

A Study into Vocal registers and how to successfully handle changes between them.

Contents

1. The Portfolio

- Introduction and Rationale
- Aims
- Objectives
- Literature Review Process
- Critical Reflection

2. The Assignment

3. References

Introduction and Rationale

Vocal register changes hold predominant importance in the field of singing , serving as a foundation for vocal proficiency and artistic expression. These shifts in registers, distinct ranges of the human voice , contribute to the versatility and dynamism that define a skilled singer. A brief examination of prominent singing pedagogy texts promptly reveals that vocal registration has consistently been a contentious subject from various perspectives. Questions such as the number of registers, the definition of a register, its parameters, the distinct production processes, and even the nomenclature have posed challenges for vocal pedagogues over many decades (Chapman, 2016, Shewell, 2009, Doscher, 1994, Miller, 1986,; Chipman, 2008,; McKinney, 2005,). Historical research on vocal registers has evolved over centuries, reflecting changing perspectives on vocal production and pedagogy. These enquiries hold significant weight , especially considering that a substantial segment of vocal training revolves around the notion of a unified singing voice - one that upholds consistent, clear resonance and quality across the entire vocal range

(Vennard, 1967). Consequently, achieving a consensus on the mechanics and existence of vocal registers emerges as a pivotal aspect in voice training (Chapman, 2016)

The objective of this study is to investigate vocal registers with a specific interest in how to successfully navigate changes between them. It is essential to explore various aspects to gain a comprehensive understanding. This research aims to undertake a comprehensive exploration of physiological aspects by investigating studies on anatomy and physiology of the larynx during transitions between vocal registers and the behaviour of the vocal folds. Furthermore In an endeavour to delve deeper into the definitions of vocal registers, the navigation thereof by singers, and the effective translation of this knowledge into teaching strategies, my exploration will extend to established pedagogical models and historical evolution of register terminology. Additionally, I aim to scrutinise recent scientific research that has significantly influenced our perspectives on vocal registers. My aim is to analyse the latest information regarding the nature of voice registers, delve into a comprehensive understanding of the challenges associated with transitioning between them, in the hope that in the future and further on past this assignment I could formulate a robust strategy to assist my students in navigating these transitions with greater ease. To enhance knowledge acquisition, additional, comprehensive investigation into historical perspectives and how perceptions and teachings have evolved over time, I will then consider how historical pedagogical approaches may inform contemporary understanding. Perceptual studies, pedagogical approaches, recent literature and emerging trends are all areas to be explored. By gaining insights into these aspects, deeper understanding of the vocal registers can be achieved and utilised to help the singing performer develop their own knowledge and skill. A well rounded literature review is a comprehensive overview of the current state of knowledge on vocal registers and how to navigate changes between them. The research aims to offer practical strategies for the teacher of singing and the performer. To support this research, a variety of resources will be utilised, including academic literature from reputable journals, such as the NATS Journal of Singing, International Journal of Research in Choral Singing and Journal of Voice. Additionally, books written by renowned singing teachers and experts in the field will be examined to provide practical insights and perspectives.

Executing a thorough investigation demands meticulous planning and organisation. Utilising effective search strategies, including the incorporation of precise keywords and the application of the "pearl growing" technique (Boell & Cecez-Kecmanovic, 2010), is

essential for ensuring a comprehensive and inclusive collection of pertinent information. Emphasising the quality and validity of sources, particularly by prioritising peer-reviewed publications (Greenhalgh et al., 2014), is critical in maintaining the integrity of the research process. It is crucial because it enhances the reliability, accuracy, and credibility of the information gathered, contributing to the overall quality of the research.

Sundberg was a prominent researcher known for his contributions to the field of vocal science. He conducted research on various aspects of vocal physiology, acoustics and pedagogy. Sundberg has conducted research on topics such as register transitions, vocal fold behaviour, and the acoustics of singing. Sundberg conveys that “The chaos in register terminology merely reflects a regrettable lack of objective knowledge...” Sundberg (1987). The mention of "chaos" by Johan Sundberg in 1987 highlights a long standing challenge in the field of voice pedagogy, achieving consensus and clarity in vocal register terminology. This issue, as noted by various singing voice pedagogues like Shewell (2009), Doscher (1994), and Chipman (2008), persists despite advancements in medical technology that allow for more detailed examinations of vocal function. The frustration expressed in the passage is a common sentiment among singing teachers who grapple with conflicting terminology and theories. This reflects the difficulty arising from a lack of unified understanding or agreement among prominent voice researchers and pedagogues. This discord in terminology and concepts related to vocal registers underscores the complexity of the human voice and the ongoing challenges in reconciling different perspectives within the field of voice science and pedagogy. It also emphasises the importance of continuous research, dialogue, and collaboration to address these challenges and provide more clarity for singing teachers and practitioners. Having suffered the effects of this as a teacher , assuming responsibility for my students' vocal health and efficiency, I hoped to embark on a thorough exploration of the pertinent literature and research. The aim was to gain a more comprehensive understanding of the intricacies involved in transitions between lower and upper voice registers. This rigorous analysis was driven by the aspiration to enhance my knowledge and, consequently, my ability to guide students through these vocal transitions with precision and care. In the process of transitioning between lower and upper registers, students may inadvertently overstrain their vocal mechanism. This tendency is often observed when individuals attempt to force their voice into a higher range without the necessary coordination, leading to increased tension in the vocal folds and surrounding muscles. Such overstraining can hinder the fluidity of register transitions and, more critically, pose risks to vocal health if not addressed through proper technique and

guidance.” (IR Titze, 2014). Having heard these effects among my students, I have attempted to address them through various methods, namely the phenomenon of Semi Occluded Vocal Tract (SOVT) exercises, introduced by Ingo Titze in 2006. This pertains to the scientific principle that a partially narrowed vocal tract can achieve a balance in air pressure both above and below the vocal folds, facilitating more economical and flexible vocal fold vibration. As Titze notes, the toolkit for addressing adduction, register, and voice quality includes various voiced consonants, lip or tongue buzzes, and phonation into narrow tubes or straws. Incorporating exercises like pitch glides and slides, coupled with Semi-Occluded Vocal Tract (SOVT) aids mentioned earlier, fosters laryngeal flexibility across registers. These exercises are straightforward to explain and demonstrate, making them easily comprehensible and applicable for students. Their effectiveness is supported by scientific studies, including research by Guzman et al. (2013), Titze (2013), and Dargin et al. (2015). While the insights gained from the mentioned knowledge have been valuable in assisting students facing challenges during vocal register changes, they represent only one aspect of a more intricate challenge. Recognising this, a holistic approach to vocal training is advocated, as noted by Sundberg (2003). It has become evident that to make register changes more accessible and comprehensible for my students, I must deepen my understanding of the technical intricacies of vocal register transitions and the underlying scientific principles. This, I believe, is crucial in my teaching endeavours to mitigate the risk of over-strain and constriction that often arises when untrained students attempt to push their lower speech quality too high in the range, seeking powerful higher notes without employing appropriate techniques. By amalgamating insights from diverse disciplines such as physiology, psychology, and pedagogy, this study seeks to augment and complement current knowledge concerning vocal registers and their transitions. Through a thorough examination of both historical perspectives and scientific aspects, it aspires to foster a broader understanding of the complexities and challenges associated with register changes. The potential impact of this research extends to informing vocal pedagogues, speech therapists, and researchers, ultimately enhancing the support and guidance available for singers and teachers alike.

