“Identifying Strategies for the Prevention of Vocal Problems among Potential Music Educators”

Honors Thesis Submission

Kathleen M. Crane

Fourth Year Music Education Major with Choral Emphasis

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*Presentation poster available for viewing in Dr. Brenda Smith’s office, MUB 302

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Abstract

The voice is the greatest tool of the music educator, whose daily tasks require voice use including both speaking and singing. Those who teach instrumental or vocal music must use the singing voice to demonstrate phrasing, articulation, and good tone quality through “modeling.” In addition to communicating with the voice for singing, music educators use the speaking voice to instruct students both musically and otherwise. In fact, music educators are among those whom Dr. Robert T. Sataloff termed “professional voice users” or individuals who require healthy voices for speaking and singing to be effective in their daily work. As such, it is vital that those who teach music preserve and protect their voices. The purpose of this research study, sponsored by the University Scholars Program at the University of Florida, is to measure and evaluate the vocal efficiency of music students preparing for their student teaching internships. Using Estill Voice Evaluation Suite (VES) software, ten students were acoustically screened before and after a prescribed, video recorded teaching task with the intention of identifying positive vocal behaviors and preventing vocal injury. The participants were also asked to fill out a questionnaire regarding their vocal health as it relates to their career in teaching through a series of subjective and objective questions. The data from the pre- and post-acoustical measurements with evidence from the video recording were compiled for comparison and analysis. The paper will demonstrate the methods and report the findings from subjective and objective data.
Background Information

Music teachers are unique among teachers. They are what can be called “performing teachers” or teachers who use both speaking and singing in the course of their work. As such, they are thought to have a greater risk of developing voice problems that can affect their job performance and even develop into more serious pathologies. Despite this very real danger, relatively little research has been done about the unique vocal issues facing music teachers.

In recent years, however, an increasing amount of attention has been paid to the vocal problems of the general teacher population. In a study researching the frequency of voice problems among teachers and other occupations, Smith et al. found that teachers were more likely than those in other occupations (32% versus 1%) to report previous voice problems, higher frequency of symptoms, and difficulty with a weak, tired, or effortful voice. They were also more likely to perceive a negative impact on their job performance due to voice problems and to miss work due to issues with their voice (20% of teachers and only 4% of non-teachers).

Other studies have focused on the caseloads of otolaryngology and voice analysis clinics. For example, Titze, Lemke, and Montequin completed a study that found that 20% of the patients at a University of Wisconsin clinic were teachers though they only comprise of 4.2% of the working population. This result is all the more shocking in light of another study that found that while at least 50% of teachers experience issues with

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vocal health, only about 20% of these vocally troubled teachers sought help from medical professionals.\textsuperscript{4} This suggests that the number of treatment-seeking teachers, while extremely disproportionate to other occupations, is far less than the total number of teachers affected by voice problems. Smith et al. suggest many possible reasons for this discrepancy. For example, some teachers may fear that a physician will tell them that they must reduce their voice use or face permanent damage. This may mean lower job productivity and efficiency or even the need to quit teaching altogether. The teachers may also be unable to take off work for the appointment especially if they think that their work-related evaluations may be negatively affected if other school staff find out about the problem.\textsuperscript{5}

The number of teachers suffering from vocal issues with and without treatment creates a great need for strategies of prevention. If teachers are unable to use their greatest commodity, their voice, they will be less efficient in the classroom and may even be required to consider a change in occupation. This possibility would place a high economic toll on both the teacher and the school system. In addition to the financial hardship of medical intervention, the emotional and physical health of the teacher may be adversely affected. As such, there is an overwhelming call for prevention rather than intervention.

While research has shown that schoolteachers are at a greater risk for developing vocal problems, limited research has been done on the unique circumstances facing music teachers. However, there has been significant discussion about the need for research as music educators are widely thought to be the subgroup at greatest risk. For example,

\textsuperscript{5} Smith et al., “Frequency of Voice Problems Among Teachers and Other Occupations,” 487.
Safarti suggested that teachers who alternate between speaking and singing would be at greater risk for vocal problems. Safarti also noted that music teachers, like physical education and drama teachers, are required to speak or sing over background noise for long periods of time. Similarly, Radionoff wrote that “the music educator is one of the most 'at risk' vocal professionals. The daily demands on the voice are great enough to challenge even the healthiest vocal mechanism.”

In a study on the general teacher population, some interesting results were found about the music teacher subgroup. Phillips, Gillespie, and Thompson surveyed 500 teachers and found that 230 of those teachers had experienced voice problems related to teaching. Of these 230, 13% were music teachers and 4% were band teachers. These numbers are surprising as there are often fewer music teachers in a school than other subgroups suggesting that a higher proportion of music teachers suffer from vocal problems. More research, however, is required.

In response to this need, Solberg and Proctor completed a survey of K-12 vocal music teachers who graduated from the University of Wisconsin- Eau Claire. They found that 63.6% of the study participants reported current vocal problems and 88.6% reported having had symptoms in the past. Symptoms included vocal fatigue (the most frequently reported), dry throat, problems with high notes, loss of endurance, discomfort, voice breaks, hoarseness, and more. Of the participants who experienced these problems, only about one third sought treatment and about 14% had vocal nodules. Additionally, 25%  

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reported having missed work because of their symptoms and an incredible 76% reported that they did not feel that they were supported by supervisors concerning their vocal circumstances.\(^9\)

Solberg and Proctor also investigated the factors that could be impacting the voice problems faced by music teachers. They found that hydration was a large factor as participants reported drinking, on average, two cups of caffeinated beverages and only six cups of non-caffeinated beverages per day. They also reported that they drank approximately 2.5 alcoholic drinks per week and 18% of the participants take dehydrating medications. While none of the participants smoke, 68.2% of the participants reported allergies. Additionally, environmental conditions are also a factor. Teachers reported low humidity, extraneous or competing noise, poor air circulation, and poor acoustics as significant problems. Perhaps the most surprising statistic resulted when the teachers were asked about their level of stress. About 61% of the teachers reported having felt overwhelmed, anxious, or tense relating to their job. This could be a significant factor as stress can often manifest itself in body tension that could lead to vocal problems.\(^{10}\) Music teachers rely heavily on their singing and speaking voices for musical and other classroom instruction and their teaching ability depends on their voice. This study clearly shows the need for more research into ways to help music teachers overcome these issues for better vocal health.

