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A study in the design and impact of an oral/aural bridge component in second language literacy

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A STUDY IN THE DESIGN AND IMPACT OF AN ORAL/AURAL BRIDGE COMPONENT IN SECOND LANGUAGE LITERACY

by

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ABSTRACT

This study examines the factors impacting how child speakers of two minority languages spoken in India, Bondo and Desiya, acquire phonological awareness of sounds in Oriya, the language of instruction in many schools in the state of Orissa. Previous research has shown that learners benefit from instruction that teaches how to analyze and synthesize sounds in their first and second language rather than repeat and memorize them. Learners also have shown better recognition of sounds when they are presented in minimal contrasts than when they are not. Previous research also recommends that learners benefit from learning only oral and aural skills in the beginning stages of acquiring additional languages. Bondo and Desiya speaking children often acquire Oriya in ways that do not follow these findings.

In this research, I prepared a set of oral/aural sound discrimination lessons to supplement language programs. An examination of the data from this study shows that when these lessons were used for at least two months, most students showed gains improvement in their phonological awareness of Oriya sounds. In my research, I discovered specific factors that seemed to relate to the development of phonological awareness. These factors are the teaching approach used in the experimental lessons, especially learning to contrast sounds through minimal phonetic differences; the learner's existing knowledge of the Oriya writing system and vocabulary that was enhanced through the experimental lessons; sufficient cognitive maturity to handle sound

discrimination tasks that required analytical thinking skills; and previous educational experience.

Data also revealed that the students did not show significant improvement in their production skills. Results from production tasks do show that learners have specific patterns of production that reveal developmental stages. Bondo and Desiya speakers approximate Oriya aspirated stops by adding frication, by producing shorter aspiration noise and by producing longer aspiration times before the vowel.

This research indicates that students are able to improve their perceptual skills when they receive lessons that explicitly teach how to discriminate sounds in the second language that do not occur in their first language. Further research is needed to test how students can also advance in their second language production skills.

CHAPTER 1

INTRODUCTION

How to best teach reading has been debated in both societies that have been literate for centuries and societies that are gradually becoming literate. The scope of issues debated within the field of literacy is vast, including methodologies and approaches to teaching reading, development and use of reading materials, sociolinguistic attitudes and dynamics affecting the literacy process and programs, language acquisition, and the development of reading readiness skills. Attention has been focused on studying how the linguistic experiences of minority language speakers influence learning of other languages. These studies are based on the premise that mother tongue (L1) literacy skills have transferable elements to facilitate literacy in additional languages. The first stages in mother tongue literacy programs focus on reading readiness and phonological awareness of the sounds in the language. This same focus is also important in the early stages of second language (L2) learning in order to build foundational skills that facilitate reading and writing in the second language.

I am interested in studying the effects of adding supplementary oral and aural sound discrimination lessons (phonological awareness tasks) to language acquisition programs for mother tongue speakers of minority languages. These lessons use teaching approaches that differ from the way minority language speakers typically learn awareness of the phonological features in the target language. Instead of using repetition, memorization, or holistic approaches, the supplementary lessons use analysis and synthesis of sounds in

both the L1 and the L2 with approaches that present the difference between L1 and L2 sounds through minimal contrasts. I am interested in discovering the effects the supplementary lessons have on perceptual and production ability in the L2. I expect that those who learn using the supplementary lessons will improve their performance on phonological awareness tasks more than those who continue to learn their L2 using the existing approaches.

In section 1.1 of this chapter, I review the main trends used to build phonological awareness skills in the L1 and L2 of minority language speakers followed by a discussion in section 1.2 about issues pertaining to building phonological awareness in languages that have a four-way stop contrast and use an alphasyllabary writing system. Next, I present in section 1.3 the particular issues that minority language speakers in the Indian state of Orissa encounter in their acquisition of the state language Oriya. This chapter concludes in section 1.4 with a presentation of general hypotheses regarding the expected outcomes of adding experimental aural and oral sound discrimination lessons to existing programs designed to support L1 and L2 linguistic and academic development for children who speak minority languages in Orissa.

1.1 Trends in Building Phonological Awareness for Minority Language Speakers

Minority language speakers often live in multilingual societies where it is necessary to acquire additional languages. Phonological awareness of the sounds in the first language and of each additional language acquired has been reported as a foundational skill that facilitates the reading process (Troyer and Yopp 1990, Waters 1998). Moskowitz (1978)[1] describes phonological awareness as the ability to manipulate all the

[1] Cited in Clark et al. (2008) *Language: Introductory readings*. 7th ed. Boston: Bedford/St. Martin's.

phonetic variations of language, learning to produce each one precisely and automatically. It includes the awareness of abstract features such as intonation, syllables, distinctive features and consonant-vowel segments. Phonemic awareness is a distinct element of phonological awareness. Trehearne (2003:118) defines phonemic awareness as "a component of phonological awareness referring to the knowledge of a word at the level of individual sounds, how to segment, blend or manipulate individual sounds in words." Phonological and phonemic awareness are critical for building oral/aural sound discrimination skills not only for being able to read and write well but for acquiring listening and speaking skills in a second language. Throughout this study, the main focus is on phonological awareness because the lessons and tasks develop and test perception and production rather than decoding and writing.

Historically, as teaching approaches have emerged and changed over the years, phonological awareness has been taught as a component within different types of literacy programs for minority language speaker. In 1934, Morris Swadesh, influenced by Sapir's phonemic principle, provided an approach to orthography development and planning for mother tongue literacy programs. In 1938, Kenneth Pike interpreted the phonemic principle as a model to be employed in schools, thus integrating principles of phonological awareness into literacy programs (Barros 1995).

Sadoski (2004) shows that throughout history approaches used to teach reading skills have fluctuated between decoding-emphasis approaches and comprehension-emphasis approaches. Decoding-emphasis approaches produce readers who are mechanically proficient but pay too little attention to meaning, while comprehension-emphasis approaches produce readers who lack independence in reading unfamiliar text. Methods and materials designed for L1 and L2 literacy programs have moved from using synthetic

approaches where phonemic units and syllables are directly taught through phonics to holistic approaches where phonological awareness is built by learning the sounds of a language as they occur within words contained within meaningful texts. Sadoski (2004) reports that at the close of the 20th century a growing trend towards a balanced approach to reading emerged with the influence of Marilyn Jager Adams and the publication of *Beginning to Read*: *Thinking and Learning about Print* (Adams 1994). Adams stresses that the ability to tell sounds apart in spoken words (phonemic awareness) is an important precursor of learning phonics.

The balanced approach to reading has influenced the revision of literacy methods and materials and has been an approach that has been acknowledged in the development of new materials for both L1 literacy programs and multilingual programs for minority language speakers. In sections 1.1.1 and 1.1.2 I review components from literacy methods and materials that demonstrate the various ways L1 and L2 phonological awareness has been taught to minority language speakers and discuss issues that correlate with the phonological awareness component in literacy programs for L1 and L2 language development.

1.1.1 Approaches in Teaching Phonological Awareness in Literacy for Development Programs

The methods and materials facilitators use for building phonological awareness in community-based literacy for development programs have changed as different trends have emerged. Variations exist between the following widely-used approaches: phonic, syllable synthetic, holistic, analytic and teaching by contrasting sounds in minimal contrast.

Phonic and syllable approaches teach learners to understand phonological relationships between sounds from the phonemic level and the syllable level (Lane 1999). Lane (1999) explains that Laubach's popular methods and materials teach phonological awareness through a phonic and syllable approach. Learners become aware of phonemic units by decoding blends and changing sounds as they occur in different word positions. Syllable structures are learned by reading short stories included in the lessons.

In the synthetic approach, learners are taught phonological awareness by understanding sounds at the phoneme level and synthesizing phonemes to syllables and then to words (Walter 1996). In the Gudschinsky Method (Gudschinsky 1973) learners build phonological awareness through a synthetic approach. Lorin Anderson's revised Bloom's Taxonomy shows that learners who process information through synthesis are using higher levels of cognitive processing than learners who process information through other ways such as through recognizing or comparing (Pickard 2007). Therefore, the synthetic approach is a cognitively challenging approach. This can be beneficial for learners who are developmentally ready to process synthetically and improve their ability to process at higher cognitive levels.

In the holistic approach, learners implicitly learn sound/symbol correspondence from cues that the print provides (Walter 1996). In the 1970's with the onset of Kenneth Goodman's Interactive Whole Language Method (Goodman 1986), the synthetic, phonic and analytic approaches to phonological awareness shifted to a holistic approach where explicit attention to phonemes and their abstract parts diminished. Without knowledge of the phonemic units, learners who are taught phonological awareness through holistic approaches may find independent reading difficult.

Analytic approaches were similar to synthetic, except the teacher teaches phonological awareness by starting at the word-level and breaking the word into its syllable and phonemic units. The Multi-Strategy Method (Stringer and Faraclas 2001) uses a syllable approach to teach phonological awareness with analytic and synthetic processing exercises. Like the synthetic approach, Lorin Anderson's revised Bloom's Taxonomy places analytical skills above recognition and comparing (Pickard 2007). Learners use higher cognitive skills when they learn phonological awareness through analytic approaches. The Multi-Strategy Method also reflected the movement towards designing materials and methods for literacy for development programs using a balanced approach. Stringer and Faraclas (2001) use analytical and synthetic approaches alongside holistic approaches. The balanced approach helps learners to read and write independently with accuracy.

Stringer (1987) presents a study evaluating the outcome of the Multi-Strategy Method in the preschool literacy programs in the Enga province of Papua New Guinea. One group of students learned phonological awareness through only an analytical approach while a second group received instruction using only a holistic approach. A third group received instruction in both analytic and holistic approaches. Stringer reported that learners from the schools using both methods read with fluency, sounded out unknown words, and became creative writers with an impressive ability to spell correctly. When only holistic approaches were used, learners struggled to spell with accuracy and decode words. Stringer's study shows that learners are not aware of units of sound when only holistics approaches are used.

Stringer (1982) also researched methods for building aural sound discrimination skills, testing the effects of sound discrimination exercises included in children's literacy programs in Papua New Guinea. Stringer discovered that students performed better on hearing minimal differences between similar disyllabic units in words than on finding the change in very different patterns located in syllable initial position. Her research emphasizes that exercises that present phonemes through minimal contrasts can contribute to successful development of phonological awareness skills.

All of the methods discussed in this section include ways to connect meaning with words and sounds, acknowledging that in the early stages of building phonological awareness, it is important to support the abstract concepts of sounds with concrete, meaningful contexts. Kosonen et al. (2007:54), in an overview of the methods that have been widely used in literacy programs for mother tongue speakers of minority languages, state, "Many strategies for learning to read and write work in different socio-cultural situations. Some teachers mainly focus on teaching the alphabet, syllables and the sound/symbol relationships in a language. In order for learners to be successful readers and writers, they need to have mastered both the skills of reading for meaning and accurate reading." Therefore, the most important thing for any literacy program is to ensure that it maintains a balance between focusing on parts of the language and whole texts.

The components in literacy programs that focus on language parts often differ from one another in the ways sound analysis is presented. In the Laubach and Gudschinsky methods, learners will have strong analytical skills that will enable them to identify phonemes and decode, but have little opportunity to build knowledge of the phonological

components of language when sounds are embedded in texts with meaningful contexts. The approaches in the Interactive Whole Language Method include the essential aspect of learning sounds within meaningful contexts but little explicit attention to learning the phonemes and their phonological features. Instead, learners need to rely on their intuition to process and organize sounds. The development of phonological awareness within the L2 is thus seen more as an inherent process of awareness rather than an emergent process. Metsala (1999) explains that emergent processing means that the phoneme emerges as a result of the growth of spoken vocabulary. As vocabulary expands, there is an increasing cognitive demand to be able to discriminate between a growing number of words with similar sounds in similar environments. Therefore, methods and approaches need to address the cognitive demand of vocabulary growth, and its relationship to how sounds are processed and discriminated in both the L1 and the L2.

Phonic, synthetic, analytic and holistic reading approaches have been widely used in both L1 and L2 literacy for development programs for minority language speakers. In the next section, I present details of how phonological awareness has been incorporated into literacy programs designed to bridge between L1 and L2. Furthermore, I present an overview of how methods for building phonological awareness apply to bridge programs for minority language speakers who need to acquire an additional language mainly for the purpose of understanding the language of instruction in their educational contexts.

1.1.2 Building L2 Phonological Awareness in Literacy for Development Programs with a Bridge Design

Mother tongue literacy for speakers of minority languages has not always been thought of as being beneficial in the acquisition of additional languages. The main opposition has been that learning the mother tongue detracts from time spent learning the

L2, which is the dominant language for communication in commerce and the language of instruction. Kosonen et al. (2007:12) report the following statements from those who oppose L1 literacy: "It is a waste of time and resources. The best way for minority children to learn a new language is for them to use it as soon as possible and as much as possible!" and "Using minority languages in school will cause ethnic divisions and lead to all kinds of trouble!"

In the case of Kashmiri, the state language of Kashmir, a northern state in India, L1 literacy was rejected due to government policy. Tickoo (1994) describes Kashmiri as a majority language reduced to the status of a minority language. He reports that Kashmiri does not find a place in either schooling or government because of the failure of successive state governments to implement their policies regarding language teaching in primary school. In contexts where opposition to L1 literacy exists, minority speakers need to acquire phonological awareness through the L2 without the scaffolding from their awareness of the sounds in their L1. Advocates of L1 mother tongue literacy programs agree it is more efficient to teach reading skills first in the mother tongue and then use the ability to read as part of the tool for teaching a second language (Gudschinsky 1973, Hunter 1994, Alex 2004, and Kosonen et al. 2007). In addition, a strong foundation in the L1 develops stronger literacy abilities in the school language (Cummins 2000).

Unfortunately, many minority language speakers have received their education through a language other than their mother tongue. They lack a strong foundation in L1 phonological awareness and literacy skills and consequently, the acquisition of L2 phonological awareness and literacy skills are hindered. To address this situation, multilingual literacy programs referred to as bridge programs were established. Kosonen

et al. (2007:8) explains the characteristics of bridge programs: "Learning is started with and through something that the learners already know, i.e. their first language, and unfamiliar things, such as the second language, are introduced gradually and learned after a solid foundation in the first language has already been accomplished." Thus, learners receive ample time to acquire phonological awareness in the L1 before starting to learn the sounds of the L2. Bridge programs emphasize that maintenance of the first language throughout the learner's education is important.

Educators have designed curriculum for incorporating the components of phonological awareness into bridge programs using a balanced approach to literacy development. Kosonen's (2002) guide lists the steps involved in developing a biliteracy primer. Sounds are taught using the following principles:

1. Each lesson has vowels as well as consonants.
2. Symbols looking quite similar are taught in different lessons.
3. Similar sounds are taught separately.
4. Short and long vowels taught separately (e.g. **o** vs. **oo**).

The following three points are principles from Kosonen (2002) for word building:

1. Only symbols learned in previous lessons can be used.
2. Words must be picturable.
3. All words are provided with an L1 gloss.

If materials for bridge programs follow these principles, learners may build L2 phonological awareness. However, these guidelines are only general guidelines. There are other factors to consider that relate to L2 phonological awareness. Kosonen's principles do not instruct lesson designers how to select and arrange sounds in the L2 so

that learners can notice contrastive differences between the phonological features of the L1 with the new features found in the L2. Kosonen's principles mainly describe the physical design of a biliteracy primer. It would also be important to understand how factors such as script characteristics, teaching approaches, language attitudes and cognitive levels of L2 learners impact primer design and the development of phonological awareness. In section 1.2, I evaluate and summarize a number of such factors that relate to developing phonological awareness in Indo-Aryan and Dravidian languages that contain the four-way stop contrast.

1.2 Issues in Building Phonological Awareness in Languages with the Four-Way Stop Contrast and an Alphasyllabary Writing System

Indo-Aryan languages are unusual among the world's languages because they possess a four-way contrast between voiced aspirated, voiced unaspirated, voiceless aspirated and voiceless unaspirated stops. Phonemes in Indo-Aryan and Dravidian languages with this four-way stop contrast are often represented using an alphasyllabary writing system: that is, each consonant-vowel sequence is written as a unit where the vowel symbol functions as an obligatory diacritic to the consonant. Minority language speakers need to learn to distinguish the separate phonemes in the four-way stop contrast, a feature in the language of instruction used in their educational settings. Phonological awareness of Indo-Aryan and Dravidian languages used as the language of instruction is typically taught through repetition, memorization and holistic approaches. Various studies reveal the effects of these approaches and relate phonological awareness to the size of the phonological unit and the visual cues represented by the writing system.

Mishra and Stainthorp (2007) compared the phonological awareness of fifth graders who learn Oriya as their first language of literacy and then English with fifth graders who learn English as their first language of literacy and then Oriya. Their research demonstrated how teaching approaches, first language of literacy and size of the phonological unit effect phonological awareness. In the government schools, Oriya is the first language of literacy when it is the language of instruction and English is the first language of literacy when it is the language of instruction. Mishra and Stainthorp (2007:35) describe the approach teachers in government-run schools use to teach phonological awareness of Oriya sounds: "Reading instruction in Oriya is predicated on a whole word approach to word reading but children generally know the identities of the symbols used in the scripts they will learn when they begin school. Exposure to print experiences in the early school years is 'casual' and implicit through display boards and exploring print in books. The books promote single word and simple sentence reading." Mishra and Stainthorp (2007:33) report the results from word and pseudo-word reading tests in Oriya and English. They state that learners who attended Oriya-medium schools whose first language of literacy was Oriya, showed relatively less phonological awareness of English than Oriya. Also, Mishra and Stainthorp (2007:31) report, "Oriya phonological awareness contributed to Oriya pseudo word reading, but it did not contribute to real word reading." Teaching approach was one factor that was attributed to these results. Mishra and Stainthorp (2007:31) explain that the results "would suggest that these children may have been reading these items via a lexical, whole word route to reading."

Native speakers of Oriya attending English-medium schools were more successful reading words and pseudo-words in English than in Oriya. Mishra and Stainthorp (2007:34) suggest that while phonological awareness of the L1 leads to reading in the L2,

phonological awareness in L2 does not necessarily lead to reading in the L1. The results from this study demonstrate it is beneficial for literacy programs to have materials and lessons that are designed to teach L1 phonological awareness first so that learners succeed at reading in the L1 and L2.

Mishra and Stainthorp also show that word reading corresponds with awareness of the size of the phonological unit the written script represents. Those who learn Oriya literacy become aware of sounds primarily at the syllable level with some exposure to the phoneme level. Those who learn English literacy become aware of sounds primarily at the phoneme level. Mishra and Stainthorp (2007:34) report that: "Awareness of large Oriya phonological units made a significant unique contribution to the Oriya word and pseudo-word reading of the group whose first language of literacy was Oriya. There was no additional variance accounted for by awareness at the phoneme level." The pattern for the group who learn English as their first language of literacy had the reverse result. "Awareness of Oriya phonemes contributed significantly to Oriya word and pseudo-word reading with no additional variance being accounted for by awareness of the large units." Overall, those who learn English as their first language of literacy performed better on English word and pseudo-word phonological awareness tasks than on Oriya phonological awareness tasks. Mishra and Stainthorp indicated that these learners were using their knowledge of the phoneme level rather than the syllable level in their attempts at Oriya phonological awareness tasks. Mishra and Stainthorp (2007:34) attribute performance on the phonological awareness tasks to the size of the phonological unit and to teaching approach by stating, "It may be that the whole word/look-and-say approach to teaching did not support induction of units below the level of the syllable initially for the group that learns Oriya as a first language of literacy." The results from the study examining the

relationship between the size of the phonological unit and phonological awareness indicate that those learning Oriya as their first language of literacy have different approaches to decoding than those learning English as their first language of literacy.

From this study we can gain further insight into the relationship between the alphasyllabary writing system and the skill of making sound/symbol correspondences. Because the symbols represent larger units of sounds, syllable units rather than phoneme units, readers need to associate fewer symbols per word. In addition, the alphasyllabary represents sound-symbol relationships in closer one-to-one correspondences than many alphabetic systems such as English. Therefore, the alphasyllabary writing systems may help in facilitating the development of phonological awareness. However, even though these systems do have these features, they represent complex syllables with complex symbols that can be challenging to read.

This study reveals how the Oriya sound system is commonly taught, how L1 literacy skills transfer to the L2, and how the alphasyllabary writing system can influence phonological awareness. However, this study did not consider the difference between reading performance of beginning readers with performance of advanced readers. Mishra and Stainthorp did not reveal how a beginning reader would perform on phonological awareness tasks when L1 and L2 literacy skills are learned through languages that both use alphasyllabary systems. Baker (2001:331) however states, “When biliteracy is encouraged in minority language children, literacy skills and strategies from the first language appear to transfer to the second language (if using a similar writing system.” Baker (2001:330) specifies that the skills that are transferred are scanning, skimming, guessing words using context, knowledge of text structure, visual-perceptual training and cognitive functions; whereas, the skills that need explicit teaching in each language are

learning the sounds of letters and decoding of words. Baker's statements suggest that the specific features of the new sounds in the L2 are not a part of the skills that are being transferred. Further studies are needed to test how beginning readers would perform on phonological awareness tasks if letter sounds represented by alphasyllabary systems were taught explicitly with opportunities for learners to transfer L1 and L2 skills and learn through approaches other than those reported by Mishra and Stainthorp.

Nag (2007) researched the pace at which early learners acquire phonemic awareness in a comparative study of the acquisition of English and Kannada, a Dravidian language which also has an alphasyllabary writing system. One of the tests that Nag (2007) uses in the study is a phoneme substitution test. This test assesses phonemic awareness through an oral/aural drill. Johns et al. (2002) explains what a phoneme substitution test would be like in English: "Listen to the word 'fun'. If I take the /f/ off of 'fun' and put on /r/, you make 'run'. Now say the word 'car', take off the /c/ and put on a /j/ to make a new word. The new word is _____." The child will fill in the blank with the new word. Nag (2007) reports that the results from the phoneme substitution test revealed that first grade learners performed at 5% accuracy for initial substitutions and 8% accuracy for terminal substitutions, compared to fourth graders who showed an average accuracy rate of 51%.

This study reveals the range and type of phonological awareness early learners achieve when learning the alphasyllabary system of Kannada, when Kannada is their L1, and they were not being influenced by prior literacy skills from additional languages.[2] Correlations between phonological awareness of languages with alphasyllabaries, age and educational experience are reported by Nag (2007:19): "Kannada is a shallow

[2] Nag (2007) does mention that some of the learners in the study did speak other languages at home, but this was never analyzed as a correlating factor in the results; thus, the reported results here are based on the premise that this factor was not considered as having a distinctive effect on the results.

orthography but the pace of learning is not as would be predicted from a classification of orthographies along a transparent–opaque continuum. The pace of learning of Kannada orthographic knowledge is drawn out over at least 4 years." This study revealed the complexities in learning alphasyllabary writing systems that have ligaturing rules. In many languages that use alphasyllabary writing systems, including Kannada and Oriya, ligaturing rules apply to syllable structures beyond CV. A ligature is formed for CCV and CCCV syllable structures. In Kannada, Nag (2007:8) explains, "To form a symbol for a CCV structure, post-consonantal vowels are placed either to the right, top or bottom of the initial consonant. The second consonant is positioned at the bottom right of the first consonant. The right and top vowel diacritics are positioned relative to the first consonant." The result after applying the ligaturing rules is a complex visuo-spatial arrangement to represent syllables.

In languages like Kannada that have complex syllable arrangements, children are actually acquiring more than 400 symbols; therefore, learners acquiring languages like Kannada are learning extensive orthographies. These extensive orthographies make a greater cognitive demand on learners in their processing of abstract information and sound/symbol correspondences. One possible explanation for the slower progress in the development of phonological details is that these cognitive functions may not be at full capacity in younger learners.

Nag (2007:20) discusses the effects teaching approaches may have on learning pace and test performance. Learners are commonly taught phonological awareness by reciting the sounds and copying the written symbols for the sounds onto paper as they are learned. This is an indigenous teaching method used for centuries with beginning readers. The

slow learning pace that Nag discovers could be present because teachers are not using balanced approaches that teach learners to analyze sound units rather than memorize them. Further investigation is needed to discover if young native speakers of Kannada would increase their learning pace if teachers used a balanced approach to teach phonological awareness.

Nag's study does not show which sounds were difficult for learners on the aural/oral assessment. It would be interesting to discover if there were phonemes that were more difficult to discriminate than others and whether phonological features in the Kannada phonemes could be identified as the features which were difficult to perceive.

Nag's study focused on understanding the factors that correlate with learning pace in the development of early reading skills in the L1. It is possible to predict that teaching approach and characteristics of the alphasyllabary writing system are also factors that would affect learning pace of early reading development in the L2.

Davis (1995) presents one of the clearest studies dealing with acquiring phonological awareness of the four-way stop contrast. In part of her study she examines the development of voice onset time in Hindi. Her study reveals the potential challenges children have as they acquire perception and production of sounds in the four-way stop contrast. Davis analyzed the speech productions of Hindi-speaking children and adults using acoustic analysis. The results showed which pairs of velar stops in the four-way contrast children articulated with contrastive production and revealed the developmental order children acquired each contrastive pair.

To discover the developmental order, Davis (1995) compared child productions of Hindi velar stops with adult productions. Davis discovered that adults produced each

velar stop with different lengths of voice onset time (VOT). The shortest mean VOT difference in adult models was between /k/ and /g^{fi}/ and the largest mean VOT difference was between /g/ and /k^{h}/. Davis' study confirmed that children acquire pairs of sounds that adults produced with larger mean voice onset times (VOT) earlier than pairs of sounds with a small mean VOT difference. Davis (1995:304) explains that "the results of this study indicate that the developmental order of contrastive production follows from the magnitude of acoustic differences in adult productions."

This study indentifies particular aspects of the phonemes in the four-way stop contrast which help us understand the challenges learners may face in acquiring perception and production skills. The same methodologies that Davis used could be adapted to discover the acoustic properties of L2 sounds that children produce. An analysis of these acoustic properties could show how their productions change as they go through developmental stages in second language acquisition.

Davis's study provides helpful insight into the details of phonological awareness in child language acquisition; however, her study only focuses on velar stops in the four-way stop contrast occurring in word-initial position. Extending the analysis to sounds contrasting in other word positions and to stops with other places of articulation may reveal some results contrary to those reported. In addition, Davis' study only involved children between the ages of one to six who were native speakers of Hindi. It does not explore the developmental sequences of children older than six years old who acquire phonological awareness of the four-way stop contrast when it is a part of the phonemic inventory of their second language and not a part of the inventory of phonemes in their native language.

1.3 Minority Languages in Orissa and the Acquisition of Oriya

In this section, I explain sociolinguistic issues related to literacy programs for minority language speakers in Orissa and the educational challenges that affect the acquisition of Oriya as a second language.

1.3.1 Orissa State

The state of Orissa, located in the southeastern region of India, has a population of 36,706,920 according to the 2001 Census (Department of School and Mass Education, Government of Orissa 2006). Orissa is located in the tribal belt, a region where many minority ethnic groups reside. The state of Orissa is one of the most linguistically diverse states in India. "There are sixty-two tribal groups speaking more than forty languages belonging to the Indo-Aryan, Dravidian, and Munda families of languages" (Sinha 2005). Mishra (2004), reports that minority ethnic groups constitute 22% of the total population. The state language of Orissa is Oriya, one of the eighteen national languages of India. Many who inhabit Orissa, however, are multilingual because of the linguistic diversity that exists in this state. This poses educational challenges that affect speakers of minority languages and their acquisition of Oriya.

1.3.2 Educational Challenges

The languages that are predominantly used as the language of instruction include Oriya and/or English. The national languages, Hindi and English are learned in the government and private education systems in the state of Orissa. Children living in Orissa typically start their education at age four if they attend a private English-medium school or at age six if they attend a state Oriya-medium school. According to Mishra and Stainthorp (2007), children who attend English-medium schools will start to learn to read

in English in grade 1 while those in Oriya-medium schools will learn English in grade 2. Sunwani (2006) summarizes the role of the mother tongue as the language of instruction as stated by the National Council of Research and Training of India: "Primary school education must be covered through the home language(s). It is imperative that we honor the child's home language(s). According to Article 350A of our Constitution, 'It shall be the endeavor of every state and of every local authority within the state to provide adequate facilities for instruction in the mother tongue at the primary stage of education to children belonging to linguistic minority groups.' " Ensuring that the mother tongue is the language of education for minority language speakers has been a concern among those working in literacy for development programs.

Not allowing minority language speakers to receive education in their mother tongue has been detrimental to the economic and educational status of the tribal communities. Mishra (2004) describes his observations regarding the attitude of tribal children in the Oriya-medium schools in Orissa: "Fear and threat of unforeseen challenge is another aspect, which prohibit the tribal children from attending the school. Even in the Ashram Schools, the children's self-image or self-confidence is not built properly to help the tribal children maintain their self-image and feel their self-esteem." Mishra administered a language attitude assessment in 26 regional blocks in Orissa that are known for their linguistic diversity and discovered: "Children in school do not understand the Oriya language; they are also reluctant to speak the Oriya language in the class."

Malone (2004) summarizes the situation in Asia regarding education for multilingualism and multi literacy in ethnic minority communities, explaining that negative consequences have resulted from practices and hierarchical language and educational policies for ethnic minority communities. Malone (2004) specifies that

schools established in response to the policies are often inappropriate to the minority communities because most of the teachers do not speak the language of their learners and teach curriculum containing themes that are unrelated to the lives of minority language speakers.

High drop-out rates are common among children who live in tribal communities. MacKenzie (2003) reports that drop-out rates in some tribal communities in India are as high as 80%. She states that the following are factors contributing to high drop-out rates: socio-economic factors, inattention to the language and culture of minority language speakers in the school curriculum and the lack of support given by and to teachers. In Orissa, there are high drop-out rates among speakers of minority languages who attend Oriya-medium schools. Speakers of Gutob-Gadaba, a minority language spoken in the Malkangiri District of Orissa, are reported to have the motivation to attend government schools and learn Oriya, but most of them fail in 10th grade (Rajan 2003). Drop-outs are due to low academic achievement and parents calling their children home to teach them field work. Another factor contributing to drop-out and low achievement may be low motivation to learn to speak and develop L1 literacy skills before attending Oriya-medium schools. Even if the L1 literacy materials that have been created for adults were to be used for children, motivating children to attend literacy classes would be a challenge due to their reported attitude towards their mother tongue. Rajan (2003) says that young Gutob-Gadaba speakers feel superior when they speak Desiya and look down on speakers who use Gutob-Gadaba with them. The drop-out rates continue to increase in the district where my research in phonological awareness takes place. In a recent study, Abhijit (2008) reports that the drop-out rates of children in the primary grades (1-5) in the

Malkangiri District of Orissa have increased from 11% in 2003-2004 to 21% in 2005-2006. Further research is needed to identify ways to address the academic and second language acquisition needs of minority language speaking children in this district.

In Orissa, it is challenging to provide education for speakers of minority languages who live in remote, isolated areas. Hannah Alex, a literacy for development worker for the Asha Kiran Society who has lived and worked among the Bondo of the Malkangiri District, reports that in 1994, less than 10% of Bondo children went to school and that there were only 8 primary schools for 30 villages in the Bondo Hills (Alex 2004). She judges these schools to be dysfunctional because children were receiving small amounts of education all conducted in Oriya. Another reason why these schools are dysfunctional is because village primary school teachers teach without prior knowledge about the culture or the language of the people in the village and teachers' attendance has been poor. Alex (2004), reports that parents would rather keep their children at home to do work than send them to schools that are inconsistent in providing education.

