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Teachers represent one of the largest groups of professional voice users in the country and are among those individuals at greatest risk for developing vocal problems. This study investigated the efficacy of a specific therapy approach for treating voice problems among teachers.

Five female teachers with reported voice problems participated in six sessions of voice therapy to improve body posture and diaphragmatic breathing, establish forward resonance patterns, reduce laryngeal tension through speaking and singing exercises, and improve vocal hygiene habits. Data was obtained via perceptual analysis, objective voice measurements, and two patient-based treatment outcome measures: the Voice Handicap Index (VHI) and a Vocal Symptoms Questionnaire.

Results suggested that teachers with reported voice problems can establish and maintain healthier, more efficient voice use and improved vocal hygiene habits with the described course of treatment. Furthermore, voice clinicians can consider these techniques as effective alternatives in clinical settings when treating this population.

A THERAPEUTIC APPROACH FOR IMPROVED  
VOCAL PERFORMANCE IN INDIVIDUALS  
IN TEACHING OCCUPATIONS

by

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## TABLE OF CONTENTS

	Page
LIST OF TABLES .....	v
LIST OF FIGURES .....	vi
CHAPTER	
I. INTRODUCTION .....	1
Background Information .....	1
Purpose of the Study .....	2
Research Questions .....	3
Basic Assumptions .....	3
Limitations .....	3
Definition of Terms .....	5
II. REVIEW OF THE LITERATURE .....	9
Normal Laryngeal Functioning .....	9
Resonance .....	12
Healthy Voice Use .....	13
Occupational Risks for Teachers .....	14
Prevalence of Voice Problems Among Teachers .....	16
Prevalence of Voice Problems and Gender .....	19
Common Vocal Symptoms Among Teachers .....	20
Prevention .....	21
Voice Therapy .....	22
III. METHODS .....	29
Participants .....	29
Procedures .....	29
Perceptual Analysis .....	36
IV. RESULTS .....	38
Case Study: Participant 1 .....	38
Case Study: Participant 2 .....	43
Case Study: Participant 3 .....	48

Case Study: Participant 4 .....	53
Case Study: Participant 5 .....	58
V. SUMMARY AND DISCUSSION .....	72
Perceptual Analysis .....	72
Questionnaires .....	72
Objective Measurements .....	73
Implications .....	73
Conclusion .....	78
REFERENCES .....	79
APPENDIX A. PROMOTIONAL FLYER .....	84
APPENDIX B. INTERVIEW QUESTIONS .....	85
APPENDIX C. VOICE HANDICAP INDEX QUESTIONNAIRE .....	86
APPENDIX D. VOCAL SYMPTOMS QUESTIONNAIRE .....	88
APPENDIX E. VOICE EVALUATION FORM .....	90
APPENDIX F. ANATOMY LESSON .....	92
APPENDIX G. VOICE JOURNAL .....	94
APPENDIX H. VOCAL HYGIENE PROGRAM .....	95
APPENDIX I. POSTURE LESSON .....	98
APPENDIX J. BREATHING DESCRIPTION AND EXERCISES .....	99
APPENDIX K. RESONANT VOICE THERAPY .....	100
APPENDIX L. SINGING EXERCISES .....	103

## LIST OF TABLES

	Page
TABLE 1. Participant 1- Objective Voice Evaluation Measurements .....	40
TABLE 2. Participant 1- Results for Vocal Symptoms Questionnaire .....	42
TABLE 3. Participant 1- VHI Total and Subscale Scores .....	43
TABLE 4. Participant 2- Objective Voice Evaluation Measurements .....	46
TABLE 5. Participant 2- Results for Vocal Symptoms Questionnaire .....	47
TABLE 6. Participant 2-VHI Total and Subscale Scores .....	47
TABLE 7. Participant 3- Objective Voice Evaluation Measurements .....	50
TABLE 8. Participant 3- Results for Vocal Symptoms Questionnaire .....	52
TABLE 9. Participant 3- VHI Total and Subscale Scores .....	52
TABLE 10. Participant 4- Objective Voice Evaluation Measurements .....	55
TABLE 11. Participant 4- Results for Vocal Symptoms Questionnaire .....	56
TABLE 12. Participant 4- VHI Total and Subscale Scores .....	56
TABLE 13. Participant 5- Objective Voice Evaluation Measurements .....	60
TABLE 14. Participant 5-Results for Vocal Symptoms Questionnaire .....	61
TABLE 15. Participant 5- VHI Total and Subscale Scores .....	62
TABLE 16. Frequency of Occurence of Vocal Symptoms and Voice Use Patterns .....	65

## LIST OF FIGURES

	Page
FIGURE 1. Total Number of Vocal Symptoms and Voice Use Patterns.....	63
FIGURE 2. Total Vocal Handicap Index (VHI) Scores .....	64
FIGURE 3. Combined Results for Maximum Phonation Time.....	67
FIGURE 4. Combined Results for Vital Capacity .....	68
FIGURE 5. Combined Results for s/z Ratio.....	68
FIGURE 6. Combined Results for Maximum Phonational Range.....	69
FIGURE 7. Combined Results for Mean Fundamental Frequency (Reading Passage) ....	69
FIGURE 8. Combined Results for Mean Fundamental Frequency (Conversation).....	70
FIGURE 9. Combined Results for Frequency Perturbation .....	70
FIGURE 10. Combined Results for Amplitude Perturbation .....	71

## CHAPTER I

### INTRODUCTION

#### Background Information

A professional voice user is an individual whose job places extraordinary demands on the voice. For such a person, the consistent quality and endurance of the voice is paramount to a professional in his or her career. Approximately 5%-10% of the workforce in the United States is classified as “heavy occupational voice user” or professional voice user (Titze, Lemke & Montequin, 1997).

Of the 144 million employed civilians in the labor force (United States Bureau of Labor Statistics, 2001), 4.5 million (3.13%) are elementary, secondary, and higher education teachers (Digest of Education Statistics, 2001). Teachers represent one of the largest groups of professional voice users in the country and are considered among those individuals at greatest risk for developing vocal problems. Several factors contribute to this risk: the professional demands placed on the voice, unsuitable acoustic working environments, lack of voice training, individual voice characteristics, and psychological factors such as stress and anxiety (Sapir, Keidar, & Mathers-Schmidt, 1993).

Teachers are required to use their voices for prolonged periods of time, often with few or no breaks between classes. Smith, Lemke, Taylor, Kirchner & Hoffman (1998) reported that teachers taught an average of six classes per day, requiring almost 5 hours of continuous voice use (Smith et al., 1998). The acoustics in classroom environments are usually less than desirable, requiring teachers to raise their voices often to compete with background noise. Teachers are also required to use their voices in situations other than the classroom that demand even greater loudness levels, such as the hallway, lunchroom, schoolyard, gymnasium, and during extracurricular activities (Roy, Weinrich, Gray, &

Tanner, 2002). Unfortunately, vocal education and training are not a standard part of most teacher training programs. Teachers often enter the workforce and begin their careers with limited knowledge of the vocal mechanism, vocal hygiene, and effective voice use. In addition, teachers continually are exposed to upper respiratory infections, putting them at great risk for developing illnesses that adversely affect their vocal mechanism (Smith, Gray, Dove, Kirchner & Heras, 1997).

The majority of studies addressing voice problems within the teaching population have evaluated prevalence and frequency by gathering subjective comments from participants through self-report surveys. Limited studies have attempted to establish the benefits of vocal education, including vocal hygiene, and prevention programs for teachers (Chan 1994; Holmberg, Hillman, Hammarberg, Södersten & Doyle, 2001; Roy, Gray, Simon, Dove, et al., 2001; Stemple, Lee, D'Amico, & Pickup, 1994). Even fewer studies (Holmberg et al., 2001; Roy et al., 2001; Roy et al., 2002; Roy, Weinrich, Gray, Tanner, et al., 2003) have employed direct intervention approaches during specific vocal instruction. Studies that incorporate specific voice treatment approaches in combination with vocal education and vocal hygiene may be able to determine the most appropriate voice treatment for this at risk population.

#### Purpose of the Study

The purpose of this research study will be to test the efficacy of a specific therapy approach to voice problems that occur in adults in teaching occupations, and to help those individuals establish more efficient, healthy voice use and good vocal hygiene habits. To accomplish this objective the specific aims are:

- 1) Quantify the effects of a specific voice therapy approach on obtained voice evaluation measures in adults in teaching occupations.
- 2) Assess the impact of voice training on participants' perception of voice severity and vocal symptoms pre- and post-training.

- 3) Assess the impact of voice training on the listener's perception of the loudness, pitch, and quality of the voice in adults in teaching occupations pre- and post-training.

#### Research Questions

The specific research questions are:

1. Can individuals in teaching occupations establish healthy, efficient voice use and good vocal hygiene habits with a specific therapy approach?
2. Can these individuals maintain the new vocal behaviors learned during the therapy period, establishing healthier voice use and better vocal hygiene habits in their daily jobs and lives?

#### Basic Assumptions

Several assumptions have been made about the procedures for this study. First, the participants will be able to provide reliable self-perceived information about their voices via the two questionnaires, the Voice Handicap Index (VHI) (Jacobson, Johnson, Grywalski, Silbergleit, Jackbson, Benninger, et al., 1997) and the Vocal Symptoms Questionnaire. Second, the clinician will be able to effectively teach the new vocal skills and behaviors during the therapy period. Third, the participants will be able to learn and adapt to the new vocal techniques during a consecutive six week period. Finally, the participants will perform the at home practice that needs to be done in order to learn the new vocal skills and behaviors.

#### Limitations

There are two limitations to this research study. The first is the design of the study. The principal investigator will recruit the participants through distribution of a promotional flyer and by word of mouth. Participants will include classroom teachers (primary and secondary), university instructors, and individuals in any other teaching occupations. Some teachers will not respond because they may view vocal problems as an occupational hazard and not seek treatment for them. Possibly, they are not even aware

of the help that is available to reduce or eliminate such problems. A few studies (Sapir et al., 1993; Russell, Oates & Greenwood, 1998) found such treatment-seeking patterns among teachers who reported voice problems.

Another limitation is the age range (22-45 years) criteria for participation in the study. Teachers that are experiencing voice problems may be older teachers who are experiencing a cumulative effect of years of vocal use and injury (Roy, Merrill, Thibeault, Parsa, Gray & Smith, 2004). A recent study reported that women in the age range of 40-59 years represented a high-risk group for reporting voice problems (Roy et al., 2004). Another study revealed a higher frequency of voice problems reported among teachers who were 50 years of age or older (Russell et al., 1998). The size of the population sample may be limited due to these two factors.

In conclusion, several factors were considered in planning the design of this research study. Teachers represent one of the largest groups of professional voice users in the country. Too few studies have examined the benefits of specific intervention approaches in voice research and therefore, we have limited evidence as to their effectiveness in clinical settings. This study attempts to provide such evidence to assist voice clinicians in planning appropriate treatment protocols for teachers with voice problems.

## Definition of Terms

The following list of definitions was compiled as an educational reference for the reader. They were predominantly obtained from *Terminology of Communication Disorders: Speech-Language-Hearing* (Nicolosi, Harryman & Kresheck, 1996). Additional information from *Understanding Voice Problems: A Physiological Perspective for Diagnosis and Treatment* (Colton & Casper, 1996) and <http://dictionary.reference.com> is also included where necessary.

**Abduction** – A drawing away from the midline of the body or a moving away from each other, *e.g.*, the two vocal folds; opposite of adduction.

**Adduction** – A drawing toward the midline of the body or a bringing toward each other, *e.g.*, the two vocal folds; opposite of abduction.

**Aerodynamics** – The study of air and other gases in motion, forces setting them into motion, and results of such motion.

**Aphonia** – Complete loss of voice as a result of hysteria (conversion), growths, paralysis, disease, or overuse of the vocal folds which may develop suddenly or over a period of time; in a less severe form, often referred to as dysphonia.

**Aryepiglottic folds** – Aryepiglottic muscles and the upper edge of the quadrangular membrane that together form the entrance to the larynx; they extend bilaterally from the sides of the epiglottis to the top and side surfaces of the arytenoids cartilages.

**Cartilage** – firm fibrous connective tissue that does not contain blood vessels.

**Epithelial** – A vascular cellular outer layer of the skin and mucous membrane.

**Diaphragm** – Muscular and tendinous partition separating the thorax from the abdominal cavities; the primary muscle of inhalation.

**Dysphonia** – A broad term that refers to any deviation in phonation; may include periods of normal voicing, explosive vocalization alternating with extreme hoarseness, aphonia, and/or strained phonation.

**Epidemiology** - The branch of medicine that deals with the study of the causes, distribution, and control of disease in populations.

**Extrinsic muscles of the larynx**– two groups of muscles which support the larynx and change its vertical position, and have at least one attachment to a structure outside the larynx.

Glottal – Of or pertaining to the glottis.

Glottis – Vocal apparatus of the larynx, consisting of the true vocal folds and the opening between them.

Hoarseness – One of the more common dysphonias that can be produced by anything that interferes with optimum vocal fold adduction; pitch level is usually low and the range is restricted; pitch breaks and/or aphonic episodes may also be observed.

Hyperfunctional – excessive forcing and straining, usually at the level of the vocal folds, but which may occur at various points along the vocal tract.

Hypofunctional – Reduced vocal capacity resulting from prolonged overuse, muscle fatigue, tissue irritation, or general laryngeal or specific problems relating to the opening and closing of the glottis; characterized by air loss and sometimes hoarseness and pitch breaks.

Incidence – Frequency of occurrence.

Intrinsic muscles of the larynx– those muscles that control phonation and have their origins and insertions within the larynx.

Larynx – Primary organ of phonation; a cartilaginous and muscular funnel-shaped structure situated at the top of the trachea and below the tongue roots and hyoid bone; sound is produced by vibration of its vocal folds and regulated by movements of its cartilages, which are activated by voluntary muscles.

Oscillate – Back and forth motion of a body about its rest position; *laryngeal oscillation* vibration of the vocal folds.

Pharyngeal – relating to the pharynx.

Pharynx – irregular tubular space, considered to be part of the respiratory and alimentary tracts, which extends from the nasal cavities to the esophagus and which is also continuous with the larynx, mouth, and Eustachian tubes. It is considered to be the principal resonator of the human voice.

Phonation – Physiological process whereby the energy of moving air in the vocal tract is transformed into acoustic energy within the larynx; production of voiced sound by means of vocal fold vibration.

Prevalence - The total number of cases of a disease in a given population at a specific time.

Resonance – Sympathetic or forced vibration of the air in the cavities above, below, in front of, or behind the source of a sound.

Sign – Any abnormality indicative of a disease or disorder; an objective symptom.

Subglottic – below the vocal folds; opposite of supraglottic.

Supraglottic – above the vocal folds; opposite of subglottic.

Symptom – Any change or abnormality of structure, function, or sensation experienced by the individual and indicative of disease or a disorder; a subjective sign.

Tone focus – Emphasis of resonance along the vocal tract or pharyngeal pathway; may be in the laryngopharynx, oropharynx, or nasopharynx.

Viscera – organs of the thoracic and abdominal cavities.

Vocal abuse – Mistreatment, usually by overuse, of the laryngeal and pharyngeal musculature; *e.g.*, by screaming or yelling.

Vocal attack – manner by which phonation is initiated in relation to the timing of the closure of the glottis; usually refers to the manner in which vowels are initiated.

Vocal focus – sensation associated with the placement of the tone in the head; the feeling of the location of the focal point of the tone.

Vocal folds – Thyroarytenoid ligaments of the larynx, often referred to as the true vocal folds.

Vocal fry (glottal fry) – syncopated vocal fold vibration which generally occurs over the lower part of the pitch range; usually described as a bubbling, cracking type of low-pitched phonation.

Vocal fatigue – Deterioration of vocal quality due to prolonged use; may be the result of vocal abuse or be indicative of a pathological condition.

Vocal misuse- Incorrect use of pitch, tone focus, quality, volume, breath support, or rate which may occur singly or in combinations.

Vocal resonance – Modification of the laryngeal tone by passage through the chambers of the throat and head, so as to alter its quality.

Vocal tone – or *glottal tone* – Original tone produced by the activity of the vocal folds.

Voice disorder – Any deviation in pitch, intensity, quality, or other basic vocal attribute which consistently interferes with communication, draws unfavorable attention, adversely affects the speaker or the listener, or is inappropriate to the age, gender, or perhaps the culture or class of the individual; may be organic or functional in nature and may be the result of laryngeal function or resonance disorders.

## CHAPTER II

### REVIEW OF THE LITERATURE

#### Normal Laryngeal Functioning

Understanding voice disorders requires a basic knowledge of the anatomy and physiology of respiratory function, the laryngeal mechanism, and normal laryngeal functioning (Stemple, Glaze & Klaben, 2000). Knowledge of these anatomic and physiologic systems further provides the foundation necessary when evaluating and treating individuals with voice disorders.

#### *Respiratory Function*

The respiratory function consists of the skeletal system and actions of the lungs, the diaphragm, and the vocal folds. The lungs are protected by the rib cage, which is bounded superiorly by the first rib and clavicle, and inferiorly by the twelfth rib. The lateral and anterior portions of the rib cage are comprised of the ribs and sternum. The thorax is attached to the vertebral or spinal column, a structure that contains the spinal cord, which is the nervous system supply for the body and extremities (Seikel, King, and Drumright, 2000).

The lungs are separated from the viscera by the diaphragm. The diaphragm is a large, dome-shaped muscle. The top of the diaphragm and the bottom of the lungs are attached by a pleural lining. During inhalation, the diaphragm contracts or flattens downward. The viscera is compressed, and simultaneously, the lungs are pulled downward. Lung volume is expanded and air is passively drawn into the lungs. During exhalation, the diaphragm relaxes and returns to its resting position, lung volume decreases, and air is pushed out of the lungs and upward through the vocal folds by passive elastic recoil. During quiet exhalation, the vocal folds are abducted so no sound

is made. The vocal folds adduct at midline during exhalation for speech, creating a constriction of the airflow stream as it exits the lungs. This aerodynamic energy causes the vocal folds to oscillate, creating phonation (Stemple et al., 2000). When air pressure, airflow, and vocal fold approximation are maintained, sustained phonation is produced by the interaction of subglottal pressure, tissue elasticity, and the airflow constriction caused by the vocal folds (Seikel et al., 2000).

### *Laryngeal Mechanism*

Understanding of the normal structure and function of the larynx provides the groundwork necessary for the interpretation of diagnostic results and the development of voice treatment plans (Stemple et al., 2000). The larynx is a musculo-cartilagenous structure that connects inferiorly to the upper end of the trachea (Seikel et al., 2000; Stemple et al., 2000). It is comprised of three unpaired cartilages: the cricoid, thyroid, and epiglottis cartilages; and three paired cartilages: the arytenoids, corniculate, and cuneiform cartilages. The cricoid cartilage is located above the most superior cartilage of the trachea. It resembles the shape of a signet ring, with the narrow band in front, and the larger section comprises the back wall of the larynx. The thyroid cartilage is suspended from the hyoid bone and serves as a protective cover for the vocal folds. This cartilage forms the projection in the front of the throat known as the Adam's apple (McKinney, 1994). The arytenoids cartilages are shaped like a pyramid and have four surfaces: anterior, lateral, medial, and a base. Projecting forward at the base, the anterior angle forms the vocal process (Stemple et al., 2000).

The thyroid and cricoid cartilages articulate by means of the cricothyroid joint that permits a rocking motion between the two cartilages. This joint can rock anteriorly and posteriorly and also slide laterally. These motions allow the vocal process tips to move in order to achieve abduction, adduction, and stabilization of the vocal folds. The arytenoids and cricoid cartilages also articulate with a joint that permits motion. The

corniculate cartilages are located on the superior surface of the arytenoids, while the cuneiform cartilages are within the aryepiglottic folds (Stemple et al., Seikel et al., 2000).

The laryngeal muscles are divided into two groups: extrinsic and intrinsic. The extrinsic laryngeal muscles are attached internally to the larynx and externally to a point, such as the hyoid bone, sternum, mandible, or skull base. Both ends of the intrinsic muscles are attached within the laryngeal cartilages. When contracted, the laryngeal muscles increase tension and shorten, creating a “pull” between these muscular attachments (Stemple et al., 2000).

The primary function of the extrinsic muscles is to manipulate laryngeal height or tension. Extrinsic muscle contractions alter the shape and filtering characteristics of the supraglottic vocal tract, modifying the pitch, loudness, and quality of the voice. The chief function of the intrinsic muscles is to alter the shape and configuration of the glottis. The position, tension, and edges of the vocal folds are modified. These muscles adduct (close) and abduct (open) the vocal folds, as well as, modify vocal fold length, tension, and thickness. Both the intrinsic and extrinsic laryngeal muscles are an essential component of normal laryngeal functioning, assisting in the movements required for ventilation, airway protection, and communication (Stemple et al., 2000).