While all music teachers are at risk, some interesting research has been done specifically on the choral or vocal music teacher. In 2006, Sandra Schwartz completed a

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dissertation on the “Vocal Health of Middle School and High School Choral Directors” at the University of Miami. She came to many interesting conclusions in her study. Through a combination of subjective and objective tests, she concluded that choral directors are not aware of their reduced vocal capabilities. Not only does this make them unable to accurately self-evaluate, but they could also cause further damage without being aware of how they are affecting their vocal health. She also found that age, gender, years of teaching, and other factors did not significantly affect their vocal health suggesting that all choral directors are affected by similar vocal problems likely due to the demands of their profession.\(^{11}\) This conclusion suggests that programs for prevention would be necessary for the entire choral teacher population (and probably other music teachers) rather than intervention for those affected the most.

In a more recent study, Sandra M. Schwartz examined middle and high school choral directors' voices for frequency and intensity using a Voice Range Profile. She also compared choral directors' voices with vocally trained and untrained singers as well as trained healthy and dysphonic voices. She found that choral directors' vocal intensity range was smaller and minimum intensity was significantly higher than healthy and dysphonic trained voices. Additionally, vocal frequency ranges of choral directors were reduced as compared with trained and untrained singers and healthy trained voices. From her research, she concluded that choral directors are at risk of developing vocal problems and more research needs to be done for prevention.\(^{12}\)

\(^{11}\) Sandra M. Schwartz, “Vocal Health of Middle School and High School Choral Directors,” (Ph.D. diss., University of Miami, 2006).

\(^{12}\) Sandra M. Schwartz, “Voice Range Profiles of Middle School and High School Choral Directors,” *Journal of Research in Music Education*, 56 No. 4 (2009), 293-309
As the issue of vocal health among music educators is widespread, possibilities for prevention need to be discussed. One likely route is teaching prevention during teacher education. As a preliminary step, Rhonda Hackworth completed a study of preservice teachers’ perceptions about vocal hygiene. Among many interesting results, Hackworth found that 48% of preservice teachers thought that the teaching profession is at high risk for voice problems. Additionally, 60% of the preservice teachers believe that a voice disorder would affect their career and 31% think that it might. She also compared the results of the surveys by instrumental and vocal majors. It is easy to assume that choral directors would be more at risk due to the nature of their subject but that may not be the case. Hackworth found that instrumental majors gave a much higher rating for the vocal stress of demonstration singing than vocal majors. Instrumental majors may not feel are well trained in that area and may see it as a stressful activity.\textsuperscript{13} This stress may transfer to the voice and in combination with the speaking requirements of all music teachers, create further damage. Therefore, all music teachers, choral or instrumental, are at risk of developing voice disorders.

Another interesting study by Rhonda Hackworth examined the effect of vocal hygiene and behavior modification training of self-reported vocal behaviors of music teachers. The subjects were assigned to one of three groups: a control group or two experimental groups. Both experimental groups received instruction in vocal hygiene but only one received instruction in vocal behavior modification. She found that the behavioral modification experimental group significantly increased vocal rest and

decreased reports of vocal problems. This suggests that behavior modification should be included in vocal hygiene instruction in order to decrease detrimental vocal behaviors.\textsuperscript{14}

Vocally, music educators are at great risk. With voice as the tool of their trade, it is vital that they preserve and protect their voices. More research is necessary to understand and prevent voice disorders among the subgroup of teachers thought to be most at risk: music teachers.

**Methods**

Participants were recruited from the University of Florida chapter of Collegiate Music Educators National Conference and the Music Education department. The final participant pool consisted of 10 female undergraduate Music Education majors ranging from ages 18-23. Five of the participants are primarily vocalists, four instrumentalists, and one student is a vocalist/instrumentalist.

Prior to the day of the research study, I met with the participants to give a demonstration of the protocol to be followed during the teaching task phase of the experiment. I explained each step of the experimental sequence, demonstrated the prescribed aspects of the lesson plan (the warm-up and cool down segments), and answered any questions.

On the day of the study, the participants were first asked to fill out a questionnaire regarding their vocal health as it relates to their career in teaching through a series of

subjective and objective questions (see Attachment #1). Next, each participant took part in a three-phase experimental sequence that involved acoustical screenings before and after a prescribed teaching activity. Each student was provided with a 20 fl oz bottle of water for purposes of vocal hygiene and experimental control.