Educational challenges exist in communities of minority language speakers who feel threatened by majority language speakers. Minority language speakers located in remote areas have been reported to have low motivation to learn the language of wider communication. Gustafsson (1991), reports that the Kond, who live in remote locations near Orissa, are reluctant to change, especially if the changes involve state language learning programs. This reluctance would make it challenging for minority language speakers to accept L2 literacy programs designed to prepare children to learn through the language of wider communication in the government schools.

Another educational challenge is that there is a lack of trained teachers who can support both L1 and L2 academic and linguistic needs of children who speak minority languages. Traditional teaching practices still exist in some villages. Gustafsson (1991) explains that teachers of Oriya in minority communities have been self-appointed teachers for the village. Students learn Oriya by forming letters of the Oriya alphabet with a sharpened stick and later make whole words and sentences. "Once a student has written a slab of writing, he reads it over and over again until he has memorized the written letters, words, and sentences. Then he proceeds with the next lesson. Very few students reach full literacy in Oriya through this method, however, probably due to dropout or discontinuation of the class" (Gustafsson 1991). Therefore, even though literate teachers may be available in the village, training them in the language acquisition process and equipping them with better methods to help children to acquire Oriya is an additional challenge affecting education and successful language acquisition of Oriya by minority language speakers. Investment in teacher training and in development of a variety of L1 and L2 materials will most likely impact the future of education in communities with minority language speakers. These investments are two out of the many that will need attention in order to reduce drop-out rates and provide sustainability for village-based education. It is one challenge to get children to schools, but another to keep them there so they can achieve academic success.

In order to address the prevalent educational challenges, the Asha Kiran Society introduced educational programs in the mother tongue for preschool literacy and adult literacy to the Bondo community. The programs were designed based on the following principles from Alex (2004). First, concepts and ideas are more easily understood and

thoroughly formed when communicated through one's mother tongue. Second, the literacy skills learned in his or her first language are transferable to the second language. Alex (2004) reports that because of the preschool literacy programs, children who chose to attend residential Oriya-medium boarding schools were motivated to remain in school even though the schools are outside their village. Children were more successful at learning in their L2 than those who went to school before the preschool class existed because they had arrived at the boarding school with prior literacy skills in the L1, and an introduction to part of the Oriya alphabet and some vocabulary through an alphabet book. Hannah also provides teacher training for the adults from the literacy class. The training addresses the need for trained teachers who understand how to teach children based on language acquisition and literacy principles. There are few educational programs such as the one in the Bondo community that have been started and sustained in other villages in Orissa. There is a need for research to be conducted in communities in Orissa that experience these educational challenges to further study different methods that can be used in educational programs for children who need to acquire Oriya as their L2 for educational settings.

1.4 Research Hypotheses

As stated in the introduction to this chapter, I am interested in discovering the impact of supplementary sound discrimination lessons to teach phonological awareness and the acquisition of Oriya in existing educational programs. This study is based on the following assumptions.

1. Teaching approaches that use repetition, memorization or only holistic approaches may contribute to a lack of development in phonological awareness of the L1 and L2

(Nag 2007, Mishra and Stainthorp 2007, Gustaffson 1991, Stringer 1987). Also, learners who are taught to notice minimal phonetic contrasts between phonemes perform better on sound discrimination tasks than those who are not taught to notice minimal phonetic contrasts (Stringer 1982).

2. Knowledge of the L2 writing system can facilitate phonological awareness. However, teaching approaches can impact the influence this knowledge has on the learners' ability to succeed at phonological awareness tasks that test perception and production of L2 sounds (Mishra and Stainthorp 2007, Nag 2007).
3. Learners can acquire perceptual skills earlier than production skills (Krashen 1985, Asher 1972, Kosonen et al. 2007).
4. In acquiring the ability to produce the sounds in the four-way stop contrast, voiceless aspirates are acquired earlier than voiced aspirates (Davis 1995).
5. Learners who have less educational experience and have less developed cognitive maturity show low performance on phonological awareness tasks (Nag 2007).
6. The pace learners improve in their development of L2 phonological awareness may increase as learners are taught new sounds in the L2 through their knowledge of the L1 (Mishra and Stainthorp 2007, Baker 2001, Kosenen et al. 2007, Gudschinsky 1973, Hunter 1994, Alex 2004). Furthermore, the pace at which learners improve in their L2 phonological awareness may increase if teachers use approaches that research has shown facilitate acquisition of phonological awareness skills better than traditional approaches (Nag 2007).

Based on these assumptions, I test the following six hypotheses in this study.

1. Students who learn sounds in their L2 through teaching approaches that use analysis, synthesis and contrast between minimal phonetic sounds will demonstrate an ability to perceive new sounds in the L2 with more accuracy than those who receive instruction using traditional methods.
2. Students who have more experience learning the L2 writing system will perform better on phonological awareness tasks than those who have less experience learning the L2 writing system.
3. Students will show greater improvement in perception than in production. Although perception can facilitate production because the speaker has the knowledge of perceptual cues, L2 articulatory skills require the development of additional skill sets such as motor skills which develop with instruction, feedback and experience producing the sounds.
4. Learners will show less difficulty producing voiceless aspirated stops than voiced aspirated stops.
5. Younger learners with less educational experience will not demonstrate significant increased perception due to their less developed cognition.
6. Students who learn through the teaching approaches used in the experimental lessons will show an increase in their learning pace when compared with learners who do not receive the experimental lessons.

In the next chapter, I explain the modifications made to the existing language acquisition programs for children who are native speakers of either Desiya or Bondo, two minority languages spoken by minority groups in Orissa. Also, I introduce background

information about Bondo and Desiya speakers and explain the phonological contrasts between Bondo, Desiya and Oriya.

CHAPTER 2

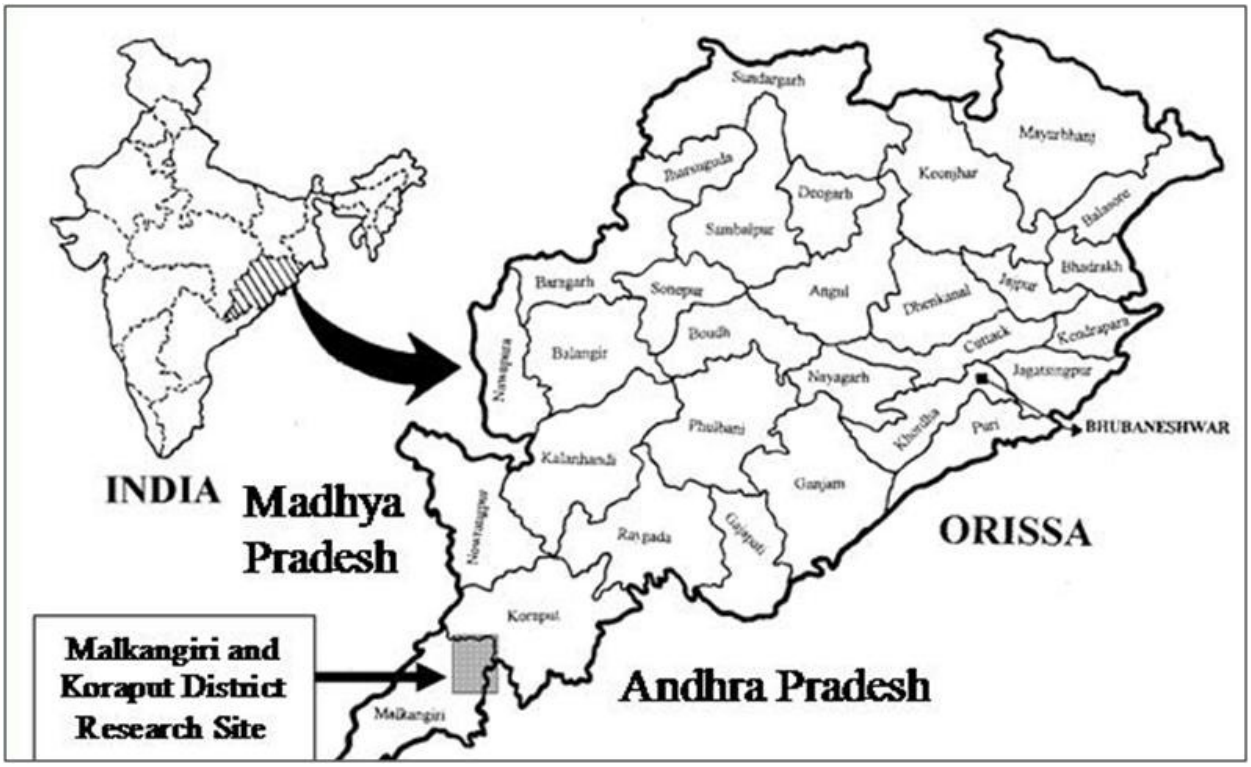
PROGRAM MODIFICATIONS

The research hypotheses were explored by making modifications to two out of four educational programs for the Bondo and Didiya children who reside in the state of Orissa. This chapter provides an orientation to the region in which the research took place (2.1) and an overview of the Bondo and the Didya and their existing educational programs the children attend. In this chapter I will also introduce the components of the lesson book that I designed and used to modify programs that facilitate Oriya language development for Bondo and Didiya children. In section 2.2, I will describe the experimental sound discrimination and production tasks for building phonological awareness and explain how teachers taught the lessons using the approaches that were being tested in the research. Then, in section 2.3 I will summarize the results I anticipated from the program modifications applied to educational programs for Bondo and Desiya children.

2.1 The Malkangiri and Koraput District of Orissa

This research was conducted in the Malkangiri and Koraput districts, the southernmost districts in the state of Orissa as shown in Figure 1.

Figure 1: Orissa State and the Koraput and Malkangiri District



The western border is shared with the state of Madhya Pradesh and the southeastern border is shared with the state of Andhra Pradesh. These two districts have mountain ranges, hills and plains. There are two hilly ranges, one the 2,000 ft. plateau of Jeypore extending from Koraput into the Malkangiri district and the high hilly regions of the Eastern Ghat lying between the Jeypore plateau and the Visakhapatnam coastal plains (Shah et al. 2005). Geographical features have deterred others living in the coastal plains from settling among the minority people groups inhabiting these districts. Shah et al. (2005) note that, "Outsiders never penetrated in to the Koraput Distruct due to steep hills, fear of malaria and dense forest." National, state, and minority languages converge within this district, creating situations where it is necessary for the inhabitants to develop multilingual skills in an area where there are educational challenges like those described

in section 1.3.2. In the next two sections (2.1.1 and 2.1.2) I present the sociolinguistic characteristics, educational programming and issues in language acquisition for the Didiya and the Bondo, two people groups within the Malkangiri and Koraput Districts that were a part of the research reported in this thesis.

2.1.1 The Didiya

Many Didiya live in the Koraput District and the Nowrunpur District. The Didiya speak Desiya as their mother tongue. Desiya is an Indo-Aryan language related to Oriya (Gordon 2005). Although Desiya is related to Oriya, it is mutually unintelligible with Standard Oriya, the form of Oriya that is spoken in schools. Desiya is also referred to as Tribal Oriya, a low form of Oriya. It has 80-85% of lexical similarity with Adavasi Oriya, a dialect spoken in the neighboring state of Andhra Pradesh. Adavasi Oriya is written using Telagu script. Desiya is spoken in the rural areas and used as a trade language among speakers of minority languages in parts of the Lamptaput Block, a small region in the Koraput District where speakers of minority languages and Oriya intermingle, especially for the purposes of commerce. Minority language speakers living near areas in the district where Desiya is spoken have been moving towards accepting Desiya as their mother tongue. Most Didiya children who go to school attend government Oriya-medium schools close to their village. The language of instruction in these schools is Oriya with the addition of English in the second grade. Though there are educational opportunities for Desiya native speakers, Gordon (2005), reports that the literacy rate in Oriya is at 6% among native speakers of Desiya.

The Asha Kiran Society, an Indian non-governmental organization that works on literacy and other various community development projects in the Malkangiri and Koraput Districts started adult mother tongue literacy classes for the Didiya. These

classes use transition primer materials to introduce reading and writing in Oriya. Learners start this primer after about a year of mother tongue literacy classes, completing a preprimer and three graded readers. The bridge primer uses the Gudschinsky Method (1973). In the bridge primer, learners study sounds that are similar to Desiya first, read Oriya in words and short sentences with Desiya translations, and do vocabulary-building exercises. In the vocabulary-building exercises, learners match the Oriya words to a corresponding picture and practice reading sentences that contain the words from the vocabulary-building exercises.

The Asha Kiran Society also attends to the educational and linguistic needs of children who go to Oriya-medium government schools during the day[3]. Community developers with the Asha Kiran Society manage and provide tutoring programs before and after school. In these programs, an Asha Kiran tutor who speaks Desiya and Oriya provides content-based instruction by reviewing concepts from the curriculum used in the schools. Students follow along in their Oriya textbooks while the tutors give oral instruction explaining the academic content in the mother tongue of the children. These village-based tutoring programs, however, do not include studies in mother tongue literacy. The tutors provide individual help with English to the older students, explaining the meaning and grammatical forms using the students' mother tongue so that the children can complete their workbooks.

2.1.2 The Bondo

The Bondo are a minority people group that live in the mountainous areas of the Malkangiri District. The Bondo community is divided into two major groups: the Upper

[3] Although Asha Kiran Society works with children from villages who attend residential schools (boarding schools), they currently do not provide educational and linguistic support at these schools.

Bondo and Lower Bondo. According to the 1991 census, the total population of the Bondo was about 8,000 made up of 4,500 Upper and 3,500 Lower Bondo (Alex 2001). The Bondo language belongs to the South Munda subgroup of the Austro-Asiatic family of languages. Gordon (2005) reports Bondo has 32% of lexical similarity with Desiya. According to Alex (2002), the Upper Bondo dialect of Bondo has fewer influences from Oriya and Desiya than the Lower Bondo dialect, thus maintaining a purer form of Bondo.

There are more community resources such as clinics, schools and commerce in the regions where the Lower Bondo live. Upper Bondo have distinctly different cultural characteristics due to their isolation and the remote location of their villages. They not only differ from the Lower Bondo, but also differ from other people groups from the surrounding communities in education, culture, language contact and language use. The Upper Bondo live in 1370 houses in 30 homogeneous villages located in the remote parts of the Bondo Hills. The cultural changes among this people group have been more limited than those of the minority people groups living in the lower valley regions. As a result, the Bondo have been able to live as monolingual speakers of their mother tongue in a state where the majority of the population is multilingual.

The Upper Bondo traditionally have an oral culture. Analysis of the language began in 1998 through an Asha Kiran project; thus, writing and reading in the mother tongue has been recently introduced. Hannah Alex (2004) reported that informal village preschool sessions which focused on reading readiness were introduced in 1998 and adult literacy classes began in 2001. The literacy rate in Oriya was reported at 4% (Gordon 2005). Literacy students start the Oriya primer after completing the Bondo primer and lesson books 1-3. Oriya literacy was introduced into the adult village literacy classes with a transition primer that is similar to the Gudschinsky primer described in 2.1.1. This adult

primer is in a diglot format. Each Oriya word, sentence and story is followed by a Bondo translation of the text. Students in the adult literacy program learned some oral skills and functional literacy skills in Oriya. Children are introduced to Oriya through an alphabet picture book which teaches all the vowels and consonants of the Bondo language along with the Oriya equivalent. A reading readiness exercise book was developed with exercises for developing oral, aural, visual and manual skills.

One goal of the preschool program was to equip children with foundational literacy skills in their mother tongue so that they could be more prepared to attend Oriya-medium schools. The Oriya-medium schools are located in government-run residential schools outside the village. Children from the Bondo village of Dumripada who attend these schools need to stay in hostels and return home during periodic breaks. Though the residential schools are still located in the Bondo Hills, students there are more exposed to Oriya because it is the language of instruction. Alex (2004) reports the preschool program has been successful: in 2001 eight boys from the preschool program enrolled in the Oriya-medium school and remained. In 2004, plans were being made to develop a formal primary school for the village and develop a bridge program that includes acquisition of Oriya. In 2004, literacy consultant Mary Stringer and Hannah Alex held a literacy workshop in order to move forward with the plans for a formal primary school. Seven literate Bondo community members and one native speaker of Oriya who taught the Oriya transition classes attended this workshop. The participants created mother-tongue literacy materials for the preschool program following the Multi-Strategy Method (Stringer and Faraclas 2001). They also practiced teaching with the materials using the Multi-Strategy Method.

Those involved in the development of the literacy programs had a desire to formalize the process of adding the L2 to the L1 by using practices that were being developed in the area of multilingual education, including the development of a stronger oral L2 component. Additional Oriya materials were not produced during the 2004 workshop, but plans for a bridge program were drafted in 2004 and 2005. Those working with the Desiya literacy programs were also involved in the planning. Development of L2 materials for children was to possibly start after completing a collection of L1 materials for children.

2.1 Phonemic and Phonological Contrasts Between Oriya, Bondo and Desiya

The purpose of this section is to provide a phonemic description of the languages involved in this study along with highlights of the phonology for each.

2.1.3 Oriya Phonemes and Phonology

Oriya is widely spoken in the southeastern state of Orissa. Over 100,000 speakers of Oriya live in the states of Madhya Pradesh (721,348), Bihar (404,443), Andhra Pradesh (259,947), West Bengal (170,001), and Assam (140,782) (Central Institute of Indian Languages 2009). Oriya is an Indo-Aryan language with an alphasyllabary writing system. At the phonemic level, Oriya has 6 vowel phonemes and 39 consonant phonemes. Table 1 depicts the vowels that have been analyzed as separate phonemes and Table 2 depicts the consonants that have been analyzed as separate phonemes along with the graphemes used to write each phoneme. Each of the vowels, except /o/, have nasal and oral contrasts, and short and long contrasts.

Table 1: Oriya Vowel Phonemes

Front	Center	Back
i ଇ		u ଉ
e: ଏ		o ଓ
	a ଆ	ɔ ଅ

Table 2: Oriya Consonant Phonemes

	Labial	Dental	Alveolar	Retroflex	Palatal	Velar	Glottal
Unaspirated Stop	p ପ b ବ	t̪ ତ d̪ ଦ		ʈ ଟ ɖ ଡ		k କ g ଗ	
Aspirated Stop	p^h ଫ $b^ɦ$ ଭ	t^h ଥ $d̪^ɦ$ ଧ		$ʈ^h$ ଠ $ɖ^ɦ$ ଢ		k^h ଖ $g^ɦ$ ଘ	
Fricative			s ସ				h ହ
Unaspirated Affricate					tʃ ଚ dʒ ଜ		
Aspirated Affricate					$tʃ^h$ ଛ $dʒ^ɦ$ ଝ		
Nasal	m ମ		n ନ	ɳ ଣ	ɲ ଞ	ŋ ଙ	
Unaspirated Flap			ɹ ର	ɽ ଡ଼			
Aspirated Flap				$ɽ^ɦ$ ଢ଼			
Liquid			l ଲ	ɭ ଳ			
Approximate	w ୱ				j ଯ		

The Oriya script comes from the Kalinga script which descends from the Brahmi and Devanagari scripts. Forty-six graphemes are used in Oriya. Symbols are mainly represented at the syllable level although some are at the phonemic level. When vowels occur in syllable structures that include a consonant or consonant cluster in the onset, vowels are marked with a diacritic on the last consonant grapheme in the onset. Consonants which are not marked with a diacritic have the inherent vowel, [ɔ]. Some consonant graphemes act as secondary forms to modify other consonant graphemes. There is a separate symbol for each vowel in order to represent vowel sounds that occurs independent from a consonant at the phoneme level. For example, /ɑ/ is written as, ଆ.

When consonants occur as independent phonemes, they are notated with a diacritic known as a halant. The diacritic is a diagonal line beneath the consonant symbol.

Like Kannada, Oriya has ligatures. When certain consonants occur together, special conjunct symbols are used which combine the essential parts of each sound and increase the inventory of symbol patterns. The conjunct symbols have a visual-spatial organization that does not exactly represent the sequence of the phonological syllable. Mishra and Stainthorp (2007:25) evaluate the orthographic representation of Oriya's sound system as follows: "There are mostly regular and consistent correspondences between graphemes and sounds." However, as reported by Nag (2007), the high symbol inventory that alphayllablary systems have when conjuncts are included in the count, potentially increases the learning difficulty of phonological awareness tasks.

Most frequently, Oriya follows a CV or VC pattern. Patterns such as CVC occur less frequently than open syllable patterns because consonants typically do not occur syllable-finally. Consonant clusters are allowed syllable-initially, forming a CCV pattern.

"The distinction between the light and heavy syllables is based on the length of the vowel and the coda consonant, if any. Thus CV is a light syllable and VV and CVC are heavy and CVV(C) is super heavy" (Central Institute of Indian Languages 2009). Gemination is also present in Oriya: the 11 consonants /k, tʃ, dʒ, ʈ, ɖ, t̪, d̪, n, p, m, ɭ, l/ can geminate, with the geminate being pronounced for an audibly longer period of time than a single consonant (Central Institute of Indian Languages 2009).

2.1.4 Bondo Phonemes and Phonology

The inventory of phonemes in Bondo is, for the most part, a subset of the inventory in Oriya. Bondo has phonemic contrast between five of the six oral and nasal vowels in

Oriya; Bondo does not have an /o/. Bondo does not have any of the aspirated phonemes, the retroflex lateral, /ɭ/, the retroflex nasal /ɳ/ or the voiceless affricate /tʃ/ found in Oriya. The only consonant phoneme unique to Bondo is the glottal stop /ʔ/. Bondo thus has 20 consonant and 10 vowel phonemes. Because the inventory in Bondo is mostly a subset of the inventory in Oriya, the Oriya script can easily be modified for writing individual phonemes in Bondo with the addition of an apostrophe (') used for the glottal stop. Nasalization is infrequently indicated in Oriya, but a diacritic to notate nasalization does exist in Oriya which is used for the Bondo nasalized vowels.

The phonemes in Bondo clusters differ significantly from the phonemes in Oriya clusters. For example, Bondo has many prenasalized stops occurring both word-initially and word-medially that have been analyzed as consonant clusters. According to Alex (2002), this can result in a C_1C_2C cluster where C_1C_2 is a prenasalized stop. Prenasalized stops exist in Oriya, but not to the degree of frequency as in Bondo. In spite of the differences, these clusters in Bondo are written using rules similar to ligaturing rules in Oriya. Clusters that include prenasalization are realized as a single symbol that has a consonant symbol for the C_1, a diacritic for the C_2, and the diacritic for the vowel. A small superscript circle after the consonant is used in both Bondo and Oriya to indicate a syllable-final velar nasal. Because of these similarities, those literate in Bondo will have reading skills transferable to reading Oriya conjuncts as the visual-spatial formation of the sound/symbol representation is similar.

2.1.5 Desiya Phonemes and Phonology

There are more similarities between Desiya and Oriya than there are between Bondo and Oriya. Desiya does not have any of the aspirated phonemes, the retroflex lateral /ɭ/, the velar nasal /ŋ/, the retroflex nasal /ɳ/, the retroflex flap /ɽ/, or the labial approximate

/w/ found in Oriya. Desiya has the same ten vowel phonemes as Bondo, five pairs of oral and nasal vowels.

Desiya has prenasalization that is analyzed as homorganic nasals with a plosive or an affricate, not as separate clusters. Prenasalization occurs before /ʈ ɖ ɖ dʒ ɡ/. The prenasalized segment assimilates to the following plosive or affricate in place of articulation. The orthography used for Bondo is also used for Desiya. To indicate the prenasalized segments, diacritics are used to make complex symbols just like those described for Bondo. The syllable structure in Desiya does not expand beyond the pattern of CCVC. Therefore, the symbols are not as complex as those found in Bondo.

2.2 Experimental Supplementary Sound Discrimination Lessons

The experimental supplementary sounds discrimination lessons were designed using theories and principles of language acquisition and literacy reviewed in Chapter 1. In addition, these lessons were designed taking into consideration the affective factors related to language learners. The language attitudes towards Oriya as reported in section 1.3.2 suggest that language learners need approaches that do not produce high anxiety. Therefore, the lessons were designed to have a balance between aural and oral exercises. Pressure to speak is reduced through lessons that meet the needs of learners who progress through a silent period of language acquisition. Krashen (1985) and Asher (1972) recommend that language learners in the early stages of language learning benefit from lessons that concentrate on comprehension. Asher (1972) states that learners whose instructors acknowledge the silent period will perform higher not only in listening skill but also in both pronunciation and control of grammar. The lessons were also intentionally designed to introduce a small inventory of Oriya vocabulary in order to

provide more opportunities for comprehensible input along with the opportunity for learners to produce comprehensible output.

The other factors considered in the design of the experimental lessons were the educational and linguistic background of Desiya and Bondo speaking children, the teaching experiences of the teachers who instruct village-based educational programs, and the approaches the village-based teachers used in the existing programs available for supporting acquisition of Oriya. The experimental lessons were adapted from the Word-Building Track found in the Multi-Strategy Method (Stringer and Faraclas 2001) because this track complemented holistic approaches that were already being used in the village-based programs. Both the tutoring program for the Desiya speakers and the literacy program for Bondo speakers included opportunities for children to encounter Oriya in the context of sentences.

Another reason the experimental lessons were designed using components from the Multi-Strategy Method (MSM) was because the instructor for the Oriya literacy class for Bondo speakers had learned to use the method during the 2004 workshop described in section 2.1.2. In addition, because the Bondo literacy program was moving towards using the MSM, I wanted to align the experimental materials with this direction of the program rather than introduce a new method or continue with previous methods. Finally, the Oriya teacher who would teach the supplementary materials was new to the program and therefore had not been using the previous methods for a significant period of time prior to his MSM training.

The adaptations and additions made to the Word-Building Track were based on the stages that are recommended for L2 development in multilingual bridge programs. Kosonen et al. (2007:14) recommend that in the initial stages of L2 acquisition, learners

should focus on L2 listening and speaking skills. Therefore designers of bridge primers should include listening and speaking exercises rather than reading and writing. The Bondo classes were being introduced to new Oriya sounds, but not in an approach that focused on perceptual discrimination and articulatory skills of the contrastive sounds between the L1 and L2. The Desiya children were introduced to new Oriya sounds as their textbooks from the government schools introduced the alphabet and symbols. However, the children were not receiving training in oral or aural sound discrimination between L1 and L2 through explicit lessons.

The lesson books contain exercises that develop discrimination of the thirteen Oriya sounds not found in Desiya and the fifteen Oriya sounds not found in Bondo. Each of the lesson books were divided into a low-beginner section and a high-beginner section. Table 3 shows the Desiya lessons and their corresponding sound contrasts and Table 4 shows the Bondo lessons and their corresponding sound contrasts. The shaded lesson numbers in Table 3 and Table 4 indicate the lessons that were in the low-beginner format, while the unshaded lesson numbers were in the high-beginner format.

Table 3: Sound Contrasts for the Desiya Lessons

Lesson	1	2	3	4	5	6	7
Sound Contrast	/d/ /dʱ/	/b/ /bʱ/	/k/ /h/	/ɔ/ /o/	/l/ /ɭ/*[4]	/k//kʰ/*	/i/ /i:/*
Lesson	8	9	10	11	12	13	
Sound Contrast	/t̪/ /t̪ʰ/	/g/ /gʱ/	/p/ /pʰ/	/dʒ/ /dʒʱ/	/ɖ/ /ɖʱ/*	/ʈ/ /ʈʰ/*	

[4] An asterisk (*) indicates the phoneme pairs were contrasted in syllable-final position.

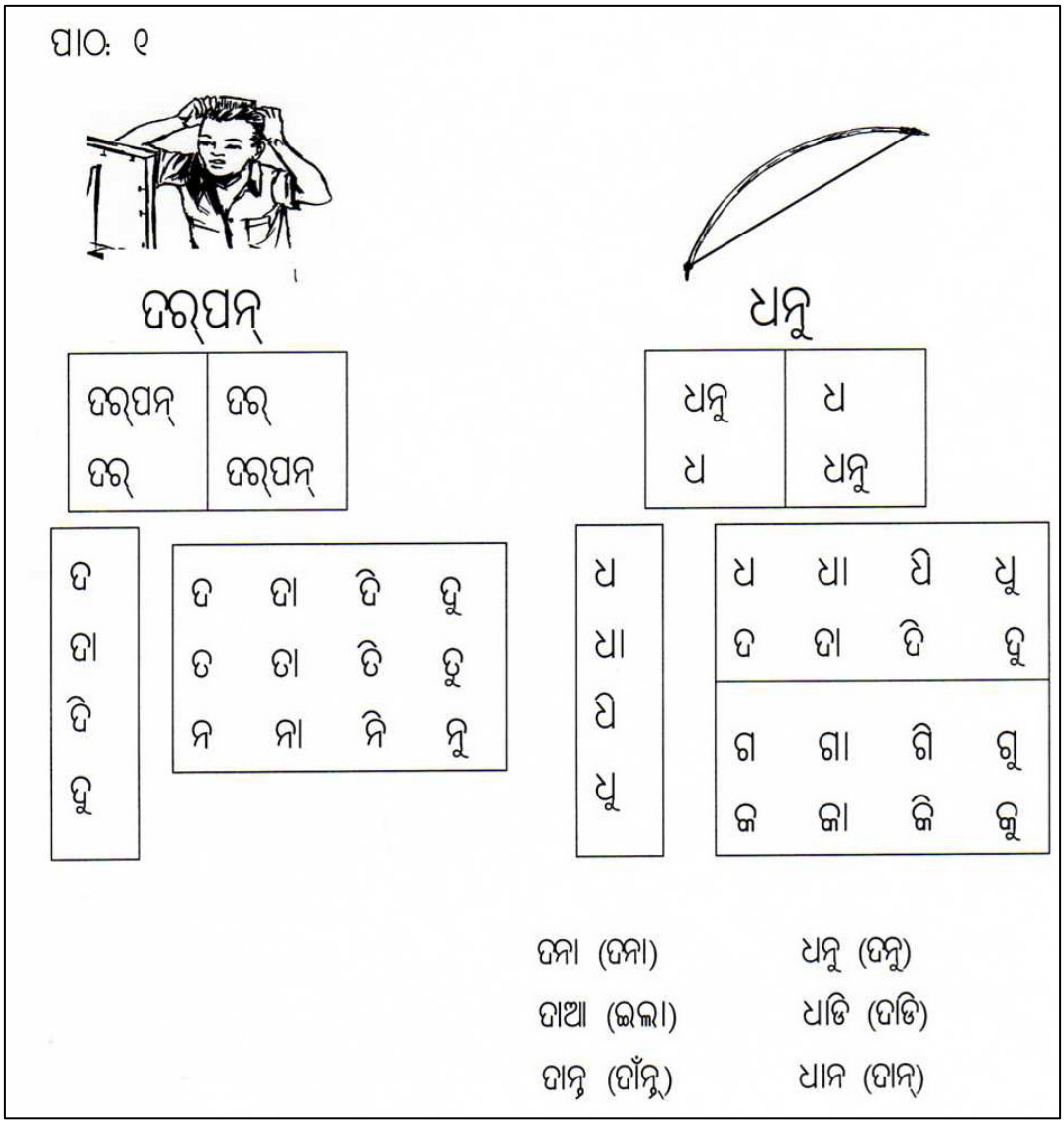
Table 4: Sound Contrasts for the Bondo Lessons

Lesson	1	2	3	4	5	6	7	8
Sound Contrast	/dʒ/ /tʃ/[5]	/s/ /ç/[6]	/d̪/ /d̪ʱ/	/ɓ/ /ɓʱ/	/ɔ/ /o/	/k/ /h/	/l/ /ɭ/*	/k/ /kʰ/*
Lesson	9	10	11	12	13	14	15	
Sound Contrast	/i/ /i:/*	/ʈ̪/ /ʈ̪ʰ/	/g/ /gʱ/	/p/ /pʰ/	/dʒ/ /dʒʱ/	/ɖ/ /ɖʱ/*	/ʈ/ /ʈʰ/*	

Each lesson contained word-building, sound discrimination and pronunciation exercises in both the mother tongue and Oriya. This differs from the format of exercises in the MSM where all of the analysis and synthesis of sounds is in one language, either the L1 or the L2. In this section I will describe the unique features of the experimental lessons and note the similarities with the MSM format. Figure 2: Page One, Lesson One of the Experimental Lesson Book for Desiya Native Speakers is an example of the first page of lesson one in the Desiya lesson book.

