KISWAHILI PHONOLOGICAL INVENTORY FOR CHILDREN AGED 3-6 IN NAIROBI COUNTY, KENYA

BY

DOROTHY MINAGE

A THESIS SUBMITTED TO SCHOOL OF ARTS AND SOCIAL SCIENCES IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF SCIENCE IN SPEECH-LANGUAGE PATHOLOGY

MOI UNIVERSITY

2021

DECLARATION

Declaration by Candidate

This thesis is my original work and has not been presented for a degree in any other university or any other award. No part of this research may be reproduced without prior permission of the author and / or Moi University.

Signature: _____ Date:_____

Dorothy Minage

SASS/PG/SLP/01/2015

Declaration by Supervisors

This thesis has been submitted with our approval as the university supervisors

Signature: _____ Date: _____

Dr. Simon Nganga

School of Arts and Social Sciences

Moi University

Signature: _____ Date: _____

Dr. Billian Khalayi Otundo

School of Arts and Social Sciences

Moi University

DEDICATION

In recognition of my mother Rhoda Onzere, a great woman, a pace setter, a selfless mother, who tirelessly supported and inspired me to carry to the end whatever I start.

ACKNOWLEDGEMENT

ABSTRACT

Phonological inventories aid in the assessment and determination of children's phonological abilities. They should be language specific due to difference in language sound systems. However, Speech–Language Therapists in Kenya use English Phonological inventories to assess Kiswahili sounds, syllable structures and phonological processes of bilingual children. This leaves phonological aspects, such as sounds, peculiar to Kiswahili, which is the second most spoken language, unaccounted for. Therefore, this study set out to investigate Kiswahili consonant sounds, syllable structures and phonological processes with the aim of developing a Kiswahili Phonological inventory for the Kenyan children aged from 3-6. The specific objectives were: to investigate if there is variation in Kiswahili sounds among children aged from 3-6 is caused by frequentness of mother tongue use, with the aim of developing a phonological inventory; to describe the differences in Kiswahili syllable structures present among boys and girls aged from 3-6 so as to develop a phonological inventory; and to describe Kiswahili phonological processes present among children aged from 3-6 with the aim of developing a phonological inventory. The study was guided by theoretical principles from distinctive features theory. A cross-sectional survey design was used to analyse Kiswahili phonological features of 240 out of the targeted 2027 pre-school children, sampled using the Yamane Model and a two-stage sampling technique. Questionnaire and interview schedule supplemented by pictures were used to collect data. Preliminary analysis revealed that firstly /p, b, t, d, h, k, g, f, v, l, r. m, n, s, z. w, y, ʤ ɲ, ʃ/ had been acquired by age 3.6. secondly, CV, CCV, CVV, CVCVV, CVCVCV, CCVCVCV, CVCV, CVCCVCV, VCVCV, CVCVCV syllable structures were consistent among all age groups while phonological process which included addition, deletion and substitution, reduced as age increased. Confirmatory findings revealed that there was no statistically significant variation in mean scores of children's frequency in usage of mother tongue. This implied that there was no variation in Kiswahili sounds as a result of frequentness of L1 usage. $F_{(4,217)} = 2.044; p > .05$. Only 0.3% of the variance in Kiswahili sounds could be explained by how frequently the children spoke L1; secondly, there was no statistically significant variation in mean syllable structures among children of different sexes (T (220) = 1.447; p>.05) two tailed test. However, sex represented a very small size effect as only .09% of the variance in syllable structures; and there was a statistically significant difference in mean phonological processes in six different age groups studied ($F_{(5,216)} = 8.576; p < .05$).In conclusion, since how frequently a child spoke L1 and sex differences did not cause variation in the inventory, it can be used to assess Kenyan children regardless of L1 and sex. The study contributes to recent discussions in research in SLT on the need for language specific inventories. The findings of this study can be used in designing curriculum for school children aged from 3-6.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

OPERATIONAL DEFINITION OF TERMS

Individualised Education Programme (IEP): A written plan created by a school's special education team with input from the parents with the aim of specifying a student's academic goals and the how to achieve these goals.

Phonetics: The physical aspect of sounds; that is, what we hear and articulate

Phonological inventory: A developmental representation of language-specific sounds, syllable structures and phonological processes realised by children

Phonological Processes: Patterns of sound errors that typically developing children use to simplify speech as they are learning to talk

Phonology: The mental representation of the articulated sounds in a particular language and the rules that govern combination of sounds to form meaningful words and simplification words to form phonological processes.

Speech-Language Therapist (SLT): A specialist who evaluates and treats patients with speech, language, and swallowing disorders.

Syllable Structure: A unit of organization for a sequence of speech sounds in a particular language.

CHAPTER ONE

1.0 Introduction

This study focused on Kiswahili Phonetic sound system, syllable structures and phonological processes of Kenyan children aged 3-6 with the aim of developing a Kiswahili Phonological Inventory. Prior to designing a phonological inventory for a language, there is need to know its status and how widely it is spoken. Therefore, in this section, the background to this study was mapped out in terms of Kenyan geographic space, population size, economic activities and Kenyan linguistic context. Introduction to Phonological Inventory, statement of the problem, objectives of the study, hypotheses of the study, justification of the study, scope and limitations of the study were also discussed.

1.1 Background: Demographics of Kenya

Kenya is an East African country with 47 semi-autonomous counties headed by elected governors. The country is bordered by South Sudan to the North West, Ethiopia to the North, Somalia to the East, Uganda to the West, Tanzania to the South and the Indian Ocean to the South-East (Munene, 2019). Having a surface area of 580,367 square kilometres makes Kenya the world's 48th largest country. In 2019, the total enumerated population was 47,564,296 of which 23,548,056 were Males, 24,014,716 were Females and 1,524 were Intersex (Munene, 2019). The theme of the 2019 census was "Counting Our People for Sustainable Development and Devolution of Services" (Munene, 2019).This was in response to the demand for statistical information for implementation of Kenya's development agenda. These include; the Big Four, Vision 2030 and other global initiatives including the Sustainable Development Goals (Munene, 2019). With its current population, Kenya ranks 27th world wide with an annual growth rate of 3.88%. Of the 47,564,296 people enumerated in 2019, the largest ethnic groups are;

Kikuyu which comprise17%, Luhya are 14% and Kalenjin are 13%. Others include; Luo which comprise 11%, Kamba are10%, Kisii are 6%, Meru are 4% while 13% comprise of other African ethnicities. Non-Africans such as Asian, European and Arab population total to 11%.

Nairobi is Kenya's capital city with a total surface area of 696 kilometres squared. Besides having a population of 4,397,072 with 2,192,452 males, 2,204,375 females and 245 inter sex in the census conducted in 2019 Munene (2019) ; Nairobi has had the highest number of population since 2009 (Kenya National Bureau of Statistics, 2010). Census conducted in 2009 revealed that Kenya had a population of 38,610,097 with Nairobi city having the highest number of people totalling to 3,138,369 (Kenya National Bureau of Statistics, 2010). The 2009 census also disclosed urban areas to be densely populated with 26,122,722 people totalling to 67.5 percent while rural area had 12,487,375 people accounting for 32.5 percent (Kenya National Bureau of Statistics, 2010). With a population of 4,397,072 as per the census done in 2019, Nairobi ranked top followed by Kiambu (2.4 million), Nakuru (2.1million), Kakamega (1.8 million) and Bungoma (1.6 million). The least populous counties are Lamu (143,920), Isiolo (268,002), Samburu (310,327), Tana River (315,943) and Taita Taveta (340,671) (Munene, 2019).

According to Munene (2019), Nairobi is the most populous city in kenya with of 4,397,073 people. It is also a city of convergence for all Kenyan ethnicities where Kiswahili prominently features as Lingua-Franca. This leads to increased number of Kiswahili speakers. Therefore, this research considered Nairobi suitable for collecting data on Kiswahili sounds, syllable structure and phonological processes with the aim of developing Kiswahili Phonological Inventory. Furthermore, conducting this research in Nairobi enabled the researcher feature all major L1 categories such as Bantu, Nilotic

and Cushite when investigating whether how frequently a child speaks mother tongue has impact on Kiswahili sound system.

Studies have revealed that the major industries in Kenya where Kiswahili is used as a means of communication are agriculture, forestry, fishing, mining, manufacturing, energy, tourism and financial services (Munene, 2018). Kiswahili is also used as a language of advertising on billboards, social media, radio and television. Kenyan economic survey done by Munene (2018) revealed positive economic prospects with above 6% Gross Domestic Product (GDP) growth thus increment in the use of Kiswahili as a language of business. The positive economic prospects were possible because of recovery in agriculture and expansion in telecommunications, transport and construction sectors. Presence of educated professionals and improved levels of IT literacy also supported this growth (Munene, 2018). As of 2019, according to World Economic Outlook Data Base (2019), Kenya was ranked the 61st largest economy in the world (Munene, 2018). This is because Kenya had an estimated GDP of $98.264 billion and per capita GDP of $1,991. Vision 2030, which aims to transform the Kenyan industry is a current blueprint for Kenya's future of economic growth. Economic, social, and political pillars have been put into place in order to achieve this (Munene, 2018). The economic areas targeted so as to achieve economic growth averaging more than 10% are tourism, agriculture, wholesale/retail trade, manufacturing, IT-enabled services, and financial services. In all of these sectors, Kiswahili is used during communication (Ndung'u et al., 2011).

1.1.1 Kenyan Linguistic Situation

Kenya is a multilingual society with 42 indigenous languages (L1s), English and Kiswahili (Kibui, 2014). In Kenya, indigenous languages are mainly used in both rural and urban areas for intra-ethnic communication (Kibui, 2014). The status of Kiswahili

has been gained by its wide usage and also through nation language policy whereby the government has purposed to promote the diversity, development and use of indigenous languages including Kiswahili (Kibui, 2014). Furthermore, the National language policy of Kenya has accorded Kiswahili the status for development and use as a national Language and an official language (Timammy and Oduor, 2016). Studies have further indicated that Kiswahili is the most widely used language because it is used both as a first and second language (Oduor and Rotich, 2016).

The most spoken L1s in Kenya, according to SIL Ethnologue (2009) as cited by Oduor and Rotich (2016), are divided into Bantu and Nilotic families of languages. The majority Bantu languages are Kikuyu with 6, 622, 576 speakers, Oluluhyia (5, 338, 666), Kikamba (3, 893, 157) and Ekegusii with 2, 205, 669 speakers (Oduor and Rotich, 2016). The majority Nilotic languages are Dholuo with 4, 044, 440 speakers and Kalenjin (4, 967, 328) (Oduor and Rotich, 2016). The Kauma, Kabe, Jibana, Chonyi, Giriama, Ribe, Dorobo, Digo and Duruma which belong to the Mijkenda were 1, 960, 574. The rest of the speech communities form 13% of the population(Oduor and Rotich, 2016). The minority languages spoken in Kenya as recorded by SIL International (2009) belong to Cushitic family (Oduor and Rotich, 2016). These minority languages include Oromo, Rendille, and Somali (Oduor and Rotich, 2016).

Kiswahili is the national language of the republic of Kenya as stated in article 7 under chapter 2 of Kenya's new constitution (Kibui, 2014). A national language brings the Kenyan multi-ethnic groups together and creates a united country. This is because it serves as a language being spoken in common by these groups thus promoting unity. The status of Kiswahili as a national language also qualifies Kiswahili as the language of nationalism. For this reason, the love for Kenya has to be manifested through the national language. Kiswahili as a national language serves as a nation's identity since

it differentiates the Kenyan nation from other nations. In addition, Kiswahili brings all the Kenyan 'nations' to function as one. Kiswahili serves as a weapon of nationalist struggle because a nationalist bases his or her patriotic views in a national language (Brann, 1994). Besides being used as a national language, Kiswahili is also serves as lingua-franca and an official language of Kenya (Kibui, 2014). As a lingua-franca, Kiswahili is spoken as a common language by speakers from different indigenous groups (Muaka, 2011). A lingua-franca is used beyond borders of its original community, for academic, political, trade and religious purposes. According to Muaka (2011), an average Kenyan speaks at least three languages including L1, English and Kiswahili. However, barely a quarter of the Kenyan population can adequately use English thus Kiswahili is mostly spoken during inter-ethnic interactions (Ogechi, 2003).

Apart from English, Kiswahili is used as an official language in Kenya (Kibui, 2014). An official language is used for communication in judiciary, legislature, administration and education systems of a country. Furthermore, Kiswahili serves as the official language of the parliament as stated in chapter 8 of the Kenya's new constitution (Kibui, 2014). The implication of Kiswahili as an official language is seen in the Kenyan education system where it is used as a medium of instruction and also taught as a compulsory and examinable subject. The current Kenyan education system is 2-6-3-3-3. Children are expected spend 2years in preschool, 6 years in primary school, 3 years in junior secondary, 3 years in senior secondary and finally 3 years in university or vocational training. In Early Childhood Education Centres (ECDE), children below 4 years old attend play group, 4-5 years pre-primary1and 5-6 years in pre-primary 2. Due to L1 diversities of children in preschool classrooms, Kiswahili and English are used as mediums of instruction.

Language is one of the aspects being focused on in ECDE (Kenya Institute of Curriculum Development, 2017). The curriculum targets: enabling the child acquire appropriate listening skills from varied experiences to enrich their ability to communicate; express own opinions, ideas and feelings creatively freely and confidently in varied situations as they appreciate others; participate in conversation using appropriate verbal and non-verbal language in their everyday experiences; articulate letter sounds correctly in preparation for reading; develop appropriate reading readiness skills in varied learning experiences and apply appropriate writing readiness skills in varied learning experiences(Kenya Institute of Curriculum Development, 2017). Children aged 3-6 are the critical age of language acquisition. Therefore, a tool to monitor their progression in Kiswahili language as they advance in age is relevant.

This study aimed to develop a Kiswahili phonological inventory given the importance of Kiswahili as an official and national language as well as a lingua franca. Because Kiswahili is the most spoken language in (Choge, 2009); development of phonological inventory for children aged 3-6 is necessary in order to provide teachers and parents with a tool they can use to monitor children's phonological ability at this critical age of development. Therefore, an inventory is necessary in order to monitor a child progression, determine any deviation from what is normal and facilitate development of treatment goals with regard to phonological processes.

1.2 Phonological Inventory

Recent research in Speech-Language Therapy (SLT) has tended towards development of language-specific phonological inventories (Jo PhD, 2017). The use of such inventories eliminates linguistic biasness during assessment since languages have divergent sound systems (Campbell et al., 1997). Furthermore, despite the universality of the syllable as a perceptual linguistic unit across languages, structural elements of

the syllable vary across languages (Goswami, 2010). That is, the number and types of sound elements vary within syllables. Patently, these factors affect phonological development in children (Goswami, 2010). The language a child speaks is an important factor SLTs consider during assessment and this supports the need for language-specific inventories (Jo PhD, 2017). This is because language-specific inventories facilitate the comprehensive assessment of a child's ability in terms of consonant sounds prowess, syllable structure and phonological processes in that particular language. However, Kiswahili phonological inventory for Kenyan children aged 3-6 years is non-existent (Bishop, 2003). This is contrary to the norm since 3-6 is a critical age of phonological development. Considering how widely Kiswahili is spoken as a first and second language, its status as a national, official and lingua-franca, there is dire need for a Kiswahili phonological inventory. Therefore, this study focused on Kiswahili sound system, syllable structure and phonological processes with the aim of developing a Kiswahili phonological inventory.

A phonological inventory is a developmental representation of language-specific sounds, syllable structures and phonological processes realised by children (Moran et al., 2020). According to Pierrehumbert (1990), both phonetics and phonology describe the pattern of human language. Phonology describes qualitative contrasts in sounds which can be used to convey qualitative different meanings in a given language. This implies that, the entities painted by phonology are attributed to the mind of the speaker or listener since this is where association between sounds occur so as to create meaning (Pierrehumbert, 1990). Therefore, a phonological inventory is the mental representation of the sounds and combinations of sounds that comprise words in a particular spoken language (Pierrehumbert, 1990).

Phonology can be further described at the acoustic, linguistic or the cognitive level (Pierrehumbert, 1990). At the cognitive level, the phonological representation is described in terms of its   constituent elements, namely consonants and vowels (Pierrehumbert, 1990). At the acoustic level, the phonological representation for a word form is analysed in terms of pitch, loudness, and duration. At the linguistic level, the word form is described in terms of the vocal tract and the ways that it constrains the production of distinct speech sounds, for example, the manner of production and the place of articulation (Pierrehumbert, 1990). The speech sounds that are capable of being produced of human vocal tract fall under the phonetic inventory, which ideally contains redundant and non-redundant sound features. Therefore, these features provide a basis for understanding of the structure and economy of phonological systems and provide a frame of reference for models of production and comprehension in speech communication (Pierrehumbert, 1990).

 As further stated by Pierrehumbert (1990), human languages do not use arbitrary collection of noises to convey word meaning. Instead, words are created by combining sounds that are meaningless on their own. Hence Phonology entails rules which specify what words are well formed. For example, a syllable should have (onset) rhyme. The sounds in the syllable may vary but the formal character of the rule is the same (Pierrehumbert, 1990). A syllable structure demands an individual speaking a particular language to combine different consonants and vowels so as to form meaningful words. Hence, phonology is grammar of phonetics since it depicts which combinations and sound patterns are allowed in a language (Pierrehumbert, 1990). For example, Kiswahili has no word final consonant.

During phonological development, the rules of phonology therefore dictate the phonological processes that are permissible in a given language. Phonological

processes are developmentally appropriate patterns children use to simplify adult speech. They are sound errors that typically developing children make during articulation (Bowen, 1998). According to Stoel-Gammon (2011), certain sounds are more difficult to produce and are usually acquired later. As more sounds are acquired, language becomes clearer. Pronunciation, fluency and intonation also improve (Stoel-Gammon, 2011). Hence, for a child to communicate efficiently he or she must acquire phonology of adult language.

The function of distinctive features is to characterize natural segment classes, that is, a set of phonemes in a language that share certain distinctive features. A phoneme is the basic unit of the phonology of language with phonic(distinctive) features such as articulatory, acoustic and auditory which enables the users to differentiate one sound from another as an independent, non-interchangeable unit capable of meaningful distinction (Trubetzkoy, 1969). According to Trubetzkoy (1969), phonemes are phonically signalled by a sound and distinctive features allow phonemes to distinguish the meanings of words. Therefore, phonic features permit phonemes to become materialised and acquire existence.

These features should further describe all segmental contrasts in all languages. They must describe all the segments correctly in terms of place, manner and voice in order to allow correct formation of words when combined with other sounds. According to Jakobson (1962), for a sound to be produced correctly, the respective articulators should meet at the expected point in the oral cavity. The airstream must go through the right cavity, either nasal or oral cavity, in order to give the correct resonance. Also, the vocal cords ought to move in the expected way since some sounds are produced when vocal cords vibrate while others without vocal cord vibration (Jakobson, 1962). Distinctive features also differentiate lexical items, which is a phonological function. In addition,

these features define natural segment classes having phonological processes (Clements and Hallé, 2010).

Articulatory Phonology treats phonetics and phonology as low- and high-dimensional descriptions of a single system (Ohala et al., 1986). According to Ohala et al. (1986), the representational units of phonology correspond to speech production events. In Articulatory Phonology, the basic units of phonological representation are not features or segments, but articulatory gestures. A gesture can be considered as a task or a goal (tract variables) to be achieved through articulatory movements. Tasks in articulation include varying positions of the tongue and opening or closing of vocal cords (Ohala et al., 1986).

Therefore, a phonological inventory is criterion-referenced tool that measures a child's performance against an already predetermined criterion. This criterion-referenced tool is descriptions of what a child should be able to perform in terms of target language sounds, syllable structures and phonological processes at a particular age of development (American Speech-Language-Hearing Association, 2020). A phonological inventory of language is developed when there is absence of such a tool to which a children's realisations can be compared so as to determine their nature of progression. This inventory is also developed when the existing tools are linguistically and culturally inappropriate. Also, these tools are usually not standardised to the population on which they are used. Linguistic inappropriateness is when the tool present was standardised to a population whose language has a different sound system from the language being assessed (Algeo, 2010). For example, Speech-Language therapist in Kenya use English inventories during assessment of Kiswahili phonology. Sounds like /ɲ/ are unaccounted for since they are peculiar to Kiswahili. Moreover, syllable structures are not comprehensively described since syllable element vary between

English and Kiswahili. These two languages also have different origins. Kiswahili is Bantu language while English is from west Germanic languages that originated from Anglo-Frisian dialects (Algeo, 2010). Different factors have also contributed to changes in these languages, resulting in notable differences in their linguistic systems. Cultural inappropriateness is when a child is expected to label pictures of items that are non-existent in their environment (Algeo, 2010). Things the child is likely to encounter in their environment should be included in the picture book let.

Research has described steps in development of an inventory. For instance, Hua and Dodd (2006), suggests four steps in the development of the inventory. First, a word list of the language being studied is created. These words should be present among the age group being studied and should be culturally appropriate. Secondly, the selected words are to be matched with culturally appropriate pictures. A picture booklet containing pictures that represent all the words in the wordlist is then created. Thirdly, typically developing children from the age groups being studied are required to verbally label the pictures. The exact realisations of these children are then noted down and transcribed using International Phonetics Association chart (IPA). The use IPA chart permits the allocation of distinctive features to the target sounds being studied and highlights syllable structures and phonological processes that are realised by the children (Caton, 1987). Fourthly, consonants and syllables should be included in an individual child's inventory if they are produced either spontaneously or in imitation by≥90percent of the children. Phonological processes should be included in the inventory if they are realised by ≥10percent of these children.

The phonological inventory is used during assessment of Children with communication pathologies such as speech sound disorders and reduced intelligibility. Speech sound disorders are characterized by difficulties in realising words or sounds correctly. During

assessment, a child is presented with a set of pictures and asked to verbally label them. The expected verbal responses normally have consonants in different word positions. The child's realisations are compared to expected age- appropriate productions present in the phonological inventory. According to Bleile (2004), a child's realisations are compared to a specific language's phonological inventory so as to determine developmental appropriateness of the child's phonology.   During assessment, the sounds produced by children and those they are stimulable to are determined (Stokes et al., 2005). Stimulable sounds are those that a child can imitate correctly when modelled by Speech –Language Therapist; meaning that the child is likely to develop the correct realisation with support. The assessment findings enable the Speech –Language therapist set appropriate goals on how to correct these phonological deviation   made by the child (Hodson and Paden, 1991).

A phonological inventory is relevant to teachers in special, preschool and primary school as it enables them to effectively listen to a child's speech, detect the possible errors and refer him/her to Speech- Language Therapist. It will also help these teachers develop an appropriate Individualised Education Programs with appropriate objectives for the problematic sounds. Therefore, a phonological inventory is necessary for language being spoken by most of the population because it aids in easy determination of phonological progression of children as they approach adulthood.

In Kenya when assessing the Kiswahili phonological ability for children aged from 3-6, SLTs use English phonological inventory that reflect normal phonological abilities of typically developing English L1 speakers. This is because there are no culturally and linguistic appropriate Kiswahili phonological inventories to be used. Studies on typical Kiswahili phonological inventories for kenyan children aged from 3-6 are currently not present. As a result, the verbal realisations from the assessed Kiswahili speaker are

then matched against the English phonological inventory in order to determine the level of Kiswahili phonological ability. This poses as a major challage considering the linguistic differences of these two language. Therefore, a phonological inventory that puts into consideration the linguistic nature of Kiswahili must be developed. This will facilitate all Kiswahili sounds, syllable structures and phonological processes present among various ages being acounted for during assessment.

1.3 Statement of the Problem

Given that every language has distinct phonological characteristics, in order to assess children's phonological ability in a given language, phonological inventory based on the language they speak should be used. However, it has been observed that when assessing Kiswahili phonological ability of Kenyan children at different ages, the English phonological inventory is used, yet as research shows a majority of the children speak Kiswahili. This creates room for bias during assessment. Therefore, the current study set out to investigate Kiswahili phonetic sounds, syllable structure and phonological processes with the aim of developing a Kiswahili phonological inventory. This study was guided by theoretical principles from distinctive feature theory to identify and describe Kiswahili sounds and also to account for syllable structures and phonological processes. The study contributes to recent discussions in research in Speech-Language Therapy on the need for language-specific inventories. The findings of this study can be used in designing curriculum for school children aged from 3-6.

1.4 Objectives of the Study

In this section, general objective and specific objectives are discussed.

1.4.1 General Objective

To develop Kiswahili phonological inventory for Kenyan children aged 3 - 6 years.

1.4.2 Specific Objectives

i.   To investigate if there is variation in Kiswahili sound system among children aged 3-6 caused by frequentness of mother tongue use, with the aim of developing a phonological inventory

ii.   To describe the differences in Kiswahili syllable structures present among boys and girls aged 3-6 so as to develop a phonological inventory

iii.   To describe Kiswahili phonological processes present among children aged 3-6 with the aim of developing a phonological inventory

1.5 Hypotheses of the Study

i.   There is no statistically significant variation in mean scores of children with different L1 speaking frequentness that would cause differences in Kiswahili sound system

ii.   There is no statistically significant variation in mean syllable structures among children of different sexes

iii.   There is no statistically significant variation in mean scores of children with different ages in phonological processes

1.6 Justification of the Study

The relevance of this research was to facilitate the collection of normative data on Kiswahili sounds, syllable structure and phonological processes of Kiswahili speaking children in Kenya aged from 3 to 6 years, with the aim of developing a phonological inventory. This normative data was collected since there is no Kiswahili phonological inventory that highlights expected phonological development for this age group. This

is a matter of concern considering the status of Kiswahili as a national, official and lingua-franca. Kiswahili is also spoken by most of the Kenyan population as a first or second language.

Descriptive cross sectional survey design was considered suitable for this study because it was done at a specific point in time and the research involved analysis of situation as it was without manipulation of data. Distinctive features theory was relevant to this study since it guided the researcher to allocate voice, place and manner distinctive features to the studied Kiswahili consonants. It also facilitated easy identification of syllable shapes and phonological processes realised by the child.