The acoustical screening prior to the teaching task included a series of simple vocal tasks that were be recorded and analyzed by Estill Voice Evaluation Suite (VES) software. According to the Vocal Innovations description of their product, this is a computer program that “automates the collection, analysis, storage, and retrieval of standard clinical voice measures.” The recording was done with an omni-directional microphone kept at a three centimeter distance from the participant to ensure standard measures. The entire recording procedure for each participant took approximately 20 minutes. The vocal tasks included: sustain /a/ for four seconds, describe the Cookie Theft picture from the Boston Diagnostic Aphasia Exam for a 10 second continuous speech sample, produce highest and lowest possible pitches, produce loudest and softest possible voice, sustain a tone for as long as possible on one breath, and say ‘uh uh uh’ as quickly and precisely as possible for 7 seconds to measure Diodochokinetic (DDK) rate, a measure of oral motor skills.

Immediately following the initial acoustical screening, the participants performed the following teaching task: a 30 minute lesson taught to a demonstration choral ensemble made up of four voice students from the School of Music, two male and two female. The participants prepared the lesson in advance following the protocol demonstrated in the pre-meeting and the information provided in written guidelines (see Attachment #2). Time allotment for each section of the lesson was monitored using a
stopwatch and the participants were given a signal indicating 2 minutes to the end and the end of each segment of the lesson. The researcher acted as the accompanist and was there for purposes of harmonic support. The pieces were rehearsed entirely a cappella and reviewing of parts was done through vocal modeling (demonstrating through singing) by the instructor.

In accordance with the prescribed lesson plan, the participants began with an opening statement written by the researcher. Next, the participants led the demonstration group in a seven minute warm-up as follows: physical warm-up (stretching, relaxation, and posture), warm-down, warm-up, diction warm-up, and chordal warm-up. The participants were given three options for each part of the warm-up. The choices for creating the warm-up regime were chosen by the researcher from Complete Choral Warm-up Book by Dr. Russell R. Robinson and Jay Althouse published by Alfred Publishing Co. and Choral Pedagogy: Second Edition by Brenda Smith and Robert T. Sataloff published by Plural Publishing Inc (see Attachment #3).

Next, the participants led a ten minute rehearsal of “Ave Verum Corpus” (KV618) by Wolfgang Amadeus Mozart excerpted from measure 22 to the end of the piece. They then led a ten minute rehearsal of the traditional piece “Amazing Grace.” Next, the participants taught a three minute “cool down” also chosen from Choral Pedagogy: Second Edition by Smith and Sataloff. Finally, the participants read a closing statement written by the researcher to maintain procedural control and to signify the end of the teaching phase. The lessons were video recorded for the purpose of vocal evaluation and analysis.
Immediately following the teaching phase, the participants were screened again using the same acoustical measurement software and protocol as outlined above. The data from the pre- and post-acoustical measurements with evidence from the video recording were compiled for comparison and analysis.

Results

The acoustical measurements yielded a number of statistically significant results. With the matched pairs experimental design, the pre- and post-acoustical screening data were compared and analyzed. The researchers found that the sustained “ah,” shimmer percentage or perturbation in amplitude increased over time. Also, the minimal fundamental frequency in continuous speech increased over time meaning that their inflections in continuous speech were higher in the second test. The maximum amplitude or loudest possible pitch reduced over time thereby reducing the maximum amplitude range. Additionally, at the participants’ maximum performance, their minimum frequency or lowest pitched increased over time while their maximum frequency or highest pitch reduced over time. Therefore, their maximum frequency range was reduced from the initial test.
<table>
<thead>
<tr>
<th>Measure</th>
<th>Mean</th>
<th>N</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Sustained Vowel Shimmer (%)</td>
<td>.9600</td>
<td>10</td>
<td>.29136</td>
</tr>
<tr>
<td>Post Sustained Vowel Shimmer (%)</td>
<td>1.1500</td>
<td>10</td>
<td>.41433</td>
</tr>
<tr>
<td>Initial Continuous Speech Min F0 (Hz)</td>
<td>154.3200</td>
<td>10</td>
<td>19.32729</td>
</tr>
<tr>
<td>Post Continuous Speech Min F0 (Hz)</td>
<td>165.3900</td>
<td>10</td>
<td>20.07422</td>
</tr>
<tr>
<td>Initial Maximum Performance Max SPL (dB)</td>
<td>102.0100</td>
<td>10</td>
<td>6.07169</td>
</tr>
<tr>
<td>Post Maximum Performance Max SPL (dB)</td>
<td>98.3300</td>
<td>10</td>
<td>6.46135</td>
</tr>
<tr>
<td>Initial Maximum Performance SPL Range (dB)</td>
<td>27.2400</td>
<td>10</td>
<td>4.06918</td>
</tr>
<tr>
<td>Post Maximum Performance SPL Range (dB)</td>
<td>23.2500</td>
<td>10</td>
<td>5.17650</td>
</tr>
<tr>
<td>Initial Maximum Performance Min F0 (Hz)</td>
<td>172.1700</td>
<td>10</td>
<td>21.63624</td>
</tr>
<tr>
<td>Post Maximum Performance Min F0 (Hz)</td>
<td>184.1500</td>
<td>10</td>
<td>29.18052</td>
</tr>
<tr>
<td>Initial Maximum Performance Max F0 (Hz)</td>
<td>816.3900</td>
<td>10</td>
<td>165.36931</td>
</tr>
<tr>
<td>Post Maximum Performance Max F0 (Hz)</td>
<td>690.5100</td>
<td>10</td>
<td>169.85535</td>
</tr>
<tr>
<td>Initial Maximum Performance F0 Range (semitone)</td>
<td>26.7000</td>
<td>10</td>
<td>3.68330</td>
</tr>
<tr>
<td>Post Maximum Performance F0 Range (semitone)</td>
<td>22.5000</td>
<td>10</td>
<td>5.31769</td>
</tr>
</tbody>
</table>

