ICS is a rating scale aimed at evaluating the intelligibility of a child's speech when communicating with various communication partners in a range of contexts (Pascoe & McLeod, 2016).

The participant group comprised of 81 participants from the Dr Ruth Segomotsi Mompati and Bojanala Platinum Districts in the North-West Province of South Africa. Participants were recruited from the North-West Province, as this is where Setswana is predominantly spoken in South Africa. The districts were selected in an attempt to obtain data on two varieties of Setswana; the Setlhaping variety in the Dr Ruth Segomotsi Mompati District and the Sekwêna variety in the Bojanala Platinum District. Sixteen of the 81 participants were recruited from Dry-Harts in the Dr Ruth Segomotsi Mompati District. Dry-Harts is a village with a population of about 7 196 people (Statistics S.A., 2011) and forms part of the Greater Taung Local Municipality, which is

predominantly rural and covers about 106 villages (Greater Taung Local Municipalities, 2019). Setswana is first language to 6 759 (93.89%) residents in this village, and other languages spoken here include English (1.50%), isiNdebele (1.20%), Sign Language (1.13%), isiZulu (0.92%), Sesotho (0.61%), Afrikaans (0.29%), isiXhosa (0.14%), Sepedi (0.13%), Tshivenda (0.07%) and 'Other' (0.14%) (Statistics S.A., 2011). The remaining 65 participants were recruited from Hebron, a village with a population of 13 927 people (Statistics S.A., 2011) in the Bojanala Platinum District. Hebron forms part of the Madibeng Local Municipality, which is situated 50 kilometres north of Pretoria (Municipalities of South Africa, 2019). It is a multilingual area with a variety of languages spoken here; Setswana is a first language to 49.04% of Hebron's population and other languages spoken in the area include Sepedi (13.10%), Xitsonga (12.32%), isiZulu (5.88%), Sesotho (5.73%), Tshivenda (3.03%), isiNdebele (2.92%), isiXhosa (1.63%), siSwati (1.58%), English (1.43%), Afrikaans (0.52%), Sign Language (0.17%), as well as 'Other' languages (2.65%) (Statistics S.A., 2011).

3.3.2 Participant Recruiment Procedures

Permission to conduct this research study was obtained from the University of Cape Town, Faculty of Health Sciences Human Research Ethics Committee (HREC/REF: 600/2016) (Appendix A). A letter detailing the purpose of the study was sent to the Departments of Education (Appendix B) and Social Development (Appendix C) in the North-West Province. This was followed by a request for approval to conduct research from the heads of preschools and primary schools in the Dr Ruth Segomotsi Mompati and Bojanala Platinum Districts (Appendix D). Once permission to conduct research was granted by heads of schools, an information letter detailing the aims of the study was distributed to educators working with children aged 2;0–6;5 years (Appendix E). The educators who were involved helped to identify children who met the selection criteria, following which informed consent was requested from parents and legal guardians to have their children take part in the research (Appendix F).

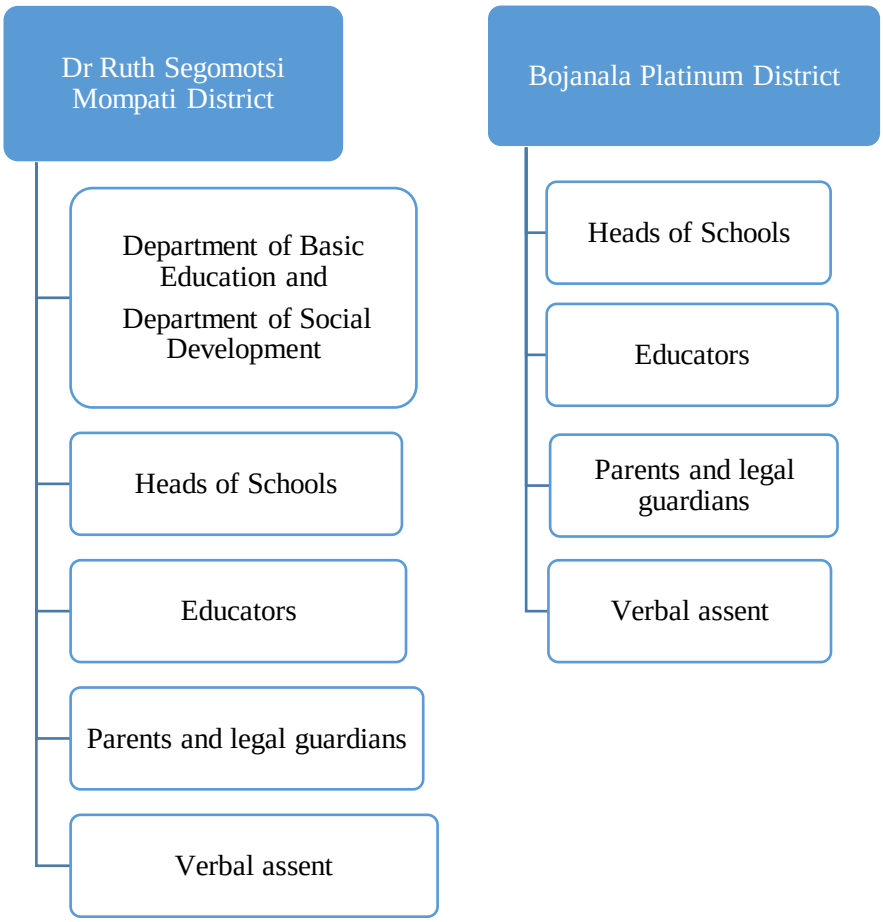

Figure 5. Stages of participant recruitment

3.4 Sampling

This study made use of a convenience sampling method, which allowed the researcher to select participants based on their availability and willingness to participate in the study (Alasuutari, Bickman & Brannen, 2009). Consent obtained from parents and legal guardians was regarded as their willingness to have their children take part in this study. The researcher obtained verbal assent (Appendix G) from the children and this was considered to indicate their willingness to take part in the study.

3.4.1 Sample Size

An estimated 125 information letters were sent out to five identified preschools and primary schools in the Dr Ruth Segomotsi Mompati District. Informed consent was obtained for 16 children at four schools in the Dr Ruth Segomotsi Mompati District. An additional 100 information letters were later sent to two preschools in the Bojanala Platinum District and informed consent was obtained for 68 participants. Three of these participants were excluded from the study: one participant had an established disability and could not take part in the study as she was non-verbal, one participant did not

wish to take part, while the third participant informed the researcher during the assessment that he no longer wished to participate. Due to the low response rate in the Dr Ruth Segomotsi Mompati District, it was not possible to ensure an equal number of participants for the Setlhaping and Sekwêna varieties. Furthermore, participants could not be distributed equally across age groups for each of the varieties studied. The final number of participants who formed part of the study was therefore 81. The different stages of participant selection are summarised in Table 5.

Table 5. Participant selection procedure for Sekwêna and Setlhaping varieties

Variety	Letters distributed	Informed consent	Participants excluded	Final participant group
Sekwêna (Bojanala Platinum District)	100	68	3	65
Setlhaping (Dr Ruth Segomotsi Mompati District)	125	16	0	16

The sample size was relatively small, particularly for the Setlhaping variety. The study sample comprises a better representation of this population than the initial preliminary study conducted in 2014 (Mahura & Pascoe, 2016), as it includes more than one variety of Setswana, children acquiring more than one language, and children with SSDs (Dodd et al., 2003). Despite this, the findings of this study will likely contribute valuable information on speech sound development of Setswana, as seen in other studies which have used smaller samples (Gildersleeve-Neumann et al., 2008; McLeod, 2007; Saaristo-Helin, 2009). Results obtained from this study can also be used to describe the nature of SSDs in Setswana-speaking children as those identified as having a speech delay formed part of the study sample. The inclusion of children with SSDs is not expected to confound the results of each age band. This is because the researcher did not intentionally seek out children with possible language difficulties/disorders and SSDs. This was also made clear to the educators during the recruitment process, i.e., that the intention of the study was not to identify SSDs in the study population but to describe the speech of both typically developing children and those with suspected speech delays. This was done in order to avoid under- and/or over-representing children with SSDs. The findings of this study will ultimately contribute towards the development of a norm-referenced standardised assessment of Setswana phonology.

3.4.2 Description of Participants

The study sample was made up of 44 (54%) girls and 37 (46%) boys. The group for the Sekwêna variety consisted of 34 (52%) girls and 31 (48%) boys, while the group for the Setlhaping variety consisted of ten (63%) girls and six (37%) boys. Fifteen participants (23%) from the Sekwêna group were bi/multilingual. Children acquiring more than one language were included in the study as bi/multilingualism is typical in South Africa, as can be seen in the number of participants reported to be acquiring more than one language in this study sample. Participants were assigned to groups of different age bands for each variety of Setswana investigated. The age groups varied in size since an equal number of participants could not be recruited for each of them. Girls and boys were randomly assigned to the different age groups and as a result, gender was not stratified. This was done as research studies that have investigated phonological development in several languages have shown that gender is not a major factor in phonological acquisition since the rate of speech sound acquisition was relatively similar between girls and boys (Dodd et al., 2003). Only children for whom written and verbal assent had been obtained, and who met the selection criteria were assigned to an age group. Information on the characteristics of the participant group is provided in Table 6.

Table 6. Information for participants acquiring the Sekwêna and Setlhaping varieties of Setswana

Sekwêna							
Age group (years;months)	Group number	*n*	Mean age (years; months)	SD (months)	% of Sekwêna sample	Girls (*n*)	Boys (*n*)
2;6–2;11	1	7	2;3	0.29	10.8	2	5
3;0–3;5	2	7	3;2	0.22	10.8	3	4
3;6–3;11	3	9	3;5	0.36	13.8	6	3
4;0–4;5	4	14	4;3	0.17	21.5	9	5
4;6–4;11	5	10	4;6	0.35	15.4	3	7
5;0–5;5	6	8	5;3	0.16	12.3	5	3
5;6–5;11	7	5	5;7	0.08	7.7	1	4
6;0–6;5	8	5	6;0	0.09	7.7	5	0
Total		65			100	34	31
Setlhaping							
Age group (years;months)	Group number	*n*	Mean age (years; months)	SD (months)	% of Setlhaping sample	Girls (*n*)	Boys (*n*)
2;6–2;11	-	-	-	-	-	-	-
3;0–3;5	-	-	-	-	-	-	-
3;6–3;11	9	1	3;7	-	6.25	1	-
4;0–4;5	-	-	-	-	-	-	-
4;6–4;11	9	3	-	-	18.75	-	3
5;0–5;5	10	1	5;5	-	6.25	1	-
5;6–5;11	10	11	-	-	68.75	8	3
6;0–6;5	-	-	-	-	-	-	-
Total	-	16	-	-	100	10	6

3.5 Materials

Participants and legal guardians who gave consent for their children to take part in the study were asked to complete a case history form (Appendix H). This form was adapted from Shipley and McAfee (2009) and was used to obtain information on participants' developmental history. Information obtained from the case history was also used to find out if any of the participants presented with a hearing difficulty since a diagnostic hearing assessment was not conducted. The case history form was available in Setswana and English to ensure that parents and legal guardians provided information in a language in which they felt comfortable.

The ICS (Appendix I) (McLeod et al., 2012) was used in addition to the case history form to obtain information on the participants' speech production. The ICS is a rating scale aimed at evaluating the intelligibility of a child's speech when communicating with various communication partners (Pascoe & McLeod, 2016). The ICS was provided in Setswana and English to ensure that parents and legal guardians understood questions asked and could answer these in a language they felt comfortable with.

A short questionnaire (Appendix J) was developed in order to obtain information on the participants' learning patterns from educators. This was only done for children whose parents and legal guardians had given permission for them to take part in the study. Since the educators did not have time to complete this questionnaire, the researcher asked them the questions included in this form verbally. The questions included in this form were selected as they provide vital information required for the assessment process.

There is currently no formal tool to assess Setswana phonology. There is, however, an unpublished tool that was used for a previous study aimed at describing Setswana speech sound development (Mahura, 2014; Mahura & Pascoe, 2016). This assessment formed the basis of the tool that was used to collect data in this study (Appendix K). Several revisions were made to the existing unpublished tool before data collection took place. The processes followed for the revision of this tool are detailed in section 3.5.1 below.

3.5.1 Setswana Speech Assessment Tool: Revisions

An unpublished Setswana speech assessment tool was selected for use in this study. Since this tool was developed for use in a previous preliminary study on Setswana speech acquisition (Mahura, 2014; Mahura & Pascoe, 2016), it was revised before being used for the current study. These revisions were deemed necessary as the previous study identified several limitations to it. The tool that was used in the first, small scale study will be referred to as Setswana v.1, with the revised version used for this

study being referred to as v.2. Below is a list of the limitations outlined in the previous study, as well as an explanation of how these were addressed during the revision process:

- The assessment did not sample all consonants and/or all consonants in different word positions: all syllabic consonants (/m/ /n/ /ɲ/ /ŋ/ /r/) were included in the initial word position and two consonants (/m/ /n/) in the penultimate syllable position of v.2 of the Setswana speech assessment word list. Although the lateral sonorant /l/ was not included word-initially, it was not expected to negatively affect the validity of the assessment since it is not used by all Setswana speakers and is limited to a specific phonetic environment (i.e., when followed by an identical consonant). Only two syllabic consonants (/m/ /n/) were sampled in the penultimate syllable position as it is uncommon to find words with syllabic velar nasal /ɲ/ and alveolar trill /r/ in this position in the Setswana vocabulary (Krüger & Snyman, 1988; UB Department of African Languages and Literature, 2001). The use of lateral sonorant /l/ is a difference seen in some varieties of Setswana and was expected to occur when some participants produce certain words already included in the word list. For example, it was expected that some participants would produce the word *'tsho**lo**la'* /t͡sʰʊ**lʊ**la/ (spill) as *'tsho**ll**a'* /t͡sʰʊ**l̩l**a/. This deletion of the vowel is a typical process that is seen in adult speech too and has been described as occurring when vowels /ɪ, ʊ, ɛ, ɔ, a/ are found between sonorants that are identical (UB Department of African Languages and Literature, 2001).
- Some phonemes were not well represented in the assessment word list of v.1: six vowels were not targeted in the initial word position and only a limited number of vowels and consonants were sampled in the penultimate syllable position. To address this challenge, the number of phonemes targeted in both word positions are almost equal in v.2. A total of 33 consonants and five vowels were targeted in the penultimate syllable position, as compared to 32 consonants and four vowels in the initial word position.
- When using v.1 it was noted that not all participants produced round ejective velar plosive /kʷ'/ in the penultimate syllable position. This was reported to have occurred as a result of confusion with the picture stimulus. For v.2, the researcher selected a word (*'le**kw**alô'* /lɪ**kʷ'**alɔ/ letter) that was easier to represent visually and less likely to be identified as a different object.
- The target phoneme could not always be elicited with v.1 as some children often produced words that did not match it (e.g., *'mo**s**amô'* /mʊ**s**amɔ/ (pillow), was sometimes produced as *'mosa**m**êlô'* /mʊsa**m**ɛlɔ/ pillow). This made it challenging to sample certain phonemes, in this case voiceless alveolar fricative /s/. It was suggested that future research detail possible variables of words (i.e., correct forms of different varieties) to ensure that all speech sounds are sampled adequately, irrespective of the variety spoken by the child. The researcher made an attempt to address this by consulting with: 1) first language Setswana speakers who are from different regions and speak different varieties (discussed in detail in section 3.6, Expert Panel Review); and, 2) a qualified SLT

who works with Setswana-speaking children whose variety is different to those spoken by the Expert Panel and researcher. In addition, the researcher aimed to use the Setswana v.2 to assess children acquiring two varieties of Setswana (i.e., Sekwêna and Setlhaping). This was done as the researcher recognised that additional variants of words included in the second edition of the tool will likely be used by the study participants. Obtaining such information will assist in guiding further considerations needed in future research that will contribute to the standardisation of this tool, and other similar ones.

- Lastly, v.1 could not be distributed to SLTs working with Setswana-speaking children once the study was concluded. This was due to the fact that the picture stimuli used to elicit target words were developed using a published picture program (Meyer-Johnson's Boardmaker Windows v.6, 2011) with copyright limitations. Although the use of Boardmaker worked well for the initial study, an illustrator was employed to develop pictures used in the current study. The set of picture cards used in this study were illustrated by a qualified SLT who had knowledge of the type of tools that are used with children in clinical practice. All pictures are colourful, and care was taken to ensure that they are culturally appropriate and would be easily recognised by the target population (Appendix L). Having an independent illustrator develop pictures for the Setswana v.2 allowed for the option of being able to make changes to various pictures during the course of data collection if necessary.

Following these revisions, the second edition of the Setswana speech assessment tool (v.2) comprised 85 words, 26 words less than the initial tool (v.1). Unlike Setswana v.1, v.2 did not include a word repetition task. A single-word naming task was used to elicit production of phonemes and is in line with research studies of a similar nature (Maphalala et al., 2014) and is widely used in tools aimed at describing speech acquisition in children whose age matches that of the participant group (Dodd et al., 2003; Goldman & Fristoe, 2000). A total of 34 consonants were sampled in the penultimate syllable position, and five vowels were targeted in various word positions. It has been suggested that the penultimate syllable is often lengthened during production of single words because it carries the most tone (Demuth, 1992). It is for this reason that production of phonemes in the penultimate syllable position was targeted. Production of phonemes was also targeted in the initial word position as it has been suggested that syllables produced word-initially are also lengthened during production of single words (Mosaka, 2000). In addition to being targeted word-initially and in the penultimate syllable position; production of vowels was assessed in the medial and final word positions. The structure of the target words sampled in v.2 is summarised in Table 7.

Table 7. The structure of target words

Length of target words	Syllable structures	
	Initial word position	**Penultimate syllable**
Monosyllabic: 2 (e.g. *"nwa"* /nʷa/ drink) **Bisyllabic:** 25 (e.g. *"pi-tsa"* /p'i-t͡s'a/ pot **Tri-syllabic:** 46 (e.g. *"di-gwê-tê"* /di-xʷɛ-t'ɛ/ carrots) **4 syllables:** 10 (e.g. *"se-fa-tlhê-gô"* /sɪ-fa-t͡ɬʰɛ-xɔ/ face) **5 syllables:** 2 (e.g. *"se-khu-ru-mê-lô"* /sekʰu-ru-mɛ-lɔ/ lid)	**CV:** 61 (e.g. *"**ta**fole"* /**t'a**fʊlɪ/ table) **V:** 6 (e.g. *"**a**pole"* /**ạ**p'ʊlɪ/ apple) **C:** 9 (e.g. *"**m**midi"* /**m̩**midi/ corn) **C^{w}V:** 9 (e.g. *"**kwê**na"* /**kʷ'ɛ**na/ crocodile)	**CV:** 60 (e.g. *"ta**fo**le"* /t'a**fʊ**lɪ/ table) **V:** 7 (e.g. *"dikausu"* /dik'a**ụ**su/ socks) **C:** 5 (e.g. *"tô**n**ki"* /t'ɔ**ŋ̩**k'i/ donkey) **C^{w}V:** 11 (e.g. "*ma**ngwê**lê"* /ma**ŋʷɛ**lɛ/ knees)

Not all Setswana consonants could be included in the word list of the Setswana assessment. This was mainly due to the fact that a number of words containing the phonemes that were omitted do not form part of young children's vocabulary and are not easy to represent visually. For instance, *'**tlhw**are'* /**t͡ɬʰʷ**arɪ/ (python) and *'**tw**atsi'*/**tʷ'**at͡si/ (virus). The Setswana v.2 picture naming task consists of 58 nouns, 19 verbs, seven adjectives and one adverb. A number of these words were used to target more than one phoneme each; e.g. the word *'**th**ubê**g**ilê'* /**tʰ**ubɛ**x**ilɛ/ (broken), sampled production of aspirated alveolar explosive /tʰ/ in the initial word position and voiceless velar fricative /x/ in the penultimate syllable position.

3.6 Validity of Revised Assessment Tool

When the Setswana assessment tool was first developed, several measures were put in place to increase its validity. These measures comprised seeking assistance from a panel to review the list of

words that had been selected by the researcher, an SLT and a native Setswana speaker. The panel consisted of two preschool educators who are first language speakers of Setswana, as well as a Setswana lecturer from the University of South Africa with a background in Linguistics. The researcher met each member of the panel individually and went through the word list with them, during which time they were asked to complete a checklist. This checklist was used to gather information on whether the panel felt that the words selected by the researcher were used by children frequently, to suggest alternative words targeting specific phonemes in cases where there was an indication that the children would be unlikely to use certain words, as well as to provide variations of target words where necessary to account for discrepancies as a result of the different varieties of Setswana. The feedback provided by this panel was then used as a guideline in developing the Setswana v.1 (Mahura, 2014; Mahura & Pascoe, 2016).

Since the measures outlined above have resulted in a tool with increased validity, it was used as a basis for the assessment in the current research study (Setswana v.2). This was also done as this study was based on a preliminary study on the acquisition of Setswana phonology. Although the study sample was small and only focused on one variety of Setswana; it contributed valuable information that could be used as a guideline by the SLT working with this population, identified challenges that ought to be considered in future research on Setswana speech acquisition, and made recommendations for addressing such challenges. These were carefully reviewed and were used as a guide in making decisions for developing the Setswana v.2. Consideration of challenges identified in the first Setswana speech acquisition study also contributed to increasing the validity of the revised tool. Information on these limitations and steps taken to address them are detailed in 3.5.1 (Setswana Speech Assessment Tool: Revisions).

Additional steps were taken to further increase the validity of the revised tool as it was not sufficient to rely solely on processes from the preliminary study. These steps were as follows: 1) the preliminary tool was given to an SLT who works with Setswana-speaking children for use in clinical practice, and 2) another panel was formed and asked to review the word list for Setswana v.2. Feedback obtained from both the SLT and panel was taken into account when developing Setswana v.2. Information on these two steps of the revision process is detailed below.

3.6.1 Use of the Setswana Speech Assessment in Clinical Practice

The Setswana v.1 was given to an SLT to use in clinical practice after the preliminary study was concluded in 2014. The SLT was informed that the tool was only based on a small research project with findings providing a guideline as they could not be generalised to all children acquiring Setswana. Sharing the tool provided an opportunity to examine its usability in clinical practice; this was especially important as the SLT is a first language English speaker and has very limited skills in Setswana. This allowed the researcher to gather information on ways in which to make it easy for SLTs who are not

fluent in Setswana to administer the tool. Furthermore, the SLT used this tool with children who speak a different variety to the study population; information regarding this was used to consider variants of target words during the revision process. This information was gathered by means of a short questionnaire (Appendix M). The questionnaire was made up of six questions and aimed to gather information on the usability of the tool for the SLT whose first language is not English, possible revisions to make administration and scoring easy, as well as items that seemed difficult for the children.

3.6.2 Expert Panel Review

As was done with the Setswana v.1, a panel was formed and asked to review the revised word list. For this panel, the researcher recruited students (Years I to IV) registered in the Speech-Language Pathology programme at the University of Cape Town and a qualified SLT. The students who expressed interest to join the panel were given information on the study and the purpose of the panel was outlined (Appendix N). The invited students were first language Setswana speakers who had both completed a course in Child Speech at the time the panel met, as well as an SLT whose first language is isiZulu and is proficient in Setswana.

A meeting was scheduled with members of the panel, but only two student SLTs attended; the researcher gave an overview of the study, as well as the purpose of the panel before the review process started. The two members of the panel were then asked to read through the list and 1) indicate whether or not each word was appropriate for the age group of the study population (i.e. 2;0–6;5 years); 2) to suggest an alternative word targeting a specific phoneme where a word was marked as inappropriate; 3) suggest a target word where the researcher had difficulty producing one for some phonemes; as well as, 4) provide a possible variant of a word where applicable since they each spoke a different variety of Setswana. Obtaining word variables for words in the word list would allow for the tool to be sensitive to variations found in different varieties of Setswana. The researcher obtained feedback from the SLT at a different time than the other members of the panel. Apart from having this done individually, the researcher followed the same procedure explained above when this SLT was asked to review the word list.

All members of the panel made suggestions for word variants to consider but expressed that they found it challenging to suggest words that children would know to elicit production of the phonemes for which the researcher did not have words. Some of these phonemes included round ejective latero-alveolar affricate /t͡ɬʷʼ/, round aspirated latero-alveolar affricate /t͡ɬʰʷ/, round aspirated velar plosive /kʰʷ/, round voiceless alveolar fricative /sʷ/, ejective palato-alveolar affricate /t͡ʃˤ/ (round and unrounded), and round voiced palato-alveolar affricate /ʤʷ/. Feedback given by the panel was considered in great detail when revising the word list for the Setswana speech assessment tool. This mainly included variations in production of aspirated palato-alveolar affricate /t͡ʃʰ/, which is produced

as alveolar /t͡sʰ/ by some Setswana-speakers. For instance, *'**tshwê**ne'* /**t͡sʰʷ**ɛnɪ/ (monkey) is likely to be produced as *'**tšhwê**ne'* /**t͡ʃʰʷ**ɛnɪ/ by a child acquiring the Setlhaping and Setlharô varieties and /**t͡sʰʷ**ɛnɪ/ by those acquiring other varieties. One of the words that the panel indicated would not be produced by children acquiring all varieties except Setlhaping and Setlharô is *'tsididi'*/**t͡s'**ididi/ (cold), since other varieties use the word *'maruru'* /maruru/ and *'tônya'* /t'ɔɲa/. As a result, alternative words to target these phonemes were added to the list reviewed by panel members.

3.7 Data Collection

Potential participants were identified with the educators' assistance; this was done only after ethical clearance had been obtained from the Faculty of Health Sciences Human Research Ethics Committee and the heads of schools had given permission for the research to be conducted at their schools. This was followed by obtaining informed consent from parents and legal guardians who were interested in having their children participate in this study. These parents and legal guardians were then asked to complete a case history form and the ICS:Set (Mahura et al., 2012; McLeod et al., 2012). Participants' educators were then asked questions relating to their behavioural and learning patterns. This information helped the researcher determine the eligibility of these children to take part in the study.

Once the researcher determined which children met the selection criteria, she assigned each of them a code. This was done to keep their identities anonymous. Each code had the first letter of the schools and a number (e.g. M3). The letters were used as a way to help the researcher remember the school that each participant was attending at the time of data collection. This also provided an easy way to identify the variety of Setswana they were acquiring when data was analysed. A participant was only assessed once s/he had given verbal assent. All responses were transcribed online. Participants' responses were also audio recorded to allow for later verification of transcriptions done during the assessment.

Assessments were carried out over a two-year period, with each one lasting between 30 and 50 minutes. All assessments were conducted in a quiet, well-lit room on the premises of each participant's school. They were recorded with a TASCAM DR-22WL voice recorder. The participants and researcher sat at a table that was appropriate for the participants' height; where a table was not provided, the researcher and participants sat on the floor. The researcher explained the assessment process to each participant, and they were encouraged to indicate if they were tired and needed a break or if they needed assistance in naming certain pictures. Participants were asked a range of questions in order to elicit spontaneous production of target words. These questions included: '*Ke eng sê? Ke mang yô? Mama o dirang fa? Papa o dirang ka garawê mô?*' (What is this? Who is this? What is mom doing here? What is dad doing here with a shovel?). When participants had difficulty identifying the pictures

spontaneously, they were given cues; e.g. '*ê ke ya go bidisa mêtsi a teê*' (this one is for boiling water for tea) when a participant had difficulty identifying '*ketlele*' /kʼɪt͡ɬʼɪlɪ/ (kettle). When participants continued to have difficulty identifying a picture after such cues were given, a forced choice option was given (e.g. '*A ke ketlele kgotsa ke kôpi?*' 'Is it a kettle or a cup?'). Only when these strategies were not successful in eliciting a spontaneous production, were participants encouraged to repeat the target word. In order to keep participants motivated during the assessment session, they were given positive reinforcement during the assessment session and a sticker once the session was concluded.

3.8 Data Analysis

All participants' responses were transcribed phonetically using IPA, and these results were analysed descriptively. With descriptive analysis, data collected can be sorted through and used to develop hypotheses to explain results obtained from the study (Cozby, 2005). The findings were evaluated using two methods of phonological analysis: independent and relational analysis.

The independent method of phonological analysis consisted of describing participants' phonetic inventories. This involved an evaluation of participants' abilities to correctly produce individual consonants and vowels, regardless of the accuracy with which words containing these phonemes were produced (Baker, 2004). Phonemes present in the participants' inventories were analysed descriptively, with consonants described according to their place and manner of production and vowels according to height and front/back dimensions. A description of the use of lexical tone was also included in the independent analysis. Phonetic inventories of participants were analysed at three levels: 1) within each age group for each of the varieties studied; 2) across the different age groups for each variety in order to determine any developmental progression present; and 3) across the two varieties studied so as to note any differences in phoneme development between them. Analysis of the Setlhaping variety was severely limited as the sample size for this group of participants was small and did not include children in all age groups. This in turn made it challenging to make reliable inferences on any differences between phoneme development in the two varieties studied.

The second method of phonological analysis was the relational analysis and involved making a comparison between participants' production of words and the target phonology (Baker, 2004). The relational method of phonological analysis included calculating the percentage of consonants (PCC), vowels (PVC) and phonemes (PPC) produced correctly and describing phonological processes that participants presented with. The formula used to calculate PCC involved dividing the number of consonants produced correctly by the total number of consonants targeted and multiplying this by 100. The same was done to calculate PVC and PPC (Hua & Dodd, 2000). This was done for words produced spontaneously and those repeated. Unlike the independent analysis, the relational method of phonological analysis takes into account sounds and words that are not produced correctly and these

are compared to the target phonology (e.g. adult speech) (Baker, 2004). Accuracy scores and phonological processes were analysed at three levels, as was done for the independent analysis: 1) within each age group for each of the Setswana varieties studied; 2) across the different age groups for each variety in order to determine any developmental progression present; and 3) across the two varieties of Setswana so as to note any differences in phoneme development between them. Since the participant group for the Setlhaping variety was small, it severely limited analysis done for the age groups for this variety and comparisons with Sekwêna.

For both methods of phonological analysis, trends have been described for five aspects of phonological acquisition in Setswana. The five aspects described are consonants, vowels, lexical tone and the nature of phonological processes in participants' speech. A table with information on individual consonants produced by each participant is included in Appendix O. A note was made for children who differed qualitatively and quantitatively. Qualitative differences, for example, included the use of idiosyncratic or unusual phonological processes not used by the other children in the group since Dodd et al., (2003) suggested that this is an indicator of an SSD. Quantitative differences included an instance where a child had a PCC that is significantly lower than the mean for the group. Preliminary prevalence estimates were calculated on the basis of this information.

Since this study aimed to contrast the speech of monolingual children to their bi/multilingual peers, qualitative comparisons between these groups were made. This consisted of making note of the phonetic inventories of bi/multilingual children and comparing them to their monolingual peers in order to determine whether differences between the two groups exist and to detail such differences where they exist. This was also done by contrasting the accuracy scores and phonological processes between the two groups. Furthermore, the speech of those who presented with a delay was compared to those of typically developing peers. This was achieved by giving a detailed account of the phonetic inventories, as well as phonological processes noted in those who presented with a delay in order to highlight the differences and to some degree, similarities between those developing speech typically and those who were atypical.

3.8.1 Analysis of Phoneme Acquisition: Criteria

A phoneme was considered present in a child's phonetic inventory if produced at least once by the child, regardless of the accuracy with which the target was produced. This was done for phonemes that were produced spontaneously and in imitation. Phonemes that were produced in imitation were accepted as they provide evidence of a child's articulatory competence (Dodd et al., 2003; Hua & Dodd, 2000).

Phoneme acquisition was further described at three levels, and this was done in an attempt to determine the ages at which Setswana phonemes are acquired. These are: 1) *age of customary*

production, which occurs when at least half of the participants in each age group can produce a phoneme in two word positions; 2) *age of acquisition*, which occurs when 75% of participants accurately produce certain phonemes in target word positions; and 3) *age of mastery*, which occurs when 90% of participants in an age group accurately produce phonemes in target word positions (Hua, 2002; Phoon, Abdullah, Lee & Murugaiah, 2014). In the present study, phoneme acquisition was targeted in the initial word position and the penultimate syllable position and was therefore described for both positions for each word. Adaptations were made to criteria for age of acquisition and age of mastery since participants were not evenly distributed in each age group. The criteria for age of acquisition and mastery of phonemes in the initial word position and penultimate syllable position for each age group are summarised in Table 8. This was only done for the Sekwêna variety as the sample size for the Setlhaping variety was too small, and data from this group was mainly interpreted descriptively.

Table 8. Criteria for age of phoneme acquisition and age of mastery for each age group in the Sêkwena variety

	Age Group (years; months)							
	1 (2;5–2;11)	**2 (3;0–3;5)**	**3 (3;6–3;11)**	**4 (4;0–4;5)**	**5 (4;6–4;11)**	**6 (5;0–5;5)**	**7 (5;6–5;11)**	**8 (6;0–6;5)**
Number of participants	7	7	9	14	10	8	5	5
Acquisition	5	5	7	11	8	6	3	3
Mastery	6	6	8	13	9	7	4	4

3.9 Validity and Reliability

Validity is the extent to which a tool adequately measures what it is designed to measure (Babbie & Mouton, 2006). 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 the preliminary Setswana speech developmental study (Mahura & Pascoe, 2016), as well as related studies (e.g. those in Sesotho and isiXhosa) will be considered in light of the findings from the current study. Content validity, on the other hand, refers to the extent to which a measure addresses all of the aspects that comprise a particular concept (Babbie & Mouton, 2006). In this case, content validity was considered by making use of words and pictures which are culturally

appropriate, cover all of the sounds of the language in a range of word positions and are appropriate for young children. A number of different steps (detailed in section 3.6, Validity of Revised Assessment Tool) were taken to increase the content validity of the tool. A standard format of the set of pictures, which correlate with the target words, were used.

Reliability refers to the consistency of results obtained from a tool used to assess a particular subject (Babbie & Mouton, 2006). For the present study intra-rater reliability was improved by having the researcher re-transcribe 25% of the recorded responses to ensure accuracy, once during each assessment and the second time when transferring the data onto a document for analysis. All transcriptions were carried out using IPA. All responses that were re-transcribed when checking for intra-rater reliability were consistent. Observations made by one person may not be reliable and increasing the number of raters helps improve reliability (Cozby, 2005). Inter-rater reliability was ensured by having a second person transcribe 10% of the data, with agreement of 98%. The second rater was a first language speaker of Setswana and a final year student SLT who has successfully completed a course in Child Speech and introductory courses in Linguistics. Results of the two raters were compared, and in the few instances where disagreements were noted the researcher listened to the speech recordings again and made corrections, suggested by the second rater. Differences in transcriptions between the raters mainly included transcription of the word *'mae'* /maɪ̯/ (eggs), which some participants produced as 'ma**ye**' /ma**jɪ**/ (eggs). Reliability was also increased by attempting to use a range of phonetic contexts and syllable structures to sample the target phonemes to ensure that results are not specific to certain lexical items.

3.10 Ethical Considerations

Permission to conduct this research study was granted by the Human Research Ethics Committee of the University of Cape Town Health Sciences Faculty. The Helsinki Declaration (World Medical Association, 2013) requires researchers to maintain several ethical considerations when conducting research. Ethical considerations upheld during the study were as follows:

3.10.1 Autonomy

This principle refers to respect for persons asked to take part in research (Cozby, 2005). Participants must be capable of deciding whether or not they would like to participate (Cozby, 2005). This was ensured by providing parents and legal guardians of participants with an information letter. This letter explained the nature, purpose and risks of the study, as recommended in the Declaration of Helsinki (World Medical Association, 2013). Parents and legal guardians were allowed an opportunity to ask the researcher questions. Participants were also given information on the study

and were allowed an opportunity to agree or refuse to participate. This was done verbally as the participants are young children who are not yet able to read or give written consent. Parents and legal guardians and participants were made aware that they were allowed to withdraw from the study at any stage without having to give an explanation and with no negative consequences to them. In addition, a list of participants was completed, and a code was assigned to each one of them in order to ensure confidentiality. The codes were kept separate from the list of participants so that no identifying information was used when reporting on results obtained. The researcher also ensured that participants' names were not used when audio-recording assessment results.

3.10.2 Beneficence

According to the Declaration of Helsinki, an assessment of risks and benefits must be made before every research project (World Medical Association, 2013). This principle refers to the requirement for research to minimise risks of harming participants during their participation, while maximising benefits (Cozby, 2005). Participants in the study will not benefit directly from this research study. Information obtained from the study may, however, aid SLTs to better identify speech sound disorders in Setswana-speaking children. Participants observed to have speech and/or language delays were referred to relevant healthcare professionals.

3.10.3 Non-maleficence

Participants did not incur any harm when taking part in this study (World Medical Association, 2013). This study was conducted on the school premises to ensure that participants stayed in their safe environment. When children felt tired, they were given breaks and the researcher ensured that the time out of class was minimised so that no child missed out on a special school event such as an outing or playtime.

3.10.4 Justice

The principle of justice must address fairness regarding individuals in certain population groups who may benefit from the study (Cozby, 2005). The participants in this study were chosen based on their availability and willingness to take part in the study. Information was made available to the participants' parents and legal guardians. Although results obtained from the study cannot be generalised to the entire population of Setswana-speaking children, it may help us understand speech acquisition in this population better. The study also contributes a tool that may be used in the assessment of phonology of Setswana-speaking children.

3.11 Summary

In this chapter, methods used in this study and rationale for the selection of these have been detailed. The aims and objectives of the study were listed, followed by an overview of the research design, as well as a description of procedures followed in selecting the study population. This research study used a cross-sectional research design to detail the stages of speech sound acquisition in 81 participants. These participants were categorised into two groups of Setswana varieties: 1) Sekwêna (65 participants), and 2) Setlhaping (16 participants). An unpublished Setswana speech assessment tool developed (Setswana v.1) for the first study on Setswana speech acquisition in 2014 was used to collect data in this research study. This tool was, however, revised before being used in this study, and measures taken in order to increase its validity and usability in clinical practice have been discussed in this chapter. This chapter also detailed the data collection process and ways in which the study findings were analysed. Lastly, a description of measures taken to increase the validity and reliability of the study, as well as ways in which ethical considerations were addressed, were included in this chapter. The study findings, in particular findings from the relational analysis, are presented in the chapter that follows.

CHAPTER 4: FINDINGS – INDEPENDENT ANALYSIS

This chapter details the findings for the first two objectives of the study aim, which is to describe the acquisition of consonant and vowel phonemes in children aged 2;6–6;5 years. This is done for each of the varieties of Setswana studied. In addressing the first two objectives, an analysis of the participants' speech samples was carried out to provide a description of the order in which Setswana phonemes are acquired between 2;6 and 6;5 years. The first section of this chapter focuses on the independent analysis for the group of the Sekwêna variety. An account of differences in phonetic inventories across the different age groups is presented first and is followed by a detailed account of the phonetic inventories of each age group. The second section of this chapter includes an independent analysis for the Setlhaping variety; the focus is largely on describing the phonetic inventories of the participants since a comparison across age groups was limited by the very small sample size for this variety. This will be followed by a comparison between the two varieties in order to note any differences in speech sound acquisition between the two groups.

4.1 Section 1: Independent Analysis – Sekwêna

4.1.1 Consonants

A phoneme was considered present in a child's phonetic inventory if produced at least once by the child, regardless of the accuracy with which the target word was produced. This was done for phonemes that were produced spontaneously and in imitation. Consonants were marked as emerging if produced by at least half the participants in an age group. Additional criteria used in determining the ages at which the target Setswana consonants are acquired and mastered differ across the age groups due to the unequal distribution of participants in each. Information on the criteria is included in Table 8 (Chapter 3, section 3.8.1) and in the sub-sections for each age group.

4.1.1.1 Across the age groups

The consonant inventory in the initial word position for all age groups in the Sekwêna variety is summarised in Table 9a.

Table 9a. Phonetic inventory in the initial word position: Across the age groups (Sekwêna)

Consonants			Age Category							
			Group 1 (2;6–2;11 years)	**Group 2 (3;0–3;5 years)**	**Group 3 (3;6–3;11 years)**	**Group 4 (4;0–4;5 years)**	**Group 5 (4;6–4;11 years)**	**Group 6 (5;0–5;5 years)**	**Group 7 (5;6–5;11 years)**	**Group 8 (6;0–6;5 years)**
Plosives	Ejective	Emerged	kʷʼ							
		Mastered	pʼ tʼ kʼ	pʼ tʼ kʼ kʷʼ	pʼ tʼ kʼ kʷʼ	pʼ tʼ kʼ kʷʼ	pʼ tʼ kʼ kʷʼ	pʼ tʼ kʼ kʷʼ	pʼ tʼ kʼ kʷʼ	pʼ tʼ kʼ kʷʼ
	Aspirated	Emerged								
		Mastered	tʰ kʰ	tʰ kʰ	pʰ tʰ kʰ	tʰ kʰ	tʰ kʰ	tʰ kʰ	tʰ kʰ	tʰ kʰ
	Voiced	Mastered	b d	b d	b d	b d	b d	b d	b d	b d
Fricatives		Acquired		f						
		Mastered	f s h x	s h x	f h	f s h	f s h	f s h	f s h	f s h x
Nasals		Emerged	nʷ							
		Acquired	n ŋʷ	n						
		Mastered	m ŋ ɲ	m nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ
	Lateral	Mastered	l lʷ	l lʷ	l lʷ	l lʷ	l lʷ	l lʷ	l lʷ	l lʷ
	Glides	Mastered	w	w	w	w	w	w	w	w
Affricates	Ejective	Emerged				t͡sʷʼ				
		Acquired	t͡ɬʼ							
		Mastered		t͡ɬʼ	t͡ɬʼ	t͡ɬʼ	t͡ɬʼ	t͡ɬʼ	t͡ɬʼ	t͡ɬʼ
	Aspirated	Emerged			t͡shw					
		Acquired	t͡shw	t͡sʰ kx͡ʰ			kx͡ʰ			
		Mastered	t͡ɬʰ t͡sʰ	t͡ɬʰ t͡shw	tɬʰ t͡sʰ	t͡ɬʰ t͡sʰ t͡shw	t͡ɬʰ t͡sʰ t͡shw	t͡ɬʰ t͡sʰ t͡shw	t͡ɬʰ t͡sʰ t͡shw	t͡ɬʰ t͡sʰ t͡shw
	Voiced	Emerged		dʒ						
		Acquired			dʒ					
		Mastered				dʒ	dʒ	dʒ	dʒ	dʒ
Heterorganic compounds		Emerged			fj					
		Acquired						fj		
Clusters		Emerged		sp’		sk’	sp’	kʰr dr		
		Acquired				sp’ dr		st’ skʰ sf	sp’ sf	sk’ sf kʰr
		Mastered				st’ skʰ	st’	sp’	st’ skʰ dr	sp’ st’ skʰ

A large number of Setswana consonants occurring word-initially appear to be acquired as early as 2;6–2;11 years. This includes plosives (ejective, aspirated and voiced), fricatives, nasals (e.g., /m, ŋ/), sonorants and fricatives. Consonants which proved difficult included those with rounding (e.g., voiceless round ejective alveolar plosive /kʷ'/ and round alveolar nasal /nʷ/), and voiced palato-alveolar affricate /ʤ/. This was, however, the case for the youngest age group only (2;6–2;11 years) as these consonants were mastered at 3;0–3;5 years. By the age of 6;0–6;5 years, all consonants elicited in the initial word position were mastered. Some phonemes were not considered missing from the participants' inventories if they were not produced in the initial word position. These include voiceless velar fricative /x/, which was sometimes produced as glottal /h/ and vice versa; as well as voiceless aspirated velar affricate /k͡xʰ/, which was often produced as aspirated velar plosive /kʰ/. For instance, *'**h**êmpê'* /**h**ɛmp'ɛ/ (shirt) was produced as *'**g**êmpê'* /**x**ɛmp'ɛ/ (shirt) by some participants, and *'**kg**akala'* /**k͡xʰ**ak'ala/ (far) was produced as *'**kh**akala'* /**kʰ**ak'ala/ (far). Although heterorganic compounds and consonant clusters are included in Table 9a, they cannot be marked as emerging, acquired or mastered word-initially by the various age groups. This was done as they were not part of the speech assessment and were produced by participants whose responses differed from the target.

A summary of all the age groups' consonant inventories in the penultimate syllable position is summarised in Table 9b.

Table 9b. Phonetic inventory in the penultimate syllable position: Across the age groups (Sekwêna)

Consonants			Age Category							
			Group 1 (2;6–2;11 years)	**Group 2 (3;0–3;5 years)**	**Group 3 (3;6–3;11 years)**	**Group 4 (4;0–4;5 years)**	**Group 5 (4;6–4;11 years)**	**Group 6 (5;0–5;5 years)**	**Group 7 (5;6–5;11 years)**	**Group 8 (6;0–6;5 years)**
Plosives	Ejective	Emerged	t’	t’	t’					
		Mastered	p’ k’	p’ k’	p’ k’	p’ k’	p’ k’	p’ k’	p’ k’	p’ k’
	Aspirated	Emerged			p^h k^h					
		Mastered		k^h		p^h k^h	p^h k^h	p^h k^h	p^h k^h	p^h k^h
	Voiced	Mastered	d	d	d	d	d	d	d	d
	Fricatives	Emerged	s^w			s^w		s^w		
		Acquired	s x^w	s^w			x x^w			
		Mastered	f h x	f s h x x^w	f s h x x^w	f s h x x^w	f s h	f s h x x^w	f s s^w h h^w x x^w	f s s^w h x^w
	Nasals	Emerged	$ŋ^w$							
		Mastered	m n ŋ ɲ	m n ŋ ɲ	m n ɲ	m n ŋ ɲ	m n ŋ ɲ		m n ŋ $ŋ^w$ ɲ	m n ŋ $ŋ^w$ ɲ
Sonorants	Lateral	Mastered	l	l	l	l	l	l	l	l
	Trill	Emerged		r		r ʀ		r ʀ		
		Mastered							r	r
Affricates	Ejective	Emerged	$\widehat{ts}^w$’							
		Mastered	$\widehat{tɬ}$’ $\widehat{ts}$’	$\widehat{tɬ}$’ $\widehat{ts}$’ $\widehat{ts}^w$’	$\widehat{tɬ}$’ $\widehat{ts}$’ $\widehat{ts}^w$’	$\widehat{tɬ}$’ $\widehat{ts}$’ $\widehat{ts}^w$’	$\widehat{tɬ}$’ $\widehat{ts}$’ $\widehat{ts}^w$’	$\widehat{tɬ}$’ $\widehat{ts}$’ $\widehat{ts}^w$’	$\widehat{tɬ}$’ $\widehat{ts}$’ $\widehat{ts}^w$’	$\widehat{tɬ}$’ $\widehat{ts}$’ $\widehat{ts}^w$’
	Aspirated	Emerged			$\widehat{ts}^{hw}$	$\widehat{ts}^h$	$\widehat{ts}^h$			
		Acquired		$\widehat{tɬ}^h$ $\widehat{ts}^{hw}$ $\widehat{tʃ}^h$						
		Mastered	$\widehat{tʃ}^h$	$\widehat{ts}^h$	$\widehat{tɬ}^h$ $\widehat{tʃ}^h$	$\widehat{tɬ}^h$ $\widehat{tʃ}^h$	$\widehat{tɬ}^h$ $\widehat{ts}^{hw}$ $\widehat{tʃ}^h$	$\widehat{tɬ}^h$ $\widehat{tʃ}^h$	$\widehat{tɬ}^h$ $\widehat{ts}^{hw}$ $\widehat{tʃ}^h$	$\widehat{tɬ}^h$ $\widehat{ts}^{hw}$ $\widehat{tʃ}^h$
	Heterorganic compounds	Emerged						pj		
		Mastered		pj	pj				pj	pj
	Clusters	Emerged				br	sk’	sk’		
		Acquired				sk’	br			
		Mastered							sk’ br	sk’

The youngest group of participants (2;6–2;11 years) have either acquired or mastered many consonants in the Setswana sound inventory sampled in the penultimate syllable position. As seen in the initial word position, a number of round consonants are some of the only phonemes that have not yet been acquired at 2;6–2;11 years. For instance, round velar nasal /ŋʷ/ and round voiceless alveolar ejective affricate /t͡sʷ'/ are not acquired at this age, but have emerged. Round voiceless aspirated alveolar affricate /t͡sʰʷ/ has not yet emerged in the penultimate syllable position at 2;6–2;11 years, but is acquired at 3;0–3;5 years. Some phonemes have been recorded in participants' inventories but were not marked as missing from the inventories of those who had not produced them. This was done as participants' responses differed from the target word and attempts to have them repeat it were often unsuccessful. The phonemes to which this applies are voiceless ejective alveolar plosive /t'/ and round voiceless alveolar fricative /sʷ/. Voiceless velar fricative /x/ and /xʷ/ is marked as acquired for Group 5 (4;6–4;11 years), although it was mastered by the younger age groups. It has, however, likely been mastered at this age too as participants often produced it as glottal fricative /h/, a trend that was noted in the word initial position.

4.1.1.2 Group 1 (2;6–2;11 years)

4.1.1.2.1 Initial word position

A consonant was considered to have been acquired if five of the seven participants (i.e., 71%) in Group 1 had it in their phonetic inventory, and mastered if present in the inventories of six participants (i.e., 86%). The consonant inventory of each participant in Group 1 is summarised in Tables 10a and 10b (Appendix O1).

Seven plosives appear to have been mastered between the ages of 2;6 and 2;11 years in the initial word position in Setswana. These include: ejective /p'/, /t'/ and / k'/; aspirated /tʰ / and / kʰ/; as well as voiced /b/ and /d/. Aspirated bilabial plosive /pʰ/ was only produced by two participants. It was, however, not considered missing from the inventory of this age group since the five participants who did not produce it experienced difficulty identifying the item used to elicit production of this target phoneme. An attempt to have these participants repeat the target word was unsuccessful as they refused to do so. Although round aspirated alveolar /tʰʷ/ was only present in the inventory of one participant (L25), it was not marked as missing from the other participants' phonetic inventories as there was no target word eliciting production of this phoneme in Setswana v.2. The round ejective velar plosive /kʷ'/ appears to emerge at 2;6–2;11 years in the initial word position, but has not yet been acquired at this age – three of the seven participants (L33, EL2, EL27) in this age group produced this target phoneme unrounded (i.e. as ejective velar plosive /k'/).

Fricatives /f/, /s/, /h/ and /x/ were produced by all participants in Group 1 in the initial word position and are marked as having been mastered at 2;6–2;11 years in children acquiring Setswana. Participants L33 and EL2 produced the glottal fricative /h/ as velar fricative /x/; this substitution was not considered an error as it is a feature of the variety of Setswana spoken in the region and is common in adult speech. Although the palato-alveolar fricative /ʃ/ was targeted word-initially, only two participants produced this phoneme. The responses given by participants when asked to name the picture eliciting production of the palato-alveolar fricative /ʃ/ word-initially differed from the target. The target word was *'**š**a'* /**ʃ**a/ (burning): two participants (L25 and L33) responded with *'**f**isa'* /**f**isa/ and *'**f**iša'* /**f**iʃa/ (to burn), two participants (L31 and EL25) said *'**fj**a'* /**fj**a/ (burning) and one participant (EL2) responded with *'**tš**huma'* /**t͡ʃʰ**uma/ (to light up/start a fire). The heterorganic compound /fj/ is a feature of the region's variety and is commonly used to substitute /ʃ/ in adult speech.

At 2;6–2;11 years of age, Setswana-speaking children appeared to have mastered nasal phonemes /m/, /ŋ/ and /ɲ/ (produced in the word initial position by all seven participants in Group 1). It must be noted that palato-alveolar nasal /ɲ/ was only elicited as a syllabic consonant (i.e. /ɲ̩/). The participants, however, produced /ɲ/ in their production of a different target word – *'**n**ônyane'* /**n**ɔɲanɪ/ (bird) was produced as *'**ny**ônyane'* /**ɲ**ɔɲanɪ/. Alveolar nasal /n/ and round velar nasal / ŋʷ/ are acquired at this age. The alveolar nasal /n/ was produced as a palato-alveolar nasal /ɲ/ by two participants (L25 and L37). In addition, round alveolar /nʷ/ was only present in the phonetic inventories of four participants in the initial word position – L33, EL25 and EL27 produced it without rounding (i.e. as /n/). Round alveolar nasal /nʷ/ therefore appears to not have been acquired in the initial word position, but has emerged at 2;6–2;11 years in Setswana-speaking children.

The lateral /l/ and /lʷ/ and medial /w/ sonorants were present in this age group's inventory word-initially and have therefore been mastered at 2;6–2;11 years. Only one participant (L33) did not produce the medial sonorant /w/ and substituted it with /j/. Alveolar trill (/r/ /rʷ/) was absent from the inventories of all participants in this age group, and one participant (EL2) had round uvular trill /ʀʷ/ in his phonetic inventory in the initial word position. The reason for this is that the words used to elicit production of these phonemes (*'**rr**ê'* /**r̩r**ɛ/ father; *'**rw**ala'* /**rʷ**ala/ (to wear shoes/hat)) were not used by participants and attempts to encourage them to repeat target words were unsuccessful. Conclusions on whether or not alveolar trills (with and without rounding) start to emerge or are acquired at 2;6–2;11 years can therefore not be drawn at this stage and should be investigated in future research.

Two voiceless aspirated affricates are mastered word-initially between the ages of 2;6 and 2;11 years. L33 produced the aspirated latero-alveolar affricate /t͡ɬʰ/ as aspirated velar plosive /tʰ/. Affricates that appear to be acquired in the initial word position at 2;6–2;11 years are the voiceless ejective latero-alveolar /t͡ɬ'/ (produced by five participants); and round voiceless aspirated alveolar /t͡sʰʷ/ (produced by five participants). Although voiceless ejective latero-alveolar affricate /t͡ɬ'/ was not produced by one participant (EL27), it was not considered absent from her phonetic inventory. This participant produced

the word used to target this phoneme (*'**tl**ôu'* /**tɬ'**ɔu̯/ elephant) in its plural form (*'**d**itlôu'* /**d**itɬ'ɔu̯/ elephants) and refused to repeat the singular form when prompted to do so. Although EL27 did not produce /tɬ'/ in the initial word position, she produced it in the penultimate syllable position. Participant EL2 on the other hand, produced voiceless ejective latero-alveolar affricate /tɬ'/ as voiceless ejective velar plosive /k'/. L33 and EL27 produced round voiceless aspirated alveolar /ts^{hw}/ without rounding (i.e. as /ts^{h}/). The voiced palato-alveolar affricate /ʤ/ has not yet emerged word-initially at 2;6–2;11 years and was only present in the phonetic inventories of three participants. Two participants (L31 and L33) produced this phoneme as voiced alveolar plosive /d/, and one participant (L37) produced voiced alveolar affricate /ʣ/ in its place. The round ejective alveolar affricate /ts^{w}'/ was removed from the list of phonemes targeted in this word-naming task as many participants experienced difficulty identifying the picture used to elicit it. Finally, the aspirated velar affricate /kx^{h}/ was not considered absent in Group 1's inventory as many participants produced this phoneme as the voiceless aspirated velar plosive /k^{h}/. This substitution is a feature of this variety and is common in the speech of adults who speak it. Other affricates present in the inventories of some participants in Group 1 word-initially include round voiceless aspirated latero-alveolar /tɬ^{hw}/ (L31) and voiceless aspirated palato-alveolar /tʃ^{h}/ (EL2). These two phonemes were not considered during analysis of age of consonant acquisition as they did not form part of target phonemes in the present study.