The vocal folds are composed of five layers of tissue: epithelial layer, lamina propria (three layers), thyrovocalis muscle. The epithelial layer is the most superficial layer of the vocal folds. It is comprised of extremely thin, squamous epithelium. Deep to the epithelial layer is the lamina propria, which is comprised of three different types of tissue. The first and second layers are made of elastin fibers that allow them to be extensively stretched. The deepest layer of the lamina propria is made of collagen fibers, that prohibit extension. Deep to the lamina propria is the thyrovocalis muscle, the fifth layer which forms the bulk of the vocal fold (Seikel et al., 2000).

### *Normal Laryngeal Functioning*

The function of the larynx involves movement of its multiple components and the results of that movement. The larynx and associated structures are used for many nonspeech functions. Coughing, throat clearing, and abdominal fixation serve important biological needs, and they are helpful in providing useful intervention techniques in therapy. Its most important role is airway protection, prohibiting entry of foreign objects into the lungs (Seikel et al., 2000).

The communicative function of the larynx is dependant on the interactive relationship of the three subsystems of speech: respiration, phonation, and supraglottic resonance. Vocal fold vibration is dependant on respiratory power, as well as tissue elasticity (Stemple et al., 2000). The intrinsic muscles of the larynx responsible for adduction approximate the vocal folds as expiration begins. The volume of air leaving the lungs is obstructed at the level of the vocal folds (glottis), and there is a build up of subglottal pressure as the vocal folds are approximating. The velocity of airflow increases as it passes through the glottis, and the vocal folds are blown apart, equalizing supraglottal and subglottal pressure (Boone & McFarlane, 2000). The Bernoulli effect states that, “given a constant volume flow of air or fluid, at a point of constriction there will be a decrease in air pressure perpendicular to the flow and an increase in velocity of the flow” (Seikel et al., 164). Because of the Bernoulli effect, the vocal folds come back together, producing a repetitive vibratory cycle of the folds being “blown” apart and then “sucked” back together. This vibratory cycle is repeated hundreds of times per second, providing the sound source for phonation (Boone & McFarlane, 2000).

### Resonance

The vocal tract serves as the resonating cavity for this acoustic energy. Resonance is created as the sound waves produced by phonation pass through the pharynx, oral and nasal cavities, and come in contact with articulator structures such as the velum,

hard palate, tongue, and teeth. The size and shape of each individual's vocal tract and its constrictions directly affect the quality and intensity of the sound (voice) that is perceived by the listener. Perceptual characteristics of phonation, such as, pitch, loudness, nasality, and quality, are a result of this resonating cavity or filter (Stemple et al., 2000).

### Healthy Voice Use

Defining normal voice is a very complex task because standards have not been established and boundaries of accepted norms among voice clinicians have not been set. Voice occurs in many forms, just as personality and physical appearance do. One must consider cultural, environmental, and other individual factors when determining what is normal. The voice changes throughout the lifespan in reaction to such things as aging structure, emotion and environment, reflecting the health of the body and of the mind (Colton & Casper, 1996). "It would be extremely difficult, if not impossible, to have a single definition that would encompass all of the ways that a normal voice can sound. Normal is not a single state but rather exists on a continuum" (Colton and Casper, 1996, p.270).

A normal voice may be characterized by five aspects that constitute a functional description of normal voice: loudness, hygiene, pleasantness, flexibility, and representation (Boone & McFarlane, 2000, p.18). These are:

- The voice must be loud enough to be heard.
- The normal voice must be produced in a manner that does not produce vocal trauma and thus laryngeal lesions, or in other words, hygienic voice production.
- The normal voice should be pleasant to listen to or pleasing in vocal quality.
- The normal voice should be flexible enough to express emotion.
- The normal voice should represent the speaker well in terms of age and gender.

Good tone focus or "forward" tone focus is a generally accepted characteristic of healthy, efficient voice production (Boone & McFarlane, 2000; Stemple et al., 2000; Verdolini, 1998). Perkins (1983) (cited in Boone & McFarlane, 2000, p.188) describes

that “voice that feels focused high in the head” is a more efficient voice, and it can survive extensive vocalization. “Focus refers to the resonance of the voice in the supraglottic vocal tract” (Stemple et al., 2000, p.301). A relaxed or open position of the vocal tract allows the sound to resonate freely, creating a “forward focus” or “placement” of tone. The forward placement allows the voice to resonate throughout the pharyngeal, nasal, and oral cavities without effort or tension (Stemple et al., 2000).

Teachers of singing often use very expressive terminology when describing a good vocal tone. McKinney (1994) states that a singer or speaker must have a valid concept of good vocal sound in order to establish good phonatory habits. The following descriptive expressions are thought to be important characteristics of good vocal sound (McKinney, 1994, p.77):

- Freely produced
- Pleasant to listen to
- Loud enough to be heard easily
- Rich, ringing, resonant
- Energy flows smoothly from note to note
- Consistently produced
- Vibrant, dynamic, and alive
- Flexibly expressive

#### Occupational Risks for Teachers

A study in 1997 identified the prevalence of professional voice users in different work settings in the United States. For that study a professional voice user was defined as: “(a) those who depended on consistent, special, or appealing voice quality as a primary tool of trade, and (b) those who, if afflicted with dysphonia or aphonia, would generally be discouraged in their jobs and seek alternative employment” (Titze et al., 1997, p.254). The results estimated that 5-10% of the workforce in the United States

were “heavy occupational voice users” (Titze et al., 1997). One of the largest groups of professional voice users in the United States is teachers. According to the Digest of Education Statistics (2001), 4.5 million elementary, secondary, and higher education teachers are employed in the United States (Digest of Education Statistics, 2001, Table 4).

Teachers are considered an at risk population for vocal problems. This risk has been attributed to factors such as vocal abuse and misuse due to the vocal demands of teaching, the poor acoustic environments in which they work, environmental conditions of school facilities, the lack of vocal education and training, length of career, types of teaching, and even factors related to the individual’s emotional state such stress and anxiety (Mattiske, Oates & Greenswood, 1998).

Vocal abuse and misuse due to the vocal demands of teaching and the poor acoustic environments of the classroom have been frequently hypothesized as causal factors of vocal problems among teachers (Mattiske et al., 1998). Vocal misuse refers to voicing behaviors that contribute to the development of laryngeal pathologies, such as nodules, cysts, polyps, and contact ulcers. The term vocal misuse includes behaviors of vocal abuse, in addition to the use of inappropriate pitch, loudness, breathing patterns, speech rate, and other vocal habits. Vocal abuse occurs when the vocal folds adduct forcefully leading to hyperfunction of the laryngeal mechanism (Stemple et al., 2000). Often vocal misuse behaviors become vocally abusive, resulting in a greater likelihood of trauma to the laryngeal mucosa (Colton & Casper, 1996). Some examples of vocally abusive behaviors are: shouting, loud talking, screaming, vocal noises, not warming up the voice prior to extensive use, and persistent coughing and throat clearing (Stemple et al., 2000).

Allergies, colds, sinus problems, and other upper respiratory illnesses are also thought to contribute to the development of voice disorders. Teachers are frequently exposed to upper respiratory infections that negatively affect their vocal mechanism

(Smith, Gray, Dove, Kirchner & Heras, 1997). They experience significantly more allergies, colds, and laryngitis as compared with nonteachers (Roy et al., 2004). Many teachers work in old public school buildings that are in need of physical repair or replacement. These school buildings often contain high levels of mold and fungi due to indoor moisture problems (Santilli & Rockwell, 2003). A limited number of studies have attempted to determine the health effects of mold exposure on teachers' health (Santilli, 2002; Patovirta, Meklin, Nevalainen & Husman, 2004). The results have shown that a wide range of health problems, including upper respiratory diseases, may be attributed to indoor mold exposure (Santilli, 2002). The National Institutes of Health (NIH) recognizes that mold can have a negative impact on health, causing allergic rhinitis. Mold and fungi exposure can lead to several different kinds of illness, including infections, allergies, asthma and other lung diseases (NIH, 2003).

One study reported extensive voice use for teachers during a typical work day or work week (Smith, Lemke, Taylor, Kirchner & Hoffman, 1998). On average, teachers provided instruction in more than six classes per day with almost five hours of continuous instruction. This yielded an average of 6.3 hours of talking at school each day, including two hours of talking over background noise. On average, teachers experienced more than 2 hours of loud talking for 3 ½ days each week, and shouted over thirty minutes daily at least twice a week (Smith et al., 1998). One of the most common communication problems experienced by teachers is talking over background noise (Smith et al., 1997). Holbrook (1977) (as cited in Orr, Jong & Cranen, 2002) found that during a six hour teaching day, primary school teachers used their voices an average of 77 minutes, including 20 minutes at decibel levels greater than 75dB (Orr et al., 2002).

#### Prevalence of Voice Problems Among Teachers

Many studies have attempted to establish the prevalence of voice problems in teachers (Miller & Verdolini, 1995; Roy et al., 2004; Russell et al., 1998; Sala, Laine,

Simberg, Pentti & Suonpää, 2001; Simberg, Laine, Sala & Rönnemaa, 2000; Smith et al., 1997; Smith et al., 1998). The majority of studies on the prevalence of voice problems in teachers have obtained data via self-report questionnaires. The findings demonstrate consistently that teachers experience self-reported voice problems at a higher rate than do individuals in other occupations.

In 1997, Smith, Gray, Dove, Kirchner, and Heras compared the frequency and effects of voice problems in teachers to a group of individuals employed in other occupations. The self-report questionnaire obtained information about the frequency of specific voice symptoms, the physical discomfort associated with those symptoms, and work-related problems as a result of those voice conditions. They found that teachers reported an average of twice as many vocal symptoms as nonteachers, were twice as likely to report symptoms of physical discomfort and to identify their voice as a problem in their future vocation (Smith et al., 1997). Teachers reported that voice problems had a significant effect on their current job performance. This was one of the first studies to confirm that teachers are more likely than individuals in other occupations to experience voice problems (Smith et al., 1997).

Smith, Lemke, Taylor, Kirchner, and Hoffman (1998) compared the differences of voice problems among teachers by gender and teaching characteristics. The results confirmed that elementary and high school teachers have a higher frequency of self-reported voice problems than individuals who work in other occupations. In this study, more than 38% of the participants reported that teaching had produced a negative impact on their voice, and almost 60% of teachers stated that their voice had been a problem at work during the previous year because it did not function properly (Smith et al., 1998).

Russell, Oates & Greenwood (1998) investigated the prevalence of self-reported voice problems during teachers' careers, during the present teaching year, and on the day of the survey. The findings revealed that 16% of teachers reported having voice problems

on the day of the survey, 20% reported having problems during the current teaching year, and 19% reported having problems at some time during their career (Russell et al., 1998). Overall, 22% of teachers reported experiencing regular voice problems that interfered with their ability to use their voices (Russell et al., 1998).

Few studies of the prevalence of voice problems among teachers (Simberg et al., 2000; Sala et al., 2001) have included a clinical examination by a laryngologist. One such study investigated the prevalence of voice disorders among future teachers. The study involved 226 students whose voices were assessed perceptually by a speech therapist, and if deemed necessary a clinical examination by a laryngologist. Twenty-four percent had abnormal voice quality, experienced two or more vocal symptoms weekly or more often, and were referred to the laryngologist for examination. Of the 24% who underwent laryngoscopic clinical examination, 89% of those students had an organic voice disorder. Results showed that voice problems are frequent among future teachers (Simberg et al., 2000). Sala, Laine, Simberg, Pentti, and Suonpää (2001) studied the prevalence of voice disorders among day care center teachers compared with nurses. Evaluative measures were a vocal symptoms questionnaire and a clinical examination performed by a laryngologist to assess voice quality and laryngeal status. Results demonstrated that teachers at day care centers had significantly more voice disorders than did nurses (Sala et al., 2001).

A recent study conducted by Roy, Merrill, Thibeault, Parsa, Gray, and Smith, (2004) is the largest epidemiologic study of the prevalence of voice disorders among randomly sampled teachers and the general population. The findings indicated that a large portion of the general population, and an even larger portion of the teaching profession, will experience a voice disorder during their lifetime. Almost 58% of teachers compared to 29% of nonteachers reported having experienced a voice problem that interfered with communication, and 11% of teachers compared to 6.2% of nonteachers reported current voice disorders. Eighty-one percent of the teachers, who indicated that they had

previously experienced a voice disorder, reported that they had experienced another voice disorder since that time, suggesting that teachers may be prone to frequent voice problems. The results of this study indicated that teachers represent a high-risk group for voice disorders and that there is also a considerable prevalence of voice problems in the general population (Roy et al., 2004).

A questionnaire study conducted in 1995 by Miller and Verdolini estimated the frequency of current and past self-reported voice problems in singing teachers and control subjects. Demographic factors, voice use patterns, exposure to dehydrating agents, and voice history were evaluated as possible risk factors for a current voice problem (Miller & Verdolini, 1995). Teachers of singing appeared to be at almost four times the risk for experiencing a voice disorder at some point in time than the population at large. Use of drying medications and experience of past voice problems were two risk factors shown to increase the likelihood of a current voice problem (Miller & Verdolini, 1995).

A limited number of studies have examined the frequency of voice problems among the teaching population in relation to their clinical representation. Titze, Lemke & Montequin (1997) found that, according to a data set at the University of Wisconsin (Bless, 1996), teachers represented about 20% of the of voice professionals typically seen in clinics, followed by singers (11%), salespeople (10%), clerks (9%), administrators and managers (7%), and factory workers (6%). In combined results from two large-scale studies from the United States and Sweden (Fritzell, 1996; Titze et al., 1997) (as cited in Verdolini & Ramig, 2001) teachers were found to be the most at-risk occupational group for voice problems and were represented clinically about four times more than the population at large.

#### Prevalence of Voice Problems and Gender

Several studies have shown that women, regardless of their occupation, have a higher prevalence of voice disorders (Coyle, Weinrich, & Stemple, 2001; Roy et al.,

2004; Russell et al., 1998; Smith et al., 1998). In one study, female teachers reported experiencing voice problems in the past more frequently than male teachers and were more likely to seek medical care when they developed voice problems. Females also reported a significantly higher frequency of both chronic and acute voice symptoms, such as hoarseness or vocal fatigue. These job related voice problems make female teachers more likely to be impaired in their ability to teach possibly leading to a reduction in overall teaching demands (Smith et al., 1998). Another group found that female teachers were twice as likely to report voice problems during their teaching careers as male teachers (Russell et al., 1998). In a recent study, investigators found that women reported a higher prevalence of voice disorders in comparison with men, regardless of age or occupational status (Roy et al., 2004).

#### Common Vocal Symptoms Among Teachers

A symptom is a specific problem and its characteristics reported by a patient. Symptoms are often what leads the patient to seek treatment and therefore, must be considered in diagnostic evaluation and treatment planning. When describing voice problems, a symptom may be described as a physical sensation associated with phonation, such as pain or soreness, or a complaint about perceptual characteristics of the quality of the voice, such as hoarseness, scratchiness, or breathiness (Colton & Casper, 1996). Colton and Casper (1996) describe nine major symptoms most commonly reported by individuals with voice problems: hoarseness, vocal fatigue, breathy voice, reduced phonational range, aphonia, pitch breaks or inappropriately high pitch, strain/struggle voice, tremor, and pain and other physical sensations.

Several studies have focused upon the vocal symptoms most commonly reported by teachers (Gotaas & Starr, 1993; Miller & Verdolini, 1995; Sala et al., 2001; Simberg et al., 2000; Smith et al., 1997; Smith et al., 1998). Smith and colleagues (1998) found that hoarseness, a tired voice, and difficulty speaking in a lower voice than normal were

the most frequently reported vocal symptoms. Scratchiness, tiredness, and roughness were the most frequently reported physical discomforts associated with voice production (Smith et al., 1998). A similar study revealed that hoarseness was the most common voice symptom, followed by tired voice, weak voice, effortful voice, and difficulty speaking in a low range (Smith et al., 1997).

In other studies (Simberg et al., 2000; Sala et al., 2001), throat clearing, tiredness of voice, and hoarseness were the most frequent vocal symptoms reported by teachers. The results from an early study in 1993 noted that 80% of the teachers surveyed experienced vocal fatigue and that the vocal demands associated with teaching contributed to vocal fatigue (Gotaas & Starr, 1993). Teachers of singing have reported that the most common voice symptoms they experienced were inability to produce high notes, tired voice, hoarseness, and effortful production (Miller & Verdolini, 1995).

#### Prevention

Very few studies have examined the effects and benefits of vocal education and prevention programs for teachers (Mattiske et al., 1998). “The prevention of vocal dysfunction should be the goal of all professionals involved in the care of vocalists, and good vocal habits should be encouraged as early as childhood” (Sataloff, 1998, p.259). Unfortunately, vocal training and prevention programs are not a standard part of most teacher training programs. The authors of several studies (Roy et al., 2004; Russell et al., 1998; Simberg et al., 2000; Smith et al., 1997; Smith et al., 1998; Yiu, 2002; ) suggest that vocal education and prevention programs are important for professional voice users, including teachers. The need for more research in this area is greatly needed. Vocal education programs that teach correct voice use and vocal hygiene are assumed to be of great value in preventing voice problems among the teaching population. This type of training may encourage teachers to seek assistance before a voice problem becomes severe or chronic (Mattiske et al., 1998).

Studies consistently have demonstrated that teaching produces a high risk of voice problems, suggesting that there are vocally abusive behaviors of a more universal nature associated with this vocally demanding occupation (Smith et al., 1998). Seventy-six percent of teachers surveyed in a study by Morton (1995) (as cited in Russell et al., 1998) indicated some degree of concern about their voice. The importance of including vocal hygiene intervention for teachers in efforts to reduce vocal fatigue, hoarseness, and other symptoms associated with teaching has been emphasized by researchers (Smith et al., 1997).

A significant relationship between the severity of voice problems and the duration of recovery time was found in a study by Russell, Oates & Greenwood (1998). Results revealed that less severe voice problems returned to normal more quickly than severe voice problems. Prevention programs that help to identify and treat voice problems early on may reduce the severity and recovery time, ultimately reducing the overall impact of the voice problems (Russell et al., 1998). In a recent study, it was suggested that prevalence estimates should be used to develop health education programs designed specifically for teachers (Roy et al., 2004).

In a study investigating the impact and prevention of voice problems in the teaching profession, teachers were surveyed about their perception of their voice condition and the impact of voice problems on their communication, social life, personal emotions, and occupation. Teachers reported that strategies to help them care for their voices were one of the most important things they could learn in an educational voice program (Yiu, 2002).

### Voice Therapy

#### *Treatment Efficacy*

The term treatment efficacy addresses several questions related to treatment effectiveness, treatment efficiency, and treatment effects (Olswang, 1990) (as cited in Ramig & Verdolini, 1998). Few studies have been conducted to determine the

effectiveness of voice therapy. Ramig and Verdolini (1998) conducted a review of the literature on the efficacy of treatment for voice disorders primarily using studies that were published in peer-reviewed journals. The data were obtained from group and single-subject experimental designs, retrospective analyses, case studies, and program evaluation. Results determined that “experimental and clinical data does exist to support the effectiveness of voice treatment for voice disorders related to vocal misuse, hyperfunction, and muscle imbalance, including organic changes, special medical or physical conditions, and psychological disorders” (Ramig & Verdolini, S112). “The goal of behavioral voice treatment is to maximize vocal effectiveness relative to the existing laryngeal disorder and to reduce the handicapping effect of the voice problem” (Ramig & Verdolini, S104).

Roy and his colleagues (2001, 2003) have employed direct intervention approaches to treat teachers with voice problems. Roy, Weinrich, Gray, Tanner, et al. (2003) studied the effectiveness of three treatments for teachers with voice disorders in a randomized clinical trial. Teachers who were experiencing voice problems at the time of the study and/or regularly had experienced voice problems in the past were randomly assigned to three treatment groups for six weeks of therapy: voice amplification using the ChatterVox portable amplifier, resonant voice therapy, and respiratory muscle training. Those participants who received the ChatterVox portable amplifier or resonance therapy reported significant lowering of their degree of voice handicap and voice disorders severity. Other studies (Roy et al, 2002; Jonsdottir, Rantala, Laukkanen & Vilkmán, 2001) have also demonstrated the benefits of sound amplification as a component of treatment programs for teachers with voice problems.