Figure 1. Initial and post means of statistically significant acoustical measurements
<table>
<thead>
<tr>
<th>Measure</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Significance (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sustained Vowel Shimmer (%)</td>
<td>10</td>
<td>-.19000</td>
<td>.26013</td>
<td>.046*</td>
</tr>
<tr>
<td>Continuous Speech Minimum F0 (Hz)</td>
<td>10</td>
<td>-11.0700</td>
<td>10.51243</td>
<td>.009*</td>
</tr>
<tr>
<td>Maximum Performance Maximum SPL (dB)</td>
<td>10</td>
<td>3.68000</td>
<td>2.18215</td>
<td>.000*</td>
</tr>
<tr>
<td>Maximum Performance SPL Range (dB)</td>
<td>10</td>
<td>3.99000</td>
<td>3.28243</td>
<td>.004*</td>
</tr>
<tr>
<td>Maximum Performance Minimum F0 (Hz)</td>
<td>10</td>
<td>-11.9800</td>
<td>14.07044</td>
<td>.025*</td>
</tr>
<tr>
<td>Maximum Performance Maximum F0 (Hz)</td>
<td>10</td>
<td>125.8800</td>
<td>113.02292</td>
<td>.006*</td>
</tr>
<tr>
<td>Maximum Performance F0 Range (semitone)</td>
<td>10</td>
<td>4.20000</td>
<td>3.42540</td>
<td>.004*</td>
</tr>
</tbody>
</table>

Figure 2. Statistical significance of acoustical measures

The participants were asked to fill out a questionnaire prior to the teaching phase of the experimental sequence. The questionnaire consisted of objective and subjective questions pertaining to the participants’ vocal health and teaching aspirations. The participants were asked how many semesters they have been fully enrolled as Music Education majors (see Figure 3), what music area they plan to teach (see Figure 4), and what age group they plan to teach (see Figure 5).
<table>
<thead>
<tr>
<th>Number of Semesters</th>
<th>Number of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>2</td>
</tr>
</tbody>
</table>

Figure 3. Participants’ enrollment in the Music Education program by semester

<table>
<thead>
<tr>
<th>Planned Instructional Area</th>
<th>Number of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chorus</td>
<td>5</td>
</tr>
<tr>
<td>Orchestra</td>
<td>1</td>
</tr>
<tr>
<td>Band</td>
<td>1</td>
</tr>
<tr>
<td>Chorus and Orchestra</td>
<td>2</td>
</tr>
<tr>
<td>Chorus and Band</td>
<td>1</td>
</tr>
</tbody>
</table>

Figure 4. Instructional area participants plan to teach

<table>
<thead>
<tr>
<th>Planned Age Group</th>
<th>Number of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elementary</td>
<td>3</td>
</tr>
<tr>
<td>Elementary and Middle School</td>
<td>2</td>
</tr>
<tr>
<td>Middle and High School</td>
<td>3</td>
</tr>
<tr>
<td>Elementary, Middle, and High School</td>
<td>2</td>
</tr>
</tbody>
</table>

Figure 5. Age groups the participants plan to teach
Additionally, in order to gather data about habits affecting the voice, the participants were asked how many bottles of water they consume during a day on average and how many bottles of water they consumed on the day of the study (see Figure 6). The participants were also asked how many caffeinated beverages they consume in an average week and how many caffeine beverages they consumed on the day of the study (see Figure 7). Finally, the participants were asked how many hours of sleep they get on average and how many hours they got the night before the study (see Figure 8).

<table>
<thead>
<tr>
<th>Number of bottles of water (approx. 20 fl oz.) consumed during a day on average</th>
<th>Number of Participants</th>
<th>Number of bottles of water (approx. 20 fl oz.) consumed on the day of the study</th>
<th>Number of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>1</td>
<td>None</td>
<td>5</td>
</tr>
<tr>
<td>1-2</td>
<td>3</td>
<td>1-2</td>
<td>4</td>
</tr>
<tr>
<td>3-5</td>
<td>4</td>
<td>3-5</td>
<td>1</td>
</tr>
<tr>
<td>5 or more</td>
<td>2</td>
<td>5 or more</td>
<td>0</td>
</tr>
</tbody>
</table>

Figure 6. Water consumption daily on average and on the day of the study

<table>
<thead>
<tr>
<th>Number of caffeinated beverages during a week on average</th>
<th>Number of Participants</th>
<th>Number of caffeinated beverages on the day of the study</th>
<th>Number of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>3</td>
<td>None</td>
<td>5</td>
</tr>
<tr>
<td>1-3</td>
<td>4</td>
<td>1-2</td>
<td>5</td>
</tr>
<tr>
<td>4-7</td>
<td>3</td>
<td>3 or more</td>
<td>0</td>
</tr>
<tr>
<td>7 or more</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 7. Caffeinated beverage consumption during a week on average and on the day of the study
Figure 8. Hours of sleep per night on average and the night prior to the study

<table>
<thead>
<tr>
<th>Number of hours of sleep a night on average</th>
<th>Number of Participants</th>
<th>Number of hours of sleep the night prior to the study</th>
<th>Number of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fewer than 5 hours</td>
<td>1</td>
<td>Fewer than 5 hours</td>
<td>1</td>
</tr>
<tr>
<td>5-6 hours</td>
<td>3</td>
<td>5-6 hours</td>
<td>2</td>
</tr>
<tr>
<td>6-8 hours</td>
<td>6</td>
<td>6-8 hours</td>
<td>5</td>
</tr>
<tr>
<td>8 or more hours</td>
<td>0</td>
<td>8 or more hours</td>
<td>2</td>
</tr>
</tbody>
</table>

Only three out of the ten participants have taken a vocal pedagogy course but eight reported having attended workshops at professional conferences such as FMEA, ACDA, NATS, or CMENC meetings where vocal health was addressed. Most reported having attended one to two workshops and one participant reported having been to three to five (see Figure 9). Eight out of ten feel that vocal health is “highly important” to their future career as music educators. The remaining two participants feel that vocal health is “important” or “very important” (see Figure 10).