In addition to the presence of single consonants found in the Setswana sound system, consonant clusters were found in the speech of some participants. These consisted of /sp'/ (*'**se**piling'* /**sɪ**p'iliŋ̩/ in the mirror → *'**sp**iling'* /**sp'**iliŋ̩/), which was produced by three participants (L25, L31, L37); /sk^{h}/ (*'**se**khurumêlô'* /**sɪ**k^{h}urumɛlɔ/ lid → *'**skh**umêlô'* /**sk^{h}**umɛlɔ/), which was produced by one participant (/L31/); as well as /dr/ (*'kgweetsa'* /kx^{hw}ɛts'a/ (drive), was produced as *'**dr**aeva'* /**dr**aẹva/), which was produced by one participant (EL25). The CC phonotactic structure (i.e. consonant cluster) is not a feature of the Setswana phonological system and the presence of such a structure in young children acquiring the language may be an indication of a change to the Setswana sound system. This is influenced by exposure to other languages since some words are loan words (e.g. 'sepili' is a loanword from the Afrikaans word 'spieël'). However, this change was also noted in words that were not derived from those of languages with consonant clusters (e.g. 'sekhurumêlô').

It should be noted that participants had all vowels targeted (/a, ɛ, ɪ, ɔ, ʊ, u, i/) in their phonetic inventories, and these occurred across the various word positions. This is to be expected, as a preliminary study on Setswana speech development found that vowels are some of the earliest acquired phonemes. Since vowels were mastered early, they are not discussed further and should be considered as mastered for the other age groups.

4.1.1.2.2 Penultimate syllable position

At 2;6–2;11 years, children acquiring Setswana phonology have mastered at least three plosives in the penultimate syllable position. Bilabial ejective plosive /pʼ/ and velar ejective plosive /kʼ/ were targeted in the penultimate syllable position and were produced by all participants in this word position. Voiced alveolar plosive /d/ has also been mastered in the penultimate syllable position and was produced by six of the seven participants in Group 1. The participant who did not produce this phoneme (L33) substituted it with bilabial nasal /m/ and lateral sonorant /l/ (e.g. *'maga**d**ima'* /maxa**d**ima/ lightning → *'maga**m**ima'* /maxa**m**ima/). Voiced bilabial plosive /b/ was only produced by three participants (L33, L37 and EL27), but inferences regarding whether this phoneme has been acquired at this age cannot be made as other participants identified the picture used to elicit production of this phoneme using a word that differed from the target. This was also seen in older age groups. Aspirated velar plosive /kʰ/ was only produced by two participants (EL25 and EL27), but was not considered absent from the group's inventory in the penultimate syllable position due to three reasons: 1) /kʰ/ was not initially targeted but was produced in place of the aspirated velar affricate /k͡xʰ/ and was accepted, as this substitution is a feature of the region's variety; 2) one participant (EL2) produced aspirated velar affricate /k͡xʰ/ in the penultimate syllable position; while 3) four of the seven participants (L25, L31, L33 and L37) produced the word used to elicit production of /k͡xʰ/ /kʰ/ in the penultimate syllable position in its singular form (i.e. *'**kh**ômo'* /**kʰ**ɔmʊ/ cow) and did not wish to repeat the target word (*'di**kg**ômo'* /di**k͡xʰ**ɔmʊ/ cows) when prompted to do so.

Fricatives /f/ /h/ /x/ were produced in the penultimate syllable position by all participants in Group 1 and are considered to be mastered at 2;6–2;11 years. Despite not being produced by all participants in this age group, alveolar /s/ and /sʷ/ (i.e. round and unrounded) was not considered absent from the group's phonetic inventory in the penultimate syllable position. One participant (EL27) did not produce the target word (*'je**s**a'* /ʤɪ**s**a/ feeding) and gave an answer different to the target (*'ja'* /ʤa/ eating) and would not repeat the target when asked to. Three participants (L31, L33, L37) produced a word different to the target word used to elicit production of round alveolar fricative /sʷ/ – the target word was *'le**sw**ê'* /lɪ**sʷ**ɛ/ (dirty) and participants identified the picture used to elicit this word as *'di**tš**hila'* /di**t͡ʃʰ**ila/ (dirty). Although these participants' responses differed from the target word, their answers were recorded since the words they produced are often used by speakers of this variety of Setswana. In addition, round velar fricative /xʷ/ appears to be acquired at 2;6–2;11 years in the penultimate syllable position, and was produced by five of the seven participants in this age group – one participant (L37) produced this phoneme as /hʷ/ and this response was accepted as it is a feature of the variety of Setswana spoken in the region. Two participants, however, produced this phoneme without rounding (i.e. as /x/), a pattern that was observed frequently in the speech of children aged 2;6–2;11 years. One participant (EL27) produced voiced labio-dental fricative /v/, a phoneme not present in the Setswana phonetic inventory.

The lateral sonorant /l/ is mastered at 2;6–2;11 years, and was produced in the penultimate syllable position by all participants in Group 1. The word used to target production of the alveolar trill /r/ in the penultimate syllable position was removed from the wordlist as many participants across all age groups had difficulty identifying the picture used to elicit production of this phoneme, *'r**r**ê'* /ɽ**r**ɛ/ (father). Three participants (L25, L31, EL25) produced a word with alveolar trill /r/ in the penultimate syllable position (e.g. *'kê**r**a'* /k'ɛ**r**a/ cut hair). This phoneme was, however, not present in these participants' inventories – two participants (L25 and EL25) produced uvular trill /ʀ/ (e.g. *'kê**r**a'* /k'ɛ**r**a/ cut hair → /k'ɛ**ʀ**a/) instead and one participant (L31) produced it as lateral sonorant /l/ (e.g. *'kê**r**a'* /k'ɛ**r**a/ cut hair → *'kê**l**a'* /k'ɛ**l**a/).

Four nasals were mastered in the penultimate syllable position by Setswana-speaking children aged between 2;6–2;11 years. These are: bilabial /m/ (produced by seven participants); alveolar /n/ (produced by all seven participants in Group 1); palatal /ɲ/ (produced by all seven participants); and velar /ŋ/ (produced by six of the seven participants in this age group). One participant (L33) produced velar nasal /ŋ/ as alveolar nasal /n/ (e.g. *'tô**n**ki'* /t'ɔ**ŋ**k'i/ donkey → /t'ɔ**ɳ**t'i/). Round velar nasal /ŋʷ/ has emerged in the penultimate syllable position at 2;6–2;11 years, and was produced by four of the seven participants in Group 1. One participant (L33) produced it as alveolar nasal /n/ (e.g. *'le**ngw**êlê'* /lɪ**ŋʷ**ɛlɛ/ knee → *na**n**êlê'* /na**n**ɛlɛ/).

Two ejective affricates appear to be mastered early in children acquiring Setswana phonology. The voiceless ejective alveolar /t͡s'/ was produced by all participants in Group 1 and voiceless latero-alveolar /t͡ɬ'/ was produced by six of the seven participants in the penultimate syllable position (L33 produced it more posteriorly as /k'/). In the penultimate syllable position, voiceless ejective alveolar /t͡s'/ was sometimes produced as voiceless ejective palato-alveolar /t͡ʃ'/ by two of the participants (EL2 and EL27). The round voiceless ejective alveolar affricate /t͡sʷ'/ has emerged at 2;6–2;11 years and was only produced by four participants – it was produced with aspiration (i.e. /t͡sʰʷ/) by one participant (L33) and without rounding (i.e. /t͡s'/) by two participants (L37 and EL27). The voiceless aspirated palato-alveolar affricate /t͡ʃʰ/ was mastered at this age (2;6–2;11 years) – it was produced by six of the seven participants. Only one participant produced aspirated velar affricate /k͡xʰ/ in the penultimate syllable position – the participants in this age group produced this phoneme as aspirated velar plosive /kʰ/. Although the voiceless aspirated alveolar affricate /t͡sʰ/ was produced by three participants (L31, L33, EL27), it was not elicited as part of the assessment and therefore not considered missing from the other participants' phonetic inventories in the penultimate syllable.

In addition to the presence of singular consonants in the participants' inventory in the penultimate syllable position, a number of heterorganic compounds and consonant clusters were produced by some of the participants. The heterorganic compounds produced by participants included /bj/ (L25), /pj/ (L25, EL25) and p͡ts'(L31). The consonant clusters produced in the penultimate syllable position included /bl/ (L31; e.g. *'sekhukhu'* /sɪkʰukʰu/ umbrella → /am**bl**ɛla/), /bʀ/ (EL2, EL25; e.g.

'sekhukhu' /sɪkʰukʰu/ umbrella → /am**bʁ**ɛla/) and /sk'/ (L31; e.g. *'bae**seke**le'* /baị**sɪkɪ**lɪ/ bicycle, was produced as /baị**sk'**ɪla/). The presence of consonant clusters is likely indicative of an emerging fourth syllable structure (CC) in the Setswana sound system.

4.1.1.3 Group 2 (3;0–3;5 years)

4.1.1.3.1 Word initial position

A consonant was considered to have been acquired if five of the seven participants in Group 2 had it in their phonetic inventory, and mastered if present in the inventories of six participants. The consonant inventory of each participant in Group 2 is summarised in Tables 11a and 11b (Appendix O2).

Setswana-speaking children aged 3;0–3;5 years have mastered production of eight plosives in the initial word position. Aspirated bilabial plosive /pʰ/ was produced by three participants (EL3, EL6 and EL28), but was not marked as missing from other participants' phonetic inventories as they used a different word to identify the picture used to elicit production of this phoneme. For instance, the target word was *'**ph**ala'* /**pʰ**ala/ (whistle (n)) and was identified as *'prômpeta'* /prɔm̩p'ɪt'a/ (an alternative word for whistle) by some participants. This was accepted as correct since many participants in the Sekwêna group were noted to use this word in identifying this picture. In addition, one participant (EL3) produced round aspirated velar plosive /kʰʷ/ in the initial word position, and this phoneme was not marked as missing from the other participants' phonetic inventories as it was not elicited in the single word naming task.

Fricatives /s/ /h/ and /x/ have been mastered by Group 2 (3;0–3;5 years) in the initial word position. The glottal fricative /h/ and velar fricative /x/ were not produced by all participants but were considered present in the group's inventory. This decision was made since some participants (L28, EL6, EL28) produced /h/ as /x/ (e.g. *'**h**êmpê'* /**h**ɛm̩p'ɛ/ shirt; *'**g**êmpê'* /**x**ɛm̩p'ɛ/ shirt), a substitution which is common in the Sekwêna variety. The voiceless palato-alveolar fricative /ʃ/ was targeted in the initial word position, but was only produced by two participants (EL6, EL11). A pattern similar to that described for Group 1 in their production of the target word (*'**š**a'* /**ʃ**a/ – burn) was noted for Group 2. Two participants (L26 and L32) responded with *'**f**iša'* /**f**iʃa/ (to burn) and three participants (L28, EL3, EL28) said *'**fj**a'* /**fj**a/ (burning). The voiceless labio-dental fricative /f/ was produced word-initially by five participants, and has therefore been acquired at 3;0–3;5 years. One participant produced voiced labio-dental fricative /v/, a phoneme not usually found in the Setswana sound system. In addition, only one participant (EL6) substituted it with another fricative (/ʃ/; e.g. ***f**utswêtsa'* /**f**ut͡sʷ'ɛt͡s'a/ to blow → *'**š**utswêtsa'* /**ʃ**ut͡sʷ'ɛt͡s'a/).

Five nasals (/m, nʷ, ŋ, ŋʷ, ɲ/) occurring in the initial word position were mastered at 3;0–3;5 years. One participant (EL28) produced round velar /ŋʷ/ anteriorly and without rounding (i.e. as /n/). Alveolar /n/ is acquired at this age, and was produced word-initially by five participants. Participants (L26 and L32) who did not produce /n/ word-initially substituted this phoneme with palato-alveolar nasal /ɲ/.

The lateral sonorants /l/ and /lʷ/ and medial sonorant /w/ were mastered at 3;0–3;5 years in the initial word position. With the exception of the round lateral sonorant, they were produced by all seven participants in Group 2 (L32 produced /lʷ/ as /w/; e.g. producing *'**lw**ala'* /**lʷ**ala/ (sick), as *'**w**ala'* /**w**ala/). The word used to target production of the alveolar trill /r/ in the initial word position (*'**rr**ê'* /**ṛ**rɛ/ father) was removed from the wordlist as many participants had difficulty identifying the picture used to elicit production of this phoneme. Three participants (EL3, EL6 and EL11), nevertheless produced a word with alveolar trill /r/ and /rʷ/ word-initially. This phoneme was, however, only present in one participant's (EL11's) phonetic inventory. The other two participants produced uvular trill /ʀ/ (EL6, e.g. /**ʀ**ɛija/ to drive) and round uvular trill /ʀʷ/ (EL3, e.g. /**ʀʷ**ala/ to wear shoes/hat) in place of it.

Voiceless ejective latero-alveolar affricate /t͡ɬ'/ was mastered by this age group (3;0–3;5 years) and was produced in the initial word position by all participants in Group 2. The voiceless round ejective alveolar affricate /t͡sʷ'/ was removed from the list of phonemes targeted in the word naming task as many participants experienced difficulty identifying the picture used to elicit it (*'**ts**w**ts**ala'* /**t͡sʷ'**ala/ – to close). Round aspirated alveolar affricate /t͡sʰʷ/ was considered to have been mastered by Group 2 (L32 produced this phoneme as round alveolar fricative /sʷ/). Voiceless aspirated alveolar affricate /t͡sʰ/ was acquired by Group 2 in the initial word position and was produced by five of the seven participants; the other two participants (EL3 and EL6) would not produce the word used to target this sound word-initially (*'**tsh**olola'* /**t͡sʰ**ʊlʊla/ spill). The voiceless round aspirated latero-alveolar affricate /t͡ɬʰʷ/ was present in the inventory of three participants (L26, L28, L32), but was not considered absent in the inventories of the other four participants in Group 2, since it was not targeted in the single word naming task. One other such phoneme included voiceless aspirated palato-alveolar affricate /t͡ʃʰ/, and was produced by one participant (L32). The aspirated velar affricate /k͡xʰ/ was present in the phonetic inventory of four participants in Group 2, and the round aspirated velar affricate /k͡xʰʷ/ in three participants' inventories. Despite not being present in the inventories of up to four participants in this age group, both /k͡xʰ/ and /k͡xʰʷ/ were not considered absent from Group 2 since many participants produced /k͡xʰ/ as /kʰ/. This substitution is a feature of the Sekwêna variety. In addition to this type of substitution, one participant's (EL3) response differed from those of his peers – six participants identified the picture stimuli as *'**kg**êila'* /**k͡xʰ**ɛịla/ (to tear), while EL3 identified it as *'**g**agola'* /**x**axʊla/ (to tear). Voiced palato-alveolar /d͡ʒ/ has emerged at 3;0–3;5 years and was produced by four of the seven participants in the initial word position. The remaining three participants (L26, L28 and EL28) produced voiced alveolar affricate /d͡z/ in place of palato-alveolar /d͡ʒ/.

Only heterorganic compound (/fj/) was produced by three participants aged 3;0–3;5 years. Furthermore, consonant clusters were found in the inventories of six participants in Group 2. These include ejective /s/ clusters (/sp'/ /st'/ /sk'/), aspirated /s/ cluster (/sk^{h}/), combinations of /s/ and fricatives (/sf/ /sx^{w}/), /d/ clusters /dr/ /dl/, as well as /tr/. The presence of consonant clusters was noted in the inventory of some participants in a younger age group (Group 1) and is likely indicative of an emerging fourth syllable structure (CC) in the Setswana sound system. Production of clusters occurred in both loan words (*'**seti**lô'* /**sɪt'i**lɔ/ chair → /**st'i**lɔ/, which is derived from the Afrikaans word 'stoel') and non-loan words (*'**segwa**gwa'* /**sɪx^{w}a**x^{w}a/ frog → /**sx^{w}**ax^{w}a/).

4.1.1.3.2 Penultimate syllable position

Plosives that have been mastered at 3;0–3;5 years in the penultimate syllable position include ejective /p', k'/, aspirated velar /k^{h}/, and voiced alveolar /d/. Participant EL3 produced /d/ as lateral sonorant /l/ (e.g. *'ku**d**u'* /k^{h}u**d**u/ tortoise → *'khu**l**u'* /k^{h}u**l**u/), a pattern he exhibited when producing it in the initial word position too (e.g. *'**d**ikgômo'* /**d**ik^{h}ɔmʊ/ cows → /**l**ik^{h}ɔmʊ/). Although voiceless ejective alveolar plosive /t'/ has emerged in the penultimate syllable position at 3;0–3;5 years, it has likely been acquired. The reason it was not produced by some participants is because the word used to target production of this phoneme in the penultimate syllable position was produced in a manner that altered its phonotactic structure. This in turn altered the target phoneme. For instance, two participants (EL6 and EL11) produced *'se**t**ilô'* /sɪ**t'**ilɔ/ (chair) as *'**st**ilô'* /**st'**ilɔ/. Round velar ejective plosive /k^{w}'/ was produced by two participants (EL3 and El11), but was not considered absent from other participants' phonetic inventories in the penultimate syllable position as it did not form part of the single word naming task. Voiced bilabial plosive /b/ was only produced by two participants (EL3 and EL6), but inferences about whether or not this phoneme has been acquired at this age cannot be made, as other participants identified the picture used to elicit production of this phoneme using a word that differed from the target. This was also seen in Group 1 and older age groups.

Fricatives /f, s, h, x/ and /x^{w}/ were all mastered by Group 2 (3;0–3;5 years) in the penultimate syllable position. L28 produced glottal fricative /h/ as velar /x/, and this production was accepted since such a substitution is typical in the Sekwêna variety. The reverse was noted in the speech sample of two participants (EL3 and EL11) who produced round glottal fricative /h^{w}/ in place of round velar fricative /x^{w}/ (e.g. *'se**gw**a**gw**a'* /sɪ**x^{w}**a**x^{w}**a/ frog → *'se**hw**a**hw**a'* /sɪ**h^{w}**a**h^{w}**a/) – one of these participants was noted to use these two phonemes interchangeably (e.g. *'di**gw**êtê'* /di**x^{w}**ɛt'ɛ/ carrots → *'dihwêtê'* /di**h^{w}**ɛt'ɛ/ in one instance; and *'se**gw**a**gw**a'* /sɪ**x^{w}**a**x^{w}**a/ (frog) in another instance). The round alveolar fricative /s^{w}/ has been acquired in the penultimate syllable position at 3;0–3;5 years, and was present in the inventories of five of the seven participants in Group 2. Two participants (L26 and L32) produced a word different to the one used to elicit production of round alveolar fricative /s^{w}/ – the target word was

*'le**swê**'* /lɪ**sʷ**ɛ/ (dirty) and participants identified the picture used to elicit this word as *'di**tšh**ila'* /di**t͡ʃʰ**ila/ (dirty). Although these participants' responses differed from the target word, their answers were recorded, since the words they produced are often used by speakers of this dialect. This was also noted in some participants in the younger age group (Group 1). Production of the voiceless palato-alveolar fricative /ʃ/ was not targeted in the penultimate syllable position, but was noted in the inventories of two participants (L26 and L32).

Four nasals (/m/ /n/ /ŋ/ /ɲ/) were produced by all participants in the penultimate syllable position and were therefore considered mastered by Group 2. This also included syllabic /m̩/ and /n̩/. Syllabic and non-syllabic lateral sonorant /l̩/ and /l/ were also mastered at 3;0–3;5 years. Syllabic /l̩/ was not considered absent from the inventory of the participant who did not produce it (L28), as it was not elicited as part of the assessment and was produced as a feature of the variety spoken by the participants (e.g. *'tsho**l**ola'* /t͡sʰʊ**l**ʊla/ spill → *'tsholla'* /tsʰʊl̩la/). Only one participant (L32) produced medial sonorant /w/ in the penultimate syllable position; this phoneme was not elicited but occurred as a result of L32's attempt to produce one of the words in the assessment (e.g. *'tlô**u**'* /tɬ'ɔ**u̯**/ elephant → *'tlô**w**i'* /tɬ'ɔ**w**i/). Alveolar trill /r/ has emerged at 3;0–3;5 years and was produced in the penultimate syllable position by four participants in Group 2. Two participants (EL3 and EL28) produced this phoneme as uvular /ʀ/ instead, while one participant (EL11) produced it as lateral sonorant /l/.

Setswana-speaking children appear to have mastered four affricates in the penultimate syllable position at 3;0–3;5 years. These include voiceless latero-alveolar ejective /t͡ɬ'/; voiceless alveolar ejective /t͡s'/; round voiceless alveolar ejective /t͡sʷ'/; as well as voiceless aspirated alveolar /t͡sʰ/. At this age, three affricates (aspirated latero-alveolar /t͡ɬʰ/; round aspirated alveolar /t͡sʰʷ/; and aspirated palato-alveolar /t͡ʃʰ/) were acquired. Two participants (L28 and EL3) produced aspirated palato-alveolar /t͡ʃʰ/ more anteriorly and as an alveolar phoneme (e.g. *'wa**tšh**e'* /wa**t͡ʃʰ**ɪ/ clock/watch → *'wa**tsh**e'* /wa**t͡sʰ**ɪ/). Only one participant (EL11) produced aspirated velar affricate /k͡xʰ/ in the penultimate syllable position, but this phoneme was not considered absent from the group's inventory in the penultimate syllable position as the other participants produced it as aspirated velar /kʰ/ (e.g. *'di**kg**ômo'* /di**k͡xʰ**ɔmʊ/ cows → *'di**kh**ômo'* /di**kʰ**ɔmʊ/ cows). This substitution is a common feature of the Sekwêna variety.

Heterorganic compounds were noted in the speech of all participants in the penultimate syllable position; six participants produced /pj/ and one participant (L28) produced /pt͡s'/. In addition, consonant clusters were present in the phonetic inventories of five participants and mainly included /b/ clusters. Consonant clusters produced by participants include /br/ (L28, L32, EL28) (*'um**br**ella'* /am**br**ɛla/); /bʀ/ (EL6) (*'um**br**ella'* /am**bʀ**ɛla/); and /bl/ (EL3) (*'um**br**ella'* /am**br**ɛla/) → *'am**bl**ela'* /am**bl**ɛla/). Consonant clusters were also produced in the initial word position and were noted in the inventories of some participants in Group 2. The presence of consonant clusters is likely indicative of an emerging fourth syllable structure (CC) in the Setswana sound system.

4.1.1.4 Group 3 (3;6–3;11 years)

4.1.1.4.1 Initial word position

For this age group, a consonant was considered to have emerged if it was present in the phonetic inventories of five participants; acquired if produced at least once by seven participants; and mastered if it was present in the phonetic inventories of eight of the nine participants. The consonant inventory of each participant in Group 3 is summarised in Tables 12a and 12b (Appendix O3).

Group 3 (3;6–3;11 years) acquired most phonemes in the initial word position. This is expected as the younger participants (Group 2, 3;0–3;5 years) have either acquired or mastered the majority of Setswana phonemes in the initial word position. This age group (3;6–3;11 years) has mastered nine plosives occurring in the initial word position. Participant L34 omitted a syllable containing the voiced bilabial plosive /b/ word-initially, e.g. *'**b**aesekele'* /**b**aɪsɪk'ɪlɪ/ bicycle → *'kele'* /k'ɪlɪ/. One participant (EL10) produced round alveolar ejective /tʷ'/, a phoneme that was not elicited in the assessment and therefore not marked as absent from the other participants' phonetic inventories. Another plosive that was not elicited in the assessment, but was noted in one participant's inventory (L34), was the round aspirated alveolar plosive /tʰʷ/.

Two fricatives (labio-dental /f/ and glottal /h/) were produced by at least eight participants in Group 3 in the initial word position, and have therefore been considered as mastered by children aged 3;6–3;11 years. Participant L34 produced glottal /h/ as velar /x/ (e.g. *'**h**êmpê'* /**h**ɛmpˈɛ/ shirt → *'**g**êmpê'* /**x**ɛmpˈɛ/ shirt) and this substitution was accepted as it is a typical feature of the Sekwêna variety. Velar /x/ was produced by four participants (L27, L34, EL8 and EL31), but has not been considered missing from the inventories of other participants as their responses differed from the target word. For instance, *'**g**agola'* /**x**axʊla/ (to tear) is the word that was used to elicit production of /x/ word-initially, but the responses of many participants was *'**kh**êila'* /**kʰ**ɛi̯la/ (to tear). Although the palato-alveolar fricative /ʃ/ was targeted in the initial word position, only three participants produced this phoneme. The responses given by participants when asked to name the picture used to elicit production of /ʃ/ word-initially differed from the target. The target word was *'**š**a'* /**ʃ**a/ (burning): four participants (EL10, EL19, EL21 and EL31) produced *'**fj**a'* /**fj**a/ (burning), three (L24, EL19 and EL21) produced *'**f**iša'* /**f**iʃa/ (to burn) and two participants (L24 and EL26) produced *'**šw**a'* /**ʃʷ**a/ (burning). The heterorganic compound /fj/ is a feature of the variety spoken in the region and is commonly used to substitute /ʃ/ in adult speech. This is a pattern that was noted in younger participants in Groups 1 and 2.

All nasals (including syllabic ones) were present in the inventories of many participants in Group 3 in the initial word position. This was to be expected as nasals are some of the earlier acquired phonemes in Setswana and many other languages. The nasals that have been mastered at 3;6–3;11 years and produced by all participants in Group 3 include bilabial /m/, alveolar /n/, round alveolar /nʷ/, velar /ŋ/, round velar /ŋʷ/ and palatal /ɲ/. L34 produced round alveolar /nʷ/ more posteriorly as /ŋʷ/ (e.g.

*'**nw**a'* /**n**^{w}a/ (to drink) → *'**ngw**a'* /**ŋ**^{w}a/), while L34 produced round velar /ŋ^{w}/ more anteriorly and without the rounding (e.g. *'**ngw**ana'* /**ŋ**^{w}ana/ (baby) → *'**n**ana'* /**n**ana/).

The lateral (/l/, /l^{w}/) and medial (/w/) sonorants are also amongst phonemes occurring in the initial word position that have been mastered at 3;6–3;11 years. The word used to target production of alveolar trill /r/ in the initial word position was removed from the wordlist as many participants had difficulty identifying the picture used to elicit production of this phoneme. However, this phoneme was noted in the speech of some participants – two participants produced it with and without rounding (L24 produced /r/ and EL10 produced /r^{w}/). Three participants produced this phoneme more posteriorly (i.e. as uvular trill /ʀ/) – EL8 and EL10 produced /ʀ^{w}/, while EL31 produced /ʀ/).

Three affricates have been mastered at 3;6–3;11 years, and were produced by eight of the nine participants in Group 3. These include voiceless latero-alveolar ejective /t͡ɬ'/ (L34 produced it posteriorly as ejective velar plosive /k'/); voiceless aspirated latero-alveolar /t͡ɬ^{h}/ (L34 produced it anteriorly as aspirated alveolar plosive /t^{h}/); and voiceless aspirated alveolar /t͡s^{h}/ (L34 produced this phoneme as aspirated alveolar plosive /t^{h}/). This age group has acquired voiced palato-alveolar affricate /d͡ʒ/, which was produced by seven participants. EL8 would not produce the target word when prompted and EL19 produced this phoneme anteriorly as alveolar /d͡z/. Round aspirated alveolar affricate /t͡s^{hw}/ was emerging at 3;6–3;11 years as it was produced in the initial word position by only six participants in Group 3. One of the participants (L34) produced it as round aspirated alveolar plosive /t^{hw}/ while one of the others (L27) produced it as aspirated bilabial plosive /p^{h}/. Ejective alveolar affricates /t͡s'/ and /t͡s^{w}'/ were produced by some of the participants in this group, but since these phonemes were not included in the single word naming task, they were not considered absent from this group's phonetic inventory in the initial word position. Two participants (L27 and EL31) produced ejective alveolar affricate /t͡s'/ (e.g. *'**ts**êbê'* /**t͡s'**ɛbɛ/ ear; *'**ts**uane'* /**t͡s'**uạnɪ/ chick) and three participants produced round ejective alveolar affricate /t͡s^{w}'/ (e.g. *'**tsw**ala'* /**t͡s^{w}'**ala/ close). Aspirated velar affricates /k͡x^{h}/ and /k͡x^{hw}/ were not produced by many participants in this age group, a trend that was noted for participants in Groups 1 and 2. Participants often produced these phonemes as aspirated alveolar plosives /k^{h}/ and /k^{hw}/, a substitution that is typical in the speech of speakers of the Sekwêna variety.

Many participants in Group 3 produced heterorganic compounds and /fj/ was the most frequently occurring one, as noted with the younger age groups. This phoneme was produced by four participants (EL10, EL19, EL21 and EL31). Other heterorganic compounds produced include /bj/ (EL10) and /p^{h}j/ (EL8). Additionally, consonant clusters were present in the phonetic inventories of seven participants aged 3;6–3;11 years. These included ejective /s/ clusters (/sp'/ /st'/ /sk'/), aspirated plosive /s/ clusters (/sk^{h}/), combinations of /s/ and fricatives (/sf/ /sx^{w}/); /d/ clusters (/dr/ /dʀ/ /dl/); /b/ clusters (/br/); as well as velar aspirated plosive /k^{h}/ clusters (/k^{h}r/ /k^{h}ʀ/). Alveolar fricative /s/ combinations are noted to be the most frequently occurring clusters, a pattern that was noted for the

younger age groups too. Since the presence of consonant clusters was noted in both loan and non-loan words, a CC syllable structure is likely an addition to the Setswana sound system.

4.1.1.4.2 Penultimate syllable position

At 3;6–3;11 years of age, a number of plosives occurring in the penultimate syllable position have been mastered by Setswana-speaking children. These include ejective bilabial /p'/, ejective velar /k'/ and voiced alveolar /d/, which were produced by all nine participants in Group 3. Plosives that appear to be emerging for this age group are ejective alveolar /t'/ (produced by five of the nine participants); aspirated bilabial /pʰ/ (produced by six participants); and aspirated velar /kʰ/ (produced by six participants). It is, however, likely that these consonant phonemes have been acquired at this age in the penultimate syllable position and that these findings have been affected by several factors. For instance, the word used to elicit production of ejective alveolar plosive /t'/ in the penultimate syllable position (*'se**t**ilô'* /sɪ**t'**ilɔ/ chair) was produced in a manner that altered its phonotactic structure, and in turn the target phoneme. This is a pattern that has been noted for the younger age groups too: in Group 3, seven participants produced *'se**t**ilô'* /sɪ**t'**ilɔ/ (chair) (a CV-CV-CV word) as *'**st**ilô'* /**st'**ilɔ/ (a **CCV**-CV word structure). Although this pattern was noted in the speech of seven participants, three of these participants (L27, L34 and EL10) produced ejective alveolar plosive /t'/ in the penultimate syllable position. This was due to the fact that they substituted this phoneme for other targets (e.g. *'di**ts**êbê'* /di**t͡s'**ɛbɛ/ ears → *'di**t**êbê'* /di**t'**ɛbɛ/). Six participants had aspirated velar plosive /kʰ/ in their inventories in the penultimate syllable position, but this phoneme was not marked as absent from the other participants' inventories. This was done as this consonant occurred when production of a target word (e.g. *'di**kg**ômo'* /di**k͡xʰ**ɔmʊ/ cows) differed slightly when articulated by some participants (e.g.*'di**kh**ômo'* /di**kʰ**ɔmʊ/). Both responses were accepted as correct since this substitution is common in the Sekwêna variety. Some participants (L24, L27, EL8, EL19, EL21 and EL26) produced aspirated bilabial /pʰ/ and voiced bilabial /b/ (L27 and EL10), which were not marked as missing from the group's inventory given that they did not form part of the assessment task. Some participants in this age group produced a few round ejective plosives in the penultimate syllable position – one participant (EL10) produced round alveolar ejective /tʷ'/, and three (L27, EL8, EL10) produced round velar ejective /kʷ'/. These additional round phonemes were not considered absent from the group's phonetic inventory in the penultimate syllable position as they did not form part of the single word naming task.

Fricatives /f/, /s/, /h/, /x/, and /xʷ/ were mastered by Group 3 in the penultimate syllable position and were produced by at least eight participants. As reported for previous age groups, substitution of glottal /h/ with /x/ and vice versa was accepted since it is typical for speakers of the Sekwêna variety. One participant (L34) substituted alveolar fricative /s/ with palato-alveolar /ʃ/ (e.g. *'je**s**a'* /ʤɪ**s**a/ to feed → *'je**š**a'* /ʤɪ**ʃ**a/) and this was accepted as correct since this is a typical substitution in the Sekwêna

variety. One participant (EL10) did not produce alveolar fricative /s/ or palato-alveolar fricative /ʃ/ in the penultimate syllable position, as she produced ejective alveolar plosive /t'/ in its place. The round alveolar fricative /sʷ/ was only produced by four participants in this group, but was not considered absent from the group's phonetic inventory in the penultimate syllable position. This was done for reasons described for Groups 2 and 3. This pattern was only observed in four participants (L24, L37, EL26 and EL31), who produced voiceless aspirated palato-alveolar affricate /t͡ʃʰ/ *'di**tš**h**ila'* /di**t͡ʃʰ**ila/ (dirty) instead of round alveolar fricative /sʷ/ in *'le**swê**'* /lɪ**sʷ**ɛ/ (dirty). One participant (EL10) produced a round ejective alveolar plosive /tʷ'/ in place of the round alveolar fricative /sʷ/ (e.g. /ma**tʷ'**ɛ/). Production of the palato-alveolar fricative /ʃ/ was not targeted in the penultimate syllable position, but was noted in the inventories of six participants (L24, L34, EL8, EL19, EL26 and EL31).

Three nasals /m/, /n/ and /ɲ/ were produced by all participants aged 3;6–3;11 years in the penultimate syllable position, and were considered mastered by Group 3. Lateral sonorant /l/ has also been mastered in the penultimate syllable position. Six participants in Group 3 (L27, L34, EL19, EL21, EL26 and EL32) had syllabic lateral sonorant /l̩/ in their inventories, which was not elicited as part of the assessment and was produced as a feature of the variety spoken by the participants (e.g. *'tsho**l**ola'* /t͡sʰʊ**l**ʊla/ spill → *'tsho**ll**a'* /tsʰʊ**l̩**la/). Alveolar trill /r/ was missing from Group 3's phonetic inventory and was produced in the penultimate syllable position by four participants – three participants (EL19, EL26 and EL31) produced this phoneme as uvular trill /ʀ/, while two participants (L34 and EL21) produced /l/ in place of /r/.

Group 3 has mastered production of five affricates in the penultimate syllable position. These include: voiceless ejective latero-alveolar /t͡ɬ'/; voiceless ejective alveolar /t͡s'/; round voiceless ejective alveolar /t͡sʷ'/; voiceless aspirated latero-alveolar /t͡ɬʰ/; and voiceless aspirated palato-alveolar /t͡ʃʰ/. The round voiceless aspirated alveolar affricate /t͡sʰʷ/ has emerged at 3;6–3;11 years in the penultimate syllable position and was produced by five participants in Group 3. It should be noted that voiceless aspirated alveolar affricate /t͡sʰ/ and round /t͡sʰʷ/ were not targeted in the single word naming task in the penultimate syllable position. Aspirated velar affricate /k͡xʰ/ was produced by only three participants (EL8, EL21 and EL26) in the penultimate syllable position. This phoneme was not marked as missing from the rest of the group's inventory since it was produced as aspirated plosive /kʰ/ by the other participants, a substitution that is typical in the Sekwêna variety.

Furthermore, participants in this age group (3;6–3;11 years) produced heterorganic compounds in the penultimate syllable position – /pj/ was common and was produced by eight participants, while /ps/ was produced by one participant (EL8). As with the younger age groups, participants in Group 3 (3;6–3;11 years) produced consonant clusters in the penultimate syllable position. These included /sk'/ (EL8, EL19, EL21 and EL26) and /br/ (EL10, EL19, EL26 and EL31), which was produced as /bl/ by one participant (L34). The presence of a fourth syllable structure (i.e. consonant clusters) has been noted

in the initial word position and penultimate syllable position for this group (Group 3), as well as the younger age groups.

4.1.1.5 Group 4 (4;0–4;5 years)

4.1.1.5.1 Initial word position

A consonant was considered to have been acquired if 11 of the 14 participants in Group 4 had it in their phonetic inventory, and mastered if present in the inventories of 13 participants. The consonant inventory of each participant in Group 4 is summarised in Tables 13a and 13b (Appendix O4).

The majority of the consonants targeted in the initial word position have either been acquired or mastered by Group 4 (4;0–4;5 years). Eight plosives, namely ejective /p', t', k'/, and /kʷ'/; aspirated /tʰ/ and /kʰ/; and voiced /b/ and /d/, have been mastered. Other consonants mastered by Group 4 in the initial word position include fricatives /f/, /s/ and /h/; nasals /m/, /n/, /nʷ/, /ŋ/, /ŋʷ/ and /ɲ/; lateral /l/, /lʷ/ and medial /w/ sonorants; as well as five affricates. The affricates that have been mastered word-initially at 4;0–4;5 years are voiceless ejective latero-alveolar /t͡ɬ'/; voiceless aspirated latero-alveolar /t͡ɬʰ/; voiceless aspirated alveolar /t͡sʰ/; round voiceless aspirated alveolar /t͡sʰʷ/; and voiced palato-alveolar /d͡ʒ/. Glottal fricative /h/ has been acquired by this age group and was produced by twelve participants. The three participants who did not have it in their phonetic inventories produced it as velar fricative /x/ (e.g. *'**h**êmpê'* /**h**ɛmp'ɛ/ shirt → *'**g**êmpê'* /**x**ɛmp'ɛ/ shirt), and this substitution was accepted as it is typical in the Sekwêna variety. Voiceless aspirated bilabial plosive /pʰ/ and round voiceless aspirated latero-alveolar affricate /t͡ɬʰʷ/ were present in the inventories of some participants, but were not considered missing from the group's phonetic inventory in the initial word position as they were not targeted in the assessment. The palato-alveolar fricative /ʃ/ has emerged for Group 4 and was produced word-initially by seven participants. It is likely that this consonant phoneme has been acquired or even mastered at this age since participants who did not produce it used a word different to the target. This was also seen in younger age groups. Velar fricative /x/ was produced by three participants (EL9, EL29 and EL30), but was not considered missing from the inventories of other participants because their responses differed from the target word (e.g. the word *'**g**agola'* /**x**axʊla/ (to tear) was produced as *'**kh**êila'* /**kʰ**ɛi̯la/ (to tear), or *'**kh**ahola'* /**kʰ**ahʊla/). This was also noted for the younger age groups. Production of alveolar trill /r/ was not targeted in the initial word position as the picture used to elicit it was abandoned since it was not recognised by participants (the target word was *'**r**rê'* /**r̥**rɛ/ father). However, this phoneme was produced by one participant (EL13), and two other participants (L35 and EL9) who attempted to produce the sound substituted it with the posterior uvular trill /ʀ/.

The aspirated velar affricates /k͡xʰ/ and /k͡xʰʷ/ were not produced by many participants in Group 4, but were not considered missing from the group's inventory in the initial word position. Seven

participants produced /k͡xʰ/ as /kʰ/, a substitution which is typical of speakers of the Sekwêna variety, while many participants identified the picture used to target /k͡xʰʷ/ (*'**kgw**eetsa'* /**k͡xʰʷ**ɛts'a/ drive) using a different word (*'rêila'* /rɛila/ drive). Other phonemes that were produced by some participants and were not targeted in the assessment included voiceless ejective alveolar affricates /t͡s'/ and /t͡sʷ'/. Round voiceless ejective alveolar affricate / t͡sʷ'/ can therefore be considered as having emerged word-initially at 4;0–4;5 years. The presence of heterorganic compounds in the inventories of many participants in the word initial position was noted for Group 4, with /fj/ being the most frequently occurring (/fj/ was produced by four participants and /fsj/ was produced by one participant). In addition, the presence of a fourth syllable structure was demonstrated by the group's use of consonant clusters in the initial word position. The /s/ clusters were the most common clusters produced by participants and include combinations with ejective plosives (/sp'/ /st'/ /sk'/); aspirated plosives (/skʰ/); and fricatives (/sf/ /sxʷ/). Other clusters included /pʀ/, /kʰr/, /bʀ/, /dr/ and /gr/.

4.1.1.5.2 Penultimate syllable position

A large number of consonants occurring in the penultimate syllable position were mastered by Group 4 (4;0–4;5 years). These include plosives (ejective /p'/ /k'/, aspirated /pʰ/ /kʰ/, and voiced /d/); fricatives (/f/ /s/ /h/ /x/ /xʷ/); nasals (/m/ /n/ /ŋ/ /ɲ/); lateral sonorant /l/; as well as affricates (ejective /t͡ɬ'/ /t͡s'/ /t͡sʷ'/, and aspirated /t͡ɬʰ/ /t͡ʃʰ/). The ejective alveolar plosive /t'/ was only produced by four participants, but was not considered a challenging phoneme for this group as many participants produced the word used to elicit it in the penultimate syllable position differently (e.g. *'se**t**ilô'* /sɪ**t'**ilɔ/ chair → *'**st**ilô'* /**st'**ilɔ/). This pattern was observed in production of this word by participants in the younger age groups. It should be noted that aspirated alveolar affricates /t͡sʰ/ and /t͡sʰʷ/ were present in the inventories of a number of participants, although they were not elicited in the assessment. Voiceless aspirated alveolar /t͡sʰ/ had, however, emerged in the penultimate syllable position, together with round alveolar fricative /sʷ/ at 4;0–4;5 years and were produced by nine of the fourteen participants in Group 4. Although marked as emerging in the penultimate syllable position, round alveolar fricative /sʷ/ is likely acquired by this older age group, for reasons described for previous age groups (Groups 1, 2 and 3 – sections 4.1.1.2.2, 4.1.1.3.2, 4.1.1.4.2). This pattern was observed in seven participants (L2, L4, EL9, EL13, EL16, EL29 and EL30), who produced /t͡ʃʰ/ *'di**tš**hila'* /di**t͡ʃʰ**ila/ (dirty) instead of /sʷ/ *'le**sw**ê'* /lɪ**sʷ**ɛ/ (dirty). Alveolar trill /r/ was present in the inventories of seven participants (L4, L21, L35, EL13, EL16, EL17-2 and EL20) and was considered emerging at 4;0–4;5 years – the other participants in Group 4 (L1, L20, L35, EL13, EL16, EL17-1, EL17-2, EL29 and EL30) produced it as uvular trill /ʀ/. Round ejective velar plosive /kʷ'/ was produced by two participants (EL9 and EL13) and round aspirated latero-alveolar affricate /t͡ɬʰʷ/ was produced by one participant (L4), but these phonemes were not marked as missing from the group's inventory in the penultimate syllable position since they were not targeted in the assessment. Two participants (L1 and L2) produced palato-alveolar fricative /ʃ/ in

the penultimate syllable position and two (L21 and EL17-1) produced round palato-alveolar fricative /ʃʷ/, phonemes that were not considered missing from the group's phonetic inventory as they were not targeted in the assessment in the penultimate syllable position.

Voiceless aspirated velar affricate /k͡xʰ/ was only produced by two participants (EL9 and EL17-1), but was not marked as missing from the group's inventory as many participants often produced this phoneme as voiceless aspirated velar plosive /kʰ/. Finally, participants in Group 4 produced heterorganic compounds and consonant clusters in the penultimate syllable position too. The heterorganic compound frequently used in the penultimate syllable position is /pj/ (ten participants), followed by /pt͡s'/. The consonant cluster that is present in this group inventory in the penultimate syllable position include /sk'/ and it was produced by twelve participants. Other clusters that were produced by some participants include /br/ (produced by eleven participants) and /bl/ (produced by two participants).

4.1.1.6 Group 5 (4;6–4;11 years)

4.1.1.6.1 Word initial position

A consonant was considered to have been acquired if seven of the ten participants in Group 5 had it in their phonetic inventory, and mastered if present in the inventories of eight participants. The consonant inventory of each participant in Group 5 is summarised in Tables 14a and 14b (Appendix O5).

Group 5 (4;6–4;11 years) has mastered the majority of consonants occurring in the initial word position. These included plosives (ejective /p'/ /t'/ /k'/ /kʷ'/, aspirated /tʰ/ /kʰ/, and voiced /b/ /d/); fricatives (/f/ /s/ /h/); nasals (/m/ /n/ /nʷ/ /ŋ/ /ŋʷ/ /ɲ/); sonorants (lateral /l/ /lʷ/, and medial /w/); as well as affricates (ejective /t͡ɬ'/, aspirated /t͡ɬʰ/ /t͡sʰ/ /t͡sʰʷ/ and voiced /d͡ʒ/). Voiceless aspirated velar affricate /k͡xʰ/ was produced by seven participants in Group 5 and was marked as an acquired consonant phoneme for this age group. Voiceless aspirated bilabial plosive /pʰ/ was produced by three participants (L13, L18 and EL15) and one participant (EL14) produced round voiceless aspirated velar plosive /kʰʷ/ in the initial word position. These two phonemes were not marked as missing from the group's inventory word-initially as they did not form part of the phonemes that were elicited in the assessment. Voiceless palato-alveolar fricative /ʃ/ was present in the inventory of only one participant (EL24) word-initially and was not considered missing from the inventories of other participants. The reason for this is similar to what has been described for other age groups – the word *'ša'* /ʃa/ (burning) was identified as *'fya'* /fja/ (burning) or *'fiša'* /fiʃa/ (to burn) by many participants. Round voiceless aspirated velar affricate /k͡xʰʷ/ was produced by one participant (EL15). The velar affricate was not marked as missing from the group's inventory word-initially since many participants produced it as voiceless aspirated plosive /kʰ/, a substitution that is common in the Sekwêna variety. Other phonemes that were not elicited in the

assessment but were produced by some participants in this age group (4;6–4;11 years) in the initial word position include voiceless ejective alveolar affricates /t͡sʼ/ (EL14 and EL15) and /t͡sʷʼ/ (EL14, EL22 and EL24), as well as aspirated palato-alveolar affricate /t͡ʃʰ/ (L29).

In addition, the presence of heterorganic compounds and consonant clusters was noted in the inventories of some participants in the initial word position. Heterorganic compound /fj/ was the only compound produced word-initially and was produced by five participants. Consonant combinations starting with alveolar fricative /s/ were the most common in Group 5's speech, a trend that was reported for the younger age groups. This age group (4;6–4;11 years) had /stʼ/ in their inventory in the initial word position, which was produced by nine of the ten participants. Other clusters that were present in the inventories of some participants include /spʼ/, /skʼ/, /skʰ/, /sf/, /sxʷ/, /kʰr/ and /dr/ (sometimes produced as /dʁ/). The presence of so many consonant combinations support the proposition of an additional syllable structure (CC) in the Setswana sound system.

4.1.1.6.2 Penultimate syllable position

Many consonants occurring in the penultimate syllable position have been mastered at 4;6–4;11 years and were present in many participants' phonetic inventories. These include plosives (ejective /pʼ/ /kʼ/, aspirated /pʰ/ /kʰ/, and voiced /d/); fricatives (/f/ /s/ /h/); nasals (/m/ /n/ /ŋ/ /ɲ/); lateral sonorant (/l/); as well as affricates (ejective /t͡ɬʼ/ /t͡sʼ/ /t͡sʷʼ/ and aspirated / t͡ɬʰ/ /t͡ʃʰ/ /t͡sʰʷ/). Voiceless alveolar ejective plosive /tʼ/ was only produced by two participants in the penultimate syllable position. Since this phoneme is one of the earliest acquired sounds in Setswana, it was not considered missing from this age group's (4;6–4;11 years) inventory. The reason it was not produced by many participants in Group 5 is similar to that reported for the younger age groups. Participants produced the target word *'se**t**ilô'* /sɪ**tʼ**ilɔ/ (chair) as *'sti**l**ô'* /stʼi**l**ɔ/ (chair) – this not only changed the target phoneme from an ejective plosive (/tʼ/) to lateral sonorant (/l/), but also altered the structure of the word from CV-CV-CV to CCV-CV. Voiceless velar fricatives /x/ and /xʷ/ were produced by up to eight participants in the penultimate syllable position in Group 5 and were marked as acquired at 4;6–4;11 years. Some participants produced them as glottal fricative /h/ and /hʷ/. This substitution has been noted in other age groups, and is common in speakers of the Sekwêna variety. Only three participants produced round alveolar fricative /sʷ/ in the penultimate syllable position, but it was not considered a challenging phoneme for this age group. The reason for this is because many participants produced a word different to the one used to elicit production of /sʷ/ – the target word was *'le**swê'*** /lɪ**sʷ**ɛ/ (dirty) and participants identified the picture used to elicit this word as *'di**tšh**ila'* /di**t͡ʃʰ**ila/ (dirty). Although these participants' responses differed from the target word, their answers were recorded since the words they produced are often used by speakers of this variety. Alveolar trill /r/ was produced by four participants in the penultimate syllable position and was sometimes substituted with velar trill /ʁ/. In addition, the

voiceless aspirated velar affricate /k͡xʰ/ was only produced by two participants in the penultimate syllable position, but was not marked absent from the group's inventory as it was produced as a plosive (/kʰ/) by many participants. A number of phonemes that were not elicited in the speech assessment were present in the inventories of some participants in the penultimate syllable position. These include voiced bilabial plosive /b/, palato-alveolar fricative /ʃ/, syllabic lateral sonorant /l̩/, and voiceless aspirated alveolar affricate /t͡sʰ/.

The presence of heterorganic compounds and consonant clusters were noted in the penultimate syllable position, as reported for Groups 1 to 4. The heterorganic compounds produced by participants in Group 5 include /pj/, /pt͡sʼ/, /pt͡ʃʼ/, /bj/ and /fj/. Furthermore, consonant clusters that were produced in the penultimate syllable position include /skʼ/, /skʼl/ and /br/, which was sometimes produced as /bʀ/. Production of consonant clusters supports the hypothesis of presence of a CC syllable structure in the Setswana sound system.

4.1.1.7 Group 6 (5;0–5;5 years)

4.1.1.7.1 Initial word position

A consonant was considered to have been acquired if six of the eight participants in Group 6 had it in their phonetic inventory, and mastered if present in the inventories of seven participants. The consonant inventory of each participant in Group 6 is summarised in Tables 15a and 15b (Appendix O6).

Group 6 has mastered all consonants elicited in the initial word position. Although the voiceless aspirated velar affricate /k͡xʰ/ was only produced by one participant (EL23), it was not considered missing from the group's phonetic inventory in the initial word position. This phoneme was produced as voiceless aspirated alveolar plosive /kʰ/ by many participants, and this substitution was accepted since it commonly occurs in the speech of the Sekwêna variety. Other phonemes that were noted in the inventories of some participants include voiceless aspirated bilabial plosive /pʰ/; round voiceless aspirated alveolar plosive /tʰʷ/; voiceless ejective alveolar affricate /t͡sʼ/ and /t͡sʷʼ/; and voiceless aspirated palato-alveolar /t͡ʃʰ/.

Six participants in this age group (5;0–5;5 years) produced the heterorganic compound /fj/ in the initial word position. Similar to the younger age groups, a number of consonant clusters were present in Group 6's inventory word-initially. Only /spʼ/ is present in all the participants' inventories in the word initial position. The other consonant clusters produced include /stʼ/, /skʼ/, /skʰ/, /sf/, /sxʷ/, /kʰr/ (sometimes produced as /kʰʀ/), as well as /dr/ (sometimes produced as /dʀ/).

4.1.1.7.2 Penultimate syllable position

Most consonants elicited in the penultimate syllable position were mastered in this age group's (5;0–5;5; years) phonetic inventory. Alveolar trill /r/ has emerged at 5;0–5;5 years in the penultimate syllable position and was produced by four participants. This phoneme was sometimes produced as uvular trill /ʀ/ and was present in the phonetic inventories of five participants. Only two participants produced voiceless ejective alveolar plosive /t'/ in the penultimate syllable position, but this phoneme was not deemed as challenging for this age group for reasons stated for the younger age groups. Other phonemes that were not produced by many participants, but were not considered a challenge for them include the round voiceless alveolar fricative /sʷ/ (only produced by four participants in Group 6) and voiceless aspirated velar affricate /k͡xʰ/ (only produced by one participant). This was due to the fact that the picture used to elicit the word with /sʷ/ in the penultimate syllable position was identified using a different word, which had /t͡ʃʰ/ instead (*'le**swê**'* /lɪ**s**ʷɛ/ dirty →*'di**tšh**ila'* /di**t͡ʃʰ**ila/ dirty). In addition, voiceless aspirated velar affricate /k͡xʰ/ was substituted with voiceless aspirated velar plosive /kʰ/, a common substitution in the Sekwêna variety. Participants in Group 6 also produced a few consonants that were not elicited in the penultimate syllable position. These phonemes include plosives (voiceless aspirated /tʰ/, and voiced /b/ /g/); voiceless palato-alveolar fricative /ʃ/; syllabic lateral sonorant /l̩/; and voiceless aspirated alveolar affricates (/t͡sʰ/ /t͡sʰʷ/).

Heterorganic compounds and consonant clusters were produced by a number of participants in Group 6. Heterorganic compound /pj/ was produced by six participants in the penultimate syllable position and /pt͡s'/ was produced by one participant. The consonant cluster that occurred most frequently is /sk'/ and was produced by six participants. This was followed by /br/ (sometimes produced as /bʀ/ and /bl/). Other consonant clusters produced in the penultimate syllable position are /st'/ and /pl/, which were each produced by one participant.

4.1.1.8 Group 7 (5;6–5;11 years)

4.1.1.8.1 Initial word position

A consonant was considered to have been acquired if three of the five participants in Group 7 had it in their phonetic inventory, and mastered if present in the inventories of four participants. The consonant inventory of each participant in Group 7 is summarised in Tables 16a and 16b (Appendix O7).

Almost all consonants elicited in the initial word position were mastered by Group 7. Other phonemes that were present in the inventories of some participants are voiceless aspirated bilabial plosive /pʰ/, voiced labio-dental fricative /v/, round voiceless palato-alveolar /ʃʷ/, and voiceless alveolar ejective affricates /t͡s'/ and /t͡sʷ'/. The voiceless aspirated velar affricate /k͡xʰ/ was only produced by two

participants, but not considered absent from the group's inventory in the initial word position as some participants produced it as aspirated /kʰ/, a substitution that is common in the Sekwêna variety.

Heterorganic compounds and consonant clusters were produced by some participants in the initial word position. Two heterorganic compounds were produced word-initially; /fj/ was produced by three participants and /fsj/ was produced by one participant. Consonant clusters produced included /sp'/, /st'/, /skʰ/, /sf/, /sk͡xʰ/, /kʰr/ (sometimes produced as /kʰʀ/), /dr/ (sometimes produced as /dʀ/), as well as /bl/.

4.1.1.8.2 Penultimate syllable position

Many consonants were produced in the penultimate syllable position and have been mastered at 5;6–5;11 years. Although voiceless velar fricatives /x/ and /xʷ/ were not produced by all participants, they were marked as present in the group's inventory in the penultimate syllable position as some participants produced them as glottal fricatives /h/ and /hʷ/. This substitution was accepted as accurate since it is typical in the speech of many speakers of the Sekwêna variety. Other phonemes that were present in the inventories of some participants in the penultimate syllable position are voiceless ejective alveolar plosive /t'/, voiceless aspirated plosives /pʰ/ and round /kʰʷ/, voiced bilabial plosive /b/, voiceless palato-alveolar fricative /ʃ/, uvular trill /ʀ/, syllabic lateral sonorant /l̩/, round voiceless ejective affricate /t͡ʃʷ'/, voiceless aspirated palato-alveolar affricate /t͡sʰ/ and voiced affricate /d͡ʒ/.

