Effects of articulatory training on English middle-school learners' production and perception of SENĆOŦEN uvular stops

Sarah Smith
University of Victoria

This study examines the effects of linguistic training (explicit training on the nature of the target sounds) on the perception and production of difficult sound contrasts for middle-school learners of SENĆOŦEN, a Central Salish language. Also, the motivation and attitude towards learning is examined through a self-reporting survey. The participants completed a survey on language attitude and motivation, a production task and a perception task before and after a training session. The training focused on explicitly teaching the physical properties of the production of the target sound (e.g. where the tongue moves in a particular sound). The training did have a positive effect on the production and perception of the difficult sound in SENĆOŦEN in the posttest, but attitude and motivation towards learning language did not change as a result of explicit training in the language.

1 Introduction[1]

Although much effort has been expended on second language learning and training effects of certain languages, less attention has been paid to the effects of explicit linguistic training. That is, training which involves direct attention to how certain sounds are made in a language. This paper will examine the effects of linguistic training on middle-school learners' perception and production of a First Nations language—SENĆOŦEN.

SENĆOŦEN is a Central Salish language spoken in the Northern Straits around the southern tip of Vancouver Island (Bird & Leonard, 2009a). The phonology of this Central Salish dialect is rich in its consonant inventory (35 consonants) with few vowels (only four) (Montler, 1986). The particular focus of this study will be on SENĆOŦEN velar and uvular stops, [k] and [q]. English does not have the uvular stop [q] in its phonetic inventory (*Handbook of the IPA*, 1999), making it confusable with the English voiceless velar stop [k].

---

[1]A special thanks to Dr. Sonya Bird for inspiring me to continue pursuing research in SENĆOŦEN and for continued support in writing and editing this paper. Also to Dr. Li-Shih Huang for offering continued encouragement and constructive feedback.

First, a discussion of previous research in this area will reveal a gap in that research; this will be followed by the research questions and predictions. Next, the methodology will be discussed, including the participants, stimuli and procedure. The analysis will follow, describing how the data were summarized and presented in the results section. Finally, the discussion will interpret the findings which will be summarized in the conclusion.

2 Previous findings

2.1 Second language acquisition and difficult sounds

It is well established that adult speakers are perceptually biased to their first language sound contrasts. It is believed that infants are born with the perceptual ability to distinguish all sound contrasts, and limited exposure to these sounds (by influence of their first language) causes foreign sound distinctions to be lost (Werker, Gilbert, Humphrey & Tees, 1981). There are conflicting debates regarding this notion of a critical period where a child loses this ability to perceive all speech sounds at a certain point in development (Best & McRoberts, 2003). The Critical Period Hypothesis was developed in 1967 by Lennenberg, as an attempt to explain why humans lose the ability to distinguish all language's sound contrasts. Lennenberg (1967) hypothesized that this loss of ability occurs around the age of five due to cerebral lateralization. Whether the Critical Period Hypothesis is true or false, adult speakers do have trouble perceiving and producing second language sound contrasts (Best & McRoberts, 2003). Due to this loss of perceptual ability, an interesting area of linguistic research involves looking for tools to improve speakers' perception of a foreign language.

Another interesting topic relevant to this study is the influence of L1 on the perception of a second language. A study by Wang, Behne and Jiang (2009) discussed the influence of L1 experience on perception of speech. The authors studied Korean and Mandarin speakers producing English fricatives in three places of articulation: labiodental (nonexistent in Korean), interdental (nonexistent in Korean and Mandarin, and alveolar (occurring in both). They presented stimuli in three ways: auditory only (listening only), visual only (seeing the articulation of the sound only), or audio-visual (hearing and seeing articulation of sound). Their results yielded an effect of stimuli presentation, with the audio-visual presentation giving the highest correct perception of the L2 sounds. The speakers with different L1 backgrounds produced different results. For the labiodental fricatives, the Korean speakers had the lowest accuracy in the visual domain, but the same accuracy in the audio and audio-visual domain. For the interdentals, both the Korean and Mandarin L1 speakers had lower accuracy than the English L1 speakers in the visual domain, but had similar English L1 accuracy in the audio and audio-visual domains. They concluded that L1 experience does have an effect on L2 perception, and this relies on the weighting of visual cues used in the speakers' L1. The current study is unique in using both visual and auditory presentations of sounds that are important in the perception and production of difficult L2 sounds.

2.2 Learning and teaching strategies

Wipf (1985) described how teaching pronunciation and spoken features of sounds is just as important as teaching lexical items to learners of a second language. This researcher found that many L2 learners were competent in their lexical knowledge of the language but showed poor pronunciation in their production abilities. Teaching features of sounds to aid in L2 learners' production and perception of L2 sounds is the foundation for this paper. The exact tools for teaching these linguistic features are not well researched. Esling and Wong (1983) established voice quality settings as helpful tools for English as Additional Language (EAL) speakers to improve their English accent. These voice quality settings, influenced by the position of the tongue, larynx, pharynx, lips and velopharyngeal system, help reflect phonation types which influences the speech accent. For American English, Esling and Wong (1983) described seven voice quality settings which represent articulatory habits proven to be easily learned and observed by students. These were: "spread lips, open jaw, palatalized tongue body position, retroflex articulation, nasal voice, lowered larynx and creaky voice" (Esling & Wong, 1983, p. 91). The same study also recognizes pronunciation difficulties resulting from the "learner's inability to grasp the generalization that a particular [voice quality] setting [will] represent" (Esling & Wong, 1983, p. 93). This study concluded that awareness of vocal tract settings does help to improve second language learners of English spoken language. This basic understanding leads to the main focus of this paper: training learners on the physical and linguistic aspects of sounds can help them produce them better.

Studies have shown that the more experience adults have in their L2 the better their pronunciation and perception of the sounds in that language will be (e.g. Flege, Bohn and Jang, 1997). They examined the effects of language experience on production and perception of the L2 language. The authors studied German, Spanish, Mandarin, and Korean speakers on English vowels. Research is needed to examine what *type* of training will be beneficial to learners in perceiving L2 sounds.

An example of a study which used different training types on perception (not production) of foreign sounds is Hardison (2003), which studied Japanese and Korean speakers' perception of English. They used different training techniques for teaching Japanese and Korean speakers to perceive the English /r/ and /l/ distinction. A pretest and posttest design with three consecutive weeks of training found a significant effect of training type (training types varied on a continuum from audio-only to audio and articulatory gesture (talker's face) video presentation of stimulus); more perceptual improvement was found as training included more articulatory gestures were presented. The bulk of the current study focuses on production and perception of L2 sounds.

An important aspect of L2 language learning is the understanding of the best ways for learners to internalize new knowledge. *Experiential learning theory* was presented by Kolb (1984) and is the basis for a current way of teaching in which learning is considered to be a continuous, or cyclical, process where knowledge is formed "by transforming experience into existing cognitive frameworks, thus changing the way a person thinks and behaves" (Sewchuk, 2005, p. 1311). The basic ideas of the Experiential Learning Model are shown in Figure 1.

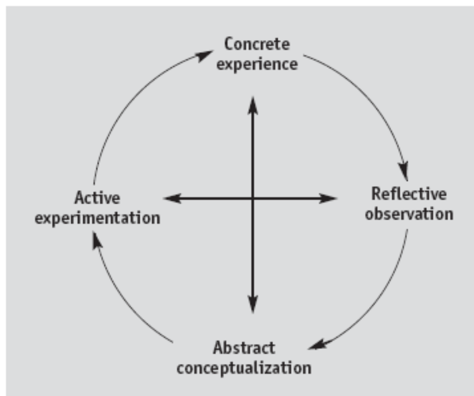


Figure 1. Kolb's Experiential Learning Model (Sewchuk, 2005, p. 1313)

In this model of learning, experiences are understood through either apprehension (which results from participating in an actual experience) or comprehension (by either listening to an instructor or from reading text). The foundation of this theory is the idea that all learners can benefit from all different types of learning strategies, and the best learning experience comes from a variety of learning styles. The learning cycle, shown above, involves four major ideas: concrete experience, reflective observation, abstract conceptualization and active experimentation (Sewchuk, 2005). Each of these interacts while the learner experiences new knowledge and learning happens when the new knowledge is both grasped and transformed (Kolb, 1984). The training session (as described in the procedure) is based on this idea of experience-based learning.

2.3 The current study, including research questions and predictions

The sociolinguistic aspects of language are also important factors in learning. Movements towards preserving indigenous languages through education build confidence in indigenous families and youth (Whitright-Falcon, 2004). This confidence is crucial in preventing loss of languages. According to Hinton (2003), only 20 of the 184 indigenous languages in Canada and the United States are still learned by children in their homes, and even those 20 languages are in danger of being lost. This is occurring even with much effort towards the revitalization of indigenous languages in these areas. Passing the languages on to younger generations is crucial to their survival.

The current study is motivated by a need to get young generations learning SENĆOŦEN. It is also motivated by supporting evidence (as mentioned above) that foreign sound distinctions are difficult to learn; however, humans do have the capacity to learn how to pronounce and perceive them. Specifically, this study examines the effect of articulatory training on middle-school learners' production and perception of six SENĆOŦEN velar and uvular stop consonants which vary by place and manner of articulation (see Table 1). The focus will be on the learner's ability to produce and perceive each consonant in different sound environments.

First, this study examines if the process of participating in this experiment will increase the students' motivation and interest in learning SENĆOŦEN. The research question also considers if training middle-school aged English speakers in the articulatory features of the consonants listed in Table 1, of which tongue position would be an example, will improve the production and perception of the sound.

Based on the literature review, the following predictions were made regarding this study: 1) on average, students who report having a higher motivation and better attitude towards learning will improve the most on all tasks, 2) on average, the students will improve their perception of the SENĆOŦEN stop consonants after the training, and 3) the students will more closely produce sounds similar to the presented sounds after the training than before it. Also, it was predicted that the type of sound environment (word initial, internal or final) will have an effect on their accuracy in production and perception of the sounds.