The collected data highlighted age-specific Kiswahili consonant sounds, syllable structures and the phonological processes. A Kiswahili phonological inventory was therefore developed. This inventory is relevant to Special Needs Education teachers as it will enable them to detect the phonological errors in children's speech and refer them to Speech- Language Therapists. The phonological inventory will further help these Special Needs Education teachers develop appropriate Individualised Education Plans with specific objectives for the problematic sounds. When developing a Kiswahili curriculum for children aged from 3-6, the curriculum developers will be able to consider the phonological abilities of these children as highlighted by the phonological inventory. During assessment, the phonological inventory will guide Speech-Language therapist concerning children's phonological developmental age with regard to their performance in consonant sounds, syllable structures and phonological processes. Also, this inventory will make it easier for the Speech-Language therapists to determine Kiswahili phonological errors exhibited by the assessed child thus facilitating developing of treatment goals. After a cochlear implant, which is a device that improve hearing in individuals with severe to profound hearing impairments, the data will help

Speech-Language therapists to know the sounds which they should be working on considering the hearing age of the client. Relevance to this is whether the client was born deaf or acquired hearing impairment later in life.

1.7 Scope and Delimitation of the Study

This study developed Kiswahili phonological inventory for Kenyan children aged from 3-6. It strictly focused on phonetic aspects of consonant sounds, syllable structures and phonological processes for kids   aged 3-6, as this is the standard way of developing an inventory. This study was done in stand-alone ECDE centres in Nairobi county, namely; Upper Hill, Umoja I, Mugumo, Simba, Unity, Mwangaza, Bahati, Nairobi West, Kaloleni, Ofafa, Tana, Njoro, Mbotela, Ziwani, Starehe, Central, Parklands, Ngara East, Kileleshwa, State house and Lady Northey. This is because Nairobi brings together children from different ethnic and linguistic backgrounds.

Only typically developing bilingual Kiswahili speaking children aged 3-6 were selected because 3-6 years of age is a critical period in language acquisition and development. Children with atypical Speech-Language development were not included in this study. The 21 stand-alone ECDE centres were considered since this age group could only be found in such institutions.

This study was guided by distinctive features theory because the study only focused on verbal responses and how speech sounds vary in relation to other speech sounds. The distinctive features theory was therefore considered ideal for this research.

CHAPTER TWO

LITERATURE REVIEW

2.0. Introduction

This research investigated Kiswahili sounds, syllable structures and phonological processes realised by Kenyan children aged 3-6 with the aim of developing a Kiswahili phonological inventory. In this chapter, the relevant literature to this study is reviewed. Scholarly literature related to this study is organised and discussed according to the objectives. That is; the origin of English and Kiswahili, differences between these two languages, phonological inventory in literature on language acquisition, how an inventory is made, parameter in the making of an inventory: 1. L1 usage and the phonological inventory, 2. sex and phonological inventory, 3. age and phonological inventory and lastly the intention of this study. Further, theoretical framework and conceptual framework are discussed in accordance to the objectives of this research. The relevance of Distinctive Features theory to this study is discussed while the relationship of the studied variables is depicted in the conceptual framework.

2.1 Origin of Kiswahili and English

It remains a matter of concern as to why English phonological inventories standardised to L1 English speakers are used to assess Kiswahili phonological abilities of Kenyan children. Studies have shown that English and Kiswahili have different origins and English is not spoken as L1 by most Kenyan children since they acquire it when they start school. Research has further inclined towards the hypothesis that Kiswahili developed from Arabic, since the word Kiswahili is the modification of 'sawahili,' plural of 'sahil, 'meaning coast; while the origin of the English language is traced from west Germanic languages that originated from Anglo-Frisian dialects ((Polome, 1967).

Later, Arabs intermarried with the locals of kilwa thus producing Kiswahili speaking people ((Polome, 1967).

Mazrui and Shariff (1994) have also proposed that Kiswahili developed from Arabic pidgin whose origin was Arabic. Arab traders reached the east African coast by 100AD and an Arab based pidgin popped up since then to facilitate their communication with the inhabitants along the coast ((Mazrui and Shariff, 1994). A pidgin is a grammatically simplified language that develops between two or more groups that do not have a language in common so as to ease communication. The vocabulary and grammar of a pidgin are limited and often drawn from several languages (Muysken and Smith, 1995). The Arab traders intermarried with these inhabitants and their off springs learned this pidgin, which later developed into a creole ((Mazrui and Shariff, 1994). A creole is a stable natural language that develops from a mixture of different languages. Unlike a pidgin, which is a simplified form that develops as a means of communication between two or more groups, a creole language is a complete language, used in a community and acquired by children as their native language (Muysken and Smith, 1995).

However, due to contact with Sabaki languages spoken along the coast such as Mijikenda and Pokomo, decreolization occurred thus Kiswahili emerged. Decreolization is when over time a creole language reconverges with the lexifier, a language that provides basis for majority of a creole's vocabulary, from which it originally derived (Aitchison, 2001). This is a process of language change a creole language undergoes when in contact with its lexifier (Aitchison, 2001).The major challenge a decreolized language faces is that it is very difficult to account for its geneses since it will have lost all its traces((Mazrui and Shariff, 1994). Mazrui and Shariff, (1994), acknowledged that it was challenging to come up with a linguistic

evidence to account for origin of Kiswahili because of decreolization. Therefore, it will only be identified with the substratum languages.

2.1.1 Languages Related to Kiswahili

Some studies have stated that Kiswahili developed out of Bantu matrix and is not so atypical linguistically and socio linguistically from Bantu languages thus it is considered to be a Sabaki language (Nurse et al., 1993). Sabaki is divided into Mijikenda, Pokomo, Comorian and Kiswahili groups. Kiswahili is further stratified into northern and southern dialects. Some of the northern dialects include Kimvita and Kiamu while the southern dialects include Kiunguja, Kipemba and Kimtang'ata. Kiswahili is considered as a sub category of Sabaki because it has the same lexicostatistical status as other subgroups like Mijikenda and Pokomo; and retained almost same percentage of Sabaki vocabulary like in these subcategories (Nurse et al., 1993). This indicates that there's lexical uniformity among Kiswahili and other Sabaki languages due to uniformity in lexical cohesiveness as in Pokomo and Giriama (Nurse et al., 1993).

Since Kiswahili is considered a Bantu language, languages belonging to this category are closely related in terms of structural features. Most Bantu languages comprise a five vowel system. Bantu languages are also considered as tone languages in that different tense, aspect or difference between two lexicon items is indicated by difference in pitch on various syllables thus bringing out difference in meaning (Polome, 1967). Bantu languages are also considered to have a prominent CVCV syllable structure (Nurse et al., 1993).

There are linguistic aspects that are not unique to Kiswahili alone but are also present in other Sabaki dialects. For example, like other Sabaki dialects, Kiswahili contrasts

voiceless stops from voiceless aspirated stops. Morphologically, there are similarities in Kiswahili system and other Sabaki dialects. For example, *-ta-* is used to express the future tense; for example; ***nitaenda sokoni***. *–ka-* is used in Kiswahili, Pokomo and Mijikenda to mark narrative. it is an indicator of 'then.' For example, ***n(i-ka-)ongea na wazazi wake***.

2.1.2 Direction of Movement of Kiswahili

Two sets of Arabic loan words were distinguished in Kiswahili (Nurse et al., 1993). The recent set of loan words was during the 17th century during the Omani suzerainty while the earlier set goes before 17th century. Phonological and semantic similarities are noted between the recent set and Kiswahili loaned words thus phonological processes are not exhibited. On the other hand, the earlier set is characterized by phonological processes. For example, when ***'ngamila'*** an Arabic vocabulary for camel is loaned to Kiswahili, it becomes; '***ngamia.***'

Studies on Kiswahili as Sabaki has led to the work of Mazrui and Shariff (1994) being critiqued. For example, they stated that it was hard to account for its origin because of decreolization hence they provide little chronology continuum of Kiswahili after its emergence since 100AD. Also, for the emergence of Arab pidgin to occur, the Arab traders must have been socially dominant and must have been the main trade initiators while other groups that participated in trade such as Bantu and Cushite were minor traders.

2.1.3 Direction of Movement of English

Current research in Speech-Language Therapy has advocated for the use of language specific phonological inventories during assessment in order to avoid biasness since different languages have peculiar features than can only be studied by such inventories

(Jo PhD, 2017). Therefore, English inventories are not adequate when assessing Kiswahili phonology since studies have further indicated that these two languages have different origins ((Polome, 1967).

After its emergence, English was later brought to Britain by Anglo –Saxon settlers in mid-5th to 7[th]century AD (Algeo, 2010). The dialects spoken by Germanic immigrants who settled in Britain during this period included those spoken in regions that lie within modern Denmark, Netherlands and northwest Germany. These dialects spoken by immigrants later developed into Anglo Saxon (old English). It displaced the Brittonic Celtic areas of Britain that later formed the kingdom of England. However, the Celtic languages remained in areas like Scotland and wales. The Latin alphabet introduced by Irish missionaries later replaced the futhorc that was earlier used in old English. Later on the introduction of Christianity led to the addition of Latin loan word into old English.

Middle English later emerged from 1066 after Norman conquest in the 15[th]century. It was influenced by both Anglo-Norman and Anglo-French (Algeo, 2010). During this period Norman and French loan words entered middle English. Some of the loan words were associated with church, fashion, military and even government. English changed during the middle English period in terms of pronunciation, grammar and also vocabulary. A standardized London based dialect penetrated into the government and transformed middle English even further. During mid-16[th]century to early 17[th]century, the period of early modern English developed. This was when the first English dictionary was published. Authors like William shake spear existed during this period. During this period, borrowing of Latin and Greek words into English was prominent; with eventual disappearance of Latin words that were used with their original inflection (Algeo, 2010).

The late modern English period kicked in during the time of Samuel Johnson (1975), a time when English word usage and spelling become standardized (Algeo, 2010). Many words in late modern English arose from industrial revolution and technologies that created need for new words. During this period, English language continued to borrow several words from other languages. A lot of phonological changes have occurred in English since the old to late modern English. For example, there was an introduction of umlaut processes in vowels, where by a mark is placed over vowels to indicate a vowel becoming more similar to a nearby vowel during pronunciation.

2.1.4 Differences between Kiswahili and English

There are major differences that occur between Kiswahili and English; for example, [i]: [I], [u]: [u], [e]: [ε] and [o]: [i] in Kiswahili are in complementary distribution or depending on the individual speaker in free variation. In English such distinctive features as the difference in height and tension of [i]: [I] or [u] [u]: (Algeo, 2010). Besides, the distribution of vowel length is different in Kiswahili and English, stress and nasal clusters being mainly responsible for lengthening in Kiswahili, whereas, in English, voice in pre-consonantal position makes the vowel half long and word-final position entails a more marked lengthening. Also, Kiswahili has no correspondences for the special dialectal treatments of vowels before [r] as in American English, and for the diphthongs /ai/, /oi/, /au/ (Algeo, 2010). Thus, an American speaker of Kiswahili will tend to diphthongize the mid high allophones of /e/ and /o/ and also distribute length incorrectly, especially in lengthening all word-final vowels.

A Kiswahili speaker learning English must learn the redistribution of vowel allophones. He or she must also develop an awareness of their contrast in the environment in which they are used. When learning to differentiate /æ:/a/ or /:/3/ which are allophones of /a/ phoneme, the Kiswahili speaker will likely contrast the first two as the front and back

allophones. They will have trouble distinguishing the last two with reference to the mid low central unstressed [ə] allophone of this /a/ phoneme. Also /ɲ/ is peculiar to Kiswahili while only English has consonants in word final position (Algeo, 2010).

2.1.5 Gap in Research

Studies have therefore shown that English and Kiswahili have different origins and different factors have influenced changes in these languages thus each language has certain peculiar linguistic features. These major differences make English phonological inventory inadequate to assess Kiswahili phonological abilities. Therefore, there is need for Kiswahili phonological inventory that takes into consideration unique factors that its speakers are exposed to and also addresses the current SLT research need for language specific phonological inventories. This research investigated Kiswahili phonetic sounds, syllable structures, phonological processes, with the aim of developing a Kiswahili phonological inventory for Kenyan kids aged 3-6.

2.2 Phonological Inventory in Literature on Phonological Acquisition

Several studies have been conducted on speech sound acquisition by different scholars; the data collected has resulted to different hypotheses that are either agreed or disagreed upon. For example, Jakobson, (1968) stated that infants babble sounds of all languages and there is always a discontinuity between babbling and first words. Jakobson also stated that phonemes are acquired in a universal order (Velleman and Vihman, 2007). This school of thought, however, has had its short comings since phonological development is viewed to be based on pre linguistic knowledge. Infants produce sounds that are absent from the language they hear. The non-native sounds they produce are linked to incomplete consonantal closure and natural physiological linkages of tongue and jaw position (Velleman and Vihman, 2007). These factors impact on later acquisition.

Velleman and Vihman, (2007) stated that bilabial plosives, /p/ and /b/, are not only common in languages but are acquired earlier. Voiced fricatives like/z/ are less common and later learnt than voiceless fricatives, for example /s/, since they are hard to produce because of aerodynamic reasons. Also, the interdental fricative, /θ/, may be rare because of its perceptual similarity to /f/.

Research has shown that despite phonological similarities, languages differ at the level of articulation. There are some sounds like bilabials that are common in all languages and develop during early stages of life. However, some sound like fricatives are not common in all languages and they are not acquired in a universal manner. Therefore, this research intends to show inventory of Kiswahili consonants for the age groups being studied.

When investigating a child's phonological ability, consonants, syllable shapes and phonological processes present are usually investigated (Gangji et al., 2014). Therefore, in order to develop a Kiswahili phonological inventory for children aged 3-6, this research considered consonants, syllable shapes, that is, consonant and vowel combinations present in Kiswahili and phonological processes, which are patterns that young children use to simplify speech, as variables.

Research has shown that consonants produced by a child differ with regard to age (Smit et al., 1990). Smit et al. (1990) further developed IOWA NEBRASKA norms, according to which vowels are considered complete at the age of three. As highlighted in IOWA NEBRASKA norms, typically developing British English speaking children aged three should articulate /p/, /b/ and /m/ correctly despite differences in sex. It is considered as a delay when the child at the age of 3 ½ has not yet articulated these phonemes. Smit et al (1990) also stated that phonological processes play a role in the

acquisition of language. These patterns explain the deviation of the child's speech from expected adult speech. Therefore, studying these phonological processes will delineate normal course of acquisition.

Kiswahili phonological inventory used to assess phonological abilities of Kenyan children aged 3-6 is non-existent. Most of the studies on Kiswahili acquisition have focused on grammar. For example, Jonasson and Wann (2007): translated the Test for Reception of Grammar, Version 2 (TROG-2) into Kiswahili (Bishop, 2003) . They also investigated the validity of the assessment in Kenya for children in two age groups (3.11–6.6; 13.9–17.0) in either English or Kiswahili. The results of their study indicated that TROG-2 was not appropriate for the younger children because of both cultural and linguistic differences.

A study done in Dar es Salaam, Tanzania, concerning Kiswahili phonological inventory for typically developing pre-school children aged from 3.0-5.11, revealed different phonological capacities with regard to different ages (Gangji et al., 2014).This study revealed that children between 3.0-3.5 years should have acquired /a, e, i, o, u/, /b, p/, /t, d, k, g/, /m, n, ŋ/. It would be inappropriate to use the findings from the research conducted in Dar es Salaam to assess Kiswahili phonology of Kenyan children considering the environmental and L1 differences of these two regions that may cause differences in realisations of Kiswahili sounds and phonological processes.

Since there is no Kiswahili phonological inventory that reflects the phonological capacity of typically developing Kenyan children, this research investigated consonant sounds, syllable shapes and phonological structures present among normally developing children aged from 3-6, with the aim of developing a phonological inventory that can aid assessment in the Kenyan context.

2.2.1 Process of Making a Phonological Inventory

Hua and Dodd (2006), suggest four steps in the development of the inventory. First, a word list of the language being studied is created. The created words should test the target sounds in varying word positions, must be culturally appropriate and present among the age group being studied. Words that are culturally offensive and sound complex to the group being studied are to be avoided. Secondly, all the selected words are then matched with culturally appropriate pictures so as to create a picture booklet. Culturally appropriate pictures represent things that the children being studied are likely to encounter in their environment. Thirdly, only typically developing children from the age groups being studied are allowed to verbally label the pictures because an inventory represents normal development only. The exact realisations are then noted down and transcribed using International Phonetics Association (IPA) chart; which permits the allocation of distinctive features to the target sounds being studied, highlights syllable structures and phonological processes that are realised by the children (Caton, 1987). Fourthly, consonants and syllables should be included in an individual child's inventory if they are produced either spontaneously or in imitation by≥90percent of the children. Phonological processes should be included in the inventory if they are realised by ≥10percent of these children.

2.2.2 Parameters in Making a Phonological Inventory

According to Moran et al. (2020), a phonological inventory should represent typical phonological progression of children who speak a particular language. The parameters of a phonological inventory are target language consonant sounds, syllable structures and phonological processes (Moran et al., 2020).

However, research has shown that, a child's mother tongue is likely to affect how they learn the second language (Appel and Muysken, 2005). According to Duskova (1969),

cited in Appel and Muysken, (2005), L1 affects how a child acquires the sounds of second language. Therefore, literature on the impact of L1 on Kiswahili sound system is discussed. Further, according to van der Slik et al. (2015), sex is a possible variable that could cause variation in syllable structure of a language. Hence, literature on impact of sex on syllable structure is discussed. Since research by Bowen (1998) has also proven that age has an impact on phonological processes made by children, literature on impact of age on phonological processes is also discussed.

2.2.2.1 L1 Use and Phonological Inventory

Studies have shown that L1 spoken by a child may have an impact on how they acquire the sound system of second language (Appel and Muysken, 2005). Sounds are among the parameters contained in a phonological inventory. These sounds are a catalogue of all distinct phonemes present in a given language (Safaa, 2014). According to Safaa (2014), languages of the world have different vowel systems, some with as few as three vowels, and others with up to twelve vowels. Vowels are described in terms of three main articulatory properties: tongue height, tongue advancement and lip rounding. American English has a 12-vowel system. The front vowels are /i, ɪ, e, ɛ, æ /, central vowels /ə, ʌ/ and back vowels /u, ʊ, o, ɑ/. Arabic has a 6-vowel system, consisting of /i, u, a/ and their corresponding long vowels /iː, uː, aː / . According to research, vowels are complete by age 3 (Gangji et al., 2014).

According to Edwards (1992), American English has consonants as shown in table 1.

Table 1: English Phonemic Inventory

	Bilabial	Labiodental	Interdental	Alveolar	Post alveolar	Palatal	Velar	Glottal
Plosive	p b			t d			k g	
Nasal	m			n			ŋ	
Trill								
Tap or								
Flap								
Fricative		f v	θ ð	s z		ʃ ʒ		h
Affricate					ʧ dʒ			
Glides(Approximant)	w					j	w	
Liquid (Lateral)				l				
Liquid(Rhotic)				ɹ				

Studies have revealed that Kiswahili has five vowels:/a, e, i, o, u/. Choge (2009) reported five long vowels / a:,e:,i:,o:, u:/ He also identified two diphthongs /au, oa/. Mohamed (2001) on the other hand identified 26 consonants in Kiswahili. He stated in his work that /mb, nd, nj and ŋ /were realised as phonemes since they function as single sounds. That is, during articulation, these sounds are not articulated separately but as a single unit. Consonants in Kiswahili include: /p, b, t, d, k, g, ʧ, f, v, ɵ, h, x, ŋ, ɲ, ð, j, m, n, l, r, s, z, w, ʃ/.

Kiswahili is mostly acquired as a second language by Kenyan speakers who speak different L1s. According to Duskova (1969), cited in Appel and Muysken (2005), error in second language acquisition are traceable to the first language. It's evidenced that first language influences some phonological processes that exists in second language acquisition. For example, if /ʃ/ is missing in a speaker's L1 it will be hard for him to realize the same phoneme in the second language. Therefore, a child faces difficulty in realising sounds that are present in second language but absent in L1 hence causing pronunciation problems in the second language.

Literary convergent conclusions state that bilingual children have differentiated linguistic systems by age two (Meisel, 1989). There is an interaction between these two systems yet the extent of interaction still remains unclear. The decelerate, accelerate and transfer hypotheses account for the interaction between these two systems (Paradis and Genesee, 1996). The deceleration hypothesis means bilinguals acquire certain linguistic features at a slower rate compared to monolinguals. This is attributed to phonotactics impeding a certain feature in a target language. Deceleration has been evident especially in syntactic and phonological acquisition in bilinguals. Conclusions from the studies carried out by Gildersleeve-Neumann et al. (2008) indicated a slower acquisition of English phonology by 3 years old Spanish-English bilinguals. There were lower intelligibility ratings for these bilinguals accompanied by uncommon error patterns, compared monolingual English speaking children.

Acceleration hypothesis on the other hand states that bilingual children demonstrate a quicker rate of acquisition compared to monolinguals. Lleó et al. (2003) examined the realization of coda consonants, consonant sounds of a syllable that follow the nucleus, in Spanish-German bilingual children. Their findings highlighted that there is a higher rate production of coda in Spanish realizations of bilinguals compared to monolinguals. This led to the assumption that fewer restrictions against German coda consonants compared to Spanish had facilitated the effect on bilingual acquisition of coda consonants in Spanish. The transfer hypothesis was based on the fact that interaction between two languages spoken by bilinguals, leads to the occurrence of sound pattern unique to one language occurring in the other language and that transfer can be examined through the analysis of phonemic inventory (Barlow, 2003).

Flege's (1980) Speech Learning Model as cited by Safaa (2014) states that the phonetic system established in childhood is dynamic and can undergo change when one language

interacts with another. Unsuccessful interactions between the language systems may result in learners failing to learn the phonetic differences between pairs of sounds in L2, or between similar sounds in L1 and L2. Flege (1980) attributed this to category assimilation mechanism where L2 sounds become associated with the closest L1 sounds and learners ignore the differences between the two sounds in L1 and L2.

Safaa (2014), proposed Native Language Magnet model which proposed that children grow up learning to perceive and discriminate sets of sound units, developing acoustic prototypes for those sounds. Speech prototypes are sounds that are ideal representatives of adult speakers of a particular language. When learning a new language, these prototypes function as perceptual magnets that attract similar non-native sounds towards them. Therefore, having a prototype in mind makes listeners categorize any similar foreign sounds as belonging to that prototype (Safaa, 2014). Since L1 provides relevant acoustic cues and one can only create these prototypes of the sounds they know from this mother tongue. Therefore, L1 stands between the learner and his or her ability to perceive the new foreign sounds. This study investigated the impact of L1 on a child's Kiswahili consonants. The researcher investigated if how frequently a child speaks L1 impacts on Kiswahili consonants.

Research has shown that poor performance in Kiswahili during KCSE in Nyakach was linked to interference from Dholuo, the native language of this region (Dete and Odera, 2015). This is because some phonemes absent in Dholuo like /ʃ/ were present in Kiswahili. Therefore, the impact of transfer hypothesis was seen where children were not able to realize these phonemes in L2 leading to errors. Further findings from this study revealed that 85% of the schools in this region continued to perform below average despite the government deploying more Kiswahili teachers. Historical factors are seen to have contributed to the poor performance in Kiswahili. For example,

Kiswahili is considered as a Bantu language thus articulation of some sounds by Luos, who are River Lake Nilotes is tasking. The emergence of Kiswahili started at the East African Coast and spread to other parts of the country. Therefore, later spreading of Kiswahili to areas like Nyakach, led to poor acquisition of Kiswahili since most Dholuo speakers in such regions preferred speaking their L1 in their various environs which made the learning of Kiswahili difficult (Dete and Odera, 2015).

Transmission of Kiswahili from school to home was also very minimal. Kiswahili was rarely spoken in home and school environment thus poor performance in Kiswahili. The study by DeteandOdera (2015) cleraly shows that apart from other factors, how frequently a Luo child in Nyakach speaks dholuo has impact on Kiswahili consonants. However, the study by Dete and Odera (2015) was done in Nyakach, a luo speaking community hence the impact of other L1s spoken in Kenya on Kiswahili consonants was not comprehensively studied, The reseach by Dete and Odera (2015) was also done on adult speakers and not children aged 3-6. Therefore the study on Kiswahili Phonological Inventory of Children aged 3-6 investigated the impact of L1 speaking frequency on Kiswahili consonants among children aged 3-6. This research was done in Nairobi, a cosmopolitan society, where most ethnicities converge, so as to capture the impact of different L1s on Kiswahili consonants.

 Data showing Kiswahili sound inventory for Kenyan children aged 3-6 is currently not present. Therefore, the researcher investigated Kiswahili consonant sounds present among these age groups in order to depict their inventory. Since this study targeted bilinguals who speak different mother tongues, L1 was considered a possible variable which could impact on Kiswahili consonants. The researcher further investigated whether how frequently a child spoke mother tongue has impact on their Kiswahili consonants sounds.

2.2.2.2 Sex and Phonological Inventory

Syllable structure is also another parameter represented in phonological inventory. Sex is likely to cause variation in syllable structure (van der Slik et al., 2015). Richards and Schmidt (2010) defined a syllable as a unit of speech consisting minimally of one vowel (V) and maximally of vowel preceded by a consonant (C) or consonant cluster and followed by a consonant or consonant cluster. Syllable structure can be divided into onset and rhyme. Onset is any consonant that precede the nucleus elements (the vowel). Rhyme has two constituents these are nucleus and coda. Coda is any consonant that follow the nucleus in the syllable.

The syllable aids phonological organization of a language since languages have different patterns of syllables. This is because every language has its syllabification constraints that determine the syllable boundaries in its words. However, studies have shown that all languages have CV syllable structure, which is a universal syllable (Mwaliwa, 2014). Also, the syllable regulates how segments (consonants and vowels) of a language combine to form a word qualifying it to be a phonotactic unit. Syllable structure determines which combinations are allowed and which ones are not. For example, Kiswahili words do not have coda. The syllable structure ensures that phonological rules of a language are applied. Therefore, the type of phonological processes is determined by how segments are arranged in a syllable. Also, the syllable controls the structure of complex segments. Hence the combination of these segments are controlled so as to associate them with CV-tier (Mwaliwa, 2014).