Heterorganic compound /pj/ is present in this age group's inventory in the penultimate syllable position and was produced by five participants. Furthermore, two consonant clusters were present in some of the participants' inventories in the penultimate syllable position. These are /sk'/ and /br/ (produced as /bʀ/ by one participant).

4.1.1.9 Group 8 (6;0–6;5 years)

4.1.1.9.1 Initial word position

A consonant was considered to have been acquired if three of the five participants in Group 8 had it in their phonetic inventory, and mastered if present in the inventories of four participants. The consonant inventory of each participant in Group 8 is summarised in Tables 17a and 17b (Appendix O8).

All the consonant phonemes that were elicited in the initial word position have been mastered at 6;0–6;5 years and are present in the inventories of at least four participants in Group 8. One participant (L14) produced voiceless velar fricative /x/ in place of glottal fricative /h/ (e.g. *'**h**êmpê'* /**h**ɛm̩p'ɛ/ shirt → *'**g**êmpê'* /**x**ɛm̩p'ɛ/ shirt), and this substitution was accepted as it is common in the

Sekwêna variety. Voiceless aspirated velar affricate /k͡xʰ/ was produced by one participant, but was not considered missing from the group's inventory word-initially as other participants substituted it with voiceless aspirated velar plosive /kʰ/. This substitution is also common in speakers of the Sekwêna variety. Voiceless aspirated palato-alveolar affricate /t͡ʃʰ/ was not targeted in the initial word position, but was present in one participant's phonetic inventory.

The use of heterorganic compounds in the initial word position was not as frequent for Group 8 as it was for the other age groups. Two participants had /fj/ in their phonetic inventories. In addition, the use of consonant clusters was also noted in this oldest age group (6;0–6;5 years) of children, with /sp'/ and /st'/ present in Group 8's inventory. Other consonant clusters that were produced by participants but were not present in the group's inventory word-initially include /sk'/, /skʰ/, /spʰ/, /st͡ɬʰ/, /skʷ'/, /pr/, /sf/, /kʰr/, as well as /dr/ (sometimes produced as /dʀ/).

4.1.1.9.2 Penultimate syllable position

This older group of children (6;0–6;5 years) have mastered more phonemes in their inventory in the penultimate syllable position. Some phonemes that were elicited, but not produced in the penultimate syllable position by all participants included voiceless ejective alveolar plosive /t'/ and voiceless aspirated velar affricate /k͡xʰ/. Both of these phonemes were not considered challenging for this group of children as the word used to elicit production of /t'/ was produced differently by participants (e.g. *'se**t**ilô'* /sɪ**t'**ilɔ/ chair → *'**st**ilô'* /**st'**ilɔ/), a pattern that was observed across the age groups. In addition, many participants produced affricate /k͡xʰ/ as voiceless aspirated velar plosive /kʰ/, a substitution that is common for the Sekwêna variety. Other phonemes that were not elicited but were produced by some participants in the penultimate syllable position include voiced bilabial plosive /b/, voiceless palato-alveolar fricative /ʃ/, voiced labio-dental fricative /v/, and uvular trill /ʀ/.

As noted in younger participants, heterorganic compounds and consonant clusters were present in the inventories of some participants in Group 8 in the penultimate syllable position. Heterorganic compound /pj/ was present in this age group's inventory and was produced by all participants. Consonant clusters that were noted in Group 8 include /sk'/, /br/ (sometimes produced as /bʀ/ or bl), as well as /skʰ/.

The independent analysis for the Setlhaping variety is provided next.

4.2 Section 2: Independent Analysis – Setlhaping

4.2.1 Consonants

Due to the limited sample size for the group for the Setlhaping variety, findings for participants in Groups 9 (3;6–3;11), 10 (4;6–4;11) and 11 (5;0–5;11) have all been summarised in Tables 19a and 19b. There was one participant (S3) in Group 9, three (S1, GD3, GD6) in group 10, and one (B1) in Group 11. Following a summary of this data, results obtained from children aged 5;6–5;11 years are provided in Tables 20a and 20b.

Table 19a. Phonetic inventory in the initial word position: 3;6–5;5 years (Setlhaping variety)

	Manner	S3	S1	GD3	GD6	B1
Plosives	Ejective	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’
	Aspirated	pʰ tʰ kʰ	pʰ tʰ kʰ	pʰ tʰ kʰ	pʰ tʰ kʰ	pʰ tʰ kʰ
	Voiced	b d	b d	b d	b d	b d
	Fricatives	f s ʃ x h	s ʃ x h	s ʃ x h	s ʃ x h	s ʃ x h
	Nasals	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ
	Trill	r rʷ	rʷ ʀ	ʀ ʀʷ	ʀʷ	r rʷ
	Lateral	l	l	l	l	l
	Glides	w	w	w	w	w
Affricates	Ejective	t͡ɬ’	t͡ɬ’ t͡ʃʷ’	t͡ɬ’	t͡ɬ’	t͡ɬ’ t͡ʃʷ’
	Aspirated	t͡ɬʰ t͡ʃʰ t͡ʃʰʷ k͡xʰ	t͡ɬʰ t͡ʃʰ t͡ʃʰʷ k͡xʰ	t͡ɬʰ t͡ʃʰ t͡ʃʰʷ k͡xʰ	t͡ɬʰ t͡ʃʰ t͡ʃʰʷ k͡xʰ	t͡ɬʰ t͡ʃʰ k͡xʰ k͡xʰʷ
	Voiced	ʤ	ʤ	ʤ		ʤ
	Clusters	st’ sk’ skʰ sf sxʷ	sp’ st’ sk’ skʰ sxʷ	sk’ skʰ sxʷ	sp’ st’ sk’ skʰ sk͡xʰ sxʷ dr gj	st’ sk’ skʰ sxʷ dr

All consonant phonemes elicited word-initially were present in the youngest participant’s phonetic inventory (S3). This can be expected given her age (3;7 years), and preliminary findings have shown that majority of Setswana phonemes are likely acquired earlier than 3;0 years (this finding was seen in young participants in the group of children speaking the Sekwêna variety in the current study). Decisions on whether phonemes were considered to have emerged, developed or mastered were not made due to the limited sample size in the group of children acquiring the Setlhaping variety. The youngest participant had alveolar trill /r/ and /rʷ/ in her phonetic inventory. This phoneme was, however,

absent in the inventories of some of the older participants, who instead had the more posterior uvular trill /ʀ/ and /ʀʷ/ in their inventories. Voiceless labio-dental fricative /f/ was not considered missing from the inventories of children in the Setlhaping group as they produced the target *'**f**utswêla'* /**f**ut͡sʷ'ɛla/ (blow), as '**b**utšwêla' /**b**ut͡ʃʷ'ɛla/. Their response was not considered incorrect as it is a difference seen in adults who speak this variety and was accepted. Other differences that were noted as features of the Setlhaping variety include production of voiceless alveolar affricate /t͡s'/ and /t͡sʰ/ as voiceless palato-alveolar /t͡ʃ'/ and /t͡ʃʰ/ (e.g. *'**tshw**êne'* /**t͡sʰʷ**ɛnɪ/ monkey → *'**tšhw**êne'* /**t͡ʃʰʷ**ɛnɪ/). Although two participants had voiceless ejective round affricate /t͡ʃʷ'/ in their inventories in the initial word position, these were not considered missing from other participants' inventories as they were not targeted during the single word naming task.

All affricates were present in these participants' inventories word-initially. One participant did not produce voiced palato-alveolar /ʤ/, which was not marked as missing since he produced this phoneme as /ɟj/. For instance, *'jesa'* /ʤɪsa/ (to feed) → /ɟjɪsa/. This is also another difference seen in some speakers of the Setlhaping variety. Similar to those speaking the Sekwêna variety, children in the group for the Setlhaping variety had a number of consonant clusters in their phonetic inventories word-initially. These were noted for loan words (*'**seti**lô'* /**sɪt'i**lɔ/ chair → /**st'i**lɔ/, which is derived from the Afrikaans word 'stoel') and non-loan words (*'**segwa**gwa'* /**sɪxʷa**xʷa/ frog → /**sxʷ**axʷa/). This further supports the proposition of a fourth syllable structure (one with consonant clusters), in Setswana.

Table 19b summarises the phonetic inventory of those aged 3;6–5;5 years in the penultimate syllable position.

Table 19b. Phonetic inventory in the penultimate syllable: 3;6–5;5 years (Setlhaping variety)

	Manner	S3	S1	GD3	GD6	B1
Plosives	Ejective	pʼ kʼ	pʼ tʷʼ kʼ	pʼ tʼ kʼ	pʼ kʼ	pʼ tʼ tʷʼ kʼ kʷʼ
	Aspirated	pʰ kʰ	pʰ kʰ	pʰ kʰ	pʰ kʰ	pʰ kʰ
	Voiced	b d	d	b d	b d	b d
	Fricatives	f s ʃ ʃʷ x xʷ	f s ʃ ʃʷ x xʷ	f fʷ s ʃ x xʷ	f s ʃ x xʷ v	f s ʃ ʃʷ x xʷ
	Nasals	m n ŋ ŋʷ ɲ ɲʷ	m n ŋ ŋʷ ɲ ɲʷ	m n ŋ ŋʷ ɲ	m n ŋ ŋʷ ɲ ɲʷ	m n ŋ ɲ ɲʷ
Sonorants	Lateral	l	l	l	l	l
	Trill	r		r ʀ	r ʀ	r
Affricates	Ejective	t͡ɬʼ t͡sʼ t͡ʃʼ t͡ʃʷʼ	t͡ɬʼ t͡sʼ t͡ʃʼ t͡ʃʷʼ	t͡ɬʼ t͡sʼ t͡ʃʼ t͡ʃʷʼ	t͡ɬʼ t͡sʼ t͡ʃʼ t͡ʃʷʼ	t͡ɬʼ t͡sʼ t͡ʃʼ t͡ʃʷʼ
	Aspirated	t͡ɬʰ t͡ʃʰ t͡ʃʰʷ k͡xʰ	t͡ɬʰ t͡ʃʰ k͡xʰ	t͡ɬʰ t͡ʃʰ t͡ʃʰʷ k͡xʰ	t͡ɬʰ t͡ʃʰ t͡ʃʰʷ k͡xʰ	t͡ɬʰ t͡sʰ t͡ʃʰ t͡ʃʰʷ k͡xʰ
	Voiced					d͡ʒ
	Clusters				sk’	sk’

The children aged 3;6–5;5 years in the group for the Setlhaping variety all had phonemes that were targeted in the penultimate syllable position in their inventories. Voiceless ejective alveolar /t’/ was not considered missing from some of the participants’ inventories in the penultimate syllable position since they produced the word used to target it differently (e.g. *‘se**t**ilô’* /sɪ**t’**ilɔ/ chair → *‘**st**ilô’* /**st’**ilɔ/), a pattern that was observed in the older group of children in the Setlhaping group, as well as those in the Sekwêna group. Some participants were observed to produce voiceless round labio-dental fricative /fʷ/ and unrounded /f/ in place of voiceless round palato-alveolar /ʃʷ/ (e.g. *‘le**š**wê’* /lɪ**ʃ**ʷɛ/ dirty → *‘le**f**wê’* /lɪ**f**ʷɛ/ or *‘le**f**ê’* /lɪ**f**ɛ/). For these participants, /ʃʷ/ was not marked missing from their inventories in the penultimate syllable position since production of /ʃʷ/ and /fʷ/ is common in the speech of some adults who speak the Setlhaping variety. Round palatal /ɲʷ/ was present in some participants’ inventories and occurred when target word *‘nônyane’* /nɔɲanɪ/ (bird), was produced as *‘nyô**nyw**ane’* /ɲɔ**ɲ**ʷanɪ/. It was therefore not marked as missing from those who did not produce it in the penultimate syllable position. Two participants had alveolar trill /r/ and uvular /ʀ/, while two participants sometimes produced /r/ accurately and sometimes as /ʀ/. One participant did not produce a trill in the penultimate syllable position and since it was not targeted in this word position, it was not marked as missing from his inventory. He was, however, noted to produce /r/ in other word positions (e.g. *‘sekhu**r**umêlô’*

/skʰu**r**umɛlɔ/ lid; *'**rw**ala'* /**r**ʷala/ wear). Voiceless round aspirated palato-alveolar /t͡ʃʰʷ/ and voiced /ʤ/ were not considered missing from the inventories of participants who did not produce them. This was done as production of /t͡ʃʰʷ/ occurred when the target word *'ditšhô**šw**ane'* /dit͡ʃʰɔ**ʃ**ʷanɪ/ (ants), was produced as *'ditšhô**tšhw**ane'* /dit͡ʃʰɔ**t͡ʃ**ʰʷanɪ/. The word used to elicit production of /ʤ/ (*'bo**j**ang'* /bʊ**ʤ**aŋ̩/ grass) on the other hand, was removed from the word list when several participants in the Setlhaping group could not produce it spontaneously, even when shown two different pictures illustrating the target word. In addition, the presence of consonant clusters, specifically /sk'/, was noted in the inventories of two participants in the penultimate syllable position.

The phonetic inventories of children aged 5;6–5;11 years who speak the Setlhaping variety are summarised in Tables 20a and 20b.

Table 20a. Phonetic inventory in the initial word position: 5;6–5;11 years (Setlhaping variety)

	Manner	M1	M2	M3	M4	S2	GD1	GD2	GD4	GD5	GD7	GD8
Plosives	Ejective	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’
	Aspirated	pʰ tʰ kʰ	pʰ tʰ kʰ	pʰ tʰ kʰ	pʰ tʰ kʰ	pʰ tʰ kʰ	pʰ tʰ kʰ	pʰ tʰ kʰ	pʰ tʰ kʰ	pʰ tʰ kʰ	pʰ tʰ kʰ	pʰ tʰ kʰ
	Voiced	b d	b d	b d	b d	b d	b d	b d	b d	b d	b d	b d
	Fricatives	s ʃ x h	s ʃ x h	s ʃ x h	s ʃ x h	s ʃ x h	s ʃʷ x h	s ʃ x h	s ʃ x h	s ʃ x h	f s ʃ x h	s ʃ x h
	Nasals	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ
	Trill	r rʷ ʀ	ʀ ʀʷ	r rʷ ʀ	r ʀ ʀʷ	r rʷ	r ʀʷ	ʀ	ʀʷ	ʀ ʀʷ	rʷ	ʀ ʀʷ
	Lateral	l	l	l	l	l	l	l	l	l	l	l
	Glides	w	w	w	w	w	w	w	w	w	w	w
Affricates	Ejective	t͡ɬ’ t͡ʃʷ’	t͡ɬ’ t͡ʃʷ’	t͡ɬ’ t͡ʃʷ’	t͡ɬ’ t͡ʃʷ’	t͡ɬ’	t͡ɬ’	t͡ɬ’ t͡ʃʷ’	t͡ɬ’	t͡ɬ’	t͡ɬ’	t͡ɬ’
	Aspirated	t͡ɬʰ t͡sʰʷ t͡ʃʰ t͡ʃʰʷ k͡xʰ k͡xʰʷ	t͡ɬʰ t͡sʰʷ t͡ʃʰ t͡ʃʰʷ k͡xʰ k͡xʰʷ	t͡ɬʰ t͡ʃʰ t͡ʃʰʷ k͡xʰ k͡xʰʷ	t͡ɬʰ t͡ʃʰ t͡ʃʰʷ k͡xʰ k͡xʰʷ	t͡ɬʰ t͡ʃʰ t͡ʃʰʷ k͡xʰ	t͡ɬʰ t͡ʃʰ t͡ʃʰʷ k͡xʰ	t͡ɬʰ t͡ʃʰ t͡ʃʰʷ k͡xʰ	t͡ɬʰ t͡ʃʰ t͡ʃʰʷ k͡xʰ	t͡ɬʰ t͡ʃʰ t͡ʃʰʷ k͡xʰ	t͡ɬʰ t͡ʃʰʷ k͡xʰ k͡xʰʷ	t͡ɬʰ t͡ʃʰ t͡ʃʰʷ k͡xʰ
	Voiced	d͡ʒ	d͡ʒ	d͡ʒ	d͡ʒ	d͡ʒ		d͡ʒ		d͡ʒ	d͡ʒ	d͡ʒ
	Clusters	sk’	st’ sk’ skʰ dr	skʰ	skʰ	sp’ st’ sk’ skʰ sf sxʷ	st’ sk’ skʰ sxʷ gj	st’ sk’ skʰ dr	sp’ st’ sk’ skʰ sf sx sk͡xʰ dr	st’ sk’ skʰ sk͡xʰ sxʷ	sp’ st’ sk’ skʰ	st’ sk’ skʰ sk͡xʰ sxʷ

Almost all consonant phonemes have been mastered word-initially by children who speak the Setlhaping variety at 5;6–5;11 years. Alveolar trill /r, rʷ/ is the only phoneme that was not present in all participants' inventories in the initial word position, as it was sometimes produced posteriorly (i.e. as /ʀ, ʀʷ/). The absence of voiceless labio-dental fricative /f/ from the inventories of participants in this age group (5;6–5;11 years) word-initially was not considered unusual, a pattern observed for the younger age group (3;6–5;5 years) who speak the Setlhaping variety of Setswana. Voiceless round ejective palato-alveolar affricate /t͡ʃʷ'/was not marked missing from the phonetic inventories of participants who did not produce it word-initially since it was not targeted in the single word naming task. A variation in production of certain phonemes was noted amongst the participants. This included production of round voiceless aspirated alveolar /t͡sʰʷ/, which was commonly produced as palato-alveolar /t͡ʃʰʷ/ by those who speak the Setlhaping variety (e.g. *'**tshwê**ne'* /**t͡sʰʷ**ɛnɪ/ monkey → *'**tšhwê**ne'* /**t͡ʃʰʷ**ɛnɪ/); as well as voiced palato-alveolar /dʒ/, which was produced as /gj/ by some participants (e.g. *'**j**esa'* /**dʒ**ɪsa/ feed → /**gj**ɪsa/). Furthermore, the presence of an additional syllable structure (i.e. consonant clusters) was noted in these participants' speech. This was noted for both loan and non-loan words, a pattern observed for younger children as well as those in the Sekwêna group. It should also be noted that no big differences in the ages at which phonemes were acquired in both varieties investigated. The only differences noted were the manner in which certain words were produced (e.g. *'**tshwê**ne'* /**t͡sʰʷ**ɛnɪ/ monkey for the Sekwêna variety and *'**tšhwê**ne'* /**t͡ʃʰʷ**ɛnɪ/) for the Setlhaping variety. This was seen across the age groups and in the two word positions targeted.

Table 20b. Phonetic inventory in the penultimate syllable: 5;6–5;11 years (Setlhaping variety)

	Manner	**M1**	**M2**	**M3**	**M4**	**S2**	**GD1**	**GD2**	**GD4**	**GD5**	**GD7**	**GD8**
Plosives	Ejective	p’ t’ tʷ’ k’ kʷ’	p’ tʷ k’ kʷ’	p’ t’ tʷ’ k’ kʷ’	p’ t’ tʷ’ k’ kʷ’	p’ k’	p’ k’	p’ k’	p’ k’	p’ k’	p’ k’	p’ k’
	Aspirated	pʰ kʰ	pʰ kʰ	pʰ kʰ	pʰ kʰ	pʰ kʰ	pʰ kʰ	pʰ kʰ	pʰ kʰ	pʰ kʰ	pʰ kʰ	pʰ kʰ
	Voiced	b d	b	b d	b d	b d	b d	b d	d	b d	d	d
	Fricatives	f s ʃ ʃʷ x xʷ	f s ʃ ʃʷ x xʷ	f s ʃ ʃʷ x xʷ	f s ʃ ʃʷ x xʷ	f s ʃ ʃʷ x xʷ	f fʷ s ʃ h x xʷ	f s ʃ ʃʷ x xʷ	f s ʃ ʃʷ x xʷ	f s ʃ ʃʷ x xʷ	f s ʃ ʃʷ x xʷ	f s ʃ ʃʷ x xʷ
	Nasals	m n ŋ ŋʷ ɲ ɲʷ	m n ŋʷ ɲ ɲʷ	m n ŋ ŋʷ ɲ	m n ŋ ŋʷ ɲ ɲʷ	m n ŋ ŋʷ ɲ ɲʷ	m n ŋ ŋʷ ɲ	m n ŋ ŋʷ ɲ ɲʷ	m n ŋ ŋʷ ɲ	m n ŋ ŋʷ ɲ	m n ŋ ŋʷ ɲ	m n ŋ ŋʷ ɲ ɲʷ
Sonorants	Lateral	l	l l̩	l	l	l	l j	l	l j	l	l j	l
	Trill	ʀ	r ʀ	ʀ	r ʀ	ʀ	ʀ	r ʀ	r	ʀ		ʀ
Affricates	Ejective	t͡ɬ’ t͡s’ t͡ʃ’ t͡ʃʷ’	t͡ɬ’ t͡s’ t͡ʃ’ t͡ʃʷ’	t͡ɬ’ t͡s’ t͡ʃ’ t͡ʃʷ’	t͡ɬ’ t͡s’ t͡ʃ’ t͡ʃʷ’	t͡ɬ’ t͡s’ t͡ʃ’ t͡ʃʷ’	t͡ɬ’ t͡s’ t͡ʃ’ t͡ʃʷ’	t͡ɬ’ t͡s’ t͡ʃ’ t͡ʃʷ’	t͡ɬ’ t͡s’ t͡ʃ’ t͡ʃʷ’	t͡ɬ’ t͡s’ t͡ʃ’ t͡ʃʷ’	t͡ɬ’ t͡s’ t͡ʃ’ t͡ʃʷ’	t͡ɬ’ t͡s’ t͡ʃ’ t͡ʃʷ’
	Aspirated	t͡ɬʰ t͡sʰ t͡ʃʰ t͡ʃʰʷ k͡xʰ	t͡ɬʰ t͡sʰ t͡sʰʷ t͡ʃʰ t͡ʃʰʷ k͡xʰ	t͡ɬʰ t͡sʰ t͡ʃʰ t͡ʃʰʷ k͡xʰ	t͡ɬʰ t͡sʰ t͡ʃʰ t͡ʃʰʷ k͡xʰ	t͡ɬʰ t͡ʃʰ k͡xʰ	t͡ɬʰ t͡ʃʰ t͡ʃʰʷ k͡xʰ	t͡ɬʰ t͡sʰ t͡ʃʰ t͡ʃʰʷ k͡xʰ	t͡ɬʰ t͡ʃʰ t͡ʃʰʷ k͡xʰ	t͡ɬʰ t͡ʃʰ t͡ʃʰʷ k͡xʰ	t͡ɬʰ t͡ʃʰ t͡ʃʰʷ k͡xʰ	t͡ɬʰ t͡ʃʰ t͡ʃʰʷ k͡xʰ
	Voiced	ʤ	ʤ	ʤ	ʤ							
	Clusters			br		sk’		sk’	sk’			

Almost all participants aged 5;6–5;11 years in the Setlhaping group had all phonemes elicited in the penultimate syllable position. As noted for other participants, voiceless ejective alveolar /t'/ was not considered absent in the inventories of those who did not produce it in the penultimate syllable position in this age group (5;6–5;11 years). Voiceless round ejective plosives /tʷ'/ and /kʷ'/, as well as voiced alveo-palatal affricate /ʤ/ were not marked missing from some participants' phonetic inventories in the penultimate syllable position, as the words used to elicit production of these phonemes were removed from the word list when several participants in this dialectal group found it challenging to spontaneously identify target items. Alveolar trill /r/ was not present in some participants' inventories, which was also noted in the age-matched Sekwêna group. Additionally, consonant clusters /sk'/ and /br/ were produced in the penultimate syllable position by some participants, thereby supporting the proposition of an additional syllable structure in Setswana.

4.3 Summary

This chapter provided a detailed analysis of the consonant and vowel phonemes acquired by children in the word-initial and penultimate syllable positions. This was done for those acquiring the Sekwêna and Setlhaping varieties of Setswana. Vowel phonemes were seen to have been acquired as early as 2;6–2;11 years. Consonant phonemes acquired early include plosives (ejective /p', t', k'/, aspirated /tʰ, kʰ/, voiced /b, d/), all fricatives, sonorants (lateral and medial), nasals, as well as affricates. Certain consonants still emerging at 2;6–2;11 years are mainly those with rounding (e.g. round ejective velar /kʷ'/ and round alveolar nasal /nʷ/), and this trend was noted in both the word-initial and penultimate syllable positions. For the Setlhaping variety, the youngest age group (3;6–3;11 years) had acquired all phonemes in both word positions assessed. Alveolar trill /r/ was not acquired by the oldest group acquiring the Setlhaping variety, but was seen to be used by children in both the young and older age groups in various word positions. This was also observed in children in the Sekwêna variety; although many did not have /r/ in their inventories, they were noted to produce this phoneme in other word positions and during conversation with the researcher. The next chapter details information on the accuracy with which speech was produced across the age groups for both varieties of Setswana, as well as the nature of phonological processes seen in Setswana-speaking children.

CHAPTER 5: FINDINGS – RELATIONAL ANALYSIS

This chapter provides an account of the accuracy with which Setswana-speaking children aged 2;6–6;5 years produced speech. In the first section, accuracy scores (PCC, PVC and PCC) and phonological processes are detailed for each age group in the Sekwêna group, with comparisons across the age groups subsequently made. The second section of this chapter includes relational analysis (accuracy scores and phonological processes) for the children in the Setlhaping group; the focus is largely on describing the participants' speech in relation to the target since a comparison across age groups was limited by the very small sample size. This will be followed by a comparison between the two dialects in the third section in order to note any differences in speech sound acquisition between the two groups.

5.1 Section 1: Relational Analysis – Sekwêna

This section focuses on relating participants' speech sound production to the target phonology. This is specifically done for the Sekwêna variety.

5.1.1 Accuracy Scores

The accuracy with which participants produced Setswana speech sounds is outlined in this part of the section. This is done by providing mean accuracy scores – percentage consonants correct (PCC), percentage vowels correct (PVC), and percentage phonemes correct (PPC) – obtained by children of varying ages. The accuracy scores have been presented in 12-month age bands, since making use of 6-month age bands made it challenging to define a clear pattern of progression in the use of accurate speech as children grow older. Some of the older age groups obtained lower accuracy scores than younger ones, and this was mainly due to lower scores obtained by children who were either bi/multilingual or diagnosed with a speech sound disorder (SSD). This also allowed for a bigger number of children to be compared in each group. Accuracy scores for individual participants are summarised in Appendix P. Table 21 gives a summary of accuracy scores across age groups, for children acquiring the Sekwêna variety.

Table 21. Accuracy scores (PCC, PVC and PPC): across age groups (Sekwêna variety)

	2;6–3;5 years	3;6–4;5 years	4;6–5;5 years	5;6–6;5 years
PCC (%)	88	93	95	96
PVC (%)	96	98	98	98
PPC (%)	92	95	97	97

Note: PCC – Percentage Consonants Correct; PVC – Percentage Vowels Correct; PPC – Percentage Phoneme Correct

The high PVC scores obtained by the youngest age group suggests that the accuracy with which vowels are produced is achieved as early as 2;6 years, and possibly earlier. The oldest group of children (5;6–6;5 years) produced speech more accurately than the youngest group (2;6–3;5 years). This was seen as they obtained higher PCC, PVC and PPC scores. Although the difference in the accuracy scores between 3;6–4;5 years and 5;6–6;5 years is not substantial, it is clear that consonants are produced more accurately as children grow older. Since little difference can be seen in the accuracy with which phonemes are produced by children aged 4;6–6;5 years, it can be suggested that children acquiring Setswana achieve adult-like speech as early as 4;6 years, but that they continue to make a few errors when producing a small number of phonemes beyond that point.

5.1.2 Phonological processes

In this part of the section, the phonological processes found in the speech of participants are described; this is done for each age group, after which a comparison of all eight groups is made. A child was noted as having a phonological process when s/he presented with the same error twice or more (Dodd et al., 2003). Furthermore, a phonological process was considered appropriate for an age group if present in the speech of at least 10% of participants in a single age group, and delayed if used by less than 10% of participants (Hua, 2002).

5.1.2.1 Group 1 (2;6–2;11 years)

Table 22 provides a summary of phonological processes that participants in Group 1 presented with during the single-word naming task.

Table 22. Phonological process used by participants in Group 1 (2;6–2;11 years) (Sekwêna variety)

Phonological processes	Target	L25	L31	L33	L37	EL2	EL25	EL27
Syllable deletion: /sɪ/ word-initially	**sɪ**kʰurumɛlɔ (lid)	kʰulumɛlɔ	-	kʰuḷmɛlɔ	kʰuḷmɛlɔ	kʰuʀmɛlɔ	kʰuʀmɛlɔ	kʰumɛlɔ
Assimilation (Consonant harmony)	**n**ɔɲanɪ (bird)	**ɲ**ɔɲanɪ	-	**ɲ**ɔɲanɪ	**ɲ**ɔɲʷanɪ	**ɲ**ɔɲʷanɪ	**ɲ**ɔɲanɪ	**ɲ**ɔɲanɪ
Fronting	mʊna**ŋ** (mosquito)	-	mʊna**ni**	mɪna**nɪ**	-	-	-	-
	t'ɔ**ŋk'**i (donkey)	-	-	t'ɔ**nt'**i	-	-	-	-
Stopping	**t͡ɬʰ**axʊla	-	-	**k'**axʊla	**t'**axʊla	**kʰ**axʊla		**tʰ**axʊla
Backing /r/	diạp'a**r**ɔ (clothes)	-	-	-	-	diạp'a**ʀ**ɔ	diạp'a**ʀ**ɔ	-
Specific phoneme substitution: /d/→/l/	**d**it͡sʰɔsʷanɪ (ants)	-	-	-	-	**l**it͡ʃʰɔsʷanɪ	-	-
Specific phoneme substitution: /r/→/l/	sɪkʰ**u**rumɛlɔ (lid)	kʰ**u**lumɛlɔ	skʰuḷmɛlɔ	kʰuḷmɛlɔ	kʰuḷmɛlɔ	-	-	-
	dikʰɛ**r**ɔt͡s'ɪ (carrots)	dikʰɛ**l**ɔt͡s'	dikʰɛ**l**ɔt͡s'	tʰɛ**l**ɔt͡s'	kʰɛ**l**ɔt͡s'	-	-	kʰɛ**l**ɔt͡s'
Simplifying Cʷ phonemes	**kʷ'**ɛna (crocodile)	-	-	**k'**ɛna	-	**k'**ɛna	-	**k'**ɛna
	fu**t͡sʷ'**ɛt͡s'a (blow)	-	-	-	fu**t͡s'**ɛt͡s'a	-	-	fu**t͡s'**ɛt͡s'a
Vowel substitution	k͡xʰɛị**la** (tear)	kʰɛị**lɛ**	-	-	-	-	-	-
	ṃmɔp'**u** (corn)	-	ṃmɔp'**ʊ**	ṃmɔp'**ʊ**	-	-	-	-
	ṃmɛlɛk'**ɛ** (milk)	-	-	-	-	ṃmɛlɛk'**a**	-	-

Notes: Dash indicates no processes used

Eight different phonological processes were noted in participants aged 2;6–2;11 years, and they were all considered age appropriate as they were used by more than 10% of participants in Group 1. They included deletion of syllable /sɪ/ word-initially, assimilation, fronting, stopping, backing alveolar trill /r/, specific phoneme substitution, as well as simplification of C^w phonemes. Six of the seven participants in Group 1 omitted syllable /sɪ/ in the initial word position, where it serves as a singular noun class prefix (e.g. *'**se**fapanô'* /**sɪ**fap'anɔ/ cross (n) → *'fapanô'* /fap'anɔ/). Some participants were also noted to delete syllable /lɪ/ (a singular noun class prefix) word-initially (e.g. *'**le**feelo'* /**lɪ**fɛlɔ/ broom → *'feelo'* /fɛlɔ/), as well as /sɪ/ word-medially (e.g. *'bae**seke**la'* /baị**sɪ**k'ɪla/ bicycle → *'baekela'* /baịk'ɪla/). The omission of /lɪ/ word-initially and /sɪ/ word-medially was not documented as being present in the children's speech as they occurred in isolation. Additionally, production of /baị**sɪ**k'ɪla/ (bicycle) as /baịk'ɪla/ may be due to contact with English (where the children may know the target word as 'bike').

Assimilation was noted in the speech of six participants in Group 1 (e.g. *'**n**ônyane'* /**n**ɔŋanɪ/ bird → *'**ny**ô**ny**ane'* /**ŋ**ɔ**ŋ**anɪ/). Four participants aged 2;6–2;11 years presented with stopping; for instance, voiceless aspirated latero-alveolar affricate /$\widehat{\text{tl}}^h$/ was sometimes substituted with voiceless alveolar plosive /t/ (ejective and aspirated), and other times with voiceless velar plosive /k/ (ejective and aspirated). E.g. *'**tlh**agola'* /**$\widehat{\text{tl}}^h$**axʊla/ → *'**t**agola'* /**t'**axʊla/ and *'**kh**agola'* /**k^h**axʊla/. Alveolar trill /r/ was produced more posteriorly in the oral cavity and substituted with velar trill /ʁ/ by two participants aged 2;6–2;11 years (e.g. *'sekhu**r**umêlô'* /sɪk^{h}u**r**umɛlɔ/ lid → /k^{h}u**ʁ**mɛlɔ/). This phoneme was mostly substituted with lateral sonorant /l/ by participants in Group 1 (e.g. *'dikhê**r**ôtse'* /dik^{h}ɛ**r**ɔ$\widehat{\text{ts}}$'ɪ/ carrots → *'dikhê**l**ôts'* /dik^{h}ɛ**l**ɔ$\widehat{\text{ts}}$'/). Furthermore, voiced alveolar plosive /d/ was sometimes substituted with its allophone, lateral sonorant /l/ (e.g. *'**d**itshôswane'* /**d**i$\widehat{\text{ts}}^h$ɔs^{w}anɪ/ ants → /**l**i$\widehat{\text{ts}}^h$ɔs^{w}anɪ/).

Other phonological processes noted in participants aged 2;6–2;11 years include the simplification of C^w phonemes, with participants producing C^wV syllables as CV (e.g. *'**kw**êna'* /**k^w'**ɛna/ crocodile → *'**k**êna'* /**k'**ɛna/; and *'fu**ts**w**ê**tsa'* /fu**$\widehat{\text{ts}}^w$'**ɛ$\widehat{\text{ts}}$'a/ blow → *'fu**ts**ê**tsa'* /fu**$\widehat{\text{ts}}$'**ɛ$\widehat{\text{ts}}$'a/). Although this occurred in isolation and was not documented as being present, some participants were noted to reduce consonant clusters. This mainly occurred when they used an English word to identify certain pictures (e.g. *'am**br**êla'* /am**br**ɛla/ umbrella → *'am**b**êla'* /am**b**ɛla/; and *'**dr**aeva'* /**dr**aịva/ drive → *'**d**aeva'* /**d**aịva/). Lastly, Group 1 presented with phonological processes affecting vowels in the final word position. One participant (L25) substituted open /a/ with front mid-low /ɛ/ (e.g. he produced *'kgêil**a**'* /k$\widehat{\text{x}}^h$ɛịl**a**/ (to tear), as *'kheil**ê**'* /k^{h}ɛịl**ɛ**/); two participants (L31 & L33) substituted close back /u/ with back close-mid /ʊ/ (e.g. *'mmôp**u**'* /ṃmɔp'**u**/ corn → *'mmôp**o**'* /ṃmɔp'**ʊ**/); and one participant substituted front mid-low /ɛ/ with open /a/ (e.g. *'mmêlêk**ê**'* /ṃmɛlɛk'**ɛ**/ milk → *'mmêlêk**a**'* /ṃmɛlɛk'**a**/).

5.1.2.2 Group 2 (3;0–3;5 years)

Phonological processes noted in the speech of participants in Group 2 are documented in Table 23.

Table 23. Phonological processes used by participants in Group 2 (3;0–3;5 years) (Sekwêna variety)

Phonological processes	Target	L26	L28	L32	EL3	EL6	EL11	EL28
Syllable deletion: /sɪ/ word-initially	**sɪ**kʰurumɛlɔ	kʰirimɛlɔ	kʰilimɛlɔ	-	-	-	-	-
Assimilation (Consonant harmony)	**n**ɔŋanɪ	**ŋ**ʊ**ŋ**anɪ	**ŋ**ʊ**ŋ**anɪ	**ŋ**ɔ**ŋ**anɪ	-	-	-	**ŋ**ɔ**ŋ**anɪ
Fronting	**dʒ**ɪsa	**dz**ɪsa	**dz**ɪsa	-	-	-	-	-
Backing /r/	sɪkʰu**ɹ**umɛlɔ	-	-	-	skʰu**ɻ**mɛlɔ	skʰu**ɻ**mɛlɔ	-	-
Specific phoneme substitution: /l/→/d/	**d**i͡tsʼɛbɛ	-	-	-	**l**i͡tsʼɛbɛ	-	-	-
Specific phoneme substitution: /r/→/l/	**ɻ**rɛ	-	-	-	**l̩**lɛ	-	-	-
Simplification C^{w} phonemes	**kʷʼ**ɛna	-	-	**kʼ**ɛna	-	-	-	-
	sɪ**x**ʷa**x**ʷa			sɪ**x**a**x**a				-
Metathesis	t͡ɬʰa͡tsʷʼa	-	**t͡ɬ**ʰʷa͡tsʼa	-	-	-	-	-
Vowel substitution	sɪkʰu**r**umɛlɔ	kʰi**r**imɛlɔ	kʰi**l**imɛlɔ	-	-	-	-	-
	lɪxapʼ**u**	-	-	mɛxapʼ**ʊ**	-	-	-	-
	dipʰ**u**kʼa	-	-	-	dipʰ**ʊ**kʼa	-	-	-
	t͡sʰʊl**ʊ**xilɛ	-	-	-	-	-	t͡sʰʊl̩l**ɛ**xilɛ	-

Notes: Dash indicates no processes used

Children aged 3;0–3;5 years presented with eight different phonological processes in their speech and all were considered age appropriate for this age group as they occurred in the speech of more than 10% of participants in Group 2. These phonological processes include deletion of syllable /sɪ/ in the initial word position, assimilation, fronting, backing of alveolar trill /r/, specific phoneme substitution, simplification of C^w phonemes, as well as metathesis.

Omission of syllable /sɪ/ word-initially and assimilation were noted in fewer participants in Group 2 (3;0–3;5 years) as compared to Group 1 (2;6–2;11 years). Two participants in Group 2 omitted singular noun class prefix /sɪ/ in the initial word position (e.g. *'**se**khurumêlô'* /**sɪ**k^{h}urumɛlɔ/ lid → *'khirimêlô'* /k^{h}irimɛlɔ/), and four participants presented with assimilation (e.g. *'**n**ônyane'* /**n**ɔɲanɪ/ bird → *'**ny**o**ny**ane'* /**ɲ**ɔ**ɲ**anɪ/). Omission of syllable /sɪ/ in the word medial position was also noted in the speech of two participants in Group 2 (e.g. *'bae**se**kela'* /baɪ**sɪ**k'ɪla/ bicycle → *'baekela'* /baɪk'ɪla/), and similar to Group 1, it was not documented as being present in the participants' speech as it occurred in isolation. Two participants presented with fronting and produced back consonants more anteriorly in the oral cavity. For instance, aspirated palato-alveolar affricate /t͡ʃ^h/ in *'wa**tšh**e'* /wa**t͡ʃ^h**ɪ/ (watch, n), was produced as aspirated alveolar affricate /t͡s^h/ (i.e. as /wa**t͡s^h**ɪ/); and voiced palato-alveolar /ʤ/ in *'**j**esa'* /**ʤ**ɪsa/ (to feed), was produced as voiced alveolar /ʣ/ (i.e. as /**ʣ**ɪsa/). Alveolar trill /r/ was produced more posteriorly by two participants and substituted with uvular trill /ʀ/ (e.g. *'sekhu**r**umêlô'* /sɪk^{h}u**r**umɛlɔ/ lid → /sk^{h}u**ʀ**mɛlɔ/). It was also sometimes substituted with lateral sonorant /l/ (e.g. *'d**r**aeva'* /d**r**aɪva/ drive → *'d**l**aeva'* /d**l**aɪva/). One participant (EL3) substituted voiced alveolar plosive /d/ with its allophone lateral sonorant /l/ (e.g. *'khu**d**u'* /k^{h}u**d**u/ tortoise → *'khu**l**u'* /khu**l**u/). Other phonological processes noted in some participants aged 3;0–3;5 years included the simplification of C^w phonemes, with one producing C^wV syllables as CV (e.g. *'se**gw**a**gw**a'* /sɪ**x^w**a**x^w**a/ frog → *'sexaxa'* /sɪ**x**a**x**a/), as well as metathesis (e.g. *'tlhats**wa**'* /t͡ɬ^{h}at͡s^w**'**a/ wash → *'tlh**w**atsa'* /t͡ɬ^{hw}ats'a/).

Some phonological processes occurred in isolation, such as affrication, which only occurred when participants produced one particular word (e.g. *'ditshô**sw**ane'* /dit͡s^{h}ɔ**s^w**anɪ/ (ants), was produced as *'ditshô**tshw**ane'* /dit͡s^{h}ɔ**t͡s^{hw}**anɪ/). This was observed across all age groups and in both varieties of Setswana studied. In addition, participants aged 3;0–3;5 years substituted vowels in the word medial (L26, L28, EL3 & EL11) and final positions (L32). For instance, closed back /u/ was substituted with front close /i/ (*'sekh**ur**u**r**umêlô'* /sɪk^h**ur**umɛlɔ/ lid → *'kh**ir**imêlo'* /k^h**ir**imɛlɔ/), and sometimes with back close-mid /ʊ/ (producing *'diph**u**ka'* /dip^h**u**k'a/ feathers, as *'diph**o**ka'* /dip^h**ʊ**k'a/). The back close-mid /ʊ/ was also substituted with the more front open-mid /ɛ/ word-medially by one participant (El11 produced *'tshol**o**gilê'* /t͡s^{h}ʊl**ʊ**xilɛ/ spilled → *'tsholl**ê**gilê'* /t͡s^{h}ʊl**ɛ**xilɛ/).

5.1.2.3 Group 3 (3;6–3;11 years)

Table 24 provides a summary of phonological processes that participants in Group 3 presented with during the single-word naming task.

Table 24. Phonological processes used by participants in Group 3 (3;6–3;11 years) (Sekwêna variety)

Phonological processes	Target	L24	L27	L34	EL8	EL10	EL19	EL21	EL26	EL31
Syllable deletion: /sɪ/ word-initially	**sɪ**kʰurumɛlɔ (lid)	-	kʰurumɛ	kʰumɛlɔ	-	kʰurumɛlɔ	-	-	-	kʰuɻmɛlɔ
Syllable deletion: /lɪ/ word-initially	**lɪ**pʰut͡s’i (pumpkin)	-	-	-	-	-	-	-	-	pʰut͡s’i
Assimilation (Consonant harmony)	**n**ɔɲanɪ (bird)	**ɲ**ɔɲanɪ	-	**ɲ**ɔɲʷanɪ	-	**ɲ**ɔɲanɪ	-	-	-	**ɲ**ɔɲʷanɪ
	fu**t͡s**ʷ**’**ɛt͡s’a (blow)		fu**f**ɛt͡s’a		-	fu**f**ut’a	-	-	-	-
Cʷ simplification	**t͡s**ʰʷɛnɪ (monkey)	-	**p**ʰɛni	-	-	-	-	-	-	-
Aspiration	**p’it͡s’**a (pot)	-	**p**ʰ**it͡s**ʰa	-	-	-	-	-	-	-
Backing /r/	diɻap’a**r**ɔ (clothes)	-	-	-	-	diɻap’a**ʁ**ɔ	diɻap’a**ʁ**ɔ	-	-	diɻap’ɔ**ʁ**a
	ɻap’a**r**a (wear)	-	-	-	-	-	-	-	ɻap’a**ʁ**a	-
Stopping	**t͡ɬ**ʰaxʊla	-	t͡ɬʰa**k’**ʊla	**t’**ɔxʊla	-	t͡ɬʰa**k’**ʊla	-	-	-	-
	t͡ɬʰap’i (fish)	-	-	**t**ʰap’i	-	**t’**ap’i	-			-
Specific phoneme substitution: /r/→/l/	k’ɛ**r**a (cut)	-	k’ɛ**l**a	-	-	-	-	k’ɛ**l**a	-	-
	dikʰɛ**r**ɔt͡s’ɪ (carrots)		-	kʰa**l**ɔt’ɪ		-	-	dikʰɛlɔt͡s’	-	-
Deaffrication	wat͡ʃʰɪ	-	-	waʃɪ	-	-	-	-	-	-
Vowel substitution	k’**u**t’a	k’**ʊ**t’a	-	-	-	-	-	-	-	-
	maŋʷ**ɛl**ɛ	maŋʷ**ɪl**ɪ	-		-		-			
	sɪfap’an**ɔ**	sɪpʰap’an**ɪ**	-		-		-			
	ɻmilɛ	-	**ɻ**milɛ		-		-			
	nɔɲanɪ	-	-		nʊɲane		-			
	di**ɻ**ap’arɔ	-	-		di**ɛ**p’arɔ		-			
	dit͡sʰ**ɔ**sʷanɪ	-	-		dit͡sʰ**ʊ**sʷanɪ		dit͡sʰ**ʊ**t͡sʰʷanɪ			
	ɛlɛfɛɳt’ɛ	-	-		-		**ɔl**ɔfɛɳt’			
Vowel assimilation	diɻap’ar**ɔ**	-	diɻap’**ar**a	-	-	-	-	-	-	-

Notes: Dash indicates no processes used

Eight different phonological processes were noted in the speech of participants aged 3;6–3;11 years. They include deletion of syllables /sɪ/ and /lɪ/ word-initially, assimilation, stopping, substitution of specific consonant phonemes, backing alveolar trill /r/, simplification of Cʷ phonemes, aspiration, as well as deaffrication.

Participants in Group 3 deleted syllables occurring word-initially. Syllables that were deleted in the initial position are those that serve as singular noun class prefixes. Omission of noun class prefix /sɪ/ occurred more frequently and was noted in five of the nine participants in Group 3 (e.g. *'**se**khurumêlô'* /**sɪ**kʰurumɛlɔ/ lid → *'khurumêlô'* /kʰurumɛlɔ/). One participant omitted noun class prefix /lɪ/ (e.g. *'**le**phutshe'* /**lɪ**phut͡sʰi/ pumpkin → *'phutshe'* /pʰut͡shi/). Participants in this age group also omitted syllables occurring in the medial word position (e.g. *'bae**se**kele'* /baɪ**sɪ**k'ɪlɪ/ bicycle → *'baekele'* /baɪkɪɪlɪ/), but this occurred in isolation and was not recorded as present in the group's speech.

Five of the nine participants in Group 3 presented with assimilation (e.g. *'nônyane'* /nɔŋanɪ/ bird → *'**nyônyane'* /**ŋɔŋ**anɪ/). Phonological processes that occurred less frequently include simplification of Cʷ phonemes, fronting and deaffrication, and were noted in one participant each. L27 simplified Cʷ phonemes and produced CʷV syllables as CV (e.g. *'tshwêne'* /**t͡sʰʷ**ɛnɪ/ monkey → *'phêni'* /**pʰ**ɛni/) and presented with aspiration (e.g. *'**pit**sa'* /**p'**i**t͡s'**a/ pot → *'**phitsh**a'* /**pʰ**i**t**ʰ**s**a/), while L34 presented with deaffrication (e.g. *'wa**tšh**e'* /wa**t͡ʃʰ**ɪ/ watch → *'wa**š**e'* /wa**ʃ**ɪ/). Four participants produced alveolar /r/ more posteriorly in the oral cavity and substituted it with uvular trill /ʀ/ (e.g. *'diapa**r**ô'* /diap'a**r**ɔ/ clothes → /diap'a**ʀ**ɔ/), and three participants substituted this sound with lateral sonorant /l/ (e.g. *'kê**r**a'* /k'ɛ**r**a/ cut → *'kê**l**a'* /k'ɛ**l**a/). In addition, three participants presented with stopping (e.g. *'tlha**g**ola'* /t͡ɬʰa**x**ʊla/ → *'tlha**k**ola'* /t͡ɬʰa**k'**ʊla/).

Several phonological processes were noted but were not recorded as present as they occurred in isolation. These include affrication, which was only observed during production of one word (e.g. *'ditshô**sw**ane'* /dit͡sʰɔ**sʷ**anɪ/ ants → *'ditshô**tshw**ane'* /dit͡sʰɔ**t͡sʰʷ**anɪ/), a trend that was noted for Groups 1 and 2. Others include metathesis; for this phonological process, participants swapped phonological features (specifically rounding) instead of phonemes (e.g. *'tlhats**w**a'* /t͡ɬʰat͡sʷ'a/ wash → *'tlh**w**atsa'* /**t͡ɬʰʷ**at͡s'a/). Furthermore, participants substituted vowels occurring in various word positions. For instance; the more back open-mid /ɔ/ was sometimes substituted with a back close-mid /ʊ/ (producing *'ditsh**ô**swane'* /dit͡sʰ**ɔ**swanɪ/ (ants), as *'ditsh**o**swane'* /dit͡sʰ**ʊ**swanɪ/) and close back /u/ (producing *'**ô**milê'* /**ɔ̟**milɛ/ (dry), as *'**u**milê'* /**u̟**milɛ/).

5.1.2.4 Group 4 (4;0–4;5 years)

Table 25 provides a summary of phonological processes that participants in Group 4 presented with during the single-word naming task.

Table 25. Phonological processes used by participants in Group 4 (4;0–4;5 years) (Sekwêna variety)

Phonological processes	Target	L1	L2	L4	L20	L21	L35	EL9	EL13	EL16	EL17-1	EL17-2	EL20	EL29	EL30
Syllable deletion: /sɪ/ word-initially	**sɪ**k'ip'a (t-shirt)	-	-	-	-	-	-	k'ip'a	-	-	-	-	-	-	-
Assimilation (Consonant harmony)	**n**ɔŋanɪ (bird)	**ɲɔŋ**anɪ	-	-	**ɲɔŋ**anɪ	-	-	**ɲɔŋ**^{w}anɪ	-	**ɲɔŋ**anɪ	**ɲɔŋ**anɪ	-	**ɲʊŋ**anɪ	-	-
Backing /r/	diąp'a**r**ɔ (clothes)	-	-	-	-	-	-	diąp'a**ʀ**ɔ	diąp'a**ʀ**ɔ	diąp'a**ʀ**ɔ	-	-	diąp'a**ʀ**ɔ	-	diąp'a**ʀ**ɔ
	k'ɛ**r**a (cut)	k'ɛ**ʀ**a	-				k'ɛ**ʀ**a		-	-					-
	amb**r**ɛla	-	amblɛ**r**a												amb**ʀ**ɛla
Specific phoneme substitution: /r/→/l/	dik^{h}ɛ**r**ɔt͡s'ɪ	dik^{h}ɛ**l**ɔt͡s'ɛ	dik^{h}ɛ**l**ɔt͡s'ɛ	-	-	-	-		-	-	-	-	-	-	-
Aspiration	sɪ**k'i**p**'**a	-	-	-	-	-	-		sk^{h}ip^{h}a	-	-	-	-	-	-
Metathesis	t͡^{h}at͡s^{w}'a	-	**t͡^{hw}at͡s'**a	-	**t͡^{hw}at͡s'**a	-	-		-	-	-	-	-	-	-
	am**br**ɛla		am**bl**ɛ**ʀ**a		-					-					
	sɪ**f**a**p**'anɔ		sɪ**p'af**anɔ		-					sɪ**p'af**anɔ					
Vowel substitution	dik^{h}ɛrɔt͡s'**ɪ**	dik^{h}ɛlɔt͡s'**ɛ**	dik^{h}ɛlɔt͡s'**ɛ**	-	-	-	-		-	-	-	-	-	-	-
	maŋ^{w}**ɛl**ɛ	-	-	maŋ^{w}**ɪl**ɪ	-	maŋ^{w}**ɪl**ɪ	-		-	-	-	-	-	-	-
	dit͡s^{h}**ɔ**s^{w}anɪ	-	-	-	-	-	dit͡s^{h}**ʊ**s^{w}a nɪ	dit͡s^{h}**ʊ**s^{w}a nɪ	-	-	-	-	-	-	-
Vowel assimilation	ąp'**ʊl**ɪ	-	ap'**ʊlʊ**	-	-	-	ap'**ʊlʊ**		-	-	-	-	-	-	-

Notes: Dash indicates no processes used

Children aged 4;0–4;5 years presented with six phonological processes, and four of these were considered age appropriate while two were not, as they occurred in less than 10% of children in Group 4. Age appropriate phonological processes include assimilation, backing alveolar trill /r/, specific phoneme substitution, as well as metathesis. Those that were seen in less than 10% of the age group's speech are deletion of singular class prefix /sɪ/ word-initially and aspiration. Six participants presented with assimilation; e.g. *'**n**ôynane'* /**n**ɔŋanɪ/ (bird) → *'**ny**ônyane'* /**ɲ**ɔŋanɪ/, *'sefa**p**anô'* /sɪfa**p'**anɔ/ (cross, n) → *'sefa**f**anô'* /sɪfa**f**anɔ/ or *'se**p**apanô'* /sɪ**p'**ap'anɔ/. Eight participants produced alveolar trill /r/ posteriorly and substituted it with uvular trill /ʀ/ (e.g. *'diapa**r**ô'* /diạp'a**r**ɔ/ clothes → /diạp'a**ʀ**ɔ/), while two participants substituted this phoneme with lateral sonorant /l/ (e.g. *'dikhê**r**ôtse'* /dikʰɛ**r**ɔ͡ts'ɪ/ carrots → *'dikhê**l**ôtsê'* /dikʰɛ**l**ɔts'ɛ/). The final age-appropriate phonological process noted in Group 4 is metathesis and was present in the speech of three participants (e.g. *'se**f**a**p**anô'* /sɪ**f**a**p'**anɔ/ a cross → *'se**p**a**f**anò'* /sɪ**p'**a**f**anɔ/). The two delayed phonological processes were produced by one participant each; EL9 omitted the singular noun class prefix /sɪ/ word-initially (e.g. *'**se**kipa'* /**sɪ**k'ip'a/ t-shirt → *'kipa'* /k'ip'a/), and EL13 produced ejective plosives with aspiration (e.g. *'se**k**i**p**a'* /sɪ**k'**i**p'**a/ t-shirt → *'s**kh**ipha'* /s**kʰ**i**pʰ**a/).

Affrication occurred in the speech of ten participants, but was not documented as being present in the group's speech as it was seen in isolation (e.g. *'ditshô**sw**ane'* /dit͡sʰɔ**sʷ**anɪ/ ants → *'ditshô**tshw**ane'* /dit͡sʰɔ**t͡sʰʷ**anɪ/). Another phonological process that occurred in isolation is substitution of voiced alveolar plosive /d/ with its allophone, the lateral sonorant /l/ and was seen in one participant (e.g. *'khu**d**u'* /kʰu**d**u/ tortoise → *'khu**l**u'* /kʰu**l**u/). Lastly, substitution of vowels occurred frequently in this age group too; for instance, front open-mid /ɛ/ was substituted with front close-mid /ɪ/ (*'mangw**ê**l**ê**'* /maŋʷ**ɛ**l**ɛ**/ knees → *'mangw**e**l**e**'* /maŋʷ**ɪ**l**ɪ**/) and back open-mid /ɔ/ was substituted with back close-mid /ʊ/ (e.g. *'n**ô**nyane'* /nɔŋanɪ/ was produced as *'n**o**nyane'* /nʊŋanɪ/).