3 Methods

3.1 Participants

One group of middle-school students enrolled in a SENĆOŦEN language class (ages 13-15, 6 females and 9 males) participated in this study: 15 Canadian English speakers with varied previous experience with SENĆOŦEN. All had between 4 months and 1 year of the SENĆOŦEN language class. The curriculum for the class focused on building vocabulary and simple sentences in SENĆOŦEN. All were middle-school students attending a middle school on Vancouver Island (British Columbia) at the time of the study. These participants were recruited because they had previous experience with the language but had no direct training producing and perceiving uvular stops, and no previous linguistic training. However, there were no observable vision or hearing impairments and all were entered into the first phase of this experiment. The participants were not compensated for their participation.

3.2 Stimuli

The stimuli consisted of 66 of words (36 for production + 18 for perception + 12 for training) based on various sound environments, each word containing only one of the sounds depicted below in Table 1. These consonants were the target sounds for the experiment. The stimuli consisted of words taken from Montler's (1986) word list and recorded by a fluent SENĆOŦEN speaker.

Table 1. Phonetic features of stimuli presented to all participants in each condition.

IPA	Description	SENĆOŦEN orthography
[k]	Voiceless unrounded velar plosive	C
[kʷ]	Voiceless rounded velar plosive	Ȼ
[k'ʷ]	Voiceless rounded velar ejective	Q
[q]	Voiceless unrounded uvular plosive	Ḵ
[qʷ]	Voiceless rounded uvular plosive	Ḱ
[q'ʷ]	Voiceless rounded uvular ejective	Ꝁ

The speaker had produced three utterances of each of the 700 items (making 2100 utterances). After segmenting each utterance, the researcher selected the highest quality recording from each of the repeated stimuli. For example: any sound files with clips, unwanted background noise (coughing or laughing from the speaker) or low amplitude (from the participant producing quiet utterances with poor spectral recording) were not included in the analysis. Further, clear production of the target stop consonant (one of six from Table 1.) was a factor in choosing the best token. This reduced the number of utterances to 700.

The particular lexical items (see Appendix A for production word list, Appendix B for perception word list, and Appendix C for training word list) were chosen for the following reasons: (1) ease of pronunciation, the stop consonant was the only uvular or velar stop consonant in the word and (2) word availability: the word was available through existing SENĆOŦEN resources. In particular, the lexical items had one of the six sounds either in initial, intervocalic or final position.

3.3 Procedure

After four months of observation of the language class, three times were arranged at the teacher's convenience to complete the experiment. For the pretest and posttest, the researcher would need the students to be available to be pulled individually from class, and the whole class as a group was needed to participate in the training session. Each participant was first asked to carefully read and sign the consent form if they agreed to continue with their participation. The experimenter read aloud the consent form to the class. They were then reminded that ongoing consent was required to complete the study as there was a one-week training period. Further, due to the young age of the participants, the parent(s) or guardian of each participant was contacted by telephone. The parent(s)/guardian was read a verbal consent script and asked for consent for the ongoing participation of their child in the experiment. The researcher was responsible for conducting two testing sessions (one week apart) and one group training session in between.

A survey was used to understand the participants' motivation and attitude towards their school, their learning, and their language and culture. The questions in the survey were modeled after a study on adolescents' perspectives on motivation and achievement in academics using self-reported questionnaires by Schmakel (2008). This is known to be a reliable measure of motivation and attitude and is used in many studies of adolescent learning and motivation (Duncan & McKeachie, 2005; Murphy et al., 2007; Pintrich, Roeser & De Groot, 1994; Roeser, Strobel & Quihuis, 2002; Schmakel, 2008). The literature on self-reported surveys (cited above) and the questions created by Schmakel (2008) provided models used in creating the survey administered in this experiment (see Appendix D). The researcher administered one questionnaire immediately before the pretest and the same one immediately before the posttest. The survey consisted of 29 questions of which 12 tested motivation, 11 tested attitude, and 5 tested current learning perceptions. Each question was read aloud individually to each participant, each being instructed to ask questions as needed. Also, to ensure as truthful responses as possible, the participants were reminded that the survey was anonymous and their individual responses would not be reported to their teacher or affect their grade. Students completed the survey at their own pace, with the researcher guiding them through it. The questions and scale are presented in Appendix D.

A pretest was generated using Microsoft Word PowerPoint (see Appendix E). This test consisted of an introduction to the experiment, including instructions on how to navigate through the test. Each of the 15 participants was seated in a quiet office or classroom at the middle school. Two students at a time were taken from their class to participate. They were separated into a different classroom or office space where a desk was set up. On each desk, a laptop was seated on the desk immediately in front of the participants, measured to be 20 centimeters from the edge of the desk. The participants wore Sony Dynamic Stereo Headphones, model MDR-7506 Professional. A Sony ECM MSP08C Electret microphone was placed to the left of the laptop, approximately 15 centimeters away from the edge of the desk. The participants were instructed to sit comfortably upright in the chair; their mouths being about 20 centimeters away from the microphone. The microphone was attached to an M-Audio MicroTrack II digital recorder device to record the sounds in WAV format in 16-bit depth, and at 44.1 kHz sample rate. The sensitivity of the microphone was adjusted to avoid clipping in the sound files.

Preceding the instructions, one slide played an arbitrary utterance of a SENĆOŦEN word not used in the main study. This utterance was to ensure the volume was set at a comfortable level for the participants, which they were free to adjust at this point in the experiment.

A practice slide with automated instructions was used to allow participants to become accustomed to pressing the sound button on the slide and repeating the sound. The actual test phase consisted of 54 stimuli presented through the headphones as WAV files. 36 stimuli were presented for production, and 18 for perception. The production phase was first, followed by a new set of instructions for the perception section. For production, each of the six stimuli (see Table 1. above) were presented six times, varying sound environments. The stimuli were presented in random order (the same random order was presented to each participant). The six stimuli presented randomly six times made 36 stimuli. The participants were instructed to click on the "hear" button on the left center of the slide, listen to the sound once and then repeat the sound once before clicking "next" in the bottom right-hand corner and moving on to the next sound. There was no time limit or set interval between each sound; this was to allow participants to work through the sounds at their own pace, making the production as comfortable and natural as possible. However, they were not able to move backwards through the slides.

After the 36 stimuli in the production stage, the perception stage began with a set of instructions. The participants were first introduced to six sound buttons which were labeled with the appropriate SENĆOŦEN orthographical letter to the target sound heard. They were informed through the slides that the velar sounds were produced with their tongue further forward compared to the uvular sounds. They were free to spend as much time on this slide, clicking on the different sounds and listening to the difference between the velar ("further forward") and uvular ("further back") sounds. They were then instructed to make a decision on the following slides as to whether the sound they heard contained a stop consonant which was further forward or further back. They had a sheet in front of them where they checked "forward" or "back." Following the instructions, the participants clicked on the button labeled "sound," made a perceptual decision about the stop consonant on the sheet (either forward or back) and then clicked "next" in the bottom right hand of the slide to proceed to the next slide. There were 18 stimuli for this stage of the experiment (3 sound environments x 6 sounds = 18 stimuli). The pretest concluded with a slide thanking the students for participating in the experiment.

Three days following the pretest, a group training session was scheduled. This training session was modeled after Kolb's Experiential Learning Model (see page 4). Focusing on a balance between instruction, participation and group discussion, a presentation was generated using Microsoft Word PowerPoint (see Appendix F). It was focused on teaching linguistic techniques to help the participants improve their production and perception of the target sounds. First, an introduction of the vocal tract was shown, followed by an explanation of the major types of sounds: voiced versus voiceless and stop versus continuous sounds. An interactive website was used to show the vocal tract (more specifically tongue) movement in different sounds (taken from http://homes.chass.utoron to.ca/~danhall/phonetics/sammy.html). The students were asked throughout the training session to attempt to mimic the different types of sounds, saying them out loud to their peers and trying to correct themselves and others. The last major section of the training focused on the target sounds. This involved the difference between a rounded and unrounded sound, the difference in place of articulation between a uvular and velar sound and how to make an ejective sound. SENĆOŦEN words were presented (which were different from the words in the testing phase) containing different target sounds to compare each sound. Finally, the students participated in an activity where a sound was played and they decided if it was rounded or unrounded, velar or uvular, or ejective or non-ejective. This activity was done in small groups, with the researcher answering any questions and offering guidance.

The posttest, completed one week following the pretest and training phase, followed the same procedure used in the pretest: the researcher returned to the middle school and set up the experiment in the same classroom and office setting. The participants filled out the same questionnaire, wore the same headphones, used the same recorder and microphone, and the same testing procedure was used on all participants as was in the pretest. The participants were debriefed on the purpose of the experiment and thanked for their participation.

3.4 Analysis

3.4.1 Survey

The survey had two sections: one measuring level of agreement (from strongly agree to strongly disagree important to not important) and one measuring frequency (from always to never) (see Appendix D). Both sections had a "not sure" choice which was taken as a null response and left out of the average calculations. Each response was given a number (e.g. strongly agree = 1). The average and standard deviations were calculated for each participant on the pre- and post-training survey (to analyze each participants' results), as well as the average and standard deviations for each question for pre- and post-training survey (to analyze results on each question) using Excel automatic functions.

3.4.2 Perception

As stated in section 3.3, each participant was given a perceptual decision task on 18 stimuli. A table was created recording each participant's response, and then given a value for "0" if it was incorrect and "1" if it was correct. A response was "correct" if it matched the label given for the SENĆOŦEN target sound. For example, a response of "Forward" was correct if the presented word contained a velar target sound. Percent correct was calculated overall for pretest and posttest scores for each participant. To see if there was a difference between scores on the velar and uvular sounds, average percent correct was calculated for each individual word. The words were separated into velar and uvular categories and then the average was calculated for each, as presented in the perception results section. The scores were also separated into target environment (initial or intervocalic). Average scores and standard deviation were measured using automatic functions in Excel and computed into tables and graphs, as shown below in the results section.