Richard and Schmidt (2010) stated that syllable structures can be compared and contrasted between English and Kiswahili. First, the number of consonant in onset and coda are different in syllable structure. English syllable onset can be formed with two consonant and followed by a vowel coda with two consonants like CCVCC in the word

/**plant**/. This structure is not present in Kiswahili. Another difference is that the velar nasal sound / ŋ / frequently occurs at the end of syllables sing / **siŋ** / and never appears at the beginning of English syllables. In Kiswahili, /ŋ/ appears at the beginning of some words like /**ŋombe**/. Syllable structures of Kiswahili and English are similar in that every syllable structure must contain a nucleus/vowel. Also, in both languages syllables are divided according to the vowels in a word. In both languages, the glottal fricative /h/ never occurs in the coda of a syllable. /h/ occurs only in syllable-initial position. / h / is a well-formed syllable onset in English (Harley, 2006). It is never found at the ends of syllables and hence never at the ends of words pronounced. Finally, both can form a syllable with the nucleus only in the words with onset and coda not being obligatory components. Therefore, Kiswahili specific phonological inventory is necessary so as to enhance the assessment of Kiswahili syllables.

Studies on syllable structure analysis of Standard Kiswahili loan words from modern Standard Arabic are present (Mwaliwa, 2014). Generative CV-Phonology model was applied to show the number of syllables in Kiswahili words, nucleus and syllable margins. Mwaliwa (2014) based her research on three tasks and two principles within this model. The tasks were: specifying well-formed expressions of the theory, specifying parameters governing syllable types choice and to specify language specific rules that govern syllabification. The two principles were core syllable division, which is dividing word into syllables and syllable transformation, which are the processes by which core syllable representations are transformed into the frequently distinct set of surface syllable trees. Every language has its own core syllable structure; however, the CV syllable type is found in all languages. Mwaliwa (2014) highlighted syllable structures present in Kiswahili. However, these syllable structures were based on

Kiswahili adult speech only. How children perform differently with regard to syllable structure is not studied.

Other syllable types are realised by application of different rules to CV syllable type (Clements and Keyser, 1983). For example, according to Mwaliwa (2014) if there's deletion of syllable initial C, V syllable type is obtained. CV is obtained by deletion of C at the end of CVC syllable type. All languages can either fall into these syllable type categories: (1) CV (2) CV, V (3) CV, CVC (4) CV, V, CVC, VC. CV syllable is made up of a consonant and a vowel; V syllable is made up of a vowel; CVC syllable structure is made up of a consonant, a vowel and consonant while VC is made up of a vowel and consonant. This study claims that, Kiswahili words of Bantu origin belong to the CV, V while loan words have CV, V CVC, VC syllable types. Kiswahili has consonant clusters at syllable initial and medial positions. Therefore, this study investigated if these syllables are also present among Kiswahili speaking children aged 3.0-6.0.

Sex was considered a possible variable that could cause variation in Kiswahili syllable structure competence among Kiswahili speaking boys and girls aged from 3.0-6.0. Research done on L2 Dutch learners, whose aim was to find out if there are gender differences in adult L2 acquisition, with regard to L1 differences revealed that gender had impact on speaking and writing proficiency (van der Slik et al., 2015). Despite L1 differences, female learners outperformed male learners. This gap was enhanced when individual characteristics, which impacted on L2 proficiency, such as education and type of mother tongue were taken into consideration. However, in reading proficiency, male learners scored slightly higher than female language learners but the differences were quite small. The gap between males and females widened due to many years of learning the L2 thus this impact was evident for speaking, writing, reading, and

listening proficiencies. The conclusions from the study by van der Slik et al. (2015) were that women use cognitive and meta-cognitive learning strategies than men. Considering the conclusions from van der Slik et al. (2015), this research on Kiswahili Phonological Inventory of Children Aged 3-6 regarded sex as an important aspect during the developed phonological inventory which was to be later used to assess phonological abilities of both boys and girls aged 3-6.

This research on Kiswahili phonological inventory of Children Aged 3-6, described syllable structures present among children aged 3-6 since studies on Swahili syllable structure among this age group are limited. The researcher considered sex as a possible variable that would cause difference in syllable structure performances within the age groups. There is limited research on Kiswahili syllable structures abilities between boys and girls aged from 3-6. As a result, the researcher investigated whether there are variations occurring in syllable structure performance within these age groups as a result of differences in sex.

2.2.2.3 Age and Phonological Inventory

Phonological processes are the last parameter represented in the phonological inventory. Studies have shown that as children advance in age, phonological processes reduce. According to Bowen (1998), all children make predictable errors as they learn how to talk like adults. When young, a child cannot speak with all sounds of an adult because it is too overwhelming for his or her brain. Thus the child's brain has to create rules that will simplify sounds in order to make words easier to say, hence phonological processes. Although this is a normal part for the child who is learning how to speak, these rules are out of the child's control hence the brain is doing it for him/her.

Stamp (1969) as cited by Ball and Gibbon (2013) states that, speech patterns are governed by an innate set of phonological processes. Therefore, all children, through the use of simplification process, are equipped to respond to the difficulties of speech production. When exposed to a certain language, children learn its phonological rules. As they move closer to adult speech their speech motor system also develop and they learn to inhibit certain processes. Towards the end of five years, a child's speech is closer to that of an adult. Thus, a phonological disorder presents itself when this simplifying process persists beyond the age at which they should be eradicated. The disorder severity is influenced by the number still present, the type of process, and pervasiveness of phonological processes.

Bowen (1998) stated that some of the phonological processes include: context sensitive voicing; velar fronting; word final devoicing; final consonant deletion; palatal fronting; consonant harmony; weak syllable deletion; cluster reduction; stopping; and gliding of liquids. She states that, although these processes are a normal part of speech development in children, they are supposed to disappear at a certain age. For example, context sensitive voicing where by 'pin' is realised as 'bin', is a phonological process that should disappear by the age of 3.0 while fronting where by 'can' is realised as 'tan', should disappear by 3.6.

Akinlabi (1995), stated that linguistic research in Africa has contributed to knowledge of phonological processes in general. Phonological processes studied most in African countries are morphological and phono tactical with regard to adult speech. There are limited studies on developmental phonological processes.

A study by Gangji et al. (2014) concerning collection of Kiswahili phonological standards for children aged 3.0-5.11 years was done in Dar es Salaam . They described the phonological inventory of these children in terms of phonemic catalogue, syllable structure and phonological processes. The common phonological processes were /r/ being realised as /l// for example:/*redio*/ realised as /*ledio*/ phoneme substitution; /*zawadi*/ realised as /*thawadi*/ weak syllable deletion; /*themanini*/realised as /*nini*/ and initial consonant deletion for example/ *nanasi*/ realised as /*anasi*/. However, these findings were standardized to Tanzanian Kiswahili speakers only. Studies that highlight phonological processes present among Kiswahili speaking Kenyan children aged 3-6 are not present. Therefore, in order to facilitate the development of standardised tool that would aid in assessment of phonology, this research investigated phonological processes that were present among this population so as to determine the course of normal phonological development.

Iribemwangi (2011) focused on phonotactical phonological processes characteristic to Kiswahili nasal consonants. Errors from the target sound made by children as they learn to grasp adult speech are not highlighted.

Studies highlighting developmental phonological processes for Kiswahili speaking Kenyan children are currently not present. As a result, this study described phonological processes made by Kiswahili speaking Kenyan children aged 3- 6 with the aim of developing a phonological inventory.

2.3 Theoretical Framework

This study was premised on Distinctive Features theory (Jakobson,1962) as used by (Hua and Dodd, 2006). Jakobson pioneered structural analysis of language during the first half of 20th century. This theory argues that phonemes should be contrasted by

describing properties of segments rather than by treating these segments as alphabetic entities. Jakobson developed methodology of analysing sound systems in languages thus constituting phonology as a field of study (Jakobson, 1962).

According to Caton (1987), distinctive features are defined as smallest units of linguistic structure that differentiate one phoneme from another. They are considered to be building blocks of speech thus larger units are built from these small units. The major aim of distinctive features theory is to establish a set of features that can adequately describe the segmental contrasts and phonologically important segment groups found in the world's languages (Caton, 1987).

Distinctive features are involved in the study of spoken language. They are specified by binary values. If a segment is described by a positive value [+] it denotes the presence of a feature, while a negative value [−] indicates its absence. Therefore, a feature that distinguishes one phoneme from another is considered to be a distinctive feature.

 Distinctive features are divided into categories that describe: major class features, laryngeal features, manner features, and place features. Major class features represent the major classes of sounds. They are [+/-consonantal] and [+/-sonorants]. [+consonantal] represents affricates, fricatives, plosives, nasals and laterals. They are produced with constriction in the vocal tract. Vowels, glides and laryngeal sounds are [-consonantal]. [+sonorant] represents vowels and sonorant consonants. They are produced without turbulence in the vocal tract. Therefore. [-sonorant] are produced with turbulence in the vocal tract.

According to Jakobson as cited by Rischel (1997), laryngeal features specify the glottal status during articulation of sounds. [+voice] signifies vibration of vocal cords during

articulation. For example, /s/ is [-voice] since it is articulated without vibration of vocal cords while /z/ is voiced since there is vibration of vocal cords during articulation. Manner features define how a sound is articulated (Rischel, 1997). For example, [+nasal] feature describes those segments that are articulated by lowering the velum so that air can pass through nasal tract. Place features specify place of articulation. For example, labial segments are articulated with the lips.

Hua and Dodd (2006), applied the tenets of Distinctive Features theory to SLT context so as to determine age appropriate consonant sounds, syllable structures and phonological processes. This research on Kiswahili Phonological Inventory of Kenyan Children Aged from 3-6, applied theoretical and methodological principles of Distinctive Features theory to develop a Kiswahili inventory in the Kenyan context. A list of 44 Swahili appropriate words with consonants in initial and medial positions were generated with the help of preschool teachers. These words were present in the vocabulary of preschool children and had various syllable shapes. These words were then matched with appropriate pictures. Typically developing bilingual Kiswahili speaking Kenyan children aged from 3-6 were then required to label the pictures verbally. In this study, a child's Kiswahili realisations were transcribed using IPA, present in appendix **7** and the consonants being studied allocated voice, place and manner features.

If the target consonants and syllables were spontaneously produced correctly or imitated by ≥90% of the children in a particular age group, they were included in their inventory. Phonological processes were included in an age groups inventory if they are produced by ≥10% of participants in that group. A 90% criterion is used because

estimates of children with speech disorders is 10% of the normal population (Hua and Dodd, 2006).

Distinctive features theory was relevant to this study since it guided the researcher to allocate voice, place and manner distinctive features to the studied Kiswahili consonants. It also facilitated easy identification of syllable shapes and phonological processes realised by the child. This theory was relevant to this study since the researcher only focused on children's speech. The articulated Kiswahili words had specific consonants in initial and medial positions that this research targeted. The exact child's realisation was transcribed with the aid of IPA chart and distinctive features allocated to speech sounds with regard to voice, place and manner features. These realisations were also compared to the target words so as determine syllable shapes and deviation (phonological processes) present in each age group

2.4 Conceptual Framework
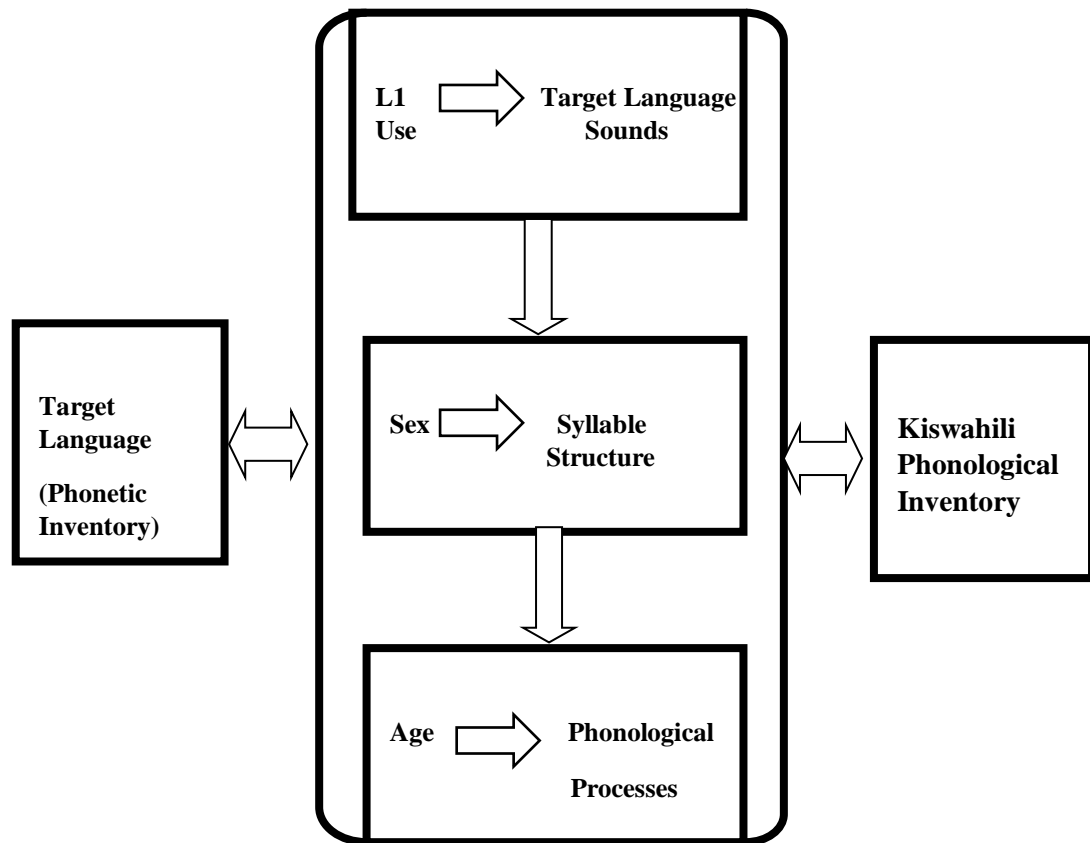
Figure 1: Kiswahili Phonological Inventory with respect to L1 frequentness, sex and age

Figure 1 portrays a conceptual framework showing the relationship between phonetics and phonology. Phonetics is the physical aspect of sounds. That is, what we hear and articulate. Phonology on the other hand is the mental representation of the articulated sounds present in a particular language and the rules that govern how sounds ought to combine so as to form meaningful words. These rules also govern how children at different ages simplify words thus phonological processes. Therefore, phonetics is a physical representation of the abstract phonological units. Further, figure 1 highlights what the parameters of a phonological inventory of a language should be. They include; target sounds of that particular language, syllable structures and phonological processes. This figure further portrays that; syllables structures are a combination of

different sounds of a given language. Also, phonological processes can only be determined from meaningful words which represent different syllable structures of a given language. In order to determine a Kiswahili phonological inventory, first Kiswahili consonants in initial and medial word positions were   used to form words which were articulated by children present in 3.0-3.6,3.6-4.0, 4.0-4.6,4.6-5.0, 5.0-5.6, 5.6-6.0 age groups. It was investigated whether the studied consonants and syllable structures were realised by children in each age group. Also, the type of phonological processes made by these children were also investigated. Consonants and syllable structures were considered to be part of an age group's catalogue if they were realised by≥90 percent of the children in that age group while a phonological process was considered to be part of their inventory if realised by≥10 percent of the children in the age group. In order to obtain Kiswahili phonological inventory, this study investigated if L1 frequentness use categories namely very rarely, rarely, sometimes and often caused variation in the target language consonant sounds present in the catalogue of each age group since the developed inventory will be used to assess children from different ethnicities. Variation in syllable structure present in these age groups due to sex categories namely boys and girls was also investigated since the inventory is intended to be used among different sexes. Finally, variation in phonological process present among the age groups due to age categories namely 3.0-3.6, 3.6-4.0, 40-4.6, 4.6-5.0,5.0-5.6,5.6-6.0 was also investigated because the inventory is to be used among children of different ages.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

The main question for this study was to analyse the Kiswahili consonant sounds, syllable structures and phonological processes among Kenyan children aged 3.0-6.0 with the aim of developing a Phonological Inventory (Hua and Dodd, 2006). This chapter mainly focuses on the research methodology that guided the study.   In particular, research design, area of the study, population of study, sample design, data sources, research instruments, validity and reliability, ethical considerations and data analysis methods were discussed.

3.1 Research Design

As a blue print, this study employed descriptive cross-sectional survey design. Descriptive cross sectional survey design was considered suitable because besides enabling the researcher to conduct a study with maximum control over factors that are likely to interfere with validity of findings, it also involves analysis of situation as it is without manipulation of data and also involves measurement, classification, analysis, comparison and interpretation of data (Kothari, 2004). In this study, participants were divided into different groups and test conducted on every member of each group to determine the phonological abilities present among the various groupings.

3.2 Area of the Study

The study was conducted in stand-alone ECDC centres of Nairobi County, Kenya. Nairobi is the capital city of Kenya located at latitude of 1.2921^0S and longitude 36.8219^0E. Nairobi County has an area of 696 km^2 comprising 17 parliamentary constituencies. According to 2009 census the county had a population of 3,138,369 people with density of 4,800/km^2. It is bordered by Kiambu County to the North,

Machakos County to the East and Kajiado County to the South. It is in this county where the study was conducted in 21 ECDE centres, namely; Upper Hill, Umoja I, Mugumo, Simba, Unity, Mwangaza, Bahati, Nairobi West, Kaloleni, Ofafa, Tana, Njoro, Mbotela, Ziwani, Starehe, Central, Parklands, Ngara East, Kileleshwa, State house and Lady Northey. Nairobi was considered adequate for this study since Bantu, Cushitic and Nilotic groups were given equal chance to participate in this study.

3.3 Population of the Study

The study targeted 2027 preschool children aged three to six years going to public stand alone nursery schools with normal development of speech. Three to six was considered adequate for this research since this is the critical age for phonological development. Also, most phonological disorders are detected at this age. The number 2027 was adopted from Nairobi city taskforce as shown in table 2. The target population according to age groups was distributed as shown in table 2.

Table 2*: Distribution of target population by age*

Age group	Number of pupils	Number of pupils (%)
3:0-3:6	338	16.67
3:6-4:0	340	16.77
4:0-4:6	351	17.32
4:6-5:0	380	18.75
5:0-5:6	372	18.35
5:6-6:0	246	12.14
Total	**2027**	**100.00**

Source: Adopted from Nairobi City Task Force Report on Education (2017)

3.4 Sample Design

In order to arrive at the required sample size, Yamane Taro model $n = \dfrac{N}{1 + Ne^2}$ cited by Israel (1992) was used. In the model, n is the required sample size, N is the population size, and e is the error margin. Assuming e = 0.05 then

$$n = \frac{2027}{1 + 2027(0.05)^2}$$
$$\approx 334$$

Proportionate distribution of the sample size to each group was done as shown in table 3.

Table 3*: Distribution of sample size by age*

Age groups	Number of pupils	Number of pupils (%)
3:0-3:6	55	16.67
3:6-4:0	56	16.77
4:0-4:6	58	17.32
4:6-5:0	63	18.75
5:0-5:6	61	18.35
5:6-6:0	41	12.14
Total	**334**	**100.00**

In order to reach the desired units, the study adopted a two-stage cluster sampling technique. Cluster sampling was considered adequate because it enabled the researcher to cover a relatively large area and also because of its ability to use inferential statistics, which informs this study (Ahmed, 2009). In the first stage, six out of twenty-one schools were chosen randomly from the cluster points, namely; Westlands, Starehe, Embakasi and Makadara. In Westlands and Makadara with six schools each a sample of two was randomly chosen from each of them. In Embakasi and Starehe with five and four schools respectively, a school was randomly chosen from each. In the second stage, pupils were randomly chosen in the six schools from the age groups specified in table 3.2. This was done until the desired number was reached. While conducting the study, the inclusion criteria considered children whose development progression was normal and were within the age bracket from 3.0 to 6.0. This was because the researcher was

expected to describe normal patterns of phonological development within the age bracket. The pupils within the age group were to be Kiswahili speakers who spoke other different types of mother tongue. The exclusion criteria considered pupils with oral cavity problems like cleft palate, toothlesness that is not age appropriate, communication difficulty, learning difficulty or other special needs. Also those with speech disorders, those with a history of hearing loss and neurological difficulties were excluded. Children who didn't speak Kiswahili were also excluded.

3.5 Data Types and Sources

Mainly, the study involved primary data which is data collected from first hand sources. First, primary data was collected from parents and then children in the chosen schools by assessing their phonology.

3.6 Data Collection Instruments and Procedures

The data collection instruments in this study were questionnaires and interview schedule which was accompanied by a picture booklet, scoresheet and a voice recorder. A questionnaire was considered appropriate for the study because : it was economical and supplied a considerable amount of research data at a relatively low cost; easy to arrange; standardized in answers, a questionnaire enabled all respondents to be exposed to exactly the same set of questions; and it provided pre-coded answers as they were designed (Denscombe, 2014). The questionnaires revealed straightforward information on views and beliefs of parents on children's L1. Questionnaires were used to gather information on child's date of birth, type of L1 spoken and frequentness of how often L1 is spoken at home.

The interview schedule was structured in such a way that the questions were in a standardized order and the interviewer did not deviate from the pre-set schedule. It also

included pictures and a score sheet. The child being interviewed was asked a question from the interview schedule and required to verbally label the pictures. Audio recording of the child's speech was done to facilitate future reference in order to make the exact transcription of the child's speech using the IPA chart, which was later entered into a score sheet.

3.7 Validity and Reliability of the Research Instrument

The research instruments were tested to check for content, construct and face validity (Mugenda and Mugenda, 1999). Content validity was done to ensure that contents of the instrument contained adequate sample of the domain of content it was supposed to represent. Face validity dealt with the format of the instrument and included aspects like clarity of printing, font size and type, adequacy of workspace, and appropriateness of language among others. Construct validity determined the nature of psychological constructs or characteristics measured by the instrument. Validity was ensured through the involvement of research supervisors. The instruments were given to the supervisors to evaluate and rate the items in relation to the objectives as very irrelevant or very relevant on 1-4 scale. Validity index was determined from the ratio $n_{3/4}/N$ as .78, where $n_{3/4}$ was the number of items rated 3 or 4 by supervisors, and N was the total number of items evaluated. The score was above the recommended minimum validity index of .70 and was therefore valid (Oso and Onen, 2009).

Reliability was tested through test -retest method (Carmines and Zeller, 1979). The researcher administered a phonological test to children, recorded and analysed the results. After three weeks, the researcher went back to the same school, administered 10 items of test to the same children and compared results with the previous finding. According Kline (2000), ten items are considered to be the minimum number for a test-retest in order to determine reliability index. According to Hair (2010) acceptable

number of participants to test a variable is ten and therefore the retest was administered to ten children in each group. The results turned out to be highly correlated with a correlation index of .76. The score was above the recommended minimum reliability index of .70 and therefore the tools were reliable (Oso and Onen, 2009).

3.8 Pilot Study

Pilot phase of this study was conducted so as to determine the workability of the research instruments which were questionnaire and interview schedule accompanied by audio recorder, score sheet and picture booklet. The pilot study was done in Kisumu because of its cosmopolitan nature since it ranks as the third most populous city in Kenya. This enabled the researcher to capture most ethnic groups during the pilot phase. Twelve children participated in the pilot study. Each group was allocated one girl and one boy. Parents of the studied children responded to the items in the questionnaire. According to Van Belle (2012), a number of 12 participants is adequate for a pilot study. Descriptive survey design was employed. Children were able to identify and verbally label the pictures and their realisations keyed into SPSS for analysis. The researcher noted that the younger children took more time in labelling these pictures. Parents adequately responded to the items in the questionnaire and their responses were then coded and keyed into SPSS. Therefore, discovery from pilot study spoke to the main research in that older children were to be studied first and the researcher was to study the youngest age group last so as to save time. Also, the selected tools collected the desired data during pilot study and the same tools could be used during ta main study.

3.9 Ethical Considerations

Before the administration of the research instruments, there was need to seek consent from relevant authorities. The consent to collect data was sought from the School of Graduate Studies, Moi University. Thereafter, research permit was sought from

NACOSTI. Authorization from City Hall to collect data in the stand alone nursery schools was sought. This was because the stand alone nursery schools in Nairobi County are managed by the county government. The researcher went to the field herself, sampled the schools then the children. Notice of intent to collect data was sent in advance to selected schools to make them aware of the activities. Since this research involved children, consent of their parents was sought. The selected children were contacted one on one by the researcher. The child's speech was recorded by a voice recorder, transcribed using IPA chart then scored on a score sheet. The questionnaires were picked by parents from school and dropped back after being filled.

3.10 Data Analysis Methods

Preliminary to entering data in Statistical Package for Social Sciences version 20 ready for processing, completed questionnaires and interview schedules were: edited for consistency; and coded to enable the responses to be grouped into appropriate categories. Both descriptive statistics and inferential statistics were used to analyse data. Descriptive statistics was used as preliminary analyses of hypotheses of the study. In particular, the mean and the standard deviation were used and results consequently presented through tables and bar charts adequately interpreted. In the first objective, descriptive analysis was conducted on exact children's articulation keyed into SPSS so as to determine the number of children that expressed a particular sound. The sound expressed by ≥ 90 percent of the kids was entered into the consonant inventory. In the second objective syllables structures present among various age groups were described. The syllable structure realised by ≥ 90 percent and phonological processes realised by ≥ 10 percent of the kids were considered to be part of their inventory. Inferential statistics was used to analyse the variation in Swahili phonological inventory among children from age three to six. Specifically, inferential statistics was used to: assess the

variation in acquisition of Kiswahili consonants due to frequentness of mother tongue use variable; compare syllable structures present in children of different sexes; and establish the variation in phonological processes with regard to age variable. Objectives one and three were particularly analysed through the F-statistics. This was particularly so because they involved the comparison of more than two groups. Objective two was analysed through the t-statistics. This was because it involved the comparison of two groups. The results were presented in well interpreted tables.