A similar 6 week study was conducted by Roy, Gray, Simon, Dove, et al. (2001). The three treatment groups were: vocal hygiene education, vocal function exercises (Stemple), and a no treatment control group. The teachers who underwent vocal function

exercise training showed a reduction in the degree of patient-perceived handicap and reported more overall voice improvement. In addition, these participants reported greater ease and clarity of their speaking and singing voice. An earlier study (Stemple et al., 1994) has also shown the effectiveness of vocal function exercises.

### *Vocal Hygiene*

Vocal hygiene education and counseling is often considered an important component of any voice therapy treatment approach, whether it is the entire therapeutic program or only one part of it. In cases where misuse and abuse of the voice are the causative factors, vocal hygiene is a necessary part of treatment. Vocal hygiene education can also be used as a preventative measure in the final stages of voice therapy after objectives have been met, emphasizing the importance of carryover (Colton and Casper, 1996). A vocal hygiene program can help to develop positive alternatives to vocally abusive behaviors (Sataloff, 1998).

Vocal hygiene counseling is one of the most effective ways to remedy voice abuse and misuse. Suggested steps in this rehabilitative process are: identification of the abusive vocal behaviors, patient education regarding the effects of trauma on the vocal mechanism, and determination of exactly why the patient presents with specific vocal behaviors (Stemple et al., 2000). Subsequently, the treatment plan should involve “(a) eliminating the abusive behaviors that may be eliminated (b) modifying those abusive behaviors which cannot be totally eliminated to reduce the traumatic impact on the vocal mechanism and (c) manipulating the environment to secure more favorable voicing conditions” (Stemple et al., 2000, p.274).

Several studies have been conducted to evaluate the effectiveness of vocal hygiene education for teachers (Chan 1994, Holmberg et al. 2001, Roy et al., 2001, 2002). One important study investigated the efficacy of a vocal hygiene education program implemented for kindergarten teachers. Fifty kindergarten teachers were divided

into two groups: a treatment group that participated in a 1.5 hour workshop on vocal hygiene education and daily practice of vocal hygiene for two months, and a control group that did not receive any treatment. Results suggested that kindergarten teachers improved their voices and showed significant voice improvement with vocal hygiene education, regardless of age and years of experience. Participants who received no treatment showed no significant change in their voices (Chan, 1994).

### *Comparison of Speaking and Singing*

The laryngeal mechanism and the physical processes involved for speaking and singing are fundamentally the same. Furthermore, speaking and singing share the same respiratory, phonatory, resonatory, and articulatory systems. Speech and song do not sound the same; however, the differences exist only in degree or extent of usage. Singing can be thought of as stretched-out or prolonged speech, therefore, a skilled speaker and singer can shift from speaking tasks to singing tasks with relative ease (McKinney, 1994). Some singing authorities believe that the singing voice is a natural extension of a good speaking voice (Sataloff, 1998).

Normal speech differs from singing in several ways (McKinney, 1994):

- Speech is produced in a much more restricted range of pitches than singing.
- Normal speech is produced at a faster rate than singing.
- The distribution of sound energy differs when speaking and singing.
- Speech utilizes neutral, unstressed vowel sounds more than singing does.
- Speaking does not require the breath capacity and control that singing does.

### *Singing in Voice Therapy*

In an article published in the *NATS Bulletin* in 1969, Berton Coffin, makes the following statements about singing:

Surely our profession exists to raise the quality of human life. One of the priority skills in our culture is the use of the human voice by which most of our

communications take place—we may call ourselves teachers of singing, or we may call ourselves teachers of voice. Both pertain to the use of the same wonderful instrument as a means of communication. The teaching of singing and of voice should be inextricably interwoven. Our efforts should be directed both to stardom on the musical stage, and success in daily life – as teachers, preachers, salesmen, legislators or business men through the use of the vocal instrument.

Singing brings about an aesthetic, social, psychological and physiological transformation of the personality. The voice is never the same after vocal study. The laughter is more exuberant, there is greater poise of the individual, and the qualities of the voice forever changed – the personality has been augmented. (Coffin, 1989, pp.262-263).

Specialized singing training can be beneficial to nonsingers with voice problems. Singing training in its beginning stages teaches techniques that increase abdominal, laryngeal and neck muscle strength, develop diaphragmatic breath control and management, and facilitate relaxation during phonatory tasks. This training is accomplished through techniques that are very similar to the ones used in voice therapy for the speaking voice. Singing provides “aerobic” exercises and training that can ultimately enhance the speaking voice, so that the demands of speaking seem less difficult for the professional voice user following training (Sataloff, 1998). The singing teacher brings an introspective set of skills to the therapy setting with respect to the instruction of breathing patterns, support, and placement of the voice. These skills can often expedite voice therapy and improve results (Sataloff, 1998).

Abdominal exercises, breath control, and good body posture help to develop the power sources of the voice and are a standard part of singing lessons. Singing exercises involve training in all areas of the singer’s anatomy. Singing lessons provide the following through a variety of vocal exercises (Sataloff, 1998):

- increased neuromuscular strength and coordination at the laryngeal level
- improved range, quality, and vibratory symmetry
- smooth control over changes in subglottal pressures, registers, and other variables

- optimal vocal tract position and shape creating the desired harmonics without unnecessary muscle tension
- improved resonance

This training process leads to consistent, gradual improvements for the student, resulting in improved vocal quality, phonational range, breath support and management, efficiency of voice use, and stamina and endurance of the voice (Sataloff, 1998).

#### *Resonant Voice Therapy*

Resonant Voice Therapy (RVT) is a holistic voice therapy program developed by Katherine Verdolini (Verdolini, 1998). The exercises are based on techniques to improve voice production in actors and singers (Colton & Casper, 1996; Lessac, 1997).

Resonant voice is defined as voice production involving oral vibratory sensations, usually on the anterior alveolar ridge or higher in the face in the context of easy phonation. It is a continuum of oral sensations and easy phonation building from basic speech gestures through conversational speech. The therapy goal is to achieve the strongest, cleanest, possible voice with the least effort and impact between the vocal folds to minimize the likelihood of injury and maximize the likelihood of vocal health. (Stemple et al., 2000, p.340).

The training methodologies of RVT are experimental and focus on the processing of sensory information (Verdolini, 1998). A study on laryngeal adduction in resonant voice use (Verdolini, Druker, Palmer & Samawi, 1998) suggested that when resonant voice was produced correctly, it was associated with vocal folds that were barely adducted or barely abducted (Verdolini et al., 1998.) This position of the vocal folds appears to produce a strong, clear voice while requiring the least amount vocal fold impact stress and lung pressure needed for vocal fold vibration. Resonant voice is a relatively strong, clear voice that is physically easy to produce and appears to provide some protection from injury (Verdolini, 1998). Stemple and colleagues report that RVT has been found useful in the training of forward focus voice production and complementary in therapy

programs used for a wide variety of voice disorders (Stemple et al., 2000). The results from a recent clinical trial provided some of the first objective evidence that supported the use of resonance therapy as a treatment alternative for teachers with voice disorders (Roy et al., 2003).

## CHAPTER III

### METHODS

#### Participants

The participants for this study were recruited through distribution of a promotional flyer (Appendix A) and by word of mouth. The target group included classroom teachers (primary and secondary), university instructors, and individuals in any other teaching occupation. In response to this inquiry, five adult females volunteered as participants. Inclusion criteria for this study were (1) employment in a teaching occupation, (2) ages 22 to 45 years, (3) normal intelligence as evidenced by graduation from an accredited college or university, (4) employment in a professional setting, (5) English as first language, and (6) passing a hearing screening.

#### Procedures

##### *Pre-Test*

The purpose of the pre-test was to identify the vocal symptoms that each participant experienced and the vocal behaviors and vocally abusive patterns used by each participant. All testing was conducted in the Applied Communication Sciences Lab in Ferguson Building on UNCG's campus and took approximately 45-60 minutes. All testing was recorded via audio tape and with written records. The pre-test consisted of the following components for each participant:

##### *Permission*

Prior to any testing, all participants were informed of their rights by way of a short oral presentation and a participant consent form that was signed before testing began. Each participant was assigned a number to protect their privacy, so that he or she was not identified by name as a participant in this study.

### *Hearing Screening*

At the time of the pre-test, each participant was given a hearing screening using a portable audiometer. Participants were required to pass octave frequencies from 500 to 8000 Hz at the 25 decibel level to be included in the study.

### *Interview*

During a brief interview, the investigator asked each participant a series of questions related to their present voice concerns, medical history, previous voice experiences (i.e., training for speaking or singing voice, etc.), professional and avocational activities, and current demands placed on the voice. These questions can be seen in Appendix B.

### *Questionnaires*

The participants were given two questionnaires to fill out during the pre-test. The Voice Handicap Index (VHI) (Appendix C) helped the examiner to gain an understanding of the functional impact of the voice disorder on the individual in daily life. The 30 multiple choice items examines self-perceived voice severity as related to functional (impact of the patient's voice disorder on daily activities), physical (self-perceptions of laryngeal discomfort and voice output characteristics), and emotional (patient's affective responses to the voice disorder) issues. A 5 point scale was used to rate each statement as it reflected the participants' experience with their voice problem (1=Never, 2= Almost Never, 3=Sometimes, 4=Almost Always, 5=Always). The ratings of the 30 statements were totaled to give each participant a VHI score (Jacobson et al., 1997; Stemple et al, 2000).

The Vocal Symptoms Questionnaire (Appendix D) required the participants to circle voice use patterns that were appropriate to them in four separate categories: Speaking (i.e., talking too loudly, frequently "hoarse"), Singing (i.e., inadequate breath support, jaw tension), Vocal Health (i.e., exposure to dust or fumes, current medications),

Choral Pedagogy (i.e., vocal fatigue after rehearsals, no previous singing training), and Pathologies (i.e., vocal nodules, acid reflux). There was also an opportunity on this questionnaire for each participant to note any additional voice concerns they were experiencing.

### *Voice Evaluation*

A complete voice evaluation (Appendix E) was performed on each subject, evaluating the following measures:

Maximum Phonation Time and s/z ratio were obtained by use of a stopwatch.

- Maximum Phonation Time (MPT) refers to the maximum time a subject can sustain a tone on one breath. The subjects sustained /ah/ for as long as possible until running out of air for three consecutive trials.
- s/z ratio refers to the ratio between an individual's ability to sustain vocalization (i.e., /z/) for a period of time equal to that of sustained expiratory airflow without vocalization (i.e., /s/). This measure was designed to examine the effect of pathology on phonation. The subjects sustained /s/ and /z/ for as long as possible until running out of air for three consecutive trials.

Maximum phonational range, habitual pitch, frequency perturbation, and amplitude perturbation were obtained by use of the CSL (Computerized Speech Lab), a self-calibrating PC-based speech and signal processing software program that contains a broad range of voice analysis tools and is used for speech analysis in research and clinical settings.

- Maximum phonational range or pitch range refers to the range of frequencies (measured in Hertz), from lower to highest, that

a person can produce. The subjects phonated on /ah/ from the middle to the highest part of their range, and from the middle to the lowest part of their range for three consecutive trials.

- Habitual pitch refers to the frequency (measured in Hertz) that an individual habitually uses in reading and conversational speech. The subjects read a passage of text and conversed with the principal investigator.
- Frequency perturbation refers to the variation of fundamental frequency (measured in percentage) present in a sustained tone. The subjects sustained /ah/ for 4 seconds for three consecutive trials.
- Amplitude perturbation refers to variation of amplitude (measured in decibels) of the vocal fold tone from one cycle of vibration to the next during a sustained tone. The subjects sustained /ah/ for 4 seconds for three consecutive trials.

Vital Capacity was obtained by use of a hand held spirometer, a device used to measure timed expired and inspired lung volumes.

- Vital Capacity refers to the amount of air that can be forcibly expelled from the lungs after breathing in as deeply as possible. The subjects took a very deep breath and exhaled the air as fast and as forcefully as possible into the mouthpiece for three consecutive trials.

In addition to the above described measures, perceptual judgments were made throughout the evaluation by the examiner about intensity, intensity range of the voice, the breathing mechanism, the rate of speech, and connected speech. These were recorded via written records in the Qualitative Judgments section of the Voice Evaluation Form (Appendix E).

### *Therapy Approach*

Following the pre-test, each subject participated in six individual voice therapy sessions with the principal investigator. These one hour sessions took place over a period of four weeks, with a minimum of two days between sessions. The purpose of the therapy approach was to reduce the vocal symptoms and modify the specific vocal behaviors or patterns of vocal abuse that were identified during the pre-test, and to implement a good vocal hygiene program. During the therapy period, each participant was required to keep a daily voice journal, recording all information relevant to their voice condition on each day.

The therapy approach used was individualized and specified to each participant's pre-test results. Each session included vocal exercises for the speaking voice as well as the singing voice, incorporating the following goals: (1) good body posture and alignment, (2) proper diaphragmatic breathing, (3) appropriate pitch patterns, (4) appropriate resonance patterns, and (5) appropriate levels of laryngeal tension. During the first of the six therapy sessions, normal laryngeal anatomy was introduced and explained to each participant by the investigator, with the aid of pictures and diagrams (Appendix F).

### *Voice Journal*

Each participant was required to keep a daily voice journal, which was provided by the investigator at the first voice therapy session, for three consecutive weeks (Appendix G). In this journal, they kept written records of all information relevant to their voice condition on each day. The categories of this information were diet (food and beverage), voice use, voice symptoms experienced, vocal exercise and warm-up routine, and any other information that the participant felt was important to report about their voice that day.

### *Vocal Hygiene Program*

Each participant was required to follow a vocal hygiene program that was discussed in the first session. At this time, the investigator discussed various vocal misuse

or abuse patterns and some positive alternatives to those behaviors. Each participant was given a handout with the vocal hygiene program by the investigator (Appendix H).

### *Therapy Techniques*

The following therapy techniques and exercises were used with each participant. Each session was recorded via audio tape. The participants were given a copy of each tape and encouraged to practice the new techniques learned in each session as a vocal warm-up routine once or twice daily between sessions.

#### *Posture.*

Each participant was guided in establishing good body posture and alignment for speech and singing. Steps for this component of therapy can be seen in Appendix I.

#### *Diaphragmatic Breathing.*

Each participant was given a description of the abdominal/diaphragmatic breathing process, followed by a series of breathing exercises (Appendix J). The exercises progressed from consonant-vowel combinations (i.e., ha) to speech tasks such as counting, phrases, and eventually reading and conversation.

#### *Resonant Voice Therapy (RVT).*

Resonant Voice Therapy (Appendix K) is a holistic voice therapy program developed by Katherine Verdolini and is based on the work of Arthur Lessac. See chapter II for a more detailed description of this voice therapy approach. Each participant was taught the basic training gesture, which is a special type of humming that gradually expands to functional phrases and ultimately conversational voice through a seven step program (Stemple et al., 2000; Verdolini, 1998).

#### *Singing Exercises.*

A series of brief singing exercises was used in each session. Scale tones for the musical patterns are represented by numbers 1-5 (Appendix K).

### *Post-test*

A post-test was given six weeks after the final session of the voice therapy period. The purpose of the post-test was to determine generalization and carryover of the new vocal behaviors learned during the therapy period, and whether or not the subjects were maintaining healthier voice use and better vocal hygiene habits in their daily lives. All testing was conducted in the Applied Communication Sciences Lab in Ferguson Building on UNCG's campus and took approximately 45-60 minutes. All testing was recorded via audio tape and with written records. The post-test consisted of the following components for each participant:

#### *Interview*

During a brief interview, the investigator asked each participant a series of questions related to their present voice concerns, medical history, previous voice experiences (i.e., training for speaking or singing voice, etc.), professional and avocational activities, and current demands placed on the voice. A detailed list of interview questions can be seen in Appendix B.

#### *Questionnaires*

The participants were given two questionnaires to fill out during the post-test. The ratings of the 30 statements from the Voice Handicap Index (VHI) were totaled for both pre-treatment and post-treatment scales. A total change of 18 points or more represented a significant change in the participants' psychological functioning, as related to the voice disorder. The participant's responses from the Vocal Symptoms Questionnaire (Appendix D) were evaluated before and after treatment.

#### *Voice Evaluation*

A complete voice evaluation (as stated above in the pre-test section) was performed on each subject following treatment. Objective measures for Maximum Phonation Time (MPT), s/z ratio, Maximum Phonational Range, Habitual Pitch, Frequency Perturbation,

Amplitude Perturbation were obtained during this evaluation. Perceptual voice quality characteristics were also determined by the examiner.

### Perceptual Analysis

#### *Reliability*

During the voice evaluation at the time of testing (pre-test and post-test) the examiner will make subjective perceptual judgments about each participant's voice in the areas of pitch (i.e., monopitch, inappropriate pitch, pitch breaks, reduced pitch range), loudness (i.e., reduced loudness variability, loudness variation, reduced loudness range), and quality (i.e., hoarseness, roughness, breathiness, tension, tremor, strain/struggle). All data will be collected by the examiner at the time of testing. Audio recordings will be made of a connected speech sample and reading passage for each participant for perceptual analysis in the following areas: pitch, loudness, and quality. The data will be placed on a master recording in randomized order and judged by two second year speech pathology graduate students. The perceptual judgments will then be compared with the examiner's judgments and only those judgments in which there is 90% agreement will be used for data analysis.

#### *Data Analysis*

The results for each participant for the Voice Handicap Index (VHI), Vocal Symptoms Questionnaire (VSQ), and voice evaluation will be analyzed as single case studies. A discussion will summarize the differences in self-perceived voice severity, experience of vocal symptoms, measurements from the voice evaluation, and results from the treatment program for each participant. Selected information from each participant's voice journal may also be included. All results for each participant will be displayed in a table.

The Voice Handicap Index (VHI) will provide results about how each participant perceives their voice severity as related to functional, physical, and emotional issues. The ratings of the 30 statements will be totaled to give each participant an overall VHI

score. A change of 18 points or more between pre- and post-testing results will represent a significant change in the participants' psychological functioning, with respect to their voice problem.

The Vocal Symptoms Questionnaire (VSQ) will provide results about which vocal symptoms each participant experiences before and after treatment. The total number of vocal symptoms will be calculated to provide a VSQ score. The pooled data for vocal symptoms for the participants will be listed in a table to show order of prevalence.

Differences in measurements from the voice evaluation (Maximum Phonation Time, Vital Capacity, s/z ratio, pitch range, habitual and optimum pitch, frequency perturbation, and amplitude perturbation) before and after treatment will be discussed in each case study. Any changes in perceptual and qualitative judgments made by the principal investigator about intensity and intensity range of the voice, the breathing mechanism, the rate of speech, and connected speech will also be discussed.

## CHAPTER IV

### RESULTS

#### Case Study: Participant 1

##### *Background*

Participant 1 was a 42 year-old music therapist with an 11 year history of voice problems. In addition to her job as a music therapist, she also taught Kindermusik classes, preschool, and private flute and guitar lessons. Her teaching career spanned a total of 24 years. Participant 1 began having voice problems in the fall of 1993. Her symptoms developed gradually over a few months, and by November 1993, she reportedly had “lost” her voice. She worked weekly with a voice therapist and reported that her voice improved greatly by June of the following year. She participated in what she considered “successful” voice therapy for the next five years without experiencing a return of symptoms. In June of 1998, participant 1 was reportedly diagnosed by her otolaryngologist with a unilateral vocal fold cyst, a reactive nodule on the opposite vocal fold, and vocal fold scarring. She subsequently had the cyst removed. Following surgery, she had voice therapy for a six month period without significant improvements.

Participant 1 was a generally healthy, nonsmoker with a history of allergies and gastroesophageal reflux. She reported inadequate sleep and rest and unresolved stress at work and home. She reported no regular exercise, but considered herself to be very active during teaching activities. Medications included Acifex for reflux, and Singulair, Zyrtec, and Nasacort for allergies. Her daily intake of fluid included more than 5 servings of water, 1-2 servings of tea, 1-2 servings of herbal tea, 1 serving of coffee per week, and 1 serving of caffeinated soda per week.

Participant 1's reported symptoms at the time of the initial evaluation for this study were considerable vocal fatigue following short periods of singing and speaking, chronic hoarseness, and loss of high range in her singing voice. Reflux symptoms included heartburn, indigestion, and throat clearing. Participant 1 reported using her voice an average of more than 10 hours on a lengthy teaching day. She missed work because of her voice problems an average of 10 days during the previous year, although she frequently taught when she was laryngitic. She described poor acoustics and excessive noise in her classroom environment. Participant 1 described significant singing voice demands on a daily basis. She had formal singing lessons in high school and sang in choirs throughout college, but at the time of this study, had refrained for years from any singing activities in addition to those during teaching. Participant 1's specific vocal concerns for her job were the length of time that she had to use her voice on a daily basis and raising her voice over noise in the classroom.