3.4.3 Production

Following the pretest and posttest production phases, the sound files were transferred from the recorder to a file on the computer. Using Praat (Boersma & Weenink, 2008), the whole strings of words were segmented into individual words and saved as individual WAV files. The pretest and posttest files were kept in separate folders, and each file was labeled according to participant number, target sound and experimental phase (pre or post). The production experiment yielded 1080 utterances (15 participants x 36 stimuli x (1 pretest utterance + 1 posttest utterance)). First, each participant's stream of utterances was segmented into individual WAV files, and sorted into either a pretest or posttest folder. A Praat script (see Appendix G) was used to open each of the sound files in the folder for production analysis. The researcher made three acoustic decisions on the target sound in each sound file. A Microsoft Excel file was created to track the responses. First, the place of articulation was analyzed using auditory judgments to tell if the target sound was a velar or uvular sound. "V" was recorded if it was a velar sound, and "U" if it was a uvular sound. Second, the rounding was analyzed also using auditory judgments. "Y" for "yes" was marked if the sound was rounded, and "N" for "no" if it was not. Third, the target sound was analyzed using auditory judgments for ejectives. "Y" for "yes" was marked if an ejective was produced, and "N" for "no" if an ejective was not produced. During the analysis, the auditory decision was based on a comparison of the SENĆOŦEN speaker's production of the sound and the researcher's knowledge of acoustic properties. This method was used for each participant's utterance for both the pretest and posttest. Three auditory decisions were made: velar or uvular, rounded or unrounded, plain or ejective. These were noted into an Excel file.

Each raw data score (pretest and posttest) was matched to the correct production feature (velar/uvular, rounded/unrounded, ejective/non-ejective) of the SENĆOŦEN speaker. The percent correct was calculated and measured: overall scores for the pretest and posttest, individual participant performance overall and on each feature, and performance on each word. Average values and standards of deviation for all measurements were calculated automatically in Microsoft Excel. It was observed that the participants were producing ejectives and uvulars more often in the posttest than in the pretest, therefore the averages for producing ejectives were separated from the average of producing plain stops, and velars from uvulars. Average percent correct in each of the calculations was computed into graphs, as seen in the following results section.

4 Results

A survey on motivation, attitude and current perceptions of school, learning, and specifically learning SENĆOŦEN was analyzed, followed by the production and perception of SENĆOŦEN uvular stops.

4.1 Survey: motivation, attitude and current perceptions

The results for the survey are categorized into the type of question asked, shown below in Tables 2-4. The results are based on numerical values given to the scale of possible answers. Figure 2 below shows the two scales, the numerical value given to each possible answer, and the questions relevant to each type of scale.

Figure 2. Survey scales with numerical values

Response	Always	Some of the Time	Most of the Time	Not Usually	Never	Not Sure
Numerical Value:	1	2	3	4	5	0

Applies to Questions # 1-8

Response	Strongly Agree	Somewhat Agree	Somewhat Disagree	Strongly Disagree	Not Sure
Numerical Value:	1	2	3	4	5

Applies to Questions # 9-29

Table 2 shows the overall results for pretest and posttest answers on motivation, Table 3 shows the overall results for pretest and posttest answers on attitude, and Table 4 shows the overall results for pretest and posttest answers on current learning perceptions.

Table 2 shows that on average, most participants “somewhat agreed” to questions about their motivation to learn. Also, they felt motivated to learn "some of the time" more often on average. Overall, the survey results for motivation were not different before and after the experiment.

Table 2. Pre- and post-survey average results for motivation

#	Question		Pretest	Survey Scale Label	Posttest	Survey Scale Label
1	I want to come to school.	AVG	2.3	Some of the Time	2.1	Some of the Time
		SD	1.1		1.2	
2	I like doing school work.	AVG	3.1	Most of the Time	2.9	Most of the Time
		SD	1.1		1.3	
6	I like going to my SENĆOŦEN class.	AVG	1.3	Always	1.7	Some of the Time
		SD	0.5		0.7	
7	I like learning SENĆOŦEN.	AVG	1.5	Some of the Time	1.6	Some of the Time
		SD	0.9		0.7	
8	I like speaking SENĆOŦEN.	AVG	1.9	Some of the Time	1.9	Some of the Time
		SD	1.2		0.7	
9	SENĆOŦEN is important to my community	AVG	1.4	Strongly Agree	1.7	Somewhat Agree
		SD	0.6		0.9	
10	It is important that I learn SENĆOŦEN.	AVG	1.6	Somewhat Agree	1.8	Somewhat Agree
		SD	1.0		1.1	
11	Learning SENĆOŦEN is important for my future.	AVG	2.0	Somewhat Agree	2.1	Somewhat Agree
		SD	0.9		1.2	
15	I want to get good grades	AVG	1.8	Somewhat Agree	1.7	Somewhat Agree
		SD	1.3		1.0	
16	I want to learn about my culture and others.	AVG	1.7	Somewhat Agree	2.0	Somewhat Agree
		SD	1.1		1.2	
27	I like doing schoolwork on the computer.	AVG	2.7	Somewhat Disagree	2.1	Somewhat Agree
		SD	1.6		1.1	

Table 3 depicts survey results before and after the training for level of attitude. Similar results were shown for both the pretest and posttest as for motivation: on average, most students reported a positive attitude towards learning, reporting "some of the time" and "somewhat agree."

Table 3. Pre- and post-survey average results for attitude

#	Question	Pretest	Survey Scale Label	Posttest	Survey Scale Label

4	I feel a part of my school.	AVG	2.3	Some of the Time	2.1	Some of the Time
		SD	1.2		1.2	
12	I feel the same about school now as I did in elementary school.	AVG	2.6	Somewhat Disagree	2.7	Somewhat Disagree
		SD	1.2		1.3	
13	I care about my grades.	AVG	1.4	Strongly Agree	1.9	Somewhat Agree
		SD	0.8		1.0	
14	My friends care about their grades.	AVG	1.9	Somewhat Agree	2.4	Somewhat Agree
		SD	1.2		1.4	
17	I think learning my ancestor's language is important.	AVG	1.5	Somewhat Agree	1.7	Somewhat Agree
		SD	1.0		1.2	
19	My family values learning SENĆOŦEN.	AVG	2.3	Somewhat Agree	2.5	Somewhat Disagree
		SD	1.5		1.6	
20	I value learning SENĆOŦEN..	AVG	1.9	Somewhat Agree	2.4	Somewhat Agree
		SD	1.2		1.1	
21	I am worried about losing SENĆOŦEN as a spoken language.	AVG	2.5	Somewhat Disagree	2.4	Somewhat Agree
		SD	1.5		1.5	
24	I feel like I should learn SENĆOŦEN.	AVG	1.6	Somewhat Agree	2.1	Somewhat Agree
		SD	0.9		1.4	
26	I find learning SENĆOŦEN frustrating.	AVG	3.8	Strongly Disagree	4.1	Strongly Disagree
		SD	1.0		1.2	
28	I feel comfortable saying SENĆOŦEN words out loud in class	AVG	3.2	Somewhat Disagree	3.3	Somewhat Disagree
		SD	1.1		1.4	
29	I feel confident in my ability to say SENĆOŦEN words.	AVG	2.6	Somewhat Disagree	2.3	Somewhat Agree
		SD	1.3		1.3	

Table 4 depicts survey results before and after the training for current learning perceptions. Similar results were shown for both the pretest and posttest as for motivation and attitude: on average, most students reported a positive attitude towards learning, reporting "some of the time" and "somewhat agree."

Table 4. Pre- and post-survey average results for current perceptions

#	Question		Pretest	Survey Scale Label	Posttest	Survey Scale Label
3	I learn when I am at school.	AVG	2.1	Most of the Time	2.1	Most of the Time
		SD	1.0		1.2	

5	My school appreciates everyone's cultures.	AVG	1.5	Most of the Time	1.7	Most of the Time
		SD	0.6		0.9	
18	Learning SENĆOŦEN is difficult.	AVG	3.0	Somewhat Disagree	4.0	Somewhat Disagree
		SD	1.3		1.2	
22	I know more SENĆOŦEN words than I did in elementary school.	AVG	2.2	Somewhat Agree	2.3	Somewhat Agree
		SD	1.6		1.4	
24	Other kids in the school think learning SENĆOŦEN is interesting.	AVG	1.9	Somewhat Agree	2.1	Somewhat Agree
		SD	1.1		1.2	

Overall there were no responses which differed greatly between the posttest and pretest. Students seemed positive towards their academics and towards learning SENĆOŦEN reporting "most of the time" and "somewhat agree" on most questions. Questions 21 and 29 provide for some interesting results. In question 21 which stated "I am worried about losing SENĆOŦEN as a spoken language" the students reported an average of "somewhat disagree" (SD = 1.5) in the pretest and "somewhat agree" (SD = 1.5) in the posttest. Also, in question 29 which stated "I feel confident in my ability to say SENĆOŦEN words" the same result was found as in question 29. Although not significant, the overall findings suggest that the students were relatively motivated and had a positive attitude towards their learning and their school.

4.2 Perception

Average percent correct on the perceptual decision task is displayed in Table 5 below. Overall, the participants had the same percent correct for the pretest and the posttest. In the pretest, the participants correctly identified the target sound as velar or uvular 64 percent of the time (*SD* = 12.8%). The same average of 64 percent was found in the posttest (*SD* = 8.7%). Seven participants improved their percent correct, two stayed the same, and six scored lower on the posttest than in the pretest.

Table 5. Average percent correct for each participant

Participant #	Pretest (%)	Posttest (%)	Improvement?	Change (%)
1	80.0	60.0	No	-20.0
2	73.3	80.0	Yes	+6.7
3	60.0	66.7	Yes	+6.67
4	66.7	60.0	No	-6.67
5	73.3	73.3	Same	0
6	60.0	53.3	No	-6.7

7	46.7	66.7	Yes	+20.0
8	73.3	60.0	No	-13.3
9	66.7	66.7	Same	0
10	33.3	46.7	Yes	+13.4
11	73.3	53.3	No	-20.0
12	53.3	66.7	Yes	+13.4
13	80.0	66.7	No	-13.3
14	60.0	73.3	Yes	+13.3
15	60.0	66.7	Yes	+6.67
Average	**64.0**	**64.0**		**+0.2**
SD	12.8	8.7		

Table 6 displays the percent correct of each individual word, separated by the place of articulation of the target sound (velar or uvular). There was no improvement on the perception of velars, (pretest *M* = 52.6%, *SD* = 14.2%, posttest *M* = 48.9%, *SD* = 11.3%); however, there was improvement on the perception of uvular sounds (pretest *M* = 54.1%, *SD* = 13.5%, posttest *M* = 59.3%, *SD* = 15.2%). On average, there was no change between the pretest and the posttest: some participants improved their percent correct in the posttest, some stayed the same and some decreased (percent change *M* = 0.2%).

