Voice and Speech Review

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/rvsr20

Voice Screenings for University Students: The Why and the How

Brett Myers , Brian Manternach & Karin Titze Cox

To cite this article: Brett Myers , Brian Manternach & Karin Titze Cox (2020): Voice Screenings for University Students: The Why and the How, Voice and Speech Review, DOI: 10.1080/23268263.2021.1858593

To link to this article: https://doi.org/10.1080/23268263.2021.1858593

Published online: 18 Dec 2020.

VOICE AND SPEECH REVIEW
https://doi.org/10.1080/23268263.2021.1858593

FORUM

Voice Screenings for University Students: The Why and the How

Brett Myers[a,b], Brian Manternach[c,d] and Karin Titze Cox[e]

[a]Division of Otolaryngology–Head and Neck Surgery, University of Utah, Salt Lake City, UT, United States; [b]Department of Communication Sciences and Disorders, University of Utah, Salt Lake City, UT, United States; [c]Department of Theatre, University of Utah, Salt Lake City, UT, United States; [d]National Center for Voice and Speech, University of Utah, Salt Lake City, UT, USA; [e]Voice Clinic, ENT Specialists, Salt Lake City, UT, USA

Vocal Health in a University Setting

Many university programs train students for careers in which they will face a lifetime of challenging vocal demands. These future professions include actors, singers, broadcasters, teachers, clergy, lawyers, sales workers, and many others. The vocal demands of these professions place these individuals at high occupational risk for developing voice problems (Roy et al. 2004; Titze, Lemke, and Montequin 1997; Angelillo et al. 2009; Russell, Oates, and Greenwood 1998; Zeine and Waltar 2002).

Actors and singers are particularly susceptible to vocal fatigue as a result of voice use in rehearsals, private practice, and performances (Novak et al. 1991; Sapir 1993; Kitch and Oates 1994). Additional lifestyle situations affect many students, such as nonperformance employment, irregular sleep patterns, late-night eating, consumption of caffeine and alcohol, smoking, and excessive talking at social gatherings (Ziegler and Johns 2012; Sapir, Mathers-Schmidt, and Larson 1996). One study tracked vocal health and negative vocal symptoms in freshman musical theatre students over ten years, and more than half of the students had voice complaints while enrolled in the training program (Donahue et al. 2014).

While it may be obvious that voice use and vocal health are crucially important for longevity in some career paths, reports in the literature indicate that vocal performance students may not have an appropriate understanding of their own vocal health. Lerner et al. (2013) examined 30 graduate students in the Yale School of Drama, and they found that 59% had excessive muscle tension in voice production and 55% had decreased mucosal wave. D'haeseleer et al. (2017) examined 31 undergraduate musical theatre students at Ghent University and found that 68% had excessive muscle tension and 45% had a vocal fold lesion. It is important to note that the students in these studies were not seeking healthcare for any voice problems, which shows that vocal pathologies may be present without the individual being aware of the symptoms.

Zeine and Waltar (2002) surveyed acting students, as well as amateur and professional actors, and found that participants had a limited knowledge of vocal health and preventive measures, though they indicated a strong interest in learning more about the subject. Furthermore, many respondents did not understand the role of the speech-

CONTACT Brett Myers Brett.Myers@hsc.utah.edu

language pathologist (SLP) in the care of the professional voice. This is concerning because the SLP is a valuable team member in diagnosing and treating voice disorders and can be a vital resource for the student's career longevity and long-term success. In an effort to fill this gap, Ziegler and Johns (2012) proposed a framework for teaching vocal health and injury prevention to student singers in a seminar setting, which proved to be beneficial and enlightening to the students. Similarly, Lee et al. (2004) composed a brochure for SLPs to educate parents of children with voice disorders, which was a useful supplement to speech therapy in schools.