#### *Perceptual Signs*

During the pre-treatment voice evaluation participant 1's voice exhibited moderate raspiness, mild breathiness, and intermittent vocal fry, especially at the end of utterances. Hard glottal attacks were present, although intermittent. Pitch was slightly low. Volume and rate of speech were judged to be within normal limits. Breath support for speech was poor, characterized by shallow inhalation, insufficient replenishment of air during connected speech, and intermittent use of functional residual capacity. Participant 1 also presented with upper body, neck, and laryngeal tension. The results of interjudge reliability displayed the following pre-test ratings for participant 1: Mild to moderate degree of overall dysphonia (44/100), mild to moderate roughness (41/100), mild to moderate breathiness (38/100) and strain (38/100). Modal pitch (42/100) was judged to be mild to moderately low for the participant's age and gender while loudness (38/100) was judged to be mild to moderately loud. All voice attributes were judged to be

consistently present in this participant’s pre-test reading passage sample.

At the time of the post-treatment evaluation, participant 1’s voice exhibited mild raspiness, very mild breathiness, and continued intermittent use hard glottal attacks. There was a significant reduction in vocal fry. Breath support for speech was improved with adequate abdominal inhalation and a reduction in the use of functional residual capacity during connected speech. Pitch, volume, and rate of speech were judged to be within normal limits. The results of interjudge reliability displayed the following pre-test ratings for participant 1: Mild to moderate degree of overall dysphonia (46/100), mild to moderate roughness (43/100), mild to moderate breathiness (42/100) and strain (41/100). Modal pitch (29/100) was judged to be mildly low for the participant’s age and gender while loudness (38/100) was judged to be mildly loud. All voice attributes were judged to be consistently present in this participant’s post-test reading passage sample.

*Objective Measurements*

Results for the pre- and post-treatment instrumental and non-instrumental voice evaluation measures for participant 1 are shown in Table 1.

Table 1. Participant 1- Objective Voice Evaluation Measurements

	Pre-test	Post-test
Maximum Phonation Time (MPT)	15 sec	17 sec
Vital Capacity	2.65 L	2.66 L
s/z ratio	2.06	2.1
Maximum phonational range (Hz)	568 Hz	559 Hz
Highest Frequency	663 Hz	668 Hz
Lowest Frequency	95 Hz	109 Hz
Fundamental Frequency		
Reading Passage	196 Hz	187 Hz
Conversation	174 Hz	200 Hz
Frequency Perturbation (Jitter)	1.77%	1.68%
Amplitude Perturbation (Shimmer)	.240 dB	.281 dB

### *Questionnaires*

Pre- and post-treatment results for the Vocal Symptoms Questionnaire (VSQ) are shown in Table 2. Participant 1 received an overall pre-treatment score of 73 and an overall post-treatment score of 45 on the Vocal Handicap Index (VHI). Table 3 shows the VHI total and subscales scores. A change of 28 points from pre- to post-treatment results indicated a significant shift in psychosocial function.

### *Results of Therapy*

Participant 1's specific goals during the course of treatment were as follows: (1) to improve posture during speech and singing (2) to improve abdominal/diaphragmatic breathing with focus on abdominal inhalation, coordination of expiratory airflow with the onset of voicing, and replenishment of air as needed during connected speech, (3) to reduce laryngeal tension with initiation of phonation, (4) to use a more forward tone focus and resonance pattern, (5) to establish use of easy onset, and (6) to use smooth, connected speech. She improved the quality of her voice with respect to goals 1, and 3-6. In addition, participant 1 increased her awareness for goal 2 during connected speech tasks, and continued to progress towards incorporating this technique in her conversational speech. The most difficult component of goal 2 was replenishment of air as necessary during connected speech. Participant 1 produced the most desired voice quality when focusing on smooth, connected speech.

By the end of the treatment period, participant 1's voice intermittently presented with a clearer, more efficient tone quality in the absence of laryngeal tension, with decreased vocal fry and hard glottal attacks. With respect to resonant voice therapy tasks, participant 1 demonstrated the ability to establish a more forward tone focus with minimal modeling by the clinician. By the end of the treatment period, participant 1 reached the reading passage level, and was progressing towards carryover and generalization in conversational speech. Participant 1 responded very well to the

relaxation/stretching and singing exercises used during each session. The singing exercises seemed to improve her ability to connect the breath and phonation. She reported that these exercises reminded her of techniques she found helpful in previous voice therapy and began using them again in her daily vocal warm-up. She reportedly benefited from them greatly, experiencing an increase in her high range for singing tasks.

Table 2. Participant 1- Results for Vocal Symptoms Questionnaire

<u>PRE-TREATMENT</u>	<u>POST-TREATMENT</u>
<b>SPEAKING</b>	<b>SPEAKING</b>
Speaking with vocal fry	Low pitch speaking voice
Breathy voice	Talking too much or too rapidly
Low pitch speaking voice	Talking while moving around vigorously
Talking too much or too rapidly	Talking over classroom, cafeteria, or barroom noise
Talking too loudly	Hoarseness first thing in the morning
Talking while moving around vigorously	Voice worse in the morning
Talking while lifting, bending, or moving arms	Vocal fatigue at the end of the work day or work week
Talking over classroom, cafeteria, or barroom noise	
Frequently “hoarse”	
Voice worse in the morning	
Voice worse later in the day, after it has been used	
Have or have had laryngitis	
Vocal fatigue at the end of the work day or work week	
Voice tires after speaking for short period of time	
Tightness in throat	
Loss of range	
Frequently clear your throat	
<b>SINGING</b>	<b>SINGING</b>
Abrupt voice onset	Excessive tension in voice or throat
Excessive tension in voice or throat	Poor posture, bent from waist at the piano
Too closed or tense jaw	Vocal fatigue after rehearsals
Poor posture, bent from waist at the piano	Loss of range
Neck tension	Difficulty singing high notes
Vocal fatigue after rehearsals	
Loss of range	
Difficulty singing high notes	

Table 3. Participant 1- VHI Total and Subscale Scores

Scale	Pre-treatment	Post treatment
Functional	26	19
Physical	28	15
Emotional	19	11
Total	73	45

Specific Vocal Hygiene program goals for participant 1 were to increase sleep and rest, reduce overall stress, to reduce overall daily voice use, to modify voice use during teaching activities (not raising voice over classroom noise, using nonverbal cues, using amplification system when voice felt fatigued), to warm-up voice daily, and to increase daily water intake. Participant 1 reported intermittent daily practice and vocal warm-up sessions and showed compliance with keeping weekly voice journal records. At the time of post-treatment evaluation, she reported increased awareness for and carryover of therapy techniques in daily voice use and teaching activities and an overall decrease in vocal symptoms such as hoarseness and vocal fatigue. She also reported being able to resume singing in her church choir on a weekly basis. Overall, participant 1 responded positively to therapy and made significant improvements in voice use.

#### Case Study: Participant 2

##### *Background*

Participant 2 was a 42 year-old first grade teacher with a 19 year teaching career. She reported a ten year history of voice problems. The onset of her difficulties was gradual, yet they have been persistent during that period of time. Participant 2 was a generally healthy, nonsmoker with no significant medical history. She reported getting adequate amounts of sleep, although she had some unresolved stress in her life. Medications included Imitrex for migraines, Wellbutrin for anxiety and depression, Prilosec for reflux (started in October 2004), and antacids for indigestion. Her daily intake of fluid included 1-2 servings of coffee, 2-5 servings of tea, 1-2 servings of

caffeinated soda, and 1-2 servings of water. Participant 2 had no previous training for her speaking voice, but studied singing for a brief period several years earlier.

Participant 2 described her voice as “hoarse,” and reported that her voice was a problem for her daily, although she experienced improvements in voice quality on the weekends and during summer break when free from her teaching responsibilities. It is important to note that the participant had not been teaching for at least a month when the initial evaluation was performed. During the academic school year, participant 2 reported using her voice on an average of more than six hours per day with very few breaks to rest during the work day. She had never missed work because of her voice, and reported frequently speaking and singing when she was laryngitic. She described “easy” voice use as almost impossible in her teaching environment, due to the age of her students and poor acoustics in the classroom. She also teaches in an old school building, and felt that this exposure to mold and mildew may be contributing to her voice problems. Her chief complaints or symptoms were hoarseness, vocal fatigue by the day’s end, low pitch speaking voice, and chronic “dryness” in the throat. Reflux symptoms included halitosis and a frequent sore throat. Additional vocal symptoms reported during pre- and post-treatment evaluation are shown in Table 5.

#### *Perceptual Signs*

Participant 2’s voice presented with moderate hoarseness, mild breathiness, frequent use of hard glottal attacks, and intermittent vocal fry, especially at the end of utterances. Breath support for speech was poor with shallow inhalation and consistent use of functional residual capacity. Volume was increased and rate of speech was fast at times. A moderate amount of laryngeal strain was also present during conversational speech. The results of interjudge reliability displayed the following pre-test ratings for participant 2: Mild to moderate degree of overall dysphonia (29/100), mild to moderate roughness (29/100), mild breathiness (15/100) and mild to moderate strain (30/100).

Modal pitch (38/100) was judged to be mild to moderately low for the participant's age and gender while loudness (30/100) was judged to be mild to moderately loud. All voice attributes were judged to be consistently present in this participant's pre-test reading passage sample.

At the time of the post-treatment evaluation, the clinician noted mild hoarseness, decreased breathiness, continued use of hard glottal attacks, and intermittent vocal fry during connected speech. Participant 2 continued to present with a moderate amount of laryngeal strain and tension. Breath support for speech was slightly improved with intermittent use of functional residual capacity at the end of utterances. Pitch and volume were judged to be within normal limits. Rate of speech was slightly fast. The results of interjudge reliability displayed the following post-test ratings for participant 2: Mild degree of overall dysphonia (19/100), mild roughness (20/100), mild breathiness (18/100) and strain (23/100). Modal pitch (7/100) and loudness (7/100) were judged to be essentially normal for the participant's age and gender. All voice attributes were judged to be consistently present in this participant's post-test reading passage sample.

#### *Objective Measurements*

Results for the pre- and post-treatment instrumental and noninstrumental voice evaluation measures are shown in Table 4.

#### *Questionnaires*

Pre- and post-treatment results for the Vocal Symptoms Questionnaire (VSQ) are shown in Table 5. Participant 2 received an overall pre treatment score of 31 and an overall post treatment score of 29 on the Vocal Handicap Index (VHI). Table 6 shows the VHI total and subscales scores. A change of 2 points from pre to post-treatment results indicated an insignificant shift in psychosocial function.

Table 4. Participant 2-Objective Voice Evaluation Measurements

	Pre-test	Post-test
Maximum Phonation Time (MPT)	10.1 sec	13.3 sec
Vital Capacity	2.93 L	2.94 L
s/z ratio	1.40	1.39
Maximum phonational range (Hz)	459 Hz	814 Hz
Highest Frequency	625 Hz	918 Hz
Lowest Frequency	166 Hz	104 Hz
Fundamental Frequency		
Reading Passage	223 Hz	233 Hz
Conversation	191 Hz	190 Hz
Frequency Perturbation (Jitter)	.606%	1.56%
Amplitude Perturbation (Shimmer)	.153 dB	.795 dB

*Results of Therapy*

Participant 2's specific treatment goals during the course of therapy were:

(1) to improve abdominal/diaphragmatic breathing with focus on coordinating expiratory airflow with onset of voicing, (2) to reduce laryngeal tension with initiation of phonation, (3) to use a more forward tone focus and smooth, connected speech, and (4) to reduce glottal fry, particularly at the end of utterances. She improved the quality of her voice production by accomplishing these goals, although integration of all techniques simultaneously was intermittent. Participant 2 needed only minimal cues and modeling by the end of the treatment period. By the 6<sup>th</sup> session, she had reached the reading passage level, and was progressing slowly towards carryover and generalization in conversational speech. Participant 2 was encouraged to experiment and incorporate these new techniques into her classroom teaching gradually, setting reasonable goals for herself on a daily basis. Participant 2 responded well and seemed to benefit greatly from the singing exercises used during the vocal warm-up portion of each therapy session. These exercises allowed her to become more comfortable with basic sound making (e.g., pitch glides) and seemed to improve laryngeal muscular control during phonation.

Table 5. Participant 2- Results for Vocal Symptoms Questionnaire

<u>PRE-TREATMENT</u>	<u>POST-TREATMENT</u>
<b>SPEAKING</b>	<b>SPEAKING</b>
Talking too much or too rapidly	Speaking with vocal fry
Talking over classroom, cafeteria, or barroom noise	Low pitch speaking voice
Frequently “hoarse”	Talking too much or too rapidly
Hoarseness first thing in the morning	Talking over classroom, cafeteria, or barroom noise
Voice worse later in the day, after it has been used	Frequently “hoarse”
Vocal fatigue at the end of the work day or work week	Voice worse later in the day, after it has been used
Tightness in throat	Vocal fatigue at the end of the work day or work week
Dry or scratchy throat	
Frequent sore throat	
Pain in throat while speaking	
<b>SINGING</b>	<b>SINGING</b>
Inadequate breath support	Inadequate breath support
Excessive tension in voice or throat	Pain in throat while singing
Too closed or tense jaw	Loss of range
Poor tone focus, voice “in the throat”	
Neck tension	
Pain in throat while singing	
Loss of range	
No vocal warm-up or cool down	

Table 6. Participant 2-VHI Total and Subscale Scores

Scale	Pre-treatment	Post-treatment
Functional	6	3
Physical	22	22
Emotional	3	4
Total	31	29

Specific Vocal Hygiene program goals for participant 2 were to decrease intake of caffeinated beverages, to increase daily water intake, and to warm up her voice before use. Participant 2 reported intermittent practice during the course of treatment, and did not keep detailed records in her voice journal. At the time of the post-treatment evaluation, participant 2 reported that vocal symptoms such as hoarseness were somewhat improved, but she continued to experience vocal fatigue and a “tightness” in

the throat on a daily basis with excessive use of her speaking voice. Since the end of the therapy period, she had reportedly been diagnosed by an otolaryngologist with severe gastroesophageal reflux and had begun medical treatment for this. She felt that this was a contributing factor to her voice problems. Overall, participant 2 responded positively to therapy and expressed motivation for continued practice and awareness for use of the learned vocal techniques during daily voice use.

### Case Study: Participant 3

#### *Background*

Participant 3 was a 40 year-old Kindermusik instructor who previously taught in the public school system for eight years (1986-1994). She began teaching children's music classes in 2000. In addition to her teaching responsibilities, participant 3 described moderate weekly singing demands at church; she sings in a small ensemble and performs solos about once a month. She was diagnosed with vocal fold lesions by her otolaryngologist in December of 2002, but reported experiencing voice problems as early as eighth grade. Participant 3 describes her voice as always having been a little "hoarse." She remembered "losing" her voice frequently after cheering at ballgames. During middle school, she was told by her doctor that she had pre-nodules on her vocal folds, and consequently, she stopped cheerleading activities in effort to take better care of her voice.

Participant 3 was a generally healthy, nonsmoker with a history of anxiety and laryngopharyngeal reflux. She reported getting adequate sleep and rest, and regular exercise several times a week. Medications and supplements included Zoloft for anxiety, Klonopin, Microgestin FE, Nexium for reflux, multi-vitamin, and calcium. Her daily intake of fluid included more than approximately 5 servings of water, and no caffeinated beverages.

In 2002, participant 3 started having more trouble with her voice as her teaching and singing responsibilities increased. She described the onset as being gradual over

several months. She reported being very “hoarse” and had extreme vocal fatigue by the last day of the teaching week, but experienced improved voice quality on the weekends. Participant 3 reported using her voice an average of more than six hours on a teaching day. She had never missed work for her voice, and reported speaking and singing in the past when she was laryngitic. Participant 3 was under the care of an otolaryngologist and a speech-language pathologist for more than one year. She had voice therapy during that period of time, and reported moderate improvements in her voice quality. Following her decision not to have surgery for her vocal fold lesions, participant 3 made significant modifications in her voice use, not only in the classroom, but during singing activities as well. She had minimal training for her singing voice which consisted of voice lessons for a few semesters in college and more recently in conjunction with her course of voice therapy.

Her reported symptoms at the time of the initial evaluation included increased hoarseness and breathiness following extended voice use, vocal fatigue, “dryness” in the throat, and “tightness” in the throat. Participant 3’s expressed goals for therapy were to be able to use the best speaking and singing voice possible on a daily basis.

#### *Perceptual Signs*

During the pre-treatment voice evaluation participant 3’s voice presented with intermittent mild hoarseness, mild breathiness, and intermittent use of hard glottal attacks. Breath support for speech was fair, with adequate abdominal inhalation, but insufficient replenishment of air during connected speech. There was intermittent use of functional residual capacity. Pitch and volume were judged to be within normal limits. Rate of speech was slightly fast during conversation. The results of interjudge reliability displayed the following average pre-test ratings for participant 3: Mild degree of overall dysphonia (18/100), mild roughness (16/100), mild to moderate breathiness (25/100) and mild strain (11/100). Modal pitch (7/100) was judged to be essentially normal for the

participant's age and gender while loudness (29/100) was judged to be mild to moderately loud. All voice attributes were judged to be consistently present in this participant's pre-test reading passage sample.

At the time of post-treatment evaluation, participant 3's voice presented with very mild breathiness and intermittent use of hard glottal attacks, although this was improved. Breath support for speech was good, with adequate abdominal inhalation, replenishment of air during connected speech, and significantly reduced use of functional residual capacity. Pitch, volume, and rate of speech were judged to be within normal limits. The results of interjudge reliability displayed the following average post-test ratings for participant 3: Mild degree of overall dysphonia (23/100), mild roughness (17/100), mild to moderate breathiness (33/100) and mild strain (11/100). Modal pitch (14/100) was judged to be slightly low for the participant's age and gender while loudness (13/100) was judged to be mild to moderately loud. All voice attributes were judged to be consistently present in this participant's post-test reading passage sample.

#### *Objective Measurements*

Results for the pre- and post-treatment instrumental and non-instrumental voice evaluation measures are shown in Table 7.

Table 7. Participant 3- Objective Voice Evaluation Measurements

	Pre-test	Post-test
Maximum Phonation Time (MPT)	13.0 sec	17.3 sec
Vital Capacity	1.97 L	2.20 L
s/z ratio	1.14	1.10
Maximum phonational range (Hz)	648 Hz	672 Hz
Highest Frequency	762 Hz	788 Hz
Lowest Frequency	114 Hz	115 Hz
Fundamental Frequency		
Reading Passage	196 Hz	190 Hz
Conversation	196 Hz	184 Hz
Frequency Perturbation (Jitter)	.970%	1.21%
Amplitude Perturbation (Shimmer)	.337 dB	.242 dB

### *Questionnaires*

Pre- and post-treatment results for the Vocal Symptoms Questionnaire (VSQ) are shown in Table 8. Participant 3 received an overall pre treatment score of 27 and an overall post treatment score of 27 on the Vocal Handicap Index (VHI). Table 9 shows the VHI total and subscales scores. A change of 0 points from pre- to post-treatment results indicated no shift in psychosocial function.

### *Results of Therapy*

Participant 3's specific therapy goals during the course of treatment were as follows: (1) to improve abdominal/diaphragmatic breathing with focus on increasing airflow, coordination of expiratory airflow with onset of voicing, and replenishment of air as needed during connected speech, (2) to reduce laryngeal tension with initiation of phonation, (3) to use a more forward tone focus and resonance pattern, (4) to use smooth, connected speech, (5) to establish use of easy onset, and (6) to reduce the rate of speech during connected speech. She improved the quality of her voice with respect to goals 1-5. In addition to these techniques, participant 3 also increased awareness for goal 6 during reading passages and intermittently during conversational speech. When all techniques were incorporated, participant 3's voice presented with a clearer, more efficient tone quality in the absence of laryngeal tension. With respect to resonant voice therapy tasks, she required much less of a warm-up period for finding forward tone focus by the 5<sup>th</sup> session, and was able to do so without modeling provided by the clinician. By the end of the treatment period, participant 3 had reached the reading passage level and was progressing rapidly towards carryover and generalization in her conversational speech. She reportedly was beginning to experience some carryover in her classroom teaching. Participant 3 responded very well to the singing exercises used during each session, and mastered each task with ease. She reported that these exercises served as a great warm-up for her voice before a long day of teaching.