Table 6. Average percent correct by word and place of articulation (velar/ uvular)

Velars			
Word (IPA)	**Pretest** (% Correct)	**Posttest** (% Correct)	**Improvement?**
k'ʷənət	46.7	53.3	Y
kenti	73.3	46.7	N
makʷət	46.7	60	Y
ləkli	53.3	66.7	Y
sak'ʷəŋ	60	60	N
kʷənət	73.3	46.7	N
kʷələn	26.7	33.3	Y
ləkʷin	53.3	40	N
k'ʷanət	40	33.3	N
Average	**52.6**	**48.9**	**No**
SD	14.2	11.3	

Uvulars			
Word#	**Pretest** (% Correct)	**Posttest** (% Correct)	**Improvement?**
leq'wən	40	53.3	Y
qələx	40	86.7	Y
qwənəs	46.7	60	Y
qəmət	60	66.7	Y
q'wələŋ	73.3	73.3	N
qwəʔən	33.3	40	Y
mətaqwən	60	60	N
səqəən	66.7	33.3	N
q'wəŋət	66.7	60	N
Average	**54.1**	**59.3**	**Yes**
SD	13.5	15.2	

Table 7 below displays the average percent correct for each word organized by the environment of the target sound (initial or intervocalic environment). The average only increased when the target sound was a uvular in the initial position (pretest *M* = 53.3%, *SD* = 15.8%, posttest *M* = 64.4%, *SD* = 15.6%) and in the velar intervocalic environment but not by a considerable amount (pretest *M* = 53.3%, *SD* = 4.7%, posttest *M* = 56.7%, *SD* = 10.0%).

Table 7. Average percent correct by environment of target sound

Initial							
Velars				**Uvulars**			
Word #	Pretest (% Correct)	Posttest (% Correct)	Improve -ment?	Word #	Pretest (% Correct)	Posttest (% Correct)	Improve-ment?
1	46.7	53.3	Yes	4	40.0	86.7	Yes
3	73.3	46.7	No	5	46.7	60.0	Yes
11	73.3	46.7	No	7	60.0	66.7	Yes
13	26.7	33.3	Yes	9	73.3	73.3	No
18	40.0	33.3	No	12	33.3	40.0	Yes
AVG	**52.0**	**42.7**	**No**	17	66.7	60.0	No
SD	20.8	8.9		**AVG**	**53.3**	**64.4**	**Yes**
				SD	15.8	15.6	
Intervocalic							
Velars				**Uvulars**			

Word #	Pretest (% Correct)	Posttest (% Correct)	Improve -ment?	Word #	Pretest (% Correct)	Posttest (% Correct)	Improve-ment?
6	46.7	60.0	Yes	2	40.0	53.3	Yes
8	53.3	66.7	Yes	14	60.0	60.0	No
10	60.0	60.0	No	16	66.7	33.3	No
15	53.3	40.0	No	**AVG**	**55.6**	**48.9**	**No**
AVG	**53.3**	**56.7**	**Yes**	SD	11.3	11.3	
SD	4.7	10.0					

Table 8 below displays the average percent correct for each word organized by the place of articulation (velar or uvular) and by the voicing (plain or ejective) of the target sound. The average only considerably increased when the target sound was a plain uvular (pretest *M* = 55.6%, *SD* = 13.9%, posttest *M* = 62.2%, *SD* = 27.0%).

Table 8. Average percent correct by voicing (plain or ejective)

Plain versus Ejectives							
Plain							
Velars				**Uvulars**			
Word #	Pretest (% Correct)	Posttest (% Correct)	Improve -ment?	Word #	Pretest (% Correct)	Posttest (% Correct)	Improve-ment?
3	73.3	46.7	No	4	40	86.7	Yes
8	53.3	66.7	Yes	7	60	66.7	Yes
15	53.3	40	No	16	66.7	33.3	No
AVG	**60.0**	**51.1**		**AVG**	**55.6**	**62.2**	
SD	11.5	13.9		SD	13.9	27.0	
Ejective							
Velars				**Uvulars**			
Word #	Pretest (% Correct)	Posttest (% Correct)	Improve-ment?	Word #	Pretest (% Correct)	Posttest (% Correct)	Improve-ment?
1	46.7	53.3	Yes	2	40	53.3	Yes
10	60	60	No	9	73.3	73.3	No
18	40	33.3	No	17	66.7	60	No
AVG	**48.9**	**48.9**		**AVG**	**60**	**62.2**	
SD	10.2	13.9		SD	17.6	10.2	

Table 9 below displays the average percent correct for each word organized by the place of articulation (velar or uvular) and by the roundedness (rounded or unrounded) of the target sound. The average considerably increased when the target sound was an unrounded uvular (pretest *M* = 55.6%, *SD* = 13.9%, posttest *M* = 62.2%, *SD* = 27.0%) and a rounded uvular (pretest *M* = 46.7%, *SD* = 13.4%, posttest *M* = 53.3%, *SD* = 11.5%).

Table 9. Average percent correct by roundedness (rounded or unrounded)

Rounded vs. Unrounded							
Unrounded							
Velars				**Uvulars**			
Word#	Pretest (% Correct)	Posttest (% Correct)	Improve-ment?	Word #	Pretest (% Correct)	Posttest (% Correct)	Improve-ment?
3	73.3	46.7	No	4	40.0	86.7	Yes
8	53.3	66.7	Yes	7	60.0	66.7	Yes
15	53.3	40.0	No	16	66.7	33.3	No
AVG	**60.0**	**51.1**		**AVG**	**55.6**	**62.2**	
SD	11.5	13.9		SD	13.9	27.0	
Rounded							
Velars				**Uvulars**			
Word#	Pretest (% Correct)	Posttest (% Correct)	Improve-ment?	Word #	Pretest (% Correct)	Posttest (% Correct)	Improve-ment?
6	46.7	60.0	Yes	5	46.7	60.0	Yes
11	73.3	46.7	No	12	33.3	40.0	Yes
13	26.7	33.3	Yes	14	60.0	60.0	No
AVG	**48.9**	**46.7**		**AVG**	**46.7**	**53.3**	
SD	23.4	13.4		SD	13.4	11.5	

Overall, no change was calculated between the pretest and posttest perception task for all sounds. However, when the results were separated into velar and uvular stops, a considerable change was noticed: on average, the perception of velars did not increase in the posttest, but perception of uvulars did increase.

4.3 Production

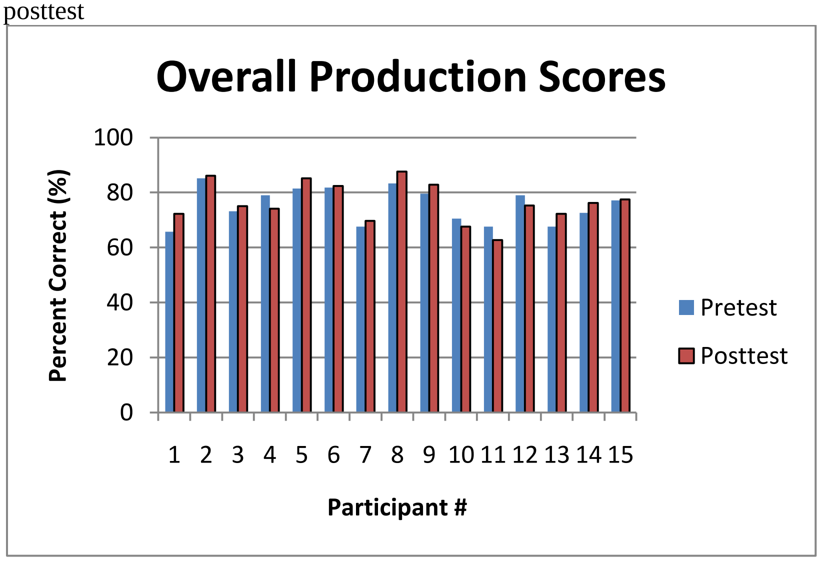
Overall, the average production percent correct (with respect to all three conditions examined: place of articulation, roundedness, and ejective quality) increased slightly as displayed below in Table 10.

Table 10. Overall production percent correct

	Overall (% correct)	
	Pretest	Posttest
AVERAGE	75.4	76.4
SD	6.3	7

Average percent correct for each participant is presented in the following figure. The posttest scores (shown in red) overall are higher than the pretest scores (11 participants had higher posttest scores, 5 had lower).

Figure 3. Graph of overall production scores by participant on pretest and posttest



Place of articulation (velar or uvular), roundedness, and ejective quality were also calculated separately from the overall scores. The results are presented in Figures 4-6. Figure 4 displays the pretest and posttest production results for place of articulation, to show if participants differentiated between velars and uvulars. On average, participants improved their performance on producing either a velar or uvular target sound (pretest M = 61.5%, SD = 8.6%, posttest M = 67.5%, SD = 11.1%). 10 out of 15 participants improved their production of velars and uvulars. One participant showed no improvement and four participants had a lower percent correct in the posttest.