Vocal Health Screenings

Another way to educate students is to provide vocal health screenings in which they receive a personal educational review of their own laryngeal anatomy and physiology. Vocal health screenings are conducted by an SLP to assess parameters affecting phonation, resonance, and respiration. At the University of Utah, we developed a vocal health screening protocol that consists of laryngeal imaging, perceptual and acoustic assessment, and educational resources for vocal health. Laryngeal imaging is performed with *videostroboscopy*—an examination that involves placing an endoscope through the oral or nasal channels to visualize the larynx. A stroboscopic light is emitted through the endoscope to assess the vibratory characteristics of the vocal folds. Another name for this procedure is *laryngoscopy*, although laryngoscopy can be performed with a steady or stroboscopic light source. Since we are interested in assessing vocal fold vibration with a strobe light, we will refer to this procedure as videostroboscopy. Perceptual voice assessment is performed by the SLP rating voice qualities of roughness, breathiness, weakness, and strain. Acoustic assessment is performed with a head-mounted microphone recording of the voice in reading and spontaneous speech tasks. This recording is analyzed for pitch, loudness, and vocal quality parameters in a computer software program (e.g., Praat). We also included a self-assessment tool in the screening to quantify the psychosocial consequences of students' signs and symptoms during the screening (The Voice Handicap Index; Jacobson et al. 1997).

The purpose of these screenings is to provide education and to assess the parameters of vocal function (American Speech-Language-Hearing Association 2020). If screeners detect abnormal deviations, the students are referred to our otolaryngology colleagues for evaluation and diagnosis, as only the otolaryngologist can diagnose pathology. The screening process is therefore worthwhile for students who are vocally healthy and for those who are experiencing vocal difficulties. In this paper, we describe why vocal health screenings are important and how these services can be provided to students in a university setting.

Pulling Back the Curtain

Many aspects of vocal study are shrouded in mystery. Indeed, the sights, sounds, and sensations experienced during vocalization can send confusing signals back to the one vocalizing. In some cases, these experiences can be in opposition to the physical reality that occurs during voice production. Therefore, when students can visualize the

biomechanics of their own voice use, they are better equipped to make informed decisions about their vocal health, vocal care, and vocal technique.

Sights

When students are watching themselves in mirrors in practice rooms or rehearsal rooms, they are not able to directly view many of the muscles, organs, structures, and spaces involved in vocalization (vocal folds, laryngopharynx, lungs, etc.). At best, they can observe some behaviors associated with movement or engagement of these apparatuses. For example, upon inhalation, students may notice abdominal distension as the result of diaphragmatic contraction pushing against the viscera and displacing abdominal contents. However, since they are not able to directly view the diaphragm moving in its actual *in vivo* location, students often incorrectly surmise that the abdominal distension is caused by the diaphragm itself descending deep into the abdominal cavity. In this case, "What you see is what you get" may not apply. We should note that many successful performers have never visualized their own vocal folds, so this exam is certainly not necessary to perform. Nevertheless, we feel that videostroboscopy is a worthwhile contribution to students' vocal education.

Sounds

Misperception extends to sound, as well. Anecdotally, many students admit to being surprised, put off, or even horrified when they hear recordings of their own voices. As Tobias Reichenbach of the Department of Bioengineering at Imperial College London explains, the way we perceive our own voices is not simply through the sound waves that reach our ears. "Interestingly, bone conduction plays a role in how we recognise our voice," he says. "This is because the process is more effective at transmitting lower frequency sounds to the brain, which means that we perceive our voice as being deeper than what it is" (as quoted in Smith 2014).

Studies indicate that other factors can also influence how we hear, and thus use, our voices, including the presence of background noise (Bosker and Cooke 2018) and the size of the room in which we are speaking or singing (Brunskog et al. 2009). Therefore, although our hearing provides important information that guides our vocal choices, it also can mislead.