Table 8. Participant 3- Results for Vocal Symptoms Questionnaire

<u>PRE-TREATMENT</u>	<u>POST-TREATMENT</u>
<b>SPEAKING</b>	<b>SPEAKING</b>
Speaking with vocal fry	Breathy voice
Breathy voice	Low pitch speaking voice
Low pitch speaking voice	Talking while lifting, bending, or moving arms
Talking too much or too rapidly	Inappropriate emphasis on vowel onset words
Talking too loudly	Use of fillers, “Uh-huh, OK, and , Uhm, etc”
Talking over classroom, cafeteria, or barroom noise	Voice worse later in the day, after it has been used
Inappropriate emphasis on vowel onset words	
Use of fillers, “Uh-huh, OK, and , Uhm, etc”	
Talking loudly at sports events	
Frequently “hoarse”	
Voice worse later in the day, after it has been used	
Have or have had laryngitis	
Vocal fatigue at the end of the work day or work week	
Tightness in throat	
Dry or scratchy throat	
<b>SINGING</b>	<b>SINGING</b>
Inadequate breath support	Inadequate breath support
Abrupt voice onset	Abrupt voice onset
Poor tone focus, voice “in the throat”	Poor tone focus, voice “in the throat”
Facial tension	Poor posture
Poor posture, bent from waist at the piano	
Neck tension	
Singing with jaw thrust or constriction	
Vocal fatigue after rehearsals	
No vocal warm-up or cool down	

Table 9. Participant 3- VHI Total and Subscale Scores

Scale	Pre-treatment	Post-treatment
Functional	4	7
Physical	21	17
Emotional	2	3
Total	27	27

Specific Vocal Hygiene program goals for participant 3 were to modify voice use in the classroom (not raising voice over classroom noise, using more nonverbal cues, and reducing overall voice use during class), to reduce time talking on the telephone, and to warm-up her voice daily. Participant 3 reported daily practice and warm-up sessions and showed compliance with keeping weekly records in her voice journal. At the time of the post-treatment evaluation, she reported teaching 4-5 weeks of the fall semester without experiencing vocal fatigue. Overall, participant 3 responded positively to therapy and made significant improvements towards use of a healthier, efficient voice quality due to her high level of motivation and commitment to practice.

#### Case Study: Participant 4

##### *Background*

Participant 4 was a 39 year-old preschool teacher with a 15 year teaching career. She was a generally healthy, nonsmoker with no significant medical history. She reported inadequate sleep and rest due to a busy schedule as a full-time teacher and graduate student. She reported no regular exercise. Her daily intake of fluid included 2-5 servings of water per day.

Participant 4 described a three year history of voice problems with a gradual onset. She reported never having a “great” voice and described it as “soft” and slightly “nasal.” She felt that poor acoustics and having to raise her voice over noisy children in the classroom had contributed to her voice problems. Her chief complaints or symptoms at the time of the initial evaluation were vocal fatigue and hoarseness. She reported mild vocal fatigue on a daily basis and considerable vocal fatigue on a weekly basis. Her voice improved over the weekends with rest, but tired with only moderate amounts of speaking and singing during the teaching week. She reported a long history of difficulty with vocal fatigue, but felt that the problem had increased more recently since she began working with infants. Participant 4 reported using her voice an average of more than eight hours

per day including classroom teaching, social activities, and a moderate amount of singing with her students on a daily basis. Participant 4 reported having laryngitis in conjunction with an upper respiratory event at least twice a year and sometimes required more than a four day recovery period for her voice. She had seen a doctor in the past for this problem, and was told to “rest her voice.” Due to the nature of her job, she felt it was difficult to modify or to stop using her voice when it was problematic. She reported missing more than six days of work in the past year due to her voice problems. Participant 4 had no training for her speaking or singing voice prior to this study.

#### *Perceptual Signs*

During the pre-treatment voice evaluation participant 4’s voice presented with mild breathiness and intermittent hard glottal attacks. Breath support for speech was fair, characterized by shallow inhalation and poor coordination of expiratory airflow and onset of voicing. Pitch and rate were judged to be within normal limits. Volume and intensity were judged to be moderately decreased. The results of interjudge reliability displayed the following average pre-test ratings for participant 4: Mild degree of overall dysphonia (18/100), mild roughness (16/100), mild breathiness (19/100) and mild strain (14/100). Modal pitch (16/100) was judged to be mildly low for the participant’s age and gender while loudness (11/100) was judged to be mildly loud. All voice attributes were judged to be consistently present in this participant’s pre-test reading passage sample.

At the time of post-treatment evaluation, participant 4’s voice was perceptually judged to be essentially normal with a reduction in breathiness and use of hard glottal attacks. Breath support for speech was improved with adequate abdominal inhalation and improved coordination of expiratory airflow and onset of voicing. Pitch, volume, and rate of speech were judged to be within normal limits. The results of interjudge reliability displayed the following average post-test ratings for participant 3: Mild degree of overall dysphonia (22/100), mild roughness (15/100), mild breathiness (16/100) and mild strain

(22/100). Modal pitch (15/100) was judged to be mildly low for the participant's age and gender while loudness (11/100) was judged to be mild to moderately soft. All voice attributes were judged to be consistently present in this participant's post-test reading passage sample.

### *Objective Measurements*

Results for the pre- and post-treatment instrumental and non-instrumental voice evaluation measures are shown in Table 10.

Table 10. Participant 4-Objective Voice Evaluation Measurements

	Pre-test	Post-test
Maximum Phonation Time (MPT)	16.0 sec	17.7 sec
Vital Capacity	2.14 L	2.26 L
s/z ratio	1.05	1.20
Maximum phonational range (Hz)	567 Hz	613 Hz
Highest Frequency	662 Hz	760 Hz
Lowest Frequency	95 Hz	147 Hz
Fundamental Frequency		
Reading Passage	196 Hz	211 Hz
Conversation	196 Hz	225 Hz
Frequency Perturbation (Jitter)	1.98%	.641%
Amplitude Perturbation (Shimmer)	.380 dB	.209 dB

### *Questionnaires*

Pre and post treatment results for the Vocal Symptoms Questionnaire (VSQ) are shown in Table 11. Participant 4 received an overall pre-treatment score of 34 and an overall post-treatment score of 20 on the Vocal Handicap Index (VHI). Table 12 shows the VHI total and subscales scores. A change of 14 points from pre- to post-treatment results indicated an insignificant but positive shift in psychosocial function.

Table 11. Participant 4- Results for Vocal Symptoms Questionnaire

<u>PRE-TREATMENT</u>	<u>POST-TREATMENT</u>
<b>SPEAKING</b>	<b>SPEAKING</b>
Talking over classroom, cafeteria, or barroom noise	Talking over classroom, cafeteria, or barroom noise
Use of fillers, “Uh-huh, OK, and , Uhm, etc”	Vocal fatigue at the end of the work day or work week
Frequently “hoarse”	Frequently clear your throat
Have or have had laryngitis	
Vocal fatigue at the end of the work day or work week	
Frequently clear your throat	
Frequent sore throat	
<b>SINGING</b>	<b>SINGING</b>
Poor posture	Poor posture
Vocal fatigue after rehearsals (instruction)	No vocal warm-up or cool down
Difficulty singing high notes	
No vocal warm-up or cool down	

Table 12. Participant 4- VHI Total and Subscale Scores

Scale	Pre-treatment	Post-treatment
Functional	14	9
Physical	14	9
Emotional	7	2
Total	34	20

*Results of Therapy*

Participant 4’s specific treatment goals during the course of therapy were (1) to improve posture for speech and singing (2) to improve abdominal/diaphragmatic breathing with focus on abdominal inhalation, the coordination of expiratory airflow and onset of voicing, and engaging the low abdominal musculature during phonation for support (3) to use a more forward tone focus, and (4) to use more smooth, connected speech. Participant 4 improved the quality of her voice with respect to all of the above stated goals. By the 6<sup>th</sup> session, she had reached the reading passage level, and was progressing slowly towards carryover of these techniques in her conversational speech.

She continued to require moderate modeling and cueing by the clinician throughout each session. Participant 4 was encouraged to experiment and gradually integrate these newly learned skills into her voice use during teaching activities. It was recommended that she choose a few short (15-20 minute) activities on a daily basis to focus on specific goals in order to move towards generalization. Participant 4 responded well to the singing exercises used during the warm-up portion of each session, in particular the pitch glides sung on “lip trills.” These exercises seemed to provide good practice for engaging the lower abdominal musculature during phonation, and she was able to utilize this technique/support during speaking voice tasks.

Specific Vocal Hygiene program goals for participant 4 were to warm-up her voice each morning before teaching, to reduce throat clearing, to reduce “noise making” during story time in class, to use more nonverbal cues in the classroom and on the playground, and to reduce overall voice use in the classroom. Participant 4 reported intermittent practice during the treatment period and did show compliance with written records in her voice journal. At the time of post-treatment evaluation, participant 4 reported increased awareness of therapy techniques during teaching and described a better awareness of when her voice began to fatigue. These new awareness levels allowed her to make modifications in her voice use when necessary to avoid fatiguing her voice more. Furthermore, she described a significant reduction in vocal fatigue since the end of the treatment period. She reported warming up her voice on a daily basis and incorporating some of these “sound making” exercises (lip trills, pitch glides) into classroom activities with her students. Overall, participant 4 responded positively to therapy, made moderate improvements in voice use, and expressed continued motivation for integrating the newly learned techniques into her conversational speech, as well as classroom teaching.

## Case Study: Participant 5

### *Background*

Participant 5 was a 25 year-old middle school choral/music teacher. She began teaching in 2001 after completing a degree in music education. She was a generally healthy, nonsmoker with a history of allergies and reported frequent upper respiratory infections. She had a tonsillectomy four years prior to participation in this study. She reported having laryngitis frequently and felt that her allergy and upper respiratory problems could be attributed to mold exposure in her classroom environment as she works in an old school building. Daily intake of fluid included 1-2 servings of caffeinated soda and 2-5 servings of water. Medications included prescription nasal spray for allergies.

Participant 5 reported a two year history of voice problems. The onset of her difficulties was gradual, and they were intermittent during that period of time. She reported that towards the end of her first year of teaching, she began experiencing extreme vocal fatigue in her speaking and singing voice that increased with use. She reportedly “lost” her voice several times over the last two years with these episodes typically occurring after a demanding preparation and performance of a choral concert. She recalled missing an entire week of school two years ago due to voice problems and had to stop singing altogether for an extended period of time until her voice improved with rest. During the academic school year, she reported speaking and singing an average of more than eight hours per day, with very limited time to rest her voice during the work day. She noted improved voice quality on the weekends and during the summer when not using her voice excessively. Over the last two years, participant 5 had already made significant modifications in her voice use in the classroom by decreasing the amount of singing during rehearsals and using an amplification system when her voice felt tired, particularly when singing.

At the time of this study, participant 5's chief complaints or symptoms were vocal fatigue after periods of excessive singing and speaking and some loss of high range in her singing voice when her voice was problematic. She also reported frequently feeling "dry" and dehydrated. Her specific concerns were amount of voice use on a daily basis and how to properly use her voice when her allergies were problematic. Participant 5 had no previous training for her speaking voice, but studied singing for several years during college.

### *Perceptual Signs*

During the pre-treatment voice evaluation participant 5's voice perceptually was judged to be essentially normal. There was intermittent vocal fry, especially at the end of utterances, and some use of hard glottal attacks. Pitch and volume were judged to be within normal limits. Rate of speech was slightly fast. Breath support for speech was fair, characterized by shallow inhalation, insufficient replenishment of air during connected speech, and intermittent use of functional residual capacity. The results of interjudge reliability displayed the following average pre-test ratings for participant 5: Mild degree of overall dysphonia (10/100), mild roughness (8/100), mild breathiness (9/100) and mild strain (11/100). Modal pitch (6/100) and loudness (6/100) were judged to be essentially normal for the participant's age and gender. All voice attributes were judged to be consistently present in this participant's pre-test reading passage sample.

At the time of post-treatment evaluation, participant 5's voice was again perceptually judged to be essentially normal. There was reduced occurrence of vocal fry and hard glottal attacks. Breath support for speech was improved with adequate abdominal inhalation and more sufficient replenishment of air during connected speech. Pitch and volume were judged to be within normal limits. Rate of speech was somewhat reduced in comparison with pre-treatment results. The results of interjudge reliability displayed the following average post-test ratings for participant 5: Mild degree of overall

dysphonia (9/100), mild roughness (8/100), mild breathiness (8/100) and mild strain (8/100). Modal pitch (7/100) was judged to be mildly low for the participant's age and gender and loudness (11/100) was judged to be for the participant's age and gender. All voice attributes were judged to be consistently present in this participant's post-test reading passage sample.

### *Objective Measurements*

Results for the pre- and post-treatment instrumental and non-instrumental voice evaluation measures are shown in Table 13.

Table 13. Participant 5- Objective Voice Evaluation Measurements

	Pre-test	Post-test
Maximum Phonation Time (MPT)	16.3 sec	17.7 sec
Vital Capacity	2.07 L	2.28 L
s/z ratio	.984	1.0
Maximum phonational range (Hz)	550 Hz	995 Hz
Highest Frequency	663 Hz	1130Hz
Lowest Frequency	113 Hz	135 Hz
Fundamental Frequency		
Reading Passage	236 Hz	239 Hz
Conversation	209 Hz	196 Hz
Frequency Perturbation (Jitter)	1.46%	.888%
Amplitude Perturbation (Shimmer)	.270 dB	.259 dB

### *Questionnaires*

Pre- and post-treatment results for the Vocal Symptoms Questionnaire (VSQ) are shown in Table 14. Participant 5 received an overall pre-treatment score of 13 and an overall post-treatment score of 5 on the Vocal Handicap Index (VHI). Table 15 shows the VHI total and subscales scores. A change of 6 points from pre- to post-treatment results indicated an insignificant shift in psychosocial function.

### *Results of Therapy*

Participant 5's specific treatment goals during the course of therapy were (1) to improve posture for speech and singing (2) to improve abdominal/diaphragmatic breathing with focus on the coordination of expiratory airflow and onset of voicing, replenishment of air as necessary during connected speech, and engaging the low abdominal musculature during phonation for support (3) to use a more forward tone focus, (4) to use more smooth, connected speech, and (5) to reduce overall rate of speech. Participant 5 improved voice use with respect to the above stated goals. By the end of the treatment period, she had reached the conversational level with minimal modeling and cueing by the clinician. Participant 5 seemed to benefit the most from the singing exercises used during the warm-up portion of each session. These exercises provided an opportunity to focus on engaging the lower abdominal musculature for support during phonation; this technique was very useful for participant 5 during speaking voice use. She reported feeling that her voice was more "connected" to her body, and was able to achieve an "easier" production.

Table 14. Participant 5- Results for Vocal Symptoms Questionnaire

<u>PRE-TREATMENT</u>	<u>POST-TREATMENT</u>
<b>SPEAKING</b>	<b>SPEAKING</b>
Low pitch speaking voice	Talking too much or too rapidly
Talking too much or too rapidly	Talking over classroom, cafeteria, or barroom noise
Talking while moving around vigorously	
Talking over classroom, cafeteria, or barroom noise	
Have or have had laryngitis	
Vocal fatigue at the end of the work day or work week	
Dry or scratchy throat	
Loss of range	
<b>SINGING</b>	<b>SINGING</b>
Too closed or tense jaw	Poor posture, bent from waist at the piano
Poor posture, bent from waist at the piano	Vocal fatigue after rehearsals

Table 15. Participant 5- VHI Total and Subscale Scores

Scale	Pre-treatment	Post-treatment
Functional	6	3
Physical	6	2
Emotional	1	0
Total	10	4

Specific Vocal Hygiene program goals for participant 5 were to get adequate sleep and rest, to increase water intake on a daily basis, to continue to find ways to modify voice use in the classroom (not raising voice over noise, using nonverbal cues), and to decrease the amount of singing during each class session. Participant 5 reported weekly practice, but did not keep detailed records in her voice journal. At the time of the post-treatment evaluation, participant 5 reported a significant increase in awareness of breath support for speech and singing and resonant voice patterns. She also described continued experimentation with modifying her voice use for speaking and singing during daily rehearsals. She had experienced few to no problems with her voice since the beginning of the academic school year two months earlier, and reported an overall reduction in vocal fatigue. Overall, participant 5 responded positively to therapy and expressed motivation for using these newly learned techniques in her everyday voice use and during conversational speech and teaching activities.

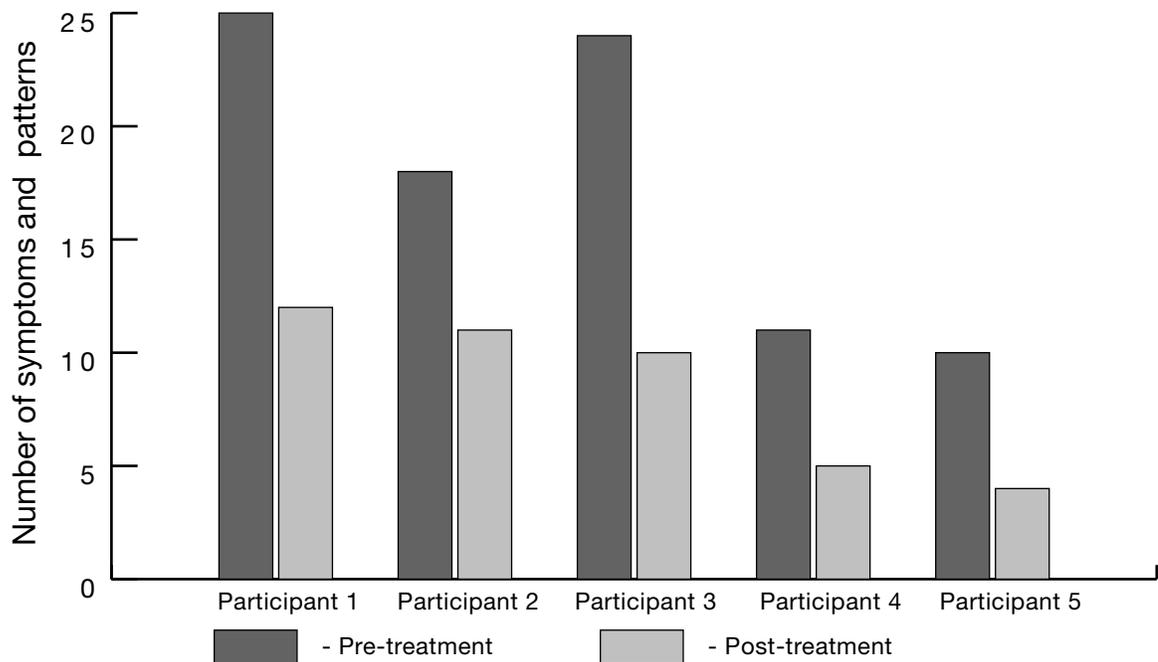
*Vocal Symptoms Questionnaire*

All five participants experienced a reduction in reported vocal symptoms and voice use patterns from pre- to post-treatment evaluation following 6 sessions of voice therapy. At the time of the post-treatment evaluation, each participant reported an overall reduction in symptoms and voice use patterns. The total number of symptoms and voice use patterns for each participant from pre- to post-treatment are shown in Figure 1. Table 16 shows the frequency of occurrence of these symptoms and voice use patterns from pre- to post-treatment for all participants.

### *Voice Handicap Index*

Four out of five participants in this study reported a decrease in their self-perceived level of voice handicap as assessed by the Voice Handicap Index (Jacobson et al., 1997). One participant experienced no change at all from pre-to post-treatment. The degree of self-perceived handicap indicated by a VHI raw score for all five participants from pre- to post-treatment evaluation are shown in Figure 2. The average shift for the VHI raw score was 10 points. Only one participant had a change (reduction) of 18 points or greater, indicating a significant shift in psychosocial function.