Figure 9. Participants’ attendance at vocal health workshops
<table>
<thead>
<tr>
<th>Importance of vocal health to career</th>
<th>Number of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not important</td>
<td>0</td>
</tr>
<tr>
<td>Somewhat Important</td>
<td>0</td>
</tr>
<tr>
<td>Important</td>
<td>1</td>
</tr>
<tr>
<td>Very Important</td>
<td>1</td>
</tr>
<tr>
<td>Highly Important</td>
<td>8</td>
</tr>
</tbody>
</table>

Figure 10. Participants’ perception of the importance of vocal health for their career

All of the participants reported experiencing vocal problems after prolonged voice use (more than 30 minutes). The most commonly reported problem was voice fatigue with nine of the ten participants reporting issues. Throat pain and difficulty with loud dynamics were reported four times each. Hoarseness, difficulty with soft dynamics, and a tickling or choking sensation were each reported twice with breathiness and difficulty with cresendo also mentioned.

Each lesson was video recorded for later analysis. Criteria for analysis were developed from *Professional Voice: Third Edition* by Dr. Robert T. Sataloff (see Attachment # 4). Kathleen Crane (Principal Investigator), Dr. Brenda Smith (Mentor), and Sarah Altman (Co-Investigator) viewed the videos in order to quantify vocal misuses and perceptually evaluate behavioral voice problems. The following vocal misuses were judged: throat-clearing, pitch elevation/decrease overuse, glottal attacks, glottal fry, jaw tension, and facial tension. The researchers found minimal throat-clearing but the pitch elevation/decrease overuse, glottal fry, and glottal attacks increased as the lesson
progressed. The longer the participants taught, the more they displayed vocal misuses.

The misuses appear to have reached a peak during the rehearsal of “Amazing Grace” late in the rehearsal (see Figure 11).

![Vocal Misuses](chart.png)

Figure 11. Quantification of vocal misuses by all participants

While all participants displayed vocal misuses, the instrumentalists were responsible for a greater percentage of the total observed misuses. For example, in the rehearsal of “Ave Verum Corpus,” the instrumentalists collectively performed 69 glottal attacks while the singers performed 36. Similarly, they were observed performing glottal fry 48 times while this was only observed in the singers 17 times. This trend continued throughout the rehearsals. However, the only throat-clearing that was observed was by one of the participants, a vocalist (see Figures 12-
Figure 12. Vocal Misuses identified in the Warm-Up by instrument

Figure 13. Vocal misuses identified during the rehearsal of “Ave Verum” by instrument
Figure 14. Vocal misuses identified during the rehearsal of “Amazing Grace” by instrument

Figure 15. Vocal misuses identified during the Cool Down by instrument
The researchers also perceptually evaluated the video recordings looking for desirable and inefficient vocal behaviors as explained in *Professional Voice: Third Edition* by Dr. Robert T. Sataloff, p969-975. Dr. Sataloff cites three inefficient vocal behaviors: yelling/screaming, loud talking, and excessive talking. Among these three, the only behavior observed was excessive talking. The researchers rated the inefficient behaviors according to the frequency of their occurrence: never, rarely, sometimes, often, or very often. Two of ten participants were often found to talk excessively and one sometimes talked excessively.

The desired vocal behaviors included breath control, breath support, tone focus in speaking, tone focus in singing, projection, prosody, and body posture including head alignment, neck alignment, chest open and erect, shoulders relaxed, knees loose, and weight on the balls of the feet. These desired vocal behaviors were rated according to their efficiency: inefficient (1), rarely efficient (2), sometimes efficient (3), often efficient (4), and very efficient (5) (see Figures 16 & 17).

The data from the video perceptual analysis show that all participants varied in the efficiency of their vocal behaviors. In general, it seems that the singers were rated more efficient with regards to their voice use (breath control, breath support, tone focus in singing and speaking, projection and prosody) but were not significantly different in terms of their posture efficiency (see Figures 18 & 19).
Figure 16. Perceptual video analysis of desired vocal behaviors by participant

Figure 17. Perceptual video analysis of participants by desired vocal behavior
Desired Behaviors: Singers vs. Instrumentalists

Figure 18. Efficiency of observed desired vocal behaviors of singers vs. instrumentalists

Posture: Singers vs. Instrumentalists

Figure 19. Efficiency of observed posture for singers vs. instrumentalists
In addition to the perceptual rating scale, the researchers also recorded subjective observations of the participants’ vocal behaviors. For all participants, they observed a decline in desirable vocal behaviors and an increase in inefficient behaviors as time progressed reaching the peak during the rehearsal of “Amazing Grace.” This decline included fatigue-related behavior such as increased vocal misuses, deteriorating posture, and body and facial tension.

Many of the vocal behaviors observed had to do with personal posture habits or other individual differences in behavior. A few, however, related to the participants’ teaching and pedagogical actions. For example, a few participants sung with the demonstration choir while they were rehearsing. One participant made a habit of talking over the singing. Another participant, a mezzo-soprano, modeled the male parts in their octave rather than the octave above. Additionally, many participants had repeated speaking behaviors such as one participant who repeatedly said “OK, so” in a staccato fashion and another who repeated “ready, alright” at frequent intervals. These teaching behaviors could contribute to deterioration of vocal efficiency.