[5] This contrast occurs between Bondo and Oriya, but not between Desiya and Oriya
[6] This contrast got deleted in the Desiya lessons after understanding that speakers of Oriya do not distinguish between /s/ and /ç/ anymore. Both symbols represent /s/

Figure 2: Page One, Lesson One of the Experimental Lesson Book for Desiya Native Speakers



The lessons start with a key word picture in the L1 (on the left) and a key word picture in the L2 (on the right). The key word is a picturable word found in the cultural context of the learners. Under the picture is the key word to label the picture. The pictures alongside the key words act as a mnemonic device facilitating the association between sounds in an abstract form with meaning in a concrete form. Key words from both the L1 and L2 are placed on the same page rather than in a separate L2 primer in order to

illustrate the phoneme contrasts between the L1 and L2 more distinctly. In the example lesson shown in Figure 2, the contrast is between the /ɖ/ found word-initially in the Desiya key word /ɖɔɹpɔn/ ‘mirror’ and the /ɖʱ/ in the Oriya key word /ɖʱɔnu/ ‘bow’.

Below the key picture words are the word-building exercises that highlight the first syllable of the key word. These exercises draw learners to notice that words have components of sound that also correlate with symbols. Below the word-building exercises are syllable practice boxes. These syllable boxes are designed to develop listening and production skills by listening to and pronouncing syllables that contrast with one another by one phonetic feature. The lessons in the beginning use syllables that contrast in more than one phonetic feature in some of the practices so that students can become familiar with the format without needing to notice minimal contrasts.

Figure 3 shows the transcriptions of the syllables in the box that is used for discriminating between sounds within Desiya.

Figure 3: Transcriptions of the Syllable Boxes for Sound Discrimination

ɖɔ	ɖɑ	ɖi	ɖu
ʈɔ	ʈɑ	ʈi	ʈu
nɔ	nɑ	ni	nu

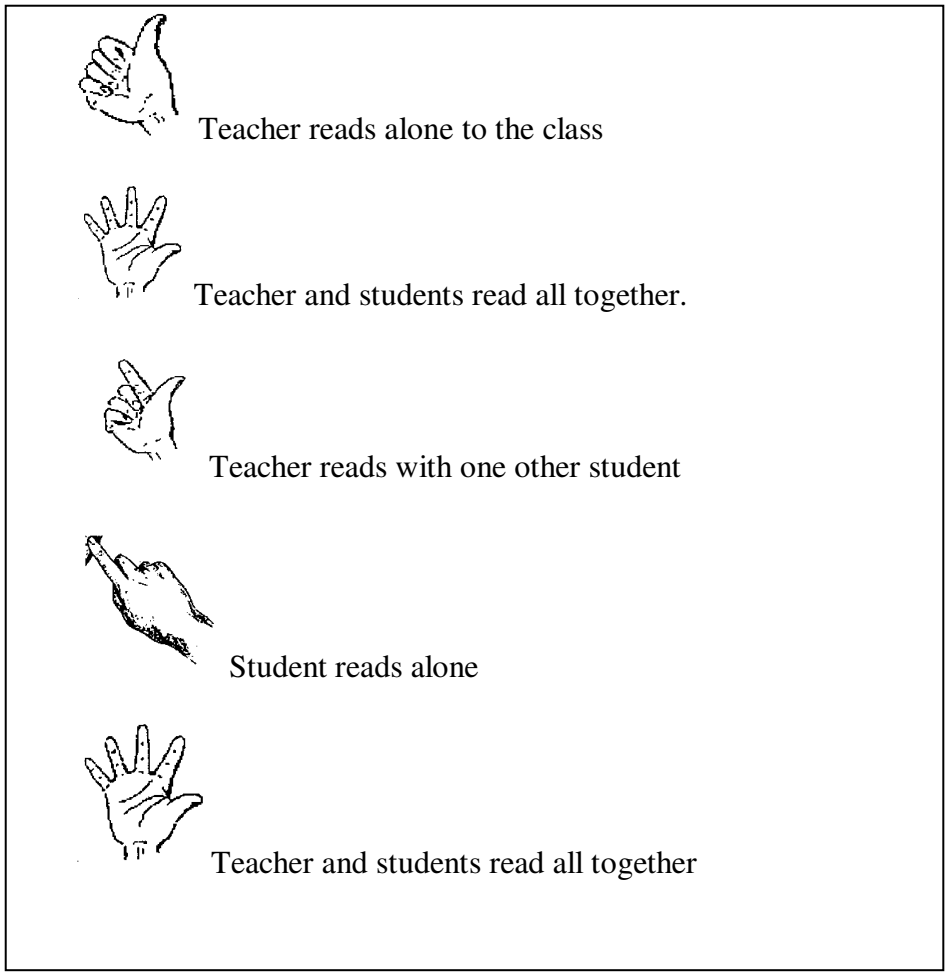
Learners learned to discriminate sounds in their own language before trying to discriminate between their L1 and new sounds in Oriya. The syllable box in Figure 3 shows that students practiced discriminating between consonants that were all alveolars, but differed in voicing or nasality when reading the syllables vertically. When they practiced horizontally, the contrast was between vowel sounds. Each lesson introduces learners to one new Oriya sound which contrasts with a sound in the L1 through the key words and syllable box exercises. Learners review Oriya sounds they have learned in the

syllable boxes of subsequent lessons. This progression follows the principles described by Hunter (1994) who describes how to construct biliteracy materials: “Most transition primers like basic primers introduce one new feature at a time because too many new things at once confuse the pupil. Each lesson introduces one new letter, diacritic or syllable pattern, giving pupils ample opportunity for recognition and practice.”

The overall teaching strategy remained similar to the MSM teaching strategy: teachers start by drawing and discussing the key word and picture, then present the syllables by writing and speaking them, and then present them in word-making exercises. All of the L1 exercises on the first page were completed first, and then the L2 exercises were attempted. The last exercise on the first page of each lesson is a Oriya word-level sound discrimination practice. This practice differs from the lessons in MSM. First, the teacher writes and models each word after it is written and provides a translation for the word in the mother tongue, then everyone completes the five-point reading plan as described by Stringer and Faraclas (2001). Learners first read vertically from top to bottom and then horizontally.

For guided practices, teachers used the five-point or four-point reading plan from the Multi-Strategy Method. The five-point reading plan was translated into the mother tongue and inserted as a separate page into the teacher’s manual. The hand symbols help the teacher to remember who is involved in each step. The thumb of the hand represents the teacher and the fingers represent students. Figure 4 shows the five-point reading plan that I refer to while describing how the lessons were taught.

Figure 4: Mary Stringer's Five-Point Reading Plan

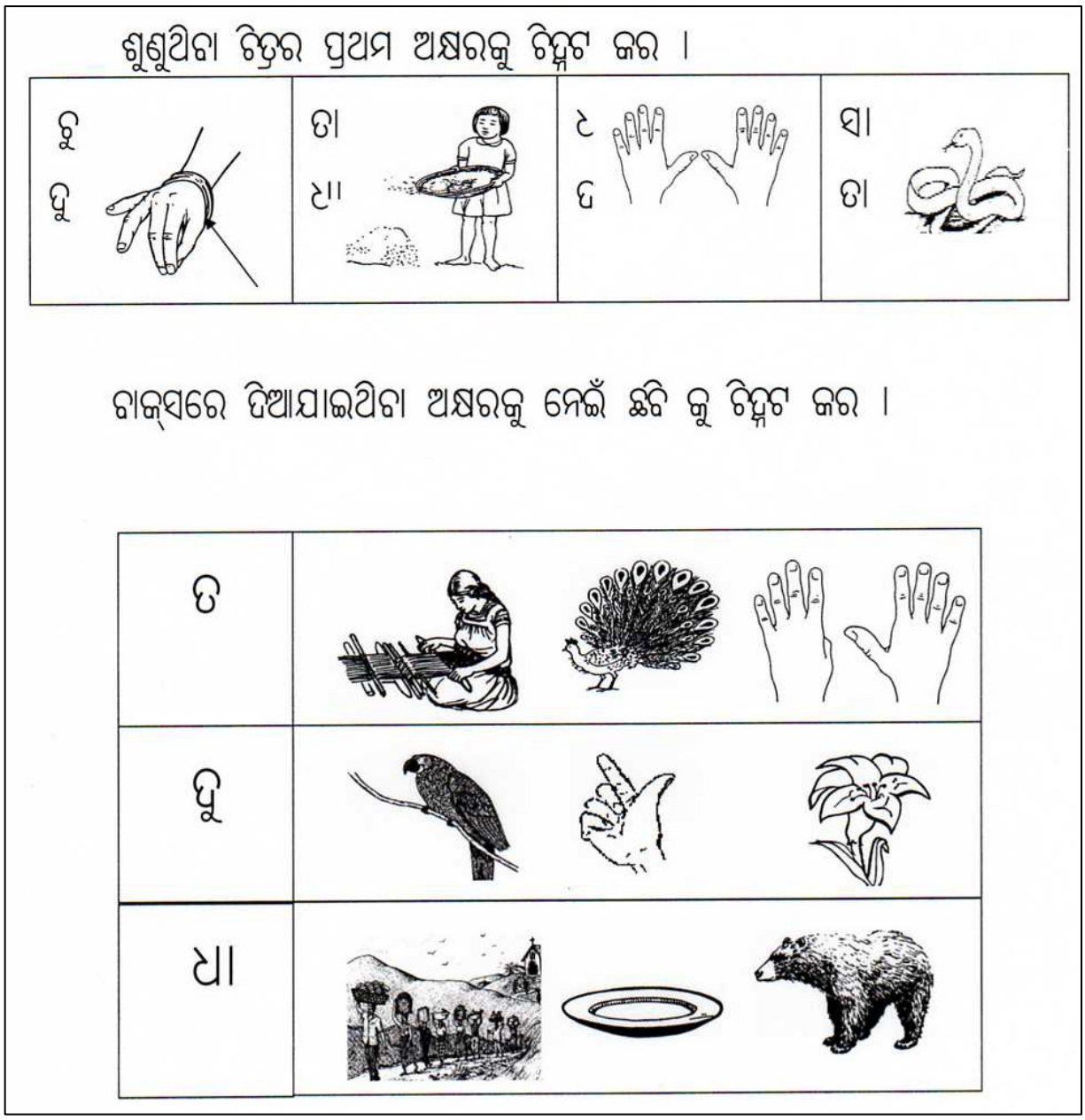


Sometimes, only the last four points are used to teach the lesson. When only the last four points are used, this is referred to as the four-point reading plan. I indicate on the pages of the teacher's manual that describes all of the lessons when to use the reading plan. For an example of the teacher's manual in a pictorial version, see Appendix C, for a version written in English, see Appendix D. In the experimental lessons, instructors sought to teach learners to notice phonological features of L1 sounds compared to L2 sounds with guided instruction and practice in perception and pronunciation.

The second and third pages of each lesson do not follow the primer design used by the MSM approach. Page two starts with listening exercises which are then used for speaking exercises. An example is shown in

Figure 5.

Figure 5: Page Two of Lesson One: Aural Discrimination Exercises



The teacher writes the letters in the first box on the board. Students are instructed to identify which sound is being pronounced at the beginning of the Oriya word for the picture. After learners hear the word, they circle the letter that represents the first sound of the word for the first picture. The teacher provides the correct answer, writes the word for the correct answer on the board and the sequence is repeated for the next three boxes. Some of the pairs of letters contrast in only one feature; some contrast in more than one feature. All of the exercises in

Figure 5 focus on phoneme contrasts in the initial position of the word for the picture. The first box contrasts /tʃu/ and /ɖ̪u/, the second contrasts /ɖ̪ɑ/ and /dʰɑ/, the third contrasts /ɖ̪ʱɔ/ and /ɖ̪ɔ/ and the fourth contrasts /sɑ/ and /ʈ̪ɑ/. This example demonstrates how students learn contrasts between phonemes that are in the L1 that are the same as phonemes in the L2 and between phonemes that are in L2 but not in L1. When the exercise is complete, the teacher follows the four-point reading plan.

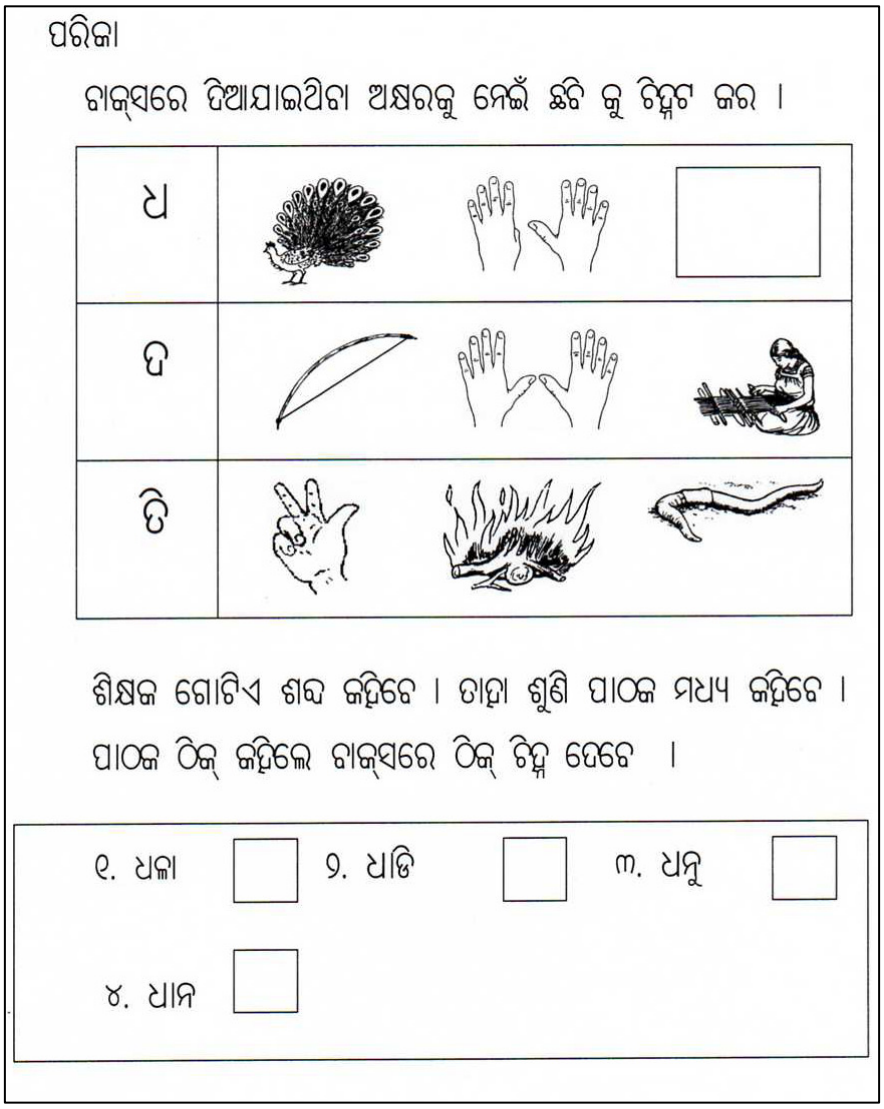
The second section on page two of the lesson book (

Figure 5) is another set of aural sound discrimination exercises. First, the teacher writes the letter from the first box on the board and asks, "Who knows this sound?" Then the teacher says: "Circle the picture that starts with this sound." The teacher says the name of each of the pictures in Oriya, repeating the sequence of names if needed. The teacher asks students to provide the answer and writes the word on the board after the answer is shared. This routine continues for the remaining two exercises. When the exercises are complete, the teacher reads with one learner, the learner reads alone and then everyone reads together. The focus of the first series shown in

Figure 5 is /ɖ̪ɔ/. The words for this picture series are /ɖ̪ɔni/ 'weave', /mɔdʒuɹɔ/ 'peacock' and /nɔ/ 'nine'.

The third page is a test page. The students complete the test one by one with the teacher. A sample page is shown in Figure 6.

Figure 6: Test Page of Lesson One

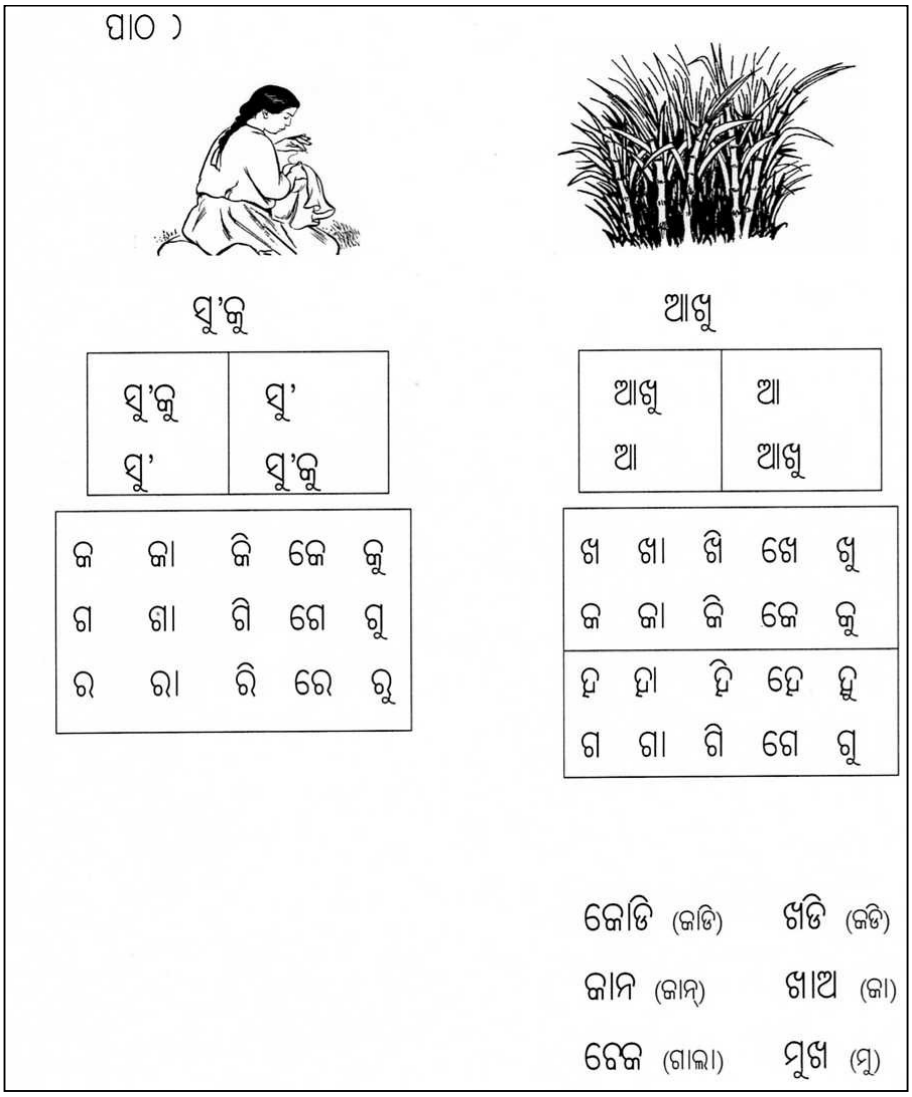


The first section of the test is exactly like the last section of the lesson; students circle the picture of the word that contains the sound given at the beginning of the series of pictures. The last portion is a production test. The teacher takes the student's book and says the test word two times, and marks a check in the box next to the word if the student

repeats it correctly. If the word is pronounced incorrectly, the box is left blank. These tests are given after every other lesson. This evaluation tests both listening and speaking in a format where the teacher can check the progress of each student and determine if areas need to be reviewed.

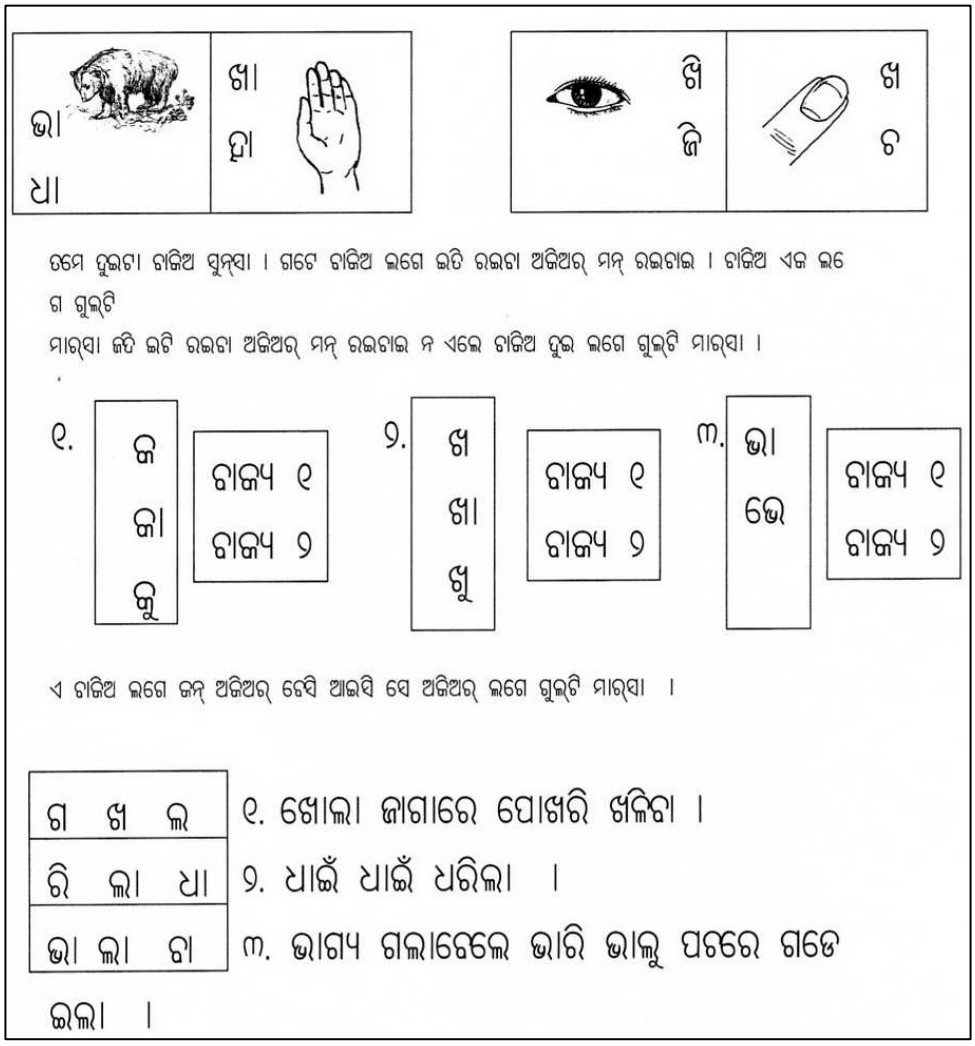
The high-beginner lessons are similar to the low-beginner lessons, with a few modifications and additions. The first page has the same layout, but fewer syllable boxes are present. While the same number of syllable boxes remain for the Oriya words, there are fewer syllables for the L1. Figure 7 below is a sample of the first page of the high-beginner lessons for Desiya speakers.

Figure 7: Page One of the First High Beginner Lesson



Students approach the second page of the high-beginner lessons like the second page of the elementary lessons. Figure 8 is an example from page two of the first high-beginner lesson.

Figure 8: Page Two of the First High-Beginner Lesson



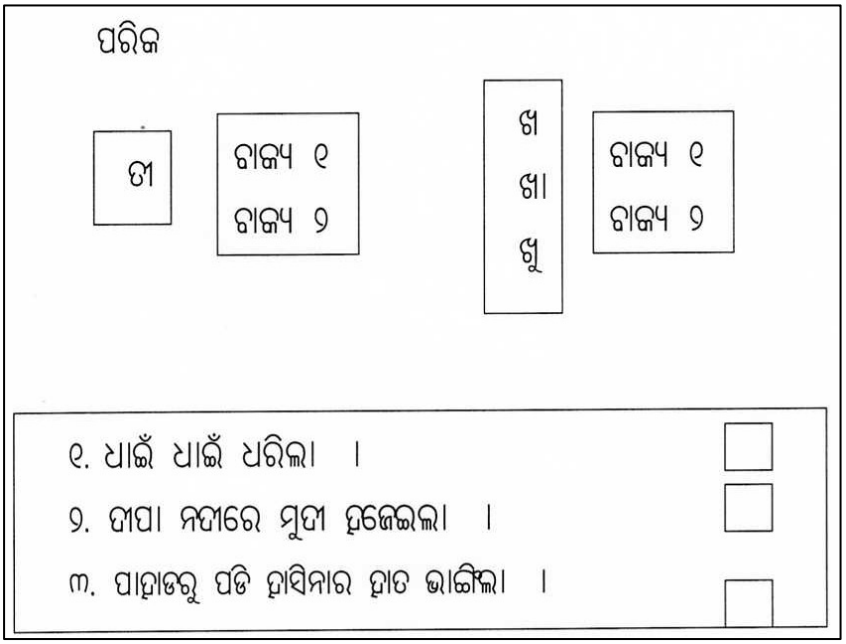
Learners focus on aural discrimination first and then use the page for pronunciation development by saying the words for the pictures. In the high-beginner lessons, sounds in this section start to be discriminated in word-final position in addition to word-initial position. The two boxes on the right side in Figure 8 are the exercises that discrimate sounds in word-final position. The word for 'eye' in Oriya is /ɑkʰi/; the top Oriya grapheme is /kʰi/ and the bottom is /ki/. The Oriya graphemes are placed after the picture to indicate the sound to listen for is in the word-final position.

After the sound discrimination exercise with pictures, students are engaged in language at the sentence level without pictures. Teachers instruct the students that they will hear two sentences from the teacher's manual. The teacher says: "If the first sentence has the sounds in the box occurring most, circle the word, sentence 1. If the second sentence has the sounds in the box occurring most, circle the word sentence 2." The box next to the narrow vertical syllable box is labeled sentence 1 and sentence 2. In the first listening exercise, the teacher reads a sentence containing /kɔ/, /kɑ/ and /ku/ most frequently. In the second listening exercise, the sentence contains /k^hu/ and /k^hɔ/ most often. This is a lesson to help students practice discrimination at the sentence level. All of the sentences for this exercise are in the teacher's guide book. Learners only practice aural discrimination in this section.

The final section focuses on identifying the sound students notice occurring most. There is a list of three phonemes next to a sentence. The learners hear the sentence read by the teacher and circle the phoneme that they hear occurring most frequently out of the choices already given. After this first aural practice, the teacher will repeat the sentence again and students will clap when they hear the sound they just circled. The teacher uses the four-point reading plan to practice reading and pronunciation using the sentences in this section. This section is also used to develop phonemic awareness of sound-letter correspondence because the learners can view the graphemes for all of the sounds. Thus, the lessons progress toward the goal of using sound discrimination in the early stages of second language learning to develop phonemic awareness.

The test for the high-beginner lessons evaluates listening and production. An example of this page is shown in Figure 9.

Figure 9: Test Page for the First High-Beginner Lesson



The listening assessment is the same as the second section on the second page in the practice lessons where learners identify whether the first or second sentence contained the syllables in the adjacent syllable box. The production test is a sentence repetition test rather than a word repetition test. The test pages appear at the end of every other lesson. Each week the teacher completed one lesson. A detailed lesson plan translated into English in Appendix D shows the sequence of sections and review of the sections throughout the week. When a concept is being reviewed, the teacher bypasses the modeling stage and immediately asks for the group's participation in the recall process. By deleting the modeling stage, it is anticipated that the students will be accessing more of their own skills rather than mimicking the teacher, encouraging them to truly recall what has been recently taught. A pictorial version and a written version of the teacher's manual were designed in both Desiya and Oriya so that teachers could follow more easily. The pictorial version is reproduced in Appendix C.

Upon the evaluation of the lessons and review with the Bondo teacher, he chose to teach the experimental lessons in smaller units after seeing the children needed a slower pace. This class also took some time to write the Oriya words for the pictures. The teacher explained that children usually needed the extra support of having the text from the book also on the board. After having these increased visuals, the children responded with more ease. This adaptation was acceptable, but must be considered when drawing conclusions about comparative results between the Desiya and Bondo experimental groups.

2.3 Anticipated Results from Program Modifications

Researchers have not made acoustic studies of the way native speakers of Desiya and Bondo produce the four-way stop contrast nor have they explored how native Desiya and Bondo speakers perceive these sounds. In addition, researchers have not explored the effects of explicitly teaching phonological awareness through these sound discrimination exercises that supplement existing village-based literacy programs for children who are native speakers of Bondo and Desiya. The specific results I anticipate from the program modifications are based on assumptions that age and educational experience, which correlate with cognitive development, are indicators of ability in the L2. A further assumption is that the remoteness of the Malkangiri District, which often means inconsistent attendance in classes, correlates with learners attaining only a low ability in the L2. I hypothesize that in order for L2 learners to develop the perceptual skills needed to notice a contrast between sounds with minimal contrast, the sounds must be taught explicitly in environments that reveal the contrasts distinctively. Furthermore, I predict that explicit teaching and practice producing L2 sounds in minimally contrastive pairs

correlates with ability to include distinctive features in the production of L2 phonological features that do not exist in the L1.

On the basis of these predictions, I anticipate the following results. First, performance on phonological awareness tasks should vary according to age and number of years of educational experience. Second, learners in remote areas will perform poorer than those who learn in less remote contexts. Third, performance on phonological awareness tasks should vary according to the types of approaches Desiya and Bondo learners receive. Specifically, native speakers of Bondo and Desiya acquiring Oriya with instruction using traditional methods of repetition and holistic approaches will perform poorer on perception and production tasks than Bondo and Desiya speakers who receive approaches that include analysis, synthesis and contrasts of sounds alongside programs that also use holistic approaches. Lastly, native speakers of Bondo and Desiya who receive explicit instruction in production skills will be more likely to produce sounds in the four-way contrast with acoustic features more similar to those of native Oriya speakers than will the native speaker of Bondo and Desiya who do not receive explicit instruction in perception and production skills.

CHAPTER 3

METHODOLOGY

The goal of the research design was to discover the specific ways the supplementary lessons impacted L2 perception and production skills. Subjects either belonged to a group that acquired Oriya through only existing programs (control group) or to a group that acquired Oriya through existing programs that also received the supplementary materials (experimental group). Research instruments and methods were designed to compare the performances on phonological tasks between different groups of subjects within the control and experimental groups. The test instruments for the research included a sociolinguistic survey, a sound discrimination listening test and a word repetition test. In this chapter I describe the research location and dates (3.1), provide an overview of the participants (3.2) and explain the research instruments along with the methods used to analyze the data collected by the instruments (3.3).