5.1.2.5 Group 5 (4;6–4;11 years)

Phonological processes noted in the speech of participants aged 4;6–4;11 years are summarised in Table 26.

Table 26. Phonological processes used by participants in Group 5 (4;6–4;11 years) (Sekwêna variety)

Phonological processes	Target	L3	L5	L13	L18	L22	L29	EL14	EL15	El22	EL24
Syllable deletion: sɪ word-initially	**sɪ**kʰurumɛlɔ (lid)	kʰurumɛlɔ	-	-	-	kʰrumɛlɔ	-	-	-	-	-
Assimilation (Consonant harmony)	**n**ɔɲanɪ (bird)	-	**ɲɔɲ**anɪ	-	-	-	-	**ɲɔɲ**anɪ	-	-	-
	futs͡ʷ'ɛ**t͡s'**a (blow)	-	futs͡ʷ'ɛ**t͡sʷ'**a	-	-	-	-	fu**f**uts͡'a	-	-	-
Affrication	dits͡ʰɔ**s**ʷanɪ (ants)	dits͡ʰɔ**t͡sʰʷ**anɪ	-	-	-	-	-	-	-	-	-
Backing /r/	k'ɛ**r**a (cut)	k'ɛ**ʀ**a	k'ɛ**ʀ**a	-	-	-	k'ɛ**ʀ**a	-	k'ɛ**ʀ**a	-	k'ɛ**ʀ**a
	diạp'a**r**ɔ (clothes)	diạ**ʀ**ɔ	-	-	diạp'a**ʀ**ɔ	-	-	-	diạp'a**ʀ**ɔ	-	diạp'a**ʀ**ɔ
Vowel assimilation	ạp'ʊl**ɪ**	ạp'**ʊ**l**ʊ**	-	ạp'**ʊ**l**ʊ**	-	ạp'**ʊ**l**ʊ**	-	-	-	-	-
Vowel substitution	maŋʷ**ɛ**l**ɛ**	lɪŋʷ**ɪ**l**ɪ**	maŋʷ**ɪ**l**ɪ**	-	maŋʷ**ɪ**l**ɪ**	maŋʷ**ɪ**l**ɪ**			-	-	-
	dits͡ʰ**ɔ**sʷanɪ	-	dits͡ʰ**ʊ**t͡sʰʷanɪ	-	dits͡ʰ**ʊ**t͡sʰʷanɪ	-	-	-	-	-	-
	nɔɲanɪ	-	-	-	-	-			ɲʊɲanɪ	ɲʊɲanɪ	ɲʊɲanɪ

Notes: Dash indicates no processes used

Four phonological processes were noted in the speech of participants 4;6–4;11 years and included deletion of syllable /sɪ/ word-initially, assimilation, affrication and backing of alveolar trill /r/, all of which were considered age appropriate for Group 5. Two participants omitted singular noun class prefix /sɪ/ in the initial word position (e.g. *'**se**gwagwa'* /**sɪ**xʷaxʷa/ frog → *'gwagwa'* /xʷaxʷa/), and deletion of syllable /sɪ/ word-medially (e.g. '*bae**se**kela'* /baɪ**sɪ**k'ɪla/ bicycle → *'baekela'* /baɪk'ɪla/) and noun class prefix /lɪ/ word-initially (e.g. *'**d**itsêbê'* /**d**i͡ts'ɛbɛ/ ears → *'**l**itsêbê'* /**l**i͡ts'ɛbɛ/) occurred in isolation. Two participants presented with assimilation (e.g. *'futswêtsa'* /fu͡tsʷ'ɛ͡ts'a/ blow → *'futswêtswa'* /fu**t͡sʷ'**ɛ**t͡sʷ'**a/ and *'**fu**futsa'* /**fu**fu͡ts'a/), one participant with affrication (e.g. *'ditshô**sw**ane'* /di͡tsʰɔ**s**ʷanɪ/ ants → 'ditshô**tshw**ane' /di͡tsʰɔ**t͡sʰʷ**anɪ/), and six participants produced alveolar trill /r/ posteriorly and substituted it with uvular trill /ʀ/ (e.g. *'kêra'* /k'ɛ**r**a/ cut → /k'ɛ**ʀ**a/). Other phonemes that were substituted are vowels; front open-mid /ɛ/ was produced as front close-mid /ɪ/ (e.g. *'mangw**ê**l**ê**'* /maŋʷ**ɛ**l**ɛ**/ knees → *'mangw**e**l**e**'* /maŋʷ**ɪ**l**ɪ**/) and back open-mid /ɔ/ was substituted with back close-mid /ʊ/ (e.g. *'n**ô**nyane'* /n**ɔ**ɲanɪ/ bird → *'n**o**nyane'* /n**ʊ**ɲanɪ/).

5.1.2.6 Group 6 (5;0–5;5 years)

A summary of phonological processes produced by participants in Group 6 (5;0–5;5 years) is provided in Table 27.

Table 27. Phonological processes used by participants in Group 6 (5;0–5;5 years) (Sekwêna variety)

Phonological processes	Target	L9	L11	L15	L16	L23	L30	EL18	EL23
Syllable deletion: /sɪ/ word-initially	**sɪ**fat͡ɬʰɛxɔ (face)	-	-	-	fat͡ɬʰɛxɔ	-	-	-	-
Assimilation	**n**ɔɲanɪ (bird)	-	-	-	-	**ɲ**ɔ**ɲ**anɪ	-	-	-
Affrication	ʤɪsa (feed)	-	-	-	-	ʤɪ**t͡s'**a	-	-	-
Stopping	k'ɛ**t͡ɬ'**ɛlɛ (kettle)	-	-	-	-	k'ɛ**t'**ɛlɛ	-	-	-
Backing /r/	sɪkʰu**ɾ**umɛlɔ (lid)	-	-	skʰu**ʁ**umɛlɔ	kʰu**ʀ̥**mɛlɔ	-	skʰu**ʁ**umɛlɔ	-	-
Specific phoneme substitution: /r/→/l/	kʰɛ**ɾ**ɔt͡s'ɪ	-	-	-	kʰɔ**l**ɔt͡s'	kʰɛ**l**ɔs	-	-	-
Simplification C^{w} phonemes	fu**t͡sʷ'**ɛt͡s'a	-	-	-	fu**t͡s'**ɛt͡sˈa	fu**t͡s'**ɛt͡sˈa	-	-	-
Vowel substitution	maŋʷ**ɛlɛ** kʰrɔkʰɔdaɻl**ɪ** nɔɲanɪ	maŋʷ**ɪlɪ** - -	- kʰrɔkʰɔdaɻl**ɛ** -	maŋʷ**ɪlɪ** - -	maŋʷɛl**ɔ** - ɲʊɲanɪ	maŋʷ**ɪlɪ** -	maŋʷ**ɪlɪ** - -	- -	- -
Vowel assimilation	ạp'ʊl**ɪ**	-	-	-	-	ạp'ʊl**ʊ**	ạp'ʊl**ʊ**	-	-

Notes: Dash indicates no processes used

Seven phonological processes were noted in the speech of participants in Group 6, all of which were considered appropriate for the 5;0–5;5 years age group. The most prevalent phonological process for Group 6 is backing of alveolar trill /r/, which was substituted with the more posterior uvular trill /ʀ/ (e.g. *'sekhu**r**umêlô'* /sɪkʰu**r**umɛlɔ/ lid → /skʰu**ʀ**umɛlɔ/). This phoneme was also substituted with lateral sonorant /l/ by some participants (e.g. *'khê**r**ôts'* /kʰɛ**r**ɔt͡sʼ/ carrots → *'khê**l**ôs'* /kʰɛ**l**ɔs/). Other phonological processes that were noted include deletion of singular noun class prefix /sɪ/ in the initial word position (e.g. *'sefatlhêgô'* /**sɪ**fat͡ɬʰɛxɔ/ face (n) → *'fatlhêgô'* /fat͡ɬʰɛxɔ/), which was seen in the speech of one participant (L16). One participant (L23) presented with assimilation (e.g. *'**n**ônyane'* /**n**ɔŋanɪ/ bird → *'**ny**ô**ny**ane'* /**ŋ**ɔ**ŋ**anɪ/ and *'**tlh**atswa'* /**t͡ɬʰ**at͡sʷʼa/ wash → *'**tlh**wa**ts**wa'* /**t͡ɬʰʷ**a**t͡sʷʼ**a/), affrication (e.g. *'je**s**a'* /dʒɪsa/ feed → *'je**ts**a'* /dʒɪ**t͡sʼ**a/), and stopping (*'kê**tl**êlê'* /kʼɛ**t͡ɬʼ**ɛlɛ/ kettle → *'kê**t**êlê'* /kʼɛ**tʼ**ɛlɛ/). In addition, two participants aged 5;0–5;5 years simplified Cʷ phonemes and produced CʷV syllables as CV (*'fu**ts**wêtsa'* /fu**t͡sʷʼ**ɛt͡sʼa/ blow → *'fu**ts**êtsa'* /fu**t͡sʼ**ɛt͡sʼa/). Similar to the younger age groups, affrication was mainly noted in production of *'ditshô**s**wane'* /dit͡sʰɔ**s**ʷanɪ/ (ants) and was produced as *'ditshô**tshw**ane'* /dit͡sʰɔ**t͡sʰʷ**anɪ/ by six of the eight participants in Group 6. It was, however, not documented as being present as it occurred in isolation. Furthermore, vowel substitution was noted; front open-mid /ɛ/ was produced as front close-mid /ɪ/ (e.g. *'mangw**ê**l**ê**'* /maŋʷ**ɛ**l**ɛ**/ knees → *'mangw**e**l**e**'* /maŋʷ**ɪ**l**ɪ**/).

5.1.2.7 Group 7 (5;6–5;11 years)

Table 28 provides a summary of phonological processes produced by participants aged 5;6–5;11 years.

Table 28. Phonological processes used by participants in Group 7 (5;6–5;11 years) (Sekwêna variety)

Phonological processes	Target	L6	L17	L19	L36	EL12
Syllable deletion: /sɪ/ word-initially	**sɪ**kʰurumɛlɔ	-	-	-	-	kʰurumɛlɔ
Assimilation (consonant harmony)	sɪfap'anɔ	-	-	-	-	sɪ**p'**a**p'**anɔ
Affrication	dik'aụ**s**u (socks)	-	-	-	-	dik'aụ**t͡s'**u
Backing /r/	diạp'arɔ (clothes)	diạp'a**ʁ**ɔ	-	-	diạp'a**ʁ**ɔ	-
Vowel substitution	kʰ**ɛ**rɔt͡s'**ɪ** kʰrɔkʰɔdaịl**ɪ** maŋʷɛl**ɛ**	kʰɔrɔt͡s'**ɛ** kʰʁɔdaịl**ɛ** -	- kʰrɔkʰɔdaịl**ɛ** maŋʷɛl**ɪ**	- - maŋʷ**ɪ**l**ɪ**	dikʰ**ɔ**rɔt͡s' - maŋʷ**ɪ**l**ɪ**	-
Vowel assimilation	ạp'ʊlɪ	-	ạp'**ʊ**l**ʊ**	ạp'**ʊ**l**ʊ**	-	-

Notes: Dash indicates no processes used

Participants in Group 7 presented with seven phonological processes, all of which were considered appropriate for this age group. The most frequently occurring phonological process is backing of alveolar trill /r/, which was substituted with uvular trill /ʀ/ by two of the five participants aged 5;6–5;11 years (e.g. ‘diapa**r**ô’ /diạp’a**r**ɔ/ clothes → /diạp’a**ʀ**ɔ/). One participant (EL12) presented with assimilation (e.g. *‘sefapanô’* /sɪfap’anɔ/ cross (n) → *‘sepapanô’* /sɪ**p’**a**p’**anɔ/), and affrication (e.g. *‘dikau**s**u’* /dik’aụ**s**u/ socks → ‘dikau**ts**u’ /dik’aụ**t͡s’**u/). Vowel substitution was noted in four of the five participants; for instance, front open-mid /ɛ/ was produced as front close-mid /ɪ/ (e.g. *‘mangw**ê**l**ê**’* /maŋʷ**ɛ**l**ɛ**/ knees → *‘mangw**e**l**e**’* /maŋʷ**ɪ**l**ɪ**/).

5.1.2.8 Group 8 (6;0–6;5 years)

A summary of phonological processes produced by participants in Group 8 is provided in Table 29.

Table 29. Phonological processes used by participants in Group 8 (6;0–6;5 years) (Sekwêna variety)

Phonological processes	Target	L7	L8	L10	L12	L14
Assimilation	**n**ɔŋanɪ	**ŋ**ɔ**ŋ**anɪ	-	-	-	**ŋ**ɔ**ŋ**anɪ
Backing /r/	diąp'a**r**ɔ	diąp'a**ʁ**ɔ	-	diąp'a**ʁ**ɔ	diąp'a**ʁ**ɔ	-
Vowel substitution	maŋ^{w}**ɛ**l**ɛ**	maŋ^{w}**ɪ**l**ɪ**	-	-	maŋ^{w}**ɪ**l**ɪ**	-
	ąp'ʊl**ɪ**	-	ąp'ʊl**ɛ**	-	ąp'**ʊ**l**ʊ**	ąp'**ʊ**l**ʊ**
	ʤɪsa	-	**ʤi**sa	-	-	-
	dik^{h}**ɛ**r**ɔ**t͡s'ɪ	-	-	k^{h}**ɔ**r**ɔ**t͡s'	-	dik^{h}**ɔ**r**ɔ**t͡s'

Notes: Dash indicates no processes used

Two phonological processes were noted in the speech of participants in Group 8 and both phonological processes were considered appropriate for the 6;0–6;5 years age group. Backing of alveolar /r/ was noted in the speech of three participants, who produced it more posteriorly in the oral cavity and substituted it with uvular trill /ʀ/ (e.g. *'diaparô'* /diąp'a**r**ɔ/ clothes → /diąp'a**ʁ**ɔ/). Some participants substituted the alveolar trill /r/ with lateral sonorant /l/, but this occurred in isolation and was not documented as being present (e.g. 'amb**r**êla' /amb**r**ɛla/ umbrella → /amb**l**ɛla/). Two participants presented with assimilation (e.g. *'**n**ônyane'* /**n**ɔŋanɪ/ bird → *'**ny**ô**ny**ane'* /**ŋ**ɔ**ŋ**anɪ/), and all participants in this age group presented with affrication (e.g. *'ditshô**sw**ane'* /dit͡s^{h}ɔ**s**^{w}anɪ/ ants → 'ditshô**tshw**ane' /dit͡s^{h}ɔ**t͡s**^{hw}anɪ/), but this particular phonological process was not considered present in the participants' speech as it occurred in isolation when they produced a specific word that posed a challenge for a large group of the study participants. In addition, vowel substitution continued to occur at 6;0–6;5 years; for instance, front open-mid /ɛ/ was produced as front close-mid /ɪ/ (e.g. *'mangw**êlê'*** /maŋ^{w}**ɛ**l**ɛ**/ knees → *'mangw**ele'*** /maŋ^{w}**ɪ**l**ɪ**/).

A comparison of phonological processes across age groups in the Sekwêna variety is made next.

5.1.2.9 Across Age Groups (Sekwêna)

Table 30 provides a summary of the use of phonological processes across the age groups.

Table 30. Percentage of participants presenting with phonological processes, across age groups (Sekwêna variety)

			Group							
Phonological processes	**Target**	**Example**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Syllable deletion: /sɪ/ word-initially	**sɪ**kʰurumɛlɔ	kʰurumɛlɔ	86	29	44	7	20	13	20	-
Syllable deletion: /lɪ/ word-initially	**lɪ**pʰut͡sʼi	pʰut͡sʼi	-	-	11	-	-	-	-	-
Assimilation	**n**ɔŋanɪ	**ŋɔŋ**anɪ	86	57	55	43	20	13	20	40
Fronting	ṇ**t͡ʃʼ**a	ṇ**t͡sʼ**a	29	29	-	-	-	13	-	-
Stopping	**t͡ɬʰ**axʊla	**tʼ**axʊla	57	-	33	-	-	13	-	-
Backing /r/	sɪkʰu**r**umɛlɔ	sɪkʰu**ʁ**umɛlɔ	29	29	44	57	60	38	40	60
SPS: /r/→/l/	diaṗʼa**r**ɔ	diaṗʼa**l**ɔ	71	14	33	14	-	25	0	-
SPS: /d/→/l/	**d**it͡sʼɛbɛ	**l**it͡sʼɛbɛ	14	14	-	-	-	-	-	-
Cʷ simplification	**kʷʼ**ɛna	**kʼ**ɛna	57	14	11	-	-	25	-	-
Metathesis	t͡ɬʰat͡sʷ**ʼ**a	t͡ɬʰʷat͡sʼa	-	14	-	21	-	-	-	-
Aspiration	sɪfa**pʼ**anɔ	sɪfa**pʰ**anɔ	-	-	11	7	-	-	-	-
Labialisation	nɔŋanɪ	ŋɔ**ŋʷ**anɪ	-	-	11	-	-	-	-	-
Affrication	dikʼaṷsu	dikʼaṷ**tsʼ**u	-	-	-	-	10	13	20	-
Vowel substitution	maŋʷ**ɛlɛ**	maŋʷ**ɪlɪ**	57	71	44	57	80	75	80	100

Notes: Dash indicates no processes used; SPS – specific phoneme substitution

A clear reduction in the occurrence of certain phonological processes can be seen across age groups in the Sekwêna group. For instance, a large number of participants in the youngest age group (2;6–2;11 years) deleted the singular noun class prefix /sɪ/ in the initial word position, while this error was made by few children in the older age groups and was not observed at all in the oldest age group (6;0–6;5 years). It is therefore likely that deletion of syllable /sɪ/ word-initially is eliminated at 5;11 years. Assimilation is likely eliminated after 6;5 years. Although it appears that the oldest group of participants (6;0–6;5 years) presents with assimilation more than younger groups (4;6–4;11 and 5;0–5;5 years), this is likely not the case since Group 8 (6;0–6;5 years) had only five participants and only two of these participants presented with assimilation as compared to two of ten participants in Group 5 (4;6–4;11 years). While some phonological processes are seen to occur less frequently with age, some are seen to occur more as children become older. For instance, fronting of back sounds and substitution of voiced alveolar plosive /d/ with its allophone (the lateral sonorant /l/) has been eliminated at 3;6 years, and backing of alveolar trill /r/ is seen to occur more in the older age groups. Participants in the younger age group (2;6–2;11 years) are seen to frequently substitute alveolar trill /r/ with lateral sonorant /l/. This indicates that although they are not yet always able to produce /r/ accurately, they attempt to maintain the place of articulation. However, as they grow older, they are likely able to reflect on speech sounds produced and make an attempt to replace it with a similar sounding phoneme, the uvular trill /ʀ/.

Although vowel substitution did not occur as frequently in participants in older age groups (Groups 4–8) in comparison to the younger age groups, it has been noted to continue to occur beyond 6;5 years.

5.2 Section 2: Relational Analysis – Setlhaping

This section focuses on relating participants' speech sound production to the target phonology. This is specifically done for the Setlhaping variety.

5.2.1 Accuracy Scores

The accuracy with which participants in the Setlhaping group produced Setswana speech sounds is outlined in this part of the section. This is done by providing accuracy scores (i.e. PCC, PVC and PPC) for participants. Table 31 gives a summary of accuracy scores across the age groups in the Setlhaping variety of Setswana.

Table 31. Accuracy scores (PCC, PVC and PPC): Across age groups (Setlhaping variety)

	3;6–4;11 years	5;0–5;11
PCC (%)	97	97
PVC (%)	99	100
PPC (%)	98	98

Note: PCC – Percentage Consonants Correct; PVC – Percentage Vowels Correct; PPC – Percentage Phoneme Correct

Participants in the Setlhaping group all obtained high accuracy scores, indicating that they likely start using adult-like speech as early as 3;7 years. Due to the limited number of participants speaking the Setlhaping variety, it is not possible to determine a clear trajectory of the accuracy with which children who speak the Setlhaping variety across the different age groups produce speech. This data, however, gives some indication that at 5;6–5;11 years, children who speak the Setlhaping variety can be expected to make a few errors in producing both vowels and consonant phonemes. This is a developmental trend that was also noted in the older group of children in the Sekwêna group.

5.2.2 Phonological processes

In this part of the section, the phonological processes found in the speech of participants are described; this is done for the two age groups, after which a comparison of both groups is made. A child was noted as having a phonological process when s/he presented with the same error twice or more. Furthermore, a phonological process was considered appropriate for an age group if present in the speech of at least 10% of participants in a single age group, and delayed if used by less than 10% of participants (Hua, 2002).

5.2.2.1 Groups 9 & 10 (3;6–4;11 years)

Table 32 provides a summary of phonological processes that participants in Group 9 presented with during the single word naming task.

Table 32. Phonological processes used by participants in Group 9 (3;6–4;11 years) (Setlhaping)

Phonological processes	Target	S3	S1	GD3	GD6
Backing /r/	**r**ɛi̯ja	-	-	**ʁ**ɛi̯ja	-
	r^{w}ala		-	**ʁ**^{w}ala	**ʁ**^{w}ala
Vowel substitution	maʊ̯t'ʊ	ma**ɳ**t'ʊ	ma**ɳ**t'ʊ	ma**ɳ**t'ʊ	ma**ɳ**t'ʊ
	maxad**ima**	-	maxad**u**m**ɔ**	-	-

Notes: Dash indicates no processes used

Children aged 3;6–5;5 years only presented with backing of alveolar trill /r/, which was substituted with a more posterior phoneme, the uvular trill /ʀ/ (e.g. *'**rw**ala'* /**r**^{w}ala/ wear → /**ʁ**^{w}ala/). These participants also presented with other phonological processes, which were not documented as being present because they occurred in isolation. These include assimilation (e.g. *'**n**ônyane'* /**n**ɔɲanı/ bird → *'**nyônyw**ane'* /**ɲ**ɔ**ɲ**^{w}anı/) and affrication (e.g. *'ditšhô**šw**ane'* /dit͡ʃ^{h}ɔ**ʃ**^{w}anı/ ants → *'ditšhôšwane'* /dit͡ʃ^{h}ɔ**t͡ʃ**^{hw}anı/). Similar to the Sekwêna variety, assimilation and affrication mainly occurred in production of two words (viz. 'nônyane' and 'ditšhôšwane' respectively). Four participants substituted syllabic /ʊ/ with syllabic alveolar nasal /n/ in the penultimate syllable position when producing the word 'maoto' (e.g. *'ma**o**to'* /maʊ̯t'ʊ/ legs → *'ma**n**to'* /ma**ɳ**t'ʊ/). Other phonological processes noted in this group of participants include specific phoneme substitution; uvular trill /r/ was the only phoneme substituted and was produced more posteriorly (e.g. *'**rw**ala'* /**r**^{w}ala/ wear → /**ʁ**^{w}ala/). One participant presented with metathesis and two simplified C^{w} phonemes.

Phonological processes noted in Group 10 are summarised next.

5.2.2.2 Group 11 (5;0–5;11 years)

Table 33 provides a summary of phonological processes that participants in Group 10 presented with during the single word naming task.

Table 33. Phonological processes used by participants in Group 10 (5;0–5;11 years) (Setlhaping variety)

Phonological processes	Target	B1	M1	M2	M3	M4	S2	GD1	GD2	GD4	GD5	GD7	GD8
Assimilation	**n**ɔŋanɪ	-	-	**ŋɔŋ**^{w}anɪ	**ŋɔŋ**^{w}anɪ	-	-	-	-	-	-	**ŋɔŋ**anɪ	-
Backing /r/	**ɻ**ɻɛ	-	-	**ʁ**ʁɛ	-	**ʁ**ʁɛ	-	-	-	-	-	-	-
	r^{w}ala	-	-	**ʁ**^{w}ala	-	**ʁ**^{w}ala	-	**ʁ**^{w}ala	-	-	**ʁ**^{w}ala	-	**ʁ**^{w}ala
	diap’a**r**ɔ	-				diąp’a**ʁ**ɔ	diąp’a**ʁ**ɔ						
Simplification C^{w} phonemes	sɪ**x**^{w}a**x**^{w}a	-	-	sɪx^{w}a**x**a	-	-	-	-	-	-	-	-	-
Vowel substitution	maɻt’ʊ	-	-	maɳt’ʊ	maɳt’ʊ	-	-	maɳt’ʊ	maɳt’ʊ	-	-	-	maɳt’ʊ

Notes: Dash indicates no processes used

Although the number of participants in the Setlhaping variety of Setswana made it difficult to make comparisons to the Sekwêna variety, it is clear from data in Table 33 that both groups of children made similar simplification errors in producing several words. Similar to children who speak the Sekwêna variety, those who speak the Setlhaping variety presented with assimilation and simplified C^w phonemes. It is likely that other phonological processes (such as syllable deletion) are present in the speech of younger children, but this must be investigated in future research.

Three phonological processes were noted in the speech of participants aged 5;6–5;11 years in the Setlhaping group, with one of them, simplifying C^w phonemes, considered delayed as it occurred in less than 10% of the group's participants. Three participants presented with assimilation (e.g. *'**n**ônyane'* /**n**ɔɲanɪ/ bird → *'**ny**ô**ny**w**a**ne'* /**ɲɔɲ**ʷanɪ/) and five with backing of alveolar trill /r/ (e.g. *'**r**wala'* /**r**ʷala/ wear → /**ʁ**ʷala/). Affrication (e.g. *'ditšhôš**w**ane'* /dit͡ʃʰɔ**ʃ**ʷanɪ/ ants → *'ditšhôš**w**ane'* /dit͡ʃʰɔ**t͡ʃ**ʰʷanɪ/) was seen in all participants, but not documented as present as it occurred in isolation. Similar to findings in Sekwêna, assimilation and affrication mainly occurred in production of two words (viz. 'nônyane' and 'ditšhôšwane' respectively). Five participants substituted syllabic /ʊ/ with syllabic alveolar nasal /n/ in the penultimate syllable position when producing the word 'maoto' (e.g. *'ma**o**to'* /mao̩tʼʊ/ legs → *'ma**n**to'* /maṇtʼʊ/). Phonological processes that occurred with less frequency include simplification of C^w phonemes and metathesis.

A comparison of phonological processes across age groups in the Setlhaping variety is made next.

5.2.2.3 Across age groups (Setlhaping)

Table 34 provides a summary of the use of phonological processes across the age groups.

Table 34. Percentage of participants presenting with phonological processes, across age groups

Phonological processes	Target	Example	3;6–4;11 years	5;0–5;11 years
Assimilation	**n**ɔɲanɪ	**ɲɔɲ**anɪ	-	17
Backing /r/	sɪkʰu**r**umɛlɔ	sɪkʰu**ʁ**umɛlɔ	50	42
C^w simplification	**kʷ'**ɛna	**k'**ɛna	-	8
Vowel substitution	mao̩tʼʊ	maṇtʼʊ	100	42

Notes: Dash indicates no processes used

Due to the very limited sample size for the Setlhaping variety, it is difficult to make hypotheses about the occurrence of phonological processes across the age groups, as was done for the Sekwêna variety. No participants (out of a total of four) aged between 3;6 and 4;11 years presented with assimilation and simplification of C^w phonemes. A reduction in the occurrence of backing of the alveolar trill /r/ and substitution of vowels can be seen in the oldest age group (5;0–5;11 years). It can also be seen that both age groups presented with fewer phonological processes when compared to their peers in the Sekwêna group. Both of these trends will, however, need to be investigated further with a bigger sample size in future research.

5.3 Summary

This chapter provided data on the accuracy with which speech sounds were produced by participants across the age groups, as well as a detailed description of the nature of phonological processes that children of varying ages presented with. This was done for those acquiring the Sekwêna and Setlhaping varieties of Setswana. Children acquiring Setswana produce vowels with high accuracy as early as 2;6–3;5 years and consonants were produced with adult-like accuracy as early as 3;6–4;5 years. Both syllable and phoneme-level phonological processes were noted in Setswana-speaking children. Participants who speak the Setlhaping variety were noted to present with fewer phonological processes than their peers in the Sekwêna group. This trend will need to be investigated further with a bigger sample size as there was a big mismatch in the number of participants between the two varieties of Setswana investigated, making it challenging to make detailed comparisons. Deletion of syllable /sɪ/ in the initial word position was noted to disappear at 5;11 years and occur more frequently in the youngest group of children (2;6–2;11 years); fronting of back sounds was seen to be eliminated at 3;5 years, while stopping ceased at 3;11 years. Unlike trends seen for other phonological processes backing of alveolar trill /r/ was noted to occur more as children got older, possibly as they developed an awareness of their limited ability in producing it and made an attempt to substitute it with a similar sounding phoneme while developing an ability to produce it more accurately.

CHAPTER 6: FINDINGS – CASE STUDIES OF SPEECH SOUND DISORDERS AND MULTILINGUAL SPEECH DEVELOPMENT

Chapters 4 and 5 focused on describing findings for the entire sample of children who participated in this study. A number of children were bi/multilingual; some were found to have speech sound disorders (SSDs) and others were bi/multilingual with SSDs. These children were included in the study as the study aimed to make comparisons in phonological development between children acquiring one or more languages; and between children for whom acquisition was typical or atypical. The study also set out to investigate the frequency of occurrence of SSDs. This chapter focuses on these children, who – for different reasons – are deserving of further study. Four children presented with an SSD; two of these children were monolingual, one was bilingual and one was multilingual and reported as acquiring four languages. The first section of this chapter aims to address the second objective of the study, which is to contrast Setswana phonology development in monolingual and multilingual children. In this section, the speech of bi/multilingual children is contrasted to that of those acquiring Setswana only. This was done to determine if any differences in speech sound acquisition between these two groups exist and to give a comprehensive description of these. The second section addresses the third study objective and includes a detailed account of the speech of each participant who presented with a SSD, which includes an inventory of consonants and the nature of phonological processes noted in their speech, followed by a classification of these according to Dodd's diagnostic framework.

Each participant's parent and/or legal guardian was asked to complete a brief case history form and the Intelligibility in Context Scale (ICS) (McLeod et al., 2012). The ICS was used to assess the participants' speech intelligibility, and parents and/or legal guardians were not asked to complete separate forms for each of the languages participants were acquiring (in the case of those acquiring more than one language). This was done to obtain an overall impression of the participants' speech intelligibility. Since not all forms were returned, the researcher could not obtain information on all the languages that the children were acquiring. It is therefore likely that the number of multilingual children who participated in this study is higher than what is reported on in this section.

6.1 Section 1: Contrast Setswana phonology development in monolingual vs multilingual children

Fourteen participants were bilingual (with five different language combinations) and two were multilingual. The different language combinations acquired by these children are: 1) Setswana and Sepedi (5 participants); 2) Shona and Setswana (5 participants); 3) Setswana and Sesotho (1 participant); 4) Setswana and siSwati (1 participant); 5) Setswana and Tshivenda (1 participant); 6) Setswana, isiZulu and English (1 participant); 7) Setswana, Sepedi, Afrikaans and English (1

participant); as well as 8) Setswana and Afrikaans (1 participant). The level to which each participant was exposed to the languages they were acquiring was not indicated. Since participants were attending a preschool where the language of communication is Setswana, they were all exposed to Setswana for an average of five hours on weekdays (i.e. twenty-five hours a week, and ±985 hours in a single year).

The accuracy scores obtained by participants who were bi/multilingual were comparable to those obtained by their monolingual peers. Some participants even obtained higher PCC scores than their peers. There were also no significant differences in the number of phonological processes that those who were bi/multilingual presented with. Some children who are bi/multilingual presented with fewer phonological processes than their peers.

6.2 Section 2: Participants with SSDs

6.2.1 *EL10 (3;10 years; bilingual – Setswana & siSwati) – Phonological delay*

EL10 was 3;10 years old at the time of data collection, and was living in the Bojanala Platinum District. Her mother reported that EL10 had no receptive and expressive language difficulties, and that she and others always understand her speech. Her mother reported a healthy pregnancy with no complications before, during and after birth. EL10 was in good physical health and did not experience recurrent ear infections or hearing difficulties. All early developmental milestones were reached at appropriate ages. EL10's phonetic inventory is summarised in Table 35.

Table 35. EL10 (bilingual female aged 3;10 years): consonant inventory in the initial word position and penultimate syllable

	Manner	Initial Word Position		Penultimate Syllable	
		Present	**Not present**	**Present**	**Not present**
Plosives	Ejective	p’ t’ tʷ’ k’ kʷ’		p’ t’ tʷ’ k’ kʷ’	
	Aspirated	tʰ kʰ		kʰ	
	Voiced	b d		b d	
	Fricatives	f h	s	f h x xʷ v	sʷ
	Nasals	m n nʷ ŋ ŋʷ ɲ		m n ŋ ɲ	
Sonorants	Lateral	l lʷ		l	
	Medial	w			
	Trill	rʷ ʀʷ		r	
Affricates	Ejective	t͡ɬ’		t͡ɬ’ t͡s’ t͡sʷ’	
	Aspirated	t͡ɬʰ t͡sʰ k͡xʰ k͡xʰʷ		t͡ɬʰ t͡ʃʰ	
	Voiced	d͡ʒ			
	Heterorganic compounds	bj fj		pj	
	Consonant clusters	dr		br	

EL10 produced many target words spontaneously, but was often given forced choice options and asked to repeat target words when prompting was not effective in eliciting spontaneous production of words. Although she presented with an SSD, she had the majority of consonant phonemes targeted both word-initially and in the penultimate syllable position. Alveolar fricative /s/ was absent from her inventory in both word positions targeted, and round /sʷ/ was absent in the penultimate syllable position. These phonemes were missing as EL10 substituted them with a plosive and was not stimulable for correct production. She had a full inventory of vowels in the medial and final word positions, as well as single vowel syllables /a/ and /ɔ/ word-initially (e.g. *‘**ô**milê’* /ɔ̩milɛ/ dry), /a, ɪ, u/ word-medially (e.g. *‘dika**u**su’* /dik’aʊ̩su/ socks), and /u/ word-finally (e.g. *‘tlô**u**’* /t͡ɬ’ɔʊ̩/ elephant). EL10 experienced difficulty producing speech accurately, with consonants presenting as more challenging than vowels. This is reflected in her accuracy scores; she obtained a PCC of 78% (much lower than PCC obtained by her peers), PVC of 95% and a PPC of 88%. She presented with seven different phonological processes, as summarised in Table 36. The most prevalent phonological process was stopping, which occurred

twenty-eight times. This was followed by deletion of syllable /sɪ/ word-initially (six times), backing of alveolar trill /r/ (three times), specific phoneme substitution (twice), and assimilation (twice).

Table 36. Phonological processes: EL10

Phonological processes	Realisation	Example	Comment
Stopping of /s/	s → t’	**sɪf**ap’anɔ (cross, n) → **t’**ɪfap’anɔ dʒɪ**s**a (feed) → dʒɪ**t’**a	Not age appropriate
Stopping /t͡s’/	t͡s’ → t’	di**t͡s’**ɛbɛ (ears) → di**t’**ɛbɛ	
Stopping /t͡sʰ/	t͡sʰ → t’	**t͡sʰ**ʊl̩lʊ**t͡s**’ɛ (spilled) → **t’**ʊl̩lʊt’ɛ	
Stopping /t͡ɬ⁽ʰ⁾/	t͡ɬʰ	sɪfa**t͡ɬʰ**ɛxɔ (face, n) → fa**t’**ɛxɔ	Age appropriate
Backing /r/	r → ʀ	diạp’a**r**ɔ (clothes) → diạp’a**ʀ**ɔ	Age appropriate
Specific phoneme substitution	r → l	k’ɛ**r**a (cut) → k’ɛ**l**a	Age appropriate
Syllable deletion: /sɪ/ word-initially		**sɪ**kʰurumɛlɔ (lid) →kʰurumɛlɔ	Age appropriate
Assimilation	n → ɲ t͡sʷ’ → f	**n**ɔŋanɪ (bird) → **ɲ**ɔŋanɪ fu**t͡sʷ’**ɛt͡s’a (blow) → fu**f**ut’a	

EL10 mainly stopped alveolar fricative /s/ (including round /sʷ/ and only stopped velar fricative /x/ once (e.g. *'tlha**g**ola'* /t͡ɬʰa**x**ʊla/ weeding with a shovel → *'tlha**k**ola'* /t͡ɬʰa**k'**ʊla/). Stopping of /s/ occurred in various word positions (*'**s**etilô'* /**s**et'ilɔ/ chair → *'**t**etilô'* /**t'**ɪt'ilɔ/; *'je**s**a'* /dʒɪ**s**a/ feed → *'je**t**a'* /dʒɪ**t'**a/; *'ma**s**wê'* /ma**sʷ**ɛ/ dirty → *'ma**t**wê'* /ma**tʷ'**ɛ/); EL10 was not stimulable for correct production of these words, and would not repeat /s/ in a syllable and in isolation when prompted. It is likely that she was aware of sounds that were difficult for her to produce as she was often reluctant to participate during stimulability testing. Although EL10 stopped alveolar fricative /s/, she produced it accurately at least twice during the duration of the assessment (e.g. *'**s**e a fja'* /**s**ɪ a fja/ it is burning). She was, however, also noted to produce it in a different manner, and this only occurred once (it almost sounded like interdental /θ/). This also occurred when EL10 produced affricates consisting of alveolar fricative /s/ (i.e. /t͡sʼ, t͡sʷʼ, t͡sʰ/). This may be because EL10 had difficulty producing alveolar fricative /s/ (e.g. *'pi**ts**a'* /pʼi**t͡sʼ**a/ pot → *'pi**t**a'* /pʼi**t'**a/; *'**tsh**ollotsê'* /**t͡sʰ**ʊl̩lʊ**t͡s**ʼɛ/ spilled → *'**t**ollotse'* /**t'**ʊl̩lʊ**t͡s**ʼɪ/; *'bu**tsw**êla'* /bu**t͡sʷʼ**ɛla/ blow → *'bu**tw**êla'* /bu**tʷ'**ɛla/). She was not stimulable for correct production of error words and of these target affricates in syllables (e.g. /**t͡sʷʼ**a/ → /**tʷ'**a/). Despite poor stimulability for correct production of alveolar affricates, EL10 was observed to be able to produce these phonemes accurately at times without any prompting. She only produced these alveolar affricates accurately when they occurred in the final syllables, but it should be noted that these words were not always produced accurately (e.g. *'tlha**ts**wa'* /t͡ɬʰa**t͡sʷʼ**a/ wash → /t͡ɬʼa**t͡sʷʼ**a/; *'dikhêrô**ts**e'* /dikʰɛrɔ**t͡sʼ**ɪ/ carrots → /dikʰɛʁɔ**t͡sʼ**ɪ/; *'nô**tsh**i'* /n̪nɔ**t͡sʰ**i/ bee).

The second most prevalent phonological process in EL10's speech is the deletion of syllable /sɪ/ in the initial word position, where it serves as a Class 4 singular noun prefix (e.g. *'**se**tilô'* /**sɪ**t'ilɔ/ chair → *'tilô'* /t'ilɔ/). She sometimes deleted /sɪ/ word-medially, but this occurred in isolation and was not documented as being present. Although EL10 was not stimulable for correct production of words for which she deleted syllable /sɪ/ (6 initially and 1 medially), she produced the correct number of syllables when prompted to repeat these target words (e.g. *'**se**-khu-ru-mê-lô'* /**sɪ**-kʰu-ru-mɛ-lɔ/ lid → *'khu-ru-mê-lô'* /kʰu-ru-mɛ-lɔ/ → *'**te**-khu-lu-mê-lô'* /**t'ɪ**-kʰu-lu-mɛ-lɔ/; *'ba-e-**se**-ke-le'* /ba-ɪ̣-**sɪ**-kʼɪ-lɪ/ bicycle → *'ba-e-ke-le'* /ba-ɪ̣-kʼɪ-lɪ/ → *'ba-e-**ke**-ke-le'* /ba-ɪ̣-**k'ɪ**-kʼɪ-lɪ/). Furthermore, additional lengthening was noted prior to production of the syllable that occurred before the one that was omitted. This only occurred when syllable /sɪ/ was deleted word-initially and the additional lengthening was noted before production of ejective and aspirated plosives (e.g. *'**se**kipa'* /**sɪ**kʼipʼa/ t-shirt → *'_kipa'* /**ː**kʼipʼa/; *'sekhurumêlô'* /sɪkʰurumɛlɔ/ → *'_khurumêlô'* /**ː**kʰurumɛlɔ/), but not before production of fricatives (e.g. *'**se**fatlhêgô'* /**sɪ**fat͡ɬʰɛxɔ/ face, n → *'fatêhô'* /fatʼɛhɔ/). This additional lengthening or pause may indicate the child's awareness of the missing syllable and her attempt to make up for this. This is likely the case as she maintained accurate tonal patterns of these words, despite missing syllables in the initial and medial positions. Another reason for this is that EL10 omitted syllable /sɪ/ as she is

aware that alveolar fricative /s/ is a challenging phoneme for her, and the additional lengthening or pause is likely a strategy that she uses to compensate for the syllable that she does not produce.

Backing alveolar /r/ is the third most prevalent phonological process in EL10's speech, followed by specific phoneme substitution (/r/→/l/) and assimilation. Alveolar trill /r/ was produced more posteriorly three times, and was substituted with uvular trill /ʁ/ (e.g. *'**rw**ala'* /**r**^{w}ala/ wear shoes → /**ʁ**^{w}ala/). This phoneme was sometimes substituted with lateral sonorant /l/ (e.g. *'sekhu**r**umêlô'* /sɪkʰu**r**umɛlɔ/ lid → *'sekhu**l**umêlô'* /t'ɪkʰu**l**umɛlɔ/) and palatal sonorant /j/ (e.g. *'kê**r**a'* /k'ɛ**r**a/ cut → *'kê**y**a'* /k'ɛ**j**a/). It should be noted that substitution of /r/ with /j/ only occurred once during the duration of the assessment, and that EL10 sometimes produced this phoneme accurately (e.g. *'borukhu'* /bʊ**r**ukʰu/ trousers; *wa tibratšha'* /wa t'ib**r**at͡ʃʰa/ she is brushing herself). Assimilation occurred twice (e.g. *'**n**ônyane'* /**n**ɔɲanɪ/ bird → *'**ny**ônyane'* /**ɲ**ɔɲanɪ/; *'fu**ts**wêtsa'* /fu**t͡s**^{w}**'**ɛt͡s'a/ blow → *'fu**f**uta'* /fu**f**ut'a/), and although EL10 was not stimulable for correct production of these words, this phonological process is age appropriate. Lastly vowel elision occurred in isolation (e.g. *'**j**êrêsi'* /**dʒ**ɛrɛsi/ jersey → /**dʒ**ʁɛt'i/).

Some inconsistencies were noted in EL10's speech; although the phonological processes she presented with were used consistently, she was sometimes able to produce phonemes that appeared challenging for her during stimulability testing. For instance, she produced /sɪkʰurumɛlɔ/ as /kʰurumɛlɔ/ during the naming task. While she omitted the first syllable during spontaneous production of the word, she produced alveolar trill /r/ accurately. She, however, substituted /r/ with /l/ during stimulability testing, and produced it accurately at other times (e.g. /t'ib**r**at͡ʃʰa/ brushing herself; /bʊ**r**ukʰu/ trousers). This was seen with other phonemes: she produced /**t͡sʰ**ʊl̩lʊ**t͡s'**ɛ/ (spilled) as /**t'**ʊl̩lʊ**t͡s'**ɛ/ and /**t'**ʊl̩lʊ**t'**ɛ/ when prompted to produce it the second time. She initially produced the voiceless ejective alveolar affricate /t͡s'/ in the final syllable, but did not do so again during the second production.

EL10 is bilingual (Setswana and siSwati); she mainly communicated in Setswana and only used two siSwati words during the speech assessment, namely *'vula'* /vula/ (open) and *'khamisa'* /kʰamisa/ (open mouth), which was produced as *'khami**t**a'* /kʰami**t'**a/. While it is important to consider the possible influence of the phonetic system of an additional language in a multilingual child, it seems unlikely that EL10's speech errors are linked to her acquisition of siSwati. The basis for this conclusion is that the errors she presented with are not common in isiXhosa and isiZulu, both of which are also Nguni languages and in the same language family group as siSwati. Data from these languages were used as there is limited information available on siSwati speech sound development.

EL10 used the correct tonal pattern when producing most of the target words, but was observed to use incorrect tone in producing two words. For instance, she produced /kʷ'álà/ (HL) (write) as /kʷ'àlà/ (LL) (close), and /lexàp'ú/ (LLH) (watermelon) as /lexàp'ù/ (LLL).

6.2.1.1 Intelligibility

The average score for EL10's intelligibility on the ICS is 4.7, which suggests that on average, she is "usually" intelligible. EL10's mother reported that EL10 is easily understood by those who are familiar with her (e.g. immediate family members and teachers), as well as those who are not (e.g. acquaintances and strangers). While one might expect that people who are familiar with the child will understand her better than those who are not, the opposite was reported for EL10. According to her mother, acquaintances and strangers understand her better than her friends do. EL10's teacher was not able to complete the ICS due to time constraints, but she raised concerns about EL10's speech. She indicated that EL10's speech was sometimes difficult to understand and that she made speech errors that her peers at the preschool were not making. Results from the ICS are summarised in Table 37 below.

Table 37. Results from the *Intelligibility in Context Scale* (completed by EL10's mother)

		Ka metlha (Always)	**Ka gale** (Usually)	**Ka dinako dingwe** (Sometimes)	**Ga e se ga ntsi** (Rarely)	**Gotlhelele** (Never)
1.	A o tlhaloganya ngwana wa gago fa a bua[1]? (Do **you** understand your child[1]?)	**5**	4	3	2	1
2.	A ba losika ba tlhaloganya ngwana wa gago fa a bua? (Do **immediate members of your family** understand your child?)	**5**	4	3	2	1
3.	A ba maloko a mangwe a losika lwa gago ba tlhaloganya ngwana wa gago fa a bua le bone? (Do **extended members of your family** understand your child?)	5	**4**	3	2	1
4.	A ditsala tsa ngwana wa gago ba a mo tlhaloganya fa a bua le bone? (Do your **child's friends** understand your child?)	5	**4**	3	2	1
5.	A batho ba bangwe mo tikologong (kgotsa morafe) ba tlhaloganya ngwana wa gago fa a bua le bone? (Do other **acquaintances** understand your child?)	**5**	4	3	2	1
6.	A barutabana ba ngwana wa gago ba a mo tlhaloganya fa a bua le bone? (Do your **child's teachers** understand your child?)	**5**	4	3	2	1
7.	A batho ba ba sa itseng ngwana wa gago ba a mo tlhaloganya fa a bua le bone[2]? (Do **strangers**[2] understand your child?)	**5**	4	3	2	1
	PALO YOTLHE YA SEKORO (TOTAL SCORE) =	**33/35**				
	PALO E E MAGARENG YA SEKORO (AVERAGE TOTAL SCORE) =	**4.7/5**				

6.2.2 L16 (5;3 years; Setswana)

L16 was 5;3 years old at the time of data collection and living in the Bojanala Platinum District. Her mother reported no receptive and expressive language difficulties and that L16 uses spoken language to communicate with intelligible speech. Her mother reported a healthy pregnancy with no complications before, during and after birth. Apart from allergies experienced until 14 months, L16 was in good physical health and did not experience recurrent ear infections or hearing difficulties. All early developmental milestones were reached at appropriate ages. L16's phonetic inventory is summarised in Table 38.

Table 38. L16 (Monolingual female aged 5;3 years): consonant inventory in the initial word position and penultimate syllable

	Manner	IWP	PS	
		Present	Present	Not present
Plosives	Ejective	p' t' k' k^{w}'	p' k'	
	Aspirated	p^{h} t^{h} k^{h}	p^{h}	
	Voiced	b d	b d	
	Fricatives	f s h	f s s^{w} ʃ h x x^{w}	
	Nasals	m n n^{w} ŋ $ŋ^{w}$ ɲ	m n ŋ $ŋ^{w}$ ɲ	
Sonorants	Lateral	l l^{w}	l	
	Medial	w		
	Trill		ʀ	r
Affricates	Ejective	t͡ɬ'	t͡ɬ' t͡s' t͡s^{w}'	
	Aspirated	t͡$ɬ^{h}$ t͡s^{h} t͡s^{hw}	t͡$ɬ^{h}$ t͡$ʃ^{h}$ k͡x^{h}	
	Voiced	d͡ʒ	pj	
	Heterorganic compounds	fj	sk' bl	
	Consonant clusters	sp' sf k^{h}ʀ		

L16 produced many target words spontaneously, but was sometimes given forced choice options and asked to repeat target words when prompting was not effective in eliciting spontaneous production of words. Although she presented with an SSD, she had the majority of consonant phonemes targeted both word-initially and in the penultimate syllable position. Alveolar trill /r/ was the only consonant phoneme missing from her inventory in the penultimate syllable position. She presented with a mild SSD and produced most phonemes accurately (PCC of 92%, PVC of 95% and PPC of 93%). L16 presented with three main phonological processes, namely syllable deletion, specific phoneme substitution and fronting. A summary of these is provided in Table 39.

Table 39. Phonological processes produced by L16

Phonological processes	Realisation	Example	Comment
Syllable deletion: /sɪ/ word-initially		**sɪ**fatl͡ʰɛxɔ (face) → fatl͡ʰɛxɔ	Not age appropriate
Backing /r/	r → ʁ	k'ɛ**r**a (cut) → k'ɛ**ʁ**a	Age appropriate
Specific phoneme substitution	r → l	dikʰɛ**r**ɔt͡s'ɪ (carrots) → kʰɔlɔt͡s' amb**r**ɛla (umbrella) → amb**l**ɛla	Age appropriate
Assimilation	n → ɲ	**n**ɔɲanɪ (bird) → **ɲ**ʊ**ɲ**anɪ	Age appropriate
Cluster reduction	dr → d	**dr**aɪva (drive) → **d**aɪfa	Age appropriate
Aspiration	p' → pʰ	sɪfa**p'**anɔ (a cross) → sfa**p**ʰana	Not age appropriate
Vowel substitution	ɛ → ɔ ɔ → ʊ	maŋʷ**ɛlɛ** (knees)→ maŋʷɛl**ɔ** nɔɲane (bird) → ɲʊɲane	

It was noted that L16 was the only child in her age group (5;0–5;5; years) to present with assimilation, affrication, fronting and deletion of syllable /sɪ/ word-initially, where it serves as a noun class prefix. The most frequently occurring phonological processes in her speech were backing of alveolar trill /r/ and deletion of syllable /sɪ/ word-initially. Alveolar trill /r/ was produced posteriorly in the oral cavity and substituted with uvular trill /ʀ/ in various word positions (e.g. *'sekhu**r**umêlô'* /sɪkʰu**r**umɛlɔ/ lid → /kʰu**ʀ**umɛlɔ/; *'kê**r**a'* /k'ɛ**r**a/ cut → /k'ɛ**ʀ**a/). This phoneme was sometimes substituted with lateral sonorant /l/ (e.g. /sɪkʰu**r**umɛlɔ/ lid → /sɪkʰu**l̩**mɛlɔ/) and palatal semi-vowel /j/ (e.g. *'amb**r**êla'* /amb**r**ɛla/ umbrella → *'amb**y**êla'* /amb**j**ɛla/). Omission of syllable /sɪ/ word-initially occurred five times (e.g. *'**se**kipa'* /**sɪ**k'ip'a/ t-shirt → *'kipa'* /k'ip'a/). L16 also omitted /sɪ/ word-medially, and although this phonological process occurred in isolation, she was not stimulable for correct production of syllable /sɪ/ in the medial position. During stimulability testing, she sometimes produced the correct number of syllables in the target word even though her production was not accurate (e.g. *'ba-e-**se**-ke-la'* /ba-ị-sɪ-k'ɪ-la/ bicycle → *'ba-e-ke-le-la'* /ba-ị-k'ɪ-lɪ-la/; *'ba-e-ke-ne-le'* /ba-ị-k'ɪ-nɪ-lɪ/ and *'ba-se-se-ke-le'* /ba-sɪ-sɪ-k'ɪ-lɪ/). Although L16 experienced difficulty producing /sɪ/ word-medially, she was stimulable for correct production of words with syllable /sɪ/ in the initial position. Another phonological process that occurred frequently in L16's speech is fronting of back sounds, observed in different word positions. For instance, voiced palato-alveolar affricate /ʤ/ was produced as alveolar /ʣ/ (e.g. *'**j**esa'* /**ʤ**ɪsa/ feed → /**ʣ**ɪsa/) and velar nasal /ŋ/ was substituted with alveolar /n/ (e.g. *'ma**ng**wêlê'* /ma**ŋ**ʷɛlɛ/ knees → *'ma**n**wêlê'* /ma**n**ʷɛlɛ/). L16 was not stimulable for correct production of these error sounds in words, but was observed to produce some of them accurately during spontaneous naming (e.g. *'**ng**wana'* /**ŋ**ʷana/ baby; *'wa mo jesa di**j**ô tsa hae'* /wa mʊ ʣɪsa di**ʤ**ɔ t͡s'a haɛ̣/).

In addition to the three phonological processes described above, L16 made other speech errors that occurred in isolation. She presented with assimilation (e.g. *'tsholohilê'* /t͡sʰʊlʊhilɛ/ spilled → *'tshohihilê'* /t͡sʰʊ**hihi**lɛ/) and was not stimulable for correct production of the word and omitted one syllable when asked to repeat it (e.g. /t͡sʰʊlʊhilɛ/ spilled → /t͡sʰʊhilɛ/ scared). Assimilation of vowels was also noted (e.g. *'khêrôtse'* /kʰɛrɔt͡s'ɪ/ carrots → /kʰ**ɔʀɔ**t͡s'/; *'sefapanô'* /sɪfap'anɔ/ cross → *'sfaphana'* /sf**a**pʰ**a**n**a**/). L16 produced round lateral sonorant /lʷ/ as velar semi-vowel /w/ (e.g. *'lwala'* /lʷala/ sick → *'wala'* /wala/); she was not stimulable for correct production of the word and produced it differently when asked to repeat it (e.g. *'walla'* /waḷla/ s/he is crying). When asked to produce /lʷ/ at a syllable level (i.e. /lʷa/), she was able to, but not without making an error at first (e.g. /lʷa/ → /wa/, /lʷa/). This error seems idiosyncratic since simplifying Cʷ phonemes often includes omitting /w/ and producing such a phoneme without rounding (e.g. *'**kw**ala'* /**kʷ'**ala/ write → *'kala'* /**k'**ala/). She also substituted voiceless labio-dental fricative /f/ with velar semi-vowel /w/ (e.g. /sɪ**f**ap'anɔ/ → /sɪ**w**ap'anɔ/). This substitution occurred when L16 made an attempt to correct her initial production of

the target word, which was inaccurate (e.g. /sɪfap'anɔ/ → /sfap^{h}ana/, /sɪwap'anɔ/). She was stimulable for this word and produced it accurately two out of three times during stimulability testing.