Figure 4. Graph of pretest and posttest production on place of articulation

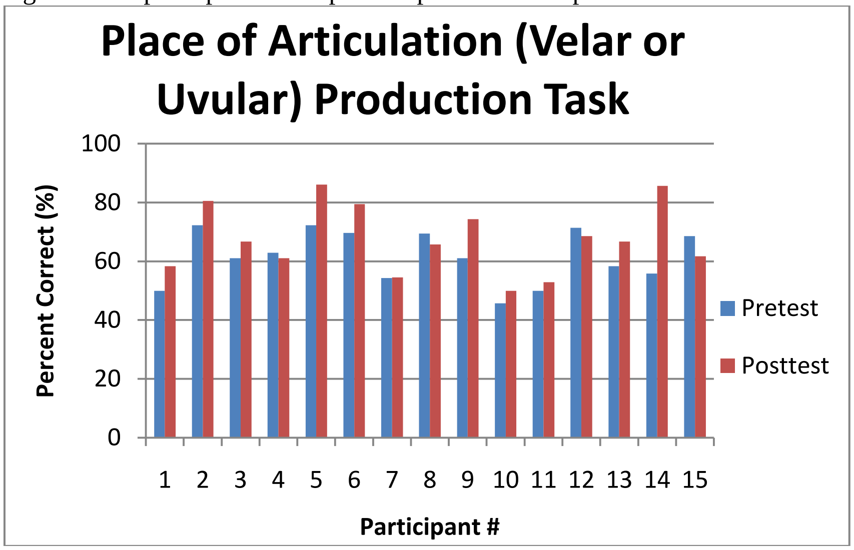


Figure 5 below shows the average percent correct for production of roundedness on the target sound in the pretest and posttest. Overall, there was no effect for roundedness, and students scored high on both the pretest and posttest for producing rounded target sounds (pretest *M* = 88.89%, *SD* = 6.5%, posttest *M* = 88.6%, *SD* = 6.2%).

Figure 5. Graph of percent correct for the production of roundedness of target sound

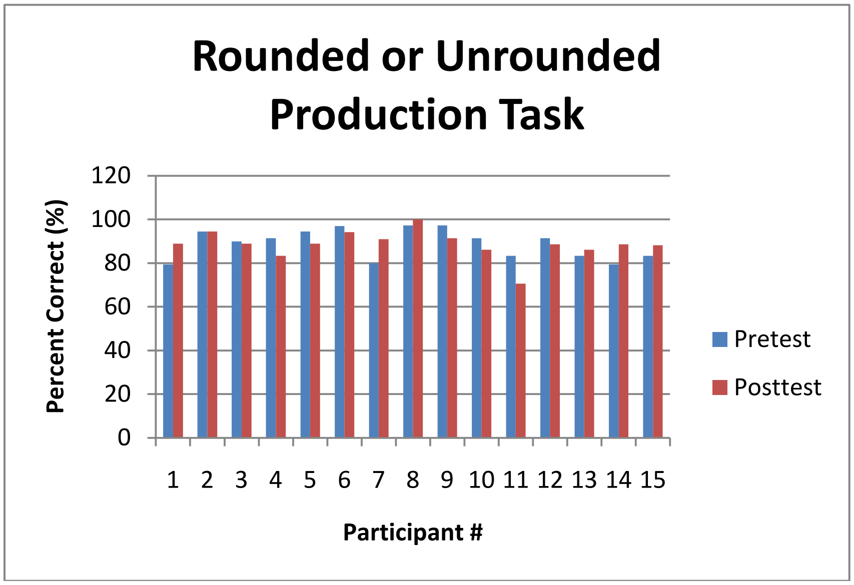
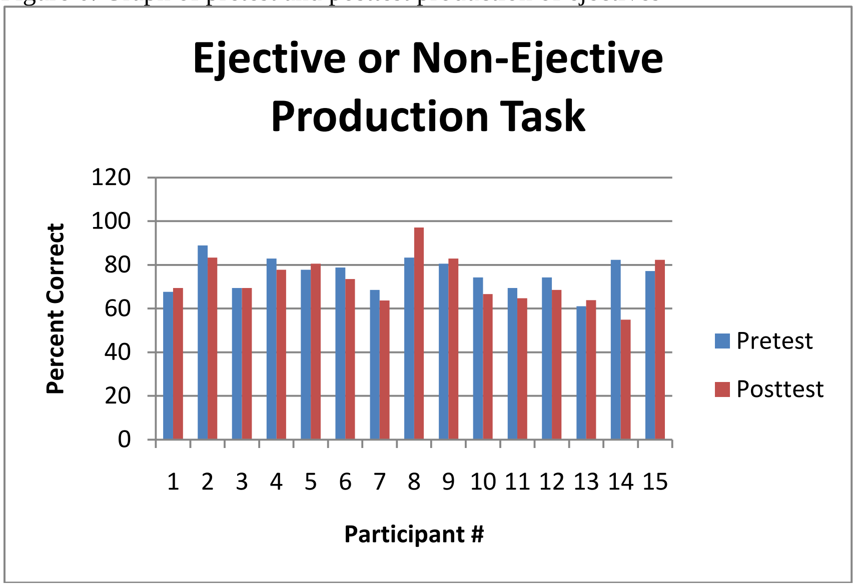


Figure 6 displays the pretest and posttest production results for ejective quality, to show if participants differentiated between ejectives and non-ejectives. On average, participants did not improve their performance on producing either an ejective or non-ejective target sound (pretest *M* = 75.8%, *SD* = 7.2%, posttest *M* = 73.3%, *SD* = 10.3%).

Figure 6. Graph of pretest and posttest production of ejectives



Percent correct of the production of ejectives when ejectives were presented to participants is displayed in Figure 7 below. It can easily be observed that there is a large amount of variation between participants. On average, the participants produced an ejective more often when an ejective was presented to them in the posttest (pretest *M* = 29.8%, *SD* = 22.3%, posttest *M* = 37.8%, *SD* = 31.9%). The production of non-ejective target sounds when non-ejective target sounds were presented is displayed in Figure 8. Participants, on average, did much better on the production of non-ejectives; however, there was a decline in performance between the pretest and posttest (pretest *M* = 94.0%, *SD* = 13.7%, posttest *M* = 84.0%, *SD* = 20.8%).

Figure 7. Production of ejectives when ejectives were presented

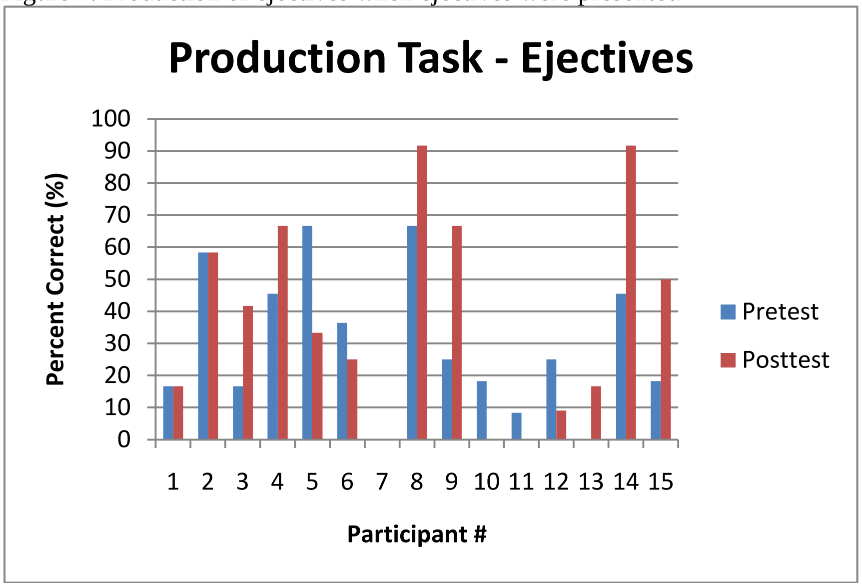
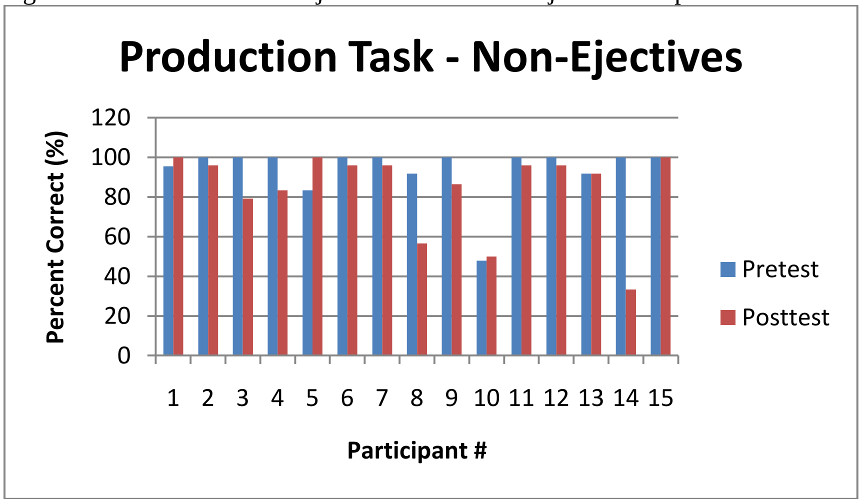


Figure 8. Production of non-ejectives when a non-ejective was presented



Percent correct of the production of uvulars when uvulars were presented to participants is displayed in Figure 9 below. It can easily be observed that there is a large amount of variation between participants. On average, the participants produced a uvular more often when a uvular was presented to them in the posttest (pretest *M* = 23.9%, *SD* = 19.3%, posttest *M* = 38.9%, *SD* = 24.2%). The production of velar target sounds when velar target sounds were presented is displayed in Figure 10. Participants, on average, did much better on the production of velars compared to uvulars; however, there was a decline in performance between the pretest and posttest (pretest *M* = 98.8%, *SD* = 3.2%, posttest *M* = 90.3%, *SD* = 22.8%).