3.1 Location and Dates

This research was conducted over the 6-month period from June 2004 to November 2004 in one Bondo-speaking village (Dumripada) in the Malkangiri District of Orissa State. The three Desiya-speaking villages (Urabir, Gumalput and Hanumal[7]) also in the Koraput District were included in the last three months of the research.

[7] Most subjects in Hanumal primarily spoke Desiya, although a few spoke Gutob-Gadaba as their mother tongue and Desiya with Desiya speakers in the village as a language for interpersonal communication. There were a greater number of Desiya speakers than Gutob-Gadaba speakers in Hanumal.

Table 5 lists the village names and the minority language(s) spoken in each village. Each village is listed in order from the most remote to the least remote in terms of distance from a town where there is more contact with Oriya and Desiya speakers.

Table 5: Research Locations and Languages

Village Name	**Minority Language(s)**
Dumripada	Bondo
Hanumal	Gutob-Gadaba and Desiya
Urabir	Desiya
Gumalput	Desiya

These villages were selected as research sites because the village children were acquiring Oriya in similar learning environments, either through village-based programs or government schools.

Dumripada differed from the other villages in that half of the subjects lived away from their village in boarding schools. In the other villages children attended government-run primary schools during the day. Though Dumripada differed from the other research sites, I included it in the study because I was interested to investigate the outcomes of including the experimental lessons in a literacy program located in the remote area where some Bondo speakers reside. In addition, there were community development workers from the Asha Kiran Society in each of the villages who were concerned about educational issues that related to the acquisition of Oriya and the vernaculars for academic success. These workers also served as research assistants who aided in the design and administration of the research instruments. The workers who served as research assistants had been living in the selected villages, were operating village-based education programs, had formed relationships with the people of the village, and could speak English, Oriya and the minority language of the village. While I

was not able to have access to Dumripada, the literacy for development workers who served as research assistants from this village frequently came to my location, allowing for periodic communication.

Research began with the children of Dumripada in June 2004. Participation in Dumripada decreased, however, due to cultural situations. During the rainy season many do not attend classes and during one season of the year, young girls leave their villages and hide from men from neighboring villages who seek to take home a bride. Therefore, research began in September 2004 in the other three villages, Urabir, Gumalput and Hanumal and concluded in November 2004 in all four villages.

3.2 Participants

A total of 77 students participated in the research. Of these, 49 completed the pre- and post- study surveys, listening tests, and speaking tests. For the rest of this thesis, the term 'subjects' will only refer to the 49 subjects who completed the surveys, listening tests and speaking tests. The participants in the study ranged from 5 to 14 years old and had completed 1 to 7 years of education. Details about the ages and educational background of the participants are given in Table 6 and Table 7.

Table 6: Number of Participants by Age Range in Each Location

	Dumripada	Hanumal	Urabir	Gumalput	Total
Ages 5-6	0	5	0	5	**10**
Ages 7-8	0	5	6	1	**12**
Ages 9-10	1	1	2	2	**6**
Ages 11-12	6	0	4	4	**14**
Ages 13-14	5	0	2	0	**7**

Table 7: Number of Participants by Number of Years of Education Completed in Each Location

	Dumripada	Hanumal	Urabir	Gumalput	Total
0- 1 year	8	8	0	5	**21**
2-3 years	2	3	7	1	**13**
4-5 years	2	0	3	2	**7**
6-7 years	0	0	4	4	**8**

The subjects were attending one of three educational programs: six of the subjects in Dumripada attended a government boarding school, six in Dumripada attended a village-based literacy program offering mother tongue literacy and Oriya literacy classes, and all 37 subjects in the other three villages attended a government-run school nearby the home village along with attendance at a village-based tutoring program. Subjects were organized into control and experimental groups. The experimental lessons were used in the village-based tutoring program in Urabir and the literacy class in Dumripada; subjects from these villages made up the experimental group. Subjects from Dumripada attending government boarding schools and subjects from Gumalput and Hanumal attending nearby government schools and village-based tutoring programs made up the control group.

There were 29 subjects in the control group and 20 in the experimental group. Fifteen of the subjects in the control group had completed one year of education, while only six in the experimental group had completed one year of education. Age distribution varied slightly between the two groups. The two groups had nearly equal numbers of subjects in the 9-14 year range: 13 subjects in the control group and 14 subjects in the experimental group. The main difference in the age distribution was that the control group had nearly

three times as many subjects from 5-8 years of age. There were 16 subjects in this range in the control group compared to 6 subjects in the experimental group.

I accounted for the uneven distribution of subjects by analyzing the results on the basis of subgroups arranged by grade level. Within the subgroups, the participants in the experimental and control groups were more evenly matched in age, level of education, total number of participants per subgroup,[8] and mother tongue. I also analyzed the amount of improvement made by each subgroup and compared these gains in improvement rather than comparing average scores on tests administered after the experimental period. Further details about how I analyzed the results using subgroups are described in section 4.1.4.

The Desiya speakers in both the control and experimental groups were involved in identical educational programs. In contrast to this, the Bondo in the control group were learning Oriya in boarding schools outside their village, while those in the experimental group were learning Oriya in village literacy classes.

All six subjects in the Dumripada experimental group spoke Bondo and ranged in age from 8 to 13. Most had never attended government-run schools or had attended a year or less. The twenty subjects in the Urabir experimental group spoke Desiya.

Table 8 below summarizes similarities and differences concerning the ages, education levels, participating villages and number of participants in the control and the experimental groups.

[8] Participants who were in the first grade continued to have the highest discrepancy in the number of participants between control and experimental groups after they were divided into their own subgroups. I address this issue when inequality is a factor that could be skewing the results.

Table 8: Control and Experimental Groups

Characteristics	Desiya Control Group	Bondo Control Group	Desiya Experimental Group	Bondo Experimental Group
Age Range	6-12 years old	10-13 years old	8-14 years old	11-14 years old
Education Range	1-6 years	1-5 years	2-6 years	1-2 years
Education Programs	Government school in L2 and tutoring in L1 & L2	Boarding school in L2	Government school in L2, village-based tutoring in L1 & L2 with experimental lessons	Village-based L1 and L2 literacy class with experimental lessons
Village(s)	Hanumal and Gumalput	Dumripada	Urabir	Dumripada
# of Participants	**23**	**6**	**14**	**6**

Each tutor/teacher participating in the experimental group needed to attend training sessions on how to use the experimental material. The supervisor for the literacy class in the Bondo village of Dumripada was trained in May 2004 so that he could train the Oriya literacy class teacher who taught the experimental lessons. I made these arrangements because I was unable to travel to the Dumripada. The teacher from the Bondo experimental group later attended a training session in August 2004 with one of the regular tutors from Urabir. The trainees watched and tried each part of the lessons in four 60 to 90 minute sessions which included time to ask questions and receive feedback.

When the teacher for the Bondo experimental group taught the experimental lessons, there was an average of sixteen students per class session from the middle of June to the beginning of October, for a total of fifteen weeks. The class met an average of four times per week. During the same time period, subjects in the Bondo-speaking control group attended classes six days per week at the government boarding school.

One tutor in Urabir who usually teaches the village-based tutoring program used the experimental lessons at the beginning of the tutoring time for about thirty minutes, three

to five days a week, for a total of eight weeks. During the same time, subjects from the control group from Gumalput and Hanumal attended similar village-based tutoring programs and attended government-run schools.

3.3 Research Instruments

Three instruments were designed to test the research hypotheses. Before and after the research period, all of the subjects completed a sociolinguistic survey, presented in section 3.3.1; a listening proficiency test, described in 3.3.2; and a speaking test, described in 3.3.3.

3.3.1 Sociolinguistic Survey

I designed and administered a sociolinguistic survey in order to gather information on the language attitudes of the subjects and their perceptions of their language abilities in Oriya. The survey was designed to assess the role of various factors that could potentially affect the language acquisition process.

The survey contained questions about the subjects' perceived frequency Oriya is used, ability to comprehend spoken Oriya, ability to be understood in Oriya, anxiety levels when speaking Oriya to native Oriya speakers, perceived comprehension strategies used to understand spoken Oriya and preferred interlocutor.

Table 9 lists the domains used in the survey instrument and a sample question that corresponds with each domain.

Table 9: Survey Instrument Domains and Sample Questions

Frequency of usage with speakers of Oriya as a second language sellers in the market native Oriya-speaking children	How often do you speak Oriya to other Desiya speakers who you know also speak Oriya
Perceived comprehension of teachers mother tongue Bondo or Desiya speakers (speaking Oriya) sellers in the market native Oriya-speaking children	When you leave the village to go to your school, how often can you understand what the teacher is reading when they read in Oriya to the class?
Perceived ability to be understood by teachers sellers in the market native Oriya-speaking children	How often do your teachers ask you to repeat what you are saying when you are speaking Oriya in your DCC class?
Anxiety levels when speaking Oriya in the market literacy classes or tutoring programs government-run schools	Do you ever feel scared to speak Oriya to other students in your school who only speak Oriya?
Comprehension strategies used to understand their native Oriya speaking teacher by guessing not doing anything watching other classmates asking the teacher to repeat themselves	When you don't understand what the teacher in your school outside your village is telling you in Oriya, which of the following things do you do?
Interlocutor who is the easiest and the hardest to speak to in Oriya teachers students sellers in the market	Who is the easiest to speak to? Who is the hardest to speak to?

Subjects gave one of three responses to the survey questions: always, sometimes, or never for all of the domains except for comprehension strategies and preferred interlocutor. They were able to quickly answer the questions because of the limited choices. While it is possible the responses would have been more accurate if the questions had been open-ended, this format was more appropriate considering the age range of the subjects.

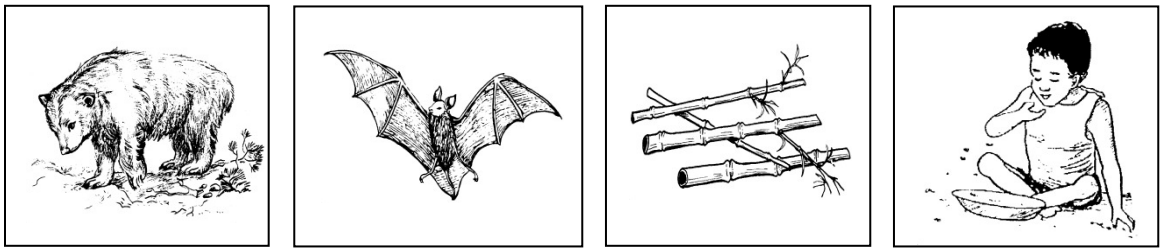
Before the survey was administered to the subjects in the research, I tested the questions with four children who attended a nearby preschool. Following this test, I made

revisions to the survey. Research assistants administered the survey in the mother tongue of each of the subjects before and after the research period.

3.3.2 Listening Proficiency Test

A listening proficiency test was used to assess ability to perceive sounds in Oriya that are not present in the native languages of the subjects. In the listening test subjects were asked to identify a particular picture in a series of pictures on the basis of aural and visual cues. The name of the correct picture always included a phoneme that was in the inventory of Oriya but not in the inventory of Bondo or Desiya. The names of the other pictures in the series always included contrasting phonemes that were common to Bondo, Desiya and Oriya. Figure 10 illustrates one of the picture series in the listening test. The phoneme /b/ is in the inventory of all three languages, but /bʱ/ is not.[9]

Figure 10: Listening Test Example



/bʱɑlu/ ‘bear’ /bɑduɖi/ ‘bat’ /bɑũsɔ/ ‘sticks’ /bɑ̤ɔkɔ/ ‘boy’

In this example, subjects needed to be able to identify which word contained a voiced aspirated consonant in word-initial position. The test phoneme and the contrasting phoneme usually only differed in one or two phonetic features. This reflected the way in which the experimental lessons were designed to teach students to perceive sounds through minimal contrasts. Since Oriya has an alphasyllabary system, the same vowel

[9] The test the subjects received only contained the pictures, no words. The transcription for the words represented in each picture is included in Figure 10 to depict the phoneme contrasts.

followed each consonant phoneme in the contrastive position so that the vowel did not appear to be the segment in contrast. For example, in Figure 10 the vowel /ɑ/ follows both /bʰ/ and /b/.

Adult mother tongue Oriya speakers who also spoke the mother tongue of the subjects administered the listening test in each village. The subjects took the test together in a group listening to a tape. The tape was used for uniformity so that the subjects would not see the speaker's articulation. The test administrators gave subjects instructions like the following in their mother tongue before hearing the words in the picture series: "Three words for these pictures start with 'baa' and one starts with 'bhaa'. Circle the picture for the word that starts with 'bhaa'." The instructions included the position of the test sounds and the two phonemes to listen for. Then the subjects listened to the words for the pictures two times on the tape and responded by circling the picture they thought represented the word that contained the test phoneme. There were fifteen sets of pictures in the listening test with two additional practice sets used before the test.

Only eight of the fifteen test items were scored and used for analysis. These eight items were the ones that tested the difference between aspirated and unaspirated phonemes.

3.3.3 Production Test

All of the Bondo and Desiya speakers completed a production test both before and after the research period, focusing on the same aspirated stops that were used in the listening test. Though the experimental lessons had exercises focused on pronunciation, they were designed without knowing the variants subjects would produce as their realizations of the Oriya phonemes. Therefore, the production test had two purposes. The major purpose was to determine whether the pronunciation of subjects in the

experimental groups improved more than the pronunciation of subjects in the control groups. Another purpose was to describe the acoustic realizations of the eight aspirated stops as they were produced by native speakers of Bondo and Desiya. It was hoped that the data from the production test would enable instructors to identify articulatory features that need to be adjusted. The descriptive analysis might also suggest ways to adjust the experimental lessons.

The production test consisted of word and sentence repetition tests, although only the results of the word repetition test were analyzed.[10] Eight Oriya words were tested: four with the voiceless aspirated phonemes /pʰ/, /tʰ/, /ʈʰ/ and /kʰ/, and four with the voiced aspirated phonemes /bʱ/, /dʱ/, /ɖʱ/ and /gʱ/. Only one unfamiliar phoneme, the test phoneme, was present in each of the test words. Including only one new Oriya phoneme per word enabled even low-level Oriya language learners to attempt the test. Table 10 lists the test phonemes, the words used and the glosses for each word.

Table 10: Word Repetition Test

Phoneme	**Word**	**Gloss**
/pʰ/	pʰulokobi	'cauliflower'
/tʰ/	tʰoɾe	'once'
/ʈʰ/	ʈʰekuɑ	'rabbit'
/kʰ/	kʰotɑ	'sour'
/bʱ/	bʱɑtɔ	'rice'
/dʱ/	ɡodʱɔ	'donkey'
/dʱ/	koɖʱɔ	'bud'
/gʱ/	gʱɑsɔ	'grass'

While it could be argued that word repetition tasks are unnatural, Davis (1995) says that it is easiest to elicit child speech pronunciations through word repetition tasks, and

[10] The design of the sentence repetition test is described in Appendix B.

that such tasks avoid co-articulation effects which could be caused by surrounding words. One potential drawback is that Oriya speakers administering the prompts for the word repetition had a tendency to produce careful speech, simulating child-directed speech. As Koening (2001) notes, "...some authors have suggested that child-directed speech may exaggerate some phonetic contrasts including voice onset time (VOT) and other durational measures."[11] The studies by Koening (2001) and by Davis (1995) indicate that there is a wider variation in VOT durations in phonemes produced by children than in those produced by adults. Exaggerated speech produced in response to adult input could be a factor in this wider variation. To avoid this, I collected a variety of measurements that will be discussed below.

There is considerable variation between the test words. The test phonemes occurred word-initially in six words, and intervocalically in two words; intervocalic position can reduce aspiration. Furthermore, the number of syllables in the test words ranged from two to four; Davis (1994) notes that differences in stress may cause variation in timing. Finally, the vowels adjacent to the test phonemes are not consistent. In spite of these variations, we should be able to draw conclusions about differences between native and non-native speakers of Oriya and between subjects in the experimental and control groups. All of the subjects completed a pre and post production test in their village. Subjects were given the following directions in their native language, "You will hear a word two times; after you hear the word two times, repeat the word into the microphone." The subjects were given no indication that there were certain sounds that they should listen for or certain sounds they were to reproduce more carefully. An adult native

[11] Koening (2001) acknowledges research that supports the reports regarding phonetic contrast exaggeration (Berstein Ratner 1986; Berstein Ratner and Luberoff 1984; Eliers 1984; Malsheen 1980) as well as counter examples (Baran, Laufer and Daniloff 1977; Gurman Bard and Anderson 1983; Shockley and Bond 1980).

speaker of Oriya spoke the test word two times to the subject speaking a little slower than natural, after which the subject repeated it into the microphone two times.

The utterances were recorded onto a Sony TCM-20CV cassette recorder or directly into the computer with an Audio-technica omnidirectional ATR35s microphone, or onto a Sony microcassette recorder M-560V with a built-in microphone. All of the utterances that were recorded on cassette were transferred to computer. Acoustic analysis was carried out using Praat (Boersma and Weenick 2008).

In order to compare native production of the test phonemes with non-native production, I recorded four native speakers producing the words from the word repetition test, two adult women and two children.[12] All four were native speakers of Standard Oriya. The adult women were in their early twenties who had been working for about two years in Desiya communities. The children were a six-year-old girl and a seven-year-old boy who were living in a nearby town among Desiya speakers from the villages. Recordings of each test phoneme were recorded once with an Audio-technica omnidirectional ATR35s microphone using Speech Analyzer (1996).

Adults articulated the words with careful speech while children spoke with natural speech. Adult productions reflected the distinctive features of the sounds; whereas child recordings reflected how sounds can be affected by characteristics of child speech and natural articulations.

All the recorded sound files were analyzed using Praat. Segment boundaries were marked around the features of the test phonemes and the measurements of the features

[12] Adult males were excluded because the speech of women and children are more similar. For example, both women and children produce more breathiness. Analysis parameters for women's speech will generally be more suitable than values for men's speech when comparing the speech patterns of children with adults (Kent and Read 2002).

were recorded. I used information on waveforms and spectrograms to identify the phonological features. I based the methodology for the acoustic analysis on previous studies that describe how to segment voiced and voiceless aspirates so that the acoustic correlates are framed for comparative analysis (Mikuteit and Reetz 2007, Ladefoged 2003, Hussain and Rami 1995, Davis 1994, Klatt 1975 and Francis et al. 2003).

The phonation sequence for voiceless aspirates begins with closure, then a burst, followed by aspiration which is a period of airflow that is then interrupted by voicing of a following vowel. Voice onset time (VOT) is typically the measurement from the release (burst) of the stop to the vowel voicing onset (VVO). Figure 11 depicts the burst and VVO for the voiceless aspirated stop in the waveform of the syllable /ʈʰe/ in the Oriya test word /ʈʰekuɑ/ 'rabbit' as pronounced by the female Oriya-speaking child. (The After Closure Time aspects of Figure 11 and 12 will be discussed below.) Figure 12 shows the entire word as seen on a spectrogram.

Figure 11: Segment Boundaries of ACT and VVO for Voiceless Aspirated Stops

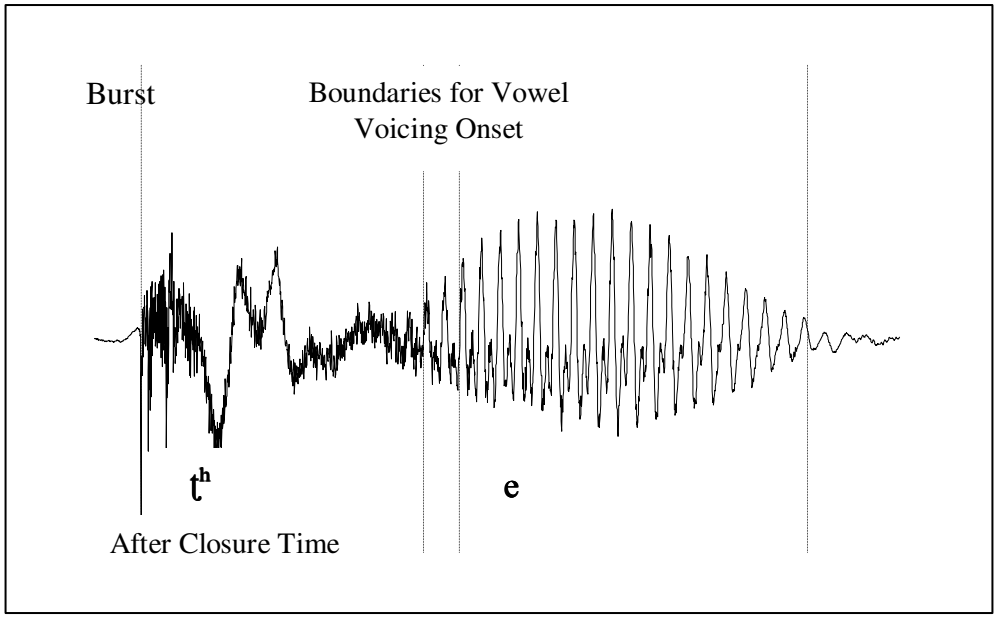
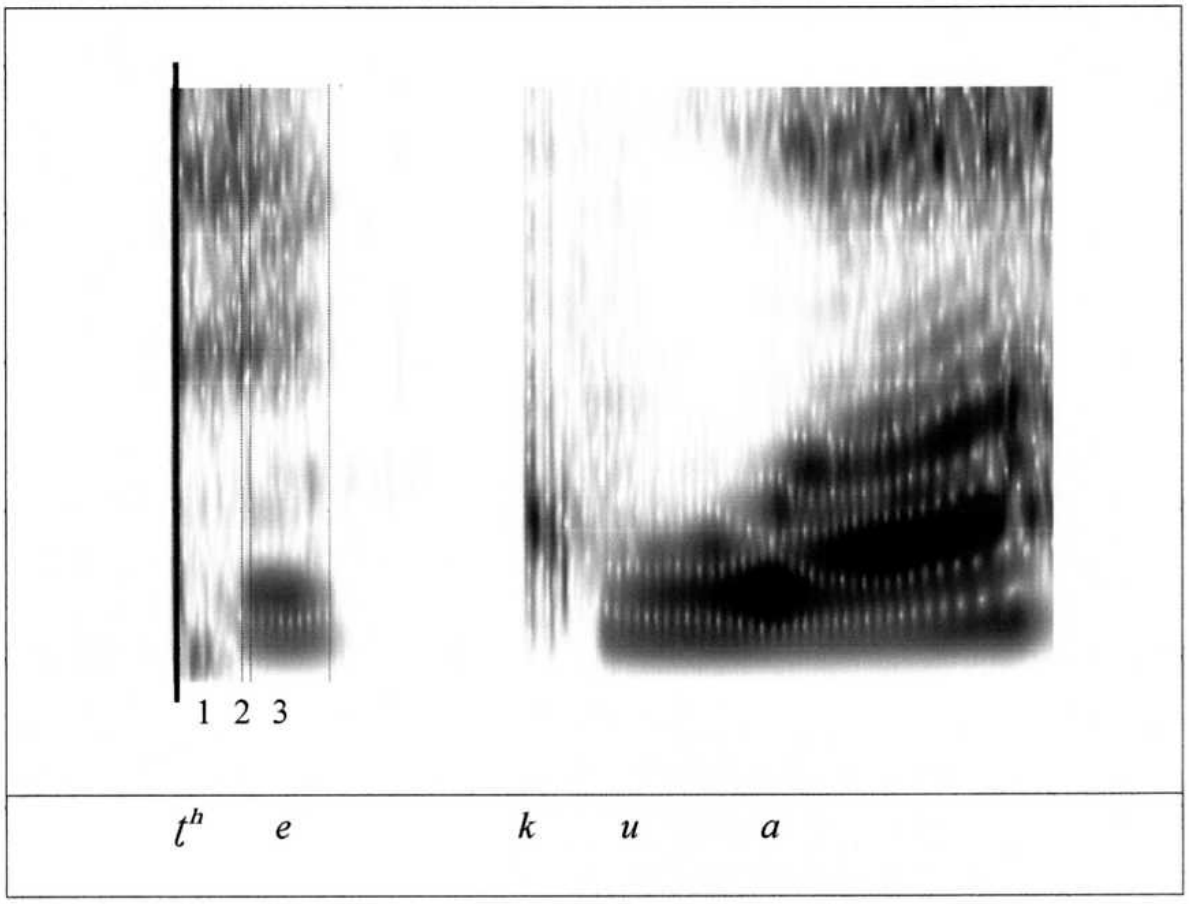


Figure 12: Spectral Segment Boundaries of ACT and VVO of Voiceless Aspirated Stops
1: After Closure Time 2: Vowel Voicing Onset (breathy vowel) 3: Modal Vowel



Researchers have typically compared measurements of the voice onset timings (VOT) to distinguish whether a phoneme has been produced as a voiceless aspirated stop rather than a voiceless unaspirated stop. A voiceless aspirate will have a lengthier VOT time than a voiceless unaspirated phoneme. Davis (1994) distinguished all four Hindi velar stops in the four-way stop contrast using VOT measurements that started at the burst and ended at the second formant (F2) in a spectrogram. I measured to the second formant in order to account for the breathy feature that is present on the vowel following the

aspirated stop.[13] The breathiness or murmur on the vowel is an important feature that provides perceptual cues of aspiration, especially on voiced aspirates.

Mikuteit and Reetz (2007) considered the breathy feature on the vowel of utterances from native Bangali speakers as superimposed aspiration (SA) and the time between the release and the onset of regular glottal pulsing of the vowel as after closure time (ACT) (See Figure 11). Thus, Mikuteit and Reetz separate Davis's voice onset time into two separate measurements. Since articulation patterns of aspirated phonemes in word-medial position, word-initial position and in various places of articulation are more noticeable with this separation, I have also measured the ACT in this study.

In my analysis, I used waveforms together with spectrograms to identify the period referred to as ACT. The beginning of the segment boundary for this first timing measurement was marked by the first burst at the end of the closure. The end of the segment boundary was marked where the first voicing information of the vowel began.

The segment boundaries for the second measurement, previously referred to as superimposed aspiration, are similar to those of Mikuteit and Reetz. The first boundary starts where the boundary for ACT ends (at the first onset of vowel voicing). The end boundary is similar to the measurement of VOT in research by Davis and by Mikuteit and Reetz. Davis marks the end of the breathy vowel at F2 in order to include the breathy information on the vowel before full modal voicing of the vowel begins. Mikuteit and Reetz used the waveform to adjust their measurements after using the F2 to locate the start of modal voicing on the vowel. They set their segment boundary further than Davis. In my segmentation of this second measurement in the VOT, I used the endpoint that

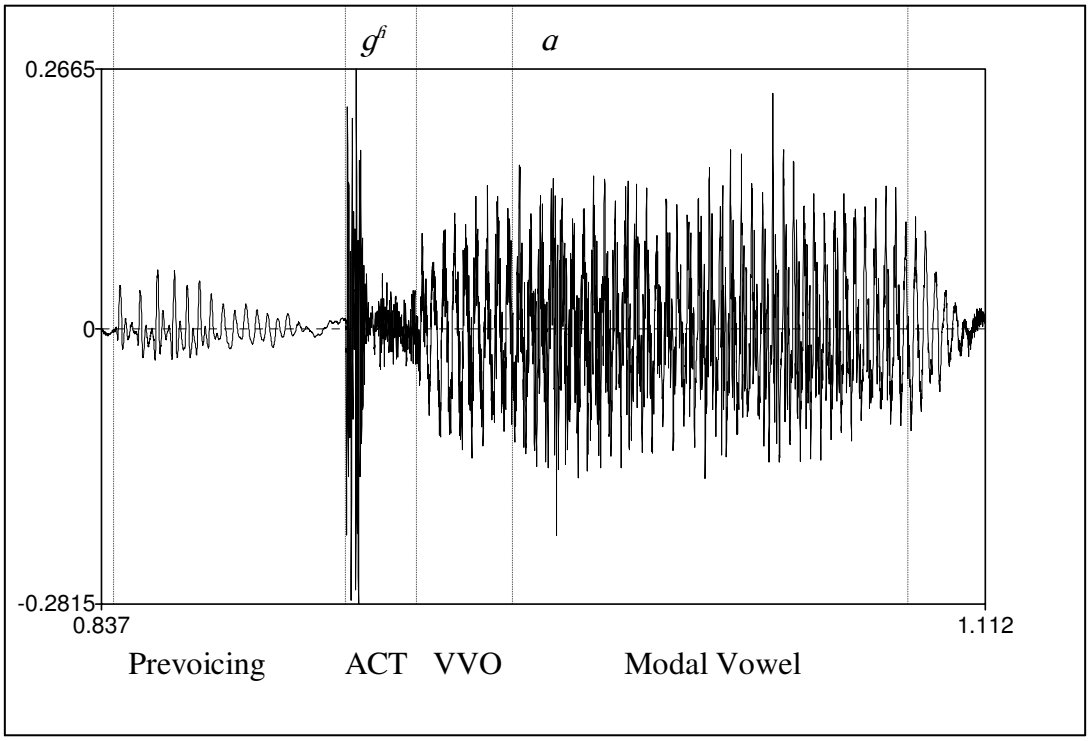
[13] Other research by Klatt (1975) and Francis, Alexander et al. (2003) indicated that variance between aspirated and unaspirated consonants does not start to be noticed until the F2.

Davis used to mark the segment boundaries onto the vowel at F2. The waveform served as a guide for more precision in determining where the breathiness ended. In this study the boundary between the end of the ACT and the F2 will be referred to as the vowel voicing onset (VVO), because my end boundaries were usually farther than Davis' but not as far as those set by Mikutiet and Reetz.

Voiced aspirates were analyzed and segmented using the same method as voiceless aspirates. Since the breathiness on the vowel was an important feature used to perceive the feature of aspiration on voiced aspirates, it was important to capture the VVO timings in particular.

In addition I took measurements of prevoicing, the lead time before the release (burst) in the articulation of the stop. Figure 13 illustrates the boundaries for marking lead voicing, the stop release, vowel voicing onset and the modal vowel for segmentation of voiced aspirated stops. The waveform is of the initial syllable /gʱɑ/ in the test word /gʱɑsɔ/ 'grass' produced by a female child native speaker of Oriya.