Other phonological processes that occurred in isolation in L16's speech are aspiration (e.g. /sɪfa**p'**anɔ/ → /sfa**p^{h}**ana/), backing round alveolar fricative /s^{w}/ (e.g. /di**t͡s^{h}ɔs^{w}**anɪ/ ants → diʃʊ**x^{w}**anɪ/), cluster reduction (e.g. /**dr**aɻva/ driving → /**d**aɻfa/), as well as substitution of /ɔ/ with /ʊ/ (e.g. /di**t͡s^{h}ɔ**s^{w}anɪ/ ants → diʃ**ʊ**x^{w}ane/). L16 was only stimulable for correct production of /sɪfap'anɔ/. While she continued to make errors when prompted to repeat some words, she was noted to produce some of the affected phonemes accurately. For instance, she initially produced /di**t͡s^{h}**ɔs^{w}anɪ/ (ants) as /diʃox^{w}anɪ/, and later as /di**t͡s^{h}**ʊs^{w}anɪ/ during stimulability testing. She was therefore able to correctly produce aspirated alveolar affricate /**t͡s^{h}**/ and round alveolar fricative /s^{w}/ even though she continued to substitute /ɔ/ with /o/. L16 was inconsistent in her production of some words, although only relative to other children, and this was seen as she sometimes alternated between an error form and the correct form.

6.2.2.1 Intelligibility

The average score for L16's intelligibility is 4, suggesting that her speech is "usually" intelligible. L16's mother reported no difference in how L16 is understood by people who are familiar with her, and those who are not. Results from the ICS are summarised in Table 40.

Table 40. Results from the *Intelligibility in Context Scale* (completed by L16's mother)

		Ka metlha (Always)	**Ka gale** (Usually)	**Ka dinako dingwe** (Sometimes)	**Ga e se ga ntsi** (Rarely)	**Gotlhelele** (Never)
1.	A o tlhaloganya ngwana wa gago fa a bua[1]? (Do **you** understand your child[1]?)	5	**4**	3	2	1
2.	A ba losika ba tlhaloganya ngwana wa gago fa a bua? (Do **immediate members of your family** understand your child?)	5	**4**	3	2	1
3.	A ba maloko a mangwe a losika lwa gago ba tlhaloganya ngwana wa gago fa a bua le bone? (Do **extended members of your family** understand your child?)	5	**4**	3	2	1
4.	A ditsala tsa ngwana wa gago ba a mo tlhaloganya fa a bua le bone? (Do your **child's friends** understand your child?)	5	**4**	3	2	1
5.	A batho ba bangwe mo tikologong (kgotsa morafe) ba tlhaloganya ngwana wa gago fa a bua le bone? (Do other **acquaintances** understand your child?)	5	**4**	3	2	1
6.	A barutabana ba ngwana wa gago ba a mo tlhaloganya fa a bua le bone? (Do your **child's teachers** understand your child?)	5	**4**	3	2	1
7.	A batho ba ba sa itseng ngwana wa gago ba a mo tlhaloganya fa a bua le bone[2]? (Do **strangers**[2] understand your child?)	5	**4**	3	2	1
	PALO YOTLHE YA SEKORO (TOTAL SCORE) =	**28/35**				
	PALO Ê E MAGARENG YA SEKORO (AVERAGE TOTAL SCORE) =	**4/5**				

6.2.3 L23 (5;3 years; Setswana, English, Afrikaans & Sepedi)

L23 was 5;3 years old at the time of data collection and living in the Bojanala Platinum District. His mother reported no receptive and expressive language difficulties, but that he is not always "clear" when he communicates. His mother reported a healthy pregnancy with no complications before, during and after birth. L23 was in good physical health and did not experience ear infections or hearing difficulties. All early developmental milestones were reached at appropriate ages. L23's phonetic inventory is summarised in Table 41.

Table 41. L23 (multilingual male aged 5;3 years): consonant inventory in the initial word position and penultimate syllable

		IWP		PS	
	Manner	**Present**	**Absent**	**Present**	**Absent**
Plosives	Ejective	p' t' k' k^{w}'		p' t' k'	
	Aspirated	p^{h} t^{h} t^{hw} k^{h}		p^{h} t^{h} k^{h}	
	Voiced	b d		b d	
	Fricatives	f s h		f s h x x^{w}	
	Nasals	m n n^{w} ŋ ɲ		m n ŋ $ŋ^{w}$ ɲ	
Sonorants	Lateral	l l^{w}		l	
	Medial	w			
	Trill		r	ʀ	r
Affricates	Ejective	t͡s'		t͡s' t͡s^{w}'	
	Aspirated	t͡s^{h} t͡s^{hw}		t͡$ɬ^{h}$ t͡$ʃ^{h}$	
	Voiced	d͡ʒ			
	Heterorganic compounds	fj		pj	

L23 produced many target words spontaneously, but was sometimes given forced choice options and asked to repeat target words when prompting was not effective in eliciting spontaneous production of words. Although he presented with an SSD, he had the majority of consonant phonemes targeted both word-initially and in the penultimate syllable position, as well as a complete inventory of vowels. Alveolar trill /r/ was the only consonant phoneme missing from L23's inventory in both word positions targeted. L23 experienced difficulty producing speech accurately, with consonants presenting as more challenging than vowels. This is

reflected in his accuracy scores; he obtained a PCC of 85% (the lowest in his age group), PVC of 97% and a PPC of 91%. L23 presented with seven different phonological processes, as summarised in Table 42.

Table 42. Phonological processes produced by L23

Phonological processes	Realisation	Example	Comment
Specific phoneme substitution: r→l	r → l	sɪkʰu**r**umɛlɔ (lid) → sɪkʰu**l̩**mɛlɔ	
Specific phoneme substitution: d→l	d → l	**d**it͡ʃʰila (dirty) → **l**it͡ʃʰila	Not age appropriate
Stopping of /s/	s → t’	**s**ɪxʷaxʷa (frog) → **t’**ɪxʷaxʷ **s**ɪfat͡ɬʰɛxɔ (face) → **t’**ɪfat’ɛhɔ	Not age appropriate
Stopping /tɬ’/	tɬ’ → t’	**tɬ’**ɔu̯ (elephant) → **t’**ɔu̯	
Stopping /t͡ɬʰ/	t͡ɬʰ	sɪ**t͡ɬʰ**ak’ʊ (shoe) → sɪ**t’**ak’ʊ	Age appropriate
Affrication	s → t͡s’ sʷ → t͡sʷ’	dʒɪsa (feed) → dʒɪ**t͡s’**a dit͡sʰɔ**s**ʷanɪ (ants) → dit͡sʰɔ**t͡sʷ’**anɪ	
Assimilation	n → ɲ t͡ɬʰ → t͡ɬʰʷ x → l	**n**ɔɲanɪ (bird) → **ɲ**ʊ**ɲ**anɪ t͡ɬʰat͡sʷ’a (wash) → **t͡ɬʰʷ**a**t͡sʷ’**a **l**ɪ**x**ap’u (watermelon) → **l**ɪ**l**ap’u	
Cluster reduction	kʰr → kʰ	**kʰr**ɔkʰɔdaɪ̯lɪ (crocodile) → **kʰ**ɔkʰɔdaɪ̯lɪ	

Stopping was the most dominant phonological process in L23's speech and occurred eleven times. He often produced the latero-alveolar affricate (both ejective /t͡ɬʼ/ and aspirated /t͡ɬʰ/) as alveolar plosive (e.g. *'**tl**ôu'* /**t͡ɬ**'ɔu̯/ elephant → *'**t**ôu'* /**t'**ɔu̯/; *'la**tlh**êla'* /la**t͡ɬʰ**ɛla/ throw → *'la**t**êla'* /la**t'**ɛla/), and this occurred in various word positions. L23 was stimulable for correct production of ejective latero-alveolar affricate /t͡ɬʼ/ in isolation, but continued to produce this phoneme as a plosive when prompted to produce it at a syllable (e.g. /t͡ɬʼa/ → /t'a/) and word level (e.g. *'e**tl**a'* /ɪ**t͡ɬ'**a/ come → *'e**t**a'* /ɪ**t'**a/). He was stimulable for production of aspirated latero-alveolar affricate at a syllable level (e.g. /t͡ɬʰa/) and in isolation (even though production of /t͡ɬʰ/ in isolation seemed more effortful for him). L23 was not stimulable for accurate production of /t͡ɬʰ/ at a word level and continued to produce it as aspirated alveolar plosive /tʰ/ (e.g. *'**tlh**agola'* /**t͡ɬʰ**axʊla/ weeding with a shovel → *'**th**axola'* /**tʰ**axʊla/). Additionally, L23 substituted voiceless alveolar fricative /s/ with ejective alveolar plosive /t'/ in the initial word position only (e.g. *'**s**egwagwa'* /**s**ɪxʷaxʷa/ frog → *'**t**egwagwa'* /**t'**ɪxʷaxʷa/; *'**s**epili'* /**s**ɪp'ili/ mirror → *'**t**epili'* /**t'**ɪp'ili/). He was not stimulable for correct production of /s/ in the initial word position, but was able to produce this phoneme in isolation. Stopping of /s/ did not seem consistent as L23 produced this phoneme accurately in a number of words he produced spontaneously (e.g. *'dikôu**s**u'* /dik'ɔu̯**s**u/ socks, *'**s**ekipa'* /**s**ɪk'ip'a/ t-shirt). The second most frequent phonological process in L23's speech was substitution of alveolar trill /r/ with lateral sonorant /l/, which occurred eight times. This substitution was noted in various word positions (e.g. *'**r**êiya'* /**r**ɛi̯ja/ driving → *'**l**êila'* /**l**ɛi̯la/; *'diapa**r**ô'* /diap'a**r**ɔ/ clothes → *'diapa**l**ô'* /diap'a**l**ɔ/); he changed the place of articulation when he attempted to correct the error sound, but maintained the manner of articulation.

Affrication occurred six times, and only appeared to affect voiceless alveolar fricative /s/ (e.g. *'fi**s**itsê'* /fi**s**it͡s'ɛ/ burned → *'fi**ts**itsê'* /fi**t͡s'**it͡s'ɛ/; *'jesa'* /ʤɪsa/ feed → *'jetsa'* /ʤɪt͡s'a/). This sometimes occurred in instances where L23 was attempting to correct his production of /s/ after substituting it with ejective plosive /t'/ (e.g. *'**s**egwagwa'* /**s**ɪxʷaxʷa/ frog → *'**t**egwagwa'* /**t'**ɪxʷaxʷa/ → *'**ts**egwagwa'* /**t͡s'**ɪxʷaxʷa/; *'**s**efapanô'* /**s**ɪfap'anɔ/ cross, n → *'**t**ifapanô'* /**t'**ɪfap'anɔ/ → *'**ts**epapanô'* /**t͡s'**ɪp'ap'anɔ/). Assimilation was the fourth most frequent phonological process and occurred during production of four words (e.g. *'nô**ny**ane'* /**n**ɔ**ɲ**anɪ/ bird → *'**ny**ô**ny**ane'* /**ɲ**ɔ**ɲ**anɪ/; *'le**g**apu'* /**lɪx**ap'u/ watermelon → *'**l**e**l**apu'* /**lɪl**ap'u/). L23 was not stimulable for correct production of error words; while he managed to produce all consonant phonemes in /lɪ**x**ap'u/, he used the incorrect tonal pattern (e.g. /lɪx**á**p'**ú**/ → /lɪx**à**p'**ò**/). Other phonological processes produced less frequently were substitution of voiced alveolar plosive /d/ with its allophone, the lateral sonorant /l/ (e.g. *'mmi**d**i'* /mmi**d**i/ corn → *'mmi**l**i'* /mmi**l**i/; *'di **d**itšhila'* /di **d**it͡ʃʰila/ they are dirty → *'di **l**itšhila'* /di **l**it͡ʃʰila/), as well as cluster reduction (e.g. *'**kh**r**kh**ôdaele'* /**kʰr**ɔkʰɔdaɛle/ crocodile → *'**kh**ôkhôdaele'* /**kʰ**ɔkʰɔdaɛle/; *'am**br**êla'* /am**br**ɛla/ umbrella → *'am**b**êla'* /am**b**ɛla/). Substitution of /d/ and /l/ occurred three times, and although L23 produced /d/ accurately most of the time without prompting, he was not stimulable for correct production of the words in which he substituted /d/ with /l/. He was also noted to substitute front semi-open vowel /ɛ/ with central open

/a/ (/kʰ**ɛ**rɔt͡s'ɪ/ carrots → /k'**a**lɔt͡s'/) and /ɪ/ (e.g. /maŋʷ**ɛ**l**ɛ**/ knees → /maŋʷ**ɪ**l**ɪ**/). These substitutions occurred in isolation and L23 produced vowels accurately throughout the assessment.

In addition to the phonological processes described above, L23's production of a number of words was not consistent. For instance, he produced *'tlhatswa'* /t͡ɬʰat͡sʷ'a/ (washing) as *'tswatsa'* /t͡sʷ'at͡s'a/ during the spontaneous naming task, and later produced it as *'thwatswa'* /tʰʷat͡sʷ'a/, *'talatswa'* /t'alat͡sʷ'a/ and *'thatswa'* /tʰat͡sʷ'a/ during stimulability testing. Other examples include producing *'segwagwa'* /sɪxʷaxʷa/ (frog) as *'tegwagwa'* /t'ɪxʷaxʷa/, *'tsegwagwa'* /t͡s'ɪxʷaxʷa/ and *'segwagwa'* /sɪxʷaxʷa/. Lastly, L23 used appropriate tone most of the time and was only observed to use incorrect tone on three occasions. For example, he produced *'nku'* /n̩kˈú/ (sheep), which has a LH tonal pattern as /n̩kˈù/ (i.e. with a LL tonal pattern).

6.2.3.1 Intelligibility

L23's average intelligibility score is 3, which suggests that his speech is on average, "sometimes" intelligible. L23's mother reported that she always understands him, but that both familiar (e.g. immediate family and teachers) and unfamiliar people (e.g. extended family and acquaintances) have difficulty understanding him. She further reported that L23's friends and strangers have greater difficulty understanding him (i.e. "rarely" understand him). In addition, L23's teacher raised concerns about his speech and reported that he was often difficult to understand. She also indicated that she has observed that L23's peers appeared to have difficulty understanding him (in the classroom and on the playground). The concerns raised by L23's teacher were therefore similar to his mother's report of his speech intelligibility.

Table 43 provides a summary of the ICS findings.

Table 43. Results from the *Intelligibility in Context Scale* (completed by L23's mother)

		Ka metlha (Always)	**Ka gale** (Usually)	**Ka dinako dingwe** (Sometimes)	**Ga e se ga ntsi** (Rarely)	**Gotlhelele** (Never)
1.	A o tlhaloganya ngwana wa gago fa a bua[1]? (Do **you** understand your child[1]?)	**5**	4	3	2	1
2.	A ba losika ba tlhaloganya ngwana wa gago fa a bua? (Do **immediate members of your family** understand your child?)	5	4	**3**	2	1
3.	A ba maloko a mangwe a losika lwa gago ba tlhaloganya ngwana wa gago fa a bua le bone? (Do **extended members of your family** understand your child?)	5	4	**3**	2	1
4.	A ditsala tsa ngwana wa gago ba a mo tlhaloganya fa a bua le bone? (Do your **child's friends** understand your child?)	5	4	3	**2**	1
5.	A batho ba bangwe mo tikologong (kgotsa morafe) ba tlhaloganya ngwana wa gago fa a bua le bone? (Do other **acquaintances** understand your child?)	5	4	**3**	2	1
6.	A barutabana ba ngwana wa gago ba a mo tlhaloganya fa a bua le bone? (Do your **child's teachers** understand your child?)	5	4	**3**	2	1
7.	A batho ba ba sa itseng ngwana wa gago ba a mo tlhaloganya fa a bua le bone[2]? (Do **strangers**[2] understand your child?)	5	4	3	**2**	1
	PALO YOTLHE YA SEKORO (TOTAL SCORE) =	**21/35**				
	PALO E E MAGARENG YA SEKORO (AVERAGE TOTAL SCORE) =	**3/5**				

6.2.4 L6 (5;6 years; Setswana) (Articulation Disorder)

L6 was 5;6 years old at the time of data collection and living in the Bojanala Platinum District. His mother reported no receptive and expressive language difficulties and that he uses spoken language to communicate. L6's mother reported that his speech is always intelligible when he communicates. L6 was born prematurely, and his mother did not indicate how many weeks early he was born. L6 was in good physical health and did not experience recurrent ear infections or hearing difficulties. All early gross motor milestones were reached at appropriate ages, but L6's early speech and language milestones were delayed as he said his first word at 24 months of age. Although L6 has been reported to only be acquiring Setswana, he seems to be acquiring English too and was noted to name certain pictures in English (e.g. wings, pumpkin, crocodile, carrots, etc.). L6's phonetic inventory is summarised in Table 44.

Table 44. L6 (monolingual male aged 5;6 years) consonant inventory in the initial word position and penultimate syllable

	Manner	IWP	PS
Plosives	Ejective	p' t' k' kʷ'	p' k'
	Aspirated	pʰ tʰ kʰ	pʰ kʰ kʰʷ
	Voiced	b d	d
	Fricatives	f v s h	f s sʷ ʃ h x xʷ
	Nasals	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ
Sonorants	Lateral	l lʷ	l
	Trill	ʍ	r ʀ
Affricates	Ejective	tɬʰ t͡sʰ t͡sʰʷ k͡xʰ	tɬ' t͡s' t͡sʷ'
	Aspirated	t͡ɬ'	t͡ɬʰ t͡sʰ t͡sʰʷ t͡ʃʰ
	Voiced	d͡ʒ	
	Heterorganic compounds	fj	pj
	Consonant clusters	st' skʰ sf sk͡xʰ kʰʀ dʀ gʀ	sk' br

L6 produced most of the target words spontaneously and was only given a forced choice option on very few occasions. Although he presented with an SSD, he had all the consonant phonemes targeted both word-initially and in the penultimate syllable position. He also produced speech with accuracy most of the time and this reflected in his high accuracy scores (PCC of 93%, PVC of 98% and PPC of 95%), which are comparable to those of his peers. L6 presented with three main phonological processes, namely backing alveolar trill /r/, assimilation and substitution of bilabial /b/ with labio-dental /v/. All Setswana vowels were present in L6's phonetic inventory and were produced in various word positions. The speech errors that L6 presented with are summarised in Table 45 below.

Table 45. Phonological processes produced by L6

Phonological processes	Realisation	Example	Comment
Assimilation	n → ɲ	**n**ɔɲanɪ (bird) → **ɲ**ɔ**ɲ**anɪ	Age appropriate
Dentalisation	b → v	**b**ɛrɛk'a (work) → vɛ**ʀ**ɛk'a tʰu**b**ɛhilɛ (broken) → tʰu**v**ɛhilɛ di͡ts'ɛ**b**ɛ (ears) → di͡ts'ɛ**v**ɛ	Not age appropriate
Backing /r/	r → ʀ	diạpˈa**r**ɔ → diʀạpˈa**ʀ**ɔ sekʰu**r**umɛlɔ → skʰu**ʀ**umɛlɔ amb**r**ɛla → amb**ʀ**ɛla	Age appropriate

The phonological processes noted in L6's speech were mainly backing of alveolar trill /r/, which was substituted with uvular trill /ʀ/ fifteen times (e.g. *'sekhu**r**umêlô'* /sɪkʰu**r**umɛlɔ/ lid → /skʰu**ʀ**mɛlɔ/). This consonant phoneme was also substituted with lateral sonorant /l/ and this occurred in isolation (e.g. *'setlha**r**e'* /sɪtɬ͡ʰa**r**ɪ/ tree → /stɬ͡ʰa**l**ɪ/). L6 was only stimulable for correct production of /r/ once (e.g. *'amb**r**êla'* /amb**r**ɛla/ umbrella) and was observed to produce this phoneme accurately during spontaneous naming one time (e.g. *'o futswêtsa kê**r**êsê'* /ʊ fut͡sʷ'ɛt͡s'a k'ɛ**r**ɛsɛ/ s/he is blowing a candle). Another consonant phoneme that was substituted was voiced labio-dental fricative /v/, a substitution that occurred five times. This substitution, referred to as dentalisation, is not common in Setswana-speaking children and occurred in various word positions in L6's speech (e.g. *'bêrêka'* /**b**ɛrɛk'a/ work → *'vêrêka'* /**v**ɛʀɛk'a/; *'ditsêbê'* /dit͡s'ɛ**b**ɛ/ ears → *'ditsê**v**ê'* /dit͡s'ɛ**v**ɛ/). L6 was stimulable for correct production of voiced bilabial plosive /b/ at a single word level, but sometimes continued to substitute it with labio-dental /v/ after having corrected his error (e.g. *'ditsê**v**ê'* /dit͡s'ɛ**v**ɛ/ → *'ditsê**b**ê'* /dit͡s'ɛ**b**ɛ/ → /dit͡s'ɛ**b**ɛ/ → /dit͡s'ɛ**v**ɛ/). The phonological process that occurred in L6's speech is assimilation and occurred twice (e.g. *'nônyane'* /nɔɲanɪ/ bird → *'nyônyane'* /**ɲɔɲ**anɪ/; *'monang'* /mʊnaŋ̩/ mosquito → *'monane'* /mʊ**n**a**n**ɪ/). L6 was stimulable for correct production of these words. The occurrence of assimilation is age appropriate and did not raise concerns as it was only noted twice in the word naming task.

There were other phonological processes that occurred in isolation and included substitution of vowels. Vowel assimilation was noted; /ɛ/ was substituted with /ɔ/ (e.g. *'khêrôtse'* /kʰɛrɔt͡s'ɪ/ carrot → /kʰɔʀɔt͡s'/). Front open-mid /ɛ/ was also substituted with front close-mid /ɪ/ (e.g. *'mangw**ê**l**ê**'* /maŋʷ**ɛ**l**ɛ**/ knees → *'mangwele'* /maŋʷɪlɪ/). L6 was able to produce these error words correctly one out of three times, and used this vowel correctly throughout the entire assessment.

In addition to the segmental speech errors described above, L6 made suprasegmental errors and used incorrect tonal patterns when producing some words. Use of incorrect tone was noted only three times; for instance *'bôfa'* /bɔ́fà/ (tie, v) is produced with a HL tonal pattern, but L6 produced it with a LL tonal pattern (/bɔ̀fà/). Although he used the incorrect tonal pattern when producing /bɔfa/ as a single word, he used the correct tone when he used this word in a sentence (e.g. /ʊ bɔ́fà dit͡ɬʰak'ʊ/ s/he is tying her/his shoes). Other words on which L6 used the incorrect tonal patterns include /lìxàp'ú/ (LLH → LLL) and /ŋ̩̀k'ú/ (LH → LL).

6.2.4.1 Intelligibility

The average score for L6's intelligibility is 4.7, suggesting that his speech is on average, "usually" intelligible. According to L6's mother, those who are familiar with him (e.g. immediate family and teachers) understand him better than those who are not (e.g. extended family and acquaintances). She further reported that his speech was more easily understood by strangers than extended family. Table 46 provides a summary of the ICS results.

Table 46. Results from the *Intelligibility in Context Scale* (completed by L6's mother)

		Ka metlha (Always)	**Ka gale** (Usually)	**Ka dinako dingwe** (Sometimes)	**Ga e se ga ntsi** (Rarely)	**Gotlhelele** (Never)
1.	A o tlhaloganya ngwana wa gago fa a bua[1]? (Do **you** understand your child[1]?)	**5**	4	3	2	1
2.	A ba losika ba tlhaloganya ngwana wa gago fa a bua? (Do **immediate members of your family** understand your child?)	**5**	4	3	2	1
3.	A ba maloko a mangwe a losika lwa gago ba tlhaloganya ngwana wa gago fa a bua le bone? (Do **extended members of your family** understand your child?)	5	**4**	3	2	1
4.	A ditsala tsa ngwana wa gago ba a mo tlhaloganya fa a bua le bone? (Do your **child's friends** understand your child?)	**5**	4	3	2	1
5.	A batho ba bangwe mo tikologong (kgotsa morafe) ba tlhaloganya ngwana wa gago fa a bua le bone? (Do other **acquaintances** understand your child?)	5	**4**	3	2	1
6.	A barutabana ba ngwana wa gago ba a mo tlhaloganya fa a bua le bone? (Do your **child's teachers** understand your child?)	**5**	4	3	2	1
7.	A batho ba ba sa itseng ngwana wa gago ba a mo tlhaloganya fa a bua le bone[2]? (Do **strangers**[2] understand your child?)	**5**	4	3	2	1
	PALO YOTLHE YA SEKORO (TOTAL SCORE) =	**33/35**				
	PALO E E MAGARENG YA SEKORO (AVERAGE TOTAL SCORE) =	**4.7/5**				

6.3 Summary

This chapter focused on findings from children who were acquiring more than one language, as well as those identified as having SSDs. The speech sound skills of bi/multilingual children were found to be comparable to their monolingual peers, and sometimes slightly more advanced. Four children, some of whom were monolingual and some bi/multilingual were identified as having an SSD, suggesting a prevalence rate of 4.9% of SSDs in the Setswana population in South Africa. The difficulties they presented with were in line with Dodd's (1995, 2005) diagnostic classification, suggesting its applicability in classifying SSDs in Setswana-speaking children.

CHAPTER 7: DISCUSSION

This study aimed to describe the development of segmental and suprasegmental phonology in children aged between 2;0 and 6;5 years. Since very little is known about how the speech sound system of Setswana is acquired, this study was conducted to further contribute to the knowledge base for clinical practice in South Africa and other parts of Southern Africa where Setswana is spoken. A comparison between two varieties of Setswana was also made to note if any differences in speech sound acquisition between the two groups exist. Such information will allow the SLT to take account of this during assessment of Setswana-speaking children. Data on the occurrence of SSDs and the nature of these in Setswana-speaking children were also provided. Such data will be beneficial for SLTs working with Setswana-speaking children. A detailed account of SSDs in Setswana-speaking children will facilitate easy identification and classification of speech errors using available theoretical models. Such information may also aid in determining which of the therapy approaches used by SLTs is most appropriate for use with the types of SSDs identified in this study. Additionally, a tool previously developed to measure phonological development in Setswana-speaking children was revised (Setswana v.2) and used with a larger group of participants acquiring two varieties of Setswana. This allowed for examination of the usability of Setswana v.2 in assessing speech sound development in Setswana-speaking children in clinical practice. An interpretation of the study findings is provided and discussed in detail in this chapter, including relating these findings to what has been documented in other languages.

This study contributes applied knowledge and adds to the evidence base on Setswana speech acquisition as the findings have significant implications for SLTs who work with this group of children. Furthermore, the project contributes to theoretical knowledge on speech sound development in indigenous African languages as the study findings are related to some of the established theoretical frameworks on speech development. These contributions are detailed in this chapter.

7.1 Consonant acquisition

A large number of Setswana consonant phonemes are acquired early. The youngest group of children (aged 2;6–2;11 years) in this study had either acquired or mastered most consonants occurring in the word-initial and penultimate syllable positions, with only a few consonant phonemes still emerging or absent from their inventories. This early acquisition of consonants is similar to findings reported for Sesotho and has been attributed to the simple syllable structure of the language (Demuth, 2007). In the initial word position, two phonemes with rounding (namely alveolar plosive /kʷʼ/ and alveolar nasal /nʷ/) were still emerging at 2;6–2;11 years, and seen to be acquired by children in the 3;0–3;5 year range. This suggests that coarticulated speech sounds are acquired later than other consonants. Almost all plosives have been acquired at 2;6–2;11 years, with only round ejective alveolar

plosive /kʷ’/ still emerging at this age. Other consonant phonemes that have been acquired word-initially include fricatives, nasals (with the exception of /nʷ/), lateral and medial sonorants, as well as ejective and aspirated affricates. Voiced palato-alveolar affricate /ʤ/ was absent in the initial word position at 2;6–2;11 years. This phoneme was, however, seen to emerge in the 3;0–3;5 year group and was acquired by the children aged 4;0–4;5 years. This omission of labial glide /w/ occurring as part of a complex onset has also been noted to persist until 3 years in Sesotho-speaking children (Demuth, 1992; 2007). The presence of heterorganic compounds in the initial word position mainly consisted of /fj/, and were only seen in the speech of children who speak the Sekwêna variety; none of the participants who speak the Setlhaping variety used such compounds in their speech.

Although consonant clusters were not included in the list of consonant phonemes elicited as part of this study, they were noted in the inventories of children across the different age groups. The youngest children (2;6–2;11 years) and those aged 3;6–3;11 years did not use consonant clusters. One consonant cluster (/sp’/) emerged at 3;0–3;5 years and had been acquired by children in the 4;0–4;5 year group. Many of the /s/ consonant clusters are similar to those found in English, with the main difference being that the plosives that follow alveolar fricative /s/ are either ejective (e.g. /st’/) or aspirated (e.g. /skʰ/). The oldest group of children (6;0–6;5 years) had acquired more consonant phonemes (they had a total of six clusters in their inventories word-initially) compared to the younger groups (4;0–4;5 years), who had acquired a total of four consonant clusters and had one emerging. Information on the ages at which consonant clusters are acquired is not conclusive since these were not elicited in the speech samples and did not occur frequently in the speech of several participants. The presence of consonant clusters has also been noted in the speech of Sesotho-speaking adults and children, particularly when using English loanwords (Rose & Demuth, 2006).

A large number of consonant phonemes occurring in the penultimate syllable position were also seen to have already been acquired at 2;6–2;11 years. Similar to the initial word position, the consonants that appeared to pose challenges for the youngest age group (i.e. 2;6–2;11 years) were those with rounding. These include velar nasal /ŋʷ/ and ejective alveolar affricate /t͡sʷ’/, which were acquired by those aged 3;0–3;5 years. Such findings are similar to those noted in children acquiring Sesotho, although they have been reported to simplify alveolar affricate /t͡s’/ to /t’/ (Demuth, 2007). The presence of heterorganic compounds and consonant clusters were also noted in the inventories of participants across the various age groups. The heterorganic compound that mainly occurred in the penultimate syllable position is /pj/. In terms of the consonant clusters, only two were noted in the penultimate syllable position and include /sk’/ and /br/. Additionally, consonant clusters were noted to start emerging from 4;0–4;5 years.

The study findings show that speech is produced more accurately as children grow older. Although the majority of consonant phonemes appear to have been developed by the youngest group of children (2;6–2;11 years), the oldest group (6;0–6;5 years) had acquired more consonants in

comparison. These findings concur with findings from studies that have documented speech sound development in various languages spoken around the world (Maphalala et al., 2014; McLeod & Crowe, 2018; Pascoe & Jeggo, 2019). Feature classes that posed challenges for the youngest children (2;6–2;11 years) and were still to be acquired by this age group are discussed further in the sub-sections below. In general, Setswana-speaking children appear to acquire plosives, nonpulmonic consonants (such as the ejective consonants), nasals, approximants, as well as lateral consonants earlier than affricates and the trill consonant present in the sound system of the language. This trend of consonant acquisition is similar to that reported for a number of languages spoken in various parts of the world (McLeod & Crowe, 2018). Similarities noted between findings from this study and those reported for other languages regarding the age and order of consonant acquisition support theories of universals (Jakobson, 1941/1968). There are, however, differences noted; for example, fricatives were acquired very early (at 2;6–2;11 years) and only a few consonant phonemes still posed challenges for the youngest group of children, which shows differences that should be noted by SLTs working with this population. This is especially important because even though the order is relatively similar across many languages, the ages at which children are expected to have acquired certain phonemes differ slightly.

7.1.1 Consonant phonemes with rounding

Consonant phonemes with rounding had not yet been acquired by children in the 2;6–2;11 year group. These include velar plosive /kʷ'/, which emerged at 2;6–2;11 years in the initial word position and was seen to be acquired by children in the 3;0–3;5 years group. Alveolar affricate /t͡sʷ'/ was seen to emerge at 2;6–2;11 years in the penultimate syllable position. It was acquired and used with more accuracy at 3;0–3;5 years and noted to occur with more frequency in the speech of children aged 5;6–5;11 years. In addition to the two ejective consonants, round alveolar nasal /nʷ/ and velar /ŋʷ/ appeared challenging for those aged 2;6–2;11 years. Both these nasal phonemes emerged at 2;6–2;11 years and were acquired at 3;0–3;5 years. Alveolar /nʷ/ was produced without rounding in the initial word position and velar /ŋʷ/ was often produced without rounding and sometimes anteriorly when occurring in the penultimate syllable position (e.g. *'ma**ngw**êlê'* /ma**ŋʷ**ɛlɛ/ knees → *'ma**n**êlê'* /ma**n**ɛlɛ/). Similar findings have been reported for Sesotho, a language that is mutually intelligible to Setswana. According to Demuth (2007), the omission of /w/ when it occurs as part of a complex onset persists until 3 years in Sesotho-speaking children and is seen to especially affect velar nasal /ŋʷ/. Omission of /w/ occurring as part of a complex onset (e.g. /ŋʷ/→/ŋ/) seems to be specific to languages belonging to the Sotho language family, and has not been reported for languages belonging to the Nguni language family (specifically isiXhosa and isiZulu).

7.1.2 Affricates

Only two affricates, namely voiced palato-alveolar /ʤ/ and round ejective alveolar affricate /t͡sʷʼ/, had not been acquired at 2;6–2;11 years. Voiced palato-alveolar affricate /ʤ/ was absent at 2;6–2;11 years and starting to emerge for the 3;0–3;5 year group. Two participants stopped this phoneme and produced it as alveolar /d/, thereby preserving voicing, while one participant produced it anteriorly as voiced alveolar affricate /ʣ/ (e.g. *'jesa'* /**ʤ**ɪsa/ feed → /**ʣ**ɪsa/). The youngest participants mainly experienced difficulty with producing ejective alveolar affricate /t͡sʼ/ when it was rounded, and unlike /ʤ/, production of /t͡sʷʼ/ was not simplified and produced as a plosive (e.g. /tʼ/). The finding that affricates pose challenges has been reported for a number of languages worldwide (McLeod & Crowe, 2018). These findings from Setswana-speaking children are, however, different to what has been reported for Sesotho. Demuth (1992, 2007) reported that Sesotho-speaking children often simplify lateral affricate /t͡ɬʼ/ to alveolar plosive /tʼ/; while such simplifications were noted widely in the speech of the youngest group of children (2;6–2;11 years), both affricates had been acquired by this group. Although Sesotho and Setswana belong to the same language family and are mutually intelligible, the difference in the acquisition of the same consonant phonemes highlight the importance of using language-specific normative data. Affricates appear to be acquired earlier in Setswana than reported for isiXhosa (Maphalala et al., 2014; Mowrer & Burger, 1991), but this may be due to the fact that the Setswana speech sound inventory has fewer affricates in comparison to isiXhosa.

7.1.3 Alveolar trill /r/

Information on the ages at which alveolar trill /r/ emerges in the inventories of Setswana-speaking children, or the ages at which it is developed or mastered is not conclusive at this point as its production could not be elicited for all participants. Some patterns were, however, noted when several participants made an attempt to produce it in the word-initial and penultimate syllable positions. This consonant phoneme was mainly produced as /l/ by the younger groups and produced posteriorly as uvular trill /ʀ/ by the older children. The younger children therefore preserved the place of articulation (i.e. consonant produced more anteriorly in the oral cavity) while the older children preserved the manner of articulation for the target phoneme. Production of alveolar trill /r/ in the back of the mouth was also reported for Sesotho-speaking children (Demuth, 1992; 2007). Although the age at which this phoneme (i.e. alveolar trill /r/) was acquired by Sesotho-speaking children was not documented, it is clear that it is one of the more difficult phonemes for children and is acquired later than most consonants. The late acquisition of alveolar trill /r/ has also been noted for isiXhosa-speaking children (Maphalala et al., 2014). While this finding supports what has been found in Setswana, it should be noted that alveolar trill /r/ occurs less frequently in isiXhosa speech than it does in Setswana. The majority of participants across the age groups – and for both varieties of Setswana – were noted to

produce alveolar trill accurately when it occurred in word positions that were not targeted, albeit inconsistently.

7.2 Vowel acquisition

All seven vowels in the Setswana sound system were acquired by children in the 2;6–2;11 year group, including when these occurred on their own as syllables (i.e. when they occurred as single vowel syllables). These findings concur with reports of the early acquisition of vowels across a large number of languages, some of which include Sesotho (Demuth, 1992; 2007), isiXhosa (Maphalala et al., 2014), kiSwahili (Gangji et al., 2015), isiZulu (Naidoo et al., 2005; Pascoe & Jeggo, 2019), and English (McLeod & Crowe, 2018). While Setswana-speaking children had acquired vowels early, they were sometimes noted to make errors on some sounds. This was mainly seen in children acquiring the Sekwêna variation, and was reported in the preliminary study that investigated the acquisition of Setswana speech in children who spoke the same variation (Mahura, 2014; Mahura & Pascoe, 2016). Similarly, it was noted that mid-vowels were the ones that were mainly affected. It cannot, however, be concluded that this error does not occur in the speech of children who speak the Setlhaping variety, or other varieties of Setswana. Information about vowel errors typical for Setswana-speaking children is important for clinical practice since errors affecting vowels are often taken into account during differential diagnosis of speech sound disorders, particularly in diagnosing childhood apraxia of speech (Bowen, 2015).

7.3 Acquisition of phonotactic structures

There were several combinations of syllables that were targeted in the Setswana speech assessment, including syllables with rounding. These comprised: 1) monosyllabic CV (e.g. *'ša'* /ʃa/ burning) and C^{w}V (e.g. *'nwa'* /n^{w}a/ drinking); 2) bisyllabic CV.V (e.g. *'tlôu'* /t͡ɬ'ɔu̯/ elephant), C.CV (e.g. *'nku'* /ŋ̩k'u/ sheep, sing), C^{w}V.CV (e.g. *'ngwana'* /ŋ^{w}ana/ baby) and CV.CV (e.g. *'pitsa'* /p'it͡sʼa/ pot); as well as 3) multisyllabic CV-CV-CV (e.g. *'panana'* /p'anana/ banana), CV.C.CV (e.g. *'tônki'* /t'ɔŋ̩k'i/ donkey), CV.CV.V.CV (e.g. *'dikausu'* /dik'au̯su/ socks), CV.V.CV.CV (e.g. *'diaparô'* /diau̯p'arɔ/ clothes, V.CV.CV (e.g. *'apole'* /au̯p'ʊlɪ/ apple), CV.C^{w}V.C^{w}V (e.g. *'segwagwa'* /sɪx^{w}ax^{w}a/ frog) and CV.CV.C^{w}V.CV (e.g. *'ditshôswane'* /dit͡s^{h}ɔs^{w}anɪ/ ants). The youngest group (2;6–2;11 years) of participants in this study produced the CV syllables accurately and mainly produced the round syllables (i.e. C^{w}V) without their rounding feature (i.e. as CV). This is to be expected since CV is the simplest syllable in Setswana, like in many Bantu languages (Demuth, 2007). The omission of the rounding feature concurs with findings reported for children acquiring Sesotho (Demuth, 1992; 2007). The 2;6–2;11 year-old participants produced words with three syllables accurately and appeared to have difficulty with four and more syllables. This included words with basic CV structure and with other

structures that are slightly more complex (e.g. CV.CV.CV.CV – *'sefatlhêgô'* /sɪfat͡ɬʰɛxɔ/, face; CV.V.CV.CV.CV – *'baesekele'* /baɪsɪk'ɪlɪ/, bicycle). These participants often omitted one or more syllables in these words, thereby simplifying production of longer words. The syllables omitted in these longer words, specifically those omitted word-initially, often consisted of noun class prefixes. This has been documented as being a typical stage of development of noun class prefixes in several Bantu languages, including Setswana (Tsonope, 1987; 1993), Sesotho (Demuth, 2003) and siSwati (Kunene, 1979). These studies, however, reported that noun class prefixes were used in their general form at 2;6–2;8 years (Demuth, 2003). This suggestion is different to what has been noted here as omission of noun class prefix was seen to occur in children aged 3;0–3;6 years, although more frequently in those aged 2;6–2;11 years. This likely indicates that noun class prefixes are used appropriately later than reported for Setswana-speaking children. While there were only fourteen participants aged 2;6–3;5 years, this pattern was seen in more children than previously studied by Tsonope (1987). It should, nonetheless be investigated further with a larger participant group.

In addition, participants across the age groups and in the two varieties investigated were noted to use a CCV syllable as they used consonant clusters. This was seen in their use of loan words; e.g. CV.CV.CV *'sepili'* /sɪp'ili/ (mirror), derived from the Afrikaans word 'spieël', was often produced as CCV.CV *'spili'* /sp'ili/ and CCV.CV.C *'spiling'* /sp'iliŋ/ (in the mirror). The use of consonant clusters was also seen widely in the production of non-loan words, especially in words which had a noun class prefix /sɪ/ in the initial word position. For instance, *'sekhurumêlô'* /sɪkʰurumɛlɔ/ (lid) was produced as *'skhurumêlô'* /skʰurumɛlɔ/. The frequent use of consonant clusters by Setswana-speaking children is demonstrative of a changing phonological system. This finding supports the proposal of a fourth syllable structure in the Setswana speech sound system, namely CCV (Mahura, 2014; Mahura & Pascoe, 2016). Rose and Demuth (2006) also reported similar findings – Sesotho-speaking adults and children were noted to use consonant clusters, particularly when using English loanwords. Another change observed was the use of words ending in a consonant that is not a syllabic velar nasal /ŋ/. This was seen only in production of English loan words (e.g. carrots) and also occurs in adult speech.

7.4 Accuracy scores

The degree to which the study participants produced consonant phonemes and vowels accurately was measured using Shriberg et al.'s (1997) formula. A total score for all phonemes was also included. The percentage correct scores were included to determine how the accuracy with which Setswana-speaking children produce speech compared to adult targets across the ages (specifically between 2;6 and 6;5 years). This was also done to establish a progressive pattern in which speech accuracy occurs over the years, a finding that has been reported in speech developmental studies (Maphalala et al., 2014). The mean accuracy scores were reported according to the twelve-month age

bands. This was only done for reporting on the accuracy with which vowels and consonant phonemes were produced; the development of other areas of speech (e.g. consonant inventories) was reported on in six-month age bands. Reporting the mean accuracy scores in twelve-month age bands allowed the researcher to outline a clear pattern of progression in the use of accurate speech as children grow older. As can be expected, and as has been reported in studies that have explored the acquisition of speech sounds, the accuracy with which Setswana-speaking children produced speech sounds increases with age. The accuracy with which vowels were produced by the youngest group of participants (2;6–2;11 years) closely approximated adult targets. This has also been reported for other languages such as Sesotho (Demuth, 2007), isiXhosa (Tuomi et al., 2001; Maphalala et al. (2014) and English (Dodd et al., 2003; Pascoe et al., 2018). Although a ceiling was not reached on PVC scores obtained by the oldest group of children (5;6–5;11 years), these findings may be used in clinical practice to make a decision on whether or not a child's speech is developing typically.

Children acquiring Setswana were noted to produce a greater number of consonant phonemes more accurately with age. For instance, children aged 2;6–3;5 years had a PCC score of 88%, while those aged 5;6–6;5 years had a score of 96%. These findings indicate that although children aged 5;6–6;5 years produce many consonant phonemes accurately most of the time, we can continue to expect a few errors in production of a small number of words. It can therefore be said that while the older children have all the consonants in their phonetic inventories, they do not always produce them accurately. The PVC and PCC scores obtained by 2;6–3;5 year old Setswana-speaking children are very similar to estimates provided for Sesotho-speaking children in similar age ranges. For instance, Demuth (2007) estimated PVC and PCC scores of 80% for Sesotho-speaking children aged 2;6–2;11 years, and 90% for those aged 3;0–3;11 years. Sesotho-speaking children are estimated to have accuracy scores of 100% from 4 years old, which is slightly higher than those obtained by Setswana-speaking children of the same age who continue to make some errors during speech production. These differences might be attributed to the fact that the accuracy scores provided for children acquiring Sesotho are estimates and were not measured using speech samples of children in the different age ranges. Furthermore, the accuracy scores obtained by children acquiring Setswana closely resemble those reported for other Bantu languages, specifically isiXhosa, isiZulu and Kiswahili, as well as South African English. For example, Maphalala et al. (2014) reported PVC and PCC scores of 97% and 91% respectively for isiXhosa-speaking children aged 3;0–3;6 years, as well as a PVC of 99% and PCC of 97% for those aged 5;0–5;11 years. Pascoe and Jeggo (2019) reported a PVC of 75% and PCC of 89% for 2;6–2;11 year old children acquiring isiZulu, as well as a PVC of 90% and PCC of 98% for those aged 6;0–6;5 years. This supports the suggestion that although the speech of 6-year-old children closely approximate adult speech, they still make some errors.

7.5 Phonological processes

Phonological processes are speech error patterns that occur during typical speech sound development, and are used by children to simplify adult targets that they have not yet mastered. The phonological processes used by children speaking the Sekwêna and Setlhaping varieties consisted of both syllable and substitution patterns, which were seen across the age groups. The youngest group of children (i.e. 2;6–2;11 years) presented with a larger range of phonological processes, and these occurred more frequently during speech production in comparison to the older groups (e.g. 5;6–6;5 years). The decrease in the number of phonological processes and the frequency with which they occur is a pattern that can be expected as children get older, and one that has been noted in studies that have investigated speech sound development in languages across the world (Dodd et al., 2003; Gangji et al., 2015; Maphalala et al., 2014). Phonological processes that occurred widely were: 1) deletion of syllable /sɪ/ word-initially; 2) assimilation; 3) backing /r/; 4) substituting /r/ with /l/; as well as, 5) vowel substitution.

Syllable /sɪ/ was mainly omitted when it occurred in the word-initial position, where it serves as a Class 4 singular prefix. For instance, *'**se**khurumêlô'* /**sɪ**kʰurumɛlɔ/ (lid), was produced as *'khurumêlô'* /kʰurumɛlɔ/. This omission occurred the most in the speech of the youngest group of children (i.e. 2;6–2;11 years). While syllable /sɪ/ was also omitted word-medially (e.g. *'bae**se**kele'* /baɪ**sɪ**k'ɪlɪ/ bicycle → *'baekele'* /baɪk'ɪlɪ/), this occurred in isolation and was likely done by young children as production of a five-syllable word was difficult. Additionally, omission of syllable /lɪ/ in the word-initial position was noted in the speech of one participant aged 3;6–3;11 years, where it serves as a Class 3 singular prefix. For instance, *'**le**phutshi'* /**lɪ**pʰut͡sʰi/ (pumpkin) was produced as *'phutshi'* /pʰut͡sʰi/). Tsonope (1987; 1993) reported the omission of noun class prefixes as being part of typical language development for Setswana-speaking children. In his longitudinal study of two children acquiring Setswana, Tsonope (1987; 1993) noted that before being able to produce nouns that are identical to those of adult forms (i.e. with noun class prefixes), children omitted prefixes. This means that they produced noun stems only, and this has been noted as the first stage of noun class prefix acquisition. This stage is followed by one in which noun stems are pre-posed by a vowel (Tsonope, 1987;1993), and was observed in the speech of some children aged 2;6–2;11 years, although it occurred in isolation (e.g. *'**se**fatlhêgô'* /**sɪ**fat͡ɬʰɛxɔ/ face → *'**a**fatlhêgô'* /**ạ**fat͡ɬʰɛxɔ/). This developmental pattern has also been reported for Sesotho, siSwati and isiZulu (Demuth, 2003). The omission of noun class prefixes by young children has been attributed to the input they hear, as parents and caregivers often simplify their speech according to what they perceive the children's level of competence to be (Tsonope 1987; 1993). Tsonope (1987; 1993) has further explained that these simplifications are mainly seen during daily object-naming routines. These simplifications are frequently bisyllabic in nature. While this explanation might hold true for why Setswana-speaking children omit noun class prefixes, it is interesting to note that only prefixes containing coronal consonants /l/ and /s/ were omitted. Machobane,

Moloi and Demuth (2007) have reported that Sesotho-speaking adults also tend to drop certain noun class prefixes, but that these prefixes (specifically those with coronal consonants) are always followed by some form of agreement when dropped. This therefore means that some of the input that children hear consists of prefix-less words. The omission of prefix /sɪ/ and /lɪ/ by children acquiring Setswana mainly occurred at 2;6–2;11 years, but has been recorded to be prevalent at 2;1–2;6 years for Sesotho (Demuth & Ellis, 2009). These findings likely suggest evidence of phonological overgeneralisation, since the participants dropped the coronal prefixes in the absence of agreement. Although the two Sesotho-speaking children described by Demuth and Ellis (2009) were younger than those reported in this study, they seldomly produced prefixes containing coronal consonants in comparison to those with non-coronal consonants. Demuth and Ellis (2009) suggested that this was demonstrative of some awareness children acquiring Sesotho and related languages have early on in speech and language development. This awareness relates to the fact that phonological conditions that noun class prefixes can be realised as null (i.e. they can be dropped).

The second phonological process that occurred widely in the speech of children acquiring Setswana was assimilation, which is also referred to as consonant harmony. It occurred with the highest frequency in the youngest group of children (i.e. those aged 2;6–2;11 years). Tsonope (1987; 1993) reported consonant harmony for one of the two children in this study. He noted that the child who presented with assimilation only copied the consonants that occurred in the penultimate syllable. This was a pattern that was also observed in the speech of children who presented with assimilation in this study. For instance, *'nô**ny**ane'* /nɔ**ɲ**anɪ/ (bird) was produced as *'**ny**ô**ny**ane'* /**ɲ**ɔ**ɲ**anɪ/, and *'sefa**p**anô'* /sɪfa**p'**anɔ/ (cross, n) was produced as *'se**p**a**p**anô'* /sɪ**p'**a**p'**anɔ/. Although this pattern was noted widely, some participants who presented with assimilation reduplicated a consonant not occurring in the penultimate syllable (e.g. *'**k**etlele'* /**k'**ɪt͡ɬ'ɪlɪ/ kettle → *'**k**e**k**ele'* /**k'**ɪ**k'**ɪlɪ/). Assimilation has been reported for children acquiring Sesotho (Demuth, 2007), although the ages at which this phonological process disappears for Sesotho-speaking children has not yet been documented. Assimilation can be expected beyond 6;5 years in children acquiring Setswana, although it occurs with less frequency in the older groups of children. For children acquiring Bantu languages, assimilation appears unique to the Sotho languages as it was not reported for children acquiring Kiswahili (Gangji et al., 2015) and Nguni languages such as isiXhosa (Maphalala et al., 2014) and isiZulu (Pascoe & Jeggo, 2019). Another syllable level speech error pattern (i.e. phonological process) is the simplification of C^w diagraphs, meaning that round syllables (C^wV) are produced as basic CV syllables (i.e. without rounding). This phonological process was reported to occur mainly in children aged 3;0–3;5 years in the first preliminary study (Mahura & Pascoe, 2016). Based on these findings, it was suggested that two-year-old Setswana-speaking children will simplify round syllables and produce them without their rounding feature (i.e. $C^wV \rightarrow CV$). Findings from the current study support this hypothesis as this phonological

process occurred frequently in the speech of children aged 2;6–2;11 years, and are in line with findings reported for children acquiring Sesotho (Demuth, 2007).

Two of the five phonological processes noted widely in the speech of Setswana-speaking children 2;6–6;5 years involved substitution of alveolar trill /r/. A high number of the younger children (2;6–6;5 years) substituted alveolar trill /r/ with latero-alveolar /l/, while most of the older children (6;0–6;5 years) produced it posteriorly and substituted it with uvular trill /ʀ/. This means that the younger children often attempted to preserve the place of articulation, while the older children preserved the manner in which alveolar trill /r/ is produced. Although the older children preserved the manner of articulation, they backed uvular trill /r/. Similar findings were reported in the Setswana preliminary study (Mahura & Pascoe, 2016) and support the suggestion that the older children may be substituting /r/ with a similar sounding phoneme because they are able to consciously distinguish that /ʀ/ sounds more identical to /r/ than /l/ does. This further suggests that children acquiring Setswana likely start reflecting on their speech early and that this is done more frequently as they get older. This can be expected as children are reported to start acquiring phonological awareness skills during their first school-going year (i.e. around five years of age) (Rvachew & Brosseau-Lapré, 2017; Stackhouse & Wells, 1997), although it likely appears slightly earlier in Setswana-speaking children. This hypothesis should be examined in future studies. Substitution of alveolar trill /r/ with latero-alveolar /l/, as well as uvular /ʀ/ has been reported for children acquiring Sesotho too (Demuth, 2007). Children acquiring Kiswahili have also been reported to substitute /r/ with /l/ and this was reported to occur beyond 5;11 years. Additionally, voiced alveolar plosive /d/ was substituted with latero-alveolar sonorant /l/ and this phonological process only occurred between 2;6 and 3;5 years. It was noted in the speech of many young children in the previous preliminary study on Setswana speech sound development (Mahura & Pascoe, 2016) that many children aged between 3;0–3;5 years substituted /d/ with /l/ (e.g. *'**d**ikôtlôlô'* /**d**ik'ɔt͡ɬ'ɔlɔ/ dishes → *'**l**ikôtlôlô'* /**l**ik'ɔt͡ɬ'ɔlɔ/). Alveolar /d/ is an allophone of /l/ and only occurs after high vowels. This substitution of allophone /d/ with /l/ has also been reported for Sesotho-speaking children aged between 2 and 3 years (Demuth, 2007).

Errors affecting vowels were noted across all age groups. These included vowel assimilation (e.g. *'ap**o**le'* /ap'**ʊ**lɪ/ apple → *'ap**o**l**o**'* /ap'**ʊ**l**ʊ**/), as well as substitution of front open-mid /ɛ/ with front close-mid /ɪ/ (e.g. *'mangwêlê'* /maŋʷ**ɛ**l**ɛ**/ knees → /maŋʷɪlɪ/), and back open-mid /ɔ/ with close-mid /ʊ/ (e.g. *'ditshôswane'* /dit͡sʰ**ɔ**swanɪ/ ants → /dit͡sʰ**ʊ**tsʰʷanɪ/). In contrast to what has been reported for other languages, vowels were not always produced accurately from a young age since Setswana-speaking children aged 6;0–6;5 years continued to make a few errors affecting vowels. It is important to note that certain vowel errors are developmentally appropriate for children acquiring Setswana, especially since errors affecting production of vowels are often used as one of the main indicators of childhood apraxia of speech (Bowen, 2015).

7.6 Intelligibility

Intelligibility refers to the degree to which one's speech is understood by others. It is important to note that speech intelligibility is different to speech accuracy, which refers to the correctness with which speech is produced (Rvachew & Brosseau-Lapré, 2017). Although speech accuracy is not the same as speech intelligibility, it is one of the factors that affect how well an individual's speech is understood by others. In this study, the children's speech intelligibility was measured using the Setswana version of the Intelligibility in Context Scale (ICS) (Mahura et al., 2012; McLeod et al., 2012). This is a rating scale that relies on caregivers' subjective evaluation of the intelligibility of their children's speech during conversation with different communication partners (McLeod et al., 2012). It therefore takes into account the speaker's speech production, as well as various contexts in which communication occurs. A preliminary study has found that the ICS is a useful tool in obtaining information on the speech intelligibility of children acquiring several of the indigenous languages spoken in South Africa, including Setswana (Pascoe & McLeod, 2016). While not all parents and caregivers returned the ICS, information on the intelligibility of most of the study participants' speech was obtained. For bi/multilingual children, parents and caregivers completed only one form so as to obtain information on their child's overall speech intelligibility. This was done since previous studies have found that the number of languages that a child speaks does not influence the total scores obtained on the ICS (Washington, McDonald, McLeod, Crowe & Devonish, 2017). Most children across the age groups obtained high scores on the ICS, with the majority of parents and caregivers indicating that their children's speech was either usually or always understood by communication partners who are both familiar and unfamiliar to the children. This was also the case for children whose accuracy scores (i.e. PCC, PVC & PPC) were relatively lower than those obtained by their peers. Although it would be expected for people who are familiar to the child to often understand her/his speech, the opposite is often found for those unfamiliar to the child (Phạm, McLeod & Harrison, 2017). Pascoe and McLeod (2016) found that in a number of cases where parents and caregivers had no knowledge of how their children's speech was understood by other people (e.g. strangers), they were likely to generalise their own perceptions of their child's speech intelligibility. This may be true for a number of the ICS reports for this study since children whose speech was often not easily understood by the researcher were reported as usually or always understood by strangers and acquaintances. The teachers also reported that some of these children were not easily understood by some of their peers in the classroom. It should be noted, however, that there was sometimes a link between accuracy scores and reports on the ICS – a couple of children who obtained low accuracy scores were also scored low on the ICS, with parents and caregivers reporting that their speech was either sometimes or usually understood. For these children, low scores were mainly seen in questions regarding how well they were understood by people who did not interact with them on a regular basis. This is interesting to note but should be explored further in research aimed at validating the Setswana ICS.