CHAPTER FOUR

DATA PRESENTATION AND INTERPRETATION

4.0 Introduction

In this section the tools used to collect raw data and the type of data collected are discussed. The main aim of this research was to develop a phonological inventory. Prior to confirmatory finding, a descriptive analysis of the children's realisations was done to determine consonants, syllable structures and phonological processes present in each age group. Consonants and syllable structures realised by ≥90% of the children was considered to be part of each age group. Phonological processes realised by ≥10% of the children was also considered to be part of each age group. Confirmatory findings were used to reject or not to reject the hypotheses.

4.1 Data Description

Prior to collecting data on exact realisations, parents were expected to fill questionnaires that were used to collect information on the age group a child belonged to, their sex, the L1 they spoke and how frequently they spoke the L1. However, out of 334 questionnaires that were distributed, only 66.17% (221) were properly filled. Table 4 below highlights the response rate.

Table 4: Response rate

Categories	Respondents	Respondents (%)
Response	221	66.17
None response	113	33.83
Total	**334**	**100.00**

Source: Survey data (2017)

Table 4 shows that out 334 questionnaires distributed 66.17% (221) were properly filled and returned. The non-response proportion accounted for 33.83% (113). According to

Mugenda and Mugenda (1999) a return rate of at least 50% is considered adequate for data analysis. In this regard the response rate for this survey was considered adequate to generate accurate results. With regard to age groups, the number of children that belonged to 3.0-3.6 age group were 40, those in 3.6-4.0 age bracket were also 40. Children in 4.0-4.6 age bracket were 41, those in 4.6-5.0 age group were 38, those in 5.0- 5.6 were 44 while those in 5.6-6.0 age bracket were 37. The data collected revealed that the number of boys was 124 while the girls were 116. L1s spoken by the children were categorised into broad groups of Bantu, Nilotic and Cushite. Data collected highlighted that there were 94 Bantu, 70 Cushitic and 76 Nilotic speakers. L1s were divided into these 3 major linguistic groups since languages under each group share common features in their linguistic patterns (Zerbian and Krifka, 2008). Table 5 highlights the number of L1 speakers present in each age group.

Table 5: L1 Groups

			Mother Tongue		
			Bantu	Nilotic	Cushitic
Age Group	3.0-3.6	Count	23	8	9
		Count (%)	57.5%	20.0%	22.5%
	3.6-4.0	Count	17	13	10
		Count (%)	42.5%	32.5%	25.0%
	4.0-4.6	Count	15	8	18
		Count (%)	36.6%	19.5%	43.9%
	4.6-5.0	Count	16	12	10
		Count (%)	42.1%	31.6%	26.3%
	5.0-5.6	Count	12	16	16
		Count (%)	27.3%	36.4%	36.4%
	5.6-6.0	Count	11	19	7
		Count (%)	29.7%	51.4%	18.9%
Total		Count	94	76	70
		Count (%)	39.2%	31.7%	29.2%

Table 6 highlights descriptive analysis of   how frequently these children spoke L1 under each age group. A total of 115 children spoke L1 very rarely, 44 spoke rarely, 40 spoke L1 sometimes,17 spoke often while 24 spoke very often.

Table 6: L1 Frequentness Use

			L1 frequentness use				
			Very rarely	Rarely	Sometimes	Often	Very often
Age group	3.0-3.6	Count	11	18	5	4	2
		Count (%)	27.5%	45.0%	12.5%	10.0%	5.0%
	3.6-4.0	Count	22	3	5	1	9
		Count (%)	55.0%	7.5%	12.5%	2.5%	22.5%
	4.0-4.6	Count	23	6	4	2	6
		Count (%)	56.1%	14.6%	9.8%	4.9%	14.6%
	4.6-5.0	Count	25	4	3	3	3
		Count (%)	65.8%	10.5%	7.9%	7.9%	7.9%
	5.0-5.6	Count	19	7	11	3	4
		Count (%)	43.2%	15.9%	25.0%	6.8%	9.1%
	5.6-6.0	Count	15	6	12	4	0
		Count (%)	40.5%	16.2%	32.4%	10.8%	0.0%
Total		Count	115	44	40	17	24
		Count (%)	47.9%	18.3%	16.7%	7.1%	10.0%

The researcher went further to investigate how each child realised all the words from the target list. These words had Kiswahili consonants in initial and medial word position. Each child was presented with a picture booklet and required to label these pictures verbally. A child's exact realisation for each word was entered into a score sheet. The data below highlights descriptive analysis various word realisations by these children under each age group so as to determine the response rate. Descriptive analysis of children's articulations with target sounds in initial and medial word positions was then done with the aid of IPA chart so as to determine varying realisations by these children. Sounds articulated $\geq$ 90 of the children in each age group were considered to be part of their sound system. Table 7 below shows different articulations of 'baiskeli' with /b/, a voiced bilabial plosive in initial word position, in each age group. There were 238/240 correct realisations of /b/ in initial position: 39 /40 correct realisations among 3.0-3.6 group,40/40 realisations among 3.6-4.0 group,41/41 correct realisation among 4.0-4.6 group,38/38 correct realisation in 4.6-5.0 group, 44/44 correct realisation in 5.0/5.6 group and finally 36/37 correct realisations in the 5.6-6.0 group.

Table 7: Realisations of /b/ in Initial Position

			/b/ Initial Child Articulation					
			baiskeli	baiki	aiskeli	bike	baikeli	baki
Age group	3.0-3.6	Count	30	6	1	2	1	0
		Count (%)	75.0%	15.0%	2.5%	5.0%	2.5%	0.0%
	3.6-4.0	Count	32	6	0	0	1	1
		Count (%)	80.0%	15.0%	0.0%	0.0%	2.5%	2.5%
	4.0-4.6	Count	30	10	0	1	0	0
		Count (%)	73.2%	24.4%	0.0%	2.4%	0.0%	0.0%
	4.6-5.0	Count	32	5	0	0	0	1
		Count (%)	84.2%	13.2%	0.0%	0.0%	0.0%	2.6%
	5.0-5.6	Count	34	5	0	4	1	0
		Count (%)	77.3%	11.4%	0.0%	9.1%	2.3%	0.0%
	5.6-6.0	Count	28	6	1	2	0	0
		Count (%)	75.7%	16.2%	2.7%	5.4%	0.0%	0.0%
Total		Count	186	38	2	9	3	2
		Count (%)	77.5%	15.8%	0.8%	3.8%	1.2%	0.8%

Table 8 shows realisations of /b/ in medial position. There were 236/239 correct realisation of medial /b/ with only one substitution with /mb/ cluster and /p/ among 3.0-3.6 age group. Therefore, /b/ in medial word position could be realised by the age of 3.0-3.6.

Table 8: Realisations of /b/ in Medial Position

			/b/ Medial Child Articulation			
			barabara	balabala	lambala	palapala
Age group	3.0-3.6	Count	37	1	1	1
		Count (%)	92.5%	2.5%	2.5%	2.5%
	3.6-4.0	Count	40	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%
	4.0-4.6	Count	41	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%
	4.6-5.0	Count	38	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%
	5.0-5.6	Count	44	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%
	5.6-6.0	Count	36	0	0	0
		Count (%)	97.3%	0.0%	0.0%	0.0%
Total		Count	236	1	1	1
		Count (%)	98.3%	0.4%	0.4%	0.4%

Table 9: Realisations of /d/ in Initial Position

			/d/ Initial Child Articulation
			Damu
Age group	3.0-3.6	Count	40
		Count (%)	100.0%
	3.6-4.0	Count	40
		Count (%)	100.0%
	4.0-4.6	Count	41
		Count (%)	100.0%
	4.6-5.0	Count	38
		Count (%)	100.0%
	5.0-5.6	Count	44
		Count (%)	100.0%
	5.6-6.0	Count	37
		Count (%)	100.0%
Total		Count	240
		Count (%)	100.0%

Table 9 above highlights 240/240 correct realisations /d/, a voiced alveolar plosive, in initial word position. This implies that this sound had already been acquired by children in the age bracket of 3.0-3.6.

There were also 239/240 correct realisations of /d/ in medial word position with one deletion of /d/ among 3.0-3.6 as highlighted in table 10 below.

Table 10: Realisations of /d/ in Medial Position

			/d/ Medial Child Articulation			
			mdomo	domo	muomo	Mduomo
Age group	3.0-3.6	Count	37	1	1	1
		Count (%)	92.5%	2.5%	2.5%	2.5%
	3.6-4.0	Count	39	1	0	0
		Count (%)	97.5%	2.5%	0.0%	0.0%
	4.0-4.6	Count	41	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%
	4.6-5.0	Count	38	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%
	5.0-5.6	Count	43	1	0	0
		Count (%)	97.7%	2.3%	0.0%	0.0%
	5.6-6.0	Count	37	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%
Total		Count	235	3	1	1
		Count (%)	97.9%	1.2%	0.4%	0.4%

Table 11 highlights different realisations of the target word 'fagio,' with /f/, a voiceless labiodental fricative, in initial word position. Among 3.0-3.6 there were 29/40 correct realisations of /f/ in initial word position. Apart from the target word, 9/40 children realised /f/ as medial sounds in words such 'kifagio' and 2/40 children deleted and substituted initial /f/ as in 'agio' and 'gagio' respectively. In 3.6-4.0 group there were 35/40 correct realisations. 4/40 were realised as medial /f/ as in 'kifagio' and one was a substitution with /g/ as in 'gagio.' Among 4.0-4.6, there were 27/40 correct realisations of /f/ in initial position. /f/ was medial sound in the remaining 13/40 realisations as in 'kifagio,' 'ufagio,' and 'kifangio.' Among 4.6-5.0 there were 23/36 correct realisations.13/36 were medial as in 'kifagio' and 'ufagio.' There were 25/44 realisations of 'fagio' among 5.0-5.6. 19/44 were medial as 'kifagio,' 'ufagio' and 'mfagio'. Finally, among 5.6-6.0 there were 21 correct realisations and 16 realisations of /f/ as medial.

Table 11: Realisations of /f/ in Initial Position

			/f/ Initial Child Articulation								
			fagio	io	kifagio	agio	ufagio	fangio	gagio	kifangio	mfagio
Age group	3.0-3.6	Count	27	1	8	1	1	2	0	0	0
		Count (%)	67.5%	2.5%	20.0%	2.5%	2.5%	5.0%	0.0%	0.0%	0.0%
	3.6-4.0	Count	33	0	4	0	0	2	1	0	0
		Count (%)	82.5%	0.0%	10.0%	0.0%	0.0%	5.0%	2.5%	0.0%	0.0%
	4.0-4.6	Count	27	0	8	0	4	0	0	1	0
		Count (%)	67.5%	0.0%	20.0%	0.0%	10.0%	0.0%	0.0%	2.5%	0.0%
	4.6-5.0	Count	23	0	8	0	5	0	0	0	0
		Count (%)	63.9%	0.0%	22.2%	0.0%	13.9%	0.0%	0.0%	0.0%	0.0%
	5.0-5.6	Count	25	0	16	0	2	0	0	0	1
		Count (%)	56.8%	0.0%	36.4%	0.0%	4.5%	0.0%	0.0%	0.0%	2.3%
	5.6-6.0	Count	21	0	16	0	0	0	0	0	0
		Count (%)	56.8%	0.0%	43.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total		Count	156	1	60	1	12	4	1	1	1
		Count (%)	65.8%	0.4%	25.3%	0.4%	5.1%	1.7%	0.4%	0.4%	0.4%

Table 12 below highlights the realisations of 'sufuria' with /f/ in medial position. There were 231/240 correct realisations. 38/40 were correct realisations among group 3.0-3.6. 38/40 realised correctly among 3.6-4.0. 41/41 were correct realisations among group with 4.0-4.6. Among 4.6-5.0, there were 38/38 correct realisations. There were 43/44 correct realisations among 5.0-5.6 and 37/37 correct realisations among 5.6-6.0. This indicated that /f/ could be realised by children in 3.0-3.6 age bracket.

Table 12: Realisations of /f/ in Medial Positions

			/f/ Medial Child Articulation					
			sufuria	ia	fufuria	ishia	Ufulia	kifuria
Age group	3.0-3.6	Count	34	1	2	1	1	1
		Count (%)	85.0%	2.5%	5.0%	2.5%	2.5%	2.5%
	3.6-4.0	Count	38	0	2	0	0	0
		Count (%)	95.0%	0.0%	5.0%	0.0%	0.0%	0.0%
	4.0-4.6	Count	41	0	0	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	4.6-5.0	Count	38	0	0	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	5.0-5.6	Count	43	0	0	0	1	0
		Count (%)	97.7%	0.0%	0.0%	0.0%	2.3%	0.0%
	5.6-6.0	Count	37	0	0	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total		Count	231	1	4	1	2	1
		Count (%)	96.2%	0.4%	1.7%	0.4%	0.8%	0.4%

Table 13: Realisations of /g/ in Initial Position

			/g/ Initial Child Articulation			Total
			gari	gali	ghari	
Age group	3.0-3.6	Count	40	0	0	40
		Count (%)	100.0%	0.0%	0.0%	100.0%
	3.6-4.0	Count	38	1	0	39
		Count (%)	97.4%	2.6%	0.0%	100.0%
	4.0-4.6	Count	41	0	0	41
		Count (%)	100.0%	0.0%	0.0%	100.0%
	4.6-5.0	Count	38	0	0	38
		Count (%)	100.0%	0.0%	0.0%	100.0%
	5.0-5.6	Count	44	0	0	44
		Count (%)	100.0%	0.0%	0.0%	100.0%
	5.6-6.0	Count	36	0	1	37
		Count (%)	97.3%	0.0%	2.7%	100.0%
Total		Count	237	1	1	239
		Count (%)	99.2%	0.4%	0.4%	100.0%

Table 13 above shows realisation of 'gari' which was used to test /g/ in initial word position.   There were 238/239 correct realisations of /g/ with only   one substitution with /gh/ among children aged 5.0-5.6.

Table 14: Realisations of /g/ in Medial Position

			/g/ Medial Child Articulation		
			Ugali	ughari	mgali
Age group	3.0-3.6	Count	40	0	0
		Count (%)	100.0%	0.0%	0.0%
	3.6-4.0	Count	39	0	1
		Count (%)	97.5%	0.0%	2.5%
	4.0-4.6	Count	41	0	0
		Count (%)	100.0%	0.0%	0.0%
	4.6-5.0	Count	38	0	0
		Count (%)	100.0%	0.0%	0.0%
	5.0-5.6	Count	44	0	0
		Count (%)	100.0%	0.0%	0.0%
	5.6-6.0	Count	36	1	0
		Count (%)	97.3%	2.7%	0.0%
Total		Count	238	1	1
		Count (%)	99.2%	0.4%	0.4%

Table 14 above shows 239/240 correct realisations of medial / g/ and one substitution with /gh/among 5.0-5.6 group. Therefore, /g/ had been acquired by age 3.0-3.6.

Table 15 below shows realisations of /h/, a voiceless glottal fricative, in initial word position as in the word 'hindi.' 239/240 correct realisations were present and one substitution of /h/ with/ d/ in 'dairi among 3.0-3.6. Hence /h/ had been acquired by children in 3.0-3.6 age group.

Table 15:Realisations of /h/ in Initial Position

			/h/ Initial Child Articulation	
			hindi	dairi
Age group	3.0-3.6	Count	39	1
		Count (%)	97.5%	2.5%
	3.6-4.0	Count	40	0
		Count (%)	100.0%	0.0%
	4.0-4.6	Count	41	0
		Count (%)	100.0%	0.0%
	4.6-5.0	Count	38	0
		Count (%)	100.0%	0.0%
	5.0-5.6	Count	44	0
		Count (%)	100.0%	0.0%
	5.6-6.0	Count	37	0
		Count (%)	100.0%	0.0%
Total		Count	239	1
		Count (%)	99.6%	0.4%

There were 226/240 correct realisations of /h/ in medial word position as shown in table 16 below. Medial /h/ was deleted in the remaining realisations as in' maindi,' 'dairi' and 'aidi.'

Table 16: Realisations of /h/ in Medial Position

			/h/ Medial Child Articulation				
			mahindi	maindi	dairi	aidi	11
Age group	3.0-3.6	Count	27	11	1	1	0
		Count (%)	67.5%	27.5%	2.5%	2.5%	0.0%
	3.6-4.0	Count	40	0	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%	0.0%
	4.0-4.6	Count	41	0	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%	0.0%
	4.6-5.0	Count	38	0	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%	0.0%
	5.0-5.6	Count	43	0	0	0	1
		Count (%)	97.7%	0.0%	0.0%	0.0%	2.3%
	5.6-6.0	Count	37	0	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%	0.0%
Total		Count	226	11	1	1	1
		Count (%)	94.2%	4.6%	0.4%	0.4%	0.4%

Table 17: Realisations of /k/ in Initial *Position*

			/k/ Initial Child Articulation		
			kiti	titi	chiti
Age group	3.0-3.6	Count	38	1	1
		Count (%)	95.0%	2.5%	2.5%
	3.6-4.0	Count	40	0	0
		Count (%)	100.0%	0.0%	0.0%
	4.0-4.6	Count	41	0	0
		Count (%)	100.0%	0.0%	0.0%
	4.6-5.0	Count	38	0	0
		Count (%)	100.0%	0.0%	0.0%
	5.0-5.6	Count	44	0	0
		Count (%)	100.0%	0.0%	0.0%
	5.6-6.0	Count	37	0	0
		Count (%)	100.0%	0.0%	0.0%
Total		Count	238	1	1
		Count (%)	99.2%	0.4%	0.4%

Table 17 above, with 238/240 correct responses, highlights the realisation of /k/ in

initial word position. There were only two substitutions with /t/ and /ʧ/ among 3.0-3.6.

Table 18: Realisations of /k/ in Medial Position

			/k/ Medial Child Articulation		
			nyoka	oka	noka
Age group	3.0-3.6	Count	38	1	1
		Count (%)	95.0%	2.5%	2.5%
	3.6-4.0	Count	40	0	0
		Count (%)	100.0%	0.0%	0.0%
	4.0-4.6	Count	41	0	0
		Count (%)	100.0%	0.0%	0.0%
	4.6-5.0	Count	38	0	0
		Count (%)	100.0%	0.0%	0.0%
	5.0-5.6	Count	43	0	0
		Count (%)	100.0%	0.0%	0.0%
	5.6-6.0	Count	37	0	0
		Count (%)	100.0%	0.0%	0.0%
Total		Count	237	1	1
		Count (%)	99.2%	0.4%	0.4%

Table 18 shows there were 239/239 correct realisations of medial /k/ cumulatively.

Therefore, /k/ was already present by age 3.0-3.6.

Apart from one deletion among 3.0-3.6, there were 239/240 correct realisation of /l/ in initial word position as shown in table 19 below.

Table 19: Realisations of /l/ in Initial Position

			/l/ Initial Child Articulation	
			leso	eso
Age group	3.0-3.6	Count	39	1
		Count (%)	97.5%	2.5%
	3.6-4.0	Count	40	0
		Count (%)	100.0%	0.0%
	4.0-4.6	Count	41	0
		Count (%)	100.0%	0.0%
	4.6-5.0	Count	38	0
		Count (%)	100.0%	0.0%
	5.0-5.6	Count	44	0
		Count (%)	100.0%	0.0%
	5.6-6.0	Count	37	0
		Count (%)	100.0%	0.0%
Total		Count	239	1
		Count (%)	99.6%	0.4%

Table 20 shows that there were 240/240 correct realisations of medial /l/

Table 20: Realisations of /l/ in Medial Position

			/l/ Medial Child Articulation	
			analala	alala
Age group	3.0-3.6	Count	38	2
		Count (%)	95.0%	5.0%
	3.6-4.0	Count	40	0
		Count (%)	100.0%	0.0%
	4.0-4.6	Count	41	0
		Count (%)	100.0%	0.0%
	4.6-5.0	Count	38	0
		Count (%)	100.0%	0.0%
	5.0-5.6	Count	44	0
		Count (%)	100.0%	0.0%
	5.6-6.0	Count	37	0
		Count (%)	100.0%	0.0%
Total		Count	238	2
		Count (%)	99.2%	0.8%

Table 21: Realisations of /m/ in Initial Position

			/m/ Initial Child Articulation			
			Mti	uti	uchi	muti
Age group	3.0-3.6	Count	38	1	1	0
		Count (%)	95.0%	2.5%	2.5%	0.0%
	3.6-4.0	Count	39	0	0	1
		Count (%)	97.5%	0.0%	0.0%	2.5%
	4.0-4.6	Count	41	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%
	4.6-5.0	Count	38	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%
	5.0-5.6	Count	44	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%
	5.6-6.0	Count	37	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%
Total		Count	237	1	1	1
		Count (%)	98.8%	0.4%	0.4%	0.4%

 Different realisations of /m/ in initial word position were depicted in table 21 above.

There were 238/240 correct realisations with 2/240 deletions of initial /m/.

Table 22: Realisations of /m/ in Medial Position

			/m/ Medial Child Articulation		
			samaki	tamaki	maki
Age group	3.0-3.6	Count	39	0	1
		Count (%)	97.5%	0.0%	2.5%
	3.6-4.0	Count	39	1	0
		Count (%)	97.5%	2.5%	0.0%
	4.0-4.6	Count	41	0	0
		Count (%)	100.0%	0.0%	0.0%
	4.6-5.0	Count	38	0	0
		Count (%)	100.0%	0.0%	0.0%
	5.0-5.6	Count	44	0	0
		Count (%)	100.0%	0.0%	0.0%
	5.6-6.0	Count	37	0	0
		Count (%)	100.0%	0.0%	0.0%
Total		Count	238	1	1
		Count (%)	99.2%	0.4%	0.4%

There were 239/ 240 correct realisations of medial /m/ as shown in table 22. One

realisation was 'maki' among 3.0-3.6 where /m/ was initial.

Appendix 8(a), in section B highlights the realisations of /n/, a voiced alveolar nasal in initial word position as use in the word 'nanasi.' There were 239/240 correct realisations of initial /n/ with only one deletion present among 3.0-3.6 age group. In appendix 8(b), 'mananasi was used to measure medial /n/ where there were 239/240 correct realisations with only one deletion among 3.0-3.6 as in 'mamaasi.' This implied that /n/ had already been acquired by 3.0- 3.6 age group.

The realisations of 'paka', with /p/, a voiceless bilabial plosive in initial word position, were as shown in appendix 9(a).' There were 239/240 correct realisations of initial /p/ with one deletion among 3.0-3.6. Appendix 9(b) shows medial /p/ realisations with 237/240 correct ones. There were three realisations of 'pila', two among the youngest group while one in 3.6-4.0. Realisations of /r/, a voiced alveolar trill, in initial word position, were highlighted in appendix 10(a). There were 238/240 correct realisations, with 1 deletion of initial /r/ and 1 substitution with /n/ in 3.0-3.6 group. Medial /r/ had 239/240 correct realisations / as shown in appendix 10(b). There was only one substitution with /l/was present among 3.0-3.6.

'Simba' was used to test initial /s/, a voiceless alveolar fricative, thus 239/240 correct realisations cumulatively and one deletion among 30-3.6 were present as shown in appendix11(a). Appendix 11(b) highlights realisations of medial /s/ with 212 correct realisations. There was 1 deletion as in 'muana' and /s/ was realised as an initial sound in 'sana' among 3.0-3.6. Appendix 12(a) shows realisations of initial /t/, a voiceless alveolar plosive, in the word target word 'taa.' There were 229 correct realisations while there were also 10 realisations as 'stima' where /t/ was in the cluster 'st.'   the 'stima' realisations were distributed as follows;2 in 4.0-4.6, 4 in 4.6-5.0 and 4 in 5.0-5.6. There were 239/240 correct realisations of medial /t/ as shown in appendix 12(b).

Appendix 13(a) shows the realisation of initial /v/, a voiced labiodental fricative, in 'viatu.' There were 239/240 correct realisations. Only one child in 3.0-3.6 group substituted /v/ with /ʧ/. The realisations of medial /v/ are depicted in appendix 13(b) with 213 correct realisations. One child in 3.0-3.6 and 24 among 3.6-4.0 realised /v/ as initial sound. Also, one child in 3.6-4.0 substituted medial /v/ with /z/. There were 238/239 cumulative correct realisations of initial /w/, a voiced labio-velar approximant, with only 1 deletion in 3.0-3.6 as shown in appendix 14(a). Medial /w/ was articulated correctly by all 240 participants as shown in appendix 14(b).

Initial /j/, a voiced palatal approximant, in 'yai' in appendix 15(a), had 238/240 cumulative correct realisations with only 2 medial realisations found in 3.0-3.6 group. Appendix 15(b) shows 240/240 correct realisations of medial /j/. Initial /z/, a voiced alveolar fricative, as shown in appendix 16(a), had 239/240 correct realisations with only one deletion among 3.0-3.6. Medial /z/ as in appendix 16(b) had 239/240 correct realisations with only one substitution with /s/ among3.0-3.6. Appendix 17(a) shows different realisations of initial /ŋ/, a voiced velar nasal. There were 198 /239 correct realisations with 29 among 3.0-3.6, 31 among 3.6-4.0,36 among 4.0-4.6, 31 among 4.6-5.0, 35 among 5.0-5.6 and 36 among 5.6-6.0. It was substituted with /m/ with 9 realisations among 3.0-3.6,8 in 3.6-4.0, 5 in 4.0-4.6. 3 in 4.6-5.0 and 1 in 5.0-5.6. There was one deletion and substitution with /g/among the youngest group. There were 13 substitutions with /ng/ with 1 in 3.6-4.0, 4 among 4.6-5.0 and 8 among 5.0-5.6. Appendix 17(b) highlights the realisations of medial/ ŋ/. 3.0-3.6 had 31/40 correct realisations.