Sensation

Phonation often creates individualized physical sensations that can guide our vocal use, as well. Recognizing bodily sensations associated with voice use is an integral part of training for actors, and students are often encouraged to be in tune with how their vocal energy transmits through their bodies (Linklater 2006; Lessac 1996; Sansom 2016). These experiences can lead students to "mis-map" their own bodies, meaning they develop beliefs about physical function that are based on sensation instead of actuality. For instance, author Kenneth Bozeman highlights the "false kinesthesia" that leads people to believe there is more pharyngeal space created by the vowel /a/ than /i/, when, indeed, the opposite is true (Bozeman 2017).

Even the terms "head voice" and "chest voice" likely emerged as a result of the sensations felt when singing in each of these registers, leading at least one historical pedagogue to surmise that it is actually the sinuses, and not the vocal folds, that are responsible for vocal tone production (White 1938; David and Irene 2020). Clearly, humans do not literally produce distinct voices in the head or chest, but the resonant sensations of different voice styles led to these descriptors. Without understanding the anatomical foundation of voice production, some students may perpetuate these and other misperceptions about their voices.

Informed Choices

Are these misperceptions of any consequence? When it comes to vocalization, as long as students are producing sound more or less efficiently, does it matter how much they know about the physical structures involved? Body mapping is one method that performers can use to train kinesthetic awareness of body alignment, and this should be based on an understanding of anatomy.[1] However, Andover Educator (of the Association for Body Mapping Education) Kurt-Alexander Zeller believes physical misperceptions actually do contribute to vocal inefficiencies. As he points out, if students believe, for instance, "that ribs are stationary or immovable [. . .] or that the diaphragm is a vertical structure [. . .]they will do their darnedest to move as if that faulty body map were reality" (Manternach 2017a).

From a vocal health perspective, students may fall into the habit of excessive throat clearing, believing they have phlegm or mucus in the throat. In many cases, the sensation of globus does not necessarily indicate an abnormal amount of mucus. Rather, it is due to any number of possible laryngeal irritations that, because the vocal folds are not immediately visible, lead to excessive throat clearing that may simply exacerbate the irritation (Bonilha et al. 2012).

Therefore, there are many ways our own sight, sound, and sensation may betray us when it comes to the reality of voice production. Voice screenings can help provide students with factual information so that they can make knowledgeable choices regarding their vocal use and vocal health.

The Student Experience with Voice Screenings

Students are often fascinated to see their vocal folds for the first time. If "a picture is worth a thousand words," a single voice screening can, in some ways, provide a greater vocal education than an entire semester of lectures on vocal anatomy and physiology. Indeed, when students have had some background coursework in voice (such as voice and text, vocal pedagogy, or class voice), the experience can be even more impactful as they make connections between their textbooks and their own bodies. As voice professor and vocologist Lynn Helding points out, students' first encounters with their vocal folds can be "reassuring," "powerful," and "almost spiritual," especially for artists whose livelihoods depend on an "invisible instrument" (Krieger 2017).

Voice screenings may reveal potential pathologies that require referral to the proper medical professionals for diagnosis. A survey of 545 college students found

that 29% of students had a history of a voice disorder (Merrill et al. 2013). In certain cases where this has occurred with students at the University of Utah, specialists have identified vocal pathologies and prescribed treatment regimens ranging from lifestyle changes to speech therapy to pharmacological interventions designed to improve vocal health.

In a 2017 article in the *Journal of Singing*, Manternach (2017b) reported that when specific students with voice complaints were referred to a voice clinic, instead of reacting with grave concern or disappointment, they were actually relieved. Some indicated feeling hopeful that they may finally find a solution to the vocal problems they had been experiencing. They were further relieved to discover that the issue may not be due to improper vocal technique or inadvertent vocal "abuse." Instead, it could be the result of overuse, a physical limitation, or other conditions affecting vocal function. Additionally, some students may be asymptomatic, but a vocal health screening may reveal pathology. If this occurs, the students will be advised to treat or monitor the condition, based on the plan of care that their provider deems most appropriate.