**Discussion**

This study was designed to observe and measure vocal behaviors in potential music educators that could contribute to a decline in vocal integrity. The experiment was designed to be a near-optimal teaching experience. Music educators have to deal with many factors that could affect their vocal efficiency. Some of these factors are common to teachers of all subjects but some are unique to the music classroom. For example, classroom management is an issue all teachers must deal with but music has a number of
special circumstances. For example, extracurricular classes are not subject to the regulations put in place by the Florida Class Size Amendment. As such, a music teacher often deals with much larger classes than the classroom teacher. This increases the possibility for vocal stress as they are required to manage much larger groups of students.

The size of the music class also presents other problems. The music teacher is not only dealing with more students than the classroom teacher, they are often dealing with educational activities that are inherently louder than those in the classroom. Whether it is an ensemble-based class or a general music class, the teacher is in a position where they must compete with large numbers of students participating in making music and therefore, making more noise than in a traditional classroom setting. The teachers often speak or even sing over this noise creating the potential for vocal deterioration.

Music teachers are also often affected by ambient noise. For example, music classrooms in the secondary schools are often placed in a fine arts area of the school. As such, the choir teacher may have to talk over the noise coming from the band room in order to be heard. Additionally, the acoustics of the music room can play a role. In order to accommodate the number of students and amount of equipment needed for music classes, the music room is often larger than a traditional classroom also contributing to environmental factors that can affect the music teacher’s voice.

These are just some of the unique issues facing music teachers. In this study, the researcher controlled for these variables by eliminating classroom management, class size, and controlling the environment. Each lesson in the study was taught in a classroom in the Music Building to a demonstration group made up of four voice students from the School of Music. This demonstration choir remained constant throughout the
experimental process. In this way, the investigators controlled the class size and eliminated the issues of classroom management.

There were many other methods of control. Each participant was provided with a 20 fl. Oz. bottle of water. Also, each participant was given a specific protocol to follow when creating their lesson. They were to lead a seven minute Warm-Up with exercises chosen from a warm-up regime developed by the researcher, a ten minute rehearsal of “Ave Verum Corpus,” a ten minute rehearsal of “Amazing Grace,” and a three minute Cool Down also designated by the researcher. Each section was timed and the participants were notified when they had two minutes left in the section and at the end of each section. Additionally, all participants were required to read an opening and closing statement as a part of the lesson protocol.

Another method of control involved the use of the piano. The researcher acted as the accompanist for the participants. The accompanist only gave pitches to the participant teachers who were then required to model for the singers. The piano was only used to support the participant rather than to help the demonstration choir. The singers were instructed that they were only allowed to sing if the teacher participant had modeled their starting pitch. In this way, the researcher controlled for the varying abilities of the participants in regards to piano skills. They were all required to vocally model rather than being able to rely on the piano for musical assistance.

Through these methods of control, a near-optimal teaching experience was created. Even with this near-optimal experimental design, mild acoustical differences were found between the initial and post-teaching task acoustical screenings. Among the acoustical measurements employed, a few measurements yielded statistically significant
changes. The mean sustained “ah” shimmer percentage or perturbation in amplitude increased over time and the participants’ inflections in continuous speech were higher over time. Additionally the mean of the participants’ loudest possible pitches reduced reducing the maximum amplitude range. Their lowest pitch increased and their highest pitch decreased reducing their maximum frequency ranged from the initial test. Each of these results displays a trend toward deterioration of vocal integrity.

Not only did all participants display acoustical changes indicative of vocal deterioration but they all displayed similar patterns in deterioration of desirable vocal behaviors over the course of the thirty minute lesson. In general the number of vocal misuses observed increased for the participants as the lesson progressed. The number of vocal misuses reached its peak during the rehearsal of “Amazing Grace,” seventeen minutes into the lesson. This suggests that the vocal misuses increase over prolonged voice use. This could be due to fatigue, decreased concentration on how one is using one’s voice, or many other factors. The participants displayed similar trends towards increasing deterioration of vocal integrity. This general increase in vocal misuses occurred for the participants regardless of their primary instrument, length of time in the Music Education program, and other factors.

Interestingly, however, there were differences between the vocalists and instrumentalists in terms of their vocal misuses. In this study, there were five vocalists, four instrumentalists, and one participant who studies primarily as an instrumentalist with voice as her secondary instrument. Classifying this participant as an instrumentalist and comparing the five vocalists to the five instrumentalists, the instrumentalists performed a significantly higher percentage of the vocal misuses performed by the entire participant
pool. This suggests that the possibility of vocal problems is not confined to those in the choral domain. It could be assumed that those who teach chorus would be more susceptible to vocal injury as they are speaking and singing throughout their daily work. However, many individuals who work in the choral realm have received formal vocal training. This could possibly increase their likelihood of using their voice efficiently thus reducing their risk of vocal problems. Instrumentalists, on the other hand, may not have such training. Although they may not have as much call to use singing as the chorus teacher, there is an increasing trend towards using vocal modeling in the instrumental classroom in order to display phrasing, articulation, and other aspects of musicality. As such, instrumental teachers also use their singing voice in addition to their speaking voice in rehearsal. It is therefore vital that all potential music educators, regardless of primary instrument, be equipped with strategies to prevent vocal problems.

The acoustical results as well as the perceptual quantification of vocal misuses suggest that vocal deterioration occurs over time during the choral rehearsal. The participants displayed mild acoustical changes indicative of vocal deterioration and increasing performance of vocal misuses as the lesson progressed. One could speculate from these results that with a longer period of voice use (ie. 8 hours/day, 5 days/week) that moderate to perhaps severe vocal deterioration would occur during the course of one’s teaching career. As such, there is a great need for more research into strategies for the prevention of voice disorders among those in the field of music education.