Figure 9. Production of uvulars when uvulars were presented

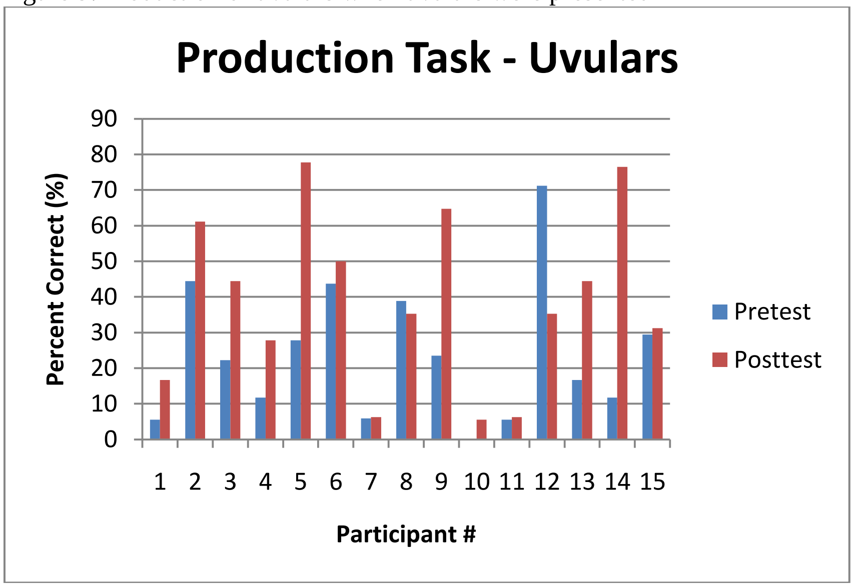
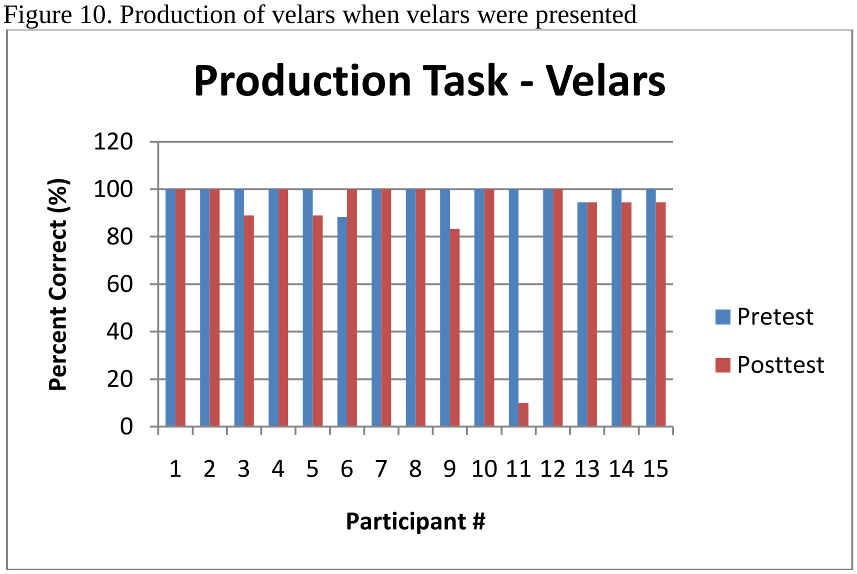


Figure 10. Production of velars when velars were presented



5 Discussion

The predictions of the study, as mentioned earlier, were not fully supported by the results. It was hypothesized that 1) on average, students who report having a higher motivation and better attitude towards learning will improve the most on all tasks. This prediction was not upheld. The students self-reported the same overall motivation and attitude before and after the training. This is not surprising because, due to time constraints, there was only one training period and only one week in between the surveys. It would not be expected that students would greatly shift their attitude and motivation towards learning in that small amount of time.

Secondly, it was predicted that on average, the students would improve their perception of the SENĆOŦEN stop consonants after the training. An average calculation found that students did not improve their perception on velar and uvular sounds. However, Table 6 in the results section showed that some students did improve on the perception of uvulars. Since the participants were L1 English speakers, they were already able to perceive and produce the velar target sounds (as velar stops are part of the English sound inventory (*IPA Handbook*, 1999)). The interest lied in the perceptual differentiation of velars and uvulars. The students needed to be able to tell the difference between velars and uvulars to score well on the perception task. Because of this, the average scores on the perception of velars were separated from the average scores on the perception of uvulars. It was found that the students did increase their percent correct for uvulars on the posttest. Interestingly it was also found that the students *decreased* their performance on the velars. A similar pattern was shown in the production phase (discussed later), wherein students did worse in the posttest on velar sounds. This is surprising because they already know how to produce and perceive velar sounds. The students showing weaker scores on velars in the posttest means they were actually perceiving more velars as uvulars. It is possible that the training heightened their perceptual awareness of uvulars, and therefore they chose uvulars more often in the posttest. Further, the environment of the target sound was found to affect the outcome. Participants only increased their perception of uvulars considerably when the uvular was in word-initial position. This indicates that some positions are more perceptually salient than others.

Thirdly, it was predicted that the students would produce sounds more similar to the presented sounds after the training than before it. Also, it was predicted that the type of sound environment (word initial, internal or final) would have an effect on their accuracy in production of the sounds. There was no considerable difference between the pretest and posttest production task. However, when the production was analyzed only with respect to the place of articulation of the target sound (velar or uvular), the participants did have a higher percent correct in the posttest. No difference was found between the pretest and posttest percent correct on the roundedness quality of the target sound. The participants overall had high scores on the production of roundedness. This is expected because there are rounded sounds in English

(*Handbook of the IPA*, 1999) so the participants should be able to produce them. The scores were also separated between ejective sounds and non-ejective sounds. It was found that on average the differentiation of ejectives and non ejectives did not improve in the posttest. During the analysis phase of the research, it was observed that the students seem to produce more uvulars and more ejectives in the posttest than in the pretest regardless of whether a uvular or ejective was presented. If the training led to increased awareness of these sounds in the posttest, this outcome would be expected. This led to the comparison between performance of ejectives produced when ejectives were presented, non-ejectives produced when non-ejectives were presented, uvulars produced when uvulars were presented, and velars produced when velars were presented (Figures 7-10).

The results for these comparisons were very interesting. There was very high variation calculated for the production of ejectives and uvulars, and lower variation for the production of non-ejectives and velars. This is expected because English speakers produce non-ejectives and velars. The participants who improved their production of ejectives in the posttest (when ejectives were presented to them) improved by a considerable amount (see Figure 7; participants 3, 4, 8, 9, 13, 14, 15).

Of those who did not improve, three stayed the same, and 5 decreased. A similar pattern was observed for the production of uvulars. On average, the students did notably better on the production of uvulars (when a uvular was presented to them) in the posttest. Nine participants improved by a considerable amount (see Figure 9; participants 1-6, 9, 13, 14), four improved slightly (participants 7, 10, 11, 15) and only two declined in performance. Interestingly, the production of velars and non-ejectives actually declined slightly between the pretest and posttest. This actually means that in the posttest, the students produced more ejectives and uvulars than they did in the pretest. This is implicational in itself. Even if the participants did not greatly improve their production and perception in the posttest, they were still producing more of the sounds which are difficult to produce and perceive after they received the training. It seems that the training raised awareness about the sound contrast, leading to some confusion in perception or production of the sounds. This can explain why their performance, in some cases, on velar perception and production actually went down. The participants were more aware that the uvular sounds existed and therefore they perceived them more often, or at least were listening for them more carefully.

This research was based on the idea that it is difficult to learn non-L1 sound contrasts (Werker et al., 1981), and linguistic training may help learners produce and perceive the sound contrasts. A study by Lord (2005) discusses the role linguistically-based teaching has on the pronunciation of an L2. The study found that explicit phonetic instruction with L2 sounds not present in the L1 benefitted the participants. Previous research has found that learning a second language after childhood (or after the Critical Period) can be especially difficult (Best & McRoberts, 2003). This is also greatly influenced by the type of teaching one receives and how motivated one is to learn (Gardner & Lambert, 1972). The language class researched for this paper focuses on vocabulary and small sentence structure. This research intended to provide evidence that it is important to teach the students explicitly how to make certain sounds, and make them aware of potential sound contrasts which may be difficult to perceive. Potentially, the students may have improved more if time allowed more of this type of training because practice is essential to second language learning (Flege et al., 1997). The training was based on a model of Experiential Learning (Kolb, 1984) where the participants were encouraged to listen to the researcher, participated in small group discussions and reflected on their learning experience. The training did have some effect on their perception and production of the difficult sound contrasts, and further research into extending the amount of training received could yield even better results.

5.1 Limitations

It is important to note that there was an overall high occurrence of variation in the results. SENĆOŦEN as a language has different relevance for each student's family. Even though all of the students attended the same language class, the amount of experience each one had with the language at home varies greatly. Some may have had no experience at home, and some may have had their parents and/or grandparents speaking to them in SENĆOŦEN on a consistent basis. Three major factors which cannot be controlled for in this type of classroom-based study are large individual variation in academic competence, level of attention during training and consistent class participation in all related activities.

These three factors have major implications on this study. The students also ranged from grades six to eight and were both female and male. The interest each student had in the experiment could have also had a major effect on their performance. Further, the students who showed little interest and little focus during the training session would have not received the same amount of knowledge and experience with training compared to a student who was completely engaged and interested in the topic. These factors could not be controlled for in this study.

Although the results seem encouraging, there are major limitations to this study. The biggest limitation is the lack of reliability of the production results. Due to time constraints, only one researcher made acoustic decisions on the participants' production sound files. At least one other person with acoustic linguistic training should have completed the same analysis in order to check for inter-reader reliability. Further, with only 15 participants, small sample size is a limitation. This is especially crucial for this study due to the major variation of the participants' background knowledge. Also, the participants were recorded in offices in their school, not sound proof booths. There is always lots of commotion happening in schools, so the recordings were not always high-quality and had background noise.

Another major limitation to the study is whether the production task actually tested for production and not perception. The participants listened to the words then repeated them. The participants must actually perceive the target sound before they produce it. Therefore the production task does not actually just test for production; it is also a perception task as well. For example, if a uvular was presented but the participant heard (perceived) a velar, then they would produce a velar and it would be a perception error not a production error. This is further reinforced through the results, as the results for the perception and production tasks were very similar. Although this is a concern from the perspective of the present research (specifically, the objective of testing for production of velars versus uvulars), giving more opportunity to the students to verbally practice words in their L2 language is beneficial to their L2 language learning.