Planned Programme of Study

Aims and Objectives:

The aims of this project are:

1. To review the history of register terminology.

2. To attain a extensive understanding of the scientific research that has shaped contemporary perspectives on registers in recent years.
3. To analyze transitions between Vocal Registers by examining the intricacies involved identifying the challenges and nuances associated with achieving seamless and controlled shifts.
4. To explore the pedagogical implications of vocal registers, focusing on how a thorough understanding of these registers can inform effective teaching strategies for vocal instructors and enhance the learning experience for students.
5. To examine the physiological aspects, considering the anatomical and muscular elements that contribute to the production and modulation of different registers.
6. To develop confidence in accomplishing a literature review, thereby enabling future studies with increased assurance. This aim involves engaging in a comprehensive literature search, critically analysing relevant research, and synthesising findings in a structured manner. By enhancing literature review skills, the study aims to facilitate future research endeavours and contribute to the academic growth of the researcher.

The objectives are:

1. Clearly define and categorise various vocal registers, providing a detailed overview of their acoustic characteristics and distinguishing features.
2. Conduct a broad search for relevant research, books, websites and journals that are significant contributors to the field of the vocal registers. This will utilise various databases and search engines to catalogue a wide range of scholarly sources related to the voice registers. By identifying key literature, the study aims to establish a solid foundation for the research investigation.
3. Carry out a detailed and comprehensive literature review by comparing and examining texts. This involves critically evaluating the identified sources to draw out key information and synthesise the findings. In analysing and comparing literature, the study aims to provide a comprehensive overview of the current knowledge on voice registers and navigating the changes between them.
4. Identify any gaps in the research area that may require further investigation in the future.

- Contribute new insights and perspectives to the existing body of knowledge on vocal registers and their transitions, with the intention of advancing the field of vocal pedagogy and performance.

The Chart below shows proposed timescales for the research.

Task	2/08/23	14/9/23	4/10/2023	4/11/2023	14/11/23	4/12/23
Agree on a topic with my tutor						
Decide on my project aims and objectives						
Source relevant literature, organise and read it						
Write draft of project proposal						
Write draft one of main text						
Allow for improvements and submit						
Assignment Complete						

Literature Review Process

"Performing a literature review is a methodical and evaluative undertaking that demands meticulous planning and organisation to guarantee a thorough exploration of pertinent literature" (Davis & Walters, 2016).

In the pursuit of understanding vocal register changes and how we navigate changes between them, it is essential to contextualise the research area. I am delving into the existing body of knowledge surrounding vocal registers and the strategies employed to navigate transitions between them. As I embark on this study it is crucial to do an in-depth exploration of scholarly works, encompassing a range of disciplines such as voice science, vocal pedagogy, and possibly related fields like physiology and psychology. My aim is to

gather, synthesise, and critically analyse the available literature to develop a comprehensive understanding of the various aspects of vocal registers, including their physiological underpinnings, historical perspectives, and practical implications for teaching and singing. This literature review serves as a foundational step to identify gaps in current knowledge, explore diverse viewpoints, and contribute to the broader discourse on effective techniques for managing vocal register changes. The process of conducting a literature review is integral to cultivating a thorough comprehension of existing research, pinpointing gaps, and shaping the research design. This section addresses the methods utilised in the review, strategies for literature search, compilation procedures, and the systematic analysis and interpretation of the gathered literature.

Given the time constraints of the project and personal commitments, it is imperative to select an appropriate review method that allows for a thorough examination of available literature. Several review methods, each with distinct strengths and limitations, are at our disposal. Initially, the rapid review approach was contemplated for its swift selection and analysis of studies (Schunemann et al., 2013). This method involves a quick search and review process to identify relevant studies and extract key information. However, concerns regarding potential bias and errors associated with this approach raised doubts about its reliability.

Another option is a narrative literature review, which furnishes a comprehensive summary of the literature without adhering to a specific methodology for study selection and analysis (Greenhalgh et al., 2018). While lacking direct comparisons between studies, this approach provides an opportunity to explore a wide array of perspectives and synthesise information from diverse sources.

Additionally, a rigorous systematic approach, influenced by Coopers (1998) and Randolph's (2009) tables of research, will be considered to ensure a systematic and objective analysis of the literature. This systematic organisation and categorisation aim to facilitate the identification of patterns, trends, and potential areas for future research.

The literature search process is a pivotal phase in conducting a thorough literature review, especially when exploring the intricate topic of vocal registers and their transitions. Employing various strategies and techniques is essential for gathering relevant information comprehensively. Initially, a broad approach was adopted using general search terms such

as "vocal registers," "voice registers," and "phonation registers" to cast a wide net and capture a diverse range of literature.

As the exploration progressed, a refinement of keywords took place, transitioning to more specific terms like "Chest Voice," "head voice," "falsetto," "modal voice," "whistle register," and "vocal development." This step aimed to narrow down the search and concentrate on the specific nuances of the desired topic. I decided to use Boolean Operators to combine and refine search terms. (Bookstein A, 1980). Boolean operators form the basis of database logic by connecting search words together to either narrow or broaden your set of results. It can help to focus a search and connect various pieces of information to find what you are looking for. Additionally, phrases like "training voice registers in singing" and "vocal technique and registers" were incorporated to uncover additional sources. This approach aligns with the "pearl growing" technique (Boell & Cecez-Kecmanovic, 2010), involving the identification of pertinent sources through citations and tracing references to access a wide array of opinions and viewpoints from notable figures in the field.

In the pursuit of a diverse array of high-quality literature, I utilised various academic databases, including PubMed, JSTOR, and Google Scholar. These platforms were instrumental in locating scholarly articles and publications relevant to my topic, guaranteeing a thorough integration of scholarly perspectives and authoritative information concerning voice registers and their transformations.