Figure 13: Segment Boundaries for Voiced Aspirated Stops



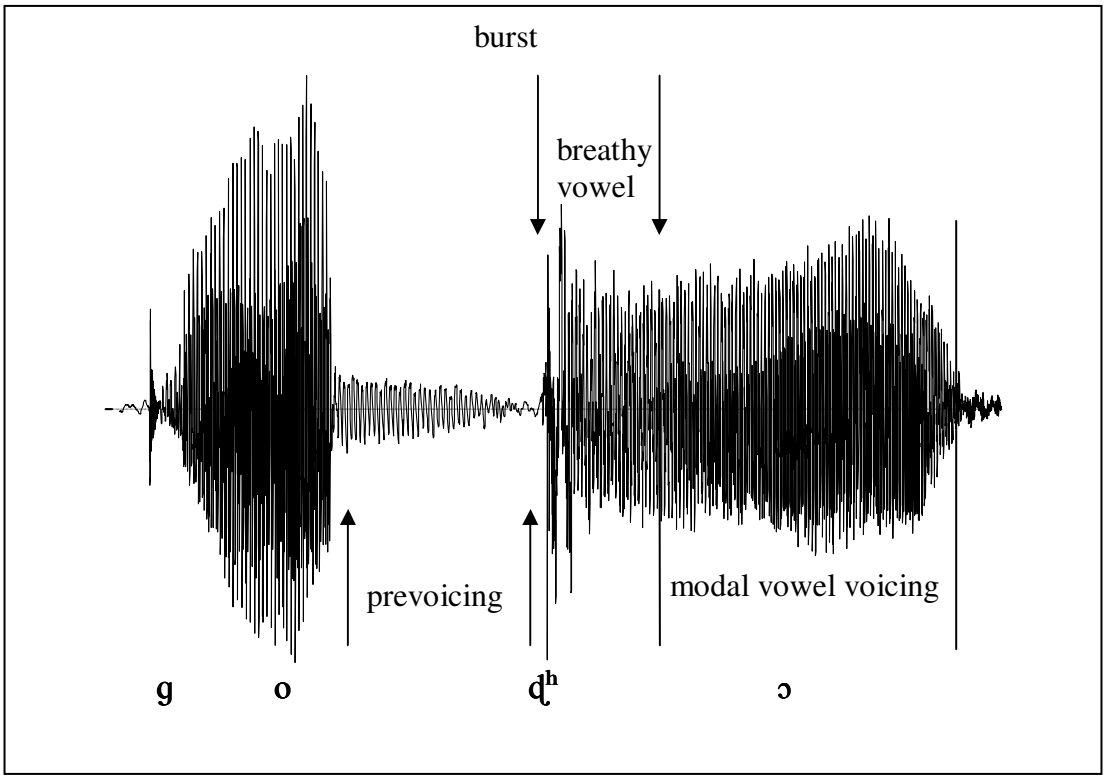
In research testing the perceptions of the four-way stop contrast in Urdu, Hussain and Rami (1995) discovered that prevoicing was the main perceptual cue for distinguishing voiced stops from voiceless stops in the four-way contrast. Therefore, the length of prevoicing was an important measurement to include as part the analysis of the voiced aspirates.

I used the waveform and spectrogram to set boundaries for prevoicing measurements. Boundaries were set starting between the burst and the beginning of low amplitude periodic waves that form prior to the burst. The boundary was placed at the point where no periodic voicing signals appeared on the waveform.

The phoneme /ɖ͡ʱ/ was measured in intervocalic position, a difficult place in which to identify contrast. I measured prevoicing, VVO and ACT using the same methods as those for measuring voiced aspirates in word-initial position. Figure 14: Segment Boundaries

for Voiced Aspirated Stops in Intervocalic Position is an example of the segmentation of intervocalic voiced aspirated stops. This example is from a female Oriya-speaking child.

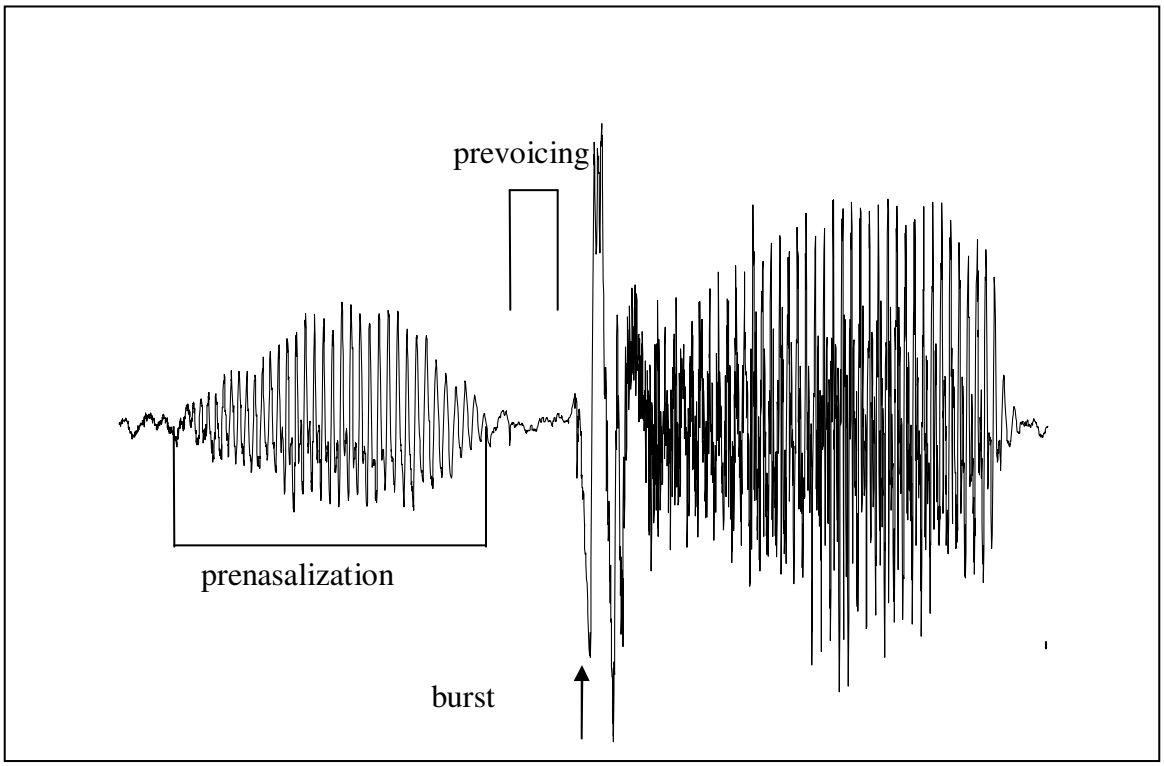
Figure 14: Segment Boundaries for Voiced Aspirated Stops in Intervocalic Position



Certain characteristics of child speech were considered during the sound analysis. Kent and Read (2002) state that "children often can be highly variable in their speech and voice characteristics, producing an utterance with widely ranging values of fundamental frequency, intervals of breathiness, or laryngealization and unexpected nasalization." Native Oriya-speaking children sometimes produced extra breathiness and nasalization. In instances where the child produced extra breathiness that extended significantly longer throughout the vowel, this extra breathiness was noted in the data collection sheet to consider during analysis and the entire measurement for the vowel was divided in half and recorded as the length for breathiness on the onset of the vowel.

Native Oriya-speaking children sometimes inserted a nasal phone before a consonant in word-initial position. It was anticipated that Bondo speakers would transfer their L1 phonation patterns in articulations of Oriya word-initial stops because prenasalization occurs frequently in Bondo. In the analysis, nasalization was documented when it occurred. Measurements for prevoicing started at the point where the waveform consistently changed to the low amplitude pattern of prevoicing, excluding any features of prenasalization. Figure 15 shows an example of a nasal phone that was inserted before the beginning of the test word and shows the point where the prevoicing measurements begin for the voiced aspirate. [14]

Figure 15: Insertion of a Nasal Phoneme Produced by a Child Native Speaker of Oriya



[14] Prevoicing is often but not consistently depicted on the waveform with periodic amplitude. Waveforms that show prevoicing in Ladefoged (2003:97) are low but not consistently periodic. Some of Ladefoged's waveforms look similar to the aperiodic amplitude found in the prevoicing of the aspirated voiced stop in Figure 15.

Minority language speakers tended to overemphasize the aspirated consonant by adding a glottal fricative [h] before the vowel. In the cases where a glottal fricative was used in the pronunciation of an aspirated consonant, the speaker produced a consonant followed by a breathy mid vowel [ə]: for example, [bʰɑtɔ] was produced as [bəhɑtɔ]. In the cases where this sequence occurred, the boundaries for segmentation were drawn from the burst through the mid vowel and the glottal fricative to the point where the waveform had consistent amplitude and periodicity in the modal vowel. The ACT plus VVO measurements would then surpass those of a native Oriya speaker, indicating the sound was most likely articulated with the insertion of additional segments of sound.

In this chapter, I presented the location and dates the research took place, the research design, and the instruments used to test the hypotheses. In the following chapter, I will explain how the data was organized and analyzed, and report the results of the analysis.

CHAPTER 4

RESULTS

This chapter presents the analysis of the sociolinguistic and performance data gathered from the three research instruments: the sociolinguistic survey (section 4.1), the listening test (section 4.2), and the production test (section 4.3). Overall, this chapter will provide information as to how Bondo and Desiya speakers in different groups varied in their performance on phonological awareness tasks before and after the research period. A second focus will be how sociolinguistic factors correlated with performances on phonological awareness tasks.

4.1 Sociolinguistic Survey Results

The sociolinguistic survey provided data on the perceptions subjects had towards their frequency Oriya is used, comprehension ability,[15] anxiety levels, and preferences in comprehension strategies.[16] This data was analyzed in terms of three domains: village location, education level and research group (experimental or control).

As described in section 3.3.1, subjects were asked about various language situations in a question framed with 'How often do you …'. Subjects reported with one of three

[15] Perceived ability to be understood was excluded from the data analysis because the responses from the subjects indicated that they may have misunderstood the question. Also, some of the answers would have skewed the data. For example, non-native speakers who did not use Oriya frequently often answered never to the following question: "How often does your teacher ask you to repeat yourself?" They do not get asked to repeat themselves because they are not speaking, not because the listener understands the non-native speaker.

[16] I also excluded the category, "preferred interlocutor" because the data did not significantly relate to the research question.

options: ‘always’, ‘sometimes’ or ‘never’. Each response was subjective and considered to be a reflection of the subject’s own perception.

For data analysis, each pattern of responses was categorized into either a low, mid or high level of perception. In the low category, subjects responded with at least one never and no always. In the high category, subjects responded with at least one always and no never responses. The mid category contained all the other options of never, sometimes and always. Table 11 reports the different response patterns that correlated with each level used to evaluate perception. (N) is never, (S) is sometimes and (A) is always.

Table 11: Responses Determining Levels of Non-Native Perceptions of Oriya

Survey Domain	**Number of questions**	**Low**	**Mid**	**High**
Usage	3 items	All (N) 2 (N) and 1 (S) 1 (N) and 2 (S)	2 (N) and 1 (A) 1 (N), 1 (S), 1 (A) All (S) 1 (N) and 2 (A)	2 (S) and 1 (A) 2 (A) and 1 (S) All (A)
Comprehension Ability	4 items	All (N) 3 (N) and 1 (S) 2 (N) and 2 (S) 3 (N) and 1 (A) 1 (N) and 3 (S)	2 (N), 1 (S), 1 (A) 1 (N), 2 (S). 1 (A) 2 (N) and 2 (A) All (S) 1 (N), 1 (S), 2 (A)	3 (S) and 1 (A) 2 (S) and 2 (A) 1 (N) and 3(A) 1 (S) and 3(A) All (A)
Anxiety	3 items	All (A) 2 (A) and 1 (S) 1 (A) and 2 (S)	2 (A) and 1 (N) All (S) 1 (N), 1 (S), 1 (A) 2 (N) and 1 (A)	1 (N) and 2 (S) 2 (N) and 1 (S) All (N)

For analyzing anxiety, a low category contained no never responses and at least one always. A high category contained at least one never and no always and the mid responses were all the other options. The responses were arranged differently because

subjects responded to the question, "How often are you afraid to speak to …?" Those who answer always, indicate they have a high anxiety level.

Comprehension strategies were analyzed by either categorizing their response as passive/non-verbal or active/verbal. Three of the responses reflected a comprehension strategy that was a passive, non-verbal interaction with their teacher and one an active, verbal interaction.[17]

In the rest of this section, I report on the results of the sociolinguistic survey. In section 4.1.1 I report on differences in perceptions associated with different village locations. Then in section 4.1.2 I deal with differences related to educational levels. Differences between the control and experimental groups are dealt with in section 4.1.3. Finally, in section 4.1.4 I discuss how subgroups were formed and used to analyze the results of the listening and production tests.

4.1.1 Language Perceptions Within the Domain of Village Location

The patterns in the perceptions of language use, ability, levels of anxiety, and comprehension strategies varied between the different villages. The villages of Hanumal and Dumripada are located in remote areas with less language contact with Oriya than the other villages involved in the study. The subjects in the Dumripada village literacy program were only exposed to Oriya in their educational setting through their literacy teacher, who was a native Oriya speaker, and their literacy materials. Similarly, most of the contact subjects in Hanumal had with Oriya was from their native-speaking teacher and their school textbooks, because they attended a school near to their village with

[17] Upon evaluation of this question, there should have been an equal number choices reflecting passive/non-verbal as there were active/verbal. There also should have been more questions related to comprehension strategies to get a better evaluation of the common strategies that are used. This question only indicates the comprehension strategies used in the classroom with their teacher.

Desiya and Gutob-Gadaba speakers. In contrast, the subjects from the villages of Gumalput, Urabir and those from Dumripada who attended the residential boarding school attended schools with children who were native speakers of Oriya. They also lived closer to centers of commerce where they would have language contact with native speakers of Oriya.

Subjects from remote villages consistently reported (on the pre-survey) lower levels of Oriya language use and comprehension and higher levels of anxiety when compared with subjects from less remote villages who shared the same education levels. The lowest frequency of use was reported by subjects in the Dumripada village literacy class, with 100% of the subjects reporting low use of Oriya. Ninety-one percent of the subjects in Hanumal reported low use or Oriya. Subjects in the less remote villages of Gumalput, Urabir and subjects within the Dumripada residential boarding school all reported mid or high levels of use. Table 12 lists the village, then the level of use that received the highest percentage of responses, then the actual percentage of subjects that responded with that level of use. Remote villages with the highest percentage of subjects from those locations reporting low usage rates are shaded, indicating the correlation between perceptions of low use and remoteness.

Table 12: Perceptions of Language Use from Subjects Within Villages

Village	Level of Use with the Highest Percent of Responses	Percentage of Responses
Gumalput (11)[18]	Mid	(45%)
Urabir (14)	Mid	(50%)
Hanumal (11)	**Low**	**(91%)**
Dumripada Village Literacy (6)	**Low**	**(100%)**
Dumripada Residential School (6)	High, Mid, and Low	(33%)[19]

4.1.2 Perceptions of Language in Correlation with Levels of Education

As I just showed, there were clear differences in perceptions according to village. There were also differences according to the level of education. In this section I first present the differences within the lower education levels and then within the higher education levels.

While patterns in frequency of use were correlated with factors of village remoteness, years of educational experience became an additional relevant factor. All subjects with only one year of educational experience reported a low level of use of Oriya, even those from less remote villages.[20] The patterns in frequency of use changed as the levels of education changed. Even for subjects from the remote village of Hanumal, frequency of use increased with levels of education. These results indicate that both remoteness and fewer than two years of educational experience correlate with low frequency of use. Subjects with one year of educational experience also reported uniform perceptions of low or mid comprehension and high levels of anxiety.

[18] The numbers in parentheses are the total number of subjects that are accounted for the percentages that are reported.
[19] This percentage means 33 % of the subjects from the Dumripada residential school reported low level of use and equally 33% a mid and 33% a high.
[20]Subjects with one year of experience from Gumalput are an exception, but since there were so few subjects in the average, they were not considered in the correlations between frequency of use and the correlating factors.

Comprehension levels were noticeably lower and anxiety levels were slightly higher for 2nd and 3rd grade subjects from remote villages than subjects from less remote villages. Additional years of educational experience were not a factor for reported comprehension levels. All of the subjects from Hanumal with one to three years of educational experience reported low perceptions of comprehension, while fifty-seven percent of the subjects from Urabir reported high comprehension levels. (This comparison is inconclusive since I have no data from Urabir subjects who had only completed one year of education.)

Comparisons of reported anxiety levels between 2nd and 3rd grade subjects in Urabir and Hanumal indicate education levels below two years, remoteness, and low levels of reported comprehension correlated with high levels of anxiety. Overall, subjects in the lower education levels share similar patterns of reported behavior. Table 13 illustrates the correlations between perception of language use, education level and village for the subjects in low education levels.

Table 13: Correlation Between Perception of Language Use, Education Level and Village for Subjects in the Low Education Level

Village	Education Level	Frequency of Language Use	Comprehension	Anxiety Level
Dumripada (6)	Village Literacy 1 yr	Low (100%)	Low (100%)	High (50%)
Gumalput (4)	1st	Low (75%)*[21]	Mid (75%)	High (75%)*
Hanumal (11)	1st	Low (100%)	Low (100%)	High (75%)
Urabir (7)	2nd-3rd	Mid (57%)	High (57%)	Mid (57%)
Hanumal (3)	2nd-3rd	Low (67%)*	Low (100%)*	Mid (75%)*
Dumripada (4) Residential School	1st-3rd	Low/Mid (50%)*	Low/Mid (50%)*	Low/High (50%)

Responses to questions about comprehension strategies indicate that forty-eight percent of 1st to 3rd graders in the study preferred to not do anything when they didn't understand their teacher. This strategy preference differed from the more active strategies generally favored by subjects in the higher education levels. The group of Urabir 2nd-3rd graders shared a verbal active strategy. This was the only group with reported strategies different from others in the 1st -3rd grade. This active strategy will be explained further in 4.1.3.

Subjects from all three villages in 4th through 6th grade gave similar responses in all three areas of language perceptions. On the basis of their responses, we can say that educational levels starting from the 4th grade correlate with perceptions of high frequency of Oriya use, high levels of comprehension, and low levels of anxiety.

[21] Scores with asterisks indicate that there were only 2, 3 or 4 subjects accounting for the response. Most of these scores containing only 2,3, or 4 subjects often seemed to be more likely to misrepresent the group making it difficult to compare using the percentages of responses.

An evaluation of comprehension strategies indicated that 6th graders were less uniform than 4th and 5th graders. The subjects in the 6th grade were the only group that preferred a comprehension strategy that required verbal communication in Oriya. Seventy-five percent of the 6th graders preferred to ask the teacher to repeat themselves as a way to facilitate understanding. All but two subjects in the 4th and 5th grade reported they preferred to watch what other students were doing in order to gain understanding about what their Oriya-speaking teacher was communicating.

In summary, the results from the sociolinguistic survey provided insight into the attitudes that existed among the subjects prior to the treatment period.

4.1.3 A Comparison of Language of Perceptions Between Experimental Group and Control Group

The perceived language patterns between the subjects in the experimental group and control group were approximately uniform within a given education level prior to the treatment period. The responses of the control and experimental groups were particularly uniform among the subjects in the 4th to 6th grades. The only noticeable differences between experimental group subjects and control group subjects are in the areas of perceived levels of comprehension and anxiety for subjects in the 2nd and 3rd grades. The experimental group of 2nd and 3rd grade subjects reported high levels of comprehension; in contrast, the control group reported low levels. In addition, 2nd and 3rd graders preferred to use an active verbal comprehension strategy in Oriya of asking the teacher to repeat themselves, where their counterparts in the control group preferred the passive strategy of not doing anything when they did not understand their Oriya-speaking teacher. These differences will be relevant when considering the significance of differences in performance between control and experimental groups.

Overall, there were more areas of uniformity than contrasts between the subjects in the control and experimental group. The areas of contrast between the experimental and control groups within the 2nd and 3rd grade are highlighted in Table 14.

Table 14: Language Perspective Comparisons between Experimental and Control Groups in 2nd-3rd Education Levels

Frequency of Use	Comprehension	Anxiety Level	Comprehension Strategy
Experimental			
Mid (7) (57%)	High (75%)	Mid (57%)	Verbal and Active Ask teacher to repeat (71%)
Control			
Low/Mid (6) (50%)	Low (67%)	Mid (50%)	Passive Don't do anything (50%)

The sociolinguistic survey was administered preceding and following the research period. I anticipated a study of the changes in perception between the two surveys may indicate how perceptions were influenced by the experimental lessons. However, the responses between the pre and post survey remained fairly consistent for all subjects in all the areas. Differences in responses between pre and post surveys may be more pronounced in a longitudinal study.

Although I particularly anticipated that subjects in the experimental group may move from a higher to lower level of anxiety and from a lower to a higher level of comprehension, this did not appear within either of the experimental groups. The consistency of the responses between pre and post survey does, however, may indicate that the responses in the pre survey were an accurate depiction of the subjects' perceptions. In the following section, I explain how the subgroups were determined.

4.1.4 Subgroups for Analysis

When analyzing the results of the listening and speaking test, I compared subgroups in which the variables of education level and subject's perceived frequency of Oriya use were kept as constant as possible. As noted above, reported perceptions among subjects in the 1st through 3rd grades differed quite distinctly between the subjects that had one year of education and those who had two or three years of education. Therefore, subjects with one year of education need to be compared separately from those in the 2nd to 3rd grade range. Subjects in the 4th through 6th grades were grouped together because of their uniformity in shared patterns of language perceptions and education level.

Bondo subjects in the experimental group learning Bondo and Oriya in the village literacy class were included with other subjects who had completed one year of education because they had all finished at least one year of literacy classes in the village. Sometimes, however, the Bondo were compared separately since in addition to the differences in language, they were different from the Desiya speakers in exposure to Oriya and in language learning approaches. Within the control group, however, the Bondo 1st graders were not divided into their own separate group because 1st graders from Hanumal, Gumalput and Dumripada attending formalized educational classes reported similar sociolinguistic patterns.

Table 15 shows the main subgroups that are used to analyze the results from the listening and speaking tests. The table gives information about the number of participants that shared variables of mother tongue, education level and village location in the control and experimental groups.

Table 15: Characteristics of Subgroups

Dumripada Village Literacy		Urabir		Dumripada Residential School		Gumalput		Hanumal	
Bondo		Desiya		Bondo		Desiya		Desiya	
1st	6	1st	0	1st	2	1st	5	1st	8
2nd-3rd	0	2nd-3rd	7	2nd-3rd	2	2nd-3rd	1	2nd -3rd	3
4th-6th	0	4th-6th	7	4th-6th	2	4th-6th	6	4th-6th	0
Experimental Group Total 20				**Control Group Total 29**					

Most of the subgroups within the experimental and control groups were nearly uniform in number and mother tongue. The subgroup of 1st graders had the greatest internal variation between the control and experimental groups. These subjects differed in their mother tongue, number of participants, and their Oriya language development program. The total number of 1st graders in the control group was fifteen while there were only six in the experimental group. At the same time, the majority of 1st graders shared similar perceptions of language use, and most were from remote areas.

In the rest of this chapter, I compare the performance of subjects in these subgroups on the listening tests (section 4.2) and production tests (section 4.3).

4.2 Listening Proficiency Test Results

In this section, I present the test results from the listening proficiency assessments administered before and after the research period. The main goal of this research instrument was to evaluate the progress made in the ability to discriminate sounds. The results from the pre and post tests were compared to discover whether the experimental lessons contributed to improvements in the phonemic awareness of Oriya. In the first section, 4.2.1, I analyze the acoustic cues the subjects received in the phoneme contrasts.

Next, in section 4.2.2, I compare the general range of performance abilities on listening tasks that existed between the control and experimental groups of subjects prior to the research period. In section 4.2.3 I compare the pre and post test results between the experimental group and the control group. The following section, 4.2.4 is an overview of the correlations between test results and language perceptions. Finally, in section 4.2.5, I present the improvements made in the awareness of the phonological features found in the test phonemes in the experimental and control group.

4.2.1 Acoustic Cues of Contrastive Sounds in the Listening Test

As indicated in section 3.3.2, subjects were asked to identify fifteen phonemes. Of these, I analyzed the production of the eight participating in the four-way stop contrast. Thus, the results are based on the performances on the sound discrimination tests which included the following inventory of phones: /bʰ/, /pʰ/, /d̪ʰ/, /t̪ʰ/, /ɖʰ/, /ʈʰ/, /gʰ/, /kʰ/. Before presenting the performance results in the next section, I will describe the acoustic cues that the subjects received when listening to the test phonemes

I analyzed the ACT and VVO timings for the voiceless aspirated and unaspirated phonemes in each of the series of contrasts occurring in the listening test. Mikuteit and Reetz (2007) reported that the acoustic cue for voiceless aspirated stops have longer ACT timing than their unaspirated counterparts. This is true in Oriya: the most distinctive perceptual cue for voiceless aspirated stops in word-initial position was ACT timing. All of the voiceless aspirated phonemes had ACT timings that were more than 24 ms longer than their unaspirated phoneme counterparts.

Prevoicing, ACT and VVO timings were acoustic cues that have been reported to be important for differentiating a voiced aspirated stop from its unaspirated counterpart. I analyzed the test phonemes in the contrastive sets used to test perception of voiced

aspirates to determine the acoustic cues the subjects received. Table 16 below lists the comparative timings for prevoicing, ACT and VVO for both voiced and voiceless segments. The timings for the aspirated phonemes are shaded.

Table 16: Native Speaker Timings of Contrastive Phonemes in the Listening Test

Voiced Phonemes				Voiceless Phonemes		
Token	Prevoicing	ACT	VVO	Token	ACT	VVO
bʱɑlu	58.8	14.0	86.9	**p**ɑʈɾɔ	11.9	2.5
bɑduɖi	111.2	0.0	5.3	**pʱ**ɑʈo	67.6	9.8
bɑosɔ	113.2	0.0	0.0	**p**ɑɳi	9.7	3.5
bɑlɔkɔ	90.5	0.0	0.0	**p**ɑd̪o	7.6	7.3
d̪oudi	93.3	0.0	7.9	**t̪**ɑɾɑ	9.6	0.0
d̪ɔɾɑdʒɑ	147.6	4.8	4.1	**t̪**ɑt̪iɑ	9.8	0.0
d̪ʱɔnu	96.5	28.8	58.1	**t̪**ɑlɑ	11.6	0.0
d̪ɔnɑ	217.1	10.4	4.7	**t̪ʰ**ɑkɔ	58.1	3.8
	Intervocalic Prevoicing	ACT	VVO		ACT	VVO
gɑ**ɖ**i	41.6	0.0	0.0	lɑ**ʈʰ**i	55.6	18.2
si**ɖʱ**i	40.6	12.7	0.0	tʃo**ʈ**i	7.0	3.5
kɑku**ɖ**i	36.7	3.5	0.0	pɑ**ʈ**i	14.5	7.7
biɾɑ**ɖ**i	45.5	5.0	0.0	bɑl**ʈ**i	14.4	3.9
	Prevoicing	ACT	VVO			
gæt̪ɔ	127.8	9.4	3.8	**k**ɑnɔ	52.6	0.0
gʱɑsɔ	95.3	26.0	56.0	**k**ɑt̪ibɑ	26.3	4.8
gɑi	185.7	10.9	8.2	**k**ɑgɔdʒɔ	9.6	0.0
gɑd̪i	109.6	14.9	7.6	**kʰ**ɑt̪ɑ	77.5	3.9

Prevoicing was an acoustic cue that was present in all of the voiced phonemes. Voiced aspirated stops in word-initial position were usually produced with shorter lengths of prevoicing than the voiced unaspirated stops. But prevoicing was not a significant acoustic cue for discriminating between voiced aspirated and unaspirated phonemes in intervocalic position.

The phoneme /ɖʰ/ was the most difficult to discriminate because listeners needed to detect the slight difference in ACT to determine which token contained the aspirated segment. Surprisingly, the intervocalic voiceless aspirate /ʈʰ/ was produced with more distinctive contrast in timing than the contrast between /kʰ/ and /k/, providing subjects with at least one instance of distinctive contrast in intervocalic position.

The perceptual cue that showed most contrast between aspirated and unaspirated voiced stops in word-initial position was the difference between the VVO timings. The native speaker produced voiced aspirated stops with VVO timings that were consistently longer for aspirated stops than for unaspirated voiced stops.

When ACT and VVO are added together for all of the segments, this timing equals the VOT used in the perceptual study of Hindi phonemes in the four-way stop contrast conducted by Hussain, Sarmad and Rumi (1995). They concluded that when VOT timings of aspirated and unaspirated phonemes were measured from the burst to the F2, the phonemes were perceived as aspirated if durations were greater than 45 ms. All of the aspirated phonemes used in the listening test produced surpassed this duration.

In addition to noting timing durations for individual sounds, I also compared the timing differences between the phonemes to evaluate the minimal contrasts in acoustic cues the subjects were receiving. This is important because subjects were comparing sounds. The figures in

Table 17 show the minimal acoustic cues of ACT and VVO timings from the recordings produced by the native speakers. Differences for the voiceless stops were calculated by subtracting the ACT timings of the lengthiest voiceless unaspirated phoneme from the ACT timings of the voiceless aspirated phoneme. Differences for the

voiced stops were calculated between the VVO timings because these timings were most distinctive for voiced phonemes.

Table 17: Minimal Acoustic Cues of ACT and VVO Timings by Native Speakers

Voiceless Aspirates Differences in ACT				**Voiced Aspirates Differences in VVO**			
p^h	$t̪^h$	$ʈ^h$	k^h	$b^ɦ$	$d̪^ɦ$	$ɖ^{ɦ22}$	$g^ɦ$
55.7	46.5	41.1	24.9	81.6	51.6	7.7	47.8

From these calculations, it appears that the pairs /k/, /k^h/, and /$ɖ^ɦ$/, /ɖ/ were articulated with similar acoustic cues, possibly affecting the ability of non-native speakers to discriminate between the phonemes. All of the other phonemes had significant timing differences, providing acoustic cues that could possibly enhance perceptual performance.

4.2.2 Performance on Listening Tasks Prior to the Research Period

Subjects in the experimental and control groups exhibited similar performance levels on listening tasks prior to the research period. Scores on the listening tests were calculated by adding the number of responses where the subject identified the correct picture for the word containing the aspirated phoneme. Each test was scored on the basis of correct items out of the total number of eight possible.

Average test scores correlated with education levels. Subjects in high education levels attained high average scores and those in low education levels attained low average scores. As shown in Figure 16, a comparison between the average scores of experimental groups and control groups within the different education levels indicates that the competency levels in sound discrimination were nearly the same prior to the treatment period.

[22] Difference is calculated between ACT timings for the intervocalic phoneme since VVO timings did not contrast.

Figure 16: A Comparison of Score Averages on the Sound Discrimination Pre test

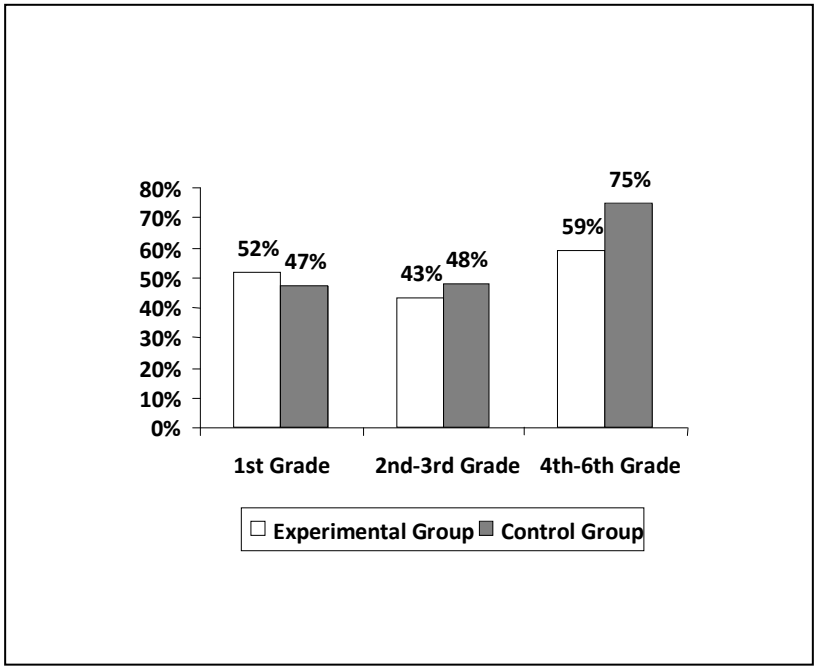


Figure 16 shows that the most significant contrast was between the performances of the experimental and control groups in the 4th through 6th grade. The average scores of the control group were 16% higher than the average scores of the experimental group. Figure 16 also shows that overall most of the control group subjects were a little higher in their preliminary performance than those in the experimental group.