7.7 Prosody

Lengthening of the penultimate syllable was used accurately by all participants across the age groups and in both Setswana varieties investigated. This suggests that children acquiring Setswana learn that the penultimate syllable is lengthened early. Demuth (2007) reported similar findings for Sesotho-speaking children, as they were noted to use penultimate lengthening at 2 years of age. Although the youngest participants in their study were 3 years old, Maphalala et al. (2014) did not report difficulties with the penultimate lengthening phenomenon in isiXhosa-speaking children, again suggesting that the penultimate syllable lengthening is used accurately from an early age. According to the University of Botswana's Department of African Languages and Literature (2001), Setswana is a two-level tonal language and has High (H) and Low (L) tone distinctions. With the exception of isolated cases, the two-year-old participants in this study used accurate tonal patterns in their production of various lexical items targeted. These findings concur with those reported for Setswana (Tsonope 1987), Sesotho (Demuth, 1993) and Chichewa (Chimombo & Mtenje, 1989), who reported the use of fixed HL lexical tones from an early age. Several studies that have investigated the acquisition of tone sandhi (i.e. rules governing changes in tonal patterns in various phonological contexts) have reported that unlike lexical tone, tone sandhi is much more difficult to acquire (Demuth, 1993). Only lexical tone was investigated in the current study, but acquisition of the rules governing tone sandhi in Setswana should be included in future research on development of Setswana phonology.

7.8 Phonological development in bi/multilingual Setswana children

Children acquiring Setswana and one or more languages were expected to acquire Setswana speech sounds later than their monolingual peers. They were also expected to continue to use phonological processes that would have been eliminated by their monolingual peers. This pattern of speech sound development in bi/multilingual children was hypothesised since some studies that have documented phonological development in children acquiring more than one language have found that bilingual children presented with smaller speech sound inventories when compared to monolingual peers, as well as using phonological processes that had been eliminated much earlier in their monolingual peers (Lam & To, 2017). This was, however, not the case and bi/multilingual children in this study were comparable to their monolingual peers in terms of ages and number of speech sounds acquired, with some children obtaining accuracy scores which were slightly higher than those obtained by monolingual children in the same age categories. This was noted across the age groups, with the exception of children who presented with SSDs since they obtained low accuracy scores. This finding may be attributed to positive transfer, where the development of speech and language skills of bi/multilingual children compares with that of monolingual children, and in some cases even exceeds that of the monolingual children (Goldstein & McLeod, 2012). It should be noted that findings from

studies that explored patterns of phonological development in bi/multilingual children are variable since some studies revealed no difference between the two groups of children, while others showed a delayed developmental trajectory in bi/multilingual children. A systematic review found that only a small number of studies reported bi/multilingual children had advanced speech and language skills in comparison to their monolingual peers (Hambly, Wren, McLeod & Roulstone, 2013). This therefore suggests that there is insufficient evidence to support the hypothesis that monolingual children often present with advanced speech sound development in comparison to their bi/multilingual peers (Hambly et al., 2013). With this said, a number of children acquiring more than one language have been found to present with phonological development patterns that vary from those seen in monolingual children (Rvachew & Brosseau-Lapré, 2017). This therefore puts bi/multilingual children at risk of being over-referred for intervention. For instance, bi/multilingual children may acquire consonant clusters later than monolingual children due to the absence of these from their first language and not because they present with an SSD (Rvachew & Brosseau-Lapré, 2017). This difference in developmental patterns is likely the reason Setswana-speaking children presented with cluster reduction beyond the ages noted for English-speaking children.

7.9 Classification of SSDs in Setswana-speaking children

For children who were identified as presenting with SSDs in this study, Dodd's (1995; 2005) diagnostic framework was used to classify which of the five categories they each fell into. This was done based on the surface-level error patterns noted in their speech and because it has been suggested that these errors are reflective of the processing deficits specific to each of the categories in the model (Rvachew & Brosseau-Lapré, 2017). This diagnostic framework was also used as it has been found to be applicable to children acquiring languages other than English.

Some of the participants who presented with SSDs were bi/multilingual, and since their speech sound development was only assessed for Setswana, it was not possible to determine if they would fall into the same categories if they were assessed in all languages they were acquiring. The classification of their SSDs was therefore for Setswana, and not for other languages being acquired. Only surface-level error patterns that suggested the participants presented with an articulation disorder and phonological delay were noted in those diagnosed with an SSD. Those classified as presenting with a phonological delay used phonological processes that were typical for children acquiring Setswana, but those typical for younger children. These findings concur with those reported for bilingual isiXhosa-English children (Rossouw, 2016), Cantonese (So & Dodd, 1994) and German (Fox, 2006), which are amongst many languages that have explored the applicability of using Dodd's (1995; 2005) diagnostic framework to classify SSDs in children.

7.10 The Psycholinguistic Framework

7.10.1 The Developmental Phase Model

Phases of speech sound acquisition were described in Chapter 1 using Stackhouse and Wells' (1997) Developmental Phase Model (Figure 2). The Developmental Phase Model is part of the psycholinguistic framework and proposes that a child who fails to successfully progress through the different phases of the model due to a breakdown in her or his speech processing is at risk of experiencing literacy difficulties, especially in cases where the breakdown is not addressed in intervention.

The youngest group of participants (2;6–2;11 years) in this study were in the systematic simplification phase of the model (third phase) as they presented with a larger range of phonological processes in comparison to the other age groups. These phonological processes also occurred more frequently in the 2-year-olds. The 3-year-old children presented with relatively more phonological processes than the 4-year-olds and are likely also in the systematic simplification phase but progressing on to the fourth phase, which is the assembly phase. The assembly phase is characterised by an attempt to produce consonantal sequences and sentences with a more complex structure in spite of immature phonological skills. Setswana-speaking children aged 3;6–3;11 years are thought to be progressing to the assembly phase as they no longer made many errors when producing C^wV syllables, a structure that appeared challenging for the younger groups. It should be noted that children acquiring Setswana appear to reach the fourth phase of the Developmental Phase Model (i.e., the assembly phase) slightly earlier than documented in the literature. These findings support those of a previous preliminary study on Setswana (Mahura, 2014). They also concur with those reported for children acquiring isiXhosa, who were found to have progressed through these phases earlier than recorded in existing literature (Maphalala et al., 2014).

The alveolar trill /r/ was produced posteriorly in the oral cavity and substituted with uvular trill /ʀ/ from as early as 2;6–2;11 years (and possibly much earlier). It was also substituted with alveolar /l/. It was, however, observed that from 3;6–3;11 years, children acquiring Setswana produced /r/ as /ʀ/ more frequently, and substitution of /r/ was seen to decrease at this time. A relatively significant increase in production of /r/ as /ʀ/ was noted at around 4;0–4;5 years. This has been attributed to the possibility that children start to develop an awareness that /ʀ/ sounds more similar to /r/, which is why they start to substitute it with a similar sounding phoneme. This occurs while these children are still acquiring the ability to produce this phoneme (/r/) accurately. It can therefore be said that Setswana-speaking children start to reflect on their speech at 3;6–3;11 years but that this occurs considerably more at 4;0–4;5 years, suggesting that they are likely making their way from the simplification phase into the metaphonological phase. This suggests that pre-literacy skills in Setswana-speaking children start to emerge early, but this proposition should be examined further in order to ascertain whether children do

indeed start acquiring phonological awareness skills. Figure 6 presents the developmental phase model from Stackhouse and Wells (1997) as applied to the Setswana-speaking children in this study. This information is based on observations from a picture naming task only and is therefore limited and should be investigated further. In doing this, the assessment should include an additional task designed specifically to investigate input and storage.

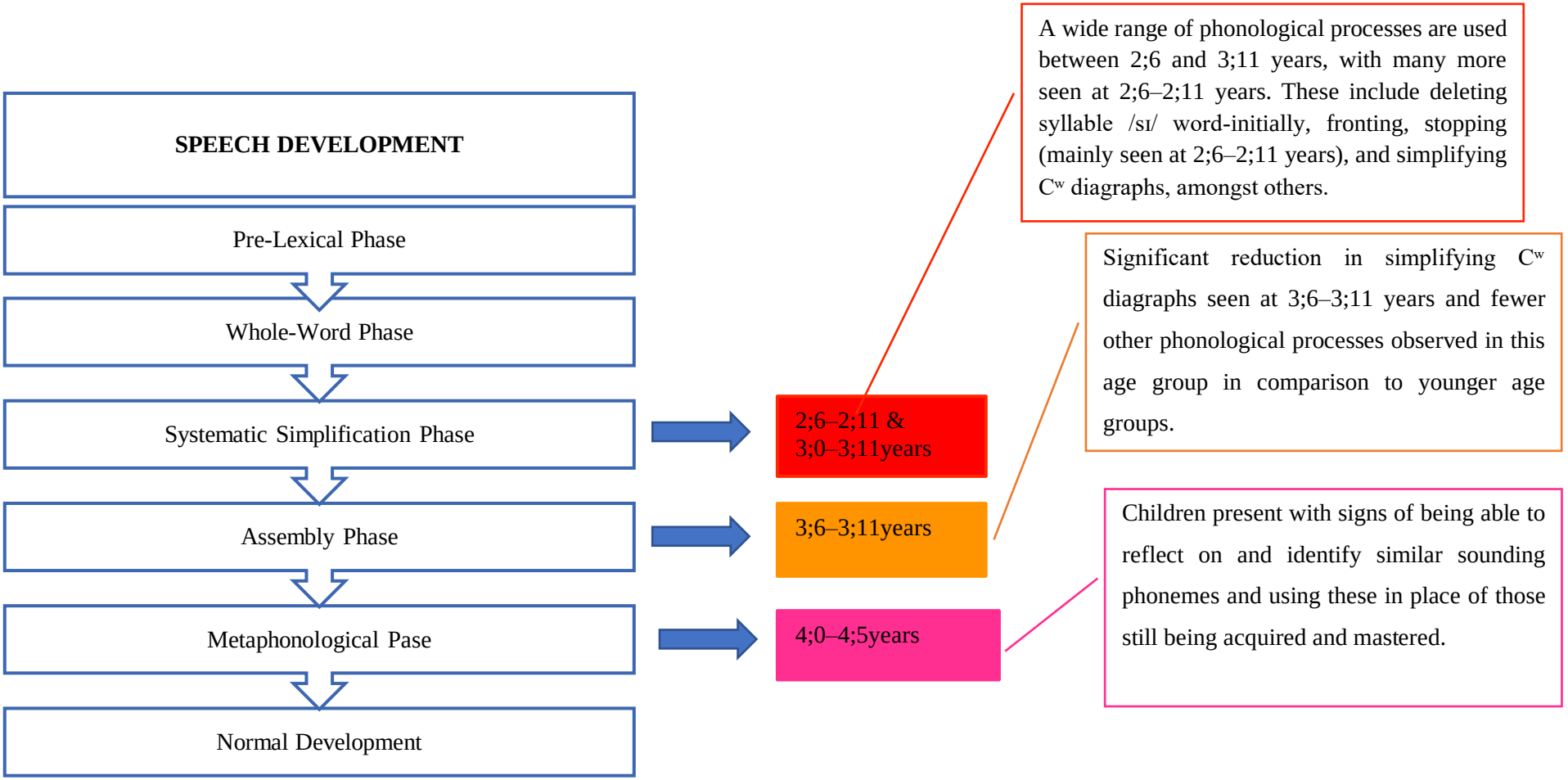

Figure 6. The Developmental Phase Model (Stackhouse & Wells, 1997, as cited in Pascoe, Stackhouse and Wells, 2006:39) applied to Setswana-speaking children

The application of the Developmental Phase Model must be done with caution since the sample included in this study was limited. Additionally, it should be noted that children did not progress through these phases in a linear fashion (e.g. those aged 3;6–3;11 years were in the systematic simplification phase but progressing onto the assembly phase). A larger sample would therefore enable us to verify findings from this study or to make alternate suggestions.

7.10.2 The Speech Processing Model

The speech processing model, detailed in Chapter 1, consists of three levels of processing, namely input processing, the lexical representation and output processing. For the children who presented with SSDs, those who were identified as having an articulation disorder could be classified as experiencing a breakdown at the level of the speech output (specifically motor execution), as marked with a red circle on the speech processing model (Stackhouse and Wells, 1997) in Figure 7.

For those classified as having a phonological delay, it is likely that they experienced a breakdown at both the lexical representation and speech output levels, or even at all three levels (i.e. input, lexical representation and output) of Stackhouse and Wells' (1997) speech processing model. To accurately determine whether or not these children presented with a breakdown at the input level, it would be beneficial to develop a valid and reliable input processing task for Setswana-speaking children, and this should be considered in future research.

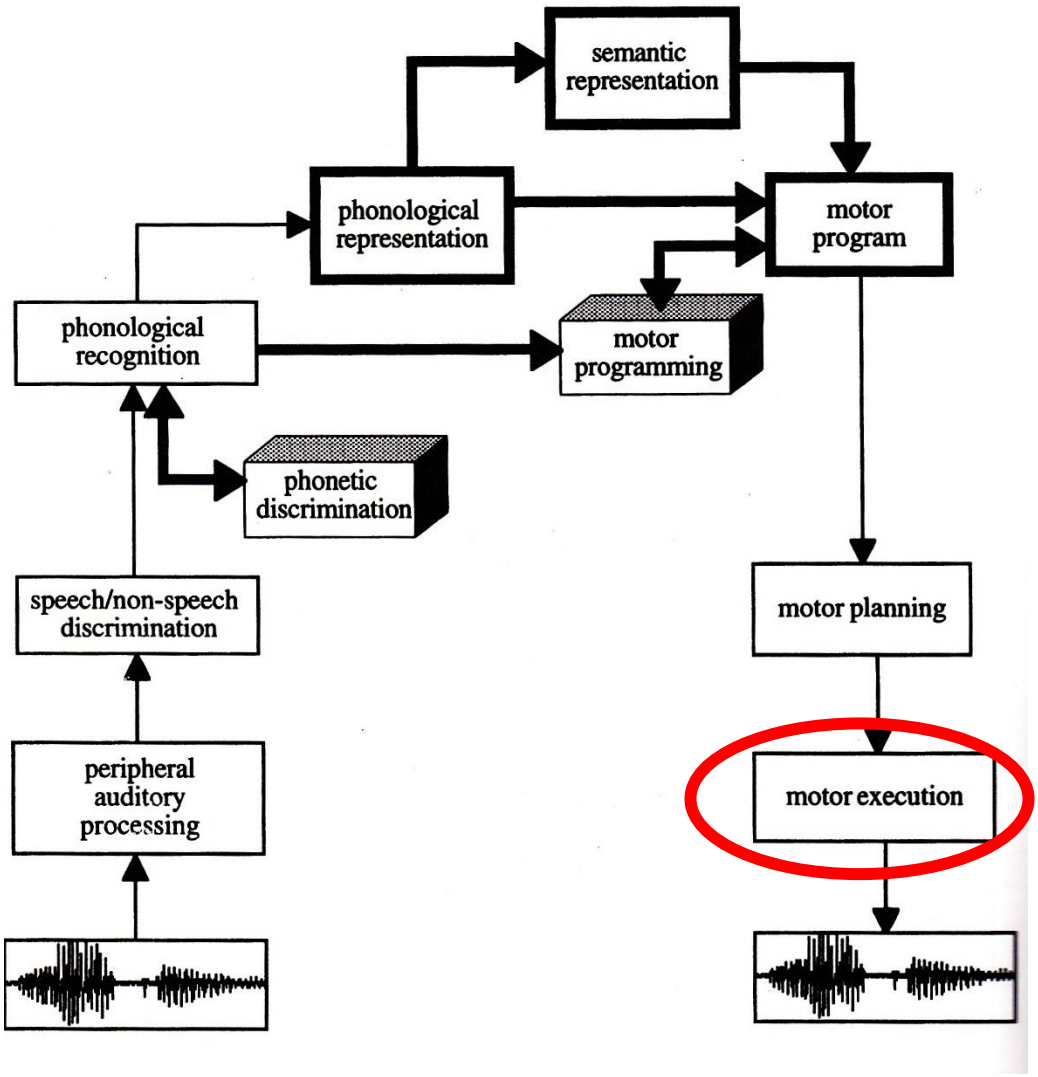

Figure 7. Speech Processing Model (Stackhouse & Wells, 1997:350).

Since the word naming task used to obtain information on speech production in Setswana-speaking children in this study only elicited speech processing and output skills, the use of an input task should be considered in future research. This will allow us to determine the levels of breakdown in children who present with difficulties, and to establish how input and speech processing skills develop in Setswana-speaking children. Pascoe et al. (2016) investigated the speech processing and production of 2-year-old children acquiring isiXhosa in South Africa, and devised auditory discrimination, naming and repetition tasks for their participants. The type of auditory discrimination task – an 'ABX task' – used in that study – could be considered for future work on speech input processing in Setswana. An ABX task requires a list of real-word minimal pairs which can be based on the items used in the naming task, as well as corresponding non-word minimal pairs. Pascoe et al. (2016) considered that words were minimal pairs if they differed by one phoneme, but in some cases real-word minimal pairs were unable to be developed and so closely-related words were used instead, e.g. 'ibhola' [ball] was paired with

‘ibhodi’ [board]). Vance et al. (2007) provide further examples of input processing tasks that can be used to evaluate the speech processing of young childen, e.g. silent sorting of picture cards, and which could be devised for this population. It is time-consuming but important to develop such tasks for all the languages of South Africa so that children’s speech processing and production can be comprehensively assessed.

7.11 Clinical Implications

This research study makes a contribution on two levels. Firstly, it adds to the existing preliminary set of data on the development of Setswana segmental phonology. This includes information on the ages at which consonants, vowels and phonotactic structures are acquired, the nature of phonological processes seen to occur between 2;6 and 6;5 years in children acquiring Setswana, as well as the occurrence of SSDs in this population. In addition, the study explored the usability of the ICS in obtaining information on Setswana-speaking children’s speech intelligibility, as reported by their parents. This was done for children acquiring Setswana only (i.e., monolingual Setswana speakers acquiring two varieties of the language) and those acquiring one or more languages in addition (i.e., bi/multilingual). This study also investigated the use of lexical tone in children aged 2;6–6;5 years and detailed information on the nature of speech sound errors noted in Setswana-speaking children identified as presenting with an SSD. Furthermore, a speech assessment previously developed and used to obtain preliminary speech sound data was revised (Setswana v.2) following recommendations previously made (Mahura, 2016; Mahura & Pascoe, 2016) in order to determine and improve the usability of this tool in clinical practice. While the Setswana v.2 requires further revision, it can be used in clinical practice to obtain information on the speech sound skills of Setswana-speaking children aged 2;6–6;5 years. This tool has been found to be reliable in identifying children with SSDs, those who are monolingual Setswana speakers and those who are bi/multilingual.

Findings from this study were related to Dodd’s diagnostic framework (1995; 2005) to determine its applicability in classifying SSDs seen in children acquiring Setswana. In this study, only children classified as falling into the Articulation Disorder and Phonological Delay subgroups were identified. This, however, does not mean that Setswana-speaking children do not present with speech errors falling into the remaining two subgroups, namely the Consistent Phonological Disorder and Inconsistent Phonological Disorder subgroups. It is likely that children belonging to these subgroups may be identified in future research including a larger group of children acquiring Setswana or a clinical sample, and using a task that includes assessment of consistency. Additionally, the study findings were related to a psycholinguistic framework, specifically Stackhouse and Wells’ (1997) Developmental Phase and Speech Processing Models. Setswana-speaking children have been found to progress through the phases described by Stackhouse and Wells (1997), although they were found to go through these

stages earlier than proposed for English-speaking children. It was also found that children acquiring Setswana do not progress through these phases in a linear fashion. The developmental model therefore needs to be modified to look at the dynamic nature of this process and how the various stages might in fact have an impact on one another. The Speech Processing Model (Stackhouse & Wells, 1997) could be used to describe the level of breakdown in Setswana-speaking children presenting with SSDs. This model could also be used to develop a subtest for Setswana speech assessment that will assess the input processing component, specifically an individual child's ability to discriminate between speech sounds that are based on the sounds that s/he has heard before they are decoded further. Lastly, information on the occurrence of SSDs in children acquiring Setswana suggests a prevalence rate of 4.9% but should be investigated further.

7.12 Limitations

There are several limitations that ought to be taken into account when assessing findings from this study, as well as the implications for clinical practice and research. Limitations include a sample that was limited in size and the nature of the resources used to obtain information on the speech sound skills of Setswana-speaking children.

7.12.1 Study sample

While this study's sample size was relatively large compared to that used in the preliminary study and included two varieties of Setswana, it was still limited, especially for the Setlhaping variety. Although adding to existing data, the findings from the current study must be applied with caution since they cannot be generalised to the whole population of Setswana-speaking children. This data is, however, useful in helping to identify typically developing Setswana-speaking children, as well as those who present with speech sound skills that deviate from the typical trajectory of phonological development. This includes children who are both monolingual and bi/multilingual. A larger sample size for the two varieties of Setswana studied will allow for the current set of normative data to be confirmed and to determine any variations that might exist in terms of gender and age. Although gender was not found to influence the rate of speech sound development, future studies must stratify gender in order to verify or refute the current findings.

Recruiting an equal number of participants in the two varieties investigated in this study was challenging. This led to the Sekwêna variety of Setswana having a significantly higher number of participants than the Setlhaping variety. Although children acquiring both varieties appeared to follow similar stages of phonological development, including a larger sample size in each of the two varieties in future research will allow us to determine if the only difference that exist lies in some vocabulary

used (e.g. *'leswê'* /lɪsʷɛ/ vs *'ditšhila'* /dit͡ʃʰila/ (dirty); *'ša'* /ʃa/ vs *'fja'* /fja/ (burning)) and not the ages at which speech accuracy is acquired. It would also be beneficial to have the same number of children across all age groups. Other varieties of Setswana should also be considered, including those spoken only in Botswana.

7.12.2 Assessment tools

The Setswana v.2 was used to obtain speech samples and describe the developmental patterns of speech sound skills in children aged 2;6 through to 6;5 years. The Setswana v.2 is a single word naming task and is not yet standardised. It is, however, a revised version of the tool that was developed as part of the first pilot study (Mahura, 2014; Mahura & Pascoe, 2016) and has therefore been based on research. This means that further measures were taken to improve the assessment following the limitations/weaknesses identified in the previous study. This was done to further increase the reliability and validity of the Setswana v.2. Some of these measures included consulting a panel of experts to assess the appropriateness of words included in the revised wordlist for children acquiring Setswana and employing an illustrator to develop culturally appropriate pictures for the tool. The expert panel consisted of student SLTs who spoke different varieties of Setswana, which allowed for the researcher to make a note of any differences between Setswana speakers and to ensure that alternative words eliciting target phonemes would be included in the assessment.

In the preliminary Setswana study, a number of syllabic consonants were not targeted. Although an effort was made to include these in various word positions, participants experienced difficulty identifying the picture used to elicit syllabic alveolar trill /r/ word-initially (e.g. *'**r**rê'* /**ṛ**rɛ/ father). It was also noted that some children experienced difficulties naming pictures depicting adjectives, although this may be because they were elicited by trying to get them to use opposites. For instance, the word *'kgakala'* /k͡xʰak'ala/ was used to elicit production of aspirated velar affricate /k͡xʰ/ word-initially and ejective velar plosive /k'/ in the penultimate syllable position. When prompting for production of this word, the researcher showed the children a picture of two trees (as depicted in Figure 8 below) and described one tree as being close and asking them to describe where the other tree was (e.g. "this tree is close by, and this tree is ___"). Many of the children indicated that the other tree was small instead of far away. This was mainly seen in the two- and three-year olds and is likely because they are still acquiring some of these concepts, and possibly because of their interpretations of the graphical representations.

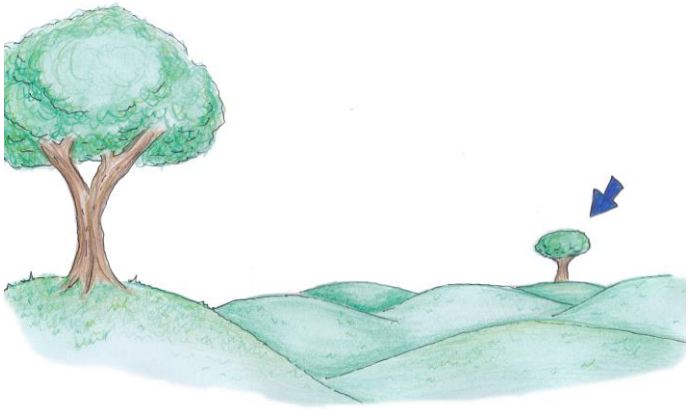

Figure 8. Visual stimuli used to elicit the word *'kgakala'* /k͡xʰak'ala/ (far).

Since the Setswana v.2 only included a picture naming task, data on the use of lexical tone across the age groups is only limited to single word production. The inclusion of a connected speech task would not only have allowed the researcher to examine development of speech accuracy and intelligibility in production of longer utterances in comparison to single words but would also have provided an opportunity to investigate the development of tone sandhi in Setswana.

Furthermore, the ICS was used and has not yet been standardised on Setswana-speaking children. Despite this, a small-scale study by Pascoe and McLeod (2016) has suggested that it is a useful tool in obtaining data from caregivers about their perception of their child's speech intelligibility with various communication partners. Although findings from this current study support propositions made by Pascoe and McLeod (2016), they suggested a possibility of over-reporting by parents and caregivers, especially when rating the degree to which acquaintances, strangers and friends understand their children's speech. It would therefore be beneficial to involve children's educators when using the ICS and making comparisons between parent reports and those of teachers to determine if there are any differences between the two raters. Additionally, the ICS was not used for all the languages a child was acquiring, and this did not allow the researcher to determine if the child's speech would have been perceived as more intelligible in one language as compared to the other.

7.13 Future research

Taking into account the limitations outlined in section 7.13 above, future research should focus on investigating similar areas of speech sound development reported on in this study. Future research should be carried out using a larger sample of participants to allow data to be more generalisable. Although the only differences noted in the two varieties of Setswana investigated in this study were the vocabulary used in identification of similar items, and the presence of heterorganic compounds in the

Setswana variety, the larger sample of participants included in future research should be equally distributed between the language varieties studied.

The word naming task should be revised further. Revisions could include developing a toy kit that would be appropriate for use with the 2;6–2;11-year-old children since they required several breaks during the picture naming task. Making use of toys will likely help to make the task more interactive and interesting for these children. It will also allow the SLT to easily obtain a connected speech sample as children are likely to comment on activities they have an interest in. Additional revisions could include a task that will allow the SLT to obtain information on a child's input processing, as well as an inconsistency subtest. Additionally, a task aimed at obtaining a connected speech sample should be developed and included in the revised Setswana speech assessment tool. The inclusion of a connected speech task in future research will also allow us to investigate the development of tone sandhi. Moreover, future research should compare parent reports of their child's intelligibility with reports from teachers using the ICS. It would also be beneficial to share the Setswana v.2 with SLTs working with Setswana-speaking children in different regions and obtain feedback on the usability of this tool in clinical practice. This feedback must then be used in combination with findings from this study when revising the Setswana v.2 further.

There is clearly a great need for development and validation of a comprehensive speech and language assessment battery for Setswana-speaking children to enable early identification of children with difficulties. This study has contributed to that vision by devising and piloting a Setswana speech assessment and obtaining a set of preliminary normative data for Setswana speech. Children's speech production is one part of their complex communication development and the information obtained from the speech assessment will need to be viewed together with information obtained from parent report measures such as the ICS, and the MacArthur-Bates Communicative Development Inventories (CDIs) currently being developed and piloted for Setswana in South Africa (Southwood, Brookes, White, Mahura & Pascoe, 2020).

7.14 Conclusion

The current study investigated the acquisition of both segmental and suprasegmental phonology in Setswana-speaking children aged 2;6–6;5 years. This research study contributes to the small set of data on the development of segmental phonology (Mahura, 2014; Mahura & Pascoe, 2016) and tone (Tsonope, 1987; 1993). While the findings are not yet generalisable to all Setswana-speaking children, they indicate that existing theoretical frameworks on speech acquisition can be applied to Setswana and that only minor differences should be taken into account. These differences are mainly in relation to the ages at which children progress through the various phases of the Developmental Phase Model (Stackhouse & Wells, 1997). These frameworks (specifically the Psycholinguistic Framework) can be

used to describe the level of breakdown in Setswana-speaking children presenting with SSDs, although an input processing task should be included in future research. Dodd's (1995; 2005) diagnostic framework has also been found as an appropriate means of classifying SSDs in Setswana-speaking children who are monolingual and bi/multilingual.

Children acquiring Setswana have a full set of vowels in their phonetic inventories as early as 2;6 years, and possibly earlier. A large number of consonant phonemes occurring in Setswana had either been acquired or mastered at 2;6–2;11 years. This was seen word-initially and in the penultimate syllable position, with only a few more phonemes still to be acquired at this age. For instance, only two phonemes with rounding (namely alveolar plosive /kʷ'/ and alveolar nasal /nʷ/) were still emerging at 2;6–2;11 years and seen to be acquired at 3;0–3;5 years in the initial word position. Voiced palato-alveolar affricate /ʤ/ was absent in the initial word position at 2;6–2;11 years. This phoneme was, however, seen to emerge at 3;0–3;5 years and was acquired at 4;0–4;5 years. The presence of heterorganic compounds in the initial word position mainly consisted of /fj/ and were only seen in the speech of children who speak the Sekwêna variety as none of the participants who speak the Setlhaping variety used such compounds in their speech. Although consonant clusters were not elicited as part of this study, they were noted in the inventories of children across the different age groups. The youngest children and those aged 3;6–3;11 years did not use consonant clusters. Many of the /s/ consonant clusters are similar to those found in English, with the main difference being that the plosives that follow alveolar fricative /s/ are either ejective (e.g. /st'/) or aspirated (e.g. /skʰ/). Similar to the initial word position, the consonants that appeared to pose challenges for the youngest age group (i.e. 2;6–2;11 years) were those with rounding. These include velar nasal /ŋʷ/ and ejective alveolar affricate /t͡sʷ'/, which were acquired by those aged 3;0–3;5 years.

This dissertation has described speech acquisition of children acquiring Setswana in South Africa – focusing on two different varieties in a sample of children aged between 2;5 and 6;5 years. It is one of the largest and most comprehensive cross-sectional studies of children's speech acquisition undertaken in Southern Africa to date, and contributes to our knowledge and understanding of Setswana speech acquisition in this context. The study adds to a growing body of knowledge about children's speech acquisition in different languages around the world, and provides information much needed for SLTs, teachers and early-years practitioners in South Africa, in particular. SLTs will not be able to deliver equitable, ethical and evidence-based services in South Africa if they do not have the knowledge and resources to assess children who speak Setswana (and each of the official languages of the country). This work has contributed to addressing that need.

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Appendix A: Ethical clearance

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee

Room E53-46 Old Main Building
Groote Schuur Hospital
Observatory 7925
Telephone [021] 406 6492
Email: sumayah.ariefdien@uct.ac.za
Website: www.health.uct.ac.za/fhs/research/humanethics/forms

31 January 2017

HREC REF: 600/2016

A/Prof M Pascoe
Division of Communication Sciences & Disorders
Health & Rehab Sciences
F-45
OMB

Dear A/Prof Pascoe

PROJECT TITLE: THE ACQUISITION OF SETSWANA PHONOLOGY IN CHILDREN AGED 2; 0-6.0 YEARS (Doctoral-candidate-O Mahura)

Thank you for your response letter, addressing the issues raised by the Human Research Ethics Committee (HREC).

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

Approval is granted for one year until the 28 FEBRUARY 2018.

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.
(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

We acknowledge that the student, O Mahura will also be involved in this study.

Please quote the HREC REF in all your correspondence.

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

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate institutional approval before the research may occur.

Yours sincerely

PROFESSOR M BLOCKMAN
CHAIRPERSON, FHS HUMAN RESEARCH ETHICS COMMITTEE

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

HREC 600/2016

Appendix B1: Information letter to North-West Province Education Department

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Department of Health and Rehabilitation Sciences
Divisions of Communication Sciences and Disorders,
Nursing and Midwifery, Occupational Therapy, Physiotherapy
F45 Old Main Building, Groote Schuur Hospital
Observatory, Cape Town, W/Cape, 7925
Tel: 021 406 6401/ 6428/ 6628/6534
Fax: 021 406 6323

Dear Sir/Madam

Re: Research study information and permission to conduct research at schools in the Dr Ruth Segomotsi Mompati and Ngaka Modiri Molema districts in the North-West Province.

I am currently registered as a Speech-Language Therapy Doctoral 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 describing the development of the speech sound system (phonology) of children between the ages of two and six years who speak Setswana as a first language.

There is very little information on how Setswana-speaking children learn to produce speech sounds, and such information is beneficial to Speech-Language Therapists working with children with speech difficulties.

The aim of this study is to describe the speech sound systems of Setswana-speaking children between the ages of two and six years. The information gained from this study will be used to help Speech-Language Therapists to develop their knowledge about how young children who speak Setswana learn to produce speech sounds. This information will also benefit Setswana-speaking children who may have problems producing speech sounds in the long term. The study will be conducted between the months of March and December 2017. It will involve conducting a speech sound developmental assessment (which looks at how children of certain ages produce different speech sounds of Setswana), as well as, asking the educators questions related to the learners' behaviour and learning patterns (e.g. do they have trouble concentrating or learning in class). The assessment is made up of showing the learners a set of pictures, asking them to name the pictures, and recording their responses on a voice recorder. Toys will also be used for younger learners who might find it difficult to recognise pictures. Results obtained from this study will be used to outline the development of Setswana speech sounds from the age of two years up to six years. The results will also be used to describe the characteristics of the speech of children whose speech development is delayed (e.g. looking at whether or not some sounds are more difficult to say and if the children are able to say them if helped by an adult).

No schools have been identified yet as being possible sites for data collection for this research study. Schools which are potential sites for this study will be identified and approached once permission has been obtained from the Education Department. In order to identify potential schools to participate in this research study, the office of the Department of Education will be asked to share some information on schools in the Dr Ruth Segomotsi Mompati and Ngaka Modiri Molema (specifically the Mahikeng region) districts. This information includes whether or not the schools in the two districts are preschools and primary schools, as well as the contact details of these schools. This information will be helpful to the researcher as it will help her easily identify schools which could be used as sites for collecting data in this research study. Once this information is obtained, the researcher will contact some of the schools and provide them with information regarding the aims of this study. Please note that the parents and legal guardians of learners who are between two and six years will only be asked for permission to have their children participate in the study once the Heads of the schools identified have allowed the researcher to conduct the study at their particular schools. In order to recruit learners who meet the criteria set out for this research study, the researcher will ask the educators for their help as they know the learners well. The educators will also be asked to complete a short questionnaire, which is aimed at understanding the learners who will be taking part better. This will only be done for children whose parents have given permission for them to take part in the study. The researcher requires approximately two hundred and forty children for the study; one hundred and twenty from the Dr Ruth Segomotsi Mompati district and one hundred and twenty from the Ngaka Modiri Molema district. The children who will be selected to take part in the study must meet the following criteria; they must be between two and six years and speak Setswana as their home language, children who may have speech and language delays or difficulties, as well as children who do not have hearing and visual difficulties. Children who have difficulty seeing will not be included in the study as the task that the children are required to complete consists of pictures.

Appropriate times for data collection will be arranged with the relevant schools and staff members. The children will be assessed individually over a period of ten months. Assessments will be conducted on the school premises, in a quiet area made available by each school. All children assessed will only be assessed once. Children who are found to have speech difficulties (i.e. those who find it very difficult to say a lot of speech sounds and words) participating in the study and who are not receiving therapy at the time of the study will be referred for speech therapy. Children who present with other forms of developmental delays will also be referred to the appropriate health professionals. All ethical guidelines will be adhered to.

The results obtained from the research study will be shared with the various schools. Feedback will be provided to the heads of schools throughout the research process. Concerns which may arise during the research process will be addressed.

I hereby request permission to conduct my research study at schools in the Dr Ruth Segomotsi Mompati and Ngaka Modiri Molema districts, as a large number of Setswana-speakers reside in the North-West Province.

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, their parents and legal guardians, as well as the schools involved.

Yours Sincerely

Olebeng Mahura
(Researcher)
Tel : 0XX XXX XXXX
Email : o.mahura@uct.ac.za

Associate Professor Michelle Pascoe
(Research supervisor)
Tel : 021XXX XXXX
Email : michelle.pascoe@uct.ac.za

You may contact Professor Marc Blockman, Chairperson of the Human Research Ethics Committee of the Faculty of Health Sciences on 021 406 6346 if you have any queries about the rights and welfare of the learners as participants in this study.

Appendix B2: Permission from the North-West Province Department of Education

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Department of Health and Rehabilitation Sciences
Divisions of Communication Sciences and Disorders,
Nursing and Midwifery, Occupational Therapy, Physiotherapy
F45 Old Main Building, Groote Schuur Hospital
Observatory, Cape Town, W/Cape, 7925
Tel: 021 406 6401/ 6428/ 6628/6534
Fax: 021 406 6323

Re: Permission to conduct research at schools in the Dr Ruth Segomotsi Mompati and Ngaka Modiri Molema districts in the North-West Province.

I, _____ (name and surname), _____ (position at the NW Education Department), hereby give permission for the study to be conducted at schools in the Dr Ruth Segomotsi Mompati and Ngaka Modiri Molema districts. The purpose of this study and what it involves have been explained to me. I understand that this study will involve asking the Education Department for information on preschools and schools for children between the ages of two and six years in order to help the researcher identify schools which are appropriate for her research study. I also understand that once the researcher has identified schools this research study, heads of those schools will be approached and asked for permission to have their schools be used as sites for collecting data, after which educators will be asked to help identify children who meet the criteria set out. I understand that educators will be asked questions regarding the identified learners' behaviour and learning patterns, as well as, assessing the speech sound development of these learners, only once the learners' parents and legal guardians have given permission to have their children take part in the study.

I understand that the learners' and educators' identities will be kept confidential and that their confidentiality will be maintained throughout the research study. I am aware that parents and legal guardians', 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.

Yours Sincerely

Olebeng Mahura
(Researcher)
Tel : 0XX XXX XXXX
Email : o.mahura@uct.ac.za

Associate Professor Michelle Pascoe
(Research supervisor)
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Appendix C1: Information letter to the North-West Province Department of Social Development

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Department of Health and Rehabilitation Sciences
Divisions of Communication Sciences and Disorders,
Nursing and Midwifery, Occupational Therapy, Physiotherapy
F45 Old Main Building, Groote Schuur Hospital
Observatory, Cape Town, W/Cape, 7925
Tel: 021 406 6401/ 6428/ 6628/6534
Fax: 021 406 6323

Dear Sir/Madam

Re: Research study information and permission to conduct research at preschools in the Dr Ruth Segomotsi Mompati North-West Province.

I am currently registered as a Speech-Language Therapy Doctoral 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 describing the development of the speech sound system (phonology) of children between the ages of two and six years who speak Setswana as a first language.

There is very little information on how Setswana-speaking children learn to produce speech sounds, and such information is beneficial to Speech-Language Therapists working with children with speech difficulties.

The aim of this study is to describe the speech sound systems of Setswana-speaking children between the ages of two and six years. The information gained from this study will be used to help Speech-Language Therapists to develop their knowledge about how young children who speak Setswana learn to produce speech sounds. This information will also benefit Setswana-speaking children who may have problems producing speech sounds in the long term. The study will be conducted between the months of June and December 2017. It will involve conducting a speech sound developmental assessment (which looks at how children of certain ages produce different speech sounds of Setswana), as well as, asking the educators questions related to the learners' behaviour and learning patterns (e.g. do they have trouble concentrating or learning in class). The assessment is made up of showing the learners a set of pictures, asking them to name the pictures, and recording their responses on a voice recorder. Toys will also be used for younger learners who might find it difficult to recognise pictures. Results obtained from this study will be used to outline the development of Setswana speech sounds from the age of two years up to six years. The results will also be used to describe the characteristics of the speech of children whose speech development is delayed (e.g. looking at whether or not some sounds are more difficult to say and if the children are able to say them if helped by an adult).

No preschools have been identified yet as being possible sites for data collection for this research study. Preschools which are potential sites for this study will be identified and approached once permission has been obtained from the Department of Social Development. In order to identify potential preschools to participate in this research study, the office of the Department of Social Development will be asked to share some information on schools in the Dr Ruth Segomotsi Mompati district. This information includes information on where the preschools are situated, as well as the contact details of these preschools. This information will be helpful to the researcher as it will help her easily identify preschools which could be used as sites for collecting data in this research study. Once this information is obtained, the researcher will contact some of the preschools and provide them with information regarding the aims of this study. Please note that the parents and legal guardians of learners who are between two and six years will only be asked for permission to have their children participate in the study once the Heads of the schools identified have allowed the researcher to conduct the study at their particular preschools. In order to recruit learners who meet the criteria set out for this research study, the researcher will ask the educators for their help as they know the learners well. The educators will also be asked to complete a short questionnaire, which is aimed at understanding the learners who will be taking part better. This will only be done for children whose parents have given permission for them to take part in the study. The researcher requires approximately two hundred and forty children for the study; one hundred and twenty children will be recruited from schools and preschools in the Dr Ruth Segomotsi Mompati district and one hundred and twenty from the Ngaka Modiri Molema district. The children who will be selected to take part in the study must meet the following criteria; they must be between two and six years and speak Setswana as their home language, children who may have speech and language delays or difficulties, as well as children who do not have hearing and visual difficulties. Children who have difficulty seeing will not be included in the study as the task that the children are required to complete consists of pictures.

Appropriate times for data collection will be arranged with the relevant schools and staff members. The children will be assessed individually over a period of ten to twelve months. Assessments will be conducted on the school premises, in a quiet area made available by each school. All children assessed will only be assessed once. Children who are found to have speech difficulties (i.e. those who find it very difficult to say a lot of speech sounds and words) participating in the study and who are not receiving therapy at the time of the study will be referred for speech therapy. Children who present with other forms of developmental delays will also be referred to the appropriate health professionals. All ethical guidelines will be adhered to.

The results obtained from the research study will be shared with the various schools. Feedback will be provided to the heads of schools throughout the research process. Concerns which may arise during the research process will be addressed.

I hereby request permission to conduct my research study at preschools that are funded by the Department of Social Development in the Dr Ruth Segomotsi Mompati district, as a large number of Setswana-speakers reside in the North-West Province.

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, their parents and legal guardians, as well as the schools involved.

Yours Sincerely

Olebeng Mahura
(Researcher)
Tel : 0XX XXX XXXX
Email : o.mahura@uct.ac.za

Associate Professor Michelle Pascoe
(Research supervisor)
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Email : michelle.pascoe@uct.ac.za

You may contact Professor Marc Blockman, Chairperson of the Human Research Ethics Committee of the Faculty of Health Sciences on 021 406 6346 if you have any queries about the rights and welfare of the learners as participants in this study.

Appendix C2: Permission from the North-West Province Department of Social Development

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Department of Health and Rehabilitation Sciences
Divisions of Communication Sciences and Disorders,
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F45 Old Main Building, Groote Schuur Hospital
Observatory, Cape Town, W/Cape, 7925
Tel: 021 406 6401/ 6428/ 6628/6534
Fax: 021 406 6323

Re: Permission to conduct research at preschools in the Dr Ruth Segomotsi Mompati district in the North-West Province.

I, _____ (name and surname), _____ (position at the NW Social Development Department), hereby give permission for the study to be conducted at preschools in the Dr Ruth Segomotsi Mompati district. The purpose of this study and what it involves have been explained to me. I understand that this study will involve asking the Department of Social Development for information on preschools for children between the ages of two and six years in order to help the researcher identify preschools which are appropriate for her research study. I also understand that once the researcher has identified preschools this research study, heads of those preschools will be approached and asked for permission to have their preschools be used as sites for collecting data, after which educators will be asked to help identify children who meet the criteria set out. I understand that educators will be asked questions regarding the identified children's behaviour and learning patterns, as well as, assessing the speech sound development of these children, only once their parents and legal guardians have given permission to have their children take part in the study.

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

Yours Sincerely

Olebeng Mahura
(Researcher)
Tel : 0XX XXX XXXX
Email : o.mahura@uct.ac.za

Associate Professor Michelle Pascoe
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You may contact Professor Marc Blockman, Chairperson of the Human Research Ethics Committee of the Faculty of Health Sciences on 021 406 6346 if you have any queries about the rights and welfare of the learners as participants in this study.

Appendix D1: Information letter to the Heads of schools

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Department of Health and Rehabilitation Sciences
Divisions of Communication Sciences and Disorders,
Nursing and Midwifery, Occupational Therapy, Physiotherapy
F45 Old Main Building, Groote Schuur Hospital
Observatory, Cape Town, W/Cape, 7925
Tel: 021 406 6401/ 6428/ 6628/6534
Fax: 021 406 6323

Dear Sir/Madam

Re: Research study information and permission to conduct research at your school.

I am currently registered as a Speech-Language Therapy Doctoral 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 describing the development of the speech sound system (phonology) of children between the ages of 2- and 6-years acquiring Setswana.

There is very little information on how Setswana-speaking children learn to produce speech sounds, and such information is beneficial to Speech-Language Therapists working with children with speech difficulties.

The aim of this study is to describe the speech sound systems of Setswana-speaking children between the ages of 2 and 6 years. The information gained from this study will be used to help Speech-Language Therapists to develop their knowledge about how young children who speak Setswana learn to produce speech sounds. This information will also benefit Setswana-speaking children who may have problems producing speech sounds in the long term. The study will be conducted between the months of March and December 2017. It will involve conducting a speech sound developmental assessment (which looks at how children of certain ages produce different speech sounds of Setswana), as well as, asking the educators questions related to the learners' behaviour and learning patterns (e.g. do they have trouble concentrating or learning concepts taught in class). The assessment is made up of showing the learners a set of pictures, asking them to name the pictures, and recording their responses on a voice recorder. Toys will also be used for younger learners who might find it difficult to recognise pictures. Results obtained from this study will be used to outline the development of Setswana speech sounds from the age of two years up to six years. The results will also be used to describe the characteristics of the speech of children whose speech development is delayed (e.g. looking at whether or not some sounds are more difficult to say and if the children are able to say them if helped by an adult).

The learners will form part of the study only once permission has been obtained from you (the Head of the school), the educators, parents and legal guardians, as well as, the learners themselves.

Two hundred and forty children who meet the criteria will be included in the study; one hundred and twenty from the Dr Ruth Segomotsi Mompati district and one hundred and twenty from the Ngaka Modiri Molema dirstict, specifically the Mahikeng region. These criteria include; children between two and six years who speak Setswana as their home language, children who may have speech and language delays, as well as children who do not have hearing and visual difficulties. Please note that I will only be able to confirm the number of learners who may be able to take part in this study once I have received information from you on the number of children who are between the ages of two and six years, enrolled at your school.

Appropriate times for data collection will be arranged with you and the educators. The children will be assessed individually over a period of ten months; between March and December 2017. Assessments will be conducted in a quiet space on the school premises. All children assessed will only be assessed once. Children who are found to have speech difficulties (i.e. those who find it very difficult to say a lot of speech sounds and words) participating in the study and who are not receiving therapy at the time of the study will be referred for speech therapy. Children who present with other forms of developmental delays will also be referred to the appropriate health professionals. All ethical guidelines will be adhered to.

The results obtained from the research study will be shared with you and the educators. Feedback will be provided throughout the research process. Concerns which may arise during the research process will be addressed. Please be aware that you and the educators may ask me questions at anytime.
I hereby request permission to conduct my research study at your school because a large number of your leaners are Setswana-speakers.

Individuals taking part in this study do so voluntarily. They may withdraw from the study at any stage during the research process. The learners' parents and legal guardians may also withdraw their children from the study as any stage during the research process without any penalties. There will be no financial costs and rewards for your school, the learners taking part, as well as the parents and legal guardians of the learners who will take part in this study.

Yours Sincerely

Olebeng Mahura
(Researcher)
Tel : 0XX XXX XXXX
Email : o.mahura@uct.ac.za

Associate Professor Michelle Pascoe
(Research supervisor)
Tel : 021XXX XXXX
Email : michelle.pascoe@uct.ac.za

You may contact Professor Marc Blockman, Chairperson of the Human Research Ethics Committee of the Faculty of Health Sciences on 021 406 6346 if you have any queries about the rights and welfare of the learners as participants in this study.

Appendix D2: Lekwalo la tshedimosetso go mogokgo

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Department of Health and Rehabilitation Sciences
Divisions of Communication Sciences and Disorders,
Nursing and Midwifery, Occupational Therapy, Physiotherapy
F45 Old Main Building, Groote Schuur Hospital
Observatory, Cape Town, W/Cape, 7925
Tel: 021 406 6401/ 6428/ 6628/6534
Fax: 021 406 6323

Go: Mogokgo

Mabapi le: Tshedimsetso ya dipatlisiso le kopo go dira dipatlisiso mo sekolong sa gago

Ke nna Olebeng Mahura , mme ke dira jaaka Speech-Language Therapist (ke thusa batho ba ba nang le mathata a go bua). Ke moithuti wa gerata ya bo Ngaka (Doctoral degree) kwa Yunibesithing ya Motse Kapa. Ke tshwanetse go dira dipatlisiso gore ke kgone go netefatsa maemo a digarata tsa me. Ke eletsa go dira dipatlisiso tse maikaelelo a teng e leng go tlhalosa ka mokgwa ô bana ba Batswana, ba ba magareng ga dingwaga tse pedi (2) le tse thataro (6), ba ithutang go bitsa medumo ya mafoko ka gone fa ba ntse ba gola.

Go na le tshedimosetso ê e nnye thata, ê e tlhalosang ka mokgwa ô bana ba Batswana ba ithutang go bitsa medumo ya mafoko ka gone fa ba ithuta go bua. Tshedimosetso ê e botlhokwa thata go diSpeech-Langauge Therapist ba ba dirang ka bana ba ba nang le mathata a go bua.

Maikaelelo a dipatlisiso tse, ke go tlhalosa gore bana ba Batswana, ba ba magareng ga dingwaga tse pedi le tse thataro, ba ithuta go bitsa medumo ya mafoko jang fa ba ithuta go bua. Tshedimosetso ê e tla kgobokanngwang mo dipatlisisong tse, e tla dirisiwa go thusa diSpeech-Language Therapist tse di dirang le bana ba ba nang le mathata a go bua (jaaka mathata a go bitsa mafoko a a rileng). Tshedimosetso ê, e tla dirisiwa go thusa bana ba Batswana ba ba nang le mathata a go bitsa mafoko a a rileng fa ba bua. Dipatlisiso tse di tla dirwa magareng ga kgwedi ya Seetebosigo le Sedimonthole, ka ngwaga wa 2017; ebile di tla tsweletswa gape ka Ferikgong fo fitlha ka Sedimonthole ka ngwaga wa 2018. Mo dipatlisisong tse; moithuti o tla tlhatlhoba puo ya bana, mme tlhatlhobo ê e tla leba gore bana ba dingwaga tse di farologaneng ba bitsa medumo ya puo ya Setswana jang. Mo tlhatlhobong ê, barutabana ba tla botswa dipotso mabapi le maitseo a bana le ka mokgwa ô ba ithutang ka gone ko sekolong (sekao: a ngwana o na le mathata a go dula sebakanyana a reetsa morutabana, a fetsa tiro ê a e filweng, kgotsa go ithuta dilo tse di rileng mo phaphosing). Tlhatlhobo ya puo ya bana e tla akaretsa go ba bontsha ditshwantsho tse di mmalwa, go ba botsa gore ba bona eng mo ditshwantshong tse, le go

gatisa dikarabo tsa bone mo motšhining wa go gatisa mantswe (voice recorder). Ditshamikisi (toys) di tla dirisiwa fa baithuti ba ba nnye, ba ba seng ba nne le kgatlhego ya go leba ditshwantsho, ba tlhatlhobiwa. Tshedimosetso ê e tla kgobokanngwang mo dipatlisisong tse, e tla dirisiwa go supa dintlha-kgolo tse medumo ya puo ya Setswana e dirisiwang ka teng ke bana ba ba magareng ga dingwaga di le pedi go ya go dingwaga di le thataro. Tshedimosetso ê e tla dirisiwa gape go tlhalosa puo ya bana ba e leng gore ba na le mathata a go bua (sekao; go leba gore a go na le medumo e e leng thata gore bana ba e bitse le gore a ba kgona go e bitsa sentle fa ba thusiwa ke mogolo).

Baithuti ba tla kopiwa go tsaya karolo mo dipatlisisong tse morago ga gore wena (Mogokgo wa sekolo), barutabana le batsadi ba bana, lo ntetlelele go dira dipatlisiso tse.

Bana ba le makgolo a mabedi le masome a mane (240), ba ba maleba le lenaane kgetho ba tla tlhopiwa go tsaya karolo mo dipatlisisong tse. Bana ba le lekgolo le masome a mabedi (120) ba tla tlhopiwa go tswa mo distrikting ya Dr Ruth Segomotsi Mompati, mme ba bangwe (lekgolo le masome a mabedi) kwa distrikting ya Ngaka Modiri Molema. Lenaane kgetho lê le akaretsa;

- bana ba ba magareng ga dingwaga tse pedi le tse thataro, mme ba bua Setswana kwa lapeng
- bana ba gongwe ba nang le mathata a puo
- bana ba ba se nang mathata a go utlwa le a go bona.

Ke tla kgona go netefatsa palo ya bana ba ba tlhokegang mo dipatlisisong tse fela morago ga go bona tshedimosetso ya gore go na le bana ba ba kae ba ba magareng ga dingwaga tse pedi le tse thataro, ba ba mo sekolong sa gago.

Dinako tse dipatlisiso di tla dirwang ka yone e tla rulaganngwa le wena le barutabana ba ba maleba. Mongwe le mongwe wa bana ba ba tsayang karolo o tla tlhatlhobiwa gangwe fela. Ditlhatlhobo tse di tla direlwa mo sekolong, mme lefelo le le didimetseng le tla kopiwa go wena. Bana ba go belaelwang ba na le mathata a go bua ba tla romelwa gongwe go ya go bona Speech-Language Therapist. Bana ba go belaelwang ba saletse morago mo kgolong ya bone ba tla romelwa go bona thuso ko go maleba (gongwe ko tliniking kgotsa ko sepatala). Tsepamo ya melaotlhomo yotlhe e tla obamelwa.