5.2 Pedagogical implications and future research

This small-scale research only examined six target sounds in SENĆOŦEN. However, the results suggest that linguistically based information can be helpful in the perception of L2 sounds. Also, it can be effective in helping L2 learners perceive and produce difficult sounds. The pedagogical implications of the results suggest that teaching physical linguistic features of sounds should be incorporated into middle-school second-language class curriculum. This is especially significant to First Nations languages which have sounds difficult to produce for English speakers. The importance of encouraging young people to learn endangered indigenous languages is tremendous. Any research which helps pass on indigenous languages to newer generations is vital. More research should focus on the best ways to pass on the languages to these younger generations.

If these findings are supported by future, larger-scale studies, efforts should be made to include this type of training into language classroom teachings. Future research should include more difficult sounds in the language and more valid tasks for testing production. Further, multiple linguistically trained researchers should observe the data to check for inter-reader reliability, and other forms of analysis should be completed (for example, acoustic analysis of the sounds).

6 Conclusion

This paper studied the implications of linguistic training (explicit training on the nature of the target sounds) on the perception and production of difficult sound contrasts for middle-school learners of SENĆOŦEN. Also, a survey was given before and after the training to see if there was an effect of the training on the participants' attitudes and motivations towards learning SENĆOŦEN. This paper contributes to the field of applied linguistics and more importantly to the field of second language teaching of First Nations languages. Any efforts in encouraging youth to learn a cultural language is beneficial to both the youth and the culture to which the language belongs. This research shows that it is important for the teacher to explicitly present difficult sounds and sound contrasts in the second language, so that learners become aware of them. Further, it is beneficial to use models of the vocal tract to help show learners how to physically produce sounds, if the sound is not in their first language inventory. Future research should focus on extending the training period of this experiment, and working with students to help increase their motivation and interest in learning the language.

Appendix A: Production word list

Production Task #	APA	Orthography	English Gloss
1	hik̓ʷəŋ	HIQEṈ	river rising from rain (not tide)
2	pək̓ʷəŋ	PEQEṈ	spray
3	sk̓ʷey	SQȺ	taboo, forbidden
4	sk̓ʷalwəs	SQOLWES	parent of son/daughter-in-law
5	mək̓ʷ	MEQ	all (of them)
6	k̓ʷes	QÁS	to burn one's skin
7	skʷaməʔ	SȻOME	ratfish
8	ləkʷəx̣	LEȻE	rib
9	šəmikʷəs	ŚEMIȻES	smallpox, chicken pox, measles
10	puyəkʷ	BUYEȻ	gun
11	kʷənət	ȻENET	grab with hands
12	skʷiwə̓l	SȻIWEL	be visible
13	ləkwin	LECWIN	cross, crucifix
14	lisék	LISÁK	sack
15	kəčən	CEĆEN	kitchen
16	kalə	COLE	collar
17	stakən	STOCEN	stocking, sock
18	kenti	CANTI	candy
19	čiq	ĆIḴ	snow (coming down)
20	sqam̓əs	SḴOMES	bow heavy
21	nəqəŋ	NEḴEṈ	dive (a person)
22	qəlet	ḴELÁT	have some more
23	hiqət	HIḴET	put somthing into oven
24	sqes	SḴÁS	take out (of box)
25	t̓əqʷəŋ	DEḰEN	thimbleberry
26	sqʷaθən	SḰOŦEN	raphia
27	qʷenəs	ḰÁNES	call s.o. to you; invite
28	liqʷət	LIḰET	loosen (as belt, clothes)
29	nəqʷ	NEḰ	sleep
30	sqʷəmin	SḰEMIN	Arbutus Island
31	saʔəq̓ʷ	SOEꝀ	cow-parsnip; Indian rhubarb
32	sq̓ʷəŋəs	SꝀEṈES	forehead
33	sq̓ʷaʔ	SꝀO	companion
34	pəq̓ʷəŋ	PEꝀEṈ	powder

35	niq̓ʷəm	NIꝀEM	smooth
36	q̓ʷəl	ꝀEL	ripe

Appendix B: Perception word list

Perception Task #	APA	Orthography	English Gloss
1	k̓ʷələw̓	QELEW	animal hide
2	sak̓ʷəŋ	SOQEN	bathe
3	k̓ʷənət	QENET	look at something
4	kʷələŋ	ȻELEṈ	airport
5	kʷənət	ȻENET	grab with hands
6	makʷət	MOȻET	put something into mouth
7	ləkwin	LECWIN	cross, crucifix
8	ləkli	LECLI	key; lock
9	kenti	CANTI	candy
10	qəmət	ḴEMET	merganser (river sawbill)
11	səqeen	SEḴÁÁN	bracken fern
12	qələx̣	ḴELEX	salmon eggs, roe
13	mətaqʷəŋ	METOḰEN	spring of water
14	qʷaʔən	ḰOEN	mosquito
15	qʷənəs	KENES	Hagan Creek
16	leq̓ʷəŋ	LÁꝀEṈ	raw fish
17	q̓ʷələŋ	ꝀELEṈ	barbecue meat
18	q̓ʷəŋət	ꝀEṈET	bring up (a child)

Appendix C: Training word list

Training Sound #	APA	Orthography	English Gloss
1	lək’ʷiʔ	LEQI,	waterlilly; pondlilly
2	pukʷ	BUȻ	book
3	təqʷ	TEḰ	tight
4	təq	TEḴ	raid
5	leq’ʷəŋ	LAꝀEṈ	raw fish
6	kul	CUL	gold
7	k’ʷsəŋ	QSEṈ	count
8	qəs	ḴES	fall overboard
9	t’ᶿaqʷət	ȾOḰET	suck on something

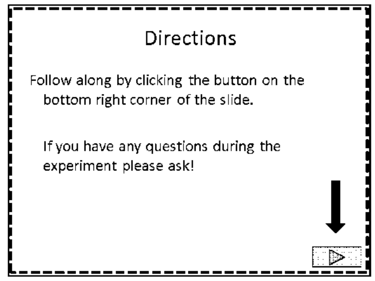
10	q’^{w}ay	ꝀÍ	die
11	šuk^{w}ə	ŚUȻE	sugar
12	šik	ŚIC	Shaker Church

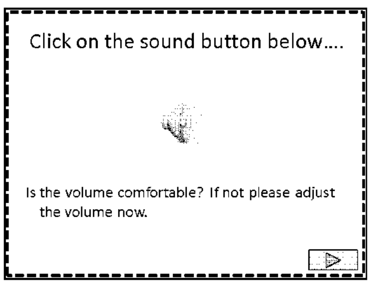
Appendix D: Survey

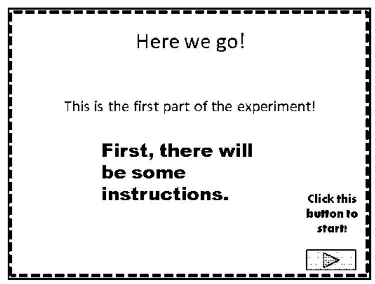
		Always	Most of the time	Sometimes	Not usually	Never	Not Sure
1.	**I want to come to school.**	☐	☐	☐	☐	☐	☐
2.	**I like doing school work.**	☐	☐	☐	☐	☐	☐
3.	**I learn when I am at school.**	☐	☐	☐	☐	☐	☐
4.	**I feel a part of my school.**	☐	☐	☐	☐	☐	☐
5.	**My school appreciates everyone’s cultures.**	☐	☐	☐	☐	☐	☐
6.	**I like going to my SENĆOŦEN class.**	☐	☐	☐	☐	☐	☐
7.	**I like learning SENĆOŦEN.**	☐	☐	☐	☐	☐	☐
8.	**I like speaking SENĆOŦEN.**	☐	☐	☐	☐	☐	☐
		Strongly Agree	Somewhat agree	Somewhat disagree	Strongly disagree	Not sure	
9.	**SENĆOŦEN is important to my community.**	☐	☐	☐	☐	☐	
10.	**It is important that I learn SENĆOŦEN.**	☐	☐	☐	☐	☐	

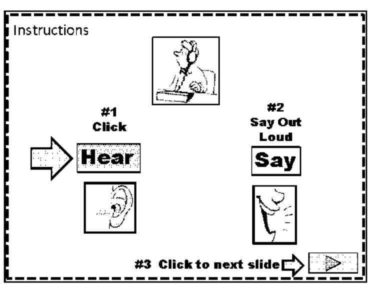
11.	**Learning SENĆOŦEN is important for my future.**	☐	☐	☐	☐	☐
12.	**I feel the same about school now as I did in elementary school.**	☐	☐	☐	☐	☐
13.	**I care about my grades.**	☐	☐	☐	☐	☐
14.	**My friends care about their grades.**	☐	☐	☐	☐	☐
15.	**I want to get good grades.**	☐	☐	☐	☐	☐
16.	**I want to learn about my culture and others.**	☐	☐	☐	☐	☐
17.	**I think learning my ancestors' language is important.**	☐	☐	☐	☐	☐
18.	**Learning SENĆOŦEN is difficult.**	☐	☐	☐	☐	☐
19.	**My family values learning SENĆOŦEN.**	☐	☐	☐	☐	☐
20.	**I value learning SENĆOŦEN.**	☐	☐	☐	☐	☐
21.	**I am worried about losing SENĆOŦEN as a spoken language.**	☐	☐	☐	☐	☐
22.	**I know more words in SENĆOŦEN than I did in elementary school.**	☐	☐	☐	☐	☐
23.	**Other kids in the school think learning SENĆOŦEN is interesting.**	☐	☐	☐	☐	☐
24.	**I feel like I should learn SENĆOŦEN.**	☐	☐	☐	☐	☐
25.	**Some things in SENĆOŦEN are hard to say.**	☐	☐	☐	☐	☐
26.	**I find learning SENĆOŦEN frustrating.**	☐	☐	☐	☐	☐
27.	**I like doing schoolwork on the computer.**	☐	☐	☐	☐	☐
28.	**I feel comfortable saying SENĆOŦEN words out loud in class.**	☐	☐	☐	☐	☐
29.	**I feel confident in my ability to say SENĆOŦEN words.**	☐	☐	☐	☐	☐

Appendix E: Pretest and posttest experimental presentation









Part 2

This next part focuses on the K and Q sounds in SENĆOŦEN that are difficult.