Throughout the research process, a comprehensive list of relevant literature has been compiled, including articles and journals from sources such as "The Journal of Music and Meaning", "Journal of Voice", "Journey of Acoustic Society of America", "Logopedics Phoniatrics Vocology", "Music Perception: An Interdisciplinary Journal", "Journal of Speech and Hearing". These sources provide valuable insights into various aspects of vocal registers, physiological and anatomical characteristics associated with different voice registers, acoustical features of various voice registers, vocal pedagogy and training methods specific to voice registers, offering guidance on techniques for developing and transitioning between registers, laryngeal structures, and other physiological factors contribute to register changes. To broaden both the scope and depth of this study, an examination of published works authored by respected singing instructors and subject matter experts will be undertaken. It is important to acknowledge that certain biological journals and terminology may require a higher level of academic proficiency, resulting in a

more controlled literature landscape. Therefore, the inclusion of a diverse array of sources is imperative to ensure a comprehensive coverage of the literature. Special emphasis will be placed on peer-reviewed publications, prioritising their inclusion based on the criteria of quality, rigour, and validity, as emphasised by Greenhalgh et al. (2014). By incorporating literature from a variety of sources, this review aims to present a well-rounded and balanced perspective on the topic. The process of analysing literature goes beyond a simple recapitulation of existing research; it involves a discerning assessment and amalgamation of the discoveries, arguments, and viewpoints articulated in the literature. As the analysis progresses, the anticipation is that the references embedded within the sources will guide towards additional publications, forming an intricate network of interconnected knowledge. This iterative quality of the research process guarantees the dynamic and current essence of the literature review, perpetually integrating novel findings and perspectives. The research process adheres to an iterative model, aligning with the steps outlined in the "data analysis spiral" by Denscombe (2007). This iterative approach facilitates a deeper comprehension of the subject matter through revisiting and reassessing the literature. Additionally, the hermeneutical approach proposed by Gadamer (1960) can be applied to interpret and grasp the meanings embedded in the literature. Recognising the subjective nature of interpretation, this approach underscores the significance of establishing a dialogue between the researcher and the text. Through engaging in a hermeneutical dialogue with the literature, the review aims to reveal underlying themes, conceptual frameworks, and theoretical perspectives that contribute to the understanding of vocal registers and the dynamics of transitioning between them.

In conclusion, conducting a literature review is a meticulous and critical process that requires careful planning, organisation, and thoroughness. This essay has explored the importance of contextualising the research area, selecting appropriate review methods, employing effective literature search strategies, compiling a comprehensive list of literature, and analysing and comprehending the literature. By adhering to these processes, the literature review strives to provide a comprehensive understanding of vocal registers and strategies for navigating changes between them.

Through the synthesis and interpretation of existing research, the review not only contributes to the current body of knowledge but also identifies gaps in the literature. Furthermore, it lays the foundation for future research endeavours in this domain. Serving as a valuable contribution, the literature review paves the way for a more nuanced

understanding of the intricate interplay of vocal register changes and how to navigate between them.

Critical Reflection

As I conclude my study, I initiate a phase of critical reflection, a pivotal component of my research. This process enables me, the researcher, to evaluate the quality and relevance of the gathered sources, discern biases or assumptions, and identify any gaps in my research. Engaging in critical reflection is instrumental not only in refining my own critical thinking skills but also in enhancing the foundation for future studies.

Prior to commencing my research, I identified gaps in my knowledge within certain areas of my teaching studio. To address this, I applied Schon's concept of "reflection in-action" during vocal sessions, heightening my awareness of what I knew and what I didn't know. This ongoing process of self-reflection and analysis became a means of self-education, helping me identify areas where I needed to enhance my teaching skills. This reflection-in-action persisted throughout my research project, it was very helpful for me to start justifying what I was learning and what my desired goals might be, aligning with Schon's emphasis on continual self-reflection and learning for professional development.

I initiated the practice of video recording my lessons, providing an avenue for in-depth review during my study. This not only allowed for deeper reflection but also facilitated the identification of gaps in my teaching approach. Reflecting on mistakes and their impact on others became a powerful mechanism for personal growth and for pinpointing areas for improvement (Bisson, 2018). The insights gained through this process have proven invaluable in both my learning journey and my role as a singing teacher.

In the initial phases of my research, the organisational structure was frail, and I grappled with a sense of overwhelm in the face of the extensive process and the abundance of available publications. Recognising the inefficiency of sifting through irrelevant papers, I introduced the use of a learning journal to formulate a structured "to-do list" and bring clarity to my literature search. However, I soon realised that my approach was somewhat superficial (Entwistle, 1991), as it primarily involved recording notes without adequate reflection on my strategies and objectives. Moreover, the intellectual complexity of the available literature impeded my reading and processing time, leading to heightened

anxiety and a pervasive feeling of being overwhelmed. As a result, I had to reassess my learning goals and come to terms with the substantial nature of the project.

Recognising the need for further tools to effectively carry out a literature review, I revisited works by Denscombe (1998), Bell (2005), and Hart (2014). I also sought guidance from friends and colleagues who had recently undertaken similar research, which improved my understanding of the research process and boosted my confidence. After exploring various methodologies, I decided to adopt the "What, So What, Now What" framework to guide my analysis of the research process and its impact on my study. As John Dewey once stated, "We do not learn from experience... we learn from reflecting on experience" (Dewey, 1933). Adopting a reflective process enabled me to systematically evaluate the quality and relevance of the sources gathered, as well as recognise any biases or assumptions. This approach appeared to be the most straightforward way to assess my learning experience and to "re-frame (my) practice in order to make sense of it" (Bolton on Schön, p.6, 2014). I align with Ghaye's perspective that reflective cycles often have an 'unfinished business' feel to them (Ghaye, p. 16, 1998). Therefore, I opted for a reflective model with a more defined end-point rather than the cycles proposed by Gibbs or Kolb. This decision was driven by the belief that having a clear endpoint would enhance the effectiveness of my research. I aimed to approach my research with an open mind, using Driscoll's reflective questions as 'tin openers' (Bolton, p. 8, 2014) to delve into my learning experience. By engaging in critical reflection, I can deepen my understanding of the literature and its implications for my practice. As David Boud, et al. emphasize, "Reflection allows us to understand our experiences, make meaning of them, and ultimately change and improve our practice" (Boud et al., 2013). Applying the "What, So What, Now What" framework helped me analyse the significance of the literature and its relevance to my role as a pedagogue. Through this process, my aim was to refine my research approach, broaden my perspectives, improve my critical thinking skills, and enhance my ability as a practitioner.