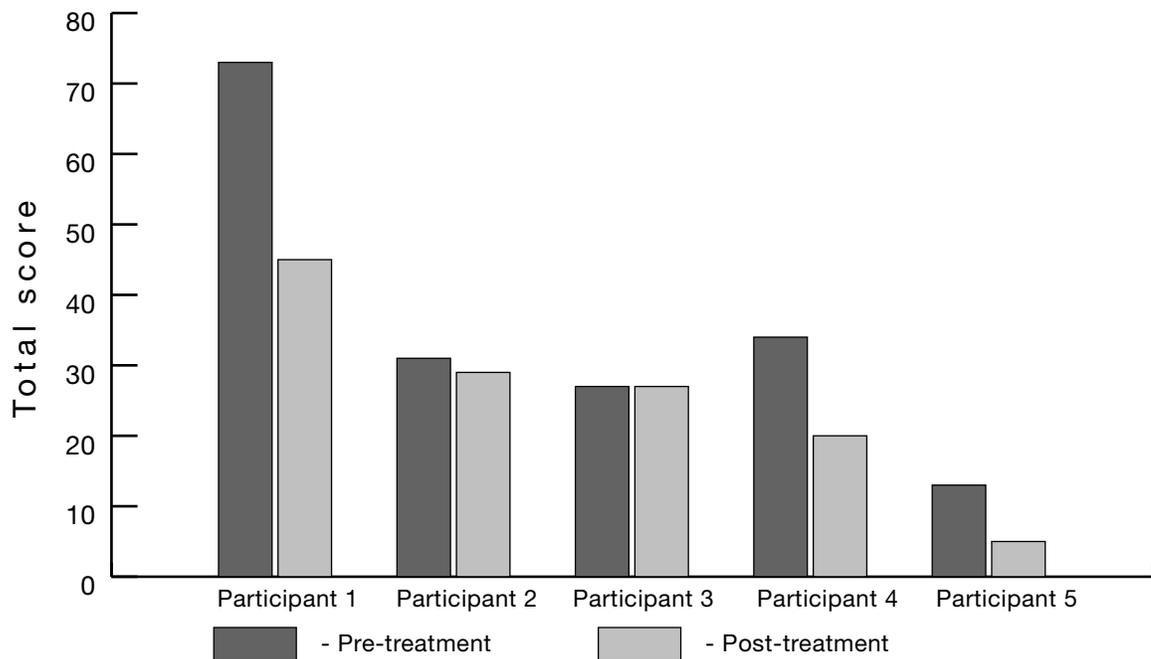
Figure 1. Total Number of Vocal Symptoms and Voice Use Patterns



### *Voice Journal*

Three out of five of the participants showed compliance with keeping weekly voice journal records of information relevant to their voice condition and voice use on each day. These three participants did report that this task was helpful in monitoring their specific vocal hygiene goals during the course of treatment.

Figure 2. Total Voice Handicap Index (VHI) Scores



### *Perceptual Analysis*

Two methods for obtaining perceptual analysis were used in this study. First, the clinician made subjective perceptual judgments for each participant in the areas of pitch, loudness, and quality of voice during pre- and post-treatment evaluation. Perceptual judgements for all five participants were improved across pre- and post-treatment evaluations and are discussed in detail in the individual case studies.

To establish interlistener reliability, the clinician and two second year speech pathology graduate students rated pre- and post-treatment readings of the first paragraph of the Rainbow passage for each participant. These readings were in randomized order on an audio recording. Variability in perceptual judgments among voice clinicians is related to level of experience. It is important to note that all three of the listeners for perceptual analysis, including the examiner and second year speech pathology students, had completed specialized practicum training in clinical voice settings prior to this study.

Table 16. Frequency of Occurrence of Vocal Symptoms and Voice Use Patterns

	PRE-TREATMENT	POST-TREATMENT
<b>SPEAKING VOICE</b>		
Speaking with vocal fry	40%	20%
Breathy voice	40%	20%
Low pitch speaking voice	60%	40%
Talking too much or too rapidly	80%	60%
Talking too loudly	40%	0%
Talking while moving around vigorously	40%	20%
Talking while lifting, bending, or moving arms	20%	20%
Talking over classroom, cafeteria, or barroom noise	100%	80%
Inappropriate emphasis on vowel onset words	20%	20%
Use of fillers, “Uh-huh, OK, and , Uhm, etc”	40%	20%
Talking loudly at sports events	20%	0%
Frequently “hoarse”	80%	40%
Hoarseness first thing in the morning	20%	20%
Voice worse in the morning	20%	20%
Voice worse later in the day, after it has been used	60%	40%
Have or have had laryngitis	80%	0%
Vocal fatigue at the end of the work day or work week	100%	60%
Voice tires after speaking for short period of time	20%	0%
Tightness in throat	60%	20%
Dry or scratchy throat	60%	0%
Loss of range	40%	0%
Frequently clear your throat	40%	20%
Frequent sore throat	40%	20%
Pain in throat while speaking	20%	0%
<b>SINGING VOICE</b>		
Inadequate breath support	40%	40%
Abrupt voice onset	40%	20%
Excessive tension in voice or throat	40%	20%
Too closed or tense jaw	60%	0%
Poor tone focus, voice “in the throat”	40%	20%
Facial tension	20%	0%
Poor posture, bent from waist at the piano	80%	80%
Neck tension	60%	0%
Singing with jaw thrust or constriction	20%	0%
Vocal fatigue after rehearsals	60%	40%
Pain in throat while singing	20%	20%
Loss of range	40%	40%
Difficulty singing high notes	20%	20%
No vocal warm-up or cool down	60%	0%

### *Objective Measurements*

The following objective measurements were obtained: Maximum Phonation Time (MPT), Vital Capacity (VC), s/z ratio, Maximum Phonational Range, Habitual Pitch, Jitter, and Shimmer. There were little to no changes in Vital Capacity, s/z ratio, and Habitual Pitch measures for any participant from pre- to post-treatment measures. Combined results for pre- and post-treatment objective measurements for all five participants are shown in Figures 3 through 10.

All five participants' measures for MPT during pre- and post-treatment evaluations were below normal for their age and gender, however, there were improvements from pre- to post-treatment measures for all five participants with an average increase of 2.52 seconds.

Four of the five participants improved vocal function by extending their maximum phonational range by an average of 217 Hz. All five participants extended the high end of their frequency range by an average of 178 Hz, and one participant extended the low end of their frequency range by 62 Hz. Although none of the pre-treatment measures for maximum phonational range were considered below normal, this result is a positive improvement for the participants as improved vocal range is frequently a goal when treating individuals with voice problems (Stemple et al., 1994).

### *Perturbation Measures*

Four of the five participants had normal measures from pre- to post-treatment for amplitude perturbation. One participant had normal amplitude perturbation measures at the time of pre-treatment evaluation and abnormal measures at the time post-treatment evaluation.

Two of the five participants showed an improvement in frequency perturbation from pre- to post-treatment measures, moving from abnormal measures to normal measures. One participant had high frequency perturbation measures from both pre- and

post-treatment evaluations. One participant had normal measures during pre- treatment evaluation and slightly abnormal measures at the time of post-treatment evaluation. Only one participant had normal frequency perturbation measures at both pre- and post-treatment evaluations.

Figure 3. Combined Results for Maximum Phonation Time

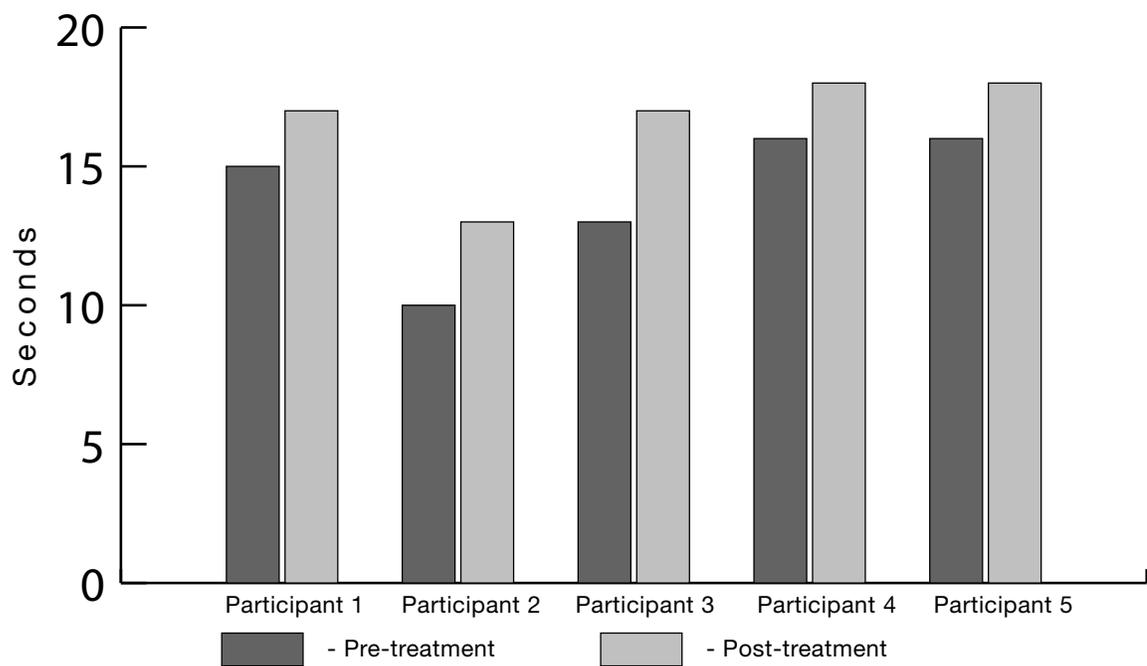


Figure 4. Combined Results for Vital Capacity

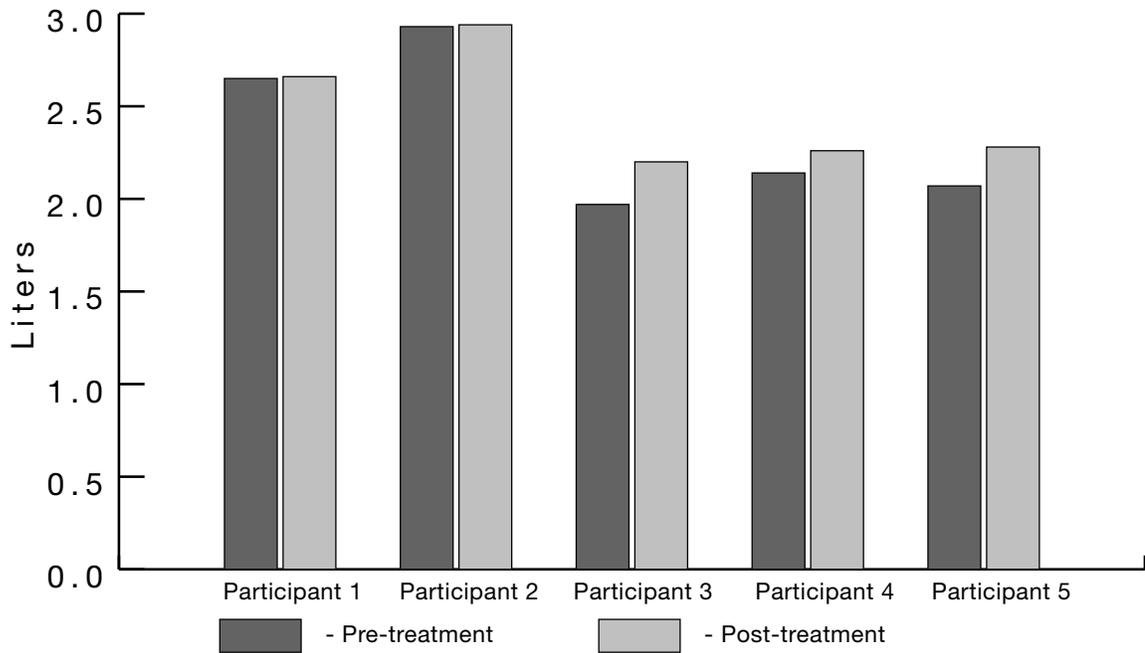


Figure 5. Combined Results for s/z Ratio

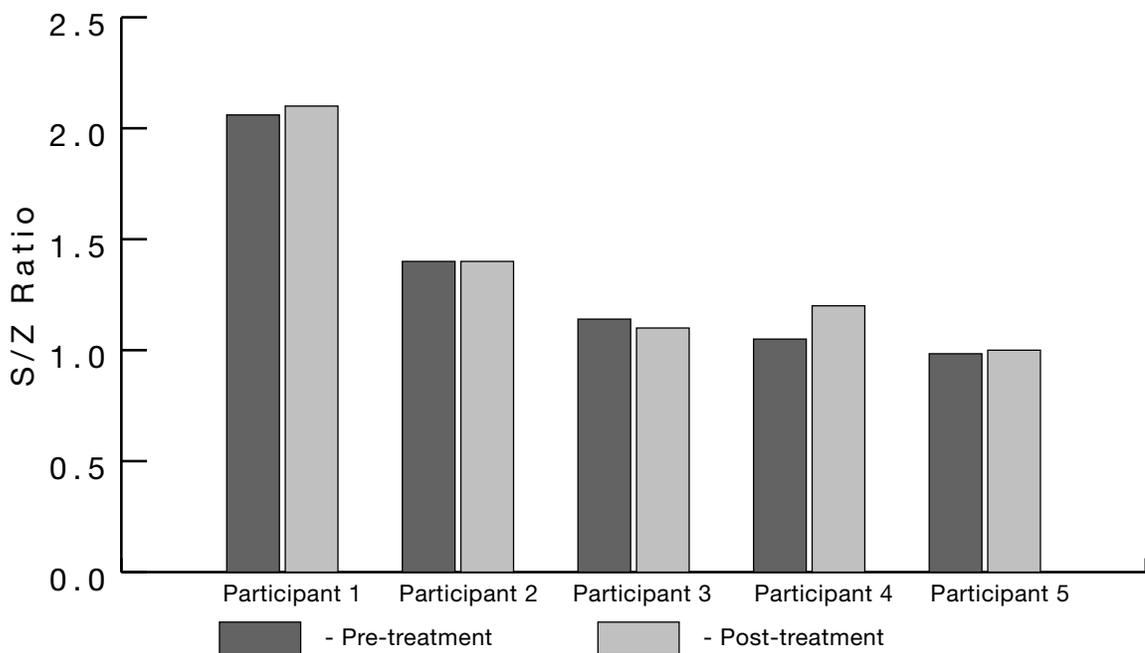


Figure 6. Combined Results for Maximum Phonational Range

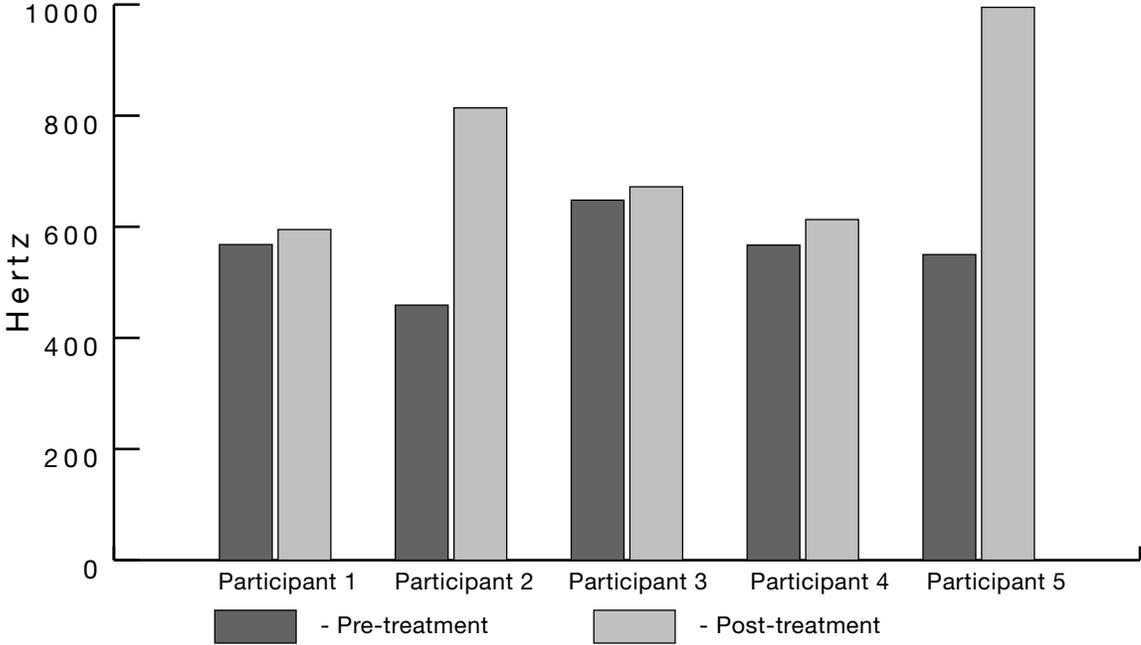


Figure 7. Combined Results for Mean Fundamental Frequency (Reading Passage)

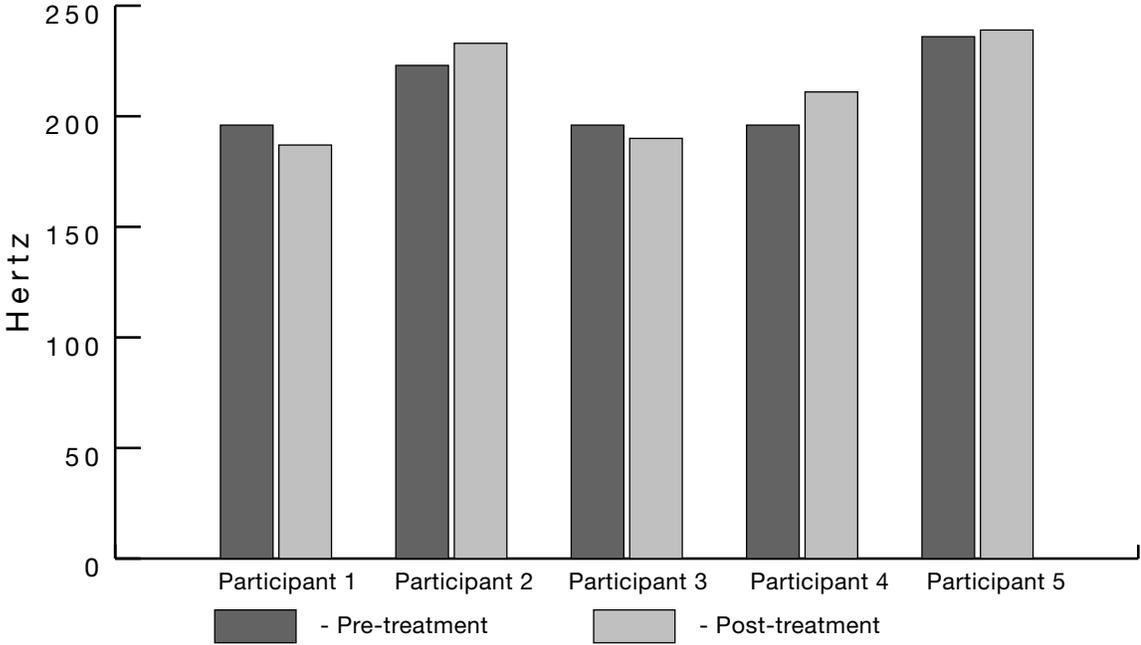


Figure 8. Combined Results for Mean Fundamental Frequency (Conversation)