Ditshwetso tsa dipatlisiso di tla abelwa wena le barutabana ba gago, mme lo tla fiwa tshedimosetso fa dipatlisiso di ntse di tsweletse. Matshwenyego a a leng gone a tla rarabololwa go netefatsa gore ditlhatlhobo tsa bana di tsamaya ka mokgwa yo o kgotsofatsang. Mogokgo, barutabana le batsadi ba bana, lo ka nna lwa mpotsa dipotso ka nano nngwe le nngwe.

Ke kopa tetlelelo ya go dira dipatlisiso tse mo sekolong sê ka gonne baithuti ba ba ntsi mo sekolong se ba bua Setswana.

Baithuti ba ba tsayang karolo mo dipatlisisong tse, ba dira jalo ka boithaopo. Ba letleletswe go fetola menagano ya bone, gape ba letleletswe go ikgoga go tswa dipatlisisong nako nngwe le nngwe. Baithuti ba ba tsayang karolo, batsadi ba bone le sekolo ga nkitla lo kopiwa go patela, mme mmatlisisi ga a kitla a patela sekolo, barutabana, batsadi le bana go tsaya karolo mo dipatlisisong tse.

Tetlelelo ya melaotlhomo e bonwe go tswa go Komiti ya Dipatlisiso tsa Batho, Karolo ya dithuto tsa boitekanelo (Faculty of Health Sciences) kwa Yunibesithing ya Motse Kapa (HREC/ REF: 600/2016).

Weno

Olebeng Mahura

Mmatlisisi

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Associate Professor Michelle Pascoe

Motlhokomedi wa Mmatlisisi

Tel : 021XXX XXXX

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O ka leletsa Professor Marc Blockman, modula setilo wa komiti ya dipatlisiso tsa batho, wa karolo ya dithuto tsa boitekanelo (Faculty of Health Sciences) mo 021 406 6496, fa o na le matshwenyego a ditshwanelo tsa baithuti ba gago jaaka batsayakarolo mo dipatlisisong tse.

Appendix D3: Permission from the Heads of schools

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Department of Health and Rehabilitation Sciences
Divisions of Communication Sciences and Disorders,
Nursing and Midwifery, Occupational Therapy, Physiotherapy
F45 Old Main Building, Groote Schuur Hospital
Observatory, Cape Town, W/Cape, 7925
Tel: 021 406 6401/ 6428/ 6628/6534
Fax: 021 406 6323

Re: Permission to conduct research at _____ School.

I, _____, hereby give permission for the study to be conducted at _____ School. The purpose of this study and what it involves 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 confidential 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.

Yours Sincerely

Olebeng Mahura
(Researcher)
Tel : 0XX XXX XXXX
Email : o.mahura@uct.ac.za

Associate Professor Michelle Pascoe
(Research supervisor)
Tel : 021XXX XXXX
Email : michelle.pascoe@uct.ac.za

You may contact Professor Marc Blockman, Chairperson of the Human Research Ethics Committee of the Faculty of Health Sciences on 021 406 6346 if you have any queries about the rights and welfare of the learners as participants in this study.

Appendix D4: Tetla go tswa go mogokgo

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Department of Health and Rehabilitation Sciences
Divisions of Communication Sciences and Disorders,
Nursing and Midwifery, Occupational Therapy, Physiotherapy
F45 Old Main Building, Groote Schuur Hospital
Observatory, Cape Town, W/Cape, 7925
Tel: 021 406 6401/ 6428/ 6628/6534
Fax: 021 406 6323

Mabapi le: Tetlelelo ya go dira dipatlisiso le kopo ya go dira dipatlisiso mo sekolong sa _____

Nna, ke le _____, ke fa tetla ya gore dipatlisiso tse di dirwe mo sekolong sa _____. Ke tlhaloseditswe maikaelelo a dipatlisiso tse le gore di akaretsa eng. Ke tlhaloganya gore barutabana ba tla botswa dipotso ka ga maitseo a baithuti, le ka mokgwa ô ba ithutang ka gone. Ke tlhaloganya gape gore go tlilwe go dirwa ditlhatlhobo tse di lebang ka mokgwa ô baithuti ba buang ka gone.

Ke tlhaloganya gore maina a baithuti le barutabana ga a na go itsiwe, mme sê se tla dirwa morago ga gore dipatlisiso tse di fele. Ke a itse gore baithuti le barutabana ba ithaopa go tsaya karolo, ebile ba na le ditshwanelo tsa go bua fa ba sa tlhole ba batla go tsaya karolo nako nngwe le nngwe, ntle le go tlhalosa mabaka.

_____ _____ _____

Leina Saena Letlha

Fa o na le dipotso o ka nteletsa, kgotsa wa romela imeile.

Weno

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Associate Professor Michelle Pascoe
Motlhokomedi wa Mmatlisisi
Tel : 021XXX XXXX
michelle.pascoe@uct.ac.za

O ka leletsa Professor Marc Blockman, modula setilo wa komiti ya dipatlisiso tsa batho, wa karolo ya dithuto tsa boitekanelo (Faculty of Health Sciences) mo 021 406 6496, fa o na le matshwenyego a ditshwanelo tsa baithuti ba gago jaaka batsayakarolo mo dipatlisisong tse.

Appendix E1: Information letter to the Educators

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Department of Health and Rehabilitation Sciences
Divisions of Communication Sciences and Disorders,
Nursing and Midwifery, Occupational Therapy, Physiotherapy
F45 Old Main Building, Groote Schuur Hospital
Observatory, Cape Town, W/Cape, 7925
Tel: 021 406 6401/ 6428/ 6628/6534
Fax: 021 406 6323

Dear Sir/Madam

Re: Research study information and permission to assist with information of learners taking part in the study.

I am currently registered as a Speech-Language Therapy Doctoral 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 describing the development of the speech sound system (phonology) of children between the ages of 2- and 6-years acquiring Setswana.

There is very little information on how Setswana-speaking children learn to produce speech sounds, and such information is beneficial to Speech-Language Therapists working with children with speech difficulties.

The aim of this study is to describe the speech sound systems of Setswana-speaking children between the ages of 2 and 6 years. The information gained from this study will be used to help Speech-Language Therapists to develop their knowledge about how young children who speak Setswana learn to produce speech sounds. This information will also benefit Setswana-speaking children who may have problems producing speech sounds in the long term. The study will be conducted between the months of March and December 2017. It will involve conducting a speech sound developmental assessment (which looks at how children of different age groups produce different speech sounds of Setswana), as well as, asking you, the educator, questions related to the learners' behaviour and learning patterns (e.g. do they have trouble concentrating or learning concepts taught in class). The assessment is made up of showing the learners a set of pictures, asking them to name the pictures, and recording their responses on a voice recorder. Toys will also be used for younger learners who might find it difficult to recognise pictures(e.g. those between the ages of two and four years). Results obtained from this study will be used to outline the development of Setswana speech sounds from the age of two years up to six years. The results will also be used to describe the characteristics of the speech of children whose speech development is delayed (e.g. looking at whether or not some sounds are more difficult to say and if the children are able to say them if helped by an adult).

The learners will form part of the study once permission has been obtained from the Head of the school, you (the educator), parents and legal guardians, as well as the learners themselves.

Two hundred and forty children who meet the criteria will be included in the study; one hundred and twenty from the Dr Ruth Segomotsi Mompati district and one hundred and twenty from the Ngaka Modiri Molema district (specifically the Mahikeng region). These criteria include; children between two and six years who speak Setswana as their home language, children who may have speech and language delays, as well as children who do not have hearing and visual difficulties. Please note that I will only be able to confirm the number of learners who may be able to take part in this research study once I have received information on the ages of the learners in your classroom, as well as how many learners you have in your classroom.

Your assistance is required in identifying learners who meet the above-mentioned criteria. Once learners who may be able to take part in this study have been identified by you, a letter with information on what the aims of the study is will be sent to the learners' parents and legal guardians. A permission slip will also be attached to this information letter for parents who would like to have their children take part in this study. Please note that you will be asked to help send these documents to the learners parents and collect them from the learners whose parents have agreed to have their children take part in the study, because you see the children on a regular basis. Parents are free to contact me should they have questions; my mobile number is included in the letter that will be sent to the parents. I will also be able to meet parents and legal guardians who wish to discuss anything related to the study in person. Additional forms will be sent to parents and legal guardians of children who have given permission to have their children take part in the study. Please note that you will be asked to distribute and collect these from the children. The researcher will provide all the forms and letters and you will not be required to print or make copies of any of the documents. Your assistance will also be required in providing information on the learners learning abilities. This consists of completing four questions and will likely take between five and ten minutes of your time. Please note that the questions you will be asked are only about the learners whose parents and legal guardians have agreed for them to take part in the study.

Appropriate times for data collection will be arranged with you and an effort will be made to not disrupt your schedule. The children will be assessed individually over a period of ten months. Assessments will be conducted in a quiet space on the school premises and will each be 30-45 minutes long. A break will be given to children who require it. All children assessed will only be assessed once. Children who are found to have speech difficulties (i.e. those who find it very difficult to say a lot of speech sounds and words) participating in the study and who are not receiving therapy at the time of the study will be referred for speech therapy. Children who present with other forms of developmental delays will also be referred to the appropriate health professionals. All ethical guidelines will be adhered to.

The results obtained from the research study will be shared with the head of school, you, as well as each child's parents or legal guardians. Feedback will be provided throughout the research process. Concerns which may arise during the research process will be addressed. Please be aware that you and the other educators may me ask questions at anytime.
I hereby request for your assistance in identifying learners suitable for this study and your permission to assess the identified learners in your classroom.

Individuals taking part in this study do so voluntarily. The learners may withdraw from the study at any stage during the research process without any penalties. The learners' parents and legal guardians may also withdraw their children from the study at any stage during the research process without any penalties. There will be no financial costs and rewards for your school, the learners involved, as well as the learners' parents and legal guardians.

Yours Sincerely

Olebeng Mahura
(Researcher)
Tel : 0XX XXX XXXX
Email : o.mahura@uct.ac.za

Associate Professor Michelle Pascoe
(Research supervisor)
Tel : 021XXX XXXX
Email : michelle.pascoe@uct.ac.za

You may contact Professor Marc Blockman, Chairperson the Human Research Ethics Committee of the Faculty of Health Sciences on 021 406 6346 if you have any queries about the rights and welfare of the learners as participants in this study.

Appendix E2: Lekwalo la tshedimosetso go barutabana

UNIVERSITY OF CAPE TOWN
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Tel: 021 406 6401/ 6428/ 6628/6534
Fax: 021 406 6323

Go: Morutabana

Mabapi le: Tshedimosetso ya dipatlisiso le kopo ya thuso ya gago mo go tlhopeng baithuti ba ba maleba

Ke nna Olebeng Mahura, mme ke dira jaaka Speech-Language Therapist (ke thusa batho ba ba nang le mathata a go bua). Ke moithuti wa gerata ya boNgaka (Doctoral degree) kwa Yunibesithing ya Motse Kapa. Ke tshwanetse go dira dipatlisiso gore ke kgone go netefatsa maemo a digarata tsa me. Ke eletsa go dira dipatlisiso tse maikaelelo a teng e leng go tlhalosa ka mokgwa ô bana ba Batswana, ba ba magareng ga dingwaga tse pedi (2) le tse thataro (6), ba ithutang go bitsa medumo ya mafoko ka gone fa ba ntse ba gola.

Go na le tshedimosetso ê e nnye thata, ê e tlhalosang ka mokgwa ô bana ba Batswana ba ithutang go bitsa medumo ya mafoko ka gone fa ba ithuta go bua. Tshedimosetso ê e botlhokwa thata go diSpeech-Langauge Therapist ba ba dirang ka bana ba ba nang le mathata a go bua.

Maikaelelo a dipatlisiso tse, ke go tlhalosa gore bana ba Batswana, ba ba magareng ga dingwaga tse pedi le tse thataro, ba ithuta go bitsa medumo ya mafoko jang fa ba ithuta go bua. Tshedimosetso ê e tla kgobokanngwang mo dipatlisisong tse, e tla dirisiwa go thusa diSpeech-Language Therapist tse di dirang le bana ba ba nang le mathata a go bua (jaaka mathata a go bitsa mafoko a a rileng). Tshedimosetso ê e tla dirisiwa go thusa bana ba Batswana ba ba nang le mathata a go bitsa mafoko a a rileng fa ba bua. Dipatlisiso tse di tla dirwa magareng ga kgwedi ya Seetebosigo le Sedimonthole, ka ngwaga wa 2017; ebile di tla tsweletswa gape ka Ferikgong fo fitlha ka Sedimonthole ka ngwaga wa 2018. Mo dipatlisisong tse; moithuti o tla tlhatlhoba puo ya bana, mme tlhatlhobo ê e tla leba gore bana ba dingwaga tse di farologaneng ba bitsa medumo ya puo ya Setswana jang. Mo tlhatlhobong ê, barutabana ba tla botswa dipotso mabapi le maitseo a bana le ka mokgwa ô ba ithutang ka gone ko

sekolong (sekao; a ngwana o na le mathata a go dula sebakanyana a reetsa morutabana, a fetsa tiro ê a e filweng, kgotsa go ithuta dilo tse di rileng mo phaphosing). Tlhatlhobo ya puo ya bana e tla akaretsa go ba bontsha ditshwantsho tse di mmalwa, go ba botsa gore ba bona eng mo ditshwantshong tse, le go gatisa dikarabo tsa bone mo motšhining wa go gatisa mantswe (voice recorder). Ditshamikisi (toys) di tla dirisiwa fa baithuti ba ba nnye ba ba seng ba nne le kgatlhego ya go leba ditshwantsho ba tlhatlhobiwa. Tshedimosetso ê e tla kgobokanngwang mo dipatlisisong tse, e tla dirisiwa go supa dintlha-kgolo tse medumo ya puo ya Setswana e dirisiwang ka teng ke bana ba ba magareng ga dingwaga di le pedi go ya go dingwaga di le thataro. Tshedimosetso ê e tla dirisiwa gape go tlhalosa puo ya bana ba e leng gore ba na le mathata a go bua (sekao; go leba gore a go na le medumo e e leng thata gore bana ba e bitse le gore a ba kgona go e bitsa sentle fa ba thuswa ke mogolo).

Baithuti ba tla kopiwa go tsaya karolo mo dipatlisisong tse morago ga gore mogokgo, morutabana, batsadi ba bana le bana, lo mphe tetla ya go dira dipatlisiso tse.

Bana ba le makgolo a mabedi le masome a mane (240), ba ba maleba le lenaane kgetho ba tla tlhopiwa go tsaya karolo mo dipatlisisong tse. Bana ba le lekgolo le masome a mabedi (120) ba tla tlhopiwa go tswa mo distrikting ya Dr Ruth Segomotsi Mompati, mme ba bangwe (lekgolo le masome a mabedi) kwa distrikting ya Ngaka Modiri Molema. Lenaane-kgetho lê le akaretsa;

- bana ba ba magareng ga dingwaga tse pedi le tse thataro, mme ba bua Setswana kwa lapeng
- bana ba gongwe ba nang le mathata a puo
- bana ba ba senang mathata a go utlwa le a go bona.

Ke tla kgona go netefatsa palo ya bana ba ba tlhokegang go tswa mo phaposing ya gago fela morago ga go bona tshedimosetso ya dingwaga tsa baithuti ba gago le palo ya bone.

Ke kopa thuso ya gago mo go tlhopheng baithuti ba ba maleba le manaane-kgetho a a tlhalositsweng. Lekwalo la tshedimosetso le le tlhalosang maikaelelo a dipatlisiso tse le tla romelwa go batsadi le batlhokomedi ba baithuti go ba kopa go letlelela gore bana ba bone ba tseye karolo. Wena o le Morutabana, o tla kopiwa go thusa go romela ditokomane tse go batsadi le batlhokomedi ba bana, le go di amogela go tswa go batsadi ba ba dumelang gore bana ba bone ba tseye karolo. Se se kopiwa mo go wena ka gonne o bona baithuti thata mo gare ga beke. Batsadi le batlhokomedi ba bana ba rotloetswa

go nteletsa fa ba na le dipotso, mme nomore ya me ya mogala e kwadilwe mo makwalong otlhe a a ka rommelwang le bana. Ke tal dira nako ya go kopana le batsadi ba ba eletsang go bua ka tshedimosetso ya dipatlisiso le go bossa dipotso. Go na le diforomo tse di tal romelwang go batsadi le batlhokomedi ba ba letlelelang gore bana ba bone ba tseye karolo mo dipatlisisong tse. O tla kopiwa gape go di aba le go di amogela fa di busiwa ke bana. Mmatlisisi o tla go neela makwalo le diforomo tsotlhe, mme ga go kitla go tlhokega gore wena o di gatise. Lwa bofelo, o tla kopiwa go fa mmatlisisi tshedimosetso e e rillen mabapi le bokgone sjwa baithuti. Se se akaretsa go araba dipotso di le une, mme se se tla go tsaya metsotso e le tlhano go e le some. Ke kopa o itse gore depots tse o tla di bodiwang di mabapi le baithuti ba batsadi ba bone ba letleletseng gore ba tseye karolo fela.

Dinako tsa gore ke tle go dira ditlhatlhobo tsa me di tla rulaganngwa le wena, mme ke tla leka thata gore ke seke ke a tshwenya lenaane la gago la thuto. Mongwe le mongwe wa bana ba ba tsayang karolo o tla tlhatlhobiwa gangwe fela. Ditlhatlhobo tse di tla direlwa mo sekolong, mo lefelong le le didimetseng. Bana ba go belaelwang ba na le mathata a go bua ba tla romelwa gongwe go ya go bona Speech-Language Therapist. Bana ba go belaelwang ba saletse morago mo kgolong ya bone ba tla romelwa go bona thuso ko go maleba (gongwe ko tliniking kgotsa ko sepatala). Tsepamo ya melaotlhomo yotlhe e tla obamelwa.

Ditshwetso tsa dipatlisiso di tla abelwa wena le mogokgo ba gago, mme lo tla fiwa tshedimosetso fa dipatlisiso di ntse di tsweletse. Matshwenyego a a leng gone a tla rarabololwa go netefatsa gore ditlhatlhobo tsa bana di tsamaya ka mokgwa ô o kgotsofatsang. Wena, mogokgo le batsadi ba bana lo ka nna lwa mpotsa dipotso ka nako nngwe le nngwe.

Ke kopa thuso ya go tlhopa bana ba ba ka tsayang karolo go tswa mo phaphosing ya gago le tetlelelo ya go tlhatlhoba baithuti ba.

Baithuti ba ba tsayang karolo mo dipatlisisong tse, ba dira jalo ka boithaopo. Ba letleletswe go fetola menagano ya bone, gape ba letleletswe go ikgoga go tswa dipatlisisong nako nngwe le nngwe. Baithuti ba ba tsayang karolo, batsadi ba bone le sekolo ga ba kitla ba patedisiwa, mme ba ka se patelwe go tsaya karolo mo dipatlisisong tse.

Tetlelelo ya melaotlhomo e bonwe go tswa go Komiti ya Dipatlisiso tsa Batho, Karolo ya dithuto tsa boitekanelo (Faculty of Health Sciences) kwa Yunibesithing ya Motse Kapa (HREC/ REF: 600/2016).

Weno

Olebeng Mahura

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Associate Professor Michelle Pascoe

Motlhokomedi wa Mmatlisisi

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michelle.pascoe@uct.ac.za

O ka leletsa Professor Marc Blockman, modula setilo wa komiti ya dipatlisiso tsa batho, wa karolo ya dithuto tsa boitekanelo (Faculty of Health Sciences) mo 021 406 6496, fa o na le matshwenyego a ditshwanelo tsa baithuti ba gago jaaka batsayakarolo mo dipatlisisong tse.

Appendix E3: Permission from the Educators

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Department of Health and Rehabilitation Sciences
Divisions of Communication Sciences and Disorders,
Nursing and Midwifery, Occupational Therapy, Physiotherapy
F45 Old Main Building, Groote Schuur Hospital
Observatory, Cape Town, W/Cape, 7925
Tel: 021 406 6401/ 6428/ 6628/6534
Fax: 021 406 6323

Re: Permission to assist with information of learners taking part in the study.

I, _____, hereby agree to assist the researcher to identify in my classroom to take part in 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, a speech development assessment of the learners whose parents have given permission for them to take part in the study, as well as assisting the researcher in handing out forms to parents and collecting them once they have been completed. I understand that I may only give the researcher information on the children whose parents have given permission to have them take part in this study.

_____ _____

(Name) (Signature)

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

Yours Sincerely

Olebeng Mahura
(Researcher)
Tel : 021 XXX XXXX
Email : o.mahura@uct.ac.za

Associate Professor Michelle Pascoe
(Research supervisor)
Tel : 021XXX XXXX
Email : michelle.pascoe@uct.ac.za

You may contact Professor Marc Blockman, Chairperson of the Human Research Ethics Committee of the Faculty of Health Sciences on 021 406 6346 if you have any queries about the rights and welfare of the learners as participants in this study.

Appendix E4: Tetla go tswa go morutabana

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Department of Health and Rehabilitation Sciences
Divisions of Communication Sciences and Disorders,
Nursing and Midwifery, Occupational Therapy, Physiotherapy
F45 Old Main Building, Groote Schuur Hospital
Observatory, Cape Town, W/Cape, 7925
Tel: 021 406 6401/ 6428/ 6628/6534
Fax: 021 406 6323

Go: Morutabana

Mabapi le: Tetlelelo ya go thusa go tlhopha baithuti ba ba kgonang go tsaya karolo mo dipatlisisong tsê le go fa tshedimosetso ya baithuti ba.

Nna, ke le _____, ke fa tetla ya go thusa mmatlisisi go tlhopha baithuti ba ba tla tsayang karolo mo dipatlisisong tse ke di tlhaloseditsweng. Ke tlhaloseditswe maikaelelo a dipatlisiso tse, le gore di akaretsa eng. Ke tlhaloganya gore go tsaya karolo ga me go akaretsa go bodiwa dipotso mabapi le maitseo a baithuti ba ba tlhophilweng, le ka mokgwa ô ba ithutang ka gone. Ke tlhaloganya gape gore go dirwa ditlhatlhobo tse di lebang ka mokgwa ô baithuti ba buang ka gone, le gore ke tlile go kopiwa go thusa mmatlisisi go ntsha makwalo le go a amogela fa batsadi ba file tetla. Ke a tlhaloganya gore ke tla fa mmatlisisi tshedimosetso ya bana ba batsadi ba bone ba dumelang gore ba tseye karolo mo dipatlisisong tse.

Ke tlhaloganya gore leina la me le maina a baithuti ga a na go itsiwe, mme sê se tla dirwa le morago ga gore dipatlisiso tsê di fele. Ke a itse gore ke a ithaopa go tsaya karolo, ebile ke na le ditshwanelo tsa go bua fa ke sa tlhole ke batla go tsaya karolo nako nngwe le nngwe, ntle le go tlhalosa mabaka.

_____ _____ _____

Leina Saena Letlha

Fa o na le dipotso o ka nteletsa, kgotsa wa romela imeile.

Weno

OlebengMahura

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Associate Professor Michelle Pascoe

Motlhokomedi wa Mmatlisisi

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michelle.pascoe@uct.ac.za

O ka leletsa Professor Marc Blockman, modula setilo wa komiti ya dipatlisiso tsa batho, wa karolo ya dithuto tsa boitekanelo (Faculty of Health Sciences) mo 021 406 6496, fa o na le matshwenyego a ditshwanelo tsa baithuti ba gago jaaka batsayakarolo mo dipatlisisong tse.

Appendix F1: Information letter to parents and/or legal guardians

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Department of Health and Rehabilitation Sciences
Divisions of Communication Sciences and Disorders,
Nursing and Midwifery, Occupational Therapy, Physiotherapy
F45 Old Main Building, Groote Schuur Hospital
Observatory, Cape Town, W/Cape, 7925
Tel: 021 406 6401/ 6428/ 6628/6534
Fax: 021 406 6323

Dear Sir/Madam

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

I am currently registered as a Speech-Language Therapy Doctoral 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 describing the development of the speech sound system (phonology) of children between the ages of 2- and 6-years acquiring Setswana.

There is very little information on how Setswana-speaking children learn to produce speech sounds, and such information is beneficial to Speech-Language Therapists working with children with speech difficulties.

Two hundred and forty children are required for this study, and your child is requested to take part because s/he speaks Setswana and is between the ages of two and six years. I hereby request for permission to have your child participate in the research study.

The research study will include:

1. Asking educators questions related to your child's behaviour and learning patterns (e.g. does s/he understand well when the educator teaches in class or does s/he need extra help from the educator?).
2. Conducting a speech developmental assessment (i.e. looking at how your child produces sounds and words).
3. Asking you to complete two forms; one about your child's general development and the other one about how well you and other people understand your child when s/he speaks.

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. This will be done in a quiet space that has been made available by the school. The assessment will be 30 – 45 minutes long; your child will be given a break if s/he gets tired during the assessment and s/he child will only be assessed once. S/he will be shown a set of pictures or toys which s/he will be asked to name and describe while the

answers are recorded on a voice recorder. The assessment of your child will be of no cost to you. Please note that the researcher will play with your child in an attempt to build a relationship with him/her before conducting the assessment. This will be done to ensure that your child feels free and is comfortable for the duration of the assessment. Please note that in addition to you giving the researcher to assess your child's speech development; your child will be asked if s/he would like to take part in the research study. The aim of the study and what the assessment involves will be explained to your child in a language that s/he can understand. S/he will therefore only be assessed if she agrees to take part in the research study. Please note that should your child not want to participate and you have given permission for him/her to be part of this study; the researcher will respect your child's decision not to take part in the study.

Participation is entirely voluntary and you and your child's identities will be kept confidential. Recorded responses will be kept in a locked cupboard, and only the researcher and supervisors will have access to these during the course of the study. Once the researcher concludes this research study, has given you feedback on your child's speech sound development and has written up the results of the study; she would like to share the audio recordings of your child's assessment with other researchers who are interested in learning about ways in which children who speak different languages learn to speak. Please be aware that your child's name will not be used when the assessments are recorded using a voice recorder. His/her identity will therefore remain anonymous throughout the entire process and will not be known by other researchers either when the recordings are shared. You will be allowed an opportunity to indicate if you would like your child to take part in the study and whether or not you would like to have their recorded answers shared. Please be aware that you can indicate if you want your child to take part in the study but do not wish to have his answers shared with other researchers. You can also indicate if you do not want your child to take part in the study at all.

Should you wish for your child to withdraw, you may do so at any stage without having to provide an explanation. Please note that you can ask me questions at anytime before giving permission, while your child is taking part in the study and after your child has participated in the study. Following the assessment, you will be provided with written feedback to let you know whether or not the researcher suspects that your child has a speech sound difficulty (e.g. having trouble producing some sounds and words, which may make it difficult for people around him to understand what s/he might be trying to say). Should your child be suspected to have a speech sound difficulty, the researcher will be available to meet with you and explain this information, as well as provide information of where you can seek help.

There are no risks expected for participation in this study, and you and your child will receive no rewards for taking part.

Attached to this letter is a consent form. Kindly complete it should you wish your child to participate in this study. Please also indicate if you would like the researcher to share the recordings once the study has been completed.

Yours Sincerely

Olebeng Mahura
(Researcher)
Tel : 021 XXX XXXX
Email : o.mahura@uct.ac.za

Associate Professor Michelle Pascoe
(Research supervisor)
Tel : 021XXX XXXX
Email : michelle.pascoe@uct.ac.za

You may contact Professor Marc Blockman, Chairperson of the Human Research Ethics Committee of the Faculty of Health Sciences on 021 406 6346 if you have any queries about the rights and welfare of the learners as participants in this study.

Appendix F2: Lekwalo la tshedimosetso go batsadi

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Fax: 021 406 6323

Go: Mme/ Rre

Mabapi le: Tshedimsetso ya dipatlisiso le kopo ya gore ngwana wa gago a tseye karolo mo dipatlisisong tse.

Ke nna Olebeng Mahura, mme ke dira jaaka Speech-Language Therapist (ke thusa batho ba ba nang le mathata a go bua). Ke moithuti wa gerata ya boNgaka (Doctoral degree) kwa Yunibesithing ya Motse Kapa. Ke tshwanetse go dira dipatlisiso gore ke kgone go netefatsa maemo a digarata tsa me. Ke eletsa go dira dipatlisiso tse maikaelelo a teng e leng go tlhalosa ka mokgwa ô bana ba Batswana, ba ba magareng ga dingwaga tse pedi (2) le tse thataro (6), ba ithutang go bitsa medumo ya mafoko ka gone fa ba ntse ba gola.

Go na le tshedimosetso ê e nnye thata, ê e tlhalosang ka mokgwa ô bana ba Batswana ba ithutang go bitsa medumo ya mafoko ka gone fa ba ithuta go bua. Tshedimosetso ê e botlhokwa thata go diSpeech-Langauge Therapist ba ba dirang ka bana ba ba nang le mathata a go bua.

Maikaelelo a dipatlisiso tse, ke go tlhalosa gore bana ba Batswana, ba ba magareng ga dingwaga tse pedi le tse thataro, ba ithuta go bitsa medumo ya mafoko jang fa ba ithuta go bua. Tshedimosetso ê e tla kgobokanngwang mo dipatlisisong tse, e tla dirisiwa go thusa diSpeech-Language Therapist tse di dirang le bana ba ba nang le mathata a go bua (jaaka mathata a go bitsa mafoko a a rileng). Tshedimosetso ê e tla dirisiwa go thusa bana ba Batswana ba ba nang le mathata a go bitsa mafoko a a rileng fa ba bua.

Mmatlisisi o tlhoka bana ba le makgolo a mabedi le masome a mane (240) go tsaya karolo mo dipatlisisong tse. Ngwana wa gago o kopiwa go tsaya karolo ka gonne o bua Setswana ebile o magareng ga dingwaga tse pedi le tse thataro.

Dipatlisiso tse di tla akaretsa:

- Go botsa barutabana dipotso mabapi le maitseo a ngwana wa gago le ka mokgwa ô a ithutang ka gone (sekao: a ngwana wa gago o tlhaloganya sentle fa morutabana a ruta dilo tse di rileng kgotsa o tlhoka thuso go feta bana ba bangwe go tswa go morutabana?).

- Go tlhatlhoba puo ya ngwana wa gago (ke leba mokgwa ô ngwana wa gago a bitsang medumo ya puo le mafoko ka gone).

- Go go kopa go tlatsa diforomo tse pedi; nngwe e mabapi le ka mokgwa ô ngwana wa gago a golang ka gone, mme e nngwe ke tshedimosetso e e maleba le gore a wena le batho ba bangwe lo tlhaloganya ngwana wa gago go le kae fa a bua.

Se se tla kopiwa go wena fela fa o file tetla ya gore ngwana wa gago a tseye karolo mo dipatlisisong tse. Ngwana mongwe le mongwe ô o tsayang karolo o tla tlhatlhobiwa a le mongwe ka nako ê e rulagantsweng le barutabana. Se se tla dirwa kwa sekolong, ka nako e sekolo se tseneng ka yone. Ngwana wa gago o tla tlhatlhobiwa gangwe fela, mme tlhatlhobo ê e tla tsaya metsotso e le 30 go e le 45. Mmatlisisi o tla emisa tlhatlhobo go fa ngwana wa gago nako ya go ikhutsa, fa a bontsha a lapile. Mo tlhatlhobong e, ngwana wa gago o tlile go bontshiwa ditshwantsho di le mmalwa a be a kopiwa go di tlhalosa. Dikarabo tsa gagwe di tlile go gatisiwa ka motšhini wa go gatisa mantswe (voice recorder). Ditlhatlhobo tse di tla dirwa mahala, mme ga o kitla o kopiwa go patela. Mmatlisisi o tla tshameka le ngwana wa gago pele ga tlhatlhobo e simololwa. Se se tla dirwa gore ngwana wa gago a kgone go phuthuloga ka nako e a tlhatlhobiwang ka gone. Itse gore ngwana wa gago le ene o tlile go tlhalosediwa maikaelelo a dipatlisiso tse, le go bodiwa gore a go siame gore mmatlisisi a mo tlhatlhobe. Mmatlisisi o tla tlhompha tshwetso ya ngwana wa gago fa a sa batle go nna karolo ya dipatlisiso tse.

Go tsaya karolo go tswa mo go wena; maina a gago le ngwana wa gago ga a kitla a itsewe ke ope fela. Lisete ya maina a bana ba ba tsayang karolo botlhe ga a kitla a kopanngwa le dikarabo, go netefatsa gore maina a bone ga a itsewe ke ope. Dikarabo tsa bana botlhe di tlile go bewa mo kôbôtlông e e lotlelwang, mme di tla bonwa fela ke mmatlisisi le motlhokomedi wa gagwe (supervisor). Mmatlisisi o tla rata go aroganya dikarabo tsa ngwana wa gago tse di gatisitsweng le babatlisisi ba ba nang le kgatlhego ya go ithuta ka mokgwa ô bana ba ba farologaneng ba ithutang go bua ka gone. Itse gore

leina la ngwana wa gago ga le kitla le dirisiwa fa dikarabo tsa gagwe di gatisiwa, ebile ga le kitla le newa babatlisisi ba bangwe fa o tla dumela gore dikarabo tsa ngwana wa gago di aroganngwe. O tlile go fiwa tšhono ya go supa gore a o na le kgatlhego ya gore ngwana wa gago a tseye karolo mo dipatlisisong tse, le gore a go siame gore dikarabo tsa gagwe tse di gatisitsweng di aroganngwe. Itse gore o kgona go supa fa o batla gore ngwana wa gago a tseye karolo, mme o sa batle dikarabo tsa gagwe di aroganngwa le babatlisisi ba bangwe. O kgona gape le go supa fa o sa batle ngwana wa gago a tsaya karolo.

Fa o file tetla, mme o be o fetola monagano, o kgona go ikgoga (wena le ngwana wa gago) go tswa mo dipatlisisong tse, ntle le go tlhalosa mabaka. O kgona go mpotsa dipotso ka nako nngwe le nngwe pele ga o fa tetla ya gore ngwana wa gago a tseye karolo. O kgona gape go botsa dipotso fa dipatlisiso di ntse di tsweletse, le morago ga gore ngwana wa gago a tlhatlhobiwe. Mmatlisisi o tla go kwalela morago ga go tlhatlhoba ngwana wa gago go go tlhalosetsa gore ngwana wa gago o na le bothatanyana jwa puo (sekao: fa a na le mathata a go bitsa mafoko le fa go le bothatanyana gore a tlhaloganngwe ke batho ba bangwe). Fa pelaelo ê e le gone, mmatlisisi o tla dira nako ya go kopana le wena go go tlhalosetsa tshedimosetso ya gore o ka bona thuso kae.

Ga go na diteleketso/ dikotsi tse go solofelwang di tla tlhaga fa ngwana wa gago a tsaya karolo mo dipatlisisong tse. Ga go na dikabelo fa wena le ngwana wa gago lo tsaya karolo.

Go na le foromo ê e patagantsweng le lekwalo le, ya go kopa tetla ya gore ngwana wa gago a tseye karolo. O kopiwa go e tlatsa fa o ka rata gore ngwana wa gago a tseye karolo mo dipatlisisong tse. O kopiwa gape go bontsha gore a o na le kgatlhego ya gore mmatlisisi a aroganye dikgatiso tsa dikarabo fa a feditse ka dipatlisiso tse.

Tetlelelo ya melaotlhomo e bonwe go tswa go Komiti ya Dipatlisiso tsa Batho, Karolo ya dithuto tsa boitekanelo (Faculty of Health Sciences) kwa Yunibesithing ya Motse Kapa (HREC/ REF: 600/2016).

Weno

Olebeng Mahura

Mmatlisisi

071 XXXXXXX

o.mahura@uct.ac.za

Associate Professor Michelle Pascoe

Motlhokomedi wa Mmatlisisi

021 XXX XXXX

michelle.pascoe@uct.ac.za

O ka leletsa Professor Marc Blockman, modula setilo wa komiti ya dipatlisiso tsa batho, wa karolo ya dithuto tsa boitekanelo (Faculty of Health Sciences) mo 021 406 6496, fa o na le matshwenyego a ditshwanelo tsa ngwana wa gago jaaka motsayakarolo mo dipatlisisong tse.

Appendix F3: Permission from parents and/or legal guardians

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F45 Old Main Building, Groote Schuur Hospital
Observatory, Cape Town, W/Cape, 7925
Tel: 021 406 6401/ 6428/ 6628/6534
Fax: 021 406 6323

Re: Permission for my child to participate in the study.

I, _____ (name of parent), hereby give permission for my child, _____ (name of child), to take part in this research study.

The purpose of this study and what it involves 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 abilities, as well as, a speech development assessment (i.e. looking at how my child speaks).
I understand that my child's identity will be kept confidential and that his/her confidentiality will be maintained throughout the research study and thereafter. I am aware that my child's participation is completely voluntary and that we may withdraw from the study at any time without penalty and without giving a reason.

_____ _____

(Name) (Signature)

Please continue reading below if you would like the researcher to share your child's assessment recordings.
In addition to this, the researcher has explained to me that she would like to share the audio recordings of my child's assessment with other researchers who are interested in learning about ways in which children who speak different languages learn to speak. I am aware that I can choose to have my child take part and refuse to have his/her recordings shared. I am also aware that my child's name will not be known to anyone and will be kept anonymous when this recording is shared.

I, _____ (name of parent), hereby give permission to have the researcher share a recording of _____ 's (name of child) speech assessment with other researchers who are interested in learning about how children speaking different languages learn to speak.

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

Yours Sincerely

Olebeng Mahura
(Researcher)
Tel : 021 XXX XXXX
Email : o.mahura@uct.ac.za

Associate Professor Michelle Pascoe
(Research supervisor)
Tel : 021XXX XXXX
Email : michelle.pascoe@uct.ac.za

You may contact Professor Marc Blockman, Chairperson of the Human Research Ethics Committee of the Faculty of Health Sciences on 021 406 6346 if you have any queries about the rights and welfare of the learners as participants in this study.

Appendix F4: Tetla go tswa go batsadi

UNIVERSITY OF CAPE TOWN
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Fax: 021 406 6323

Go: Motsadi

<u>Mabapi le: Tetla ya gore ngwana wa gago a tseye karolo mo dipatlisisong.</u>

Nna, ke le ____ (leina la motsadi), ke fa tetla ya gore ngwana wa me, e leng ____ (leina la ngwana), a tseye karolo mo dipatlisisong tse.

Ke tlhaloseditswe maikaelelo a dipatlisiso tse le gore di akaretsa eng. Ke tlhaloganya gore fa ngwana wa me a tsaya karolo, mmatlisisi o tla botsa morutabana dipotso tse di maleba le maitseo a ngwana le ka mokgwa o a ithutang ka gone. Go tsaya karolo go akaretsa gape go tlhatlhoba puo ya ngwana mo go tla lebiwang ka mokgwa yo ngwana wa me a buang ka gone. Ke a tlhaloganya gore leina la ngwana wa me ga le nkitla le itsewe ke ope fela, mme ke a tlhaloganya gore sê se tla dirwa fa dipatlisiso di tsweletse le morago ga gore di fele. Ke a tlhaloganya gore ke a ithaopa gore ngwana wa me a tseye karolo mo dipatlisisong tse, le gore re kgona go ikgoga mo dipatlisisong ntle le go fa mabaka le gore ga go kitla go nna le ditlamorago.

________________________ ___________________ __________________

Leina Saena Letlha

- -

O kopiwa go tswelela go bala fa o na le kgatlhego ya gore mmatlisisi a aroganye dikarabo tsa ngwana wa gago.

Mo godimo ga sê se tlhalositsweng, mmatlisisi o ntlhaloseditse gore o na le kgatlhego ya go ka aroganya dikarabo tsa ngwana wa me tse di gatisitsweng le babatlisisi ba bangwe ba ba nang le kgatlhego ya go ithuta ka mokgwa yo bana ba ba farologaneng ba ithutang go bua ka gone.

Ke a itse gore ke kgona go dumela gore ngwana wa me a tseye karolo, mme ke gane gore dikarabo tsa gagwe tse di gatisitsweng di aroganngwe. Ke a itse gape gore leina la ngwana wa me ga nkitla le itsewe ke ope le gore go tla nna jalo le fa dikarabo tse di gatisitsweng di ka aroganngwa.

Nna, ke le _____ (leina la motsadi), ke fa mmatlisisi tetla ya go aroganya dikarabo tse di gatisitsweng, tsa ga _____ (leina le ngwana) le babatlisisi ba bangwe ba ba nang le kgatlhego ya go itse gore bana ba ba farologaneng ba ithuta go bua jang.

_____ _____ _____

Leina Saena Letlha

Fa o na le dipotso o ka nteletsa, kgotsa wa romela imeile.

Weno

Olebeng Mahura

Mmatlisisi

071 XXX XXXX

o.mahura@uct.ac.za

Associate Professor Michelle Pascoe

Motlhokomedi wa Mmatlisisi

021 XXX XXXX

michelle.pascoe@uct.ac.za

O ka leletsa Professor Marc Blockman, modula setilo wa komiti ya dipatlisiso tsa batho, wa karolo ya dithuto tsa boitekanelo (Faculty of Health Sciences) mo 021 406 6496, fa o na le matshwenyego a ditshwanelo tsa ngwana wa gago jaaka motsayakarolo mo dipatlisisong tse.

Appendix G1: Informed verbal assent from participants

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Dear Learner

Re: Invitation to participate in a study.

My name is Olebeng Mahura and I am trying to find out how children in preschool speak. Finding out how children learn to speak will help me to understand how to help children who find it hard to say words. I would like you to help me understand how small children learn to say words.

If you would like to help me then I will show you pictures/toys 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 today. The only people who will be allowed to listen to the recordings are my teachers and I. I will put these away in a locked cupboard to make sure that they are safe. We will work in a quiet place here at school to make sure that I can hear you well when you talk. I have asked your mom and dad if you can play with me and they have agreed. It is okay if you want to change your mind and do not want to play with me anymore. No one will be upset with you.

You will not get into trouble if you do not know some of the pictures and toys I show you. You can tell me when you are tired and we will take a break. I will only ask you to tell me what you see on the pictures we do not have to do this again if we finish looking at the pictures and toys today.

Tell me if you do not understand and I will tell you again and show you what to do.

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.

Participant Code : _____
Name of researcher : _____
Date : _____

Appendix G2: Tetla go tswa go batsaakarolo

UNIVERSITY OF CAPE TOWN
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Fax: 021 406 6323

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 H1: 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. when expressing his/her 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 H2: 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 : _____

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 I: Intelligibility in Context Scale

Teko ya tlhaloso ya puo: Setswana

Intelligibility in Context Scale (ICS): Tswana

(McLeod, Harrison, & McCormack, 2012)

E fêtotswê ke (Translated by): Olebeng Mahura, MSc, Melanie Brunette, BSc, Suzette Brynard, BSc, Inge Burger, BSc, Sarah Janse van Rensburg, BSc, Heidi Meyer, BSc, Amazement Nemaungane, BSc, & Michelle Pascoe, PhD
Yunibesithi ya Motse Kapa, Aforika Borwa / University of Cape Town, South Africa, 2016

Leina la ngwana (Child's name): _____

Letlha la ngwana la matsalo (Child's date of birth): _____ Mosimane/Mosetsana (Male/Female): _____

Dipou tse ngwana a di buang ko gae (Language(s) spoken): _____

Letlha la gompieno (Current date): _____ Dingwaga tsa ngwana (Child's age): _____

Leina la motho yo o tlatsang foromo boemong jwa ngwana (Person completing this form): _____

Kgolagano ya gago le ngwana (Relationship to child): _____

Dipotso tse dilatelang dimabapi le puo ya ngwana. Dipotso tse, dibotsolotsa gore puo ya ngwana e tlhalogangwa jang ke batho ba ba farologanyeng. Pele o araba dipotso tse dilatelang, o kopiwa go akanya ka puo ya ngwana mo dikgweding tse di mmalwa tse difitileng. Tshwaya karabo ya gago ka sedika fa o araba dipotso tse dilatelang.

(The following questions are about how much of your child's speech is understood by different people. Please think about your child's speech over the past month when answering each question. Circle one number for each question.)

	Ka metlha yotlhe (Always)	Ka metlha (Usually)	Ka metlha e mengwe (Sometimes)	Eseng ka metlha (Rarely)	Eseng ka metlha yotlhe gotlhelele (Never)
1. A o tlhaloganya ngwana wa gago fa a bua[1]? (Do **you** understand your child[1]?)	5	4	3	2	1
2. A balosika ba tlhaloganya ngwana wa gago fa a bua? (Do **immediate members of your family** understand your child?)	5	4	3	2	1
3. A ba maloko a mangwe a losika lwa gago ba tlhaloganya ngwana wa gago fa a bua le bone? (Do **extended members of your family** understand your child?)	5	4	3	2	1
4. A ditsala tsa ngwana wa gago ba a mo tlhaloganya fa a bua le bone? (Do your **child's friends** understand your child?)	5	4	3	2	1
5. A batho ba bangwe mo tikologong (kgotsa morafe) ba tlhaloganya ngwana wa gago fa a bua le bone? (Do other **acquaintances** understand your child?)	5	4	3	2	1
6. A barutabana ba ngwana wa gago baa mo tlhaloganya fa a bua le bone? (Do your **child's teachers** understand your child?)	5	4	3	2	1
7. A batho ba ba sa itseng ngwana wa gago baa mo tlhaloganya fa a bua le bone[2]? (Do **strangers**[2] understand your child?)	5	4	3	2	1
PALO GOTLHE YA SEKORO (TOTAL SCORE) =	/35				
PALO E MAGARENG YA SEKORO (AVERAGE TOTAL SCORE) =	**/5**				

[1] Dimejamente tse di dirisitsweng fano, di ka dirisetswa go mejara puo ya bagolo.
(This measure may be able to be adapted for adults' speech, by substituting *child* with *spouse*.)

[2] O tlhoka fela go fetolela lefoko *ngwana* go *molekane*. (The term *strangers* may be changed to *unfamiliar people*)

McLeod, S., Harrison, L. J., & McCormack, J. (2012). The Intelligibility in Context Scale: Validity and reliability of a subjective rating measure. *Journal of Speech, Language, and Hearing Research, 55*(2), 648-656. http://jslhr.asha.org/cgi/content/abstract/55/2/648

McLeod, S., Harrison, L. J., & McCormack, J. (2012). *Teko ya tlhaloso ya puo: Setswana* [Intelligibility in Context Scale: Tswana]. (O. Mahura, M. Brunette, S. Brynard, I. Burger, S. Janse van Rensburg, H. Meyer, A. Nemaungane, & M. Pascoe, Trans.). Bathurst, NSW, Australia: Charles Sturt University. Retrieved from http://www.csu.edu.au/research/multilingual-speech/ics. Published March 2016.

Appendix J: Questionnaire for Educators

Learner'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 and give an example.

_____

_____

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 K: Setswana speech assessment – target word list

Phoneme	Word		IPA	Response	Stimulability
/pʼ/	panana *(banana)*	Ke eng se?	/**p**ʼa**n**ana/		
/pʰ/	phala *(whistle/ trumpet)* l*ephutshe (pumpkin)*	Ke eng se? (e lotsiwa ke referee, a re 'prrr') Ke eng se?	/**pʰ**ala/ /le**pʰu**tsʰe/		
/b/	baesekele *(bicycle)*	Ke eng se?	/**b**aẹse**k**ʼele/		
/tʼ/	tafole *(table)* tonki (donkey)	Ke eng se? Ke eng se?	/**t**ʼa**f**ole/ /**t**ʼɔ**ŋ̩**kʼi/		
/tʰ/	thubegile *(broken)*	Go diragetseng ka komiki? (E wele, e be e diregang?)	/**tʰ**ubɛ**x**ilɛ/		
/d/	nonyane *(bird)* diphuka/ mafofa *(feathers)* dikgadima/ magadima (lightning) dikgomo *(cows)*	Use same picture to elicit bird and feathers. Ask: ke eng se? (nonyane) E fofa ke eng? (mafofa) Pula e na ka eng? E re___(imitate sound made by thunderstorms) Ke eng tse?	/**n**ɔ**ɲ**ane/ /**d**i**pʰ**ukʼa/ /**m**a**f**ofa/ /**d**ik͡x**ʰ**a**d**ima/ /**m**axa**d**ima/ /**dik͡xʰ**ɔmo/		

Phoneme	Word		IPA	Response	Stimulability
	dikausu *(socks)* dikhai/ diaparo (clothes)	Ke eng tse? Ke eng tse?	/**d**ikˈa**ụ**su/ /di**kʰ**aị/		
/tɬˈ/	tlou *(elephant)*	Ke eng se?	/**tɬ**ˈɔu/		
/tɬʰ/	tlhagola tlhatswa *(washing)* tlhapi *(fish)* latlhela *(throwng)*	Papa o dirang mo? (Can prompt: o tshwere garawe, o dirang ka yone?) Mama o dirang mo? (Prompt: o tshetse metsi le sesepa. O dirang ka diaparo?) Ke eng se? Mosimne o dirang ka bolo? (Forced choice: A wa e raga kgotsa wa e latlhela?)	/**tɬʰ**a**x**ola/ /tɬʰa**t͡sʷ**ˈa/ /**tɬʰ**apˈi/ /la**tɬʰ**ɛla/		
/kˈ/	ketlele *(kettle)*	Ke eng se?	/kˈe**tɬ**ˈele/ /**k**ˈɛ**tɬ**ˈɛlɛ/		
/kʷˈ/	kwena *(crocodile)* kwala (*write)*	Ke eng se? (Ke eng ka Setswana? If answer is in English. Forced choice: Ke ntša kgotsa ke kwena?) Motho yo o dirang?	/**k**ʷˈɛna/ /**k**ʷˈala/		

Phoneme	**Word**		**IPA**	**Response**	**Stimulability**
/kʰ/	khutshwane	Ke monna yo mo telelele (point to tall man). Yo ena o ntse jang? (Forced choice: o mo khutshwane kgotsa o mo telelele?)	/**kʰ**u**tʂ͡ʰʷ**ane/		
	khudu *(tortoise)*	Ke eng se?	/kʰudu/		
	sekhukhu/ mokgele *(umbrella)*	Ke eng se?	/se**kʰ**ukʰu/ /mo**k͡xʰ**ɛlɛ/		
/s/	sefapaano (*cross* (*n*))	Ke eng se?	/**s**efa**p**ˈanɔ/		
	setilo *(chair)*	Ke eng se?	/**s**e**t**ˈilɔ/		
	sefatlhego *(face)*	Ke eng se? (use same pic for this and 'ditsebe')	/**s**efa**tlʰ**ɛxɔ/		
	ditsebe *(ears)*	Tse tsone ke eng?	/di**t͡s**ˈɛbɛ/		
	pitsa *(pot)*	Ke eng ê? (use same picture for 'sekhurumelo')	/pˈi**t͡s**ˈa/		
	sekhurumelo *(lid)*	Ke eng se? (Prompt: Se tswala pitsa)	/**s**ekʰuru**m**ɛlɔ/		
	segwagwa *(frog)*	Ke eng se?	/**s**ɛxʷa**x**ʷa/		

Phoneme	**Word**		**IPA**	**Response**	**Stimulability**
	sekipa *(t-shirt)*		/**s**e**k**ˈipˈa/		
/ʃ/	ša *(burn)* maše/ mêlêkê *(milk)*	Go diragalang ka setlhare mo? (Prompt: Molelo wa se fisa – setlhare se a ___) Ke eng se?	/**ʃ**a/ /ma**ʃ**e/ /**m̩**mɛ**l**ɛkˈɛ/		
/ʃʷ/	ditšhoswane *(ants)*	Ke eng tse di tsamayang mo setlhareng tse?	/dit͡s^{h}**ɔs**^{w}ane/		
/x/	gagola/ kgeila *(tear)* legapu *(watermelon)*	Mosimane o dirang ka pampiri mo? (Can demonstrate if child can't say) Ke eng se?	/**x**axola/ /**kx**^{h}**ɛi̯**la/ /le**x**apˈu/		
/xʷ/	segwete/ digwete *(carrots)*	Dilo tse ke eng?	/se**x**^{w}**ɛ**tˈɛ/		
/h/	hempe *(shirt)*	Ke eng se?	/**h**ɛ**m̩**pˈɛ/		

Phoneme	**Word**		**IPA**	**Response**	**Stimulability**
/m/	maoto *(legs)*	Ke eng tse? (use same picture for ‘mangwele’)	/**m**ao̤tˈo/		
		Ke eng tse mo maotong?			
	mangwele *(knees)*		/maŋʷɛlɛ/		
		Ke eng e? (Prompt: E re ____(imitate sound of			
	montsane/ monang	mosquito), e go loma bosigo o robetse).	/**m**oo̤**t͡s**ˈane/ /monaŋ̤/		
		Ke eng e?			
	mmutla	Ke eng e?	/**m̤**mutɬˈa/		
	mmidi/ mmopu		/**m̤**midi/ /**m̤**mɔpˈu/		
/n/	ntša *(dog)*	Ke eng se?	/**n̤**ʧ͡ʰa/		
	nnotshi *(bee)*	Ke eng se? E re fa mamepe. E re ___(imitate buzzing sound of bee)	/**n̤**nɔt͡sʰi/		
	penta *(painting, v)*	Mama o tshwere pente, o dirang ka yona?	/pˈɛ**n̤**tˈa/		
/nʷ/	nwa *(drinking)*	Mama o dirang mo?	/**n**ʷa/		
/ŋ/	nku *(sheep, sing)*	Ke eng e? (Prompt: imitate sound made by sheep)	/**ŋ̤**kˈu/		

Phoneme	**Word**		**IPA**	**Response**	**Stimulability**
/ŋʷ/	ngwana *(baby)*	Ke mang yo?	/**ŋʷ**ana/		
/ɲ/	nyenyane	Ê ke bolo e e tonna/kgolo, e yone e__	/**ɲɲ**ane/		
/l/	lebante/ lepanta *(belt)* letsogo *(arm)* leswe/ ditšhila (dirty) lefielo *(broom)*	Ke eng se? Ke eng se? Ke dikipa tse pedi. Sê se sekono, sê sone se ___? Ke eng se?	/lebaɲtʻɛ/ /lepʻaɲtʻa/ /le**t͡s**ʻɔxɔ/ /le**s**ʷɛ/ /dit͡ʃʰila/ /lefi**ɛ**ɬlɔ/		
/lʷ/	lwala *(ill)*	Mosimane o robetse ko sepetle. Go diragalang ke ene? (Forced choice: A o siame fela kgotsa o a lwala?)	/**l**ʷala/		
/t͡sʷʻ/	tswala *(close)* butswela/ futswetsa *(blow)*	Papa o dirang ka mojako/kgoro mo? Mama ene o dirang mo? (Prompt: O tima dikerese a re ___ demonstrate blowing)	/**t͡s**ʷʻala/ /bu**t͡s**ʷʻɛla/ /fu**t͡s**ʷʻɛt͡sʻa/		
/t͡sʰ/	tsholola/ tshologile *(spilled)*	Mama o dirang ka metsi mo? Or – go diragetseng ka metsi mo?	/**t͡sʰ**olola/ /t͡sʰoloxilɛ/ /t͡sʰoɬloxilɛ/		

Phoneme	Word		IPA	Response	Stimulability
/t͡sʰʷ/	tshwene *(monkey)*	Ke eng e? (Ke eng ka Setswana? If child gives English name. Forced choice: A ke tshwene kgotsa ke ntsa?)	/**t͡sʰʷ**ɛne/		
/ʤ/	jesa *(feeding)*	Mama o dirang mo?	/**ʤ**esa/		
/kx̂ʰ/	kgakala/ kgole *(far)*	Setlhare se se gaufi, sena sona se kae? (Forced choice: A se gaufi le sona, kgotsa se kgakala/ kgole?)	/**kx̂ʰ**a**k**ˈala/ /k͡xʰolɛ/		
/kx̂ʰʷ/	kgweetsa/ reiya *(driving)*	Mama o dira eng ka koloi?	/**kx̂ʰʷ**ɛtsˈa/ /rɛi̯ja/		
/w/	watshe *(watch)*	Ke eng e? (Prompt: E re bolelela nako)	/wa**t͡ʃʰ**e/		
/a/	apole *(apple)*	Ke eng se?	/**a̤**pˈole/		
/e/	mae *(eggs)*	Ke eng tse? (Prompt: Re di fiwa ke koko)	/ma**e̤**/		
/o/	beola/ kera *(cutting hair)*	Se ke motšhini (point to machine) – ba dirang ka one?	/bɛ**o̤**la/ /kˈɛra/		
/ɔ/	omile *(dry, v)*	Sekipa se se metsi ne (point to t-shirt dripping water), mama o se anegile. Mona (point to dry t-shirt) se ntse jang? (Additional: A se metsi?)	/**ɔ̤**milɛ/		
/i/	ikama *(combing own hair)*	Mama o dira eng ka kama mo?	/i̤kˈama/ /i̤t͡ʃʰɛba/ /i̤tˈebɛl̤la/		

Phoneme	**Word**		**IPA**	**Response**	**Stimulability**
	itšheba/ itebelela *(looking at oneself)* seiponeng/ sepiling *(in the mirror)*	Mo mama o dira eng? (use this picture to elicit next item) O itšhebile/ itebelletse mo kae?	/seɪpˈɔneŋ̩/ /sepˈiliŋ̩/ /spˈiliŋ̩/		

Appendix L: Picture stimuli for the Setswana speech assessment

Appendix M: Setswana speech assessment tool – feedback

Setswana Speech Assessment Tool

1. How many times have you administered the Setswana assessment tool?

_____

_____

2. How old were the children whom you assessed using this tool?

_____

_____

3. Please indicate whether or not you found it challenging to use this tool.

   3.1 Please comment on the length and usability of the tool for an SLT whose first language is not Setswana.

_____

_____

   3.2 What do you feel can be done in order to make the test easy for you to use? (e.g. inclusion of normative data, scoring, etc.).