4.2.3 Comparisons Between Pre Test and Post Test Results

It was anticipated that all of the subjects in the experimental group would improve their ability to discriminate sounds as a result of receiving the experimental lessons designed to teach subjects an awareness of the phonological features in Oriya. The differences between pre and post test were analyzed to discover any gains in score averages, individual score improvements and improvements in perception of individual phonemes. In this section I summarize differences in progress between the subjects in the experimental and control groups.

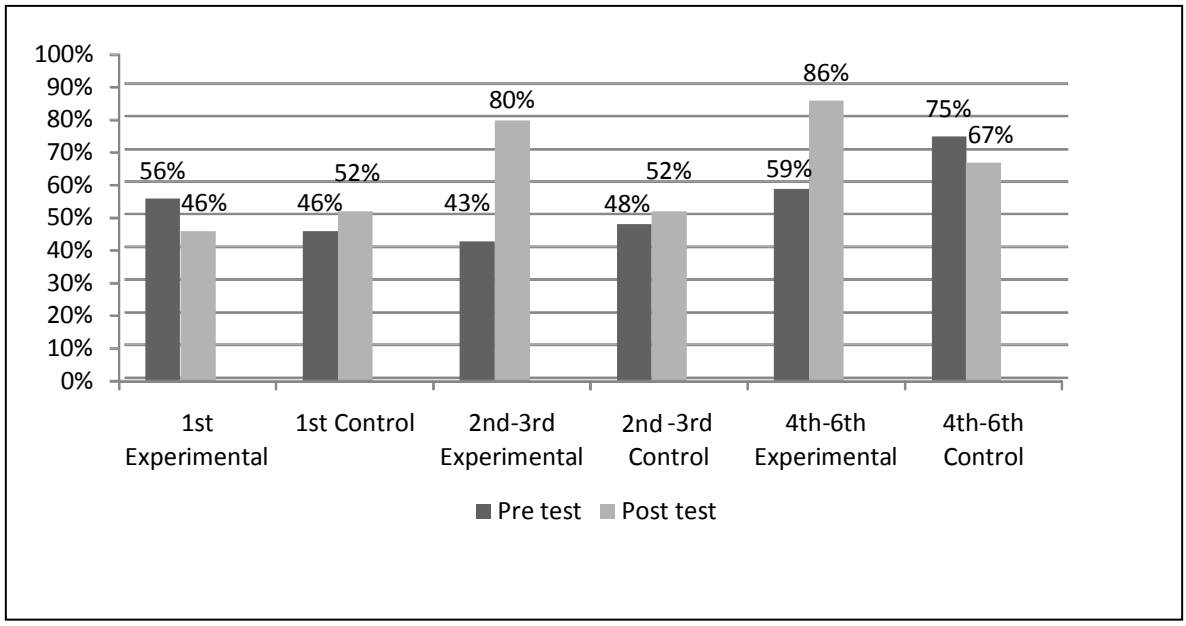
The experimental groups generally did make more gains than the control group. Both the 2nd and 3rd grade and the 4th through 6th grade experimental groups and the 1st and the 2nd and 3rd grade control groups made gains between pre and post test score averages. Both research groups had one education level that did not make gains: the 1st grade experimental group, and the 4th through 6th grade control group. The results for the 1st grade experimental group were particularly unexpected: in spite of receiving the experimental lessons for the longest time period, their average score decreased by eighteen percent.

The 2nd and 3rd grade experimental group subjects made the most improvement in their average scores: the difference between their pre and post average score was 47% gain. In comparison, the 2nd and 3rd grade control group made only an 8% gain. The 4th through 6th grade experimental group made the next highest gains with a 27% gain. In comparison, the 4th through 6th grade control group had a decrease in average score rather than a gain.[23]

Figure 17 illustrates the comparative improvements in average scores between the pre and post test.

[23] A paired two sample t-test indicated that the improvement was significant for subjects in the 2nd and 3rd grade experimental group (p=0.018) and the 4th through 6th grade experimental group (p=0.003). Improvement was not significant for the 2nd and 3rd grade control group (p=0.7) and the 1st grade control group (p=0.4).

Figure 17: Comparative Improvements in Average Scores Between the Pre and Post Test

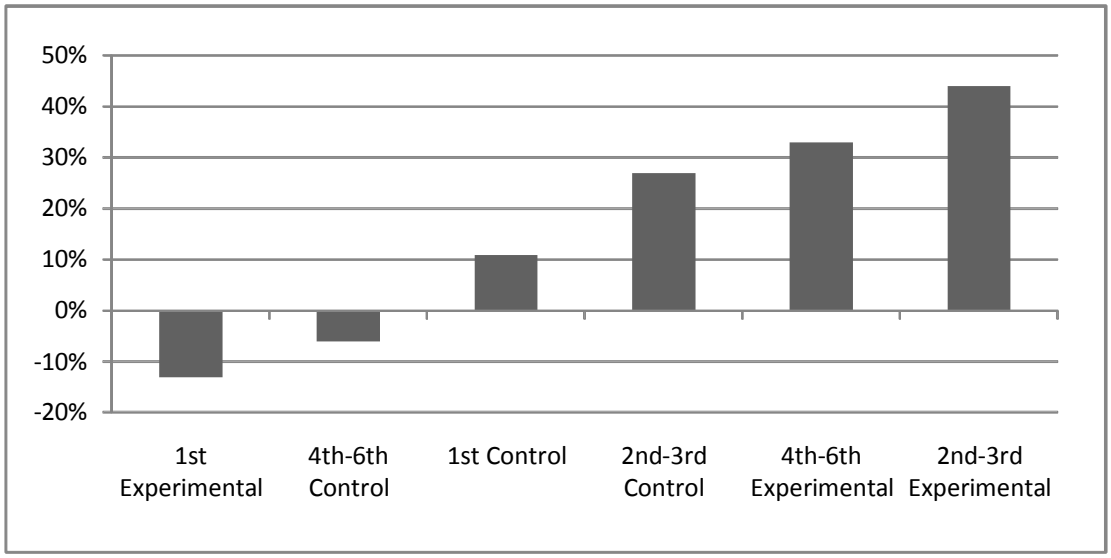


The data was also analyzed by first figuring the individual rather than group percentage gains. An average level of improvement was then calculated for the individual percentage gains within each research subgroup. In this analysis, the average individual percentage gains for the 2nd and 3rd grade control group were 27% as opposed to 44% for the experimental group. This difference is not, however, statistically significant.[24] The 4th through 6th group still kept its position as the group making the second greatest level of improvements with an average individual percentage gain of 33% as opposed to an 11% decrease for the control group. This difference is statistically significant.[25] Figure 18 shows that group averages calculated on the basis of individual gains follow the same ranking order as group percentages of improvement shown in Figure 18.

[24] A two-sample t-test of unequal variances indicated that the increase in mean scores for the 2nd and 3rd grade experimental group was not significantly higher than the increase for the comparable control group (p=0.38).

[25] A two-sample t-test of unequal variances indicated that the increase in mean scores for the 4th through 6th grade experimental group was significantly more than that for the comparable control group (p=0.02).

Figure 18: Sound Discrimination Test Averages in Individual Percentage Gains



4.2.4 Correlations Between Language Perceptions and Performances on the Listening Test

A comparison of performance on the listening test and language perceptions resulted in evidence of both predictable and unpredictable correlations. I predicted that subjects with perceptions of low usage, low comprehension and high anxiety would receive low scores on the pre test and those with perceptions of high language use, high comprehension or low anxiety would receive a high score. This was not, however, always the case.

Most of the unpredictable correlations involved subjects with lower education levels, reporting low usage, low comprehension or high anxiety, but achieving average or high scores on the listening proficiency test. Therefore, their perceptions were not always predictable indicators of their test score. Table 18 lists the type of unpredictable correlation and the number of times the unpredictable correlation occurred.

Table 18: Number of Unpredictable Correlations between Language Perception Levels and Listening Test Scores

Low Usage/ High Score		**Low Comprehension/ High Score**		**High Anxiety/ High Score**	
Pre	Post	Pre	Post	Pre	Post
9	7	8	5	7	5

There were slightly more unpredictable correlations in the pre assessment cross analysis than the post. Often, an equal number of control group subjects and experimental subjects had these unpredictable correlations. Subjects in the higher education levels exhibited more consistency between reports of high language use, high comprehension or low anxiety along with a high score on the listening proficiency test.

4.2.5 Varied Ability and Improvements in the Awareness of Phonological Features

While the results from the listening proficiency tests demonstrated that the experimental lessons improved subjects' abilities to discriminate sounds used in Oriya, they also showed that some Oriya phonemes were easier to distinguish than others. The analysis of the native speaker productions of the test phonemes in 4.2.1 indicated that subjects received varying degrees of difference in the acoustic cues differentiating between the aspirated and unaspirated phonemes. On this basis, I predicted that certain phonemes may be easier to distinguish than others. In this section, I will summarize how the subjects perceived each individual phoneme and improved in discriminating different phonological features.

Research supports that it would be more difficult to distinguish voiced aspirated consonants than voiceless aspirated consonants (Davis 1995, Hussain and Rami 1995). This expectation was fulfilled by the results of the listening test. On the pre test, most of the subjects in all education levels performed better on the items testing awareness of

voiceless aspirated phonemes than on those testing voiced aspirated phonemes. The only exception was that subjects in the experimental and control groups in the 4th through 6th grades correctly distinguished the voiced aspirated phonemes more frequently than the voiceless aspirated phonemes. The values in Table 19 represent the percentage of subjects in each subgroup that correctly discriminated each test phoneme. The bolded phonemes were in intervocalic position. The shaded boxes indicate that at least half of the subjects in the relevant subgroup were able to correctly distinguish the test phoneme in the column heading, giving an indication of the strengths and weaknesses in perception.

Table 19: Comparisons Between the Percentages of Subjects Correctly Distinguishing Each Test Phoneme in the Listening Pre Test

Research Group		**Voiced Aspirated**					**Voiceless Aspirated**			
		bʰɑ	dʰɔ	**ɖʰi**	gʰɑ		pʰɑ	tʰɑ	**ʈʰi**	kʰɑ
Experimental	1st	67%	33%	33%	50%		50%	67%	50%	67%
	2nd-3rd	43%	86%	0%	29%		29%	43%	43%	57%
	4th-6th	**71%**	**86%**	**14%**	**71%**		29%	71%	43%	71%
Control	1st	47%	40%	33%	40%		33%	80%	27%	73%
	2nd-3rd	50%	33%	17%	67%		33%	67%	33%	83%
	4th-6th	**100%**	**88%**	**63%**	**88%**		75%	63%	63%	75%

The results from this analysis indicate the preliminary phonological awareness of each specific phoneme. In general, as grade levels increased, performance increased.

This analysis also reveals which phonemes were the easiest and most difficult for subjects to perceive prior to the research period. A phoneme was considered difficult for a subgroup if more than fifty percent of the subjects could not distinguish it. The most difficult test phoneme was /ɖʰ/ and the least difficult was /kʰ/. Surprisingly, /pʰ/ was a difficult phoneme to perceive. Retroflexes were the probably the most difficult to perceive due both to their place of articulation and the fact that they were in intervocalic position.

The amount of improvement was determined by comparing the percentage of subjects able to discriminate the phoneme correctly in the pre test with the percentage of subjects able to discriminate it correctly in the post test. Table 20 shows the differences in discrimination between the pre test and post test. In each cell, the number to the left is the pre test percentage, and the number on the right is the post test percentage. The shaded boxes indicate an improvement in discrimination. The numbers in bold indicate the phonemes for which over twenty percent of the subjects made gains between pre and post test.

Table 20: Comparisons between Pre and Post Listening Test in the Percentage of Subjects Correctly Distinguishing each Test Phoneme

Research Group		**Voiced Aspirated**				**Voiceless Aspirated**			
		bʱɑ	dʱɔ	ɖʱi	gʱɑ	pʰɑ	tʰɑ	ʈʰi	kʰɑ
Experimental	1st	67/17	**33/67**	33/33	50/50	50/33	67/50	50/0	**67/100**
	2nd-3rd	**43/86**	86/86	**0/43**	**29/100**	**29/71**	**43/86**	**43/86**	**57/86**
	4th-6th	**71/100**	86/100	**14/43**	**71/100**	**29/100**	71/57	**43/86**	**71/100**
Control	1st	**47/73**	40/40	33/40	40/47	33/7	80/67	**27/53**	73/87
	2nd-3rd	50/67	33/50	17/33	67/33	33/33	67/83	33/17	83/100
	4th-6th	100/75	88/88	63/38	88/75	75/63	**63/100**	63/25	75/75

The results were that subjects in the experimental group in the 2nd and 3rd grades and in the 4th through 6th grades, as well as subjects from the control group in the 1st grade and in the 2nd and 3rd grades improved in their ability to discriminate voiced aspirated phonemes. The subjects in the experimental group in the 2nd and 3rd grades and in the 4th through 6th grades showed the most improvement. There was only one phoneme for which these two groups did not show improvement in discrimination. Unexpectedly, the experimental subjects in the first grade showed improvement for fewer phonemes than did the subjects in the first grade control group. An examination of the numbers in bold reveals that among subjects in the 2nd through 6th grades more subjects in the experimental group than in the control group made gains from the pre to the post test. When the control group made gains, there were not as many subjects showing improvement.

Subjects varied in their ability to discriminate sounds according to place of articulation and word position of the test phoneme. On the pre test, all of the groups had difficulty discriminating retroflexes. Subjects from the experimental group in 2nd and 3rd grades and in 4th through 6th grades made the greatest gains in their phonological awareness of retroflexes. The number of subjects in the experimental group in the 2nd and 3rd grades who could distinguish /ɖʱ/ increased from zero to forty-three percent between the pre test and the post test. Similarly, the number of subjects in both the 2nd and 3rd grade group and 4th through 6th grade group who could perceive /ʈʰ/ increased from forty-three percent to eighty-six percent between the pre test and the post test. More subjects improved in these groups than in their control group counterparts. The largest gain in the perception of retroflexes among subjects in the control group came from those in the 4th through 6th grades where the number of the subjects who could perceive /ʈʰ/ increased from sixty-three percent to one hundred percent.

In general, the experimental group of subjects from the 2nd and 3rd grades showed the most improvements in listening proficiency, regardless of the focus of the analysis.

4.3 Production Test

In this section I report on the acoustic realizations of Oriya aspirated phonemes in the production test. The subjects' pronunciations were compared to pronunciations of native Oriya speakers. The primary purpose of the analysis was to discover the acoustic properties subjects were demonstrating and analyze the ways production changed from pre to post test.

I analyzed four out of the eight phonemes from the listening test, comparing data between native speakers of Oriya[26] and 24 of the 49 subjects. The subjects included some who had performed poorly and some who had performed well on the listening test, representatives from each educational program and representatives from each educational level. Table 21 shows the composition of subjects in the experimental and control group that were used in the analysis of the production test.

Table 21: Composition of Subjects in the Experimental and Control Groups

Experimental Group		**Control Group**	
Bondo village literacy	4	Gumalput 1st	2
Urabir 3rd	4	Hanumal 1st	2
Urabir 5th-6th	4	Gumalput 2nd	1
		Hanumal 2nd-3rd	2
		Dumripada 3rd	1
		Dumripada 5th	2
		Gumalput 6th	2
Total	**12**	**Total**	**12**

I chose one phoneme to analyze from each of the four places of articulation; two were voiced and two were voiceless. One of the phonemes was in word-medial position in the listening test, and one was in medial position in the production test. The four phonemes and the particular features they represented are listed in Table 22.

[26] These are the same Oriya native speakers who were described in section3.3.3: two adults and two children.

Table 22: Selected Production Test Phonemes and Their Features for Analysis

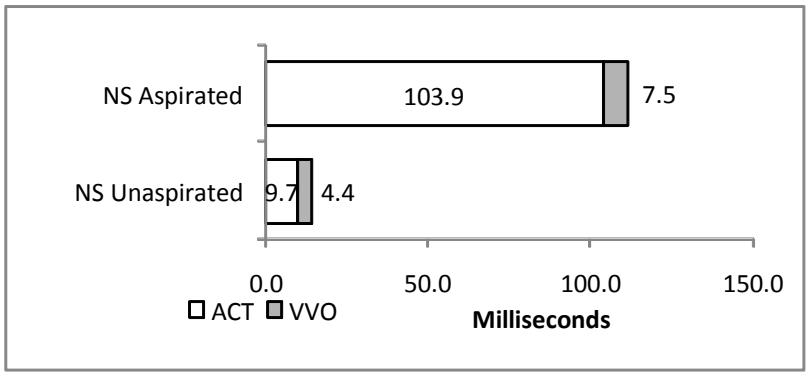
Features	d̪ʱ	gʱ	pʰ	ʈʰ
Voicing	voiced	voiced	voiceless	voiceless
Place of Articulation	dental	velar	bilabial	retroflex
Word Position on Listening Test	word-initial	word-initial	word-initial	word-medial
Word Position on Production test	word-medial	word-initial	word-initial	word-initial

Each of the four phonemes is discussed in a separate subsection.

4.3.1 Acoustic Realizations of /pʰ/

I analyzed the realizations of /pʰ/ by comparing measurements of after closure time (ACT) together with vowel voicing onset (VVO) and whether frication was present or not. The phoneme /pʰ/ occurred word-initially in the word /pʰulɔkobi/. Native speakers produced /pʰ/ with much longer ACT+VVO times than the unaspirated /p/. Both child and adult native speakers produced /pʰ/ with nearly the same aspiration timings. Therefore, the two adult and two child timings were averaged together for one representation of /pʰ/ and one of /p/. Figure 19 depicts the difference between the two average lengths.

Figure 19: Average Aspiration Timings Between /p^h/ and /p/ Produced by Native Speakers

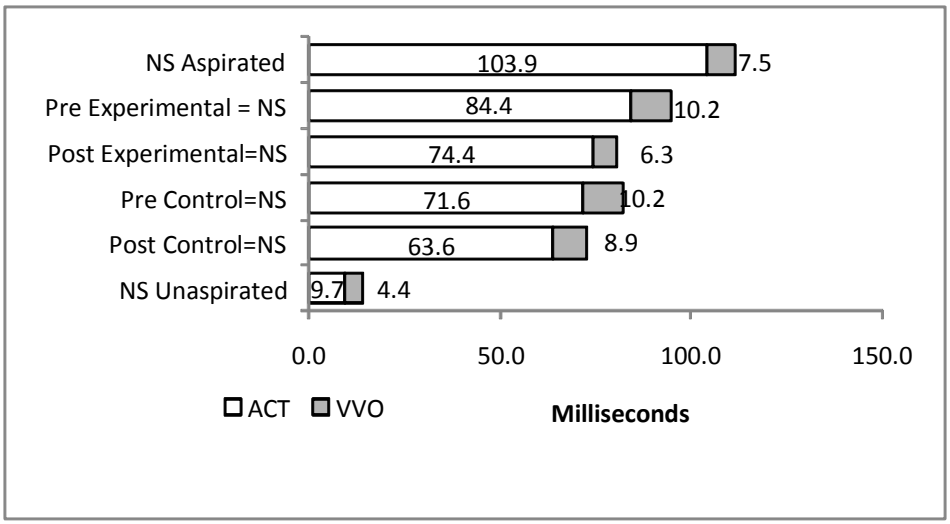


The analysis of native speaker productions of /p^h/ revealed that frication was never present when native speakers pronounced /p^h/. However, the bursts in /p^h/ were not as distinct those produced in other voiceless aspirated stops such as /t^h/ and /$ʈ^h$/, illustrating a slight presence of frication.

Non-native speakers realized /p^h/ in four different ways. Most of the twenty-four non-native speakers I analyzed realized /p^h/ with aspiration nearly equal to native speakers. The other realizations were either frication, unaspirated or substitution of a different phoneme.

Figure 20 shows the comparative average timings between native and relatively accurate realizations of /p^h/ by non-native speakers.

Figure 20: Comparative Average Timings in the Realizations of /p^h/



These results indicate that the aspiration lengths were slightly shorter for non-native speakers than for native speakers. Between the pre and post test, on average, subjects from both the experimental and control groups shortened their aspiration lengths even more. However, realizations still remained nearly equal to those of native speakers.

Non-native speakers commonly approximated /p^h/ with frication. An analysis of the waveform indicated when frication or affrication was present. Their aspiration lengths were longer than those of native speakers when they realized the /p^h/ as a fricative or affricate. Native speakers may still perceive the realization as /p^h/ when it is articulated with friction because /f/ and /pɸ/ are not separate phonemes in Oriya. However, this realization may indentify non-native speakers as having an accent because the amount of frication is much more than what native speakers produce.

Two subjects from the control group produced aspiration lengths that were half of those produced by native speakers. These may have been within the range of perception as /p^h/, especially since their timings were twice the length of aspiration produced in native articulations of /p/.

Table 23: Percentage of Subjects Producing Each Realization of /p^h/ for Pre and Post Tests

/p^h/					
Experimental Group (12)	Pre test	Post test	**Control Group (12)**	Pre test	Post test
Aspirated	50%	58%	Aspirated	75%	67%
½ of NS aspiration length	0%	0%	½ of NS aspiration length	0%	17%
Frication	42%	42%	Frication	25%	17%
Unaspirated[27]	8%*[28]	0%	Unaspirated	0%	0%

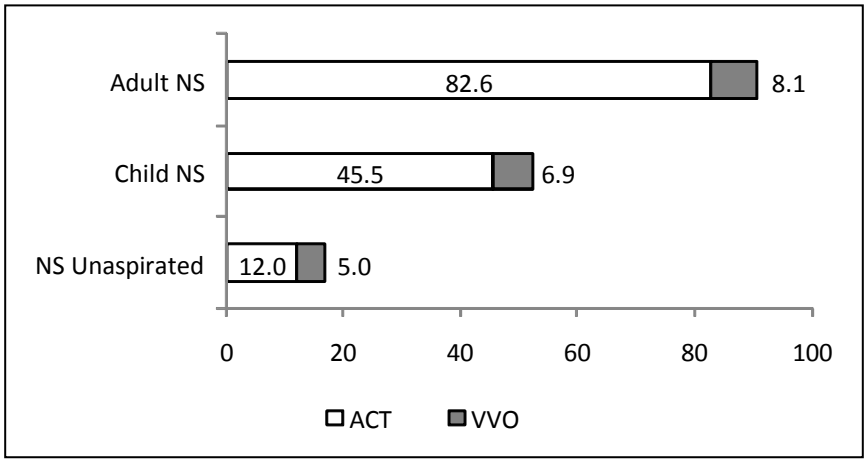
The control group consistently had higher percentages of subjects producing /p^h/ nearly equal to native speakers than the experimental group. The experimental group had more subjects producing approximations of /p^h/ as a fricative than the control group. Percentages of subjects representing each realization of /p^h/ remained similar from pre to post test. Comparing these results to the results of the listening test indicates that subjects were able to perceive /p^h/ better than they could produce /p^h/

4.3.2 Acoustic Realizations of /$ʈ^h$/

The realizations of /$ʈ^h$/ were analyzed by comparing ACT together with VVO timings. The phoneme /$ʈ^h$/ occurred word-initially in the word /$ʈ^h$ekuɑ/. Adult native speakers articulated /$ʈ^h$/ with significantly longer aspiration timings than child native speakers. Therefore, their aspiration timings were averaged separately, but unaspirated timings were averaged together.

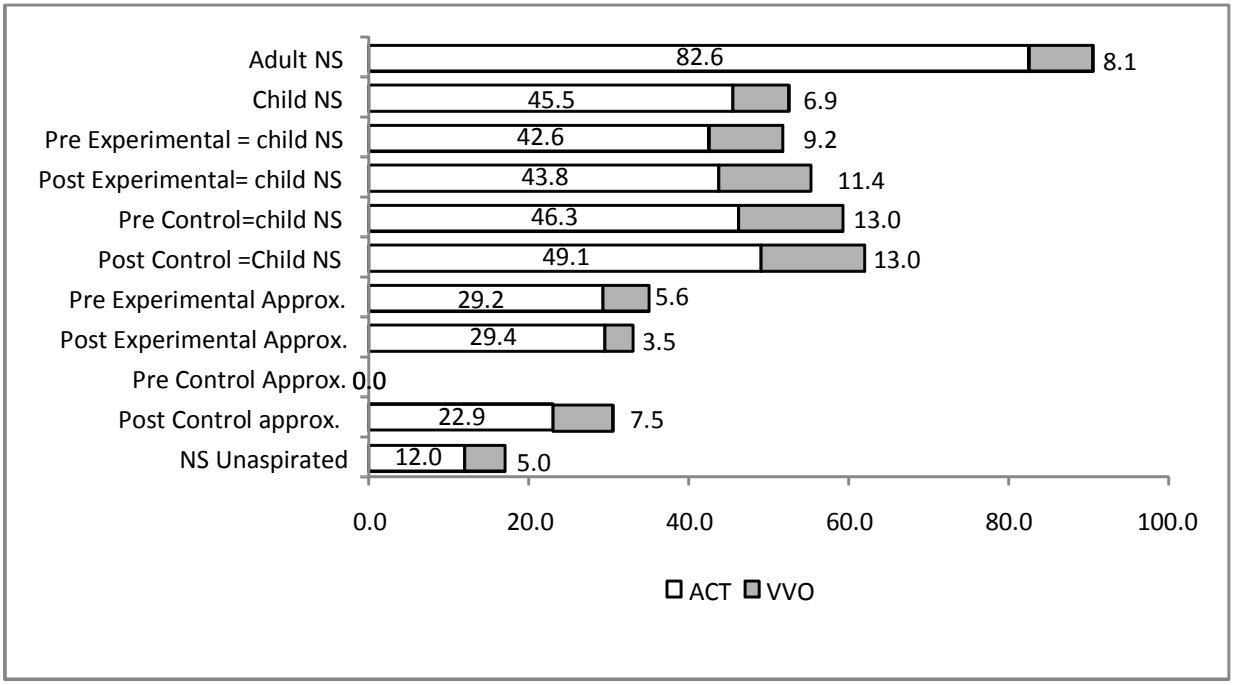
[27] 'unaspirated' equals an articulation of ACT + VVO less than 45ms.
[28] An (*) next to the number indicates one of the subjects spoke a different articulation of the phoneme instead of an unaspirated stop.

Figure 21 Comparative Averages Timings in the Realizations of /ʈʰ/



Non-native speakers realized /ʈʰ/ three different ways: with aspiration nearly equal to child native speakers, aspiration half the length of native speakers or unaspirated. Average timings for all of the realizations of /ʈʰ/ except for non-native realizations that were unaspirated are compared in Figure 22.

Figure 22: Average Aspiration Timings in the Realizations of /ʈʰ/



Approximations were just over half the length of aspiration of child native speakers. Average lengths remained fairly consistent between pre and post test results.

Both the experimental and the control group had similar percentages of subjects that realized /ʈʰ/ nearly equal to child native speakers. More subjects in the control group than in the experimental group produced an unaspirated realization on the pre test, while less produced it on the post test. Most of the subjects in the experimental group realized /ʈʰ/ by approximation. Table 24 reports the percentage of subjects that produced each realization of /ʈʰ/.

Table 24: Percentage of Subjects Producing Each Realization of /ʈʰ/ for Pre and Post Tests

/ʈʰ/					
Experimental Group	Pre test **(11)**[29]	Post test (12)	**Control Group**	Pre test (11)	Post test (11)
+ asp = child NS	36%	33%	+ asp = child NS	36%	27%
Approximation	45%	50%	Approximation	0%	36%
Unaspirated[30]	18%	17%*	Unaspirated	64%[31]	36%

There were few differences in percentages between pre to post test scores in the experimental group. In the control group, fewer subjects produced unaspirated realizations on the post test than in the pre test. Instead, a higher percentage of subjects in the control group were producing approximations in their aspiration lengths. Comparing these results to the results from the listening test, the experimental group showed more improvement in the perception of /ʈʰ/ than in the production of /ʈʰ/. The control group, on

[29] Where data from only 11 subjects was included, one of the sound files was distorted and could not be included in the analysis.
[30] 'Unaspirated' indicates an articulation of ACT+VVO less than 26ms. Twenty-six milliseconds is half the aspiration length of child native speakers.
[31] One subject's timing that had a longer VVO (26.8ms) than their ACT (10.3ms). Since ACT was the main feature indicating contrast for voiceless aspirates, this subject's realization was analyzed as unaspirated due to its short ACT even though their total aspiration time was more than 26ms.

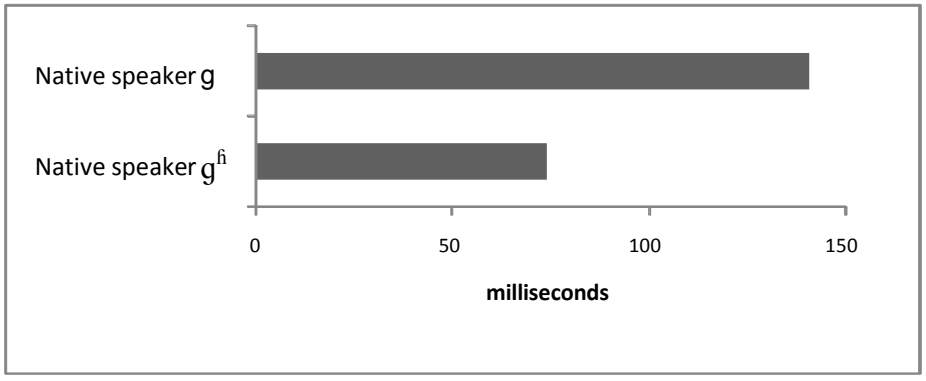
the other hand, showed some improvement in the production test although they consistently showed difficultly perceiving /ʈʰ/ in the listening test.

4.3.3 Acoustic Realizations of /gʱ/

Realizations of /gʱ/ were analyzed in terms of timings of prevoicing, total ACT and VVO lengths, and the ratio of ACT and VVO lengths. The phoneme /gʱ/ occurred word-initially in the word /gʱɑsɔ/. I will first present prevoicing patterns of native speakers and compare native and non-native productions of prevoicing. Then I will present the ACT and VVO patterns of native speakers and compare them to patterns of non-native speakers.

On average, native speakers produced prevoicing lengths of the /g/ two times as long as /gʱ/. The exception was that the Oriya-speaking boy did not include any prevoicing in his production of /gʱ/, and so his timing is not included in the averages shown in Figure 23.

Figure 23: Native Speaker Average Lengths of Prevoicing for /gʱ/ and /g/



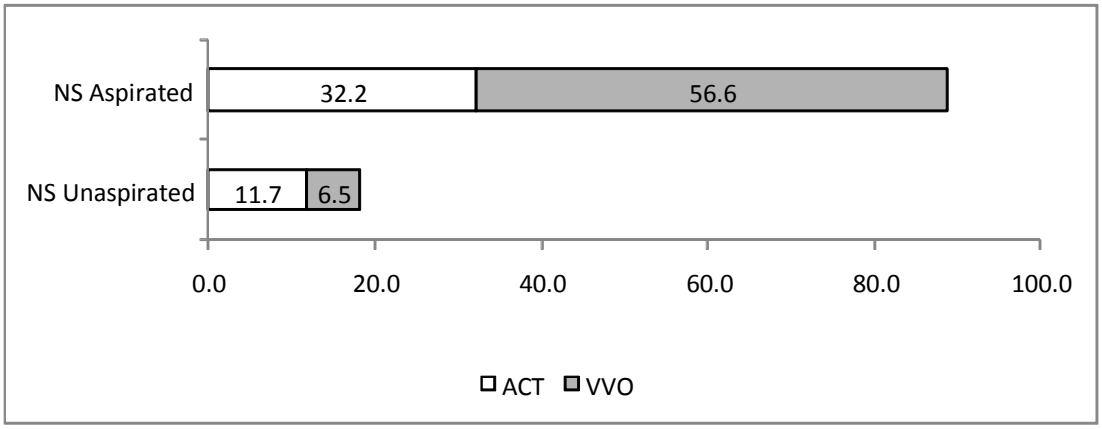
The different lengths shown in Figure 23 indicate how much of the aspiration noise reduces prevoicing in the realization of /gʱ/ and indicate how much voicing is actually present as a perceptual cue available for perceiving /gʱ/. This segment may in fact be misinterpreted as a /kʰ/ because of its shorter prevoicing length.