Involving vocal health professionals in students' education creates a team approach to vocal instruction that is invaluable to voice professors as well, since vocal pathologies can obviously inhibit students' progress in vocal technique. It is important to note that not all students necessarily require vocal health screenings, but these services may be offered to any students who are particularly interested or concerned about their vocal health. While recognizing the limitations of each professional's scope of practice, voice screenings can lead students to the resources they need in order to achieve the full vocal health and function that cannot be attained in the voice studio alone.

Cross-Campus Collaborations and Resources

Interdepartmental collaboration is essential for creating a team approach to vocal instruction. Faculty members from at least two departments within the university may facilitate the vocal health screenings: one department with an emphasis on vocal performance, and the other in a related healthcare discipline. At the University of Utah, one such relationship developed between the Musical Theatre Program (MTP) in the Department of Theatre and the Department of Communication Sciences and Disorders (CSD).

The first and second authors are the representatives from CSD and MTP, respectively, who initiated this collaboration. Through a series of discussions, we concluded that both departments would benefit from offering screenings to our students. CSD would benefit by giving their graduate students an opportunity to learn videostroboscopy and practice clinical voice assessments. MTP would benefit by promoting the vocal health of their students and by giving them the experience of a clinical voice assessment. Furthermore, the University of Utah embraces a vision of cross-campus collaborations to facilitate innovative programs, so this interaction between departments was well received by the institution.

At any given academic institution, either department can initiate a similar collaboration. From the performance side, a faculty member could investigate what options are available on campus. If the institution has a CSD program, this could be a potential avenue for collaboration, as SLPs or graduate students in the training

program could conduct the vocal health screenings under faculty supervision. The first step would be to identify a CSD faculty member who specializes in the evaluation and treatment of voice disorders. The next step would be to determine whether the individual has access to videostroboscopy equipment on campus. If this is available, then propose the idea of conducting these screenings for students who are in vocally demanding majors. Alternatively, the CSD faculty member could initiate this collaboration with the goal of providing this service to students on campus.

Videostroboscopy training is a worthwhile addition to any CSD program, as CSD graduate students will be better prepared for future clinical practice after having this experience. It is not currently standard for graduate programs to provide hands-on experience with laryngeal imaging, though some programs do offer it. At the University of Utah, we developed a series of workshops that train students on the performance and interpretation of videostroboscopy. CSD students attended the workshops in small groups for several weeks of training that involved administering the exams on each other. This process enhanced their knowledge and skills in voice assessments, and they reported that it built their confidence for performing vocal health screenings. In addition to laryngeal imaging, the students also became proficient in collecting case histories, acoustic measurements, and perceptual evaluations of the voice, which are essential components to any voice assessment (Patel et al. 2018).

Overall, an interdepartmental collaboration would be mutually beneficial to both sides. At the University of Utah, the CSD students gain training and experience with conducting the exams, and the MTP students gain knowledge of their laryngeal anatomy and vocal health. Importantly, similar relationships can also be established with other departments, such as education or law programs, as these disciplines also train students for vocally demanding professions. Likewise, if a university does not have a CSD department, the vocal performance department may collaborate with university-affiliated hospitals or clinics that would treat performers.

Private Voice Clinic Collaborations and Resources

In the United States, there may also be private voice clinics, which are not always affiliated with universities directly but often consist of a team of vocologists (otolaryngologists, SLPs, and private voice teachers/coaches). These private community voice clinics also find collaboration essential for establishing and maintaining vocal health screenings for university students in their community and state. Private voice clinic team members and members of university departments can collaborate in vocal health screening events or provide opportunities for individual vocal health screenings. As each state determines who may be licensed to perform these assessments, the teams and departments should evaluate the necessary equipment, staff, and locations required to complete the screenings appropriately. Licensing and liability should always be addressed as well as proper procedures for privacy, protection, consent, and sterilization. It is important to evaluate each setting individually to determine its feasibility. Events held on campus are usually advantageous for students in terms of cost, travel, and scheduling. If such approaches are not feasible, coordinators can arrange to hold screenings on site at particular voice clinics. The second and third authors have arranged both events and individual screening opportunities for students throughout the school year and when

students are in between semesters or on break. All collaboration should focus on the needs of the student and their best interests in providing screening opportunities.