Appendix 18(a) shows cumulative 237/240 correct realisations of initial /ʧ/, a voiceless alveolar affricate, indicating that it had been acquired by age 3.6. There 237 correct realisations of medial /ʧ/ as in appendix 18(b), with 1 deletion, 2 substitutions one with

/s/ and one with /t/ respectively all among the youngest group. Appendix 19(a) shows 237/240 correct realisations of initial /ɲ/, a voiced palatal nasal, with only 3deletions present among the youngest group. Medial /ɲ/ in the word 'nyanya' had 236/238 correct realisations as in appendix 19(b). There were only 2 substitutions with /n/ found among 3.0-3.6 age group. Appendix 20(a) shows 238/240 correct realisations of initial /ʤ/, a voiced alveolar affricate, with 1 deletion and 1 substitution with /ʧ/ found among 3.0-3.6. All 240 children realised medial /ʤ/ correctly as shown in appendix 20(b).

Initial /ʃ/, a voiceless post alveolar fricative, as in appendix 21(a) had 235/239 correct realisations. There were 2 deletions in group 3.0 3.6 and also substitution with /s/ among the youngest and also 4.6-5.0 groups. Medial /ʃ/ as in appendix 21(b) had 234 /238 correct realisations. There were 2 deletions in 3.0-3.6 and 2 substitutions with /s/ in 3.0-3.6 and 4.6-5.0 groups respectively. Appendix 22(a) highlights the realisations of /ɵ/, a voiceless dental fricative, in initial word position. There was a total of 79/240 correct realisations;3.0-3.6 had 2/40 correct realisations, 3.6-4.0 had 3, 4.0-4.6 had 4, 4.6-5.0 had 18, 5.0-5.6 had 26 while 5.6-6.0 had 26 correct realisations. Appendix 22(b) highlights realisations of /ɵ/ in medial position. There were 77/240 correct realisations. 3.0-3.6 had 1 correct realisation, 3.6-4.0 had 4, 4.0-4.6 had 2, 4.6-5.0 had 18, 5.0-5.6 had 24 while 5.6-6.0 had 28 correct realisations. Therefore, /ɵ/ was not present in any of the ages group's sound system.

4.2 Data Analysis

The current study on developing Kiswahili Phonological Inventory was based on three main hypotheses: there is no statistically significant variation in mean scores of children with different L1 speaking frequentness that would cause differences in Kiswahili sound system; there is no statistically significant variation in mean syllable structures among children of different sexes; there is no statistically significant variation in mean

scores of children with different ages in phonological processes. Data was analysed, presented and interpreted. This chapter began with descriptive analysis of realisations to determine response rate. Sounds realised by $\geq 90\%$ of the children in a particular age group were considered present in their Kiswahili sound system. ANOVA test was then conducted to confirm that how frequently children spoke L1 did not cause variation in their Kiswahili sound system thus hypothesis not rejected. Further, descriptive analysis was done do determine syllable structures (consonant-vowel combinations) present among these age groups. Consonant-vowel combinations realised by $\geq 90\%$ of the children in a particular age group were considered present in their phonological system. The tested consonant-vowel combinations remained consistent among all the age groups. T –test was then done to determine consonant-vowel combinations did not vary between boys and girls hence hypothesis not rejected. Descriptive analysis was done on these children exact realisations to determine the misarticulations present. Misarticulations realised by $\geq 10\%$ of these children were considered to be part of their performance. Descriptive findings revealed that misarticulations reduced as children progressed in age. ANOVA Test confirmed that indeed age had an impact on how children misarticulated words and thus the hypothesis rejected.

4.2.1 There is no statistically significant variation in mean scores of children with different L1 speaking frequentness that would cause differences in Kiswahili sound system

Prior to testing the above hypothesis, an analysis of phonetic aspects of Kiswahili sounds was done. A consonant was included in an individual child's inventory if it was produced either spontaneously or on imitation. Imitated sounds were accepted as evidence of articulatory competence. The speech sounds that were spontaneously produced correctly or imitated by $\geq 90\%$ of the children in each age group were included

in their sound system. A 90% criterion was used because estimates of children with
speech disorders is 10% of the normal population (Enderby and Phillipp,1986).

Table 23(a) below highlights Kiswahili consonant sounds present in each age group

Table 23(a): Kiswahili Sounds present in Each Age Group

	Age					
	3.0-3.6	3.6-4.0	4.0-4.6	4-6-5.0	5.0-5.6	5.6-6.0
Sounds present	p, b, t, d, h, k, g, f, v, l, r. m, n, s, z. w, y, ʤ ɲ, ʃ	p, b, t, d, h, k, g, f, v, l, r. m, n, s, z. w, y, ʤ, ɲ, ʃ, ʧ,	p, b, t, d, h, k, g, f, v, l, r. m, n, s, z. w, y, ʤ, ʧ, ɲ, ʃ	p, b, t, d, h, k, g, f, v, l, r. m, n, s, z. w, y, ʤ, ʧ, ɲ, ʃ	p, b, t, d, h, k, g, f, v, l, r. m, n, s, z. w, y, ʤ, ʧ, ɲ, ʃ	p, b, t, d, h, k, g, f, v, l, r. m, n, s, z. w, y, ʤ, ʧ, ɲ, ʃ, ŋ

Table 23(b): Age at Which Consonants Were Present

Age					
3.0-3.6	3.6-4.0	4.0-4.6	4.6-5.0	5.0-5.6	5.6-6.0
/p/					
/b/					
/t /					
/d/					
/h/					
/k/					
/g/					
/m/					
/n/					
/ɲ/					
					ŋ
/ʤ/					
	ʧ				
/l/					
/r/					
/w/					
/j/					
/f/					
/v/					
/ʃ/					
/s/					
/z/					

The shaded parts in table 23(b) represent age at which the speciefic sounds had already been acquired. According to table 23(b) /p, b, t, d, h, k, g, f, v, l, r. m, n, s, z. w, y, ʤ ɲ, ʃ/ had already been acquired by children in the age group of 3.0-3.6. / ʧ/ had been acquired by age3.6- 4.0. / ŋ/ was only present in the sound system of children aged from 5.6-6.0 while /ɵ/ had not yet been acquired by children aged from 3.0-6.0.

In order to test the above hypothesis, analysis of variance test was further conducted to explore if how frequently these children spoke L1 caused variation in the way Kiswahili sounds are realised. In order to test the hypothesis, variation in mean phonetic sound system was considered under five different mother tongue speaking intensities namely; very rarely, rarely, sometimes, often and very often. The results are shown in figure 2.

	Very rarely	Rarely	Sometimes	Often	Very often
■ Mean	4.83	4.71	4.83	4.87	4.81
▪ Std. Deviation	0.17	0.51	0.14	0.15	0.09
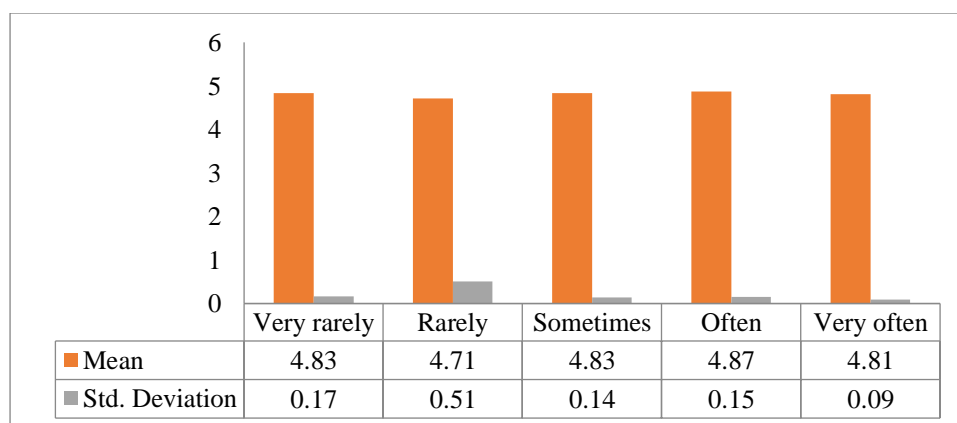
Figure 2: Descriptive analysis of Kiswahili Phonetic Sound System of children with different mother tongue speaking intensities
Source: Survey data (2017)

Figure 2 shows the descriptive analysis of Kiswahili sound system among children with different mother tongue speaking intensities: very rarely (M=4.83; SD=.17); rarely (M=4.71; SD=.51); sometimes (M=4.83; SD=.14); often (M=4.87; SD=.15); and very often (M=4.81; SD=.09). The variations in the mean values of Kiswahili Phonetic sound system among children of different mother tongue speaking intensities were

small. Moreover, the standard deviations of different levels of intensities were very low showing consistencies in scores of the children. In order to ascertain the consistencies in scores, analysis of variance was explored. The results are shown in table 24.

Table 24: ANOVA results for Kiswahili phonetic Sound system of children with different mother tongue speaking intensities

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.570	4	.143	2.044	.089
Within Groups	15.138	217	.070		
Total	15.708	221			

Source: Survey data (2017)

Table 24 shows $F_{(4,217)} = 2.044; p > .05$. The null hypothesis was not rejected. There was no statistically significant difference in Kiswahili Phonetic sound system mean scores for the five different levels of mother tongue speaking intensities studied. The actual difference in mean scores between different mother tongue speaking intensity levels was quite small as only 0.3% of the variance in Kiswahili sound system attributed to mother tongue speaking intensities. Since how frequently these children spoke L1 did not cause variation in their Kiswahili sound system highlighted in table 23(a), this implies that the sound system in table 23(b) is part of the phonological inventory of Kiswahili speaking Kenyan children aged 3.0-6.0.

4.2.2 There is no statistically significant variation in mean syllable structures among children of different sexes

Prior to testing the above hypothesis, the researcher studied how the Kiswahili target sounds in initial and medial word positions combined with other sounds so as to form meaningful words. This research investigated how the target words with specific consonant-vowel combinations were realised by these children. Therefore, descriptive analysis of these children's exact realisations was done so as to determine different

sound combinations that were present in their inventory. Findings showed that CV, CCV, CVV, CVCVV, CVCVCV, CCVCVCV, CVCV, CVCCVCV, VCVCV, CVCVCVCV combinations were present in all the age groups. Table 25 highlights consonant vowel combinations produced by 3-6 year olds.

Table 25: Kiswahili Consonant-vowel combinations

No.of Syllables	Syllable	example	Age group					
			3.0-3.6	3.6-4.0	4.0-4.6	4.6-5.0	5.0-5.6	5.6-6.1
1	*CV*	*Taa*	+	+	+	+	+	+
1	C-CV	Mti	+	+	+	+	+	+
2	CV-V	Yai	+	+	+	+	+	+
3	CV-CV-V	mayai	+	+	+	+	+	+
3	CV-CV-CV	maziwa	+	+	+	+	+	+
3	C-CV-CV-CV	mvulana	+	+	+	+	+	+
2	CV-CV	Paka	+	+	+	+	+	+
3	CVC-CVCV	daktari	+	+	+	+	+	+
3	V-CV-CV	Ugali	+	+	+	+	+	+
4	CV-CV-CV-CV	themanini	+	+	+	+	+	+

In order to test the above hypothesis, T- test was conducted by the researcher so as to explore the variation in consonant-vowel combinations among children of different sexes. Two different sexes, namely; boy and girl were considered. The null hypothesis was, "there is no statistically significant variation in mean syllable structures among children of different sexes." Descriptive results of the analysis are shown in figure 3

	Girls	Boys
Mean	4.83	4.78
Std. Deviation	0.13	0.35
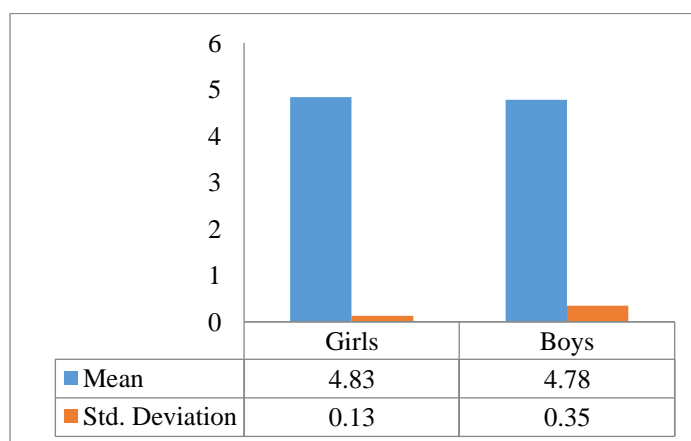
Figure 3*: Descriptive analysis of syllable structures in children of different sexes
Source: Survey data (2017)

Figure 3 shows that the descriptive scores in consonant-vowel combinations for children of -different sexes. The mean syllable structures were: girls (M=4.83, SD=.13); and boys (M=4.78, SD=.35). The results reveal that girls had superior syllable structure than boys. To ascertain this T-test was explored and the results shown in table 26.

Table 26: T-test results for syllable structures in children of different sexes

	Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Equal variances assumed	3.860	.051	1.447	220	.149	.05166	.03570	-.01870	.12202
Equal variances not assumed			1.437	137.431	.153	.05166	.03595	-.01942	.12274

Source: Survey data (2017)

Table 26 and figure 3 show that on average girls (M=4.83; SD=.13) had better syllable structures than boys (M= 4.78; SD=.35). The difference, .05, 95% CI [-.0187, .12202] was not significant T (220) = 1.447; p>.05 two tailed. Therefore, the hypothesis was not rejected since only a very small size effect as only .09% of the variance in consonant-vowel combinations could be explained by sex. Since sex had no impact on the different syllable structures, table 25 therefore highlights the syllable structures present among children aged from 3.0-6.0years.

4.2.3 There is no statistically significant variation in mean scores of children with different ages in phonological processes

Since varying realisations of the target words was evident, this research investigated age-specific misarticulations that occur within the studied Kiswahili syllable structures, resulting in age-specific phonological processes present among 3.0-6.0 year olds. These

misarticulations included; deletions, cluster reductions, additions, substitutions and consonant harmony

4.2.3.1 Deletions and cluster reduction

There were different realisations of the word 'baiskeli,' with initial /b/, across the different age groups. Misarticulations were in realisations such as: aikeli, baikeli, baiki and bike among 3.0-3.6 group. These misarticulations were deletion of/b/ in 'aikeli' which is a voiced bilabial plosive. There was also cluster reduction of /s/in 'sk' cluster in 'aikeli' and 'baikeli'. In 'baiki,' there was also deletion of /e/, a close-mid front unrounded vowel and /l/ a voiced alveolar lateral. The realisation of baiskeli as baiki was most common among the 4.0-4.6 but also minimally present in the rest of the groups. Instead of realizing the target word 'barabara' correctly, one child realised is as 'lambala,' thus there was deletion of initial /b/, /a/ and /r/ sounds and introduction of/mb/ cluster. The word 'mdomo,' with medial /d/, was also realised as 'domo' among 3.6-4.0,4.0-4.6, and 5.0-56 groups, thus cluster reduction of /m/ in the /md/ cluster

Among 3.0-3.6, the word 'fagio, with initial /f/, was also realised as 'agio,' 'fangio,' 'kiagio,' 'io,' 'kifangio,' 'mfangio' and 'ufagio' respectively. There was deletion of /f/, which is a voiceless labiodental fricative in the 'agio' realisation. During the realisation of 'kiagio,' there was also deletion of /f/. Some children realised 'fagio' as 'io' thus deletion of /f/ /a/ /g/ sounds respectively. During realisation of 'sufuria, with medial /f/,' there were no misarticulations among 4.0-4.6, 5.0-5.6 and 5.6-6.0 groups. Among4.6-5.0, only one child made the 'sfuria' realisation thus omission of /u/ vowel. Other realisations were 'ia' and 'ishia.' During the realisation of 'ia,' there was deletion of /s/, /u/, /f/ sounds respectively. In 'ishia,' there was deletion of /s/, /u/, /f/ and /r/ sounds while at the same time addition of /ʃ/.

Apart from the correct realisation of 'hindi,' with /h/ in initial word position,it was realised as 'dairi' among the youngest age group thus complete distortion of the taaget word. 'Mahindi' with medial /h/ ,which was the target word, was also articulated as: 'aidi' and dairi thus deletion of /m/ ,/n/ and /h/ consonats. 'Mahind' realisation was also made hence ommission of the final /i/ vowel. There was also 'maindi' hence deletion of /h/, a voiceless glottal fricative. There was only one realisation of 'mahind' among 4.6-5.0 hence deletion of final vowel /i/.

The word 'nyoka' with medial /k/ was also realised as 'oka' thus deletion of /ɲ/. In 'leso,' with initial /l/, there was deletion of /l/ thus 'eso,' amongst the youngest group. Amongst the youngest group, 'analala' was also realised as 'alala' thus deletion of /n/ and /a/ sounds. The rest of the groups did not have misarticulations with these words. The word 'nanasi' was used to test/n/ in initial word psition. However 'nasi' realisation was present hence weak syllable deletion. There was also weak syllable deletion when 'mananasi' with medial /n/ was realised as 'manasi.' Among all age groups , 'paka,' with initial /p/ was either articulated as 'paka' or 'pusi.' In the 'pusi' realisation , there was deletion of /k/ and /a/. 'Mpira,' with /p/ in medial position was also realised as pita,' thus cluster reduction. 'Redio,' with initial /r/ was also articulated as 'edio' thus deletion of /r/ amongst the youngest group. The word 'daktari' with medial /r/, was realised correctly amongst ages 4.0-6.0. misarticulations amongst 3.0-4.0 year olds were in realistions such as 'tali' , 'tari' and 'datari.' In 'tari' there was weak syllable deletion. In datari there was cluster reduction in that, the consonant /k/ was deleted from 'kt' cluster.

In 'simba' with initial /s/, realisation such as 'imba' was made among the youngest group, such that there was deletion of /s/ . Some children in 3.0-36 age bracket had difficulties with realizing the word 'msichana, with medial /s/. The misarticulations

included, mchana and muana. In mchana, there was deletion of /s/ and /i/ sounds respectively. In muana, there was deletion of /s/, /i/ and /ʧ/sounds and addition of /u/.

'Kitanda' with medial /t/ was realised as 'kianda' amongst the youngest age group, thus deletion of /t/ consonant. Other realisations of 'thamanini' with / ɵ/ in initial word position included 'mamanini,' where there was deletion of /ɵ/ and also redublication of 'ma' syllable. There was weak syllable deletion in the realisation'nini.' Nyumba, with initial /ɲ/ which was the target word was also realised as 'umba and uba.' In 'umba,' there was deletion of /ɲ/ while in 'uba' there was deletion of /ɲ/ and reduction of /m/in /mb/ cluster. Some children within the youngest age group also had difficulty with realizing 'jua' with /ʤ/ in initial word position. Some realised it as 'u' where there was deletion of /ʤ/ and final consonant /a/ and /ʤ/. 'Shamba' was also realised as 'aba' and 'amba.' In 'aba,' there was deletion of/ ʃ/ and cluster reduction of /m/ consonants. In 'amba,' there was deletion of / ʃ/ only. Some children in 3.0-3.6 age bracket realised 'mashavu' as 'asavu, avu, maavu and masavu. In 'asavu,' there was deletion of /m/ and substitution of / ʃ/ with /s/. in 'avu, there was weak syllable deletion.

4.2.3.2 Additions

Apart from target word 'mdomo,' there were realisations such as 'mduomo' thus addition of /u/, a close back rounded vowel; apart from cluster reduction of /d/ in /md/ cluster, in the word 'muomo,' there was addition of /u/ sound. During the realisation of 'kiagio,' there was addition of /k/, a voiceless velar plosive; /i/ a close front unrounded vowel. There was addition of /k/ /i/ and substitution of /g/ with/ng/, in 'kifangio.' In 'mfangio,' there was addition of /m/ to form 'mf' cluster. Finally, there was addition of /u in 'ufagio'. In 'Mgagio, 'there was addition of /m/ to form /mf/ cluster; and 'ufagio' were also present among 5.0-5.6 thus addition of /u/. 'kifagio, with addition of /k/ and /i/ sounds respectively, was common among all the ages. Apart from the correct

realisation of 'mti , with initial /m/,other realisations included ',miti' and 'muti' thus addition of /i/ and /u/vowels respectively. In other realisations such as 'uchi and 'uti, apart from deletion of /m/ there was addition of /u/'. 'Samaki' with /m/ in medial word position was also articulated as ' maki' hence deletion of weak syllable /sa/. Redublication as in 'nananasi' was also present during the realisation of 'nanasi, with /n/ in initial word position. In 'mananasi' with medial /n/ redublication was present in words in 'manananasi' while consonant harmony was present in 'mamanasi'

4.2.3.3 Substitutions

Apart from the correct realisation 'barabara, 'with medial /b/ there were realisation such as 'palapala' among 3.0-3.6. In this word /b/ was substituted with /p/, a voiceless bilabial plosive, thus devoicing. The /r/ sound, which is a voiced alveolar trill, was also substituted by /l/, a voiced alveolar lateral sound. 'Balabala' realisation which reduced in number of realisations as age increased, was common among all the age groups thus substitution of /r/ with /l/. There was one child who realised it as 'lambala,' thus substitution of final /r/ with /l/. There was substitution of /g/ with /ng/ in 'fangio and 'mfangio.' 'Gagio' was only common among3.6-4.0 thus velarisation of /f/ fricative. There was also 'sufulia' realisation apart from 'sufuria' which was the target word among 3.6-4.0 thus substitution of /r/ with /l/. Other Substitutions made by children in 3.0-3.6 were present in realisations such as 'fufulia,' 'fufuria,' 'kifuria,' and 'ufulia.' In 'fufulia,' there was substitution of /s/, a voiceless alveolar fricative with/f/, a voiceless labiodental fricative. /r/ was also substituted with /l/. In 'fufuria,' there was substitution of /s/ with/f/. /k/ and /i/ in 'kifuria' realisation, substituted /s/ and /u/ and there was substitution of /r/ with /l/ in 'ufulia.' In the word 'gari' with initial /g/, there were no misarticulations from 4.0-4.6 to 5.0-5.6 age groups. There was one 'ghari' realisation

among 5.6-6.0 thus substitition of /g/ with /gh/. There was 'gali' articulation from 3.0-4.0 thus substitution of /r/ with /l/.

Apart from 'Ugali' which was the target word, with medial /g/ was 'Mgali' realisation present among 3.0-4.0 thus substitution of /g/ with /mg/ cluster. Finally, there was one 'ughari' articulation thus substitution of /g/ with /gh/ among 5.6-6.0 age group. There were 'chiti and titi' realisations of the target word 'kiti,' with initial /k/ among the youngest group. Hence fronting and consonant harmony misarticulations were evident. In the word 'nyoka,' with medial/k/, there were 'noka ' realisation, thus substitution of /ɲ/, a voiced palatal nasal with /n/, a voiced alveolar nasal. 'Tamaki' was the aternative realisation of 'samaki with /m/ in medial word position hence there was stopping of the /s/ voiceless alveolar fricative. Apart from the correct realisation of 'mpira', there was 'mpita' realisation hence was stopping of /r/ . The word 'daktari' which was to test /r/ in medial word position was realised as 'daktali' thus /r/ was substituted with /l/. Realisation of 'thamanini,' with initial /ɵ/ was hard work for all the age groups but more taxing on the youngest group. The following misarticulations were present in all groups but reduced with age increase: 'samanini,' hence substitution of /ɵ/, a voiceless dental fricative with /s/, a voiceless alveolar fricative. 'Pamanini' realisation was also present with /ɵ/ substituted with /p/. In 'kamanini,' /ɵ/ was substituted with /k/ thus velarization. In 'talamini,' /ɵ/ was substituted with /t/ thus alvelarization of a dental sound. Also /m/ was substituted with /l/ hence lateralization of a bilabial consonant. In 'kamalini' /ɵ/ was substituted by /k/ sound thus velarization of a dental consonant. Also, a nasal sound,/n/ was substituted by a lateral sound /l/. There was complete distortion of the correct word in realisations such as 'kalapini' and 'kalakini.' In 'kalapini,' there was substitution of /ɵ/ with /k/ and also additions of /l/ and /p/ consonants. In 'kalakini,' apart from substitution of the dental sound with /k/, there

was addition of /l/ sound and also velarization of /n/. During 'kamamanini' realisation, apart from /k/ substituting dental /ɵ/, there was also redublication of 'ma' syllable. In 'kananini, substitution was evident. Apart from substitution of /ɵ/ with /k/, /m/, a bilabial nasal was was substituted by /n/, a velar nasal. In kalamini, /m/ a bilabial nasal was substituted by an alveolar lateral. There was voicing of /ɵ/ in 'dhamanini.

Misarticulations were noted in all age groups during articulation of 'thalathini', with medial /ɵ/. These phonological proceses reduced as age increased. In 'alatini' apart from deletion of initial /ɵ/ there was substitution of medial /ɵ/ with /t/ sound, thus alveolirization of a dental sound. In 'dalapini,' initial dental consonant was substituted with /d/ while medial dental sound substituted with /p/ which is a voiceless bilabial plosive. There was voicing of initial and medial /ɵ/ dental consonants during realisation of 'dhaladhini.' In 'dhalatini' medial /ɵ/ was substituted by /t/ while the initial was voiced. In 'kalatini,' medial was substituted by /t/ while initial by /k/. In 'kalakili,' both initial and medial dental sounds were substituted by /k/ consonant. The /n/ consonant was also substituted with /l/. In 'kalapini,' medial dental sound was substituted by /p/ while initial by /k/. There were complete distortions in the word such as, 'pafalini,' where initial /ɵ/ was substituted by /p/; /l/ substituted with /f/ and medial /ɵ/ with /l/. In 'talafini,' medial dental sound was realised as /f/, a labiodental fricative while initial as /t/. In 'taratini,' initial and medial /ɵ/ were substituted by /t/ while /l / was substituted by /r/. In 'chua', an alternative realisation of 'jua' /ʤ/ a, voiced post-alveolar affricate was substituted by/ʧ/, a voiceless post-alveolar affricate. Phonological process present in the realisation of 'samba,' which was a is-realisation of 'shamba,' with /ʃ/ initial word position was substitution of /ʃ/ with /s/. In 'masavu,' there was substitution of medial / ʃ/ with /s/.