In Q Ȼ C your tongue is further FORWARD than when you say the K̲ Ḱ Ꝁ sounds.

Click on each sound to hear a word with that sound.

Q Ȼ C

These sounds are made with your tongue further **FORWARD**

K̲ Ḱ Ꝁ

These sounds are made with your tongue further **BACK**

On your sheet....

Check FORWARD if you think it is a Q Ȼ **or** C sound

Check BACK if you think it is a K̲ Ḱ or Ꝁ sound

In this SOUND , my tongue is:

#1 **FORWARD** (Q, Ȼ or C) **BACK** (K̲, Ḱ or Ꝁ)

In this SOUND , my tongue is:

#18 **FORWARD** (Q, Ȼ or C) **BACK** (K̲, Ḱ or Ꝁ)

END

HÍSW̲K̲E

Thank you!

Appendix F: Training presentation

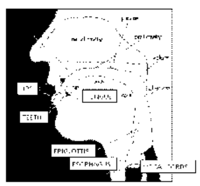
Welcome!

HÍSW̱ḴE

Today:

- The vocal tract
- How different sounds are made:
  - Stops vs non stops
  - Voiced versus voiceless
- Tongue movement
- The Q ȻC Ḵ Ḱ Ꝁ sounds

The Vocal Tract



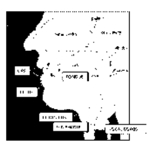
The Vocal Tract

- All of these parts of the vocal tract are very important to speech
- Without them, we couldn't make the sounds that we do!
- The parts of our vocal track move to create the different sounds

The Vocal Tract

The Important Parts:

- **Vocal Cords**
  - Sound
- **Tongue**
  - Place of Articulations
- **Lips**
  - Rounding



How Sounds are Made

Voiceless vs. Voiced

- Our vocal cords vibrate back and forth really fast as air pushed through from our lungs.
- Believe it or not, there are some sounds where we don't actually make any sound from our vocal cords!
- These are called **voiceless** sounds.
- Try saying these words out loud:
  - **H**appy **S**un **Th**is **F**lip

The first sounds in these words are made from the air hitting other things in your vocal tract, no sound from your vocal cords!

How Sounds are Made

Stops vs. Continuous

Continuous Sounds	Stops
•Continuous air stream • S, F, V, R, W, and vowels	•Air stream gets blocked •P, T, K, B, G

Let's see how the sounds are made:

http://homes.chass.utoronto.ca/~danhall/phonetics/sammy.html

K vs. Q Sounds

The sounds in SENĆOŦEN that we are trying to learn have one big difference:

In K̲ the back of the tongue goes near the back and top of the throat

In C the back of the tongue goes further back

K̲ C

http://homes.chass.utoronto.ca/~danhall/phonetics/sammy.html

Ejectives

Ejective sounds are produced when there is a build up of pressure in the vocal tract, and it makes a "click" when it is released

Try this: hold your break while trying to make a "k" sound

The Ꝁ and Q sounds in SENĆOŦEN are ejectives. Here are two words which contain the sounds.

Ꝁ Q

Can you hear a difference? In the Ꝁ sound the back of the tongue is further back than in the Q sound.

Rounding

Just by rounding your lips you can make the same sound different:

Say these two sounds:
ahhhhhhh oooooooo

Your tongue stays in the same place but just by rounding your lips the sound changes! The same thing happens with these sounds in SENĆOŦEN.

Ḱ Ȼ

Can you hear a difference? In the Ꝁ sound the back of the tongue is further back than in the Q sound.

SENĆOŦEN Sounds

The sounds I tested you on were these sounds:

Q Ȼ C K̲ Ḱ Ꝁ

Voiced or Voiceless?

Stop or continuous?

Further back or forward?

Worksheet

Sound #	
1	LEQI,
2	PUȻ
3	TEḰ
4	TEK̲
5	LAꝀEṈ
6	CUL
7	QSEṈ
8	K̲ES
9	ŦOḰET
10	ꝀÍ
11	ŚUȻE
12	ŚIC

Appendix G: Praat script for opening all sound files in a particular folder

```
##  This script opens all the files in some directory.
##  It makes a TextGrid for each of the sound files, then throws the sound file
and the
##  TextGrid into the editor so you can make marks.
# First we will make a list of all the sound (.wav) files in the directory.
Create Strings as file list... file-list *.wav
# Now we will set up a "for" loop -- the loop will iterate once for every file in
the list we just made.
# First we will query our list to see how many filenames are in it, and store that
number using the
# variable "number_of_files".  That variable will then be used in setting up the
for loop.
number_of_files = Get number of strings
print number of files: 'number_of_files' 'newline$'
for x from 1 to number_of_files
#    Now we will set up a string variable called "current_file$" and use it to store
the first
#    filename from the list.
     select Strings file-list
     current_file$ = Get string... x
     printline DEBUG: 'current_file$'
#    Now that we have the filename, we read in that file:
     Read from file... 'current_file$'
#    Now I am setting up a variable called "object_name$" that will have the
name of the
#    sound object.  This is basically equivalent to subtracting the ".wav" or ".aiff"
from
#    the filename.  This will be useful if I want to refer to the sound object later in
the script.
     object_name$ = selected$ ("Sound")
select Strings file-list
Remove
print All files processed -- woohoo! 'newline$'
## written by Katherine Crosswhite
## crosswhi@ling.rochester.edu
## edited by Marion, and Sonya, and Chris!
```

References

Best, C. C., McRoberts, G. W. (2003). Infant perception of non-native consonant contrasts that adults assimilate in different ways. *Language and Speech, 46*(2-3), 183-216.

Bird, S. & J. Leonard (2009a). The universality of articulatory conflict resolution: Evidence from Salish languages. *Northwest Journal of Linguistics, 3*(2): 1-29.

Boersma, P., & Weenink, D. (2008). Praat: doing phonetics by computer (Version 5.1.17) [Computer program]. http://www.praat.org

Duncan, T. G., & McKeachie, W. J. (2005). The making of the motivated strategies for learning questionnaire. *Educational Psychologist, 40*(2), 117-128.

Engin, A. O. 2009. Second language learning success and motivation. *Social Behaviour and Personality, 37*(8), 1035-1042.

Esling, J. H., & Wong, R. F. (1983). Voice quality settings and the teaching of pronunciation. *TESOL Quarterly, 17*(1), 89-95.

Flege, J. E., Bohn, O., & Jang, S. (1997). Effects of experience on non-native speakers' production and perception of English vowels. *Journal of Phonetics, 25*(4), 437-470.

Gardner, R. C., & Lambert, W. E. (1972). *Attitudes and Motivation in Second-Language Learning.* Massachusetts: Newbury House Publishers, Inc.

Hardison, D. M. (2003). Acquisition of second-language speech: Effects of visual cues, context, and talker variability. *Applied Psycholinguistics, 24*, 495-522.

Hinton, L. (2003). Language revitalization. *Annual Review of Applied Linguistics, 23,* 44-57.

International Phonetic Association. (1999). *Handbook of the International Phonetic Association: A Guide to the Use of the International Phonetic Alphabet.* Cambridge: Cambridge University Press.

Kolb, D. A. (1984). *Experiential Learning; Experience as the Source of Learning and Development.* New Jersey: Prentice-Hall, Inc.

Lenneberg, E. H. (1967). *Biological foundations of language*. Oxford, England: Wiley.

Lord, G. (2005). (How) can we teach foreign language pronunciation? On the effects of a spanish phonetics course. *Hispania, 88*(3), 557-567.

Montler, T. (1986). *An outline of the morphology and phonology of Saanich, North Straits Salish.* University of Montana Working Papers in Linguistics.

Murphy, P. K., Long, J. F., Knoblauch, D., Harper, B., & Monoi, S. (2007). Academic motivation and achievement among urban adolescents. *Urban Education, 42*(3), 196-222.

Pintrich, P. R., Roeser, R. W., & de Groot, E. A. (1994). Classroom and individual differences in early adolescents' motivation and self-regulated learning. *The Journal of Early Adolescence, 14*(2), 139-161.

Roeser, R. W., Strobel K. R., & Quihuis, G. (2002). Studying early adolescents' academic motivation, socio-emotional functioning, and engagement in learning: variable- and person-centered approaches. *Anxiety, Stress & Coping, 15*(4), 345-368.

Schmakel, P. O. (2008). Early adolescents' perspectives on motivation and achievement in academics. *Urban Education, 43,* 723-727.

Sewshuk, D. H. (2005). Experiential learning- a theoretical framework for preoperative edcuation. *AORN Journal, 81*(6), 1311-1318.

Shaikholeslami, R., & Khayyer, M. (2006). Intrinsic motivation, extrinsic motivation, and learning English as a foreign language. *Psychological Reports, 99,* 813-818.

Taguchi, K. (2006). Is motivation a predictor of foreign language learning? *International Education Journal, 7*(4), 560-569.

Wang, B. (2009). Motivation and language learning. *Asian Social Science, 5*(1), 98-100.

Wang, Y., Behne, D. M. & Jiang, H. (2009). Influence of native language phonetic system on audio-visual speech perception. *Journal of Phonetics, 37*(3), 344-356.

Werker, J. F., Gilbert, J. H. V., Humphrey, K., & Tees, R. C. (1981). Developmental aspects of cross-language speech perception. *Child Development, 52*(1), 349-355.

Whitright-Falcon, L. (2004). Renewal of indigenous languages. *Tribal College Journal, 15*(3), 24-27.

Wipf, J. A. (1985). Towards improving second-language pronunciation. *Die Unterrichtspraxis / Teaching German, 18*(1), 55-63.

Sarah C. Smith
7320 Ridgedown Court
Victoria, B.C.
V8M 2H7
scdsmith@uvic.ca