Participating in research created opportunities for self-reflection and personal development. Throughout the process, I faced challenges with self-confidence, influenced in part by my role as a parent to young children. Efficient time management became a struggle due to frequent unexpected situations. However, I adapted by utilising any available pockets of time, though these brief reading sessions fell short due to the intensity of the material. To overcome this limitation, I began working late into the night, discovering

that my mind functioned more effectively after the stresses of the day had eased, providing uninterrupted time to focus on the study.

Throughout the process, occasional self-doubt has crept in regarding my ability to achieve my goals, posing a potential obstacle. Despite having recently completed an assignment, I previously had taken a year off from studies, this had heightened the expected challenges, and pushing forward with the assignment revealed its difficulties. I recognised a tendency to emphasise practical aspects while overlooking the emotional dimensions of experiential learning. As someone who values action and problem-solving, I often downplayed the role of emotions in shaping my learning experiences. However, upon deeper reflection, I've come to appreciate the significance of my psychological approach to learning and how it impacts my engagement and performance. By acknowledging and embracing both the practical and emotional facets of learning, I aim to enrich my overall learning experience and attain better outcomes in this study.

In summary, critical reflection has played a pivotal role in shaping my research journey. It has been instrumental in navigating the challenges of the literature review, refining my teaching skills, and overcoming moments of self-doubt. Through the lens of reflection, I've achieved a profound comprehension of the literature, identified areas for improvement, and evolved both as a researcher and a practitioner. Moving forward, I commit to continued engagement in critical reflection to refine my practices, expand my knowledge, and make meaningful contributions to the field of female adolescent voice research.

Reflecting on this research journey brings to mind the words of Albert Einstein, who stated, "The only source of knowledge is experience." This study has been an experiential voyage marked by discoveries, challenges, and personal growth. It provided an avenue to apply theoretical knowledge to real-world situations, observe and reflect on outcomes, and learn from both successes and failures.

A notable insight gained through this research is the significance of collaboration and seeking guidance from others. Connecting with friends and colleagues with similar research experiences allowed me to tap into their wisdom, gaining a broader perspective and fortifying my own research approach. Their support played a pivotal role in boosting my confidence and affirming the value of this study.

Another valuable lesson learned is the necessity for adaptability and resilience in the face of challenges. Research is inherently non-linear, with unexpected obstacles emerging. From effective time management amidst competing priorities to grappling with self-doubt, each challenge became an opportunity for personal and professional growth. Embracing these challenges and maintaining resilience allowed me to push through and continue progressing.

Furthermore, the critical reflection process facilitated a deeper understanding of the inherent limitations and biases in research. It prompted a rigorous analysis of the quality and relevance of gathered sources, questioning my own assumptions and biases, and recognising gaps in my knowledge. This heightened awareness not only improved the rigour of my research but also enhanced my ability to approach future studies with a more critical and discerning eye.

As I conclude this critical reflection, a sense of accomplishment and gratitude fills me. This research journey has not only expanded my knowledge and skills but has also ignited a passion for lifelong learning and continuous improvement. I eagerly anticipate applying the insights and lessons learned from this study to future research endeavors, confident that they will serve as a robust foundation for my growth as a researcher and practitioner in the field of female adolescent voice development.

In essence, critical reflection stands as the cornerstone of my research journey, empowering me to assess, analyse, and enhance my work. It has driven me to question assumptions, explore alternative perspectives, and develop a nuanced understanding of the subject matter. Through this reflective process, I have not only deepened my knowledge but also honed my critical thinking skills, enabling meaningful contributions to the existing body of knowledge and inspiring further research in the field of vocal registers and how to navigate between them.

2. The Assignment

A Study into Vocal registers and how to successfully handle changes between them.

This independent study aims to bridge the gap in research by examining the literature on vocal registers and how to navigate change between them. A comprehensive survey of

prominent singing pedagogy texts underscores the longstanding and contentious nature of vocal registration. Questions regarding the quantity of registers, their definition, parameters, distinct production methods, and nomenclature have perplexed vocal pedagogues for decades (Chapman, 2016; Shewell, 2009; Doscher, 1994; Stark, 2003; Chipman, 2008; McKinney, 2005; Vennard 1967). By delving into existing research in this area, this study aims to inform teaching practices and enhance skill development for educators working with singers. Understanding the specific challenges that could occur with changing through vocal registers is crucial for effectively supporting vocal growth and long-term progress. By incorporating insights from the literature, teachers can increase their knowledge of vocal registers allowing singing teachers to tailor their instruction based on the individual needs and capabilities of each student. This understanding helps in designing exercises and vocal techniques that address specific challenges related to different registers. instructional strategies, repertoire selection, and vocal techniques to address the unique needs of female adolescent voices, promoting a positive and nurturing learning environment. In summary, a thorough understanding of vocal registers empowers singing teachers to provide personalised and effective guidance, ensuring their students develop healthy vocal habits.

This research underscores the significance of expanding expertise to better cater to the needs of my vocal students. By shedding light on the intricacies of vocal registers during the female adolescent voice change, this study seeks to make a substantive contribution to the field and empower educators in nurturing the artistic and personal development of their students. The existing body of literature draws from diverse sources, including studies, textbooks, and articles. Renowned researchers, including Shewell (2009), Doscher (1994), Stark (2003), Chapman (2016), Chipman (2008), and McKinney (2005), have delved into the controversy surrounding vocal registers. Pertinent questions about the number of registers, their definition, parameters, distinct production mechanisms, and nomenclature have long perplexed vocal pedagogues. Additionally, studies have illuminated psychological effects, particularly the physical changes that accompany the female adolescent voice transition. These enquiries assume paramount importance, given that traditional vocal training is deeply rooted in the concept of the unified singing voice—a voice characterised by clear, consistent resonance and quality across the entire range (Vennard, 1967; Fisher, Kayes et al., 2014). Many educators view this unified approach as the optimal strategy for achieving and maintaining optimal vocal health (Doscher, 1994; Chipman, 2008).

By exploring existing research in this domain, this study seeks to enlighten teaching practices and elevate skill development for educators working with vocalists. Recognising the distinct challenges and transitions that take place during vocal register changes is essential for efficiently aiding their vocal advancement and sustained improvement. By integrating knowledge from the literature, teachers can adjust their teaching methods, repertoire choices, and vocal techniques to cater to the specific requirements of individuals experiencing shifts in their vocal registers, fostering a positive and supportive learning atmosphere.

To direct this literature review and structure the findings, Rolfe's Reflective Model (Bisson, 2017) was employed. This model, which is a modification of Borton's 'What?, So What?, Now What?' framework (1970, as cited in Bisson, 2017), provides a systematic approach for examining existing knowledge, reflecting on its relevance to teaching, and considering the integration of information into practical strategies. By adhering to this framework, a more lucid comprehension of the literature was attained without delving into extensive theoretical concepts.