Table 27 below highlights age appropriate misarticulations elicited by ≥ 10 percent of

the children in each age group

Table 27: Age-Speciefic Kiswahili misarticulations

Misarticulations	Target word	examples	3.0-3.6	3.6-4.0	4.0-4.6	4.6-5.0	5.0-5.6	5.6-6.0
Syllable reduction	baiskeli	baiki	▇					
Addition: of /ki/syllable	fagio	kifagio	▇	▇	▇			
Deletion: of /h/	mahindi	maindi	▇					
Consonant harmony: of /ma/ syllable	mananasi	mamanasi	▇	▇				
Deletion: of /l/	mvulana	mvuana	▇					
Substitution of/ nz/ with /mz/	nzi	mzi	▇					
Epenthesis: addition /i/	nzi	inzi	▇	▇	▇	▇	▇	▇
Fronting: Substitution of/ŋ/ with /m/	ngombe	mombe	▇	▇	▇			
Syllable reduction	chapati	chapo	▇					
Backing (Substitution /ө/ with /k/)	thamanini	kamanini	▇	▇	▇	▇		
Stopping (substitution/ө/ with /t/	thamanini	tamanini	▇	▇	▇	▇	▇	▇
Stopping(Substituting initial /ө/ with /k/ & medial /ө/ with /p	thalathini	kalapini	▇	▇	▇	▇	▇	
Stopping(substitution/ө/ with /p/)	thalathini	palapini	▇	▇				
Kalatini (Substituting medial /ө/ with /t/)	thalathini	kalatini		▇	▇			
Stopping((Substituting initial /ө/ with /t/) Labialization(Substituting medial /ө/ with /f/)	thalathini	talafini	▇	▇				
Stopping((Substituting initial /ө/ with /k/) Labialization(Substituting medial /ө/ with /f/	thalathini	Kalafini		▇				

Syllable reduction present in the realisations /baiki/ and /chapo/ may have been attributed to the child's environment since baiskeli is mostly referred to as / bike/ or /baiki/ by adults while most Kenyans refer to chapati as /chapo/. This phonological process was only present among the youngest group. ≥ 10 percent of children did not articulate the words /baiskeli/ and /chapatti/ even on imitation. Addition of the/ki/ syllable to 'fagio' may also have been attributed to the child's environment since most individuals refer to broom as /kifagio/. However≥ 10 percent of children in 3.0-4.6 age group did not articulate 'fagio' even on imitation.

Analysis of variance test was then conducted to explore the variation in misarticulations in children of different ages. The null hypothesis was, "there is no statistically significant variation in mean scores of children with different ages in phonological processes." In order to test the hypothesis, variation in mean misarticulations were considered in six different age groups, namely; 3.0-3.6; 3.6-4.0; 4.0-4.6; 4.6-5.0; 5.0-5.6; and 5.6-6.0.

	3.0-3.6	3.6-4.0	4.0-4.6	4.6-5.0	5.0-5.6	5.6-6.0
Mean	4.59	4.76	4.81	4.86	4.9	4.91
Std. Deviation	0.56	0.14	0.067	0.093	0.096	0.086
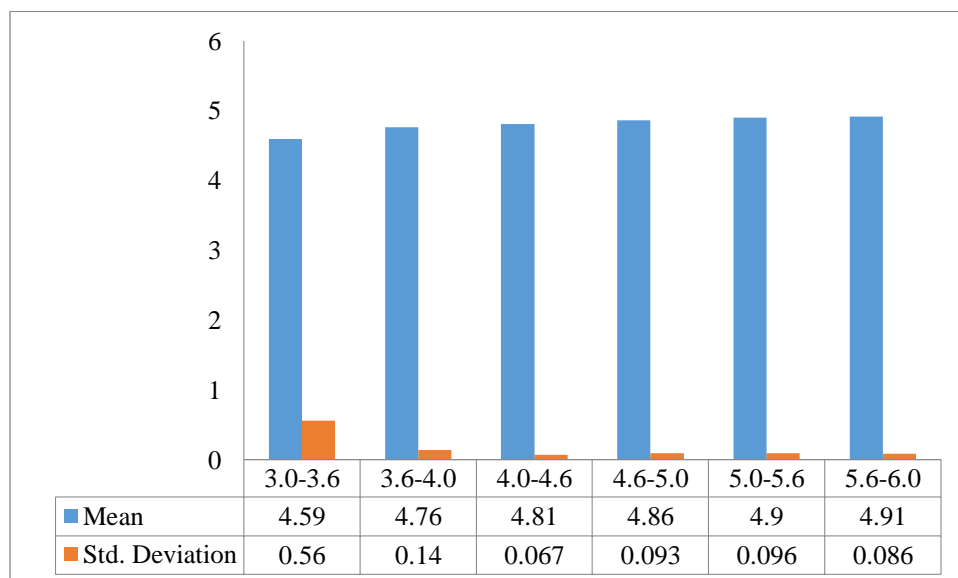
Figure 4: Descriptive analysis of misarticulations in children of different ages
Source: Survey data (2017)

Figure 4 shows the descriptive analysis of misarticulations in children of different ages: 3.0-3.6(M=4.59; SD=.56); 3.6-4.0(M=4.76; SD=.14); 4.0-4.6(M=4.81; SD=.07); 4.6-5.0(M=4.86; SD=.09); 5.0-5.6(M=4.90; SD=.10); and 5.6-6.0 (M=4.91; SD=.09). The results showed variation in the mean values of misarticulations in children of different age groups studied. In order to justify the variation in scores, analysis of variance was explored. The results are shown in table 28.

Table 28: ANOVA results for misarticulations in children of different ages

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.602	5	.520	8.576	.000
Within Groups	13.106	216	.061		
Total	15.708	221			

Source: Survey data (2017)

Table 28 shows $F_{(5,216)} = 8.576; p < .05$. The null hypothesis was rejected. There was a statistically significant difference in mean misarticulations in six different age groups studied. Post-hoc comparison using the Tukey HSD test revealed that the mean score of age group 3.0-3.6(M=4.59; SD=.56) was significantly different from groups: 4.0-4.6(M=4.81; SD=.07); 4.6-5.0(M=4.86; SD=.09); 5.0-5.6(M=4.90; SD=.10); and 5.6-6.0 (M=4.91; SD=.09). Age group 4.0-4.6(M=4.81; SD=.07) did not differ significantly from 4.6-5.0(M=4.86; SD=.09), 5.0-5.6(M=4.90; SD=.10), and 5.6-6.0 (M=4.91; SD=.09). Age group 4.6-5.0(M=4.86; SD=.09) also did not differ significantly from 5.0-5.6(M=4.90; SD=.10), and 5.6-6.0 (M=4.91; SD=.09). Similarly, age group 5.0-5.6(M=4.90; SD=.10) did not differ significantly from 5.6-6.0 (M=4.91; SD=.09). The results show that 1.7% of the variance in mean misarticulations was attributed to age and was regarded as large. Therefore, table 27 highlights age-specific phonological processes present among children aged from 3.0-6.0.

4.3 Kiswahili Phonological Inventory

A phonological inventory comprises three elements which are: target language sounds,

syllable structures and phonological inventory.

Conclusions from this research reveal the components of Kiswahili phonological

inventory to be:

Table 29: Kiswahili Sound Inventory For Children Aged From 3.0-6.0

	Age						
	3.0-3.6	3.6-4.0	4.0-4.6	4-6-5.0	5.0-5.6	5.6-6.0	
Sounds present	p, b, t, d, h, k, g, f, v, l, r. m, n, s, z. w, y, ʤ ɲ, ʃ	p, b, t, d, h, k, g, f, v, l, r. m, n, s, z. w, y, ʤ, ɲ, ʃ, ʧ,	p, b, t, d, h, k, g, f, v, l, r. m, n, s, z. w, y, ʤ, ʧ, ɲ, ʃ	p, b, t, d, h, k, g, f, v, l, r. m, n, s, z. w, y, ʤ, ʧ, ɲ, ʃ	p, b, t, d, h, k, g, f, v, l, r. m, n, s, z. w, y, ʤ, ʧ, ɲ, ʃ	p, b, t, d, h, k, g, f, v, l, r. m, n, s, z. w, y, ʤ, ʧ, ɲ, ʃ, ŋ	

Table 30: Kiswahili Syllable Structures For Children Aged From 3.0-6.0

No.of Syllables	Syllable	example	Age group					
			3.0-3.6	3.6-4.0	4.0-4.6	4.6-5.0	5.0-5.6	5.6-6.1
1	*CV*	*Taa*	+	+	+	+	+	+
1	C-CV	Mti	+	+	+	+	+	+
2	CV-V	Yai	+	+	+	+	+	+
3	CV-CV-V	mayai	+	+	+	+	+	+
3	CV-CV-CV	maziwa	+	+	+	+	+	+
3	C-CV-CV-CV	mvulana	+	+	+	+	+	+
2	CV-CV	Paka	+	+	+	+	+	+
3	CVC-CV-CV	daktari	+	+	+	+	+	+
3	V-CV-CV	Ugali	+	+	+	+	+	+
4	CV-CV-CV-CV	themanini	+	+	+	+	+	+

Table 31: Kiswahili Phonological Processes For Childrenn Aged from 3.0-6.0

Misarticulations	Target word	examples	3.0-3.6	3.6-4.0	4.0-4.6	4.6-5.0	5.0-5.6	5.6-6.0
Syllable reduction	baiskeli	baiki	▓					
Addition: of /ki/syllable	fagio	kifagio	▓	▓	▓			
Deletion: of /h/	mahindi	maindi	▓					
Consonant harmony: of /ma/ syllable	mananasi	mamanasi	▓	▓				
Deletion: of /l/	mvulana	mvuana	▓					
Substitution of/ nz/ with /mz/	nzi	mzi	▓	▓				
Epenthesis: addition /i/	nzi	inzi	▓	▓	▓	▓	▓	▓
Fronting: Substitution of/ŋ/ with /m/	ngombe	mombe	▓	▓	▓			
Syllable reduction	chapati	chapo	▓					
Backing (Substitution /ө/ with /k/)	thamanini	kamanini	▓	▓	▓			
Stopping (substitution/ө/ with /t/	thamanini	tamanini	▓	▓	▓	▓	▓	▓
Stopping(Substituting initial /ө/ with /k/ & medial /ө/ with /p	thalathini	kalapini	▓	▓	▓	▓	▓	
Stopping(substitution/ө/ with /p/)	thalathini	palapini	▓					
Kalatini (Substituting medial /ө/ with /t/)	thalathini	kalatini		▓	▓			
Stopping((Substituting initial /ө/ with /t/) Labialization(Substituting medial /ө/ with /f/)	thalathini	talafini	▓	▓				
Stopping((Substituting initial /ө/ with /k/) Labialization(Substituting medial /ө/ with /f/	thalathini	Kalafini		▓				

4.4 Discussion

Speech samples of 221 Kenyan Kiswahili-speakers aged from 3.0 - 6.0 were analysed to obtain normative data. Three aspects of phonological inventory were studied: age specific consonant sounds, syllable structures and phonological processes performances in 6 monthly age bands. Findings revealed that/ p, b, t, d, h, k, g, f, v, l, r. m, n, s, z. w, j, ʤ ɲ, ʃ /sounds were already present by age 3.0-3-6. When compared to English norms developed by Williamson (2010) that are currently being used, this study revealed that / ɲ / which is absent in the English norms had already been acquired by age 3.0-3.6. Also, / ʤ/ which is present in the English inventory of 4.0- 4.6, was already present in Kiswahili sound inventory of 3.0-3.6. Further, / ŋ/ which should be present in the English inventory of 3.0-3-6 year olds, was seen to be acquired later by Kiswahili speakers, thus present in the inventory of 5.6-6.0 year olds. On the other hand, / v/ which was present in the Kiswahili phonetic sound inventory of 3.0-6.0 ought to be acquired by age 4.0-5.6 of English speakers. Conclusions from this study on Kiswahili sounds revealed that age 3.0-3.6 is the critical age of sound development since most of the sounds are already acquired by this age. For this reason, a tool that monitors how a child advances in phonology should be present so as to monitor if there are any developmental delays of if the child is advancing typically. Due to differences highlighted between the English and Kiswahili inventories this research points out inadequacy of English inventories in assessment of competency in Kiswahili sounds. Consequently, there is need for a Kiswahili phonological inventory that will put into account all phonological features peculiar to Kiswahili.

Further, since this tool is to assess Kiswahili phonological abilities of Kenyan children speaking different L1s, the researcher investigated if how frequently a child spoke L1 caused variation in Kiswahili phonetic sound system. The hypothesis tested was "There

is no statistically significant variation in mean scores of children with different L1 speaking frequentness that would cause differences in Kiswahili sound system." The results revealed $F_{(4,217)} = 2.044; p > .05$ thus hypothesis not rejected. Since how often a child spoke L1 has no impact on Kiswahili sounds, the developed inventory can be used to assess Kiswahili phonological abilities of children from different ethnic backgrounds.

Since research has revealed that there are limited studies focusing on development of syllable structure, this research investigated Kiswahili consonant-vowel combinations present among the studied age groups (Gangji et al., 2015). Findings from this study revealed CV, CCV, CVV, CVCVV, CVCVCV, CCVCVCV, CVCV, CVCCVCV, VCVCV, CVCVCVCV were present in all the age groups. Therefore, age did not cause variation in these consonant-vowel combinations. The researcher went ahead to investigated if sex caused variation in consonant-vowel combinations present among the different age groups. The tested hypothesis was "there is no statistically significant variation in mean syllable structures among children of different sexes." Sex did not cause variation since CI [-.0187, .12202] was not significant T (220) = 1.447 and p>.05. Therefore, this tool can be used to assess the phonology of boys and girls.

Children's speech becomes more accurate and intelligible as they advance in age because they articulate more sounds correctly and use fewer error patterns (Bowen, 1998). This study on Kiswahili phonological inventory also revealed that as children progressed in age, the misarticulations reduced. When compared to misarticulations studied by Bowen (1998), a number of differences were highlighted. For example, Bowen (1998) studied phonological process of children aged from 3.0-5.0 while this study investigated misarticulations present among children aged from 3.0-6.0.

According to the findings by Bowen (1998),stopping of /ɵ/ should be gone by age 5 while this study on Kiswahili phonological inventory revealed that realisation of /ɵ/ as /t/ was present in 5.6-6.0 age bracket. Bowen (1998) also states that gliding of liquids should be gone by age 5.0. However, this study did not highlight this type of phonological process. Further, consonant harmony was present when 'mananasi' was realised as 'mamanasi by children in 3.0-3.6 and 3.6-4.0 age brackets. However, Bowen (1998) states that   this phonological process should be gone by age 3.9. Based on Kiswahili phonological inventory study, cluster reduction is gone by age 3.6 while Bowen (1998) stated that cluster reduction is gone by age 4.0. In this study, deletions and substitution were mostly realised by   children in the younger age groups. These errors reduced among older children. Therefore the hypothesis "there is no statistically significant difference in mean scores of children with different ages in phonological processes" was rejected since $F_{(5,216)} = 8.576; p < .05$. This implied that age had an impact on misarticulations. Presence of age related phonological processes advocates for the need of an inventory that would assess the age related misarticulations. Further, the differences highlighted between Kiswahili phonological processes and those studied by Bowen (1998) support the need of language specific phonological inventories.

4.5 Clinical Implications

Findings from this study have significant implications on the assessment of phonology. First, only Kiswahili phonological inventory can be used to assess Kiswahili phonology due to phonological differences highlighted between the English and Kiswahili tools. Second, L1 and sex do not cause variation in phonological inventory thus implying that this tool can be used across sexes and ethnicities. Also, age 3.0-3.6 is highlighted to be critical age of phonological development and therefore children at this age should be

monitored so as to determine any deviation. Further, age is seen to play a major role since it indicates what phonological processes are typical at a particular age. Therefore, this tool will aid in monitoring Kiswahili speaking children as they progress in age so as to determine if their phonological performance is age appropriate. Lastly since the researcher was able to collect, interpret data and present findings, this was an indication of the success of tools that were used in the collection and analysis of data. These tools were complete questionnaires, interview schedules accompanied by picture booklet and score sheet and SPSS which was used in data analysis.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter presents the summary of findings on Kiswahili phonological inventory for Kenyan children aged 3.0-6.0, recommendations for further research and conclusions. While summary of findings are presented in line with research objectives, conclusion and recommendations are based on the topic of investigation.

5.1 Summary of Findings

The intent of the study was to develop Kiswahili phonological inventory for Kenyan children aged from 3.0-6.0. In order to achieve the general objective, it was broken down into three different specific objectives each with its corresponding hypothesis to be tested. First, the study was set to investigate the variation of Kiswahili sound system due to mother tongue frequentness use. The null hypothesis was, "there is no statistically significant variation in mean scores of children with different L1 speaking frequentness that would cause differences in Kiswahili sound system." Before testing whether L1 speaking intensity caused variation in Kiswahili phonetic sound, a descriptive study was conducted which showed that /p, b, t, d, h, k, g, f, v, l, r. m, n, s, z, w, y, ʤ ɲ, ʃ/ had been acquired by age 3.6. These findings showed that most consonants had been achieved by age 3.6 years. In order to test the hypothesis, variation in mean phonetic sound inventory were considered under five different mother tongue speaking intensities namely; very rarely, rarely, sometimes, often and very often. Key finding showed $F_{(4,217)} = 2.044; p > .05$. The null hypothesis was not rejected. There was no statistically significant difference in Kiswahili phonetic sound inventory mean scores for the five different levels of mother tongue speaking intensities studied. The actual difference in mean scores between different mother tongue speaking intensity

levels was quite small. This was because only 0.3% of the variance in Kiswahili sound inventory could be explained by mother tongue speaking frequentness. This implied that this consonant inventory can be used to assess children across different L1 groups.

Second, the study was set to explore the variation in syllable structures among children of different sexes. The null hypothesis was, "there is no statistically significant variation in mean syllable structures among children of different sexes." Preliminary to testing the hypothesis, descriptive findings revealed that CV, CCV, CVV, CVCVV, CVCVCV, CCVCVCV, CVCV, CVCCVCV, VCVCV, CVCVCVCV were present in all the age groups. Findings from this research therefore implied that the investigated syllable structures had already been acquired among 3.0-3.6 age group. In order to test the hypothesis, variation in mean syllable structures were considered using boy and girl as sexes. Key finding showed that on average girls (M=4.83; SD=.13) had better syllable structures than boys (M= 4.78; SD=.35). The difference, .05, 95% CI [-.0187, .12202] was not statistically significant T (220) = 1.447; p>.05 two tailed. The null hypothesis was not rejected. There was no statistically significant variation in mean syllable structures among children of different sexes. However, it did represent a very small size effect as only .09% of the variance in syllable structures could have been explained by sex. Therefore, the developed inventory could be used to assess children with different sex.

Third, the objective was set to explore the variation in phonological processes in children of different ages. The null hypothesis was, "there is no statistically significant variation in mean scores of children with different ages in phonological processes." In order to test the hypothesis, variation in mean phonological processes were considered in six different age groups, namely; 3.0-3.6; 3.6-4.0; 4.0-4.6; 4.6-5.0; 5.0-5.6; and 5.6-

6.0. Key findings showed $F_{(5,216)} = 8.576; p < .05$. The null hypothesis was rejected because phonological processes were lesser in older children compared to the younger ones. There was a statistically significant difference in mean phonological processes in six different age groups studied. The results showed that 1.7% of the variance in mean phonological processes was attributed to age and was regarded as large. Consistent phonological error patterns were also highlighted. Age-appropriate error patterns were those used by at least 10% of the children in the same age group (Enderby et al., 1986)

While their was variation in mean phonological processes in six different age groups studied, there was no variation in Kiswahili sound system mean scores for the five different levels of mother tongue speaking intensities. Also, there was no variation in mean syllable structures among children of different sexes. Different sexes elicited similar mean syllable structures among groups of children that were studied. Therefore, the Kiswahili phonological inventory developed can be used to assess the phonological abilities of Kiswahili speaking Kenyan children regardless of their ethnical backgrounds and sex.

5.2 Conclusions

This chapter presented descriptive and confirmatory findings from the current study on Kiswahili phonological inventory. Preliminary to testing "there is no statistically significant variation in mean scores of children with different L1 speaking frequentness that would cause differences in Kiswahili Phonetic Sound Inventory" hypothesis, findings from descriptive analysis revealed that /p, b, t, d, h, k, g, f, v, l, r. m, n, s, z, w, y, dʒ ɲ, ʃ/ Kiswahili sounds had been acquired by age 3.6 while /ɵ/ had not been acquired by age 6.0. ANOVA test confirmed that L1 speaking intensity did not have an impact on Kiswahili sound system thus hypothesis not rejected. Descriptive findings on

syllable structure revealed that CV, CCV, CVV, CVCVV, CVCVCV, CCVCVCV, CVCV, CVCCVCV, VCVCV, CVCVCVCV were present in all the age groups. T-test confirmed that sex variable did not cause variation in syllable structures present among the age groups hence hypothesis was not rejected. Finally, ANOVA test confirmed that age caused variation in phonological processes thus, "there is no statistically significant variation in mean scores of children with different ages in phonological processes," hypothesis was rejected.

5.3 Recommendations

5.3.1 Policy Recommendations

As stated in the Kenyan constitution 2010, every individual has a right to the highest attainable standard of health. This is inclusive of individuals with phonological disorders. Therefore, the Kenyan health care system should adopt this Kiswahili phonological inventory to ensure that individuals with Kiswahili phonological disorders get a comprehensive assessment.

5.3.2 Recommendation for Further Research

Since mother tongue use intensity and sex variables did not elicit significant variations in Kiswahili sound system and syllable structures respectively, this study recommends searching for more evidence by conducting similar studies in different school sites. This study further recommends testing of the developed Kiswahili Phonological Inventory on the Kenyan population aged 3.0-6.0.

Finally, future research, with regard to phonological development in children, should focus on particular mother tongue and its effects on acquisition of Kiswahili phonology. This will enable researchers to discover the effects of various mother tongues on Kiswahili phonology. For example, researchers will be able to determine the

phonological processes that are present in   Kiswahili as a result of L1 interference. Also similar research could be carried out in rural areas to find out if the same results will be produced. This will validate the normative data collected in Nairobi.

REFERENCES

Ahmed, S. (2009). Methods in sample surveys. *Johns Hopkins Bloomberg School of Public*.

Aitchison, J. (2001). *Language change: Progress or decay?* Cambridge university press.

Akinlabi, Akinbiyi. (1995). *Theoretical approaches to African linguistics*. Africa World Press.

Algeo, John. (2010). *The Origins and Development of the English Language*. Wadsworth Cengage Learning.

American Speech-Language-Hearing Association. (2020). *Assessment Tools, Techniques, and Data Sources*. American Speech-Language-Hearing Association; American Speech-Language-Hearing Association. https://www.asha.org/Practice-Portal/Clinical-Topics/Late-Language-Emergence/Assessment-Tools-Techniques-and-Data-Sources/

Appel, R., and Muysken, P. (2005). *Language contact and bilingualism*. Amsterdam University Press.

Ball, M. J. (Martin J., and Gibbon, F. E. (2013). *Handbook of vowels and vowel disorders*. Psychology Press.

Barlow, J. A. (2003). The stop-spirant alternation in Spanish: Converging evidence for a fortition account. *Southwest Journal of Linguistics*, *22*(1), 51–87.

Bishop, D. (2003). *Test for Reception of Grammar: TROG-2 version 2*. Pearson Assessment.

Bleile, K. M. (2004). *Manual of articulation and phonological disorders: Infancy through adulthood*. Cengage Learning.

Bowen, Caroline. (1998). *Developmental phonological disorders. A practical guide for families and teachers*. Australian Councilfor Educational Research.

Brann, C. M. (1994). *The national language question: Concepts and terminologies*.

Campbell, T., Dollaghan, C., Needleman, H., and Janosky, J. (1997). Reducing bias in language assessment: Processing-dependent measures. *Journal of Speech, Language, and Hearing Research*, *40*(3), 519–525.

Carmines, E., and Zeller, R. (1979). *Reliability and validity assessment*.

Caton, S. S. (1987). Contributions of Roman Jakobson. *Annual Review of Anthropology*, *16*, 223–260.

Choge, S. (2009). Understanding Kiswahili Vowels. In *Journal of Pan African Studies* (Vol. 2, Issue 8). JPAS.

Clements, G. N., and Hallé, P. (2010). *"'Phonetic bases of distinctive features'": Introduction*.

Clements, G. N., and Keyser, S. J. (1983). *CV Phonology: A Generative Theory of The Syllable*. MIT Press.

Denscombe, M. (2014). *The good research guide: For small-scale social research projects*.

Dete, W. O., and Odera, F. Y. (2015). Impact of interaction between mother tongue and Kiswahili: Philosophical Analysis of Performance of Kenya Certificate of Primary Education in. Nyakach Sub County, Kisumu County, Kenya. *International Journal of Research in Progressive Education and Development. Vol*, *4*.

Edwards, H. T. (1992). *Applied phonetics:The Sound of American English:Instructor Manual*. Singular Pub. Group.

Flege, J. E. (1980). Phonetic approximation in second language acquisition 1. *Language Learning*, *30*(1), 117–134.

Gangji, N., Pascoe, M., and Smouse, M. (2014). Swahili speech development: Preliminary normative data from typically developing pre-school children in Tanzania. *International Journal of Language and Communication Disorders*, *00*(0), 1–14. https://doi.org/10.1111/1460-6984.12118

Gildersleeve-Neumann, C. E., Kester, E. S., Davis, B. L., and Pen~a, E. D. (2008). English Speech Sound Development in Preschool-Aged Children From Bilingual English–Spanish Environments. *Language Speech and Hearing Services in Schools*, *39*(3), 314. https://doi.org/10.1044/0161-1461(2008/030)

Goswami, U. (2010). A psycholinguistic grain size view of reading acquisition across languages. In *Reading and dyslexia in different orthographies* (pp. 41–60). Psychology Press.