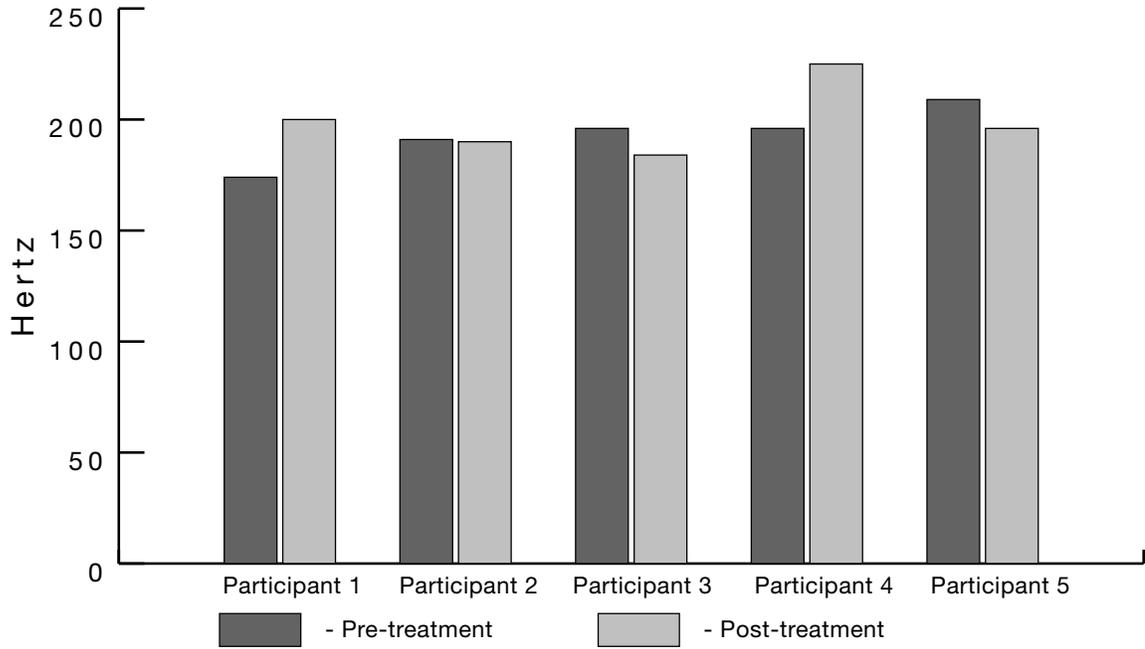


Figure 9. Combined Results for Frequency Perturbation

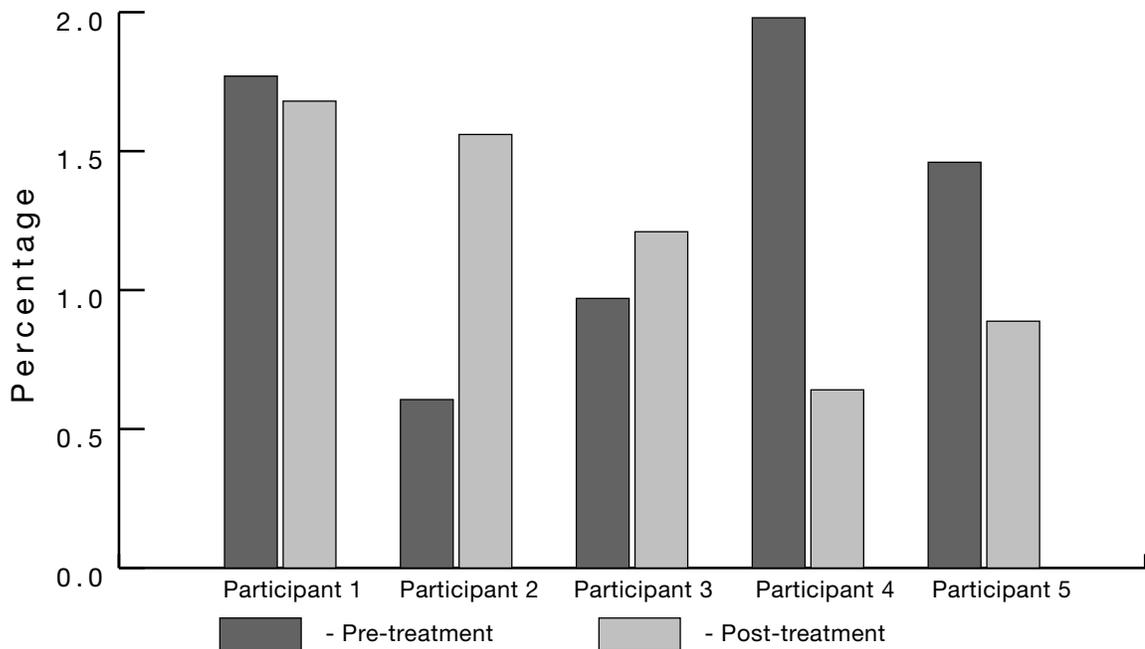
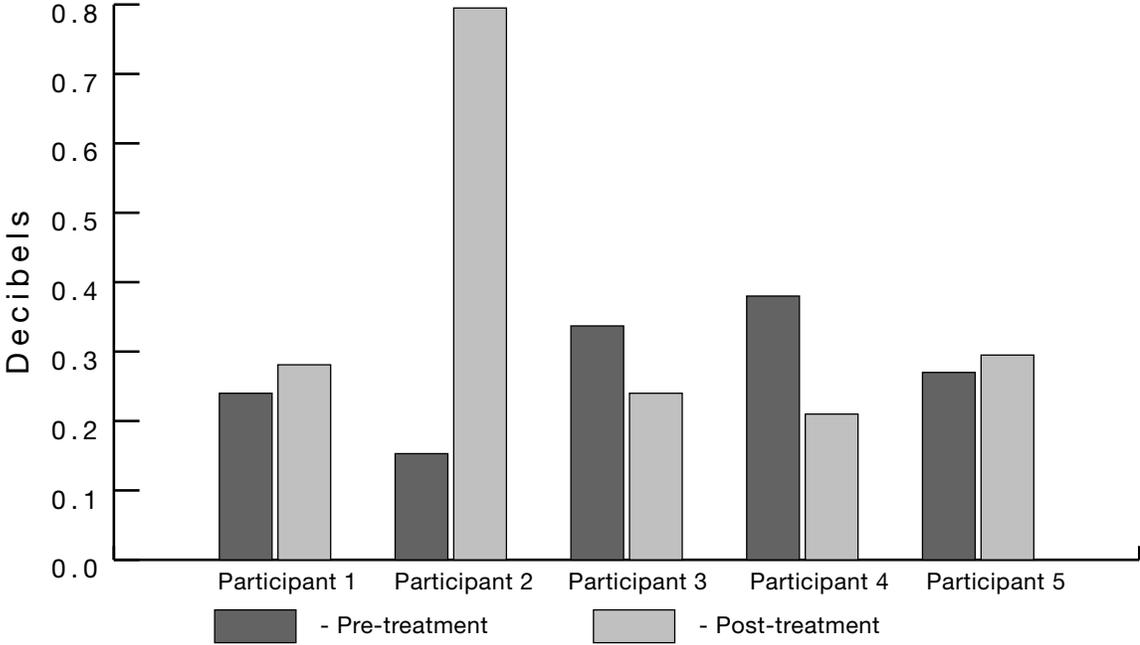


Figure 10. Combined Results for Amplitude Perturbation



## CHAPTER V

### SUMMARY AND DISCUSSION

This study used perceptual analysis, objective measurements, and two patient-based treatment outcome measures (Voice Handicap Index and Vocal Symptoms Questionnaire) to evaluate the effects of a specific therapy approach administered to five teachers with reported voice problems.

#### Perceptual Analysis

Perceptual judgments described by the clinician for all five participants in this study improved from pre- to post-treatment evaluation and are discussed in detail in the individual case studies. The data obtained from the CAPE-V rating scale for inter-listener reliability were inconclusive due to possible clinician bias and the unknown reliability of the rating tool itself. The analysis of the reading samples were conducted following the treatment period and therefore, the clinician possessed a high level of familiarity with each participant's voice at the time of the analysis. This may have biased the clinician's responses. In addition, the auditory sample used for this analysis did not include the performance of three tasks indicated for data collection: vowels, sentences, and conversational speech. The analysis was completed using an audio recording. Inter-judge agreement for voice assessment using rating scales such as the CAPE-V varies. Furthermore, the reliability and validity of the CAPE-V has not yet been assessed.

#### Questionnaires

The two post-treatment questionnaires completed by each participant verified some patient perceived benefits of the therapy program used in this study. All participants reported varying levels of overall voice improvement and greater ease in production of voice for speaking and singing. Specifically, the results from the Vocal Handicap Index

(VHI) suggest that patient perceived improvements in voice quality and voice use may have a positive impact on their daily lives as related to functional, physical, and emotional issues (Jacobson et al., 1997).

### Objective Measurements

The slight improvement in all five participants' MPT measures could be attributed to the development of abdominal/diaphragmatic breathing and improved breathing patterns for speech during the therapy training. Phonational range is considered by some voice experts to reflect the physiological limits of the individual's voice (Colton & Casper, 1996). The average frequency range extension of 271 Hz is significant and could be attributed to the pitch glide singing exercises used during treatment.

Although improvements in perturbation measures from pre- to post-treatment in clinical voice settings are often viewed positively, a direct association between any single variable and a decrease in perturbation measures is very difficult to determine (Stemple et al., 2000). Poor agreement among voice clinicians, speech scientists, and vendors who develop the measurement tools has created a lack of comparable measures, and therefore limited the development of normative data for these measurements. Variables such as aerodynamic, neurologic, biomechanical, and source-filter factors can contribute to vocal instability, therefore, making perturbation measures difficult to interpret (Stemple et al., 2000).

### Implications

The combined results of this study suggest that individuals in teaching occupations with reported voice problems can improve their voices, establishing healthier, more efficient voice use and improved vocal hygiene habits with six sessions of a specific therapy approach. This approach included techniques to improve body posture and abdominal/diaphragmatic breathing, to establish forward resonance patterns, and to reduce laryngeal tension through speaking exercises and basic singing exercises. A vocal

hygiene program was also implemented. All but one participant in this study reported a significant reduction in daily vocal symptoms such as hoarseness and vocal fatigue. This participant was reportedly diagnosed with reflux by her otolaryngologist just prior to the time of the post-treatment evaluation. It is possible that this medical condition may have had an effect on her level of improvement, as the effects of reflux on voice quality are well documented (Koufman, 1991).

There are several plausible explanations for why this treatment approach was successful. According to Stemple and colleagues (2000), successful voice therapy depends on the patient's acknowledgment of the problem and their motivation to comply with voice management suggestions provided by the clinician. Voice patients must be able to recognize negative vocal behaviors and choose to modify them with the guidance of the voice clinician (Stemple et al., 2000). It is assumed that the participants in this study were able to acknowledge that they had voice problems verified by their commitment to participate in the therapy program. All participants in this study reported at least some level of compliance with home practice of the exercises provided during each therapy session, although some were judged to be more motivated than others. This could be related to the fact that some of the participants were more comfortable with the therapy techniques and appeared more willing to use their voices in new ways during therapy tasks.

Patient education can enhance and contribute to successful voice therapy (Stemple et al., 2000). Participants in this study received a high level of patient education prior to the beginning of therapy, including appropriate information about the anatomy and physiology of the vocal mechanism, voice production, breathing coordination, and forward resonance or tone focus. This patient education may have helped make the participant more responsible than the clinician for their own improvement during the course of treatment (Stemple et al., 2000).

The individualized approach of the course of therapy used during this study may have contributed to its positive outcome. Each participant received very specific management of their voice problems based on their pre-test results. This approach helped ensure that the individuals were not learning and practicing techniques that were inappropriate for their particular voice problems. The training methods for the resonant voice therapy component of treatment were experimental and focused on sensory awareness (Verdolini 1998). This experimental therapeutic approach helped each participant identify the cues and facilitating techniques that worked best for them to establish forward tone focus during resonant voice exercises.

Not all speech-language pathologists have specialized education, training, and experience in working with disordered voices, creating a high level of variability among clinicians who treat voice problems. Working with voice disordered patients requires a solid background in the anatomy and physiology of the vocal mechanism, laryngeal pathology, and the principals of voice production (Stemple et al., 2000). A good voice clinician has the ability to determine what inappropriate techniques are influencing the sound and what adjustments should be made to improve that sound in therapy, especially when those improvements and changes are subtle. This ability requires strong skills and a high level of awareness with respect to the use of his/her own (the clinician's) voice. The clinician should be able to demonstrate "correct" and "incorrect" production of voice for the patient and to equip them with the sensory tools necessary to monitor themselves when away from the clinical setting. Strong human interaction skills also help the voice clinician communicate successfully with their patients, giving them the ability to counsel and treat the voice problem most appropriately (Stemple et al., 2000).

The results from the post-treatment evaluation of this study suggest that the participants were able to maintain use of the new vocal behaviors and voice use patterns learned during therapy for up to at least two months after treatment, thereby establishing

healthier voice use and improved vocal hygiene habits in their daily jobs and lives. Three possible explanations (carryover, intensive nature of treatment approach, and increased physical awareness of voice discomfort) for this continued maintenance are discussed below.

For the purpose of this study, carryover is defined as the transfer of new vocal behaviors from the clinical setting to the individual's natural environment – the classroom (Roth & Worthington, 2001). Generalization of new behaviors in spontaneous conversation is always a goal in any type of speech therapy. This is often considered the final and most difficult stage of therapy. By the end of the treatment period, all five participants in this study were able to incorporate the newly learned therapy techniques at the reading passage level and were progressing towards carryover and generalization of these new voice use patterns in conversational speech. At the time of post-treatment evaluation, all but one of the participants reported some consistent level of carryover of the newly learned techniques to their classroom teaching. They all felt that this had contributed to an overall reduction in their vocal symptoms.

Treatment for this study was intensive, with six hours of therapy taking place over three weeks, with a minimum of two days between sessions. The intensive nature of this therapy approach may have contributed to the participants' ability to maintain their new voice use behaviors. Regular feedback from the clinician is important in any voice therapy program in order for the participant to maintain correct use of therapy techniques during practice sessions. Only later in treatment does the individual develop more independence. This independence is in part due to increased sensory awareness of what "correct" and "incorrect" production feels like. Sensory awareness is very important in the participant's ability to monitor themselves during home practice.

At the time of post-treatment evaluation, all five participants reported increased physical awareness of when their voices were becoming problematic (i.e., laryngeal discomfort) during the work day/week. This improved awareness allowed them to make

appropriate decisions about voice use at that point in time (i.e., voice rest, modifying voice use in classroom, using nonverbal cues, increasing hydration, using amplification) which may have contributed to a decrease in their overall voice symptoms on a daily/weekly basis.

It is difficult to ascertain which component of the treatment approach was most beneficial due to the design of this study. There were essentially five components: good body posture, abdominal/diaphragmatic breathing, resonant voice therapy, singing exercises, and a vocal hygiene program. All participants responded positively to each of the five components and seemed to benefit equally from the variety of techniques with varying levels of success. Studies with treatment and control groups are more appropriate for determining which therapy approach is most helpful for teachers.

The positive results from this study support the use of these therapy techniques in voice treatment programs for individuals in teaching occupations with voice problems. This type of treatment may be done in a one-on-one clinical setting with a voice experienced speech-language pathologist following diagnosis of a voice disorder by an otolaryngologist. However, many teachers view vocal problems as an occupational hazard and do not seek treatment for their difficulties (Sapir et al., 1993; Russell et al, 1998). Therefore, it is necessary to educate teachers about the vocal mechanism, vocal hygiene, and effective voice use through some other venue. This type of training may be presented as an in-service program for teachers by school-based speech-language pathologists or other voice professionals such as physicians or singing voice specialists. Any individual conducting such a workshop or in-service must have some level of experience with the therapy techniques. Such professionals would likely benefit from additional training as many school-based speech-language pathologists have limited experience with the adult voice disordered population. This training would equip the clinician with the necessary tools to instruct teachers in vocal techniques that would

improve their voices, such as abdominal breathing and the use of resonant voice. This type of vocal education and prevention program may encourage teachers to seek help for their voice problems before they become severe or chronic (Mattiske et al., 1998). This early intervention may lead to a reduction in the the severity and length of recovery time for a voice problem, consequently reducing the overall impact of that problem on their daily lives (Russell et al., 1998).

### Conclusion

The results of this study represent subjective and objective evidence to support the use of a therapy approach for teachers that includes techniques to improve body posture and abdominal/diaphragmatic breathing, to establish forward resonance patterns, to reduce laryngeal tension through speaking exercises and basic singing exercises, and to improve vocal hygiene habits. Individuals in teaching occupations with reported voice problems can establish healthier, more efficient voice use and improved vocal hygiene habits with such a course of treatment. Voice clinicians can consider these treatment techniques as effective alternatives in clinical settings for teachers with voice problems.

Furthermore, this study strongly suggests that teachers may benefit from vocal education training and prevention programs to raise their awareness of potential voice problems and to promote vocal health. Further research is needed to demonstrate the effectiveness of resonant voice therapy and vocal hygiene programs as treatment alternatives for teachers and the patient perceived benefits of singing voice therapy as a treatment component.

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V O C A L H E A L T H R E S E A R C H

# Are you a **teacher** who experiences ***voice problems?***

Come be a part of a **FREE** exciting summer research study designed to help individuals just like you develop healthy voice use and better vocal hygiene habits.

**For more information contact Lori Sonnenberg:**

V O C A L H E A L T H R E S E A R C H

## APPENDIX B

### Interview Questions

- What is your date of birth?
- What grades, subjects and/or type of teaching do you currently do?
- How many years have you been teaching?
- Have you ever had any injuries or traumas to the head or neck area?
- Have you ever had any major surgeries?
- When did your voice problems begin?
- Were they sudden or did they come on gradually?
- Are the problems intermittent or persistent?
- What is the duration or frequency of your voice problems?
- Briefly describe your voice concerns.
- How would you describe your voice?
- Have you ever seen an ENT for your voice problems?
- If so, what was your diagnosis?
- Have you had any training for your speaking voice?
- Have you had any previous speech or voice therapy? For how long?
- Have you had any training for your singing voice? How long? Voice Classification?
- How many hours a day do you speak or sing at present?
- Do you exercise regularly?
- How many hours of sleep do you get each night?
- Do you avoid certain tasks because of your voice problems?
- Have you missed any work over the last year due to your voice problems?

## APPENDIX C

### Voice Handicap Index Questionnaire

#### The Voice Handicap Index (VHI): Development and Validation

Barbara H. Jacobson, Alex Johnson, Cynthia Grywalski, Alice Silbergleit, Gary Jacobson,  
& Micheal S. Benninger

*American Journal of Speech-Language Pathology, Vol 6(3), 66-70, 1997*

Instructions: These are statements that many people have used to describe their voices and the effects of their voices on their lives. Circle the response that indicates how frequently you have the same experience.

0=Never    1=Almost Never    2=Sometimes    3=Almost Always    4=Always

#### Part I-F

- |  |   |   |   |   |   |
|--|---|---|---|---|---|
| 1) My voice makes it difficult for people to hear me.                            | 0 | 1 | 2 | 3 | 4 |
| 2) People have difficulty understanding me in a noisy room.                      | 0 | 1 | 2 | 3 | 4 |
| 3) My family has difficulty hearing me when I call them throughout the house.    | 0 | 1 | 2 | 3 | 4 |
| 4) I use the phone less often than I would like to.                              | 0 | 1 | 2 | 3 | 4 |
| 5) I tend to avoid groups of people because of my voice.                         | 0 | 1 | 2 | 3 | 4 |
| 6) I speak with friends, neighbors, or relatives less often because of my voice. | 0 | 1 | 2 | 3 | 4 |
| 7) People ask me to repeat myself when speaking face-to-face.                    | 0 | 1 | 2 | 3 | 4 |
| 8) My voice difficulties restrict personal and social life.                      | 0 | 1 | 2 | 3 | 4 |
| 9) I feel left out of conversation because of my voice.                          | 0 | 1 | 2 | 3 | 4 |
| 10) My voice problems causes me to lose income.                                  | 0 | 1 | 2 | 3 | 4 |

#### Part II- P

- |   |   |   |   |   |   |
|---|---|---|---|---|---|
| 1) I run out of air when I talk.                    | 0 | 1 | 2 | 3 | 4 |
| 2) The sound of my voice varies throughout the day. | 0 | 1 | 2 | 3 | 4 |

- |   |           |
|---|-----------|
| 3) People ask, "What's wrong with your voice?"            | 0 1 2 3 4 |
| 4) My voice sounds creaky and dry.                        | 0 1 2 3 4 |
| 5) I feel as though I have to strain to produce voice.    | 0 1 2 3 4 |
| 6) The clarity of my voice is unpredictable.              | 0 1 2 3 4 |
| 7) I try to change my voice to sound different.           | 0 1 2 3 4 |
| 8) I use a great deal of effort to speak.                 | 0 1 2 3 4 |
| 9) My voice is worse in the evening.                      | 0 1 2 3 4 |
| 10) My voice "gives out" on me in the middle of speaking. | 0 1 2 3 4 |

Part III- E

- |   |           |
|---|-----------|
| 1) I am tense when talking to others because of my voice. | 0 1 2 3 4 |
| 2) People seem irritated with my voice.                   | 0 1 2 3 4 |
| 3) I find other people don't understand my voice problem. | 0 1 2 3 4 |
| 4) My voice problem upsets me.                            | 0 1 2 3 4 |
| 5) I am less outgoing because of my voice problems.       | 0 1 2 3 4 |
| 6) My voice makes me feel handicapped.                    | 0 1 2 3 4 |
| 7) I feel annoyed when people ask me to repeat.           | 0 1 2 3 4 |
| 8) I feel embarrassed when people ask me to repeat.       | 0 1 2 3 4 |
| 9) My voice makes me feel incompetent.                    | 0 1 2 3 4 |
| 10) I am ashamed of my voice problem.                     | 0 1 2 3 4 |

## APPENDIX D

### Vocal Symptoms Questionnaire

Please circle the following statements if they are appropriate to you. Please add any additional items that may be specific to your life.