It is important to note that university departments and private voice clinics both benefit from offering vocal health screenings to students and faculty. Generally, maintaining vocal health positively affects many aspects of public health. Administratively, maintaining vocal health also improves productivity and the economy of an academic institution. The education provided in a vocal health screening leads students and faculty (especially those underserved) in the direction of awareness and assistance. Knowledge about students' vocal health may prove to be a vital long-term benefit in maintaining their future demands and understanding future expectations.

Private voice clinics benefit as they establish trust within local communities. Voice clinics thrive when individuals share vocal knowledge with friends and family. Providing vocal health screenings fosters a relationship and trust with students and faculty, as well as their friends and family. The professional clinicians also benefit from providing baseline screenings because the screenings help clinicians establish an appreciation for both the normal and exceptional use of voice in their community. This appreciation for normal and exceptional vocal demands fosters understanding, trust, and further collaboration.

Either the academic institution or the private voice clinic can initiate collaboration. The relationships between institutions are often fostered in group settings within conferences and organizations, but they are also fostered in respectful referral relationships. It is important for voice professionals to approach other institutions with an attitude of learning and appreciation of the demands and challenges they face. Individuals and institutions rarely welcome judgment in which they experience blaming or shaming from an unfortunate injury. Trust and understanding fosters an environment in which voice professionals can help and educate effectively for the future well-being of the student and department.

Conclusion

Vocal health screenings provide meaningful assessments of vocal health for university students in vocally demanding courses and contribute to their vocal education. Screening events also provide clinical training experience to speech-language pathology graduate students. Furthermore, the collaborations that develop from the team approach to voice care are mutually beneficial to all parties involved—from various departments within the university to private voice clinics. Participating in vocal health screenings is an excellent way for students to pull back the curtain and directly address the mechanics of their own voice production. After doing so, they will be better prepared to enter the world and launch careers full of healthy voice use.

Note

1. See Moreno (2016) for review.

Disclosure Statement

No potential conflict of interest was reported by the authors.

Notes on contributors

Brett Myers, PhD, CCC-SLP is an Assistant Professor in the Department of Communication Sciences and Disorders at the University of Utah. He is also a speech-language pathologist at the University of Utah Voice Disorders Center, treating patients with voice, airway, and swallowing disorders. Brett serves as Digital Associate Editor for the Psychonomic Society. Brett's research interests include cognitive processes in speech production, motor control of voice and speech, and treatment modalities in voice disorders. Outside of the clinic, Brett is an actor, director, and dialect coach in plays and musical theatre.

Brian Manternach, DM, is an Assistant Professor (Clinical) in the University of Utah Department of Theatre and a Research Associate at the National Center for Voice and Speech. He has given presentations for the National Association of Teachers of Singing, the Pan American Vocology Association, the Voice Foundation, the Summer Vocology Institute, and VASTA. He is an Associate Editor for the *Journal of Singing*, a columnist for *Classical Singer*, and contributed a chapter to *The Voice Teacher's Cookbook* (Meredith Music). He is an active singer in both classical and music theatre genres.

Karin Titze Cox, MA, CCC-SLP/Vocologist is the Voice Clinic Director for ENT Specialists (Salt Lake City). She consults and supervises in three different private clinics. Licensed in Utah and California, she educates outside organizations and publishes research with the National Center of Voice and Speech. She's a Summer Vocology Institute instructor and recently served three years as Western Regional Governor for the Pan American Vocology Association where committees in outreach/education to community, Latin America and media lead to various presentations and published materials. She serves on the NCVS Board currently with many of her mentors and trusted colleagues.

References

American Speech-Language-Hearing Association. 2020. "Voice Disorders: Assessment." https://www.asha.org/Practice-Portal/Clinical-Topics/Voice-Disorders/

Angelillo, M., Gianna Di Maio, G. Costa, Nicola Angelillo, and Umberto Barillari. 2009. "Prevalence of Occupational Voice Disorders in Teachers." *Journal of Preventive Medicine and Hygiene* 50 (1): 26–32.