Hair, J. F. (2010). *Multivariate data analysis*. Prentice Hall.

Harley, Heidi. (2006). *English words: A linguistic introduction*. Blackwell.

Hodson, B., and Paden, E. (1991). A phonological approach to remediation: Targeting intelligible speech. *Austin, TX: Pro Ed*.

Hua, Z., and Dodd, B. (2006). *Phonological development and disorders in children: A multilingual perspective* (Vol. 8). Multilingual Matters.

Iribemwangi, P. (2011). Nasal consonant processes in standard Kiswahili. *Cell*, *722*, 804192.

Israel, G. D. (1992). *Determining sample size*.

Jakobson, R. (1968). *Child Language, Aphasia and Phonological Universals*. DE GRUYTER. https://doi.org/10.1515/9783111353562

Jakobson, R. (1962). *The phonemic concept of distinctive features*. 441–455.

Jo PhD, A. A. (2017). Differentiating language difference and language disorder: Information for teachers working with English language learners in the schools. *Journal of Human Services: Training, Research, and Practice*, 2(1), 2.

Kenya Institute of Curriculum Development. (2017). *Curriculum Designs (PP1-Grade4)*. https://kicd.ac.ke/cbc-materials/curriculum-design/#pp1

Kenya National Bureau of Statistics. (2010). *The 2009 Kenya population and housing census* (Vol. 1). Kenya National Bureau of Statistics.

Kibui, A. W. (2014). Language policy in Kenya and the New Constitution for Vision 2030. *International Journal of Educational Science and Research*, 4(5), 89–98.

Kline, P. (2000). *A psychometrics primer*.

Kothari, C. R. (2004). *Research Methodology: Methods andamp; Techniques*. New Age International (P) Ltd.

Lleó, C., Kuchenbrandt, I., Kehoe, M., and Trujillo, C. (2003). *Syllable Final Consonants in Spanish and German Monolingual and Bilingual Acquisition* (pp. 191–220). https://doi.org/10.1075/hsm.1.08lle

Mazrui, A. M., and Shariff, I. N. (1994). *The Swahili; Idiom and identity of an African people*.

Mazrui, A., and Shariff, I. Noor. (1994). *The Swahili: Idiom and identity of an African people*. Africa World Press.

Meisel, J. M. (1989). *The Bilingual Child*.

Mohamed, M. Abdulla. (2001). *Modern Swahili Grammar*. East African Educational Publishers.

Moran, S., Grossman, E., and Verkerk, A. (2020). Investigating diachronic trends in phonological inventories using BDPROTO. *Language Resources and Evaluation*, 1–25.

Muaka, L. (2011). *Language perceptions and identity among Kenyan speakers*. 217–230.

Mugenda, O. M., and Mugenda, A. G. (1999). *Research Methods: Quantitative and Qualitative Approaches*. African Centre for Technology Studies.

Munene, E. (2018, April 25). Economic Survey 2018 Launched. *Kenya National Bureau of Statistics*. https://www.knbs.or.ke/?p=4838

Munene, E. (2019, November 4). 2019 Kenya Population and Housing Census Results. *Kenya National Bureau of Statistics*. https://www.knbs.or.ke/?p=5621

Muysken, P., and Smith, N. (1995). The study of pidgin and creole languages. *Pidgins and Creoles: An Introduction*, *1*, 14.

Mwaliwa, H. C. (2014). *An analysis of the syllable structure of standard Kiswahili loanwords from modern standard Arabic*.

Ndung'u, N., Thugge, K., and Otieno, O. (2011). Unlocking the future potential for Kenya: The Vision 2030. *Office of the Prime Minister Ministry of State for Planning, National Development and Vision*, *2030*.

Nurse, D., Hinnebusch, T. J., and Philipson, G. (1993). *Swahili and Sabaki: A linguistic history* (Vol. 121). Univ of California Press.

Oduor, J. A., and Rotich, X. J. (2016). *The status of mother tongues in Kenya and China: Lessons the two countries can learn from each other*.

Ogechi, N. O. (2003). On language rights in Kenya. *Nordic Journal of African Studies*, *12*(3), 19–19.

Ohala, J. J., Browman, C. P., and Goldstein, L. M. (1986). Towards an articulatory phonology. *Phonology*, *3*, 219–252.

Oso, W. Yuko., and Onen, David. (2009). *A General Guide to Writing Research Proposal and Report*. Jomo Kenyatta Foundation.

Paradis, J., and Genesee, F. (1996). Syntactic Acquisition in Bilingual Children. *Studies in Second Language Acquisition*, *18*(01), 1. https://doi.org/10.1017/S0272263100014662

PhD, P. E., MSc, F., Therapist, C. S., and Philipp, R. (1986). Speech and language handicap: Towards knowing the size of the problem. *International Journal of Language and Communication Disorders*, *21*(2), 151–165.

Pierrehumbert, J. (1990). Phonological and phonetic representation. *Journal of Phonetics*, *18*(3), 375–394.

Polome, E. C. (1967). *Swahili Language Handbook.*

Richards, J. C., and Schmidt, R. W. (2010). *Longman dictionary of language teaching and applied linguistics*. Longman.

Rischel, J. (1997). Roman Jakobson and the phonetics-phonology dichotomy. *Acta Linguistica Hafniensia*, *29*(1), 121–147. https://doi.org/10.1080/03740463.1997.10429459

Safaa, L. (2014). *The Effect of L1 -L2 Vowel Category Mapping on L2 Word learning: English Speakers Learning Arabic Pseudo-words*.

Smit, A. B., Freilinger, J. J., Bernthal, J. E., and Bird, A. (1990). The IOWA Articulation Norms Project and Its Nebraska Replication. *Journal of Speech and Hearing Disorders*, *55*, 779–798.

Stoel-Gammon, C. (2011). Relationships between lexical and phonological development in young children. *Journal of Child Language*, *38*(1), 1.

Stokes, S. F., Klee, T., Carson, C. P., and Carson, D. (2005). A phonemic implicational feature hierarchy of phonological contrasts for English-speaking children. *Journal of Speech, Language, and Hearing Research.*

Timammy, R., and Oduor, J. A. (2016). *The treatment of Kiswahili in Kenya's education system.*

Trubetzkoy, N. S. (1969). *Principles of phonology.*

van der Slik, F. W. P., van Hout, R. W. N. M., Schepens, J. J., Graham, M., Handelsman, J., Ganiban, J., Lichtenstein, P., and Maki, P. (2015). The Gender Gap in Second Language Acquisition: Gender Differences in the Acquisition of Dutch among Immigrants from 88 Countries with 49 Mother Tongues. *PLOS ONE*, *10*(11), e0142056. https://doi.org/10.1371/journal.pone.0142056

Velleman, S. L., and Vihman, M. M. (2007). *Phonology in context* (M. C. Pennington, Ed.). Palgrave Macmillan UK. https://doi.org/10.1057/9780230625396

Williamson, G. (2010). *Speech Sound Development Chart*.

Zerbian, S., and Krifka, M. (2008). Quantification across Bantu languages. *Quantification: A Cross-Linguistic Perspective*, *64*, 383–414.

APPENDICES

Section A

Appendix 1: Consent Form
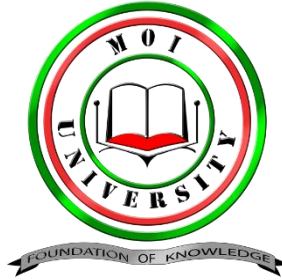
CONSENT FORM

Child's name

....

Parent's/guardian's name

....

Phone no

....

I accept my child to be a participant in the study of Kiswahili phonological

development of normal developing children be from 3.0 to 6.0 years. This entails

how children combine sounds to form words. The child will be required to name the

pictures they see

Parent's/ guardian's signature   ....

Appendix 2: Research Permit

NAIROBI CITY COUNTY

TELEGRAM "SCHOOUNG"
TELEPHONE: 2221166/224281
EXT: 2426 /2590

CITY HALL ANNEXE:
P. O. BOX 30298 GPO- 00100,
NAIROBI, KENYA

EDUCATION, YOUTH AFFAIRS & SOCIAL SERVICES SECTOR
EDUCATION DEPARTMENT

MEMO

Dorothy A. Minage

Moi University

P.O.Box 3900-30100

7TH JULY 2017

RE: RESEARCH AUTHORIZATION

In reference to your letter dated 20th June 2017, seeking aouthority to carry out a study

entitled *"variation in phonological development of kiswahili speaking from age three to*

*six in Nairobi County Kenya".*I am pleased to inform you that authority has been granted.

Liase with respective Day Nursery heads for success of your research.

On completion, this office expects a copy of the study.

Thank you.

Romans Ndungu
Deputy Chief Advisor To Schools.

"The City of Choice to Invest, Live and Work in"

NATIONAL COMMISSION FORSCIENCE, TECHNOLOGY ANDINNOVATION

Telephone:+254-20-2213471,
2241349,3310571,2219420
Fax: +254-20-318245,318249
Email: dg@nacosti.go.ke
Website: www.nacosti.go.ke
When replying please quote

9th Floor, Utalii House
Uhuru Highway
P.O. Box 30623-00100
NAIROBI-KENYA

Ref No. **NACOSTI/P/17/74850/17500**

Date: **20th June, 2017**

Dorothy A. Minage
Moi University
P.O. Box 3900-30100
ELDORET.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on *"Variation in phonological development of Kiswahili speaking children from age three to six in Nairobi County, Kenya,"* I am pleased to inform you that you have been authorized to undertake research in **Nairobi County** for the period ending **19th June, 2018.**

You are advised to report to **the County Commissioner and the County Director of Education, Nairobi County** before embarking on the research project.

On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.

GODFREY P. KALERWA MSc., MBA, MKIM
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Nairobi County.

COUNTY COMMISSIONER
NAIROBI COUNTY
P. O. Box 30124-00100, NBI
TEL: 341666

The County Director of Education
Nairobi County.

National Commission for Science, Technology and Innovation is ISO9001: 2008 Certified

Republic of Kenya

MINISTY OF EDUCATION
STATE DEPARTMENT OF BASIC EDUCATION

Telegrams: "SCHOOLING", Nairobi
Telephone: Nairobi 020 2453699
Email: rcenairobi@gmail.com
rdcnairobi@gmail.com

When replying please quote

REGIONAL COORDINATOR OF EDUCATION
NAIROBI REGION
NYAYO HOUSE
P.O. Box 74620 – 00200
NAIROBI

Ref: **RCE/NRB/GEN/1/VOL. 1**

DATE: **4th July, 2017**

Dorothy A. Minage
Moi University
P O Box 3900-30100
ELDORET

RE: RESEARCH AUTHORIZATION

We are in receipt of a letter from the National Commission for Science, Technology and Innovation regarding research authorization in Nairobi County on **"Variation in phonological development of Kiswahili speaking children from age three to six."**

This office has no objection and authority is hereby granted for a period ending **19th June, 2018** as indicated in the request letter.

Kindly inform the Sub County Director of Education of the Sub County you intend to visit.

2017

FLORENCE HUNGI
FOR: REGIONAL COORDINATOR OF EDUCATION
NAIROBI

C.C

Director General/CEO
Nation Commission for Science, Technology and Innovation
NAIROBI

Appendix 3: Interview Schedule

question code	Sound position	question
101.1 101.2	**Initial /b/** **Medial /b/**	Msichana anendesha nini? (***What is the girl riding?***) Magari mawili yako wapi?(***Where are the two cars?***)
102.1 102.2	**Initial/d/** **Medial /d/**	Huyu mtu anatokwa na nini kwenye mapua?(***What is coming out of this person's nose?***) Unaona nini kwenye picha hii?(***What do you see on this picture?***)
103.1 103.2	**Initial /f/** **Medial /f/**	Hii ni picha ya nini?(***What does the picture represent?***) Unaona nini kwenye picha? (***What do you see on this picture?***)
104.1 104.2	**Initial /g/** **Medial /g/**	Picha hii ni ya nini? (***What is on this picture?***) Hiki ni chakula kipi? (***What food is this?***)
105.1 105.2	**Initial /h/** **Medial /h/**	Huyu mtoto anakula nini?(***What is the child eating***? Unaona nini kwenye picha? (***what are you seeing on this picture?***)
106.1 106.2	**Initial /k/** **Medial /k/**	Picha hii ni ya kitu gani?(***What is on this picture?***) Huyu ni nani? (***who is this?***)
107.1 107.2	**Initial /l/** **Medial /l/**	Mama huyu amejifinga nini?(***what is this woman covering herself with?***) Mtoto anafanya nini? (***What is the child doing?***)
108.1 108.2	**Initial /n/** **Medial /n**	Hii ni picha ya nini?(***What does the picture represent?***) Unaona nini kwenye picha? (***What do you see on this picture?***)
109.1 109.2	**Initial /n/** **Medial /n/**	Tunda hili linaitwaje? (***What is the name of this fruit?***) Yakiwa mengi yanaitwaje? (***what are they called if they are many?***)
110.1 110.2	**Initial /p/** **Medial /p/**	Huyu ni mnyama yupi? (***What is the name of this animal?***) Hii ni nini? (**What is this***?*)

111.1 **111.2**	**Initial /r/** **Medial** **/r/**	Unajua hii ni nini? (*Do you know what this is?*) Huyu ni nani?(*Who is this?*)
112.1 **112.2**	**Initial /s/** **Medial** **/s/**	Huyu ni nani?(*What is this ?*) Huyu nina ni? (*Who is this?*)
113.1 **113.2**	**Initial /t/** **Medial /t/**	Hii ni picha ya nini? (*what is on this picture?*) Picha hii ni ya nini? (*What is on this picture?*)
114.1 **114.2**	**Initial** **/v/** **Medial** **/v/**	Hii ni picha ya nini? (*What is this?*) Huyu ni nani? (*Who is this?*)
115.1 **115.2**	**Initial** **/w/** **Medial** **/w/**	Hawa ni akina nani? (*Who are these*?) Kuna nini kwenye glesi hii? (*what is in the glass?*)
116.1 **116.2**	**Initial** **/y/** **Medial** **/y/**	/ Hili ni nini? (*what is this?*) Wingi wake nini ni?(*If they are many , what are they called?*)
117.1 **117.2**	**Initial /z/** **Medial** **/z/**	Mtu huyu amepokea nini? (*What is this person receiving?*) Huyu ni mdudu yupi? (*What is the name of this insect*?)
118.1 **118.2**	**Initial** **/ŋ**/ **Medial** **/ŋ/**	Huyu ni mnyama yupi?(*Which animal is this*?) Hawa watoto wanafanya nini kwa hii picha? (*What are the children doing?*)
119.1 **119.2**	**Initial/θ/** **Medial/θ/**	Nambari hii ni themanini. Ni nambari ipi? (*This is number eighty. It is number?*) Nambari hii ni thelathini. Ni nambari ipi? (*This is number thirty. It is number?*)
120.1 **120.2**	**Initial/ʧ/** **Medial/ʧ/**	Hiki ni chakula kipi? (*What food is this?*) Hii ni picha ya nini? (*what is o this picture?*)
121.1 **121.2**	**Initial** **/ɲ/** **Medial** **/ɲ/**	Unaona nini? (*what do you see?*) Huyu ni nani? (*Huyuninani?*)
122.1 **121.2**	**Initial** **/ʤ/** **Medial** **/ʤ/**	Hii ni nini kwenye picha? (*what is on the picture?*) Haya ni nini kwenye glesi? (*What is in the glass?*)
123.1 **123.2**	**Initial/ʃ/** **Medial/ʃ/**	Mtu huyu ako wapi? (*where is this person?* Mtoto amejishika wapi? (*Where is the child touching?*)

Appendix 4: Picture Booklet

101.1 101.2

/b/

102.1 102.2

/d/

103.1 103.2

/f/

104.1 104.2

/g/

	105.1	105.2
/h/		

	106.1	**106.2**
/k/		

	107.1	107.2
/l/		

	108.1	108.2
/m/		

	109.1	109.2
/n/		
	110.1	110.2
/p/		
	111.1	111.2
/r/		
	112.1	112.2
/s/		

/t/	113.1	113.2
/v/	114.1	114.2
/w/	115.1	115.2
/j/	116.1	116.2

	117.1	117.2
/z/		

	118.1	118.2
/ŋ/		

	119.1	119.2
/ɵ/		

	120.1	120.2
/tʃ/		

121.1	121.2
/ɲ/	

122.1	122.2
/ ʤ/	

123.1	123.2
/ʃ/	
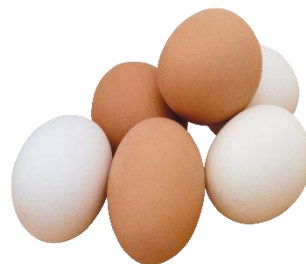
Appendix 5: Score Sheet

Student code: ....

Number Of Item	phoneme	Correct word realisations	Child's realisation
1	/b/	baiskeli	
2	/d/	damu	
3	/f/	fagio	
4	/g/	gari	
5	/h/	hindi	
6	/k/	kiti	
7	/l/	leso	
8	/m/	Mti	
9	/n/	nanasi	
10	/p/	Paka	
11	/r/	Redio	
12	/s/	Simba	
13	/t/	Taa	
14	/v/	Viatu	
15	/w/	Watoto	
16	/y/	Yai	
17	/z/	Zawadi	
18	/ŋ/	Ng'ombe	
19	/θ/	thamanini	
20	/tʃ/	Chapati	
21	/ɲ/	nyumba	
22	/dʒ/	Jua	
23	/ʃ/	shamba	
24	/b/	barabara	
25	/d/	mdomo	
26	/f/	sufuria	
27	/g/	ugali	
28	/h/	mahindi	
29	/k/	nyoka	
30	/l/	analala	
31	/m/	samaki	
32	/n/	mananasi	
33	/p/	mpira	
34	/r/	daktari	
35	/s/	msichana	
36	/t/	kitanda	
37	/v	mvulana	
38	/w/	maziwa	
39	/y/	mayai	
40	/z/	nzi	
41	/ŋ/	Ng'ang'ania	
42	/θ/	thalathini	
43	/tʃ/	kichwa	
44	/ɲ/	nyanya	
45	/dʒ/	maji	
46	/ʃ/	mashavu	

Appendix 6: Questionnaire

Student Code: .... Questionnaire code: ....

Consent obtained: ....(tick) interviewer's signature: ....

Date of interview: ....

Instructions: Write/Tick the appropriate answers in the spaces provided.

Section1: Demographic Data: (To be answered by parent/ guardian)

101. What is the child's date of birth? Day......Month ....Year..........

102. What is the child's age group?

       1) 3.0-3.6 [ ]

       2) 3.6-4.0 [ ]

       3) 4.0-4.6 [ ]

       4) 4.6-5.0 [ ]

       5) 5.6-6.0 [ ]

103. Child's sex ....

104. Mother tongue spoken by the child at home......................................

105. How often does your child use mother tongue?

    [1] very rarely

    [2] Rarely

    [3] Sometimes

    [4] Often

    [5] Very often

Appendix 7: IPA Chart

THE INTERNATIONAL PHONETIC ALPHABET (revised to 2005)

CONSONANTS (PULMONIC) © 2005 IPA

	Bilabial	Labiodental	Dental	Alveolar	Post alveolar	Retroflex	Palatal	Velar	Uvular	Pharyngeal	Glottal
Plosive	p b			t d		ʈ ɖ	c ɟ	k g	q ɢ		ʔ
Nasal	m	ɱ		n		ɳ	ɲ	ŋ	N		
Trill	ʙ			r					ʀ		
Tap or Flap		ⱱ		ɾ		ɽ					
Fricative	ɸ β	f v	θ ð	s z	ʃ ʒ	ʂ ʐ	ç ʝ	x ɣ	χ ʁ	ħ ʕ	h ɦ
Lateral fricative				ɬ ɮ							
Approximant		ʋ		ɹ		ɻ	j	ɰ			
Lateral approximant				l		ɭ	ʎ	ʟ			

Where symbols appear in pairs, the one to the right represents a voiced consonant. Shaded areas denote articulations judged impossible.

CONSONANTS (NON-PULMONIC)

Clicks	Voiced implosives	Ejectives
ʘ Bilabial	ɓ Bilabial	ʼ Examples:
ǀ Dental	ɗ Dental/alveolar	pʼ Bilabial
ǃ (Post)alveolar	ʄ Palatal	tʼ Dental/alveolar
ǂ Palatoalveolar	ɠ Velar	kʼ Velar
ǁ Alveolar lateral	ʛ Uvular	sʼ Alveolar fricative

OTHER SYMBOLS

ʍ Voiceless labial-velar fricative
w Voiced labial-velar approximant
ɥ Voiced labial-palatal approximant
ʜ Voiceless epiglottal fricative
ʢ Voiced epiglottal fricative
ʡ Epiglottal plosive

ɕ ʑ Alveolo-palatal fricatives
ɺ Voiced alveolar lateral flap
ɧ Simultaneous ʃ and x

Affricates and double articulations can be represented by two symbols joined by a tie bar if necessary. k͡p t͡s

VOWELS

Front Central Back

Close i y — ɨ ʉ — ɯ u
ɪ ʏ ʊ
Close-mid e ø — ɘ ɵ — ɤ o
ə
Open-mid ɛ œ — ɜ ɞ — ʌ ɔ
æ ɐ
Open a ɶ — ɑ ɒ
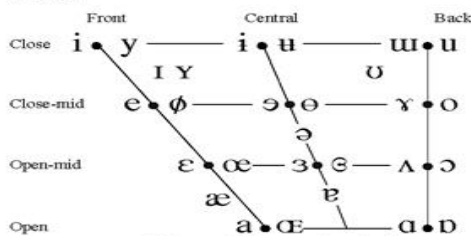
Where symbols appear in pairs, the one to the right represents a rounded vowel.

SUPRASEGMENTALS

ˈ Primary stress
ˌ Secondary stress ˌfoʊnəˈtɪʃən
ː Long eː
ˑ Half-long eˑ
˘ Extra-short ĕ
| Minor (foot) group
‖ Major (intonation) group
. Syllable break ɹi.ækt
‿ Linking (absence of a break)

DIACRITICS Diacritics may be placed above a symbol with a descender, e.g. ŋ̊

Voiceless	n̥ d̥	Breathy voiced	b̤ a̤	Dental	t̪ d̪
Voiced	s̬ t̬	Creaky voiced	b̰ a̰	Apical	t̺ d̺
Aspirated	tʰ dʰ	Linguolabial	t̼ d̼	Laminal	t̻ d̻
More rounded	ɔ̹	Labialized	tʷ dʷ	Nasalized	ẽ
Less rounded	ɔ̜	Palatalized	tʲ dʲ	Nasal release	dⁿ
Advanced	u̟	Velarized	tˠ dˠ	Lateral release	dˡ
Retracted	e̠	Pharyngealized	tˤ dˤ	No audible release	d̚
Centralized	ë	Velarized or pharyngealized	ɫ		
Mid-centralized	e̽	Raised	e̝ (ɹ̝ = voiced alveolar fricative)		
Syllabic	n̩	Lowered	e̞ (β̞ = voiced bilabial approximant)		
Non-syllabic	e̯	Advanced Tongue Root	e̘		
Rhoticity	ɚ ɚ	Retracted Tongue Root	e̙		

TONES AND WORD ACCENTS

LEVEL		CONTOUR	
e̋ or ˥	Extra high	ě or ˩˥	Rising
é ˦	High	ê ˥˩	Falling
ē ˧	Mid	e᷄ ˦˥	High rising
è ˨	Low	e᷅ ˩˨	Low rising
ȅ ˩	Extra low	e᷈ ˧˦˧	Rising-falling
↓	Downstep	↗	Global rise
↑	Upstep	↘	Global fall

Section B

Appendix 8

a. Realizations of /n/ in Initial Position

			/n/ Initial Child Articulation			
			nanasi	nananasi	nasi	aasi
Age group	3.0-3.6	Count	36	2	1	1
		Count (%)	90.0%	5.0%	2.5%	2.5%
	3.6-4.0	Count	39	1	0	0
		Count (%)	97.5%	2.5%	0.0%	0.0%
	4.0-4.6	Count	39	2	0	0
		Count (%)	95.1%	4.9%	0.0%	0.0%
	4.6-5.0	Count	37	1	0	0
		Count (%)	97.4%	2.6%	0.0%	0.0%
	5.0-5.6	Count	43	1	0	0
		Count (%)	97.7%	2.3%	0.0%	0.0%
	5.6-6.0	Count	36	1	0	0
		Count (%)	97.3%	2.7%	0.0%	0.0%
Total		Count	230	8	1	1
		Count (%)	95.8%	3.3%	0.4%	0.4%

b. Realizations of /n/ in Medial Position

			/n/ Medial Child Articulation					
			mananasi	mamananasi	nananasi	mamanasi	mamaasi	manasi
Age group	3.0-3.6	Count	27	0	1	9	1	2
		Count (%)	67.5%	0.0%	2.5%	22.5%	2.5%	5.0%
	3.6-4.0	Count	32	7	0	0	0	1
		Count (%)	80.0%	17.5%	0.0%	0.0%	0.0%	2.5%
	4.0-4.6	Count	40	1	0	0	0	0
		Count (%)	97.6%	2.4%	0.0%	0.0%	0.0%	0.0%
	4.6-5.0	Count	36	1	1	0	0	0
		Count (%)	94.7%	2.6%	2.6%	0.0%	0.0%	0.0%
	5.0-5.6	Count	41	1	2	0	0	0
		Count (%)	93.2%	2.3%	4.5%	0.0%	0.0%	0.0%
	5.6-6.0	Count	37	0	0	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total		Count	213	10	4	9	1	3
		Count (%)	88.8%	4.2%	1.7%	3.8%	0.4%	1.2%