_____

_____

4. Did the children recognise the pictures used?

_____

_____

5. Did they use the vocabulary included in the tool? If not, please indicate whether they used alternative words (for which items), or if it was because they did not know the words or if they used incorrect vocabulary.

_____

_____

6. Where there specific items in the test which most of the children found challenging? Please indicate which item/s.

_____

_____

Appendix N1: Information letter to the expert panel

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Department of Health and Rehabilitation Sciences
Divisions of Communication Sciences and Disorders,
Nursing and Midwifery, Occupational Therapy, Physiotherapy
F45 Old Main Building, Groote Schuur Hospital
Observatory, Cape Town, W/Cape, 7925
Tel: 021 406 6401/ 6428/ 6628/6534
Fax: 021 406 6323

Dear Sir/Madam

Re: Research study information and permission for your assistance in developing target words for a Setswana speech assessment tool.

I am currently registered as a Speech-Language Therapy Doctoral 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 describing the development of the speech sound system (phonology) of children between the ages of two- and six-years acquiring Setswana.

There is very little information on how Setswana-speaking children learn to produce speech sounds, and such information is beneficial to Speech-Language Therapists working with children with speech difficulties.

The aim of this study is to describe the speech sound systems of Setswana-speaking children between the ages of two and six years. The information gained from this study will be used to help Speech-Language Therapists to develop their knowledge about how young children who speak Setswana learn to produce speech sounds. This information will also benefit Setswana-speaking children who may have problems producing speech sounds in the long term.

In order to collect this information, I need to develop an assessment tool that is culturally and linguistically appropriate to use with this population. I have a preliminary assessment tool that was previously used in a similar study. I would like to develop this further and need your help in revising the word list that is currently available. This will be done in order to make the assessment tool easy to use in clinical practice, by Speech-Language Therapists who speak Setswana as a first language and those who speak it as an additional language. In order for me to do this successfully, I need other speakers of Setswana to assess the list of words I currently have. During this process, you will be asked to go through each of the potential target words, indicate whether or not you think that children between the ages of two and six years know these words, as well as give alternative words where necessary. Please note that this will only be done once and will likely only take 30 - 45 minutes; preferably after lectures and clinics, at a time that is most convenient for you.

The researcher is looking for more than one person to assist in this process as it would be beneficial to have a panel and have a short discussion of why certain words should be discarded or kept. It would also be beneficial to have people who speak Setswana as an additional language in this panel.

You will be asked to complete a permission slip should you be interested in being part of this panel. Your name will be kept confidential and not be used when reporting on the findings of the discussions that will take place. Please note that will be no financial costs and rewards for you to take part in this process of the research study.

Yours Sincerely

Olebeng Mahura
(Researcher)
Tel : 071 XXX XXX
Email : o.mahura@uct.ac.za

A/Professor Michelle Pascoe
(Research supervisor)
Tel : 0214XX XXXX
Email : michelle.pascoe@uct.ac.za

You may contact Professor Marc Blockman, Chairperson of the Human Research Ethics Committee of the Faculty of Health Sciences on 021 406 6346 if you have any queries about your rights and welfare as a participant in this study.

Appendix N2: Permission to participate in expert panel

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Department of Health and Rehabilitation Sciences
Divisions of Communication Sciences and Disorders,
Nursing and Midwifery, Occupational Therapy, Physiotherapy
F45 Old Main Building, Groote Schuur Hospital
Observatory, Cape Town, W/Cape, 7925
Tel: 021 406 6401/ 6428/ 6628/6534
Fax: 021 406 6323

Re: Permission to assist in developing target words for a Setswana assessment tool.

I, _____ (name), hereby agree to assist in this research study and form part of the panel, as indicated in the information letter.

The purpose of this study and what it involves have been explained to me. I understand that my role is to assist the researcher in reviewing a wordlist of potential target words for a speech assessment tool for children who speak Setswana, and to participate in discussions which may take place.

I understand that my identity will be kept confidential and that my name will not be used when reporting on the findings of the discussions which the panel may have. I am aware that my participation is completely voluntary and that I may withdraw from the study at any time without penalty and without giving a reason.

_____ _____

(Name) (Signature)

Yours Sincerely

Olebeng Mahura
(Researcher)
Tel : 071 XXX XXXX
Email : o.mahura@uct.ac.za

A/Professor Michelle Pascoe
(Research supervisor)
Tel : 021XXX XXXX
Email : michelle.pascoe@uct.ac.za

You may contact Professor Marc Blockman, Chairperson of the Human Research Ethics Committee of the Faculty of Health Sciences on 021 406 6346 if you have any queries about your rights and welfare as a participant in this study.

Appendix O1: Phonetic inventories (Tables 10a and 10b)

Table 10a. Phonetic Inventory in the initial word position: Group 1 (2;6–2;11 years) (Sekwêna variety)

Manner		L25	L31	L33	L37	EL2	EL25	EL27
Plosives	Ejective	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’	p’ t’ k’	p’ t’ k’ kʷ’	p’ t’ k’	p’ t’ k’ kʷ’	p’ t’ k’
	Aspirated	tʰ tʰʷ kʰ	tʰ kʰ	pʰ tʰ kʰ	tʰ kʰ	tʰ kʰ kʰʷ	pʰ tʰ kʰ	pʰ tʰ kʰ
	Voiced	b d	b d	b d	b d	b d	b d	b d
	Fricatives	f s h	f s h	f s ʃ x	f s ʃ h x	f s x	f s h	f s ʃ h
	Nasals	m nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ	m n ŋ ɲ	m nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ	m n ŋ ŋʷ ɲ	m n ŋ ɲ
	Lateral	l lʷ	l lʷ	l lʷ	l lʷ	l lʷ	l lʷ	l lʷ
	Glides	w	w	j	w		w	w
	Trill					ʀʷ		
Affricates	Ejective	t͡ɬ’	t͡ɬ’	t͡ɬ’	t͡ɬ’	t͡sʷ’	tɬ’ t͡sʷ’	t͡s’
	Aspirated	tɬʰ t͡sʰ t͡sʰʷ	tɬʰ tɬʰʷ t͡sʰ t͡sʰʷ	t͡sʰ	tɬʰ t͡sʰ t͡sʰʷ	tɬʰ t͡sʰ t͡sʰʷ t͡ʃʰ	tɬʰ t͡sʰ t͡sʰʷ k͡xʰ	tɬʰ t͡sʰ k͡xʰ
	Voiced	dʒ			dz		dʒ	dʒ
	Heterorganic compounds		fj				fj	
	Clusters	sp’	skʰ spʼ		sp’		dr	

Table 10b. Phonetic inventory in the penultimate syllable: Group 1 (2;6–2;11 years) (Sekwêna variety)

	Manner	L25	L31	L33	L37	EL2	EL25	EL27
Plosives	Ejective	p’ k’	p’ k’	p’ k’	p’ t’ k’	p’ k’ kʷ’	p’ k’	p’ k’
	Aspirated	tʰʷ		pʰ tʰ	tʰ kʰ	kʰ	pʰ kʰ	pʰ kʰ
	Voiced	d	d	b	b d	d	d	b d
	Fricatives	f s sʷ h x xʷ	f s h x xʷ	f s ʃ h x	f s h hʷ x	f sʷ h x	f s sʷ h hʷ x xʷ	f v sʷ h x xʷ
	Nasals	m n ŋ ŋʷ ɲ	m n ŋ ŋʷ ɲ	m n ɲ	m n ŋ ŋʷ ɲ	m n ŋ ŋʷ ɲ	m n ŋ ɲ	m n ŋ ɲ
Sonorants	Lateral	l	l	l	l	l	l	l
	Trill	ʀ				ʀ	ʀ	
Affricates	Ejective	t͡ɬ’ t͡s’ t͡sʷ’	t͡ɬ’ t͡s’ t͡sʷ’	t͡s’	t͡ɬ’ t͡s’	t͡ɬ’ t͡s’ t͡sʷ’ t͡ʃ’	t͡ɬ’ t͡s’ t͡sʷ’	t͡ɬ’ t͡s’ t͡ʃ’
	Aspirated	t͡ɬʰ t͡sʰʷ t͡ʃʰ	t͡ɬʰ t͡sʰ t͡sʰʷ t͡ʃʰ	t͡ɬʰ t͡sʰ t͡sʰʷ t͡ʃʰ	t͡sʰʷ t͡ʃʰ	kx͡ʰ	t͡ɬʰ t͡sʰʷ t͡ʃʰ	t͡ɬʰ t͡sʰ t͡ʃʰ
	Heterorganic compounds	bj pj	p͡ts’				pj	
	Clusters		sk’ bl			bʀ	bʀ	

Appendix O2: Phonetic inventories (Tables 11a and 11b)

Table 11a. Phonetic Inventory in the initial word position: Group 2 (3;0–3;5 years) (Sekwêna variety)

	Manner	L26	L28	L32	EL3	EL6	EL11	EL28
Plosives	Ejective	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’
	Aspirated	tʰ kʰ	tʰ kʰ	tʰ kʰ	pʰ tʰ kʰ kʰʷ	pʰ tʰ kʰ	tʰ kʰ	pʰ tʰ kʰ
	Voiced	b d	b d	b d	b d	b d	b d	b d
	Fricatives	f s h	f s x xʷ	f s sʷ h	f s h x	s ʃ x	s ʃ h x	f s x
	Nasals	m nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ	m nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ɲ
	Lateral	l lʷ	l lʷ	l	l lʷ	l lʷ	l lʷ	l lʷ
	Glides	w	w	w	w	w	w	w
	Trill				ʀʷ	ʀ	rʷ	
Affricates	Ejective	t͡ɬ’	t͡ɬ’	t͡ɬ’	t͡ɬ’ t͡sʷ’	t͡ɬ’	t͡ɬ’ t͡sʷ’	t͡ɬ’ t͡sʷ’
	Aspirated	tɬʰ tɬʰʷ t͡sʰ t͡sʰʷ	tɬʰ tɬʰʷ t͡sʰ t͡sʰʷ	tɬʰ tɬʰʷ t͡sʰ t͡ʃʰ k͡xʰ	tɬʰ t͡sʰʷ	tɬʰ t͡sʰʷ k͡xʰ k͡xʰʷ	tɬʰ t͡sʰ t͡sʰʷ k͡xʰ k͡xʰʷ	tɬʰ t͡sʰ t͡sʰʷ k͡xʰ
	Voiced	d͡z	d͡z	d͡ʒ	d͡ʒ	d͡ʒ	d͡ʒ	d͡z
	Heterorganic compounds		fj		fj			fj
	Clusters	dr		skʰ dl	sp’ st’ sk’ skʰ dl	sp’ st’ sk’ skʰ	sp’ tr dr	sp’ st’ skʰ sf sxʷ dr

Table 11b. Phonetic inventory in the penultimate syllable: Group 2 (3;0–3;5 years) (Sekwêna variety)

	Manner	L26	L28	L32	EL3	EL6	EL11	EL28
Plosives	Ejective	p’ k’	p’ t’ k’	p’ t’ k’	p’ t’ k’ k^w’	p’ k’	p’ k’ k^w’	p’ t’ k’
	Aspirated	k^h	k^h		p^h k^h	p^h k^h	p^h k^h	p^h k^h
	Voiced	d	d	d	b	b d	b d	d
	Fricatives	f s ʃ h x x^w	f s s^w x x^w	f s ʃ x h	f s s^w h h^w x x^w	f s s^w ʃ h x x^w	f s s^w ʃ x x^w h h^w	f s s^w h x x^w
	Nasals	m n n^w ŋ $ŋ^w$ ɲ	m n ŋ $ŋ^w$ ɲ	m n ŋ $ŋ^w$ ɲ	m n ŋ ɲ	m n ŋ ɲ	m n ŋ ɲ	m n ŋ ɲ
	Lateral	l	l	l	l	l	l	l
	Glides			w				
	Trill	r	r	r	ʀ	r		ʀ
Affricates	Ejective	t͡ɬ’ t͡s’ t͡s^w’	t͡ɬ’ t͡s’ t͡s^w’	t͡ɬ’ t͡s’ t͡s^w’	t͡ɬ’ t͡s’ t͡s^w’	t͡ɬ’ t͡s’ t͡s^w’	t͡ɬ’ t͡s’ t͡s^w’	t͡ɬ’ t͡s’ t͡s^w’
	Aspirated	t͡ɬ^h t͡s^h t͡s^{hw} t͡ʃ^h	t͡s^h t͡s^{hw}	t͡ʃ^h	t͡ɬ^h t͡s^h t͡s^{hw}	t͡ɬ^h t͡s^h t͡s^{hw} t͡ʃ^h	t͡ɬ^h t͡s^h t͡ʃ^h k͡x^h	t͡ɬ^h t͡s^h t͡s^{hw} t͡ʃ^h
	Heterorganic compounds	pj	pt͡s’	pj	pj	pj	pj	pj
	Clusters		br	br	bl	bʀ		br

Appendix O3: Phonetic inventories (Tables 12a and 12b)

Table 12a. Phonetic Inventory in the initial word position: Group 3 (3;6–3;11 years) (Sekwêna variety)

	Manner	L24	L27	L34	EL8	EL10	EL19	EL21	EL26	EL31
Plosives	Ejective	pʼ tʼ kʼ kʷʼ	pʼ tʼ kʼ kʷʼ	pʼ tʼ kʼ kʷʼ	pʼ tʼ kʼ kʷʼ	pʼ tʼ tʷʼ kʼ kʷʼ	pʼ tʼ kʼ kʷʼ	pʼ tʼ kʼ kʷʼ	pʼ tʼ kʼ kʷʼ	pʼ tʼ kʼ kʷʼ
	Aspirated	pʰ tʰ kʰ	pʰ tʰ kʰ	pʰ tʰ tʰʷ kʰ	pʰ tʰ kʰ	tʰ kʰ	pʰ tʰ kʰ	pʰ tʰ kʰ	pʰ tʰ kʰ	pʰ tʰ kʰ
	Voiced	b d	b d	d	b d	b d	b d	b d	b d	b d
	Fricatives	f s sʷ h	f s ʃ x h	f ʃ x	f s ʃ x h	f h	f s h	f h	f s ʃʷ h	f s x
	Nasals	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ɲ	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ	m n ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ
	Lateral	l lʷ	l lʷ	l lʷ	l lʷ	l lʷ	l lʷ	l lʷ	l lʷ	l lʷ
	Glides	w	w	j w	w	w	w	w	w	w
	Trill	r			ʀʷ	rʷ ʀʷ				ʀ
Affricates	Ejective	t͡ɬʼ	t͡ɬʼ t͡sʼ		t͡ɬʼ	t͡ɬʼ	t͡ɬʼ t͡sʷʼ	t͡ɬʼ t͡sʷʼ	t͡ɬʼ t͡sʷʼ	t͡ɬʼ t͡sʼ
	Aspirated	tɬʰ t͡sʰ t͡sʰʷ	tɬʰ t͡sʰ		tɬʰ t͡sʰ t͡sʰʷ k͡xʰ k͡xʰʷ	tɬʰ t͡sʰ k͡xʰ k͡xʰʷ	tɬʰ t͡sʰ t͡sʰʷ	tɬʰ tɬʰʷ t͡sʰ t͡sʰʷ	tɬʰ t͡sʰ t͡sʰʷ k͡xʰ	tɬʰ tɬʰʷ t͡sʰ t͡sʰʷ k͡xʰ
	Voiced	ʤ	ʤ	ʤ		ʤ	ʤ	ʤ	ʤ	ʤ
	Heterorganic compounds				pʰj	bj fj	fj	fj		fj
	Clusters		dl		skʰ	dr	sp’ st’ skʰ sf dr kʰʀ	sp’ st’ sk’ skʰ sf sxʷ br dr kʰr	sp’ st’ sk’ skʰ sf dʀ	sk’ sxʷ

Table 12b. Phonetic inventory in the penultimate syllable: Group 3 (3;6–3;11 years) (Sekwêna variety)

	Manner	L24	L27	L34	EL8	EL10	EL19	EL21	EL26	EL31
Plosives	Ejective	p’ t’ k’	p’ t’ k’ k^{w}’	p’ t’ k’	p’ t’ k’ k^{w}’	p’ t’ t^{w}’ k’ k^{w}’	p’ k’	p’ k’	p’ k’	p’ k’
	Aspirated	p^{h} k^{h}	p^{h} k^{h}	k^{h}	p^{h} k^{h}	k^{h}	p^{h} k^{h}	p^{h}	p^{h}	
	Voiced	d	b d	d	d	b d	d	d	d	d
	Fricatives	f h s ʃ x^{w}	f s s^{w} x	f h x x^{w} ʃ ʃ^{w}	f s s^{w} ʃ x x^{w}	f h x x^{w} v	f s s^{w} x x^{w} ʃ	f s s^{w} h x x^{w}	f s ʃ h x x^{w}	f x x^{w} s h
	Nasals	m n ŋ ŋ^{w} ɲ	m n ŋ ɲ	m n ŋ ɲ ɲ^{w}	m n ŋ ɲ	m n ŋ ɲ	m n ŋ ɲ	m n ŋ ɲ	m n ŋ ɲ	m n ŋ ɲ
Sonorants	Lateral	l	l	l l^{w}	l	l	l	l	l	l
	Trill	r	r		r	r	ʀ		ʀ	ʀ
Affricates	Ejective	t͡ɬ’ t͡s’ t͡s^{w}’	t͡ɬ’ t͡s’	t͡s’ t͡s^{w}’	t͡ɬ’ t͡s’ t͡s^{w}’	t͡ɬ’ t͡s’ t͡s^{w}’	t͡ɬ’ t͡s’ t͡s^{w}’	t͡ɬ’ t͡ɬ^{w}’ t͡s’ t͡s^{w}’	t͡ɬ’ t͡s’ t͡s^{w}’	t͡ɬ’ t͡s’ t͡s^{w}’
	Aspirated	t͡ɬ^{h} t͡s^{h} t͡s^{hw} t͡ʃ^{h}	t͡ɬ^{h} t͡s^{h} t͡ʃ^{h}		t͡ɬ^{h} t͡s^{h} t͡s^{hw} t͡ʃ^{h} k͡x^{h}	t͡ɬ^{h} t͡ʃ^{h}	t͡ɬ^{h} t͡s^{h} t͡ʃ^{h}	t͡ɬ^{h} t͡s^{hw} t͡ʃ^{h} k͡x^{h}	t͡ɬ^{h} t͡s^{hw} t͡ʃ^{h} k͡x^{h}	t͡ɬ^{h} t͡s^{hw} t͡ʃ^{h}
	Heterorganic compounds	pj	pj	pj	ps	pj	pj	pj	pj	pj
	Clusters			bl	sk’	br	sk’ br	sk’	sk’ br	br

Appendix O4: Phonetic inventories (Tables 13a and 13b)

Table 13a. Phonetic Inventory in the initial word position: Group 4 (4;0–4;5 years) (Sekwêna variety)

	Manner	L1	L2	L4	L20	L21	L35	EL9	EL13	EL16	EL17-1	EL17-2	EL29	EL30	EL20
Plosives	Ejective	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’
	Aspirated	pʰ tʰ kʰ	tʰ kʰ	tʰ kʰ	pʰ tʰ kʰ	tʰ kʰ	tʰ kʰ	pʰ tʰ kʰ	kʰ	pʰ tʰ kʰ	tʰ kʰ	pʰ tʰ kʰ	tʰ kʰ	tʰ kʰ	pʰ tʰ kʰ
	Voiced	b d	d	b d	b d	b d	b d	b d	b d	b d	b d	b d	b d	b d	b d
	Fricatives	f s ʃ h	f s ʃ h	f s h	f s sʷ h	f s ʃ h	f s h	f s ʃ h x	f s h	f s h	f s ʃ h	f s h	f s ʃ x	f x	f s ʃ h
	Nasals	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ̥	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ̥	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ
	Lateral	l lʷ	l lʷ	l lʷ	l lʷ	l lʷ	l lʷ	l lʷ	l lʷ	l lʷ	l lʷ	l lʷ	l	l lʷ	l lʷ
	Glides	w	w	w	w	w	w	w	w	w	w	w j		w	w
	Trill						ʀ	ʀʷ	r						
Affricates	Ejective	t͡ɬ’ t͡sʷ’	t͡ɬ’ t͡sʷ'	t͡ɬ’	t͡ɬ’	t͡ɬ’	t͡ɬ’	t͡ɬ’ t͡sʷ’	t͡ɬ’ t͡sʷ’	t͡ɬ’ t͡s’ t͡sʷ’	t͡ɬ’ t͡s’ t͡sʷ’	t͡ɬ’ t͡s’ t͡sʷ’	t͡ɬ’	t͡ɬ’ t͡sʷ’	t͡ɬ’ t͡sʷ’
	Aspirated	t͡ɬʰ t͡sʰ t͡sʰʷ	t͡ɬʰ t͡ɬʰʷ t͡sʰ t͡sʰʷ k͡xʰ	t͡ɬʰ t͡sʰ t͡sʰʷ k͡xʰ	t͡ɬʰ t͡ɬʰʷ t͡sʰ t͡sʰʷ	t͡ɬʰ t͡sʰ t͡sʰʷ	t͡ɬʰ t͡sʰ t͡sʰʷ	t͡ɬʰ t͡ɬʰʷ t͡sʰ t͡sʰʷ k͡xʰ k͡xʰʷ	t͡ɬʰ t͡sʰ t͡sʰʷ	t͡ɬʰ t͡ɬʰʷ t͡sʰ t͡sʰʷ k͡xʰ k͡xʰʷ	t͡ɬʰ t͡ɬʰʷ t͡sʰ t͡sʰʷ k͡xʰ k͡xʰʷ	t͡ɬʰ t͡sʰ t͡sʰʷ	t͡ɬʰ t͡sʰ t͡sʰʷ k͡xʰ	t͡ɬʰ t͡sʰ t͡sʰʷ k͡xʰ	t͡ɬʰ t͡sʰ t͡sʰʷ
	Voiced	ʤ	ʤ	ʤ	ʤ	ʤ	ʤ	ʤ	ʤ	ʤ	ʤ	ʤ	ʤ	ʤ	ʤ
	Heterorganic compounds			fj					fj	fsj		fj		fj	
	Clusters	sp’ st’ sk’ skʰ dr	sp’ st’ sk’ skʰ pʀ dr	sp’ st’ sk’ skʰ dr	sp’ st’ sk’ skʰ sf dr	sp’ st’ skʰ sf dr	sp’ st’ sk’ skʰ	dr	st’ skʰ gr	sp’ st’ skʰ dr	sp’ st’ sk’ skʰ sf sxʷ dr	sp’ st’ sk’ skʰ sf dr	sp’ st’ sk’ skʰ sf dr	sp’ st’ skʰ sf sxʷ dr	sp’ st’ skʰ sf sxʷ kʰr dr bʀ

Table 13b. Phonetic inventory in the penultimate syllable: Group 4 (4;0–4;5 years) (Sekwêna variety)

	Manner	L1	L2	L4	L20	L21	L35	EL9	EL13	EL16	EL17-1	EL17-2	EL29	EL30	EL20
Plosives	Ejective	p’ k’	p’ k’	p’ k’	p’ t’ k’	p’ k’	p’ k’	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’	p’ t’ k’	p’ k’	p’ k’	p’ k’	p’ k’	p’ k’
	Aspirated	pʰ kʰ	pʰ kʰ	pʰ kʰ	pʰ kʰ	pʰ kʰ	kʰ	pʰ kʰ	pʰ kʰ	pʰ kʰ	pʰ kʰ	pʰ kʰ	pʰ kʰ	pʰ kʰ	pʰ kʰ
	Voiced	d	b d	d	b d	b d	d	d	d	b d	d	d	d	d	d
	Fricatives	f s sʷ ʃ h hʷ x xʷ	f s ʃ h hʷ x xʷ	f s h x xʷ	f s sʷ h x xʷ	f s sʷ ʃʷ h x xʷ	f s sʷ x xʷ h	f s h x xʷ	f s h x xʷ	f s h hʷ x xʷ	f s sʷ ʃʷ h x xʷ	f s sʷ x xʷ h	f s h x xʷ	f s h x xʷ	f s sʷ x xʷ
	Nasals	m n ŋ ɲ	m n ŋ ŋʷ ɲ	m n ŋ ŋʷ ɲ	m n ŋ ŋʷ ɲ	m n ŋ ŋʷ ɲ	m n ŋ ŋʷ ɲ	m n ŋ ɲ ɲʷ	m n ŋ ɲ	m n ŋ ɲ	m n ŋ ɲ	m n ŋ ɲ	m n ŋ ɲ	m n ŋ ɲ	m n ŋ ŋʷ ɲ
	Lateral	l	l	l	l	l	l	l	l	l	l	l	l	l	l
	Glides	w													
	Trill	ʀ		r	ʀ	r	r ʀ		r ʀ	r ʀ	ʀ	r ʀ	ʀ	ʀ	r
Affricates	Ejective	t͡ɬ’ t͡s’ t͡sʷ’	t͡ɬ’ t͡s’ t͡sʷ’	t͡ɬ’ t͡s’ t͡sʷ’	t͡ɬ’ t͡s’ t͡sʷ’	t͡ɬ’ t͡s’ t͡sʷ’	t͡ɬ’ t͡s’ t͡sʷ’	t͡ɬ’ t͡s’ t͡sʷ’	t͡ɬ’ t͡s’ t͡sʷ’	t͡ɬ’ t͡s’ t͡sʷ’	t͡ɬ’ t͡s’ t͡sʷ’	t͡ɬ’ t͡s’ t͡sʷ’	t͡ɬ’ t͡s’ t͡sʷ’	t͡ɬ’ t͡s’ t͡sʷ’	t͡ɬ’ t͡s’ t͡sʷ’
	Aspirated	t͡ɬʰ t͡ʃʰ	t͡ɬʰ t͡sʰ t͡ʃʰ	t͡ɬʰ tɬʰʷ t͡ʃʰ	t͡ɬʰ t͡sʰ t͡ʃʰ	t͡ɬʰ t͡sʰ t͡ʃʰ	t͡ɬʰ t͡sʰ t͡ʃʰ	t͡ɬʰ t͡ʃʰ k͡xʰ	t͡ɬʰ t͡sʰʷ t͡ʃʰ	t͡ɬʰ t͡sʰ t͡sʰʷ t͡ʃʰ	t͡ɬʰ t͡sʰ t͡ʃʰ k͡xʰ	t͡ɬʰ t͡sʰ t͡sʰʷ t͡ʃʰ	t͡ɬʰ t͡sʰʷ t͡ʃʰ	t͡ɬʰ t͡sʰ t͡sʰʷ t͡ʃʰ	t͡ɬʰ t͡sʰ t͡ʃʰ
	Voiced							d͡ʒ							
	Heterorganic compounds	pj	pj	pj	pj	pj	pj		pj	pt͡sˈ	pj	pt͡sˈ	pj	pt͡sˈ	pj
	Clusters	sk’ bl	bl	sk’ br	sk’ br	sk’ br	sk’ br		sk’ br	sk’ br	sk’ br	sk’ br	sk’ br	sk’ bʀ	sk’ br

Appendix O5: Phonetic inventories (Tables 14a and 14b)

Table 14a. Phonetic Inventory in the initial word position: Group 5 (4;6–4;11 years) (Sekwêna variety)

	Manner	L3	L5	L13	L18	L22	L29	EL14	EL15	EL22	EL24
Plosives	Ejective	p’ t’ k’ k^{w}’	p’ t’ k’ k^{w}’	p’ t’ k’ k^{w}’	p’ t’ k’ k^{w}’	p’ t’ k’ k^{w}’	p’ t’ k’ k^{w}’	p’ t’ k’ k^{w}’	p’ t’ k’ k^{w}’	p’ t’ k’ k^{w}’	p’ t’ k’ k^{w}’
	Aspirated	t^{h} k^{h}	t^{h} k^{h}	p^{h} t^{h} k^{h}	p^{h} t^{h} k^{h}	t^{h} k^{h}	t^{h} k^{h}	t^{h} k^{h} k^{hw}	p^{h} t^{h} k^{h}	t^{h} k^{h}	t^{h} k^{h}
	Voiced	b d	b d	b d	b d	b d	b d	b d	b d	b d	b d
	Fricatives	f s h	f s h	f s h	f s h	f s h x^{w}	f s h	f s h	f s h	f s h	f ʃ h
	Nasals	m n n^{w} ŋ ŋ^{w} ɲ	m n n^{w} ŋ ŋ^{w} ɲ	m n n^{w} ŋ ŋ^{w} ɲ	m n n^{w} ŋ ŋ^{w} ɲ	m n n^{w} ŋ ŋ^{w} ɲ	m n^{w} ŋ ŋ^{w} ɲ	m n n^{w} ŋ ŋ^{w} ɲ	m n n^{w} ŋ ŋ^{w} ɲ	m n n^{w} ŋ ŋ^{w} ɲ	m n n^{w} ŋ ŋ^{w} ɲ
	Lateral	l l^{w}	l l^{w}	l l^{w}	l l^{w}	l l^{w}	l l^{w}	l l^{w}	l l^{w}	l l^{w}	l l^{w}
	Glides	w	w	w	w	w	w	w	w	w	w
	Trill										
Affricates	Ejective	t͡ɬ’	t͡ɬ’	t͡ɬ’	t͡ɬ’	t͡ɬ’	t͡ɬ’	t͡ɬ’ t͡s’ t͡s^{w}’	t͡ɬ’ t͡s’	t͡ɬ’ t͡s^{w}’	t͡ɬ’ t͡s^{w}’
	Aspirated	t͡ɬ^{h} t͡s^{h} t͡s^{hw}	t͡ɬ^{h} t͡s^{h} t͡s^{hw}	t͡ɬ^{h} t͡s^{h} t͡s^{hw}	t͡ɬ^{h} t͡s^{h} t͡s^{hw} k͡x^{h}	t͡ɬ^{h} t͡s^{h} t͡s^{hw} k͡x^{h}	t͡ɬ^{h} t͡s^{h} t͡s^{hw} t͡ʃ^{h} k͡x^{h}	t͡ɬ^{h} t͡s^{h} t͡s^{hw} k͡x^{h}	t͡ɬ^{h} t͡s^{h} t͡s^{hw} k͡x^{h} k͡x^{hw}	t͡ɬ^{h} t͡s^{h} t͡s^{hw} k͡x^{h}	t͡ɬ^{h} t͡s^{h} t͡s^{hw} k͡x^{h}
	Voiced	ʤ	ʤ		ʤ	ʤ	ʤ	ʤ	ʤ	ʤ	ʤ
	Heterorganic compounds	fj			fj			fj	fj	fj	
	Clusters	dr	sp’ st’ sk’ sk^{h} dʀ	sp’ st’ sk’ sk^{h} sf dr	st’ sk’ sk^{h} sf dʀ	st’ dr	sp’ st’ sk’ sk^{h} sf dʀ	st’ sk^{h} sf k^{h}r	sp’ st’ sk’ sk^{h} sf sx^{w} k^{h}r dr	sp’ st’ sk^{h} sf sx^{w} dr	sp’ st’ sk^{h} sf sx^{w} k^{h}r dr

Table 14b. Phonetic inventory in the penultimate syllable: Group 5 (4;6–4;11 years) (Sekwêna variety)

	Manner	L3	L5	L13	L18	L22	L29	EL14	EL15	EL22	EL24
Plosives	Ejective	p’ t’ k’	p’ k’	p’ k’	p’ k’	p’ k’	p’ k’	p’ t’ k’	p’ k’	p’ k’	p’ k’
	Aspirated	p^h k^h	p^h k^h	k^h	p^h k^h	p^h k^h	p^h k^h	p^h k^h	p^h k^h	p^h k^h	p^h k^h
	Voiced	d	d	b d	b d	d	d	d	d	d	b d
	Fricatives	f v s ʃ h x^w	f s s^w h h^w x	f ʃ h h^w	f s h x x^w	f s ʃ h x x^w	f s h x x^w	f s h h^w x^w	f s s^w h x x^w	f s s^w ʃ h x x^w	f s h x x^w
	Nasals	m n ŋ $ŋ^w$ ɲ	m n ŋ $ŋ^w$ ɲ	m n ŋ $ŋ^w$ ɲ	m n ŋ $ŋ^w$ ɲ	m n ŋ $ŋ^w$ ɲ	m n ŋ $ŋ^w$ ɲ	m n ŋ ɲ	m n ŋ ɲ	m n ŋ ɲ	m n ŋ ɲ
Sonorants	Lateral	l	l	l	l	l	l	l	l	l	l
	Trill	ʀ	r ʀ	r ʀ	ʀ	ɾ	ʀ		ʀ	ɾ	
Affricates	Ejective	t͡ɬ’ t͡s’ t͡s^w’	t͡ɬ’ t͡s’ t͡s^w’	t͡ɬ’ t͡s’ t͡s^w’	t͡ɬ’ t͡s’ t͡s^w’	t͡ɬ’ t͡s’ t͡s^w’	t͡ɬ’ t͡s’ t͡s^w’	t͡ɬ’ t͡s’ t͡s^w’	t͡ɬ’ t͡s’ t͡s^w’	t͡ɬ’ t͡s’ t͡s^w’	t͡ɬ’ t͡s’ t͡s^w’
	Aspirated	t͡$ɬ^h$ t͡s^h t͡s^{hw} t͡$ʃ^h$	t͡$ɬ^h$ t͡s^{hw} t͡$ʃ^h$	t͡$ɬ^h$ t͡s^{hw} t͡$ʃ^h$	t͡$ɬ^h$ t͡s^h t͡s^{hw} t͡$ʃ^h$	t͡$ɬ^h$ t͡s^h t͡s^{hw} t͡$ʃ^h$	t͡$ɬ^h$ t͡s^{hw} t͡$ʃ^h$	t͡$ɬ^h$ t͡s^h t͡s^{hw} t͡$ʃ^h$ k͡x^h	t͡$ɬ^h$ t͡s^h t͡s^{hw} t͡$ʃ^h$ k͡x^h	t͡$ɬ^h$ t͡s^h t͡$ʃ^h$	t͡$ɬ^h$ t͡s^{hw} t͡$ʃ^h$
	Heterorganic compounds	pj	pt͡s’	pj	pt͡ʃ	pj	pj	pj, bj	pj, bj	pj, fj	pj
	Clusters	bʀ	sk^h br	sk’ br	sk’ bʀ	br	sk’ br	sk’ br	sk’ bʀ	sk’l br	sk’ br

Appendix O6: Phonetic inventories (Tables 15a and 15b)

Table 15a. Phonetic Inventory in the initial word position: Group 6 (5;0–5;5 years) (Sekwêna variety)

	Manner	L9	L11	L15	L16	L23	L30	EL18	EL23
Plosives	Ejective	p’ t’ k’ k^{w}’	p’ t’ k’ k^{w}’	p’ t’ k’ k^{w}’	p’ t’ k’ k^{w}’	p’ t’ k’ k^{w}’	p’ t’ k’ k^{w}’	p’ t’ k’ k^{w}’	p’ t’ k’ k^{w}’
	Aspirated	t^{h} k^{h}	p^{h} t^{h} k^{h}	t^{h} k^{h}	p^{h} t^{h} k^{h}	p^{h} t^{h} t^{hw} k^{h}	t^{h} k^{h}	t^{h} k^{h}	p^{h} t^{h} k^{h}
	Voiced	b d	b d	b d	b d	b d	b d	b d	b d
	Fricatives	f s h	f s	f s h	f s h	f s h	f s h	f s h	f h
	Nasals	m n n^{w} ŋ $ŋ^{w}$ ɲ	m ŋ $ŋ^{w}$ ɲ	m n n^{w} ŋ $ŋ^{w}$ ɲ	m n n^{w} ŋ $ŋ^{w}$ ɲ	m n n^{w} ŋ ɲ	m n n^{w} ŋ $ŋ^{w}$ ɲ	m n n^{w} ŋ $ŋ^{w}$ ɲ	m n n^{w} ŋ $ŋ^{w}$ ɲ
	Lateral	l l^{w}	l	l l^{w}	l l^{w}	l l^{w}	l l^{w}	l l^{w}	l l^{w}
	Glides	w	w	w	w	w	w	w	w
	Trill								
Affricates	Ejective	t͡ɬ’	t͡ɬ’	t͡ɬ’	t͡ɬ’	t͡s’	t͡ɬ’	t͡ɬ’ t͡s^{w}’	t͡ɬ’ t͡s^{w}’
	Aspirated	t͡ɬ^{h} t͡s^{h} t͡s^{hw}	t͡ɬ^{h} t͡s^{h} t͡s^{hw} t͡ʃ^{h}	t͡ɬ^{h} t͡s^{h} t͡s^{hw}	t͡ɬ^{h} t͡s^{h} t͡s^{hw}	t͡s^{h} t͡s^{hw}	t͡ɬ^{h} t͡s^{h} t͡s^{hw}	t͡ɬ^{h} t͡s^{h} t͡s^{hw} k͡x^{h}	t͡ɬ^{h} t͡s^{h} t͡s^{hw} k͡x^{h}
	Voiced	ʤ	ʤ	ʤ	ʤ	ʤ	ʤ	ʤ	ʤ
	Heterorganic compounds	fj		fj	fj	fj		fj	fj
	Clusters	sp’ st’ sk’ sk^{h} sf k^{h}r dr	sp’ st’ sk’ sk^{h} k^{h}r dr	sp’ st’ sk^{h} sf dʀ	sp’ sf k^{h}ʀ		sp’ st’ sk’ sk^{h} sf k^{h}ʀ dʀ	sp’ st’ sk^{h} sf dr	sp’ st’ sk^{h} sf sx^{w} k^{h}r dr

Table 15b. Phonetic inventory in the penultimate syllable: Group 6 (5;0–5;5 years) (Sekwêna variety)

	Manner	L9	L11	L15	L16	L23	L30	EL18	EL23
Plosives	Ejective	p’ k’	p’ t’ k’	p’ k’	p’ k’	p’ t’ k’	p’ k’	p’ k’	p’ k’
	Aspirated	pʰ kʰ	pʰ kʰ	pʰ kʰ	pʰ	pʰ tʰ kʰ	pʰ kʰ	pʰ kʰ	pʰ kʰ
	Voiced	d	d g	b d	b d	b d	b d	d	d
	Fricatives	f s sʷ h xʷ	f s ʃ h x xʷ	f s sʷ ʃ h x xʷ	f s sʷ ʃ h x xʷ	f s h x xʷ	f s h x xʷ	f s x xʷ	f s sʷ ʃ h x xʷ
	Nasals	m n ŋ ŋʷ ɲ	m n ŋ ŋʷ ɲ	m n ŋ ŋʷ ɲ ɲʷ	m n ŋ ŋʷ ɲ	m n ŋ ŋʷ ɲ	m n ŋ ŋʷ ɲ	m n ŋ ɲ	m n ŋ ɲ
	Lateral	l	l	l	l	l	l	l	l
	Glides		j						
	Trill	r ʀ	ʀ	ʀ	ʀ		r ʀ	r	r
Affricates	Ejective	t͡ɬ’ t͡s’ t͡sʷ’	t͡ɬ’ t͡s’ t͡sʷ’	t͡ɬ’ t͡s’ t͡sʷ’	t͡ɬ’ t͡s’ t͡sʷ’	t͡s’ t͡sʷ’	t͡ɬ’ t͡s’ t͡sʷ’	t͡ɬ’ t͡s’ t͡sʷ’	t͡ɬ’ t͡s’ t͡sʷ’
	Aspirated	t͡ɬʰ t͡ʃʰ	t͡ɬʰ t͡sʰ t͡ʃʰ	t͡ɬʰ t͡sʰ t͡sʰʷ t͡ʃʰ	t͡ɬʰ t͡ʃʰ k͡xʰ	t͡ɬʰ t͡ʃʰ	t͡ɬʰ t͡sʰʷ t͡ʃʰ	t͡ɬʰ t͡sʰ t͡ʃʰ	t͡ɬʰ t͡sʰʷ t͡ʃʰ
	Heterorganic compounds		pj	pj	pj	pj	pj	pj	p͡ts’
	Clusters	sk’ br	sk’ st’ pl bl	sk’ bʀ	sk’ bl		sk’ bʀ	br	sk’ br

Appendix O7: Phonetic inventories (Tables 16a and 16b)

Table 16a. Phonetic Inventory in the initial word position: Group 7 (5;6–5;11 years) (Sekwêna variety)

	Manner	L6	L17	L19	L36	EL12
Plosives	Ejective	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’
	Aspirated	pʰ tʰ kʰ	pʰ tʰ kʰ	pʰ tʰ kʰ	tʰ kʰ	pʰ tʰ kʰ
	Voiced	b d	b d	b d	b d	b d
	Fricatives	f v s h	f s ʃʷ h	f s h	f s h	f v s h
	Nasals	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ
	Lateral	l lʷ	l lʷ	l lʷ	l lʷ	l lʷ
	Glides	w	w	w	w	w
	Trill					r
Affricates	Ejective	t͡ɬ’	t͡ɬ’	t͡ɬ’	t͡ɬ’	t͡ɬ’ t͡s’ t͡sʷ’
	Aspirated	t͡ɬʰ t͡sʰ t͡shw k͡xʰ	t͡ɬʰ t͡sʰ t͡shw	t͡ɬʰ t͡sʰ t͡shw	t͡ɬʰ t͡sʰ t͡shw	t͡ɬʰ t͡sʰ t͡shw k͡xʰ
	Voiced	ʤ	ʤ	ʤ	ʤ	ʤ
	Heterorganic compounds	fj		fj	fsj	fj
	Clusters	st’ skʰ sf sk͡xʰ kʰʀ dʀ	sp’ st’ skʰ sf kʰr dr	sp’ st’ skʰ sf kʰr dr	sp’ st’ skʰ dr	bl dr

Table 16b. Phonetic inventory in the penultimate syllable: Group 7 (5;6–5;11 years) (Sekwêna variety)

	Manner	L6	L17	L19	L36	EL12
Plosives	Ejective	p’ k’	p’ k’	p’ k’	p’ tʷ’ k’	p’ t’ k’
	Aspirated	pʰ kʰ kʰʷ	pʰ kʰ	pʰ kʰ	kʰ	pʰ kʰ kʰʷ
	Voiced	d	b d	d	d	d
	Fricatives	f s sʷ ʃ h x xʷ	f s sʷ h hʷ x	f s sʷ h xʷ	f s sʷ h xʷ	f h hʷ x
	Nasals	m n nʷ ŋ ŋʷ ɲ	m n ŋ ŋʷ ɲ	m n ŋ ŋʷ ɲ	m n ŋ ŋʷ ɲ	m n ŋ ŋʷ ɲ
	Lateral	l	l	l	l	l
	Trill	r ʀ	r	r	r	r
Affricates	Ejective	t͡ɬ’ t͡s’ t͡sʷ’	t͡ɬ’ t͡s’ t͡sʷ’	t͡ɬ’ t͡s’ t͡sʷ’	t͡ɬ’ t͡s’ t͡sʷ’	t͡ɬ’ t͡s’ t͡sʷ’ t͡ʃʷ’
	Aspirated	t͡ɬʰ t͡sʰ t͡sʰʷ t͡ʃʰ	t͡ɬʰ t͡sʰ t͡sʰʷ t͡ʃʰ	t͡ɬʰ t͡sʰ t͡sʰʷ t͡ʃʰ	t͡ɬʰ t͡sʰʷ t͡ʃʰ	t͡ɬʰ t͡sʰ t͡sʰʷ t͡ʃʰ
	Heterorganic compounds	pj	pj	pj	pj	pj
	Clusters	sk’ br	sk’ br	sk’ br	sk’ bʀ	br

Appendix O8: Phonetic inventories (Tables 17a and 17b)

Table 17a. Phonetic Inventory in the initial word position: Group 8 (6;0–6;5 years) (Sekwêna variety)

Manner		L7	L8	L10	L12	L14
Plosives	Ejective	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’	p’ t’ k’ kʷ’
	Aspirated	tʰ kʰ	tʰ kʰ	tʰ kʰ	tʰ kʰ	tʰ kʰ
	Voiced	b d	b d	b d	b d	b d
	Fricatives	f s h	f s h	f s h	f s h	f s x
	Nasals	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ	m n nʷ ŋ ŋʷ ɲ
	Lateral	l lʷ	l lʷ	l lʷ	l lʷ	l lʷ
	Glides	w	w	w	w	w j
	Trill				r	r
Affricates	Ejective	t͡ɬ’	t͡ɬ’	t͡ɬ’	t͡ɬ’	t͡ɬ’
	Aspirated	t͡ɬʰ t͡sʰ t͡sʰʷ	t͡ɬʰ t͡sʰ t͡sʰʷ t͡ʃʰ	t͡ɬʰ t͡sʰ t͡sʰʷ	t͡ɬʰ t͡sʰ t͡sʰʷ	t͡ɬʰ t͡sʰ t͡sʰʷ k͡xʰ
	Voiced	ʤ	ʤ	ʤ	ʤ	ʤ
	Heterorganic compounds	fj				fj
	Clusters	sp’ spʰ st’ sk’ skʷ’ sf pr dʀ	sp’ st’ skʰ kʰr dr	sp’ st’ skʰ sf kʰr dʀ	sp’ st’ st͡ɬʰ sk’ skʰ	sp’ st’ sk’ skʰ sf kʰr

Table 17b. Phonetic inventory in the penultimate syllable: Group 8 (6;0–6;5 years) (Sekwêna variety)

Manner		L7	L8	L10	L12	L14
Plosives	Ejective	p’ k’	p’ t’ k’	p’ k’	p’ k’	p’ t’ k’
	Aspirated	p^h k^h	p^h k^h	p^h k^h	p^h k^h	p^h k^h
	Voiced	d	b d	d	d	d
	Fricatives	f s s^w ʃ h x^w	f v s s^w ʃ h x^w	f s s^w h x^w	f s s^w ʃ h x x^w	f s h h^w
	Nasals	m n ŋ $ŋ^w$ ɲ	m n ŋ $ŋ^w$ ɲ	m n ŋ $ŋ^w$ ɲ	m n ŋ $ŋ^w$ ɲ	m n ŋ $ŋ^w$ ɲ
	Lateral	l ɭ	l ɭ	l	l	l ɭ
	Trill	r ʀ	r ʀ	r	r ʀ	r
Affricates	Ejective	$\widehat{tɬ}$’ $\widehat{ts}$’ $\widehat{ts^w}$’	$\widehat{tɬ}$’ $\widehat{ts}$’ $\widehat{ts^w}$’	$\widehat{tɬ}$’ $\widehat{ts}$’ $\widehat{ts^w}$’	$\widehat{tɬ}$’ $\widehat{ts}$’ $\widehat{ts^w}$’	$\widehat{tɬ}$’ $\widehat{ts}$’ $\widehat{ts^w}$’
	Aspirated	$\widehat{tɬ^h}$ $\widehat{ts^{hw}}$	$\widehat{tɬ^h}$ $\widehat{ts^{hw}}$ $\widehat{tʃ^h}$	$\widehat{tɬ^h}$ $\widehat{ts^{hw}}$ $\widehat{tʃ^h}$	$\widehat{tɬ^h}$ $\widehat{ts^{hw}}$ $\widehat{tʃ^h}$ $\widehat{kx^h}$	$\widehat{tɬ^h}$ $\widehat{ts^{hw}}$ $\widehat{tʃ^h}$
	Heterorganic compounds	pj	pj	pj	pj	pj
	Clusters	bʀ	sk’ sk^h bl	sk’ bʀ	sk’ bʀ	sk’ br

Appendix P: Accuracy scores for individual participants – Sekwêna variety

The table below provides accuracy scores obtained by participants in Group 1. These accuracy scores include the percentage consonant correct (PCC), percentage vowel correct (PVC) and the percentage phoneme correct (PPC).

Accuracy scores (PCC, PVC and PPC) obtained by Group 1 (2;6–2;11 years)

	L25	L31	L33	L37	EL2	EL25	EL27	Mean
PCC (%)	91	89	66	83	83	92	86	84
PVC (%)	96	96	88	95	94	97	95	94
PPC (%)	94	92	77	90	87	95	90	89

Group 1 obtained a high PCC score (84%), which suggests that a large number of Setswana consonants are produced accurately as early 2;6–2;11 years. This was seen as six of the seven participants in this age group had a PCC score higher than 80%. An even higher PVC score was noted for this age group, indicating a high level of accuracy for vowel production at an early age. Such findings have also been reported for other languages.

Group 2 (3;0–3;5 years)

Accuracy scores (PCC, PVC and PPC) obtained by Group 2 (3;0–3;5 years)

	L26	L28	L32	EL3	EL6	EL11	EL28	Mean
PCC (%)	93	88	87	91	93	99	96	92
PVC (%)	93	92	93	99	100	100	100	97
PPC (%)	92	89	88	95	96	99	98	94

Children aged 3;0–3;5 years also obtained high accuracy scores. These scores are slightly higher than those obtained by the youngest age group (2;6–2;11 years) indicative of increasing accuracy in speech production as children get older.

Group 3 (3;6–3;11 years)

Accuracy scores (PCC, PVC and PPC) obtained by Group 3 (3;6–3;11 years)

	L24	L27	L34	EL8	EL10	EL19	EL21	EL26	EL31	Mean
PCC (%)	96	75	74	99	78	95	96	96	88	89
PVC (%)	97	91	89	97	95	99	100	100	93	96
PPC (%)	97	84	81	98	88	96	98	98	90	92

A large number of children in Group 3 obtained a high PCC score, but a slightly lower score is seen for the group's average score in comparison to that obtained by Group 2 (3;0–3;5 years). The lower PCC score for Group 3 was likely influenced by three participants (L27, L34 & EL10), who obtained PCC scores of less than 80%. All three participants are multilingual, and one participant (EL10) presented with a phonological delay. Additionally, children aged 3;6–3;11 years obtained a high PVC score (96%), as can be expected since vowel acquisition has been reported to occur very early.

Group 4 (4;0–4;5 years)

Accuracy scores (PCC, PVC and PPC) obtained by Group 4 (4;0–4;5 years)

	L1	L2	L4	L20	L21	L35	EL9	EL13	EL16	EL17-1	EL17-2	EL29	EL30	EL20	Mean
PCC (%)	93	94	98	97	99	98	90	97	95	98	99	99	95	98	96
PVC (%)	100	98	98	99	98	98	97	99	100	100	100	100	99	99	99
PPC (%)	96	95	98	98	98	99	93	98	97	99	99	99	97	99	98

Group 4 obtained high PCC scores, with accuracy of speech productions approximating adult productions. Children in this age group had PCC and PVC scores that are much higher than those

reported for the younger age groups (Groups 1–3). All participants aged 4;0–4;5 years obtained a PCC score of 90% and higher, while PVC scores were higher than 95%.

Group 5 (4;6–4;11 years)

Accuracy scores (PCC, PVC and PPC) obtained by Group 5 (4;6–4;11 years)

	L3	L5	L13	L18	L22	L29	EL14	EL15	EL22	EL24	Mean
PCC (%)	92	97	96	96	94	97	98	96	99	97	96
PVC (%)	96	98	97	98	96	99	100	98	99	99	98
PPC (%)	94	97	97	97	94	97	99	98	99	98	97

Group 5 obtained accuracy scores that are similar to those obtained by Group 4 (4;0–4;5 years). Although this group's PPC score is slightly lower than Group 4's, the scores between these two groups are not significantly different.

Group 6 (5;0–5;5 years)

Accuracy scores (PCC, PVC and PPC) obtained by Group 6 (5;0–5;5 years)

	L9	L11	L15	L16	L23	L30	EL18	EL23	Mean
PCC (%)	98	93	95	92	85	96	98	99	95
PVC (%)	98	97	98	95	97	98	100	100	98
PPC (%)	98	95	97	93	91	97	99	100	96

Participants in Group 6 obtained high accuracy scores, with the group's average scores somewhat similar to those obtained by Groups 4 and 5. All but one participant (L23) in Group 6

obtained accuracy scores higher than 90%. L23 presented with a phonological delay, which is likely the reason for his low PCC score.

Group 7 (5;6 - 5;11 years)

Accuracy scores (PCC, PVC and PPC) obtained by Group 7 (5;6–5;11 years)

	L6	L17	L19	L36	EL12	Mean
PCC (%)	93	98	99	97	94	96
PVC (%)	98	98	98	98	98	98
PPC (%)	95	98	99	98	96	97

This age group's average accuracy scores were similar to those obtained by Groups 4 (4;0–4;5 years) up to 6 (5;0–5;5 years). Children aged 5;6–5;11 years all obtained PCC scores above 90%, but none of them obtained PVC scores of 100%.

Group 8 (6;0–6;5 years)

Accuracy scores (PCC, PVC and PPC) obtained by Group 8 (6;0–6;5 years)

	L7	L8	L10	L12	L14	Mean
PCC (%)	94	95	97	97	96	96
PVC (%)	96	98	98	97	97	97
PPC (%)	96	97	97	97	97	97

Not much difference was seen in the scores obtained by Group 8 and those obtained by Groups 4 (4;0–4;5 years) up to 7 (5;6–5;11 years). All participants in this age group obtained accuracy scores higher than 90%. None of the participants in this age group scored 100%, which likely suggests that children acquiring Setswana can be expected to make a few errors affecting both consonant and vowel phonemes beyond 6;5 years.