The 'What?' component proved helpful in identifying the existing knowledge in the realm of vocal registers and understanding how it has been incorporated into vocal pedagogy. The "So what" facet of the reflective model enabled me to ponder the significance of the existing knowledge in relation to my teaching studio and the progression of the singing voice. The 'Now What?' aspect of the reflective model prompts the consideration of how to integrate pertinent information into practical teaching strategies. Bisson (2017) highlights that Rolfe et al. regard the third and final stage of the reflective model as the most crucial for informing practice. I found the simplicity of the framework to be a valuable tool for gaining clarity without the necessity for a deep understanding and application of theoretical concepts. Given the intricacy of the literature, a straightforward overview was a welcome and effective approach. Given the complexity of the literature, a straightforward overview was a welcome approach. To understand the 'What?' element it is essential to define the subject. Wikipedia (Wikipedia, 2023) defines vocal register as a "range of tones in the human voice produced by a particular vibratory pattern of the vocal folds". My subsequent task involved creating a compilation of pertinent resources in my

research area and embarking on an extensive reading journey, annotating my findings as I progressed. I initiated this process by immersing myself in key works on voice pedagogy, considering them as my foundational reading. An integral aspect of this phase was assessing my comprehension of laryngeal physiology, particularly in relation to voice register changes, and delving into historical and contemporary perspectives on the physical aspects of this intricate process. To further understand the What and question the So What?, I needed to explore the subject further as much as possible, therefore I divided it into subheadings.

Historical Evolution of Vocal Register Terminology and Perception

The term 'register' in the context of the singing voice originated from organists' terminology in the 13th Century. Described as "...like the organ, the vocal registers appeared to owe their peculiar and distinguishing characteristics to a special type of mechanical action" (Chipman on Reid, 2008, p. 75-6). Scholars in the sixteenth Century Italian 'old school' of singing, such as Zacconi, recognised distinct 'mechanical' changes in the voice throughout its range, identifying two vocal registers: *voce di petto* (chest voice) and *voce di testa* (head voice) (Stark, 2003, p.58/59). This 'two-register theory' found general agreement among Italian, Spanish, and German pedagogues and persisted until the mid-19th Century (Stark, p. 59-70). Contemporary pedagogues affirm the existence of voice registers (Doscher, 1994; Herbst, Howard et al., 2015). This aligns with my teaching experience, particularly with beginner students who often describe a sensation of 'hitting a ceiling' when attempting to reach the higher vocal range, prompting the need for effective strategies to access their upper register.

The original 'head' and 'chest' voice descriptors referred to above were based on non-scientific perceptions of sympathetic vibrations, as at that time there were no means available to 'measure' or 'see' the actions of the larynx from the inside (Thurman, 2004). This changed with Spanish baritone singer Manuel Garcia's investigations into his own voice, culminating in his invention of the first laryngoscope in 1854. However, the discovery and use of a medical instrument with which to measure human vocal activity did not preclude a slew of different opinions in the following two centuries on the nature of vocal registers (Stark, 2003).

The diversity in the number and nomenclature of vocal registers identified by various authors and researchers in the past five decades is quite bewildering (Vennard, 1967; Sundberg, 1987; Doscher, 1994; Chipman, 2008; Shewell, 2009; Chapman, 2016). Vennard's groundbreaking work in 1967 generally aligned with Bel Canto's 'two-register theory' but acknowledged the flexibility of at least an octave that could be sung either way (Vennard, 1967). Sundberg identified two primary registers in men and three in women (Sundberg, 1987). Vennard, opting not to use the term 'register,' referred instead to 'mechanisms,' employing the figurative descriptors 'heavy' and 'light' (Vennard, 1967). Harry Hollien labeled his three recognised registers as 'pulse,' 'modal,' and 'loft' (Hollien, 1971) while Sundberg referred to 'modal' and 'falsetto' registers in male singers and employed proprioceptive terms like 'chest register,' 'middle register,' and 'head register' for the female voice. Notably, all the mentioned scholars were respected, peer-reviewed voice scientists, yet their observations on registration diverged (Cohen on Sundberg, 2012; Hoch on Vennard, 2017, *Voice and Speech Review*).

Recognising the "So What" and "Now What" aspects of Rolfe's framework, it becomes evident that the bewildering diversity in contemporary understanding, with different scholars proposing varied numbers and descriptors for vocal registers, underscores the complexity of this aspect of vocal science. The teaching experience highlights the practical implications of recognising vocal registers, particularly in addressing challenges faced by beginner students in reaching higher vocal ranges. It is essential for educators to understand the history of the terminology because this historical context provides teachers with a deeper understanding of how the concept of vocal registers has evolved over time. This context helps them appreciate the origins of terminology and how it has been shaped by different cultural and pedagogical influences. By integrating this knowledge into teaching practices, educators can enhance students and could inform a more flexible and adaptive approach to vocal pedagogy. Furthermore an awareness of historical developments enables teachers to be more adaptable in their instruction. As vocal science and pedagogy continue to evolve, teachers can integrate both traditional and contemporary perspectives, offering a well-rounded and flexible approach to their students.

Contemporary Perspectives on Vocal Registers in Voice Pedagogy

In the field of voice pedagogy, Barbara Doscher identified four registers (Doscher, 1994). Chipman, on the other hand, subscribed to the two-register theory while acknowledging the three-register theory "in a certain sense" (Chipman, 2008). Speech and language therapist Christina Shewell categorised registers as "modal" and "falsetto," considering vocal fry a 'creaky phonation quality' rather than a distinct register (Shewell, 2009). In Janice Chapman's latest pedagogy text for Classical singing, four registers for men and five for women are mentioned (Chapman, 2016).

In contrast, Henrich et al.'s work on laryngeal vibratory mechanisms aimed to simplify classification using numbered systems: M0 ('vocal fry'), M1 ('modal' or 'chest voice'), M2 ('loft,' 'falsetto,' or 'head voice'), and M3 ('whistle') (Roubeau, Henrich et al, NATS Journal 2006). Modern pedagogues increasingly adopt these numerical terms (Bozeman, 2014; Lamesch et al, 2012; Unteregger et al, 2016). However, traditional terms like 'head' and 'chest' registers persist (Herbst, 2011; Kochis-Jennings, 2011, Herbst, Howard et al, 2015).