Non-native speakers' productions of /g^{ɦ}/ showed quite different patterns of prevoicing. The majority of the subjects produced little or no prevoicing in their realizations of /g^{ɦ}/. Prevoicing may be the feature that children in general tend to eliminate, but the evidence from the results indicate that non-native speakers tend to eliminate prevoicing when attempting to pronounce /g^{ɦ}/. It would be necessary to analyze the other voiced aspirated phonemes in word-initial position produced by child native speakers before drawing further conclusions.

There were no significant changes in the articulation of prevoicing in the experimental group between the pre and post test. Only one subject included prevoicing on the post test where it had been excluded in the pre test. In the control group, three subjects produced prevoicing in the post test, where they had not included it in the pre test.

The acoustic realizations of /g^{ɦ}/ were also analyzed in terms of ACT+VVO timings and the ratio of ACT/VVO timings. Native speakers produce ACT+VVO timings that are much longer for /g^{ɦ}/ than for /g/. At the same time, native speakers produced ratios of ACT/VVO lengths for,/g^{ɦ}/, with an ACT length that is consistently shorter than the VVO length. Mikuteit and Reetz (2007:266) report that this ratio was a consistent way native speakers articulate voiced aspirates. This ratio pattern distinguished voiced from voiceless aspirated phonemes because native speakers always produced the inverse ratio of a lengthier ACT than VVO for voiceless aspirates in their study. Figure 24 depicts the average aspiration timings and patterns for how native speakers produce /g^{h}/and /g/.

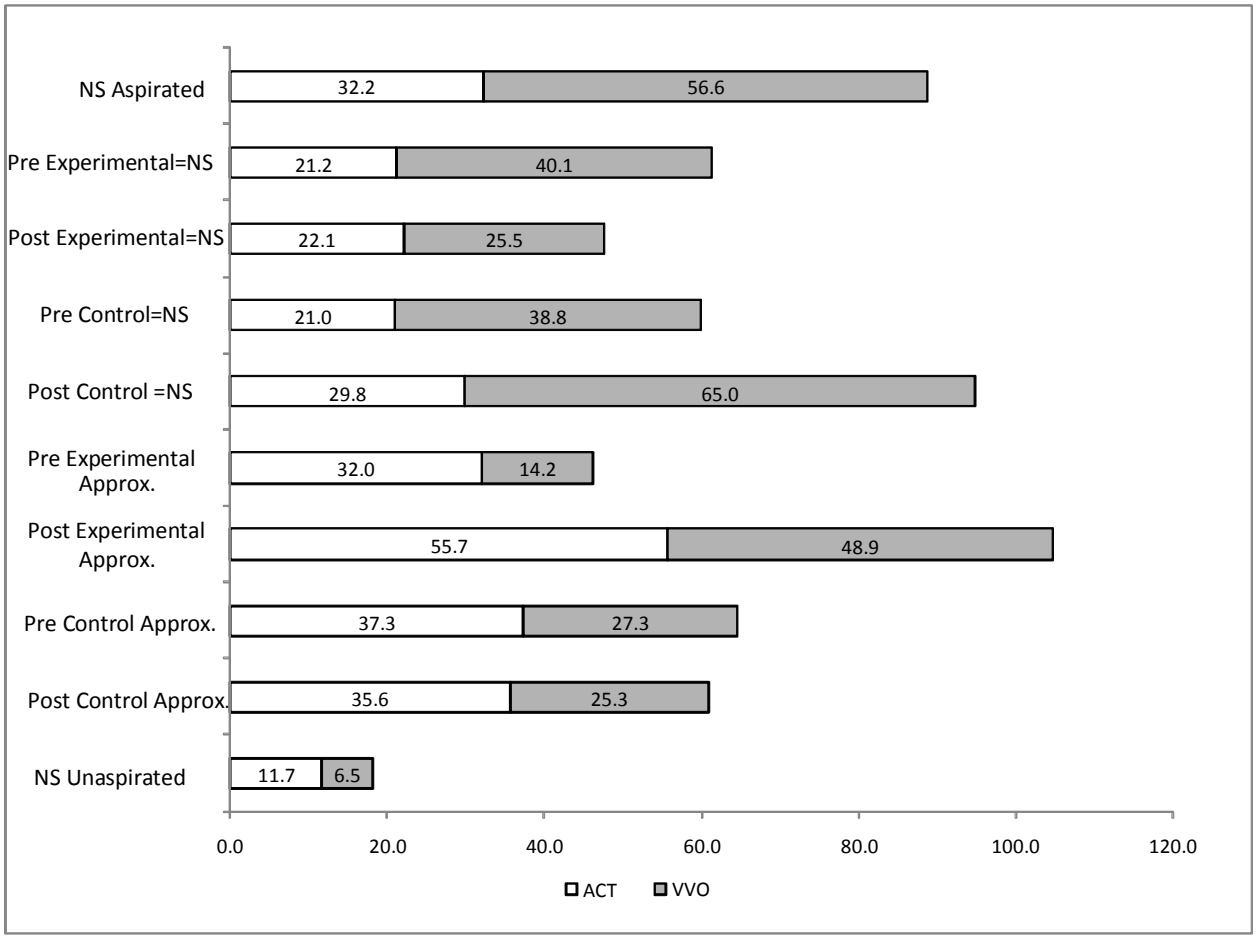
Figure 24: Average Aspiration Timing Patterns Between /g^{h}/and /g/ (Native Speakers)



Both child and adult native speakers consistently produced proportionately longer VVO timings in voiced aspirates. This analysis confirms previous research that has reported that the breathy feature in the VVO timings is the important distinctive feature of voiced aspirates.

Non-native speakers realized aspirated /g$^{\hat{h}}$/ in three different ways: with aspiration timings nearly equal to native speakers with longer VVO than ACT, with timings nearly equal to native speakers but where VVO is shorter than ACT, and unaspirated. Diagrams of the first two realizations are shown in Figure 25, where 'approx' indicates the VVO is shorter than the ACT.

Figure 25: Average Aspiration Timings and Patterns in the Realizations of /g^{h}/



Non-native speakers in both the control group and the experimental group showed variation in the total aspiration length of ACT+VVO timings even though the ratio of ACT/VVO was nearly the same as native speakers. The average aspiration times for realizations that were nearly equal to the ratio and timing of native speakers decreased from pre to post test among the experimental group and increased for the control. The ratios remained nearly equal to native speakers for both groups between the pre and post test in the experimental group, but average longer VVO times distorted the ratio for the control group. Longer VVOs may have resulted from the tendency for children to pronounce the vowel with more breathiness; this pattern was recognized in the samples from native-speaking children.

Approximations of /g$^{\text{ɦ}}$/ were realized with longer or almost equivalent overall aspiration timings of ACT+VVO to those of native speakers, but the ratios of ACT/VVO were reverse with longer ACT than VVO. This indicates that non-native speaking children were able to produce aspiration more consistently with longer overall aspiration times when the ACT was longer than the VVO. Comparing the results of the pre and post test, subjects in the experimental group increased the length of aspiration in their approximations, while subjects in the the control group decreased theirs.

There were few noticeable shifts from pre and post test in the percentages of subjects who produced each realization of /g$^{\text{ɦ}}$/. Table 25 summarizes these changes.

Table 25: Percentage of Subjects Producing Each Realization of /g$^{\text{ɦ}}$/ for Pre and Post Tests

/g$^{\text{ɦ}}$/					
Experimental Group (12)	Pre test	Post test	**Control Group (12)**	Pre test	Post test
aspiration = NS	42%	8%	Aspiration = NS	25%	42%
Approximation	17%	25%	Approximation	25%	8%
Unaspirated[32]	42%	67%	Unaspirated	50%	50%

Between the pre and post tests, subjects in the experimental group shifted towards approximations of /g$^{\text{ɦ}}$/ or unaspirated. The control group continued to have the majority of its subjects producing unaspirated realizations with some shift towards improvement from producing approximations to producing aspiration. Overall, this segment was difficult to realize with aspiration length and ACT/VVO ratio nearly equal to native speakers. Most of the subjects in both groups did not produce longer VVO than ACT timings. This may have been the result since placing breathiness on the vowel is more challenging than placing aspiration near the burst, and so an approximation was produced. Ratios were similar for unaspirated as well, longer ACT than VVO. These

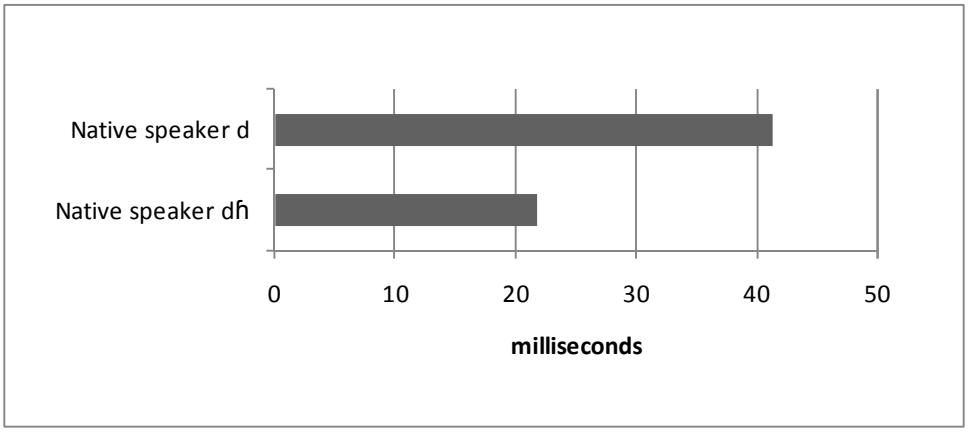
[32] 'Unaspirated' equals an articulation of ACT+VVO less than 45ms.

results may give some insight into the L2 acquisition process of voiced aspirates. It can be expected that learners will place the feature of breathiness before the onset of the vowel rather than on it. This may also account for what is perceived by native speakers as a non-native speaker accent.

4.3.4 Acoustic Realizations of /ɖʱ/

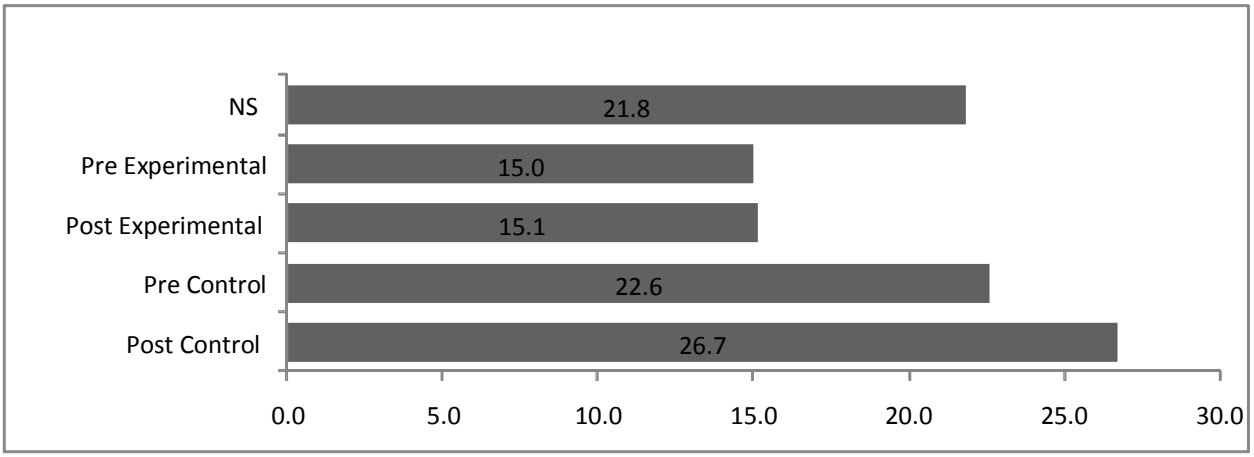
The second voiced aspirate I analyzed was /ɖʱ/. It occurred in intervocalic position in the word /koɖʱɔ/. The phoneme /ɖʱ/ was produced with half of the prevoicing length than /ɖ/. Average prevoicing times were 21.8 ms for /ɖʱ/ and 41.3ms for /ɖ/, as illustrated in Figure 26.

Figure 26: Native Speaker Average Timings of Prevoicing between / ɖʱ/ and / ɖ /



Most of the non-native speakers realized their prevoicing times nearly equal to native speakers, as shown in Figure 27.

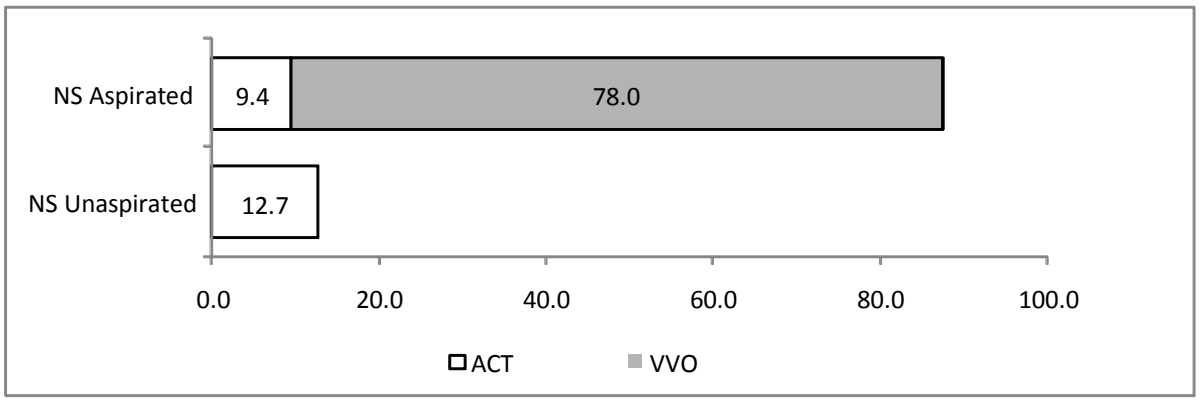
Figure 27: Comparative Averages for Prevoicing Timings



The experimental group produced shorter prevoicing times than the control group. The control group consistently produced prevoicing nearly equal to native speakers.

ACT and VVO timings were significantly shorter for /ɖʰ/ in intervocalic position than for voiced aspirated stops in word-initial position. The phoneme /ɖʰ/ was articulated with slightly shorter ACT than /ɖ/. The average ACT time for /ɖʰ/ was recorded at 9.4 ms compared to an average of 2.8 ms for the unaspirated counterpart. VVO times were the most significant feature distinguishing /ɖʰ/ from /ɖ/; they were considerably longer for /ɖʰ/ than for /ɖ/. In fact, native speakers produced no breathiness on the vowels when articulating /ɖ/, whereas measurements of VVO averaged 78.0 ms on the vowels following /ɖʰ/. The relationship of the ACT and VVO is illustrated in Figure 28.

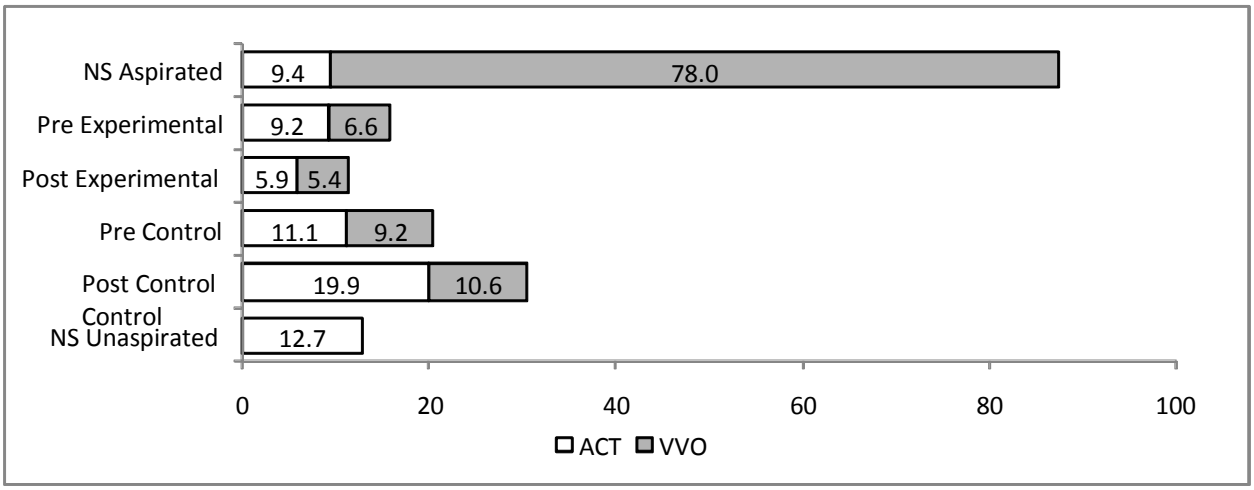
Figure 28: Average Aspiration Timings of /ɖʰ/ and /ɖ/ Produced by Native Speakers



Realizations of /ɖʰ/ produced by non-native speakers were analyzed by comparing ACT timings and VVO timings. Only one subject in the control group on the post test produced aspiration nearly equal to native speakers.[33] Productions were more equal to native speaker ACT/VVO timings for unaspirated /ɖ/. Lengths were similar, but non-native speakers placed some breathiness on the vowel, creating short VVO timings. Therefore, in this report of the results, I compare only the unaspirated timings which show non-native speaker attempts to produce aspiration. Figure 29 compares the average ACT/VVO timings in the realization of /ɖʰ/[34] for native and non-native speakers.

[33] One subject in the control group produced /ɖʰ/ on the post test with an ACT of 2.7 ms and a VVO of 81.8 ms. This was so atypical that it was not included in the average.
[34] There averages only included timings over 0. Most of the subjects produced 0 ms of ACT/VVO timings.

Figure 29: Average Aspiration Timings in the Realizations of /ɖʰ/



The average ACT/VVO timings were consistently longer for the control group than for the experimental group. Most of the ACT/VVO ratios for non-native speakers were opposite from those of native speakers.

Little improvement was shown between the pre and post test. The majority of non-native speakers produced /ɖʰ/ as unaspirated in both. The percentage of subjects producing each realization of /ɖʰ/ is summarized in Table 26.

Table 26: Percentage of Subjects Producing Each Realization of /ɖʰ/ for Pre and Post Tests

/ɖʰ/					
Experimental Group (12)	Pre test	Post test	**Control Group (12)**	Pre test	Post test
+ asp = NS	0%	0%	+ asp = NS	0%	8%
Unaspirated[35]	100%	100%	Unaspirated	100%	82%

This phoneme was the most difficult one for non-native speakers to produce correctly. Comparing these results to the results from the listening test, the experimental group improved in the perception of /ɖʰ/ and not in production. The control group, on the other

[35] 'Unaspirated' indicates an articulation of ACT+VVO less than 45 ms.

hand, did not show much improvement in their perception or production of /ɖʱ/.Voicing was the main perceptual cue that appeared when non-native speakers produced /ɖʱ/. For non-native articulations, it would be difficult for native speakers to distinguish between /ɖʱ/ and /ɖ/. However, further investigation is needed to see whether native speakers would identify the phonemes I analyzed as unaspirated as voiced aspirates when they occur in intervocalic position. It may be that these realizations would be recognized as voiced aspirates with a non-native accent.

In this chapter I have covered the results from the sociolinguistic survey, the listening test measuring perception, and the acoustic analysis analyzing the realizations of selected Oriya segments.

CHAPTER 5

DISCUSSION

The research presented in this thesis was designed to discover how supplementing government and community-based educational programs with experimental lessons teaching sound discrimination and production skills would impact L2 phonological awareness of minority language speakers acquiring Oriya. The results showed that phonological awareness was not always uniform across experimental and control groups. Performance varied between different education levels and differing educational programs the participants represented. In this chapter, I discuss the results in relation to my proposed hypotheses and expectations. I will begin in section 5.1 by discussing how phonological awareness is related to language perceptions. Then in sections 5.2 and in 5.3 I discuss factors related to results for sound discrimination tasks and results for production tasks. Finally, in section 5.4, I discuss implications of the results for teaching phonological awareness in community-based programs that support education and L2 language acquisition.

5.1 Language Perceptions and Phonological Awareness

I expected language perceptions to reflect a negative attitude towards the L2, and that these attitudes would predict low performance on L2 phonological awareness tasks. My expectations were based on the fact that the participants were in contact with Oriya in similar environments to those where Mishra (2004) found negative attitudes from non-native speakers. However, in my results language perceptions were positive among

subjects in the higher education levels from 4th through 6th grade in all areas: frequency of use, comprehension and anxiety. Sixth graders even used comprehension strategies where they actively negotiated for meaning through the use of spoken Oriya rather than passively relying on non-verbal cues from their environment. This finding is contrary to Mishra's finding that minority language speakers were reluctant to speak Oriya in class. These contradictory findings may be due to the fact that I was assessing perceptions of subjects in a focused educational group, whereas Mishra was making broader observations. Comparing the findings from my survey to Mishra's may also indicate that the language situation varies within Orissa state. In either case, my findings indicate that once Bondo and Desiya speakers reached 4th grade, their perceptions towards Oriya became more positive. Attitudes were more consistently positive in reports from the sixth grade if positive attitudes are judged based on speaking in class and perceptions of high frequency of use, high comprehension levels and low anxiety. Uniquely, 2nd and 3rd graders from Urabir also had correlations related to positive attitudes. The results from this grade level shows that in this particular village, subjects showed consistent patterns of language perceptions that indicated positive attitudes earlier than the other groups. Because reported language perceptions should not have been an impeding factor for most of the participants at the higher education levels, and 2nd and 3rd graders from Urabir, it is logical to predict that participants at this level should be able to attain a high score on phonological awareness tasks. It also follows that their language perceptions should not interfere with their learning Oriya through the government school programs, community based literacy for development programs or the experimental lessons.

However, the survey may not be gathering direct information to link perceptions to positive attitudes because positive attitudes may not be directly related to perceived

frequency of use and comprehension. One can perceive they need to use Oriya often out of necessity and perceive they can comprehend, but still have a negative attitude. Further investigation is needed by asking subjects questions such as: 'Do you desire to attain proficiency in Oriya?', 'Do you aspire to speak like native speakers of Oriya?' and 'Which language would you prefer to use as the language of instruction in your school?'.

Success in learning may also be partially due to area-wide trends among minority language speakers. Rajan (2003) reported that Gutob-Gadaba-speaking youth did not have a positive attitude towards their own language and they aspired to achieve proficiency in Oriya. Gadaba speakers were from the same language area as the participants in this research. The Bondo used to reflect similar attitudes towards their language as the Gadaba, however those attitudes have been changing. According to Alex (2004), children and adults develop positive language attitudes towards their own language the longer education in the mother tongue continues to develop in their villages. The motivation to receive education has affected attitudes towards Oriya among Bondo children. The preschool preparation has helped Bondo children to stay in school longer and reach the education levels where learning is not impeded by negative perceptions towards their acquisition of Oriya. Desiya speakers have positive attitudes towards their language and a desire to attain proficiency in Oriya.

Among participants in lower education levels, language perceptions were a factor that could possibly impede their L2 performance and learning. This was especially true among participants with only one year of education and among those living in remote areas. However, while these participants consistently reported they perceived their language ability and use to be low and their anxiety to be high, some still performed well on their listening test. On the basis of this study, I would conclude that reported

perceptions are not a fully reliable predictor of performance ability on phonological awareness tasks. Language perceptions need to be analyzed beside other factors to determine those which are contributing directly to performance. Lightbrown and Spada (2006) recognize the following are additional factors contributing to language learning: ample time to learn, language contact with access to modified input, aptitude, motivation, cognitive maturity and metalinguistic awareness.

Because there was little change in language perceptions before and after the research period among the participants in the experimental group, there is no apparent evidence that the experimental lessons were contributing to a change in language attitudes.

5.2 Factors Affecting Sound Discrimination

In this study I tested how the experimental lessons affected performance on sound discrimination tasks, particularly in the four-way stop contrast. The tasks on the sound discrimination pre and post test reflected the approach taken in the experimental lessons where learners were asked to distinguish the L2 phoneme when it was contrasted with a familiar phoneme with minimal differences. I expected participants in the experimental group to progress more than those in the control group. I did not know, however, who would show progress, how the participants in the experimental and control groups would improve compared to each other, and what factors would contribute to the performances. In the following sections I will discuss factors that might have affected performance on the listening test. I start in section 5.2.1 by discussing the phonological features the participants needed to process and how the features of the test phonemes and the environment in which they occurred may have affected perception. In addition, I will cover how a learners' knowledge of L2 vocabulary and previous phonological awareness of their L1 and L2 may be contributing factors in performance. In 5.2.2 I discuss the

psycholinguistic factors that may be related to performance including knowledge of the Oriya writing system and the ability to handle abstract concepts in relation to cognitive maturity. The final section, 5.2.3, deals with correlations between teaching approaches and ability to discriminate sounds.

5.2.1 Phonological Processes Affecting Perception

Various acoustic studies have revealed that specific phonological features facilitate the ability to perceive contrasts between sounds in the four-way stop contrast (Davis 1994; Mikuteit and Reetz 2007; Hussain and Rami 1995). The acoustic analysis of the phonemes produced by the native Oriya speaker who recorded the listening test revealed that she was realizing the phonemes with contrasts like those described in these studies. Therefore, it seems unlikely that insufficient perceptual cues were a factor that affected the performance of the participants and thus, other factors were contributing to the results. However, the listening test was not given to native speakers of Oriya to test reliability. The conclusion that the test was valid is only based on research from previous studies and my own acoustic analysis.

The factor that seemed to contribute most to the improvement on sound discrimination tasks was the experimental lessons. The experimental group showed greater gains than the control group, with the exception of the 1st grade participants. These results indicate that learners are able to improve in their ability to discriminate sounds in minimal contrastive environments starting in the second year of education. However, the greatest gains occurred when the experimental lessons supplemented tutoring programs with Desiya-speaking children who attend government-run schools. The Bondo literacy class that also received the supplemental lessons did not improve; their average scores actually decreased even though they were taught for a longer amount

of time than the Desiya. However, there was considerable fluctuation in the attendance rates of the participants in the Bondo group, whereas attendance by the Desiya participants was much more consistent over the two-month period they received the lessons. It appears that attendance was another factor that correlated with improvement.

When I analyzed the improvements made according to each phoneme, there were noticeable correlations between the phonological features of the phoneme and improvement on perceptual phonological awareness tasks. On the basis of a preliminary analysis of the sounds and a review of previous acoustic studies, I had anticipated that phonemes in intervocalic position, and voiced aspirates would be more difficult to distinguish. The experimental group in the 2nd and 3rd grades showed improvement for all of the phonemes that were categorized as difficult to distinguish. The experimental group in the 4th through 6th grades also showed improvement, although less dramatically. This is to be expected, however, since this group started with the highest performance ability and did not have as much room for improvement as in the lower education levels that started with performance levels which were lower.

According to previous research, perceptual cues of voiced aspirates lie in prevoicing and breathiness on the vowel and perceptual cues of voiceless aspirates lie in the aspiration noise from the burst to the onset of the vowel (Mikuteit and Reetz 2007, Davis 1994, Hussain and Rami 1995). The results of this research indicate that the supplementary lessons were enabling Desiya-speaking participants from the 2nd to 6th grades to notice phonological features that enabled them to particularly improve in their awareness of prevoicing, aspiration noise and breathiness in L2 phonemes.

Another potential factor that may have contributed to the noticeable improvement among participants from the experimental group is knowledge of L2 vocabulary.

Depending on their educational experiences and contact with Oriya, learners would vary in the size of their mental lexicon of Oriya vocabulary. Metsala (1999) says that as vocabulary expands, there is an increasing cognitive demand to be able to discriminate between a growing number of words with similar sounds in similar environments. Learners with more educational experience and more contact with Oriya should also have a cognitive capability to discriminate between minimal contrasts as their vocabulary grows. It is possible that participants in the 1st grade did not improve because they did not have the cognitive ability that correlates with vocabulary size.

While vocabulary size as it relates to cognitive development is an important factor that may have contributed to the discrepancy between the improvement of participants in the 2nd and 3rd grades versus those in the 1st grades, this does not explain why subjects in the experimental group showed greater improvement than those in the control group. This is especially true for participants in the same grade levels in Gumalput and Urabir. Gumalput and Urabir are close to each other in geographical location so their contact with Oriya is similar. The fact that subjects in the Urabir experimental group improved more than the subjects in the Gumalput control group even though they have had similar exposure to Oriya in the community shows that exposure to Oriya vocabulary possibly may have affected development in a slightly different way. The participants in the experimental group were receiving more exposure to Oriya vocabulary that contained the test phonemes in the experimental lessons. It may be that as their vocabulary increased, their cognitive abilities to contrast sounds also increased. Therefore, the experimental lessons may be contributing to vocabulary growth and related cognitive growth which leads to growth in phonological awareness.

5.2.2 Psycholinguistic Factors Related to Writing Systems and Their Affect on Phonological Awareness

Research has shown that psycholinguistic factors related to writing systems affect the ability to perceive sounds (Nag 2007; Mishra and Stainthorp 2007). The results of the sound discrimination test indicate that knowledge of the alphasyllabary may have contributed to the ability to perceive sounds. It is possible that learners with higher levels of educational experience would be able to recognize the contrast because of their knowledge of the writing system. Their mental processing may not have been based on contrasting phonemic sounds, but rather on contrasting graphemes in the physical representation of sounds through symbols they have learned. This may indicate phonological awareness exists if they are relying on knowledge of sound/symbol correspondence found in readers who can decode and write because they have a foundation in phonological awareness. Reading and writing tests are needed to further confirm how the visual representation of the sounds was influencing success. Though further investigation is needed to discover how those who are familiar with the writing system were using visual processing, the results from the pre test show that the ability to contrast graphemes in a sound/symbol correspondence may have been a factor that facilitated performance. Those in the higher grades who would have had more exposure to the orthographic representation of Oriya sounds performed better than those in the lower education levels with less exposure.

While none of the words on the perception test were included in the experimental lessons, the graphemes for symbols included in the test were taught in the experimental lessons. This factor may have contributed to the improvement in performance among subjects in the experimental group because these subjects were learning sound/symbol correspondences through the experimental lessons. In particular, they were learning the

representation of the contrastive sounds along with the symbols that represent the contrasts. Participants in the experimental group may have improved more because they were not only developing the ability to aurally discriminate, but to visually discriminate as well. While the sound discrimination test cannot confirm this prediction, but this psycholinguistic factor is an aspect of the experimental lessons that may have contributed to improvement.