Appendix 9

a. **Realizations of /p/ in Initial Position**

			/p/ Initial Child Articulation		
			paka	pusi	usi
Age group	3.0-3.6	Count	36	3	1
		Count (%)	90.0%	7.5%	2.5%
	3.6-4.0	Count	39	1	0
		Count (%)	97.5%	2.5%	0.0%
	4.0-4.6	Count	41	0	0
		Count (%)	100.0%	0.0%	0.0%
	4.6-5.0	Count	36	2	0
		Count (%)	94.7%	5.3%	0.0%
	5.0-5.6	Count	42	2	0
		Count (%)	95.5%	4.5%	0.0%
	5.6-6.0	Count	32	5	0
		Count (%)	86.5%	13.5%	0.0%
Total		Count	226	13	1
		Count (%)	94.2%	5.4%	0.4%

b. **Realizations of /p/ in Medial Position**

			/p/ Medial Child Articulation	
			mpira	pila
Age group	3.0-3.6	Count	38	2
		Count (%)	95.0%	5.0%
	3.6-4.0	Count	39	1
		Count (%)	97.5%	2.5%
	4.0-4.6	Count	41	0
		Count (%)	100.0%	0.0%
	4.6-5.0	Count	38	0
		Count (%)	100.0%	0.0%
	5.0-5.6	Count	44	0
		Count (%)	100.0%	0.0%
	5.6-6.0	Count	37	0
		Count (%)	100.0%	0.0%
Total		Count	237	3
		Count (%)	98.8%	1.2%

Appendix 10

a. Realizations of /r/ in Initial Position

			/r/ Initial Child Articulation		
			redio	edio	nandio
Age group	3.0-3.6	Count	38	1	1
		Count (%)	95.0%	2.5%	2.5%
	3.6-4.0	Count	40	0	0
		Count (%)	100.0%	0.0%	0.0%
	4.0-4.6	Count	41	0	0
		Count (%)	100.0%	0.0%	0.0%
	4.6-5.0	Count	38	0	0 as
		Count (%)	100.0%	0.0%	0.0%
	5.0-5.6	Count	44	0	0
		Count (%)	100.0%	0.0%	0.0%
	5.6-6.0	Count	37	0	0
		Count (%)	100.0%	0.0%	0.0%
Total		Count	238	1	1
		Count (%)	99.2%	0.4%	0.4%

b. Realizations of /r/ in Medial Position

			/r/ Medial Child Articulation	
			daktari	tali
Age group	3.0-3.6	Count	39	1
		Count (%)	97.5%	2.5%
	3.6-4.0	Count	40	0
		Count (%)	100.0%	0.0%
	4.0-4.6	Count	41	0
		Count (%)	100.0%	0.0%
	4.6-5.0	Count	38	0
		Count (%)	100.0%	0.0%
	5.0-5.6	Count	44	0
		Count (%)	100.0%	0.0%
	5.6-6.0	Count	37	0
		Count (%)	100.0%	0.0%
Total		Count	239	1
		Count (%)	99.6%	0.4%

Appendix 11

a. Realizations of /s/ in Initial Position

			/s/ Initial Child Articulation	
			simba	imba
Age group	3.0-3.6	Count	39	1
		Count (%)	97.5%	2.5%
	3.6-4.0	Count	40	0
		Count (%)	100.0%	0.0%
	4.0-4.6	Count	41	0
		Count (%)	100.0%	0.0%
	4.6-5.0	Count	38	0
		Count (%)	100.0%	0.0%
	5.0-5.6	Count	44	0
		Count (%)	100.0%	0.0%
	5.6-6.0	Count	37	0
		Count (%)	100.0%	0.0%
Total		Count	239	1
		Count (%)	99.6%	0.4%

b. Realizations of /s/ in Medial Position

			/s/ Medial Child Articulation				
			msichana	msana	sana	muana	mchana
Age group	3.0-3.6	Count	36	2	1	1	0
		Count (%)	90.0%	5.0%	2.5%	2.5%	0.0%
	3.6-4.0	Count	31	0	0	0	8
		Count (%)	79.5%	0.0%	0.0%	0.0%	20.5%
	4.0-4.6	Count	25	0	0	0	16
		Count (%)	61.0%	0.0%	0.0%	0.0%	39.0%
	4.6-5.0	Count	37	0	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%	0.0%
	5.0-5.6	Count	44	0	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%	0.0%
	5.6-6.0	Count	37	0	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%	0.0%
Total		Count	210	2	1	1	24
		Count (%)	88.2%	0.8%	0.4%	0.4%	10.1%

Appendix 12

a. **Realizations of /t/ in Initial Position**

			/t/ Initial Child Articulation	
			taa	stima
Age group	3.0-3.6	Count	40	0
		Count (%)	100.0%	0.0%
	3.6-4.0	Count	40	0
		Count (%)	100.0%	0.0%
	4.0-4.6	Count	39	2
		Count (%)	95.1%	4.9%
	4.6-5.0	Count	33	4
		Count (%)	86.8%	10.5%
	5.0-5.6	Count	40	4
		Count (%)	90.9%	9.1%
	5.6-6.0	Count	37	0
		Count (%)	100.0%	0.0%
Tota5		Count	229	10
		Count (%)	95.8%	4.2%

b. **Realizations of /t/ in Medial Position**

			/t/ Medial Child Articulation	
			kitanda	kiada
Age group	3.0-3.6	Count	39	1
		Count (%)	97.5%	2.5%
	3.6-4.0	Count	40	0
		Count (%)	100.0%	0.0%
	4.0-4.6	Count	41	0
		Count (%)	100.0%	0.0%
	4.6-5.0	Count	38	0
		Count (%)	100.0%	0.0%
	5.0-5.6	Count	44	0
		Count (%)	100.0%	0.0%
	5.6-6.0	Count	37	0
		Count (%)	100.0%	0.0%
Total		Count	239	1
		Count (%)	99.6%	0.4%

Appendix 13

   a. Realizations of /v/ in Initial Position

			/v/ Initial Child Articulation	
			viatu	chiatu
Age group	3.0-3.6	Count	39	1
		Count (%)	97.5%	2.5%
	3.6-4.0	Count	40	0
		Count (%)	100.0%	0.0%
	4.0-4.6	Count	41	0
		Count (%)	100.0%	0.0%
	4.6-5.0	Count	38	0
		Count (%)	100.0%	0.0%
	5.0-5.6	Count	44	0
		Count (%)	100.0%	0.0%
	5.6-6.0	Count	37	0
		Count (%)	100.0%	0.0%
Total		Count	239	1
		Count (%)	99.6%	0.4%

   b. Realizations of /v/ in Medial Position

			/v/ Medial Child Articulation				
			mvulana	mzulana	mvuana	mvana	vuana
Age group	3.0-3.6	Count	33	0	5	1	1
		Count (%)	82.5%	0.0%	12.5%	2.5%	2.5%
	3.6-4.0	Count	15	1	0	0	24
		Count (%)	37.5%	2.5%	0.0%	0.0%	60.0%
	4.0-4.6	Count	41	0	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%	0.0%
	4.6-5.0	Count	38	0	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%	0.0%
	5.0-5.6	Count	44	0	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%	0.0%
	5.6-6.0	Count	36	0	0	0	1
		Count (%)	97.3%	0.0%	0.0%	0.0%	2.7%
Total		Count	207	1	5	1	26
		Count (%)	86.2%	0.4%	2.1%	0.4%	10.8%

Appendix 14

a. Realizations of /w/ in Initial Position

			/w/ Initial Child Articulation	
			watoto	atoto
Age group	3.0-3.6	Count	39	1
		Count (%)	97.5%	2.5%
	3.6-4.0	Count	40	0
		Count (%)	100.0%	0.0%
	4.0-4.6	Count	40	0
		Count (%)	100.0%	0.0%
	4.6-5.0	Count	38	0
		Count (%)	100.0%	0.0%
	5.0-5.6	Count	44	0
		Count (%)	100.0%	0.0%
	5.6-6.0	Count	37	0
		Count (%)	100.0%	0.0%
Total		Count	238	1
		Count (%)	99.6%	0.4%

b. Realizations of /w/ in Medial Position

			/w/ Medial Child Articulation	
			maziwa	aiwa
Age group	3.0-3.6	Count	39	1
		Count (%)	97.5%	2.5%
	3.6-4.0	Count	40	0
		Count (%)	100.0%	0.0%
	4.0-4.6	Count	41	0
		Count (%)	100.0%	0.0%
	4.6-5.0	Count	38	0
		Count (%)	100.0%	0.0%
	5.0-5.6	Count	44	0
		Count (%)	100.0%	0.0%
	5.6-6.0	Count	37	0
		Count (%)	100.0%	0.0%
Total		Count	239	1
		Count (%)	99.6%	0.4%

Appendix 15

a. Realizations of /j/ in Initial Position

			/j/ Initial Child Articulation	
			yai	ayai
Age group	3.0-3.6	Count	38	2
		Count (%)	95.0%	5.0%
	3.6-4.0	Count	40	0
		Count (%)	100.0%	0.0%
	4.0-4.6	Count	41	0
		Count (%)	100.0%	0.0%
	4.6-5.0	Count	38	0
		Count (%)	100.0%	0.0%
	5.0-5.6	Count	44	0
		Count (%)	100.0%	0.0%
	5.6-6.0	Count	37	0
		Count (%)	100.0%	0.0%
Total		Count	238	2
		Count (%)	99.2%	0.8%

b. Realizations of /j/ in Medial Position

			/j/ Medial Child Articulation	
			mayai	ayai
Age group	3.0-3.6	Count	38	2
		Count (%)	95.0%	5.0%
	3.6-4.0	Count	40	0
		Count (%)	100.0%	0.0%
	4.0-4.6	Count	41	0
		Count (%)	100.0%	0.0%
	4.6-5.0	Count	38	0
		Count (%)	100.0%	0.0%
	5.0-5.6	Count	44	0
		Count (%)	100.0%	0.0%
	5.6-6.0	Count	37	0
		Count (%)	100.0%	0.0%
Total		Count	238	2
		Count (%)	99.2%	0.8%

Appendix 16

a. Realizations of /z/ in Initial Position

			/z/ Initial Child Articulation		
			zawadi	adi	zaadi
Age group	3.0-3.6	Count	38	1	1
		Count (%)	95.0%	2.5%	2.5%
	3.6-4.0	Count	40	0	0
		Count (%)	100.0%	0.0%	0.0%
	4.0-4.6	Count	41	0	0
		Count (%)	100.0%	0.0%	0.0%
	4.6-5.0	Count	38	0	0
		Count (%)	100.0%	0.0%	0.0%
	5.0-5.6	Count	44	0	0
		Count (%)	100.0%	0.0%	0.0%
	5.6-6.0	Count	37	0	0
		Count (%)	100.0%	0.0%	0.0%
Total		Count	238	1	1
		Count (%)	99.2%	0.4%	0.4%

b. Realizations of /z/ in Medial Position

			/z/ Medial Child Articulation							
			nzi	inzi	mzi	umui	uzi	muzi	mizi	insi
Age group	3.0-3.6	Count	15	11	9	1	1	2	1	0
		Count (%)	37.5%	27.5%	22.5%	2.5%	2.5%	5.0%	2.5%	0.0%
	3.6-4.0	Count	17	15	5	0	1	0	1	1
		Count (%)	42.5%	37.5%	12.5%	0.0%	2.5%	0.0%	2.5%	2.5%
	4.0-4.6	Count	25	13	3	0	0	0	0	0
		Count (%)	61.0%	31.7%	7.3%	0.0%	0.0%	0.0%	0.0%	0.0%
	4.6-5.0	Count	16	20	2	0	0	0	0	0
		Count (%)	42.1%	52.6%	5.3%	0.0%	0.0%	0.0%	0.0%	0.0%
	5.0-5.6	Count	14	29	1	0	0	0	0	0
		Count (%)	31.8%	65.9%	2.3%	0.0%	0.0%	0.0%	0.0%	0.0%
	5.6-6.0	Count	4	10	0	18	5	0	0	0
		Count (%)	10.8%	27.0%	0.0%	48.6%	13.5%	0.0%	0.0%	0.0%
Total		Count	91	98	20	19	7	2	2	1
		Count (%)	37.9%	40.8%	8.3%	7.9%	2.9%	0.8%	0.8%	0.4%

Appendix 17

a. **Realizations of /ŋ/ in Initial Position**

			/ŋ/ Initial Child Articulation				
			ng'ombe	mombe	obe	gombe	ngombe
Age group	3.0-3.6	Count	29	9	1	1	0
		Count (%)	72.5%	22.5%	2.5%	2.5%	0.0%
	3.6-4.0	Count	31	8	0	0	1
		Count (%)	77.5%	20.0%	0.0%	0.0%	2.5%
	4.0-4.6	Count	36	5	0	0	0
		Count (%)	87.8%	12.2%	0.0%	0.0%	0.0%
	4.6-5.0	Count	31	3	0	0	4
		Count (%)	81.6%	7.9%	0.0%	0.0%	10.5%
	5.0-5.6	Count	35	1	0	0	8
		Count (%)	79.5%	2.3%	0.0%	0.0%	18.2%
	5.6-6.0	Count	36	0	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%	0.0%
Total		Count	198	26	1	1	13
		Count (%)	82.8%	10.9%	0.4%	0.4%	5.4%

b. Realizations of /ŋ/ in Initial Position

			ng'ang'ania	Nia	ng'ania	ania	mania	ia	mamania	ng'ang'a	nanania	ngania	nangania	nyang'anyia	mang'ania	nyanga	ng'ang'anyia	Total
Age group	3.0-3.6	Count	29	1	1	1	3	1	3	1	0	0	0	0	0	0	0	40
		% within Age group	72.5%	2.5%	2.5%	2.5%	7.5%	2.5%	7.5%	2.5%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	100.0%
	3.6-4.0	Count	29	0	1	1	4	0	2	0	1	1	0	0	0	0	0	39
		% within Age group	74.4%	.0%	2.6%	2.6%	10.3%	.0%	5.1%	.0%	2.6%	2.6%	.0%	.0%	.0%	.0%	.0%	100.0%
	4.0-4.6	Count	33	0	1	0	1	0	0	0	2	0	1	2	1	0	0	41
		% within Age group	80.5%	.0%	2.4%	.0%	2.4%	.0%	.0%	.0%	4.9%	.0%	2.4%	4.9%	2.4%	.0%	.0%	100.0%
	4.6-5.0	Count	35	0	0	0	0	0	1	0	0	0	1	0	0	1	0	38
		% within Age group	92.1%	.0%	.0%	.0%	.0%	.0%	2.6%	.0%	.0%	.0%	2.6%	.0%	.0%	2.6%	.0%	100.0%
	5.0-5.6	Count	44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	44
		% within Age group	100.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	100.0%
	5.6-6.0	Count	36	0	0	0	0	0	0	0	0	0	0	0	0	0	1	37
		% within Age group	97.3%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	2.7%	100.0%
Total		Count	206	1	3	2	8	1	6	1	3	1	2	2	1	1	1	239
		% within Age group	86.2%	.4%	1.3%	.8%	3.3%	.4%	2.5%	.4%	1.3%	.4%	.8%	.8%	.4%	.4%	.4%	100.0%

Appendix 18

a. Realizations of /ʧ/ in Initial Position

			/ʧ/ Initial Child Articulation				
			chapati	chapo	apo	sapo	chapat
Age group	3.0-3.6	Count	31	4	2	1	2
		Count (%)	77.5%	10.0%	5.0%	2.5%	5.0%
	3.6-4.0	Count	40	0	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%	0.0%
	4.0-4.6	Count	41	0	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%	0.0%
	4.6-5.0	Count	38	0	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%	0.0%
	5.0-5.6	Count	44	0	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%	0.0%
	5.6-6.0	Count	37	0	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%	0.0%
Total		Count	231	4	2	1	2
		Count (%)	96.2%	1.7%	0.8%	0.4%	0.8%

b. Realizations of /ʧ/ in Medial Position

			/ʧ/ Medial Child Articulation			
			kichwa	ita	kiswa	titwa
Age group	3.0-3.6	Count	37	1	1	1
		Count (%)	92.5%	2.5%	2.5%	2.5%
	3.6-4.0	Count	40	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%
	4.0-4.6	Count	41	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%
	4.6-5.0	Count	38	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%
	5.0-5.6	Count	44	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%
	5.6-6.0	Count	37	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%
Total		Count	237	1	1	1
		Count (%)	98.8%	0.4%	0.4%	0.4%

Appendix 19

a. Realizations of /ɲ/ in Initial Position

			/ɲ/ Initial Child Articulation		
			nyumba	umba	uba
Age group	3.0-3.6	Count	37	2	1
		Count (%)	92.5%	5.0%	2.5%
	3.6-4.0	Count	40	0	0
		Count (%)	100.0%	0.0%	0.0%
	4.0-4.6	Count	41	0	0
		Count (%)	100.0%	0.0%	0.0%
	4.6-5.0	Count	38	0	0
		Count (%)	100.0%	0.0%	0.0%
	5.0-5.6	Count	44	0	0
		Count (%)	100.0%	0.0%	0.0%
	5.6-6.0	Count	37	0	0
		Count (%)	100.0%	0.0%	0.0%
Total		Count	237	2	1
		Count (%)	98.8%	0.8%	0.4%

b. Realizations of /ɲ/ in Initial Position

			/ɲ/ Medial Child Articulation		
			nyanya	ana	nana
Age group	3.0-3.6	Count	38	1	1
		Count (%)	95.0%	2.5%	2.5%
	3.6-4.0	Count	40	0	0
		Count (%)	100.0%	0.0%	0.0%
	4.0-4.6	Count	41	0	0
		Count (%)	100.0%	0.0%	0.0%
	4.6-5.0	Count	37	0	0
		Count (%)	100.0%	0.0%	0.0%
	5.0-5.6	Count	44	0	0
		Count (%)	100.0%	0.0%	0.0%
	5.6-6.0	Count	36	0	0
		Count (%)	100.0%	0.0%	0.0%
Total		Count	236	1	1
		Count (%)	99.2%	0.4%	0.4%

Appendix 20

    a. **Realizations of /ʤ/ in Initial Position**

			/ʤ/ Initial Child Articulation		
			jua	u	chua
Age group	3.0-3.6	Count	39	1	0
		Count (%)	97.5%	2.5%	0.0%
	3.6-4.0	Count	39	0	1
		Count (%)	97.5%	0.0%	2.5%
	4.0-4.6	Count	41	0	0
		Count (%)	100.0%	0.0%	0.0%
	4.6-5.0	Count	38	0	0
		Count (%)	100.0%	0.0%	0.0%
	5.0-5.6	Count	44	0	0
		Count (%)	100.0%	0.0%	0.0%
	5.6-6.0	Count	37	0	0
		Count (%)	100.0%	0.0%	0.0%
Total		Count	238	1	1
		Count (%)	99.2%	0.4%	0.4%

    b. **Realizations of /ʤ/ in Medial Position**

			/ʤ/ Medial Child Articulation	
			maji	aji
Age group	3.0-3.6	Count	39	1
		Count (%)	97.5%	2.5%
	3.6-4.0	Count	40	0
		Count (%)	100.0%	0.0%
	4.0-4.6	Count	41	0
		Count (%)	100.0%	0.0%
	4.6-5.0	Count	38	0
		Count (%)	100.0%	0.0%
	5.0-5.6	Count	44	0
		Count (%)	100.0%	0.0%
	5.6-6.0	Count	37	0
		Count (%)	100.0%	0.0%
Total		Count	239	1
		Count (%)	99.6%	0.4%

Appendix 21

a. Realizations of /ʃ/ in Initial Position

			/ʃ/ Initial Child Articulation			
			shamba	amba	samba	aba
Age group	3.0-3.6	Count	37	1	1	1
		Count (%)	92.5%	2.5%	2.5%	2.5%
	3.6-4.0	Count	40	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%
	4.0-4.6	Count	41	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%
	4.6-5.0	Count	37	0	1	0
		Count (%)	97.4%	0.0%	2.6%	0.0%
	5.0-5.6	Count	44	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%
	5.6-6.0	Count	36	0	0	0
		Count (%)	97.3%	0.0%	0.0%	0.0%
Total		Count	235	1	2	1
		Count (%)	98.4%	0.4%	0.8%	0.4%

b. Realizations of /ʃ/ in Medial Position

			/ʃ/ Medial Child Articulation				
			mashavu	avu	asavu	maavu	masavu
Age group	3.0-3.6	Count	37	1	1	1	0
		Count (%)	92.5%	2.5%	2.5%	2.5%	0.0%
	3.6-4.0	Count	40	0	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%	0.0%
	4.0-4.6	Count	41	0	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%	0.0%
	4.6-5.0	Count	37	0	0	0	1
		Count (%)	97.4%	0.0%	0.0%	0.0%	2.6%
	5.0-5.6	Count	44	0	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%	0.0%
	5.6-6.0	Count	35	0	0	0	0
		Count (%)	100.0%	0.0%	0.0%	0.0%	0.0%
Total		Count	234	1	1	1	1
		Count (%)	98.3%	0.4%	0.4%	0.4%	0.4%

Appendix 22

a. Realizations of /θ/ in Initial Position

			/th/ Initial Child Articulation																	
			thamanini	kamanini	tamanini	kamamanini	amanini	kalapini	kalakini	tananini	mamanini	kananini	pamanini	dhamanini	talamini	samanini	nini	kalamini	thalamini	Total
Age group	3.0-3.6	Count	2	25	9	1	1	1	1	0	0	0	0	0	0	0	0	0	0	40
		% within Age group	5.0%	62.5%	22.5%	2.5%	2.5%	2.5%	2.5%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	100.0%
	3.6-4.0	Count	3	18	14	0	0	0	1	1	1	1	1	0	0	0	0	0	0	40
		% within Age group	7.5%	45.0%	35.0%	.0%	.0%	.0%	2.5%	2.5%	2.5%	2.5%	2.5%	.0%	.0%	.0%	.0%	.0%	.0%	100.0%
	4.0-4.6	Count	4	17	16	0	0	0	0	0	0	0	1	2	0	0	1	0	0	41
		% within Age group	9.8%	41.5%	39.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	2.4%	4.9%	.0%	.0%	2.4%	.0%	.0%	100.0%
	4.6-5.0	Count	18	3	16	0	0	0	0	0	0	0	0	0	0	0	0	1	0	38
		% within Age group	47.4%	7.9%	42.1%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	2.6%	.0%	100.0%
	5.0-5.6	Count	25	2	10	0	0	0	0	1	0	0	2	3	0	1	0	0	0	44
		% within Age group	56.8%	4.5%	22.7%	.0%	.0%	.0%	.0%	2.3%	.0%	.0%	4.5%	6.8%	.0%	2.3%	.0%	.0%	.0%	100.0%
	5.6-6.0	Count	25	0	5	0	0	0	0	0	0	0	0	5	1	0	0	0	1	37
		% within Age group	67.6%	.0%	13.5%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	13.5%	2.7%	.0%	.0%	.0%	2.7%	100.0%
Total		Count	77	65	70	1	1	1	2	2	1	1	4	10	1	1	1	1	1	240
		% within Age group	32.1%	27.1%	29.2%	.4%	.4%	.4%	.8%	.8%	.4%	.4%	1.7%	4.2%	.4%	.4%	.4%	.4%	.4%	100.0%

b. Realizations of /ɵ/ in Medial Position

			/ɵ/ Medial Child Articulation																			Total
			thalathini	kalapini	palapini	talatini	kalatini	kalakili	alatini	talafini	kalasini	palafini	tayatini	talapini	kalafini	dhalatini	talasini	kalakini	salasini	dhaladhini	tharathini	thalapini	
Age group	3.0-3.6	Count	1	11	9	3	0	1	1	4	1	3	1	2	3	0	0	0	0	0	0	0	40
		% within Age group	2.50%	27.50%	22.50%	7.50%	0.00%	2.50%	2.50%	10.00%	2.50%	7.50%	2.50%	5.00%	7.50%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
	3.6-4.0	Count	4	9	5	2	8	0	0	4	0	1	0	1	4	0	0	2	0	0	0	0	40
		% within Age group	10.00%	22.50%	12.50%	5.00%	20.00%	0.00%	0.00%	10.00%	0.00%	2.50%	0.00%	2.50%	10.00%	0.00%	0.00%	5.00%	0.00%	0.00%	0.00%	0.00%	100.00%
	4.0-4.6	Count	2	11	3	10	6	0	0	4	0	0	0	1	0	1	0	0	1	1	0	0	40
		% within Age group	5.00%	27.50%	7.50%	25.00%	15.00%	0.00%	0.00%	10.00%	0.00%	0.00%	0.00%	2.50%	0.00%	2.50%	0.00%	0.00%	2.50%	2.50%	0.00%	0.00%	100.00%
	4.6-5.0	Count	18	4	0	3	6	0	0	2	0	0	0	3	0	0	1	0	0	1	0	0	38
		% within Age group	47.40%	10.50%	0.00%	7.90%	15.80%	0.00%	0.00%	5.30%	0.00%	0.00%	0.00%	7.90%	0.00%	0.00%	2.60%	0.00%	0.00%	2.60%	0.00%	0.00%	100.00%
	5.0-5.6	Count	23	1	0	9	1	0	0	0	1	0	0	5	0	0	0	0	0	2	2	0	44
		% within Age group	52.30%	2.30%	0.00%	20.50%	2.30%	0.00%	0.00%	0.00%	2.30%	0.00%	0.00%	11.40%	0.00%	0.00%	0.00%	0.00%	0.00%	4.50%	4.50%	0.00%	100.00%
	5.6-6.0	Count	26	0	0	3	0	0	0	0	0	0	0	0	0	0	2	0	0	4	1	1	37
		% within Age group	70.30%	0.00%	0.00%	8.10%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	5.40%	0.00%	0.00%	10.80%	2.70%	2.70%	100.00%
total		Count	74	36	17	30	21	1	1	14	2	4	1	12	7	1	3	2	1	8	3	1	239
		% within Age group	31.00%	15.10%	7.10%	12.60%	8.80%	0.40%	0.40%	5.90%	0.80%	1.70%	0.40%	5.00%	2.90%	0.40%	1.30%	0.80%	0.40%	3.30%	1.30%	0.40%	100.00%