Interestingly, I recall learning about the traditional concepts of 'head' and 'chest' voice descriptors just fifteen years ago, emphasising the historical continuity spanning centuries. Originally, these terms were rooted in non-scientific understandings of sympathetic vibrations, as there were no tools available to measure or visualise laryngeal actions internally. This changed with the advent of Manuel Garcia, a Spanish baritone singer, who introduced the first laryngoscope in 1854. Garcia's direct medical observations of vocal folds in action supported his 1840 definition of vocal registers as "a series of consecutive and homogeneous tones going from low to high, produced by the development of the same mechanical principle, and whose nature differs essentially from another series of tones equally consecutive and homogeneous produced by another mechanical principle" (Garcia 1847). Despite the introduction of a medical instrument to measure human vocal activity, diverse opinions on the nature of vocal registers persisted over the subsequent two centuries.

To question the what? I explored the So What?, the above highlights the historical evolution of the concepts of 'head' and 'chest' voice descriptors in the context of vocal registers. It underscores the shift from non-scientific perceptions rooted in sympathetic vibrations to the groundbreaking contribution of Manuel Garcia, who introduced the laryngoscope in 1854. Garcia's invention allowed for the first direct observations of vocal folds in action, confirming his earlier definition of vocal registers. Despite this progress, this

research points out that, over the following two centuries, diverse opinions persisted regarding the nature of vocal registers, emphasising the complexity and ongoing debate within the field. Overall, these findings shed light on the historical development and ongoing discussions surrounding the understanding of vocal registers in the field of vocal studies.

Advancements in Understanding Voice Register Changes.

In recent years, a more nuanced understanding of voice register changes has emerged through focused voice studies and texts. These studies primarily fall into two categories: those examining laryngeal changes and those investigating acoustic or resonance changes.

Advancements in medical imaging technology, such as the fiberoptic nasopharyngoscope (Chapman, 2016; Chipman, 2008) have allowed for real-time observation of the vocal folds and glottis from just above them. While this perspective provides an incomplete picture, as it only captures the action from above and not below, it still represents a significant improvement over previous limitations.

Despite ongoing variations in the terminology used by voice scientists and pedagogues to describe different registers, there is a more universally shared understanding of the fundamental actions of the laryngeal cartilages and muscles. Notably, the vocal processes come together to vibrate through the rocking and gliding motions of the arytenoid cartilages and their controlling muscles (Vennard, 1967).

When a person sings around the pitch of their speaking voice (referred to as 'chest voice'), the vocal folds are described as "relaxed and vibrate loosely" (Dimon, 2018). As the pitch increases, the vocal folds undergo stretching due to the antagonistic actions of the cricothyroid (CT) and thyroarytenoid (TA) muscles (Dimon, 2018, p. 42). The higher the pitch, the longer, thinner, and tauter the vocal folds become (Dimon, 2018). This coordinated muscular activity, described as a "very active and synergistic coordination of muscles" (Dimon, 2018), produces minimal changes in vocal quality when executed gradually and dynamically. However, any imbalance or dominance of one muscle over another can result in a noticeable and abrupt audible shift, accompanied by visual changes in the mass, shape, and tension of the vocal folds (Vennard, 1967).

Perspectives, Holistic Approaches, and Groundbreaking Studies

During the 1990s and early 2000s, exploration in the realm of vocal registers predominantly adhered to Hollien's earlier assertion that voice registration was fundamentally a 'totally laryngeal event' (Hollien, 1974, as cited by Sundberg, 1987).

Doscher, in 1994, acknowledged that most singers typically sense only one register bridge within the larynx (Doscher, 1994). However, she also recommended a holistic approach, advocating for a 'gestalt or functional unit composed of respiration, phonation, and resonance' to facilitate smoother register transitions (Doscher, 1994). In 2004, Leon Thurman's comprehensive paper delved into all facets of registers, maintaining the perspective that 'the vocal tract can only modify what the larynx introduces into it' (Thurman, 2004). McKinney, in 2005, concurred, asserting that 'registers originate in laryngeal function' (McKinney, 2005). Christina Shewell succinctly captured the essence, likening it to the notion that 'the best silver saxophone is no use without a good quality reed' (Shewell, 2009).

The significance of efficient vocal fold closure ('adduction') in achieving balanced 'flow phonation' is evident, as highlighted by Sundberg (1987) and Chapman (2016). Dr. Christian Herbst's groundbreaking 2011 study delved into the 'adjustment of vocal fold adduction' for producing diverse vocal timbres across lower and upper registers. The study demonstrated the feasibility of separately controlling the cartilaginous and membranous vocal folds, attributing breathy tone in both chest and 'falsetto' registers to reduced vocal fold adduction caused by a posterior glottal 'chink.' Importantly, the study tested both singers and non-singers in their ability to mimic these effects based on vocal sound cues from an instructor. The success of the trial indicated that both trained and untrained singers could discern and replicate the distinctions between registers and voice qualities.

Further Advancements in Understanding Voice Registers.

In recent years, there has been a surge in literature examining the intricate relationships among the thyroarytenoid (TA), lateral cricoarytenoid (LCA), interarytenoid (IA), and posterior cricoarytenoid (PCA) muscles within the larynx. This body of work explores their roles in controlling pitch and achieving balanced registration, delving into the influence of these muscle movements on different layers of the vocal folds. Leon Thurman's 2004

paper took a unique approach by investigating various vocal fold configurations, adduction levels, and vocal tract changes to generate a spectrum of sounds, moving away from the traditional concept of 'registers' (Thurman, 2004). Recent 3D imaging studies, such as those by Unteregger in 2016, have affirmed the LCA muscles' role in both vocal fold adduction and pitch control, yet there remains a lack of consensus on the specific muscles responsible for pitch control within various ranges (Unteregger, 2016).

A proliferation of studies and texts has also surfaced, particularly focusing on the impact of the vocal tract on registers. Johan Sundberg, a notable pioneer in this field, acknowledged the connection between vocal fold physiology, vibratory patterns, and registers. Sundberg's synthesis of contemporary studies led him to assert that register, phonation frequency, and loudness are interconnected at a laryngeal level. Moreover, he highlighted the influence of factors such as subglottal pressure, closed phases of the vocal folds, and vocal tract positioning in shaping register perception (Sundberg, 1987).

Recent studies investigating the vocal tract's role may signal a redefinition of voice registration. The exploration of how different vowel shapes, or 'formants,' impact resonance and voice quality across the range suggests the possibility of both laryngeal and acoustic 'registers' for singers. However, this concept, proposed by Doscher and Stark, raises questions about the coexistence and interaction of these registers (Doscher, 1994; Stark, 2003). Henrich further emphasised that acoustical phenomena can originate at the laryngeal or resonance cavity levels, or even both (Henrich, 2007).