Bonilha, Heather Shaw, Terri Treman Gerlach, Lori Ellen Sutton, Amy Elizabeth Dawson, and Paul J. Nietert. 2012. "Laryngeal Sensation before and after Clearing Behaviors." *Journal of Voice* 26 (5): 674.e1–674.e6747. doi:10.1016/j.jvoice.2011.12.012.

Bosker, Hans Rutger, and Martin Cooke. 2018. "Talkers Produce More Pronounced Amplitude Modulations When Speaking in Noise." *The Journal of the Acoustical Society of America* 143: EL121–EL126. doi:10.1121/1.5024404.

Bozeman, Kenneth W. 2017. *Kinesthetic Voice Pedagogy: Motivating Acoustic Efficiency*, 8–9. Gahanna, OH: Inside View Press.

Brunskog, Jonas, Anders Christian Gade, Gaspar Payá Bellester, and Lilian Reig Calbo. 2009. "Increase in Voice Level and Speaker Comfort in Lecture Rooms." *The Journal of the Acoustical Society of America* 125: 2072–2082. doi:10.1121/1.3081396.

D'haeseleer, Evelien, Sofie Claeys, Iris Meerschman, K. Bettens, S. Degeest, C. Dijckmans, J. De Smet, et al. 2017. "Vocal Characteristics and Laryngoscopic Findings in Future Musical Theater Performers." *Journal of Voice* 31 (4): 462–469. doi:10.1016/j.jvoice.2016.11.018.

David, Harris, and Laurel Irene. 2020. "The Language of Voice: How 'Head' and 'Chest' Can Pave the Way to Twenty-First-Century Terminology." *Voice and Speech Review* 14 (2): 167–183. doi:10.1080/23268263.2020.1691335.

Donahue, Erin N., Wendy D. Leborgne, Susan Baker Brehm, and Barbara D. Weinrich. 2014. "Reported Vocal Habits of First-year Undergraduate Musical Theater Majors in a Preprofessional Training Program: A 10-year Retrospective Study." *Journal of Voice* 28 (3): 316–323. doi:10.1016/j.jvoice.2013.11.011.

Jacobson, Barbara H., Alex Johnson, Cynthia Grywalski, Alice Silbergleit, Gary Jacobson, Michael S. Benninger, and Craig W. Newman. 1997. "The Voice Handicap Index (VHI): Development and Validation." *American Journal of Speech-Language Pathology* 6 (3): 66–70. doi:10.1044/1058-0360.0603.66.

Kitch, Josephine A., and Jennifer Oates. 1994. "The Perceptual Features of Vocal Fatigue as Self-reported by a Group of Actors and Singers." *Journal of Voice* 8: 207–214. doi:10.1016/S0892-1997(05)80291-7.

Krieger, Diane. 2017. "Singers Get Preventive Care for Vulnerable Vocal Cords at USC Voice Center." 18 October 2017. https://news.usc.edu/129649/lets-hear-it-for-preventive-care-usc-singers-tend-to-their-vocal-cords/

Lee, Linda, Joseph C. Stemple, Leslie Glaze, and Lisa N. Kelcher. 2004. "Quick Screen for Voice and Supplementary Documents for Identifying Pediatric Voice Disorders." *Language, Speech, and Hearing Services in Schools* 35 (4): 308–319. doi:10.1044/0161-1461(2004/030.

Lerner, Michael Z., Boris Paskhover, Lynn Acton, and Nwanmegha Young. 2013. "Voice Disorders in Actors."

Lessac, Arthur. 1996. *The Use and Training of the Human Voice*. New York City: McGraw-Hill.

Linklater, Kristin. 2006. *Freeing the Natural Voice*. Chicago: Drama Pub.

Manternach, Brian. 2017a. "The Singer's Library: Finding Your Vocal Compass." *Classical Singer* December. 44–49.