The abstract concept of contrastive sound may have been more difficult for the subjects in the lower grades. Compared to the participants in the higher levels they might not have the cognitive maturity to concentrate on the separate symbols and analyze the contrasts between sounds. Low cognitive maturity may have been a factor relating to the poorer overall performance among the subjects in the 1st grade. They would also not be relying on the contrasts in visual cues of sound/symbol correspondences due to their lower level of literacy skills and less exposure to Oriya

5.2.3 Teaching Approaches

While Oriya literacy has traditionally been taught through repetition and memorization (Gustaffson 1991; Nag 2007), holistic approaches have also been reported as common (Mishra and Stainthorp 2007). Participants in the control group did not receive instruction that built phonological awareness through analytical, synthetic and contrastive approaches. Nag (2007) was concerned that native speakers of Kannada were learning phonological awareness at a slow pace because the teaching approaches that focused on recitation and memorization were not appropriate for developing the skills children needed for decoding words and discriminating between different sounds. Based on the results that showed improvement in the experimental group on sound discrimination tasks, I would conclude that explicit teaching using at least analytical and

contrastive approaches rather than recitation, memorization and holistic approaches are needed in the acquisition of phonological awareness in the L2. I also conclude that it is important to explicitly teach the L2 phonemes rather than just rely on L1 phonological knowledge. Baker (2001) claimed that while most L1 literacy skills are transferable to L2 literacy, the sounds of letters and decoding of words have to be taught separately in each language.

The results from this research demonstrate that teaching approaches affect performance on phonological awareness tasks, but it is not clear which approach used in the experimental lessons was the most influential: analyzing, synthesizing or contrasting minimal features. Though it is unclear which approach was the most influential, there is evidence that when the approaches are used in combination, learners improvement on sound discrimination tasks.

The results may indicate that participants from the experimental group in 2nd through 6th grades were using analytical skills to complete the sound discrimination tasks on the test since, according to Baker (2001), recognizing sound units requires analytic cognitive processing. Participants who received the experimental lessons were developing their cognitive skills of analysis during the research period, and the test results indicate that the experimental group participants were using these analytical skills to make greater gains in progress than those in the control group who were not developing analytical skills. There is no evidence of transference of analytical skills among subjects in the control group. The results of the sound discrimination test reflected results reported by Stringer (1982) in which children demonstrated greater awareness of sounds when they were presented in an approach using minimal contrasts between phonemes. While the participants in the control group continued to learn through holistic and traditional methods, the

experimental group was learning through approaches similar to the contrastive approaches that Stringer used. Subjects in the experimental group who showed improvement also demonstrated they could perceive sounds with minimal contrasts, possibly transferring the skills they learned from the experimental lessons that used contrastive approaches through minimal contrast. Experimental group participants in the 2nd through 6th grades were able to improve their performance on sound discrimination tasks that test their awareness of Oriya aspirated phonemes in minimal contrast. This improvement was greater than the improvement made by participants in the 2nd to 6th grade in the corresponding control group. These results demonstrate that learners benefit from explicit teaching of Oriya sounds at the syllable level when teachers use approaches for at least two months where learners analyze, synthesize and contrast Oriya sounds through minimal contrasts. Further research is needed that compares subjects learning through analysis of sounds with minimal contrast to those learning analysis of sounds without minimal contrast.

The other contributing factor may be that the participants in the experimental group were receiving lessons that started from the known in their L1 followed by a contrast with a new sound in the L2. It is possible that this process of moving from known to unknown contributed to improvement among the participants in the experimental group. It is not clear the degree this factor impacted the performances of the experimental group. However, since all of the sound discrimination tasks required learners to distinguish between three words that included a sound from their L1 with one sound from their L2, there is evidence that participants in the experimental group that showed improvement could distinguish between known phonemes in their L1 and new phones in the L2. The approach to learning which builds from the known to the unknown may, however, be

more related to acquiring L2 phonological awareness at a faster pace because learners are not learning entirely new concepts, but building on what they know.

There are some limitations to the conclusions in this discussion. The improvement in the experimental group only correlates with the ability to discriminate the sounds in the four-way stop contrast. Ability to discriminate other sounds with comparable phonological features was not tested. The improvement in the ability to discriminate only applies to Desiya native speakers from the village of Urabir who attend a government-run Oriya-medium school where they have opportunities to have contact with native speakers of Oriya. In addition, the improvements only apply to mother-tongue Desiya speakers who had two months of instruction using the experimental lessons.

5.3 Factors Affecting Non-Native Production Patterns

In this section, I discuss the factors affecting non-native production patterns. These factors include the effects that production results have in relation to language attitudes, the effects of the experimental lessons, and the effects that alternative phonological features may have on perception.

In the communities where the research took place, Oriya is viewed as the language of prestige. The level of importance Bondo and Desiya speakers place on their development of pronunciation may be influenced from this perception. The results from the production test reveal that both Desiya and Bondo speakers pronounce Oriya with an accent, possibly with features that distinguish their identity. Revealing their identity may stigmatize Desiya and Bondo speakers. It is clear that there are adults have negative attitudes towards minority language speakers. Alex (2004) explains that teachers are not knowledgeable about the culture and language of the Bondo. Other researchers have

reported that negative attitudes towards minority communities are common (Mishra 2004). The attitudes of native Oriya-speaking children are unknown and it is not clear what the direct factor causing Desiya and Bondo speakers to report high anxiety with specific speakers is. More information is needed to understand how important it is for Bondo and Desiya speakers to focus on pronunciation accuracy for reducing social stigma.

The results from the research do, however, reveal that there are phonological features that need to be included in production for hearers to perceive the utterance more clearly. On the basis of the analysis of native productions involving both adult speech to child speech, I was able to identify the features that were present in their articulations that previous research had noted were important for perception. The results showed that the important perceptual features of prevoicing, breathiness on the vowel and longer ACT timings for aspirated consonants were present but varied between child and adult. Typically, children produced shorter ACT and VVO lengths than adults. In addition, the Oriya-speaking boy excluded prevoicing in the production of /g^{ɦ}/, producing a lengthy breathy vowel instead. Alterations in the production of sounds made by Oriya-speaking children were discussed in 3.3.3. When alterations occurred, at least one feature that was important for perception was still present. Therefore, both the child and adult native speaker productions were appropriate for making comparisons because they included the features necessary for providing perceptual cues and they also showed some of the possible area of variance.

It was expected that the experimental group would show more improvement in their production skills than the control group. Overall, participants from both groups did not show significant improvement. Surprisingly, there is slightly more evidence of

improvement in the control group than the experimental. Compared to the experimental group, the control group produced slightly longer average aspiration timings for /ʈʰ/, a slightly higher percentage of subjects shifted to produce /gʱ/ with approximation rather than unaspirated and they produced longer prevoicing times for /ɖʱ/ on both the pre and post test. In the experimental group, only a slightly higher percentage of subjects produced aspiration more equal to native speakers for /pʰ/ on the post test that the pre. The experimental group slightly declined from pre to post test in their productions of /ʈ/ and /g/. For /ʈʰ/ learners shifted towards approximations and for /gʱ/ they shifted mainly towards unaspirated. However, the 25% of subjects that produced approximations of /gʱ/, did produce much longer aspiration times on the post test than the pre. Overall, on the post test, higher percentages of subjects from the experimental group produced approximations of sounds than the control group.

The results do also reveal how a learners speaking Desiya and Bondo would progress developmentally from pronouncing L2 phonemes with their L1 productions, moving towards approximating L2 phonemes and then to articulating nearly equal or equal to native speaker productions of the L2 phonemes. Learners showed developmental patterns in their acquisition of voiceless and voiced aspirates. Bondo and Desiya speakers approximate Oriya voiceless aspirated stops by adding frication, or producing the length of aspiration noise with nearly half the length native speakers produce their aspiration noise. Voiced aspirated stops were approximated by producing longer aspiration times before the vowel instead of on the vowel and by shortening the length total length aspiration noise.

The results generally show there are no apparent significant correlations between the experimental lessons and the results from the production test. The experimental group's

shift towards approximate productions and some increases in aspiration length may have been affected by the experimental lessons since they were being taught to focus on the phonological features of sounds that were important for production. However, it was never explicit in the teacher's manual which aspect of each phoneme is important for children to learn. The difference between the patterns in the experimental group and the control group were so slight and the number of participants in each comparative group was so low that it is difficult to confirm or disconfirm whether the experimental lessons affected the patterns noticed between pre and post test. These results do also indicate that pronunciation skills were not being developed at the same rate as perceptual skills. Further investigation is needed to discover whether the alternative pronunciations can be understood by native Oriya speakers, or are acceptable pronunciations that do not invoke negative attitudes from native speakers and whether there is more acceptance of alternative pronunciations from children than from adults.

5.4 Implications for Teaching Phonological Awareness Using the Experimental Lessons in Bridge Programs in Community Development Projects

The experimental lessons were designed to supplement materials already in use within community literacy programs. More specifically, these lessons were developed in order to investigate how learners would perform on phonological awareness tasks in the L2 if they were taught using approaches similar to those in the Mult-Strategy Method and different from the traditional approaches used in the government schools. I was interested to test the effectiveness of approaches that researchers have claimed are beneficial for acquiring phonological awareness and also test materials that are similar to those made for the initial stages of L2 development in bridge literacy programs. I anticipated that the

results of this study would lead to recommendations that could be applied to existing and future materials and methods for bridge programs.

In light of research supporting the teaching of phonological awareness skills within a balanced approach, I would recommend using these lessons alongside other materials that focus on building meaning from print using holistic approaches to learning and teaching. The following sections provide further recommendations based on implications for teaching phonological awareness using the experimental lessons in bridge programs in community literacy projects. In section 5.4.1 I present recommendations for teaching sound discrimination and in 5.4.2 recommendations for teaching pronunciation.

5.4.1 Recommendations for Teaching Sound Discrimination to Non-Native Speakers of Oriya

The recommendations I present in this section are based on results limited to performance on phonological awareness tasks for languages that have a four-way stop contrast. According to the language perception survey, learners in the 1st grade use Oriya infrequently, perceive their ability as low, and have high levels of anxiety. Based on this assessment, these children need exercises that do not include pressure to speak. Therefore, I would recommend introducing the L2 to learners in the 1st grade using the sound discrimination exercises starting first with just the picture drills and introducing the syllable boxes later. The children could go through a silent period of recognizing the contrasts in sounds by physical response only when working through these lessons. This recommendation is also shared by Krashen (1981) and Asher (1972). The listen and respond approach also could be one way to provide positive experiences with a language among those who have negative attitudes associated with fear, a common socioliguistic pattern among minority language speakers.

In the experimental lessons, there are components that build on the L1 and encourage children to transfer their skills to the L2 through exercises that mirror what they have accomplished in the L1. Baker (2001) supports strategies that encourage biliteracy through methods that support transfer from the L1 to the L2. One interesting phenomenon that he recognizes is that self-confidence in being literate is an attitude that gets transferred. In these early stages, 1st grade participants could benefit from the confidence-building that occurs through the way the experimental exercises use transfer of L1 to L2 in each lesson. The results from the preliminary sociolinguistic perceptions survey noted that this confidence was not evident throughout participants until at least the 4th grade. On the basis of these observations and from research that supports the benefits of L1 and L2 transfer approaches, I would conclude that the modifications of the MSM approach on the first page of each lesson so that both L1 and L2 are included (see section 2.2) would be a beneficial modification because it provides an L1 to L2 transfer approach to learning. This would especially be beneficial to bridge programs because these programs seek to maintain the L1 and provide opportunities to build from the L1 to the L2. While it was difficult to isolate this variable in the analysis of the results to determine if the L1 to L2 transfer approach is a direct factor in improvement, based on previous research it seems this approach would benefit learning.

I would recommend starting at lesson one when teaching the experimental lessons to learners 4th through 6th grade, but moving at a quicker pace. The low-beginner lessons would be good for those in 4th through 6th grade especially if learners have not spent a lot of time learning literacy skills in their first language because they get exposure to their L1 sound system in the lessons. For many of the Desiya speakers, Oriya is their first language for literacy, not Desiya. However, it is advantageous that Desiya and Oriya

have similar writing systems. Therefore, learners could use the materials without needing to learn new symbols.

Bondo leaners began the experimental lessons with the ability to read Bondo. In spite of this, results from this research show that Bondo learners in the adult literacy program continued to have low performance on the listening test. Because of this, they may benefit from starting at lesson 1 in order to review and to build from the L1 and L2. This recommendation is also based on the evaluation of learner progress from the teacher who taught these experimental lessons in the Bondo literacy class. He stated that he needed to slow down the pace for those learners since they have little exposure to Oriya.

I would rearrange the sequence of the lessons according to the results which indicated which phonemes were more difficult than others, starting lesson one with the easiest to perceive and progressing to more difficult phonemes. Though this study only tested the contrasts between the phonemes in the four-way stop contrast, I would keep the other lessons that introduce additional contrasts between the L1 and the L2.

5.4.2 Recommendations for Teaching Pronunciation to Non-Native Speakers of Oriya

The approaches used in the experimental lessons gave learners opportunities to differentiate between sounds that required minor adjustments in order to create L2 sounds distinct from L1 sounds. Production of these contrasts would enhance speaking according to the speech and learning model proposed by Fledge (1995). This model suggests that when L1 learners encounter a new phoneme in the L2 they substitute for it the nearest L1 for the target phoneme, but with more exposure to the L2, learners gradually establish a new phonological category (Kormos 2006). The model is contingent upon age factors, but this principle has implications for the potential of the experimental lessons. Learners

would receive focused and frequent exposure to Oriya sounds in contexts that could facilitate the recognition of the features that are new because they are presented in minimal contrasts. The lessons provide a more controlled environment for noticing features which, according to Flege's model, is crucial for improving production of the L2 phonemes. This would be difficult to achieve in holistic approaches.

One possible reason for the lack of noticeable progress in production skills is that the teachers conducting the experimental lessons were not trained on how to teach pronunciation nor trained how to give corrective feedback that adjusts the pronunciation of learners. Further teacher training is needed to guide teachers as to how to use the lessons to enhance pronunciation skills. In particular, it would be good to educate teachers that approximations of the L2 phonemes are a normal part of the language acquisition process, showing that the learners are exhibiting correct progress in their production skills.

In the next chapter, I will summarize the significant factors in the research and recommend studies for future research.

CHAPTER 6

CONCLUSION

This study has examined the effects of experimental supplemental sound discrimination lessons on the development of phonological awareness. It focused on learners who speak a minority language and need to acquire Oriya, the language of instruction in the government schools they attend. In this chapter, I review the significant factors related to the research and provide recommendations for further investigations.

6.1 Significant Factors

The results of this study contribute to our knowledge of significant factors pertaining to self-perceptions of language use and attitudes, perceptual skills and production skills. In section 6.1.1 I summarize the significant patterns found in the assessment of sociolinguistic perceptions. Significant patterns found in the ability to discriminate sounds are summarized in 6.1.2 and significant patterns of pronunciation skills are summarized in 6.1.3 and 6.1.4, I review the significant factors related to supplementing community development programs with material that develops phonological awareness of the L2.

6.1.1 Significant Patterns in Language Perception

Reports have revealed that minority language speakers often have negative attitudes towards their mother tongue or towards the L2. In this study, language perceptions reported by Bondo and Desiya speaking children served as information that could be used

to assess their needs. Those from lower education levels needed more opportunities to build their confidence in language learning settings and opportunities to learn the L2 in settings that have low pressure to speak and incorporate approaches that lower anxiety.

Previous reports indicate that many minority language speakers have a negative attitude towards the language of wider communication. Children in this study, however, lived in communities where minority language speakers aspired to become fluent in Oriya. This attitude could contribute to motivation to learn using materials that facilitate learning in the L2. Therefore, new lessons such as those proposed in this study are likely to be accepted into community literacy programs.

Finally, the language perception survey was not a fully reliable instrument for making predictions whether learners in lower grade levels will perform high or low on phonological awareness tasks. This evaluation is based on the fact that learners in lower grade levels received high or average scores even though they reported low perceptions of ability and high anxiety. The language perception survey was a more reliable instrument for making predictions whether learners from the higher grade levels would perform high or low on phonological awareness tasks. However, the more reliable factors predicting low performance were that learners were in the 1st grade level from remote areas. Remoteness even remained a factor for predicting the learner would receive a low performance score on the pre test because even as grade levels increased, scores remained low for the majority of learners coming from remote areas. The more reliable factor for predicting high performance scores was whether the learners are from higher grade levels not residing in remote areas.

6.1.2 Significant Patterns in Sound Discrimination

Looking next at sound discrimination, previous research had indicated that explicit teaching of phonemes through analysis, synthesis and in environments with minimal contrast is beneficial for learners who are developing phonological awareness of their L1 and L2. By comparing the performance of learners who received lessons using these approaches with performances of learners who did not, we see that significant improvement on sound discrimination tasks can be accomplished within a two-month period for learners between the 2nd and 6th grades. Learners with less than one year of education who received the sound discrimination lessons did not show similar improvement.

Many factors may have contributed to the improvement, including knowledge of the Oriya writing system and vocabulary, more years of educational experience, exposure to Oriya and cognitive maturity. However, learners in the control group who shared these advantages with learners from the experimental group did not improve as significantly. Therefore, it seems clear that the lessons did build perceptual ability to discriminate between sounds in environments where the phoneme was in minimal contrast. The specific factor that correlated with the improvement may have been the approach and or the additional exposure to Oriya that the experimental lessons provide. This is an area for further investigation.

6.1.3 Significant Patterns in Production

Though participants in the study practiced pronouncing the sounds in their language that minimally contrast with the sounds in the L2, production was not emphasized in the experimental lessons. Those who did learn using experimental lessons did not show more improvement in either producing the sounds like native speakers or move towards

making approximations than those who did not learn using the experimental lesson. The results were more beneficial for understanding how these approximations compare with native speaker pronunciation and which phonological features are important for listeners in order to be perceived as speaking without a non-native accent.

6.1.4 Significant Factors Related to Community Literacy Programs and an L2 Phonological Awareness Component

Studies have indicated that minority language speakers who have needed educational support have benefited from materials and methods used in bridge programs. The experimental lessons serve to provide learners at the early stages of L2 acquisition with language experiences that consider the learning needs of children who are minority language speakers. The lessons address the benefit of learning the L2 by transferring strategies learned in the L1 and the need for a silent period to respond to rather than to produce the L2. The approaches that the lessons use provide learners with opportunities to develop cognitively so that they are able to analyze, synthesize and contrast sounds units so that they are able to decode words and write creatively in learning environments that often use holistic approaches to learning.

6.2 Further Research

This study examined particular, significant factors that contribute to the field of research in literacy and its relationship to acquisition of phonological awareness of the L2. It particularly relates to learning situations found in community literacy programs that are designed to support the educational and language acquisition needs of minority language speakers. There is potential for further research in each of the areas I have investigated. In the following sections, I make suggestions for further research in studies

of sociolinguistic factors in pronunciation in 6.2.26.2.1, studies related to perception in 6.2.2, and studies related to literacy materials in 6.2.3.

6.2.1 Studies of Sociolinguistic Factors in Pronunciation

In this study, pronunciation skills were analyzed by comparing pronunciations of non-native and native speakers, but the sociolinguistic factors that correlate with production were not investigated. For example, the study did not reveal which specific pronunciations of Oriya produced by Bondo and Desiya speakers lead to negative attitudes in the perception of the Oriya hearer. Further studies that investigate the perception of hearers along with longitudinal studies that show how learners could develop in their production ability would be needed to determine if the experimental lessons were addressing learner needs.

6.2.2 Perceptual Studies

In the future, more research should be conducted to find out how sound discrimination exercises enhance the acquisition of literacy skills. The purpose of developing phonological awareness is not only to enhance perception of spoken language, but also to lead to enhanced reading and writing skills. Test instruments need to be developed that include reading and writing and how the lessons affect students' performance in their daily learning environments that use holistic and traditional approaches. From this study, it can only be predicted that learners who improve their sound discrimination skills, will also improve their decoding and writing skills because they are building their awareness between sounds alongside sound/symbol correspondence, the awareness previous research has reported is necessary for decoding and generating text.

6.2.3 Materials and Methods Studies

Finally, further research is needed to discover whether the use of the L1 and L2 makes a greater impact than the use of just the L2. It was difficult to determine which factor correlated with improved awareness of sounds for those who received the experimental lessons. Further research is needed that isolates factors such as L1 and L2 language experience, exposure to Oriya, knowledge of vocabulary, cognitive maturity and the affects of orthographic knowledge. One area of research that was not addressed in this study was the difficulty with ligaturing rules. The experimental lessons do not address the extent to which learners encounter problems in the conjunct symbols. Further research needs to be conducted to develop approaches that enable L2 learners to handle conjuncts.

My hope is that the information from this research can be used to evaluate the component of phonological awareness in current and future literacy programs. More specifically, I hope it will also be used for considering the implications of approaches related to phonological awareness and the acquisition of the L2 for minority language speakers learning Oriya.

APPENDICES

Appendix A
Sociolinguistic Survey

Participant Information:
Date of Survey: _____
Standard in residential school _____
Code Number_____
Village_____
Age _____
Survey Administrator: _____

Survey Questions:	**Degree**		
Practice Question: How often do you eat ragi for your first meal of the day?	never	sometimes	always
1. When you go to the market, how often do you speak in Oriya?	never	sometimes	always
2. How often do you speak Oriya to other Desiya speakers who you know also speak Oriya?	never	sometimes	always
3. When you leave the village to go to your school, how often do you speak Oriya to other students who only know Oriya?	never	sometimes	always
4. When you leave the village to go to your school, how often can you understand what the teacher is reading when they read in Oriya to the class?	never	sometimes	always
5. How often do you understand when other Desiya speakers are talking to you in Oriya?	never	sometimes	always
6. How often do you understand when students in your school who only speak Oriya speak to you?	never	sometimes	always
7. How often do you understand when sellers at the market speak to you in Oriya?	never	sometimes	always
8. When you leave your village to go to school, how often do your teachers ask you to repeat what you are saying when you speak to them using Oriya?	never	sometimes	always

9. How often do other students in your school who only speak Oriya ask you to repeat what you are saying? never sometimes always

10. How often do sellers in the market ask you to repeat what you are saying? never sometimes always

11. Do you ever feel scared to speak Oriya to other students in your school who only speak Oriya? never sometimes always

12. Do you ever feel scared to speak Oriya in the market? never sometimes always

Practice Question:

What do you like to do most?

- Sing songs
- Play games
- Sleep

13. When you don't understand what the teacher in your school outside your village is telling you in Oriya, which of the following things do you do?

- Guess what the teacher is saying
- Don't do anything
- Watch what other students are doing
- Ask the teacher to repeat themselves

14. Who is easiest to speak to in Oriya?

- Your teacher in school outside the village
- Students you go to school with who only speak Oriya
- Sellers in the market

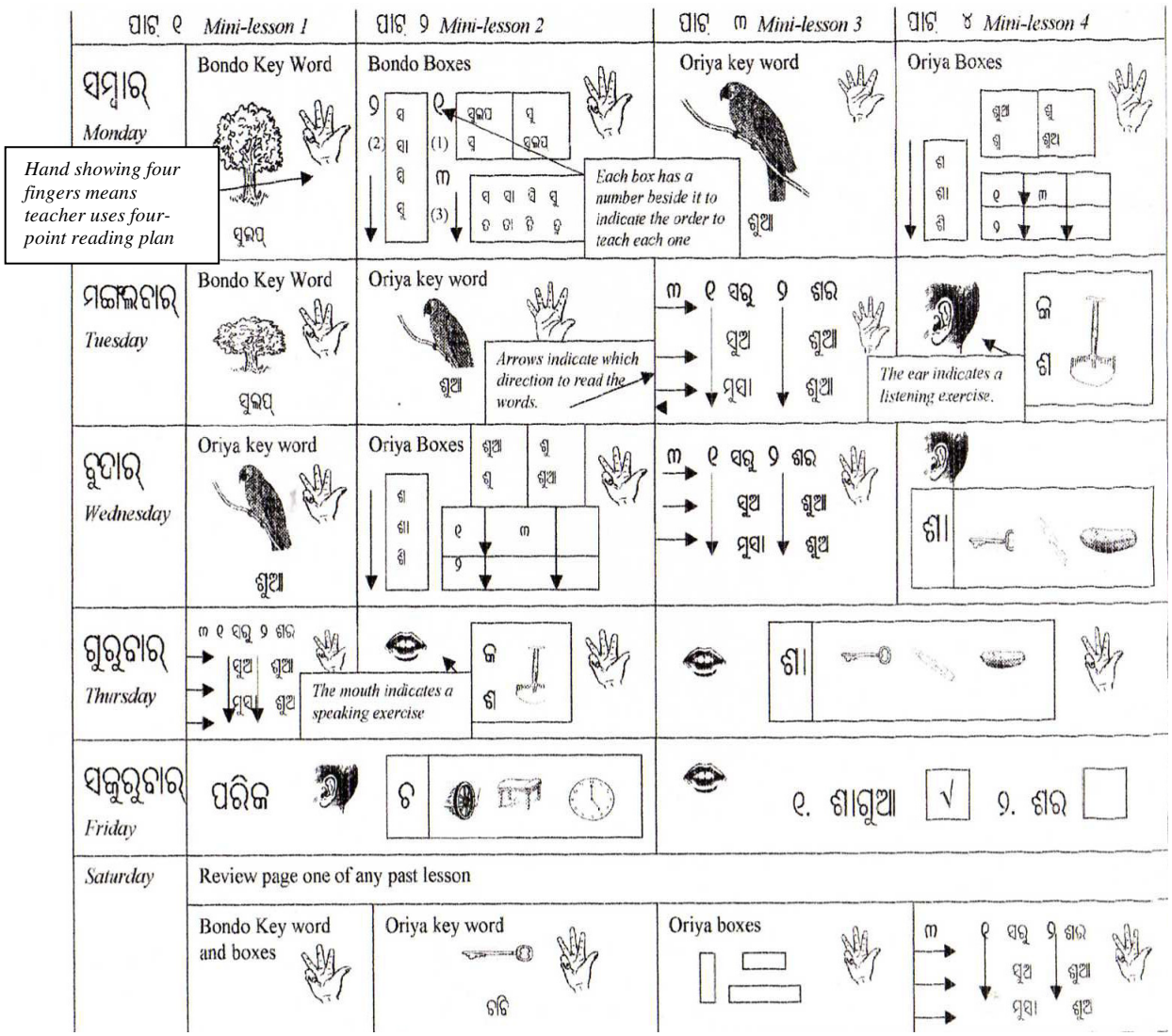
15. Who is hardest to speak to in Oriya?

- Your teacher in school outside the village
- Students you go to school with who only speak Oriya
- Sellers in the market

Appendix B
Sentence Repetition Test

Test Phoneme	Oriya Sentence and Gloss
Voiced Aspirated Phonemes	
bʰ	**bʰ**oktoku **bʰ**odʒono **bʰ**ololage 'The devotee likes to pray'.
gʰ	**gʰ**usuɾi **gʰ**osaɾi **gʰ**osaɾi soitʃhi 'The pig is rubbing while sleeping'.
dʰ	**dʰ**oba **dʰ**iɾe dʰiɾe **dʰ**outʃi 'The washerman washes slowly'.
ɖʰ	bu**ɖʰ**a bu**ɖʰ**i **ɖʰ**ogɔ sunanti 'The old man and old woman tell jokes'.
Voiceless Aspirated Phonemes	
pʰ	**pʰ**aʈokoɾe **pʰ**ulo **pʰ**ɔlo bʰɔɾitʃʰi 'Inside the gate it is full of flowers and fruit'.
kʰ	pilaʈi a**kʰ**ibudʒi **kʰ**adijo **kʰ**autʃi 'The boy closes his eyes while eating'.
tʰ	lokoʈi po**tʰ**ɔɾe **tʰ**ɔɾi **tʰ**ɔɾi dʒalutʃi 'The person is fearing as he is going'.
ʈʰ	ɾɔbi kaʈʰo pai aʈʰɔ ʈonka nei **ʈʰ**okila 'The person taking eight rupees for the food is cheating'.

Appendix C
Pictorial Teacher's Manual in Bondo[36]



[36] None of the English explanations are included in the pictorial version of the Bondo teacher's manual.

Appendix D
Teacher's Manual In Prose

Mini-lesson	Monday and Thursday
1	Desiya Key Word 1. Draw Desiya key word 2.Talk about key word 3.Write the key word4. Reading Plan 2-5 Desiya Boxes For each box: 1. Write the letter or word. 2. Ask "Who knows this sound or word?" 3. Write and ask until the box is complete. 4. Do Reading plan 2-5 after each box is complete
2	Oriya Key Word 1.Draw Oriya Key word. 2. Talk about the key word, 3.Tell what it means in Desiya. 4. Contrast Oriya sound with the Desiya sound 5.Write the key word6. Reading plan 1-5 Oriya Boxes 1. Write each letter or word in the box and tell the sound. 2. Show how to say the new sound 3. Reading plan 1-5 after each a new box is complete.
3	Oriya Word lesson 1. Write the first word 2. Ask, "who can read this word?" 3. Tell the meaning for the word using the Desiya word. 4. After all the words are on the board, do the reading plan 1-5
4	Choosing the Letter Sound 1.Write the top letter from the box 2.Ask, Who knows this sound? 3. Write the other letter from the box 4. Ask, Who knows this sound? 5. Use the teacher's lesson book to read the word for the picture 6. Say, This is a picture of a_____, Does it start with the_____ or _____ sound. Say the two sounds of the letters you already wrote on the board. 7.Say, circle the letter that matches the first sound of the word for this picture. 8.Ask, Who knows the answer? 9.Circle the letter of the correct answer on the board and in your own teacher's lesson book. 10. Write out the word for the picture.
Mini-lesson	Tuesday and Friday
1	Desiya and Oriya Key word and Boxes 1.Desiya Key word using reading plan 2-5 2. Oriya Key word using reading plan 2-5 3. Oriya comparative sound box using reading plan 2-5

2	Oriya word comparison Using the reading plan 2-5, talk about the meaning of each word as each word is written Choosing the picture for the letter sound (Listening Development) 1.Write the letter in the first box. 2.Ask, who knows this sound? 3.Read the directions on the page. 4.Say the word for each picture. 5.Point to each picture as you say the word for it. 6.Ask, Who knows the answer? 7.Point to the correct picture and circle it. 8.Write the word on the board
3	Choosing the letter for the picture boxes (Speaking Development) 1.Write on the board, the letter that is already circled. 2.Ask: Who knows this sound? 3.Ask: Who remembers the word for this picture that starts with the sound _____. 4.Say the sound to help students remember the word for the picture. 5.Write the word on the board. 6. Do steps 1-5 for all four boxes. 7. Reading plan 2-5 after all of the words from the four boxes are on the board.
4	Choosing the picture for the letter. (Speaking development) 1.Write the letter from the first box. 2.Ask: Who knows this sound? 3.Ask: Which picture starts with this sound? 4.Write the word on the board. 5.After the three words are on the board, do the reading plan 2-5.
	Wednesday
	Test 1.Call each student one at a time. 2.Read from the teacher's lesson book, the words for the pictures on the test page. 3.Have the student circle the picture for the word that starts with the sound in the first box. 4. Tell the student the correct answer after the test. 5.For the second part of the test, hold the student's book so they cannot see the words. 6.The students will repeat after each word. Say the word two times. If they repeat the word correctly, then put a tick mark in the box. If it is not correct, leave the box blank. 7. Tell the student the correct way to say the word after the test.
Note:	As you conduct the tests, record what sounds are difficult for the students. Use these records to see what lesson you can review for the next 15 minutes. Choose a lesson that practices the sound that most students get wrong.
	Review lesson Choose a lesson with sounds students need to review. Do all of page one using the reading plan 2-4

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