Another interesting result was found in the video analysis. Prior to viewing the videos, we expected to find many instances of throat-clearing on the part of the participants. It is a very common and detrimental vocal misuse. After viewing the videos,
however, we found that only one participant cleared her throat and even this was minimal. This was a very surprising result. One possible explanation has to do with the participants’ attendance at workshops relating to vocal health. For the past few years, Dr. Brenda Smith has been a regular speaker at meetings of the University of Florida’s chapter of Collegiate Music Educators National Conference (CMENC). At these vocal health workshops, one of the strategies frequently discussed is swallowing or coughing as an alternative to clearing one’s throat. As all but two participants reported attendance at vocal health workshops including those at CMENC meetings, it is possible that the awareness they gained at such workshops led to a change in vocal behaviors and a decrease in throat clearing. If this is the case, it leads one to believe that training of awareness of vocal behavior can lead to improved vocal efficiency and prevention of voice disorders.

Some of the most interesting results came from the video observations. In addition to the personal vocal behaviors, the researcher observed some pedagogical behaviors that could contribute to a decline in vocal integrity. For example, some participants sung with the demonstration choir while they were rehearsing. From an educational standpoint, this practice is discouraged because the students become reliant on hearing the teacher’s voice and the teacher is less able to accurately identify errors in the students’ singing. If this becomes habit, it will also contribute to a decline in vocal integrity. As such, this practice is undesirable from both an educational and vocal perspective.

Another behavior involved talking over the students singing. This is a more difficult issue. Brief reminders to the students can save time in the rehearsal as the
conductor will not need to stop and explain as frequently. However, if this happens too often, it can be detrimental. Additionally, when working with a large group (rather than the small, four person demonstration group from this lesson), the students may not be able to hear the teacher’s spoken directions making the practice ineffective and potentially harmful.

Many teachers frequently deal with one of the behaviors observed in the video. Choral teachers must provide a good vocal model for both genders. This can be somewhat difficult in terms of the teachers’ natural range. Male teachers frequently try to sing in falsetto (sometimes unsuccessfully) to model for their female students. Alternately, as we observed in the video, female teachers sometimes try to sing the tenor and bass parts rather than modeling in their own octave. This can be detrimental to the teacher as it would be very easy to press on the lower register contributing to vocal fatigue. Additionally, a vocal model outside of the teacher’s comfortable range will not be beneficial in helping the students develop a healthy, well-supported tone. A more desirable habit would be to sing the opposite gender’s part in one’s own octave and play the part in the correct octave on the piano until the students become accustomed to the practice.

The final teaching behavior that was observed involved speaking habits where the teacher repeats phrases over and over again. Some teachers say “like,” “umm,” “ok,” or other such interjections. This is undesirable from a teaching standpoint because some such phrases detract from the authority of the speaking and what has been termed the “teaching voice.” Additionally, it can contribute to a lack of focus on the part of the students. For example, a teacher who says “ready” repeatedly as they get the students’
attention to sing may lose their focus if it is not immediately followed by singing. Just like the conductors who bring their hands up as if about to give a conducting prep and then continue talking, the students will learn to ignore such vocal cues as they are not followed immediately by action. From the vocal point of view, such utterances can put undo strain on the voice leading to potential deterioration of vocal health and efficiency.

After eliminating confounding variables (discipline, student age and ability, class size, ambient noise, etc.), the investigators were able to create a near-optimal teaching environment. Even within a near-optimal environment, mild acoustic changes were noted in addition to several different vocal misuses and mild overall vocal deterioration. One could speculate from these results that with a longer period of voice use (ie. 8 hours/day, 5 days/week) that moderate to perhaps severe vocal deterioration would occur during the course of one’s teaching career. More research is needed to develop behavior modification strategies for the prevention of vocal problems among music educators.
References


Schwartz, Sandra M. “Vocal Health of Middle School and High School Choral Directors.” (Ph.D. diss., University of Miami, 2006).


“Developing Strategies for the Prevention of Vocal Problems Among Potential Music Educators” Questionnaire

*You may leave any question blank at your discretion.

1. Name__________________________________________________________

2. Birth date: ______________________________________________________

3. For how many semesters have you been a fully enrolled Music Education Major at the University of Florida?
   - [ ] 1  [ ] 2  [ ] 3  [ ] 4  [ ] 5  [ ] 6  [ ] 7

4. What is your primary instrument?____________________________________

5. If applicable, secondary instrument:__________________________________

6. What type of music do you plan to teach? (circle all the apply)
   - Choral  Orchestral  Band

7. Which age group do you plan to teach? (circle all that apply)
   - Elementary  Middle School  High School

8. Are you classically trained as a singer?   Yes or No

9. If you answered yes to the previous question, how long have you been studying voice? (please circle one)
   - 1 year or less  [ ] 1-2 years  [ ] 3-4 years  [ ] 4 or more years

10. Have you had vocal training in non-classical genres? If so, which genres?
    __________________________________________________________________

11. Have you ever been diagnosed with a voice disorder? Yes or No

12. If you answered yes to the previous question, was surgery required? Yes or No

13. How many caffeinated beverages do you consume during a week on average? (circle one)
    None  [ ] 1-3  [ ] 4-7  [ ] 7 or more
14. How many caffeinated beverages have you consumed today? (circle one)
   None        1-2        3 or more

15. How many bottles of water (approx. 20 fl oz) do you consume in an average day?
   None        1-2        3-4        5 or more