Manternach, Brian. 2017b. "Hesitant to Refer." *Journal of Singing* 73 (5): 545–546.

Merrill, Ray M., Kristine Tanner, Joseph G. Merrill, Matthew D. McCord, Melissa M. Beardsley, and Brittanie A. Steele. 2013. "Voice Symptoms and Voice-related Quality of Life in College Students." *The Annals of Otology, Rhinology, and Laryngology* 122 (8): 511–519. doi:10.1177/000348941312200806.

Moreno, Max A. 2016. "Body Mapping in the Vocal Studio: A Practical Guide in Refining Alignment, Breath, and Resonance." http://ezproxy.lib.utah.edu/docview/1836763858?accountid=14677

Novak, A., Olga Dlouha, B. Capkova, and Milos Vohradnik. 1991. "Voice Fatigue after Theater Performance in Actors." *Folia Phoniatrica* 43: 74–78. doi:10.1159/000266114.

Patel, Rita, Shaheen Awan, Julie Barkmeier-Kraemer, Mark Courey, Dimitar Deliyski, Tanya Eadie, Diane Paul, Jan Svec, and Robert Hillman. 2018. "Recommended Protocols for Instrumental Assessment of Voice: American Speech-Language-Hearing Association Expert Panel to Develop a Protocol for Instrumental Assessment of Voice Function." *American Journal Of Speech-language Pathology / American Speech-Language-Hearing Association* 27 (3). Epub. doi:10.1044/2018_AJSLP-17-0009.

Roy, Nelson, Ray M. Merrill, Susuan Thibeault, Rahul A. Parsa, Steven D. Gray, and Elaine M. Smith. 2004. "Prevalence of Voice Disorders in Teachers and the General Population." *Journal of Speech Language & Hearing Research* 47 (2): 281–293. doi:10.1044/1092-4388(2004/023).

Russell, Allison, Jennifer Oates, and Kenneth M. Greenwood. 1998. "Prevalence of Voice Problems in Teachers." *Journal of Voice* 12 (4): 467–479. doi:10.1016/S0892-1997(98)80056-8.

Sansom, Rockford. 2016. "The Unspoken Voice and Speech Debate [Or] the Sacred Cow in the Conservatory." *Voice and Speech Review* 10 (3): 157–168. doi:10.1080/23268263.2016.1318814.

Sapir, Shimon. 1993. "Vocal Attrition in Voice Students: Survey Findings." *Journal of Voice* 7: 69–74. doi:10.1016/S0892-1997(05)80113-4.

Sapir, Shimon, Barbara Mathers-Schmidt, and George W. Larson. 1996. "Singers' and Non-singers' Vocal Health, Vocal Behaviours, and Attitudes Towards Voice and Singing: Indirect

Findings from a Questionnaire." *European Journal of Disorders of Communication* 31: 193–209. doi:10.3109/13682829609042221.
Smith, Colin. 2014. "Scientists Explain in More Detail How We Hear via Bones in the Skull." 9 July 2014. Imperial College London. http://www.imperial.ac.uk/news/153374/scientists-explain-more-detail-hear-bones/
Titze, Ingo R., Julie Lemke, and Doug Montequin. 1997. "Populations in the US Workforce Who Rely on Voice as a Primary Tool of Trade: A Preliminary Report." *Journal of Voice* 11: 254–259. doi:10.1016/S0892-1997(97)80002-1.
White, Ernest G. 1938. *Sinus Tone Production*. reprinted, 1951. London: J.M. Dent & Sons.
Zeine, Lina, and Karen L. Waltar. 2002. "The Voice and Its Care: Survey Findings from Actors' Perspectives." *Journal of Voice* 16 (2): 229–243. doi:10.1016/S0892-1997(02)00092-9.
Ziegler, Aaron, and Michael Johns. 2012. "Health Promotion and Injury Prevention Education for Student Singers." *Journal of Singing* 68 (5): 531–541.