Professor Kenneth Bozeman has attempted to provide singing teachers with clearer strategies in this realm, utilising the Madde voice synthesiser and Voce Vista sound analysis software. Bozeman aims to demystify the science of vocal tract acoustics, offering practical teaching strategies to help singers maintain consistent resonance across their entire pitch range. However, limitations arise, as the content is tailored exclusively to the Western Classical style, and practical exercises are presented in German. This may pose challenges for Contemporary Commercial Music (CCM) singers, or Musical Theatre Singers, who typically do not engage with multiple languages. Sundberg's recent paper on the acoustics of different singing genres delineates vocal tract configurations characteristic of various styles but falls short of providing practical guidance for teachers imparting this knowledge to their students (Sundberg, 2014).

Summary

The completion of my research for this project has yielded crucial insights into the 'what' and 'why' of voice production. It delves into the processes occurring within the larynx that influence changes in voice quality, explores the physiological and acoustic parameters of vocal registration, and examines the reasons behind the existence of voice registers. However, a notable gap remains in addressing the fundamental 'how.' If voice 'training' aims to eliminate distinct voice boundaries, and we, as instructors, are the 'trainers,' the challenge lies in translating this scientific knowledge into practical techniques for the students.

The lack of agreement among prominent voice research scientists and educators is a cause of frustration, creating difficulty in determining whose viewpoint to rely on. Furthermore, this frustration extends to the realm of scientific discourse. Despite significant advancements in our understanding of the mechanics of the singing voice over the past five decades—attributed to improved voice imaging technology and the shared commitment of vocal scientists and educators to delve deeper into the intricacies of the vocal instrument for enhanced teaching and learning perspectives, translating this knowledge into practical teaching solutions remains a challenging endeavour. Even though our comprehension has greatly expanded regarding how various vocal fold vibratory patterns and vocal tract resonances affect vocal registration issues, the application of this knowledge to effective teaching solutions proves to be a formidable task.

The divergence in the language styles between scientific and artistic discourse exacerbates the difficulty. The vocabulary and construction of these languages differ, posing a challenge in bridging the gap between theoretical knowledge and practical application. This might explain why, despite recognising that terms like 'head' and 'chest' voice are purely proprioceptive, instructors often continue to use them. Singers, unable to observe their larynxes or vocal tracts while singing, must rely on perceptual feelings to make necessary adjustments. Furthermore, the scientific language frequently acts as a barrier for individuals in the arts, making it challenging for voice teachers to translate scientific knowledge into practical guidance. This challenge is especially pronounced for instructors specialising in modern Contemporary Commercial Music (CCM) and Musical Theatre styles. Notably, there is a scarcity of published works articulating science-based theories specific to these styles, in stark contrast to the abundance of studies focusing on Classical technique.

However, some contemporary voice scientists are acknowledging this challenge and striving to convey their discoveries in a more universal language with practical pedagogic strategies. Notably, the introduction of Semi Occluded Vocal Tract (SOVT) exercises by Ingo Titze in 2006 addresses the scientific principle that a partially narrowed vocal tract balances air pressure both above and below the vocal folds, allowing for more economical and flexible vocal fold vibration. This approach includes exercises like voiced consonants, lip or tongue buzzes, and phonation into narrow tubes or straws.

Pitch glides and slides, combined with SOVT aids, contribute to achieving laryngeal flexibility across registers. These exercises are straightforward to describe and model, making them easily understandable and applicable for students. Importantly, they have demonstrated efficacy, validated by various scientific studies (Guzman et al., 2013; Titze, 2013; Dargin et al., 2015).

Efforts by certain contemporary voice scientists to bridge the longstanding gap between scientific knowledge and practical advice are promising. Thurman, for instance, offers valuable insights into simple 'sound-making' exercises like vocal pitch slides and glides, aiding beginners in mastering smooth transitions between upper and lower register muscle configurations (Thurman, 2004). Bozeman's analyses become particularly accessible when he employs imagery-based observations, as seen in his statement: "If the yell instinct is stubborn, suggesting (laryngeal) depth, thinking a slightly closer vowel and an internalizing affect or direction ('sobby'; in, down and out) while ascending, are often fruitful strategies." (Bozeman, 2014).

At the outset of this study, my goals were to deconstruct the latest information on the nature of voice registers, gain an in-depth understanding of the challenges in transitioning between them, and devise a sound strategy to assist my students in navigating these transitions more seamlessly. After grappling with conflicting opinions, I must admit that there is no definitive, straightforward solution to the problem. Overcoming my apprehension of scientific language to decipher the most recent studies on voice registration has also proven challenging. Nonetheless, I acknowledge the immense significance of these studies for voice teachers and recognise the importance of working through them, consulting with colleagues, and engaging in dialogical reflective activity to grasp their essence.

I acknowledge several crucial discoveries that will significantly influence my approach to future teaching:

- Initially, it's essential to communicate to our students the existence of distinct voice registers. This is substantiated by numerous scientific studies and holds particular significance for novice students. They need to understand, at the very least, that navigating the transition between M1 and M2 (chest and head voice) can pose a substantial challenge, and it is a common aspect of the learning process for untrained singers.
- Additionally, it is crucial for the singing instructor to be well-versed in the current scientific understanding of voice registers. However, the most effective approach for the student involves a blend of relatively straightforward physiological exercises (such as pitch glides, scales, and semi-occluded vocal tract exercises), consistent practice of these exercises to enhance neural pathways (as there is no substitute for repetition), and the incorporation of imagery and primal sounds. Illustrative instances in voice pedagogy include Bozeman's concept of 'whoop timbre' (Bozeman, 2014) and Sundberg's analogy of 'shifting the gears of a car' (Sundberg, 1987)
- The terminology related to the primary voice registers in singing is notably inconsistent. Personally, I consider Thurman's usage of the terms 'lower' and 'upper' register (Thurman, 2004) to be the least perplexing and most straightforward for the student.
- Registers likely result from a combination of laryngeal vibratory mechanisms and vocal tract resonance patterns. With this in mind, my intention is to develop a customised series of vocal exercises tailored to assist students in navigating the transition from their lower to upper registers. This plan incorporates the latest scientific insights into both the larynx and the vocal tract.
- The challenge for every voice teacher lies in translating scientific knowledge into practical guidance. This is especially pronounced for instructors of CCM and musical theatre styles, given the scarcity of published works that delve into science-based theories pertaining to these styles. This scarcity stands in stark contrast to the abundance of studies focusing on Classical technique.