16. How many bottles of water (approx. 20 fl oz) of water did you consume today?
   None        1-2        3-4        5 or more

17. On average, how many hours of sleep do you receive nightly? (circle one)
   8 or more hours     6-8 hours    5-6 hours    Fewer than 5 hours

18. How many hours of sleep did you receive last night? (circle one)
   8 or more hours     6-8 hours    5-6 hours    Fewer than 5 hours

19. How important do you think vocal health is to your future career as a music educator? (circle one)
   Not Important       Somewhat Important
   Important           Very Important    Highly Important

20. Have you taken a college level vocal pedagogy course? Yes or No

21. Have you attended workshops where vocal health was addressed (at professional conferences of organizations such as FMEA, ACDA, NATS, or CMENC meetings, etc.)?
   None        1-2        3-5        5 or more

22. After prolonged voice use (more than 30 minutes), have you experienced any of the following? (Please circle all that apply)
   Hoarseness     Voice Fatigue    Breathiness    Throat Pain
   Loss of Range    Tickling or choking sensation while singing
   Difficulty with dynamics: soft    loud    crescendo    decrescendo

   Other (Please explain)__________________________________________________________
**Attachment #2**

**Research Lesson Plan**

***Time allotment will be monitored using a stopwatch and the participant will be given a signal indicating 2 minutes to the end and the end of each segment of the lesson.***

*** An accompanist will be provided for purposes of harmonic support. The pieces are to be rehearsed entirely a cappella (without piano accompaniment) and reviewing of parts must be done through vocal modeling (demonstrating through singing) by the instructor.

Participants will teach a 30 minute lesson according to the following guidelines:

1) Opening Statement

   *Good afternoon class. This rehearsal is being conducted as a part of a study entitled “Developing Strategies for the Prevention of Vocal Problems Among Music Educators.” Today is (date of study) and the time is (time of day). My name is (name of participant) and I am a (academic year and major). Today, we will be rehearsing “Ave Verum Corpus” by Wolfgang Amadeus Mozart and the traditional piece “Amazing Grace.”*

2) 7 minutes: Warm-up


   - Physical Warm-Up: stretching, relaxation, and posture
   - Warm-Down
   - Warm-Up
   - Diction Warm-Up
   - Chordal Warm-Up

3) 10 minutes: Rehearse “Ave Verum Corpus” (KV618) by Wolfgang Amadeus Mozart from measure 22 to the end

4) 10 minutes: Rehearse “Amazing Grace”


6) Closing Statement

   *Thank you very much. The time is now (time of day) on (date of study). This lesson was given as a part of the study entitled “Developing Strategies for the Prevention of Vocal Problems Among Music Educators.”*
Attachment #3

Developing Strategies for the Prevention of Voice Problems among Music Educators

Warm-Up Regime

Physical Warm-Up

Relaxation

1) Stretch the arms and legs, twist the torso, and rotate the head gently to ease tensions

2) Imagine the body to be a marionette, pulled by imaginary strings. First the right shoulder and then the left are lifted from above and relaxed. Next lift the arms and legs.

3) Touch the toes, allowing the upper extremities to hang gently and stretch. With eyes closed, slowly lift the torso to its erect position. Open the eyes when the body is standing tall. Repeat when necessary

Posture

1) Evoke the position of a winning athlete at an Olympic event, standing proud during the flag ceremony

2) Envision the head gear of Shakespearean actors with streaming cloth suspended from high, cone-shaped hats, with the head elevated, the neck relaxed, and the posture tall and stately.

3) Pretend books or fruits are balanced on the head.
Cool Down

1) A steady, well-supported sigh beginning on an easily reached upper ton and descending through the middle range followed by a gentle shrug of the shoulders, to relax the body and voice.

2) Chanting selected poetry or prose at various pitch levels and moving from the head voice through the middle voice to prepare the voice for conversation speaking tones


Warm Down, Warm-Up, Diction Warm-Up, and Chordal Warm-Up chosen from *Complete Choral Warm-up Book* by Dr. Russell R. Robinson and Jay Althouse published by Alfred Publishing Co.
Attachment #4

Criteria for Analysis of Video Recordings

***Measurements based on behavioral voice problems from *Professional Voice: Third Edition* by Dr. Robert T. Sataloff p 969-975

**Inefficient Vocal Behaviors**

*Scale: 1=Never, 2=Rarely, 3=Sometimes, 4=Often, 5=Very Often*

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<thead>
<tr>
<th>Behavior</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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</thead>
<tbody>
<tr>
<td>Yelling/Screaming</td>
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<tr>
<td>Loud Talking</td>
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<tr>
<td>Excessive Talking</td>
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**Desired Vocal Behaviors**

*Scale: 1=Inefficient, 2=Rarely Efficient, 3=Sometimes Efficient, 4=Often Efficient, 5=Very Efficient*

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<tr>
<th>Behavior</th>
<th>1</th>
<th>2</th>
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<tbody>
<tr>
<td>Breath Control</td>
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<tr>
<td>Breath Support</td>
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<tr>
<td>Tone Focus: Speaking</td>
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<td>Tone Focus: Singing</td>
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<td>Projection</td>
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<td>Prosody</td>
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<tr>
<td>Overall Body Posture</td>
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<tr>
<td>Head Alignment</td>
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<tr>
<td>Neck Alignment</td>
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<tr>
<td>Chest Open and Erect</td>
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<tr>
<td>Shoulders relaxed</td>
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<tr>
<td>Knees loose</td>
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<tr>
<td>Weight on the balls of the feet</td>
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