#### **Speaking**

Speaking with vocal fry  
Breathy voice  
Low pitch speaking voice  
High pitch speaking voice  
Talking too much or too rapidly  
Talking too loudly  
Talking while moving around vigorously  
Talking while lifting, bending, or moving arms  
Shouting and yelling excessively in the classroom  
Talking over classroom, cafeteria, or barroom noise  
Inappropriate emphasis on vowel onset words  
Use of fillers, “Uh-huh, OK, and , Uhm, etc”  
Talking loudly at sports events  
Frequently “hoarse”  
Hoarseness first thing in the morning  
Voice worse in the morning  
Voice worse later in the day, after it has been used  
Have or have had laryngitis  
Vocal fatigue at the end of the work day or work week  
Voice tires after speaking for short period of time  
Tightness in throat  
Dry or scratchy throat  
Loss of range  
Frequently clear your throat  
Frequent sore throat  
Pain in throat while speaking  
Frequent whispering

#### **Singing**

Inadequate breath support  
Excessive high breathing  
Abrupt voice onset  
Excessive tension in voice or throat  
Too closed or tense jaw  
High tongue position or tongue tension  
Reduced use of tongue in forming words / use of jaw substitution  
Poor tone focus, voice “in the throat”  
Facial tension  
Poor posture, bent from waist at the piano  
Neck tension

Singing with jaw thrust or constriction  
 Vocal fatigue after rehearsals  
 Pain in throat while singing  
 Loss of range  
 Difficulty singing high notes \_\_\_ or low notes \_\_\_  
 No vocal warm-up or cool down

**Vocal Health**

Inadequate sleep or rest  
 Unresolved stress at work or home  
 Speaking or singing when laryngitic or hoarse  
 Exposure to dust or fumes  
 Exposure to primary or secondary cigarette smoke  
 Exposure to dry air  
 Poor acoustics in the classroom

**Diet**

Spicy or acidic foods  
 Dairy products  
 Eat late at night  
 Bitter/acid taste in mouth  
 Chronic fatigue  
 Frequently thirsty; dehydrated

**Medications**

Use of antacids  
 Prescription allergy medications  
 OTC decongestants/antihistamines  
 Cough medicines  
 Aspirin/Ibuprofen  
 Other: \_\_\_\_\_

**Beverages: How many of the following do you consume?**

**Servings per day**

<b>Coffee</b>	0 _____	1-2 _____	2-5 _____	More than 5 _____
<b>Tea</b>	0 _____	1-2 _____	2-5 _____	More than 5 _____
<b>Caffeinated Soda</b>	0 _____	1-2 _____	2-5 _____	More than 5 _____
<b>Herbal Tea</b>	0 _____	1-2 _____	2-5 _____	More than 5 _____
<b>Water</b>	0 _____	1-2 _____	2-5 _____	More than 5 _____
<b>Alcohol</b>	0 _____	1-2 _____	2-5 _____	More than 5 _____

**Choral Pedagogy**

Simultaneously playing the piano, singing, and conducting  
 Demonstrating all the vocal lines of a piece of music in the written key  
 No previous singing training but are required to conduct choirs  
 Time of day you are leading rehearsals is difficult

**Are there any other vocal concerns you would like for me to know about?** \_\_\_\_\_  
 \_\_\_\_\_

\*Developed from an In-Service Program Teacher Questionnaire (Baroody, 1998).

APPENDIX E

Voice Evaluation Form

Participant \_\_\_\_\_ Date \_\_\_\_\_ Clinician \_\_\_\_\_

**Maximum Phonation Time (MPT)**

\_\_\_\_\_ seconds  
\_\_\_\_\_ seconds  
\_\_\_\_\_ seconds

Average of 3 trials: \_\_\_\_\_ seconds

**Vital Capacity (VC)**

\_\_\_\_\_ liters  
\_\_\_\_\_ liters  
\_\_\_\_\_ liters

Average of 3 trials: \_\_\_\_\_ seconds

**s/z ratio**

[s] \_\_\_\_\_ seconds  
\_\_\_\_\_ seconds  
\_\_\_\_\_ seconds

[z] \_\_\_\_\_ seconds  
\_\_\_\_\_ seconds  
\_\_\_\_\_ seconds

Average [s] : \_\_\_\_\_ seconds

Average [z] : \_\_\_\_\_ seconds

Ratio = \_\_\_\_\_

**Pitch Range**

**Upper Range**

\_\_\_\_\_ Hertz  
\_\_\_\_\_ Hertz  
\_\_\_\_\_ Hertz

\*Circle the highest of the three trials

**Lower Range**

\_\_\_\_\_ Hertz  
\_\_\_\_\_ Hertz  
\_\_\_\_\_ Hertz

\*Circle the highest of the three trials

**Habitual Pitch**

Average fundamental frequency during reading passage \_\_\_\_\_ Hertz

Average fundamental frequency during conversation \_\_\_\_\_ Hertz

**Frequency Perturbation (Jitter)**

\_\_\_\_\_ %  
\_\_\_\_\_ %  
\_\_\_\_\_ %

Average of 3 trials: \_\_\_\_\_ %

**Amplitude Perturbation (Shimmer)**

\_\_\_\_\_ %  
\_\_\_\_\_ %  
\_\_\_\_\_ %

Average of 3 trials: \_\_\_\_\_ %

**Qualitative Judgments**

Deviations in sustained vowels \_\_\_\_\_

Tremor \_\_\_\_\_

Pitch breaks \_\_\_\_\_

Variations in loudness \_\_\_\_\_

Quality \_\_\_\_\_

Intensity:

Soft		Normal		Loud
-2	-1	0	+1	+2

Intensity Range:

Monotone		Normal		Variable
-2	-1	0	+1	+2

Rate:

Appropriately constant \_\_\_\_\_ Excessively variable \_\_\_\_\_

Slow		Normal		Fast
-2	-1	0	+1	+2

**Connected Speech**

Hoarse \_\_\_\_\_

Harsh \_\_\_\_\_

Breathy \_\_\_\_\_

Hard glottal attacks \_\_\_\_\_

Strain/struggle \_\_\_\_\_

Tension \_\_\_\_\_

Other perceptual judgments \_\_\_\_\_

**Additional comments:**

## APPENDIX F

### Anatomy Lesson

The larynx is essentially a cartilaginous tube that connects inferiorly to the respiratory system (trachea and lungs) and superiorly to the vocal tract and oral cavity. This position in the body highlights the interactive relationship between the respiratory system, the phonatory system, and the resonatory system. These structures are often referred to as the “vocal mechanism.” The larynx is suspended in the neck from a single bone, the hyoid bone. Six laryngeal cartilages, three unpaired (epiglottis, thyroid, and cricoid) and three paired (arytenoids, corniculate, and cuneiform) provide structural support for the larynx and vocal folds (McKinney, 1994; Stemple et al., 2000).

- The **hyoid bone** is a U-shaped bone and serves as the superior border of the laryngeal complex. It is attached to the base of the tongue and opens toward the back of the throat. Many muscles in the larynx are attached to the hyoid bone, but it does not articulate with any other bone in the body.
- The **thyroid cartilage** is suspended from the hyoid bone and it serves as a protective housing for the vocal folds. This cartilage forms the projection in the front of the throat known as the Adam’s apple. There are two sets up horns: the superior cornua (which project upward and attach to the hyoid bone by ligaments), and the inferior cornua (which project downward and articulate with the cricoid cartilage) permitting a rocking motion between the two cartilages.
- The **cricoid cartilage** serves as the base for the larynx. The windpipe is made up of a series of circular cartilages giving shape to the trachea or breathing tube. The cricoid cartilage is attached to the top cartilage of the trachea by ligament. It forms a complete circle around its bottom edge, resembling the shape of a signet ring.
- The **arytenoids cartilages** sit on the top surface of the cricoid and are attached to the vocal folds. They are related to the position of the vocal folds. They are

shaped like a pyramid. Each arytenoid cartilage has three prongs called the vocal process, the muscle process, and the apex.

- The apex of the arytenoid cartilages are fused with upward extensions called the **corniculate cartilages**.
- The **cuneiform cartilages** are embedded in the muscular complex superior to the corniculates.
- The **epiglottis** is a leaf-shaped cartilage important to the valving function of the larynx and the production of certain speech sounds. When we swallow, the epiglottis is pulled toward the back of the throat and down over the opening of the larynx, helping keep food and drink from entering the trachea (McKinney, 1994).

The communicative function of the larynx relies heavily on the integration of the three-part system: respiration, phonation, and supraglottic resonance. Specifically, the lungs function as the power supply by providing aerodynamic tracheal pressure that blows the vocal folds apart and sets them into vibration. The vocal folds within the larynx provide the sound source for phonation. The vocal tract serves as the resonating cavity, which shapes and filters the acoustic energy to produce the sound we recognize as human voice (Stemple et al., 2000, p. 22).

APPENDIX G

Voice Journal

<b>Food and Beverage</b>	<b>Voice Use</b>	<b>Vocal Symptoms</b>	<b>RVT Exercises</b>	<b>Other warm-up exercises</b>

## APPENDIX H

### Vocal Hygiene Program

**Noisy Environments** – Classrooms, concerts, parties, cars, buses, airplanes, restaurants, social gatherings, bars, and nightclubs are almost always noisy environments. Speaking over the noise for a long period of time can cause vocal fatigue. Try not to speak over the noise. Some alternatives are:

- Always face the person you are talking to.
- Reduce the distance between you and your conversational partner.
- Over articulate rather than speaking louder.
- Speak at a normal pitch, preferably lower than higher.
- Try to reduce the background noise during conversations (e.g., turn off television or music).
- Wait until students/audiences are quiet and attentive before speaking.

**Excessive Talking** – Some helpful hints for modification of excessive talking are:

- Take vocal naps throughout the day (observe 20 minutes, 3-4 times a day).
- Limit the amount of time you spend on the telephone.
- Be a better listener when having conversations.
- When teaching, let your students participate more rather than you instructing the entire time.

**Yelling, Screaming, or Loud Talking** – Yelling, screaming, speaking loudly, or cheering may damage the vocal fold tissues. Save your voice by doing the following:

- Use nonvocal sounds or instruments to attract attention from a distance (e.g., clap, whistle, ring a bell, blow a horn).
- Engage the help of others for monitoring your voice.
- Use facial and other physical gestures to express emotions.
- Know the limits of your vocal abilities and be aware of fatigue.
- Use more articulated speech for dramatic purpose.
- Set up a system of nonvocal signals with students to get their attention and maintain discipline. Do not yell at a child who is misbehaving across the room. Walk up to that child and speak to them quietly. Apply these alternatives to your children and pets, as well.

**Throat clearing** – Clearing your throat and coughing are sometimes more of a habit than a need. Over a period of time this can hurt the vocal folds. Some alternatives are:

- Swallowing slowly and deliberately will relax the larynx.
- Take small sips of water.
- Use a “silent cough”.
- Hum lightly focusing on vocal resonance sensations.
- Talk through the mucus; natural vibration of the vocal folds may help rid of mucus.

- Vocalize on five-note scales in a comfortable range.
- Be aware of any throat clearing habits during lecturing.

**Whispering** – Whispering and other unconventional vocal sounds (e.g., growls, squeaks, imitating animals or machines) can harm vocal fold tissues. Some helpful hints are:

- Do not whisper when you are hoarse or have a sore throat (this is actually more damaging than helpful).
- Be aware to avoid using such unconventional sounds during reading time with students.

**Hard glottal attacks and fillers** – Hard glottal attacks when speaking or singing can be harmful to the voice. These abrupt onsets are heard on words that begin with vowels and are usually habitual. Be aware to avoid hard glottal attacks when speaking. Also, try to avoid using fillers during conversation or lecturing (e.g., um, uh, ah, er, etc.)

**Adequate sleep or rest** – Optimal vocal efficiency cannot be achieved if you are tired. Remember to:

- Try to get an adequate 7-8 hours of sleep per night.
- Get more rest and sleep prior to extended voice use.
- Be careful to rest when traveling to perform or lecture.
- Allow time for a short nap before an important singing or speaking engagement.

**Hydration** – Caffeine has a diuretic effect and causes dehydration of the vocal folds. Be sure to:

- Maintain proper hydration with 8-10 glasses of water per day. Keep water close by at all times, especially when teaching.
- Avoid caffeinated drinks (coffee, tea, soda) especially before voice use.
- Switch to decaffeinated drinks (water is preferable).
- Avoid alcoholic beverages; alcohol can have a drying effect on the vocal fold tissues.
- Drink a glass of water for every cup of coffee or soda.
- Some medications, including antihistamines and decongestants, can cause increased dryness of tissues. Compensate for this with increased hydration.
- A humidifier may be helpful if your home or office is extremely dry or dusty.

**Smoking** – Smoking can be harmful to your vocal folds and the surrounding tissues.

- Do not smoke!
- If you do, stop! See your general physician about ways to stop smoking.
- Avoid spending extended amounts of time in smoke-filled environments.
- Ask family members or friends to limit their smoking in your presence

**Low pitch and vocal fry** - Talking with an abnormally low-pitched voice and speaking with “vocal or glottal fry” can be harmful to your voice. Some alternatives are:

- Breathe properly and keep the voice powered by the breath flow.

- Speak slowly, pause at natural phrase boundaries, and stop to take another breath before you run out of air.
- Try not to squeeze out the last few words without sufficient breath.

**Singing** – Know your limits for comfortable pitch and loudness ranges when singing. Do not take your “chest voice” too high, and do not push your head voice beyond its limits. Allow the vocal registers to change with pitch, and seek training from a professional singing teacher.

**Other suggestions for good vocal hygiene are:**

- Rest your voice when you are tired or have upper respiratory illnesses.
- Do not force your voice when it is hoarse.
- Rest your voice before it becomes fatigued. Try not to schedule your classes or lessons back to back. Instead, schedule your day so that you have periods of vocal rest throughout the day. When you have a break, take it. Don’t spend your time socializing with friends or talking on the telephone.
- Change your style of teaching. Audiovisual materials, small group work, and student presentations will reduce the amount of constant instruction and talking you have to do. Make use of student teachers and assistants as much as possible.

\*Program developed from:

Appendix A. Vocal Hygiene Program in Roy, N., Gray, S.D., Simon, M., Dove, H., et al. (2001). An evaluation of the effects of two treatment approaches for teachers with voice disorders: A prospective randomized clinical trial. *Journal of Speech, Language, and Hearing Research, 44*(2), 286-297.

Sataloff, R.T. (1998). *Vocal Health and Pedagogy*. San Diego, CA: Singular Publishing Group (pp. 270-272).

## APPENDIX I

### Posture Lesson

Good body posture was accomplished by using the following tips (McKinney, 1994, pp. 36-40):

- Weight should be evenly distributed on the feet.
- Legs should be freely flexible and ready to move at all times.
- The hips and buttocks should conform to as much a vertical line as possible between your head and your feet. This may involve “tucking” the hips under a little.
- The upper-abdomen or chest area should feel free to move at all times.
- The back should feel lengthened and stretched along the spinal column.
- The chest should be comfortably high.
- The arms and hands should hang loosely and freely by your side.
- The head should be directly in line with the body and centered on the shoulders.

## APPENDIX J

### Breathing Description and Exercises

Each participant was given the following description of the abdominal/diaphragmatic breathing process:

When we breathe deeply, the diaphragm contracts downward, making our abdomen protrude outward or expands. This allows for better airflow into the lungs, and the thoracic cavity can expand to its maximum extent. This type of breathing better supports our voices. The more common way of breathing for speech is by raising the chest. This is the least efficient way to expand the thoracic cavity, and can create tension and increased vocal effort when we speak or sing (Stemple et al., 2000).

- **Exercise #1:** The participant pulls in his/her abdominal muscles while blowing, as if blowing out a candle. Once the air has been fully expelled, the abdominal muscles expand naturally and the participant inhales spontaneously. Tactile and visual cues were used as necessary. This was repeated several times until it was accomplished easily.

Once this technique was accomplished, other breathing exercises were used to practice controlled breathing and exhalation, using the above abdominal/diaphragmatic breathing technique. These exercises consisted of:

- **Exercise #2- Controlled exhalation on /h/-** The participants took a proper abdominal/diaphragmatic breath and released the air on /h/ for three consecutive trials.
- **Exercise #3 – Controlled exhalation on /ha/, /hi/, /hai/, /hu/-** The participants took a proper abdominal/diaphragmatic breath and released the air on /ha/, /hi/, /hai/, and /hu/ for two trials with each consonant-vowel combination.
- **Exercise #4 – Controlled exhalation on /s/ -** The participants took a proper abdominal/diaphragmatic breath and released the air on /s/ for as long as possible for three consecutive trials.

## APPENDIX K

### Resonant Voice Therapy

Therapy protocol from Stemple, J.C., Glaze, L.E., & Klaben, B.G. (2000). *Clinical Voice Pathology: Theory and Management* (2nd ed.). San Diego, CA: Singular Publishing Group (pp. 340-345).

Each therapy session begins with a series of stretching and breathing exercises that may include exercises for the shoulders, neck, jaw, mouth, lips, and tongue. The following guidelines present a seven step program for the training of resonant voice therapy.

**Basic Training Gesture for RVT:** The participant is instructed to sit with good posture, to take a comfortable breath and to vocally sigh from a high to low pitch on /m/. The pharynx is to be wide open and the energy of the /m/ is to be focused in the facial bones. Experimental sound making is used to develop a connection between the abdominal respiratory support muscles and the face and the lips.

- h-m-m-m-m...As a sigh
- Extreme forward focus is required with appropriate breath support
- Make the connection from the abdominal muscles to the lips
- Patient should feel very relaxed at the end of this gesture

**RVT Hierarchy Step 1 (All Voiced):** Nonlinguistic speech contexts are added on repetitions of /mamamama/. Vowels may be added as desired to vary the contexts.

- 1) mamamama...(sustained pitch) on \_\_\_\_\_. (choose conversational tone)
- 2) mamamama...slow-fast-slow, soft-loud-soft on \_\_\_\_\_. (comfortable conversational tone)
- 3) mamamama...as speech, vary the rate, pitch, and loudness.

- 4) Chant voiced phrases (i.e., Mary made me mad) on the musical note of your choice, exaggerating the articulation and forward resonance (comfortable conversational tone)
- 5) Over-inflect these same phrases as speech. Making the connection from the abdominal breath to the front of the face is essential.

**RVT Hierarchy Step 2 (Voiced-Voiceless):** Exercise difficulty is increased with the addition of the voiceless consonant, which requires rapid articulation.

- 1) mamapapa...vary the rate on \_\_\_\_\_. (comfortable conversational tone)
- 2) mamapapa...slow-fast-slow, soft-loud-soft on \_\_\_\_\_. (comfortable conversational tone)
- 3) mamapapa...as speech varying the rate, pitch, and loudness.
- 4) Chant voiced/voiceless phrases (i.e., Mom may put Paul on the moon) on the musical note of your choice, exaggerating the articulation and forward resonance (comfortable conversational tone)
- 5) Over-inflect these same phrases as speech.

**RVT Hierarchy Step 3 (Any phrase):** The chanted phrase is said in an extreme forward focus with exaggerated articulation.

- 1) Chant five to seven syllable phrases on the note \_\_\_\_\_.
- 2) Overinflect the same phrases with an extreme forward focus.
- 3) Repeat the same phrases in a more natural forward speech/voice production.

**RVT Hierarchy Step 4 (Paragraph Reading):** Begin combining strings of phrases which expands the difficulty of the task. Maintain the exaggerated forward focus only as long as is necessary to confirm that the task has been mastered.

- 1) Read a paragraph with phrase markers; separate each phrase only by the natural inhalation of air.
- 2) Exaggerate focus and then repeat with a more normal speech/voice production.
- 3) Repeat the above with paragraphs without phrase markers.

**RVT Hierarchy Step 5 (Controlled Conversation):** This step begins carryover to conversation of the new “forward-focus” voicing behavior. Participants should practice forward speech placement in conversation. on any topic of interest, such as job, family, vacations and hobbies. The participant is encouraged to have daily practice time at home.

**RVT Hierarchy Step 6 ( Environmental Manipulations):** The participant is encouraged to continue the use of the new vocal habits despite noisy distractions. The clinician should stimulate actual speaking environments that are functional and consistent with the participant’s needs (i.e., restaurant, noisy classroom, playground).

**RVT Hierarchy Step 7 (Emotional Manipulations):** The use of resonant voice is challenged by animating the discussion with topics that elicit laughter, loud talking, anger, indignation, and other emotions. Materials and topics that increasingly engage and challenge the participant are used based on personality, interests, work experiences and passions.

**RVT Hierarchy Home Exercises:** Home exercise is an essential part of RVT. In therapy, the participant is given the skills and tasks that must be mastered during home practice. The important aspects of each exercise during each therapy session are tape recorded for a home exercise example. Home program should include 15 to 20 minute sessions, two times per day, including stretches, basic RV gesture, and selected exercises.

APPENDIX L  
Singing Exercises

For each exercise the participants:

- 1) **Repeated Pitch Glides on /wu/** - glided on /wu/ from the middle to the highest part of their pitch range for three trials, from the middle to the lowest part of their pitch range for three trials, and finally from the lowest to the highest part of their pitch range for three trials.
- 2) **Lip Trills** - sang lip trills on musical patterns 1—3—1, 1—5—1, and 1—2—3—2—1.
- 3) **Humming** – hummed on musical pattern 1—3—1, 1—5—1, and 1—2—3—2—1.
- 4) **Onset exercises** – sang the musical pattern 1—3—5—3—1 on /ba—bi—ba—bi—ba/