With all this being said , It is crucial to acknowledge that the scientific understanding of voice registers is dynamic, and what is considered 'true' today may evolve in the future. The realm of vocal science is continually advancing, unveiling new insights and perspectives. It is imperative to recognise that there is still a considerable amount to be comprehended about the intricate nature of voice registers and the optimal methods to achieve a harmonious 'balance' among them. As researchers delve deeper into this field, ongoing discoveries and advancements may reshape our current perceptions, emphasising the ongoing need for exploration and open-mindedness in the study of vocal phenomena.

References

- Bell, C. (2004). "*International Journal of Research in Choral Singing* 2 (1): 39–52.
- Boell, S. K., & Cecez-Kecmanovic, D. (2010). *A hermeneutic approach for conducting literature reviews and literature searches. Communications of the Association for Information Systems*, 27(1), 81-104.
- Bolton, GEJ (2014) *Reflective Practice – Writing and Professional Development*, Sage Publication, London
- Borton, T (1970) *Reach, Touch and Teach: Student Concerns and Process Education*, McGraw-Hill, New York
- Bottoms, J. F. (1996). "*Investigation of William Vennard's light mechanism principle in the adolescent female voice.*" *Dissertation Abstracts International* 56 (9): 3493.
- Boud, D., & Walker, D. (Eds.). (1998). "*Promoting Reflection in Learning: A Model.*"
- Bozeman, KW (2014) *Practical Vocal Acoustics: Pedagogical Applications for Teachers and Singers*, Pendragon Press, Hillside, NY
- Callaghan, J (2014) *Singing and Science; Body, Brain & Voice*, Compton Publishing, Oxford
- Chapman, JL (2016, 3rd edition) *Singing and Teaching Singing: A Holistic Approach to Classical Voice*, Plural Publishing, Inc, San Diego
- Chipman, BJ (2008) *Singing with Mind, Body and Soul: A practical guide for Singers and Teachers of Singing*, Wheatmark Publishing, Tucson, AZ
- Cohen, Annabel J (2011) *Dedication to Johan E. F. Sundberg, Psychomusicology: Music, Mind and Brain*, Vol. 21, No 1 and 2, *Music Periodicals Database*

Cyrier, A. (1981). "A study of the vocal registers and transitional pitches of the adolescent female." *Missouri Journal of Research in Music Education* 4 (5):

Cyrier, L. D. (1981). *Changes in the Female Voice at Puberty. Journal of Research in Music Education*, 29(4), 277–284.

Dargin, T, Searl, J (2015) *Semi-Occluded Vocal Tract Exercises: Aerodynamic and Electroglottographic Measurements in Singers, Journal of Voice*, Vol. 29, No. 2

Davis, R., & Walters, S. (2016). *Writing the doctoral dissertation: A systematic approach. Barron's Educational Series.*

Denscombe, M. (1998). *The good research guide: For small-scale social research projects. Open University Press.*

Dewey, J. (1933). *How We Think: A Restatement of the Relation of Reflective Thinking to the Educative Process. D.C. Heath and Company.*

Dimon, Theodore (2018) *Anatomy of the Voice: An Illustrated Guide for Singers, Vocal Coaches and Speech Therapists, North Atlantic Books, Berkeley, CA*

Doscher B (1994) *The Functional Unity of the Singing Voice*, Scarecrow Press, Lanham MD

Driscoll, John (2007) *Practising Clinical Supervision: A Reflective Approach for Healthcare Professionals, Bailliere Tindall and Elsevier, London*

Fisher, Kayes and Popeil (2014) *Pedagogy of Different Sung Genres, Oxford Handbooks Online, The Oxford Handbook of Singing, Oxford University Press*

Gadamer, H.-G. (1960). *Truth and method. Mohr Siebeck.*

Garcia, M (1982) *Hints on Singing* (B Garcia trans), Patelson Music House, New York (Original work published 1894)

Ghaye, T (1998) *Teaching and Learning through Professional Practice: A Practical Guide for Positive Action*, David Fulton Publishers, Oxford

Greenhalgh, T., Howick, J., & Maskrey, N. (2014). *Evidence-based medicine: A movement in crisis? British Medical Journal*, 348, g3725.

Greschner, D (2003), *From Studio to Stage: Repertoire for the Voice* by Barbara Doscher, *Journal of Singing*, Vol. 59, No. 5

Greschner, D (2007) *Bookshelf: Singing and Teaching Singing: A Holistic Approach to Classical Voice* by Janice L. Chapman, *Journal of Singing*, Vol. 63, No. 5

Greschner, D (2011) *Bookshelf: Singing with Mind, Body and Soul: A practical guide for Singers and Teachers of Singing by Chipman*, Journal of Singing, Vol. 67, No. 5

Guzman, M, Laukkanen, A, Krupa, P, Horacek, J and Svec, J (2013) *Vocal Tract and Glottal Function During and After Vocal Exercising With Resonance Tube and Straw*, Journal of Voice, Vol 27, No. 4

Hart, C. (2014). *Doing a Literature Review: Releasing the Social Science Research Imagination*. SAGE Publications.

Herbst, CT, Howard, DM & Svec, JG (2015) *The Sound Source in Singing: Basic Principles and Muscular Adjustments for Fine-tuning Vocal Timbre*, Oxford Handbooks Online, OUP

Hoch, M (2017) *The legacy of William Vennard and D. Ralph Appelman and their influence on singing voice pedagogy: reflections after 50 years (1967-2017)*, Voice and Speech Review, Vol 11, No 3

Lamesch, S, Doval, B, Castellengo, M (2012) *Toward a More Informative Voice Range Profile: The Role of Laryngeal Vibratory Mechanisms on Vowels Dynamic Range*, Journal of Voice, Volume 26, No. 5

McKinney, JC (1982) *The Diagnosis and Correction of Vocal Faults*, Broadman Press, Nashville

Miller, R (1986) *The Structure of Singing; System and Art in Vocal Technique*, Schirmer, New York

Schön, DA (1983), *The Reflective Practitioner: How Professionals Think In Action*, Basic Books Inc, USA

Shewell, C (2009) *Voice Work: Art and Science in Changing Voices*, Wiley Blackwell, Chichester

Stark, J (2003) *Bel Canto; A History of Vocal Pedagogy*, University of Toronto Press 272727

Sundberg, J. (1987). The science of the singing voice. Northern Illinois University Press.

Thurman, L., and Klitzke, C. (2000). *"Highlights of physical growth and function of voices from prebirth to age 21."* In: L. Thurman and G. F. Welch (eds.) *Bodymind and Voice: Foundations of Voice Education*. Revised edition, pp. 696–703. Iowa City, IA: National Center for Voice and Speech.

Thurman, L, Welch, G, Theimer A & Klitzke, C (2004) *Addressing Vocal Register Discrepancies: An Alternative Science-based Theory of Register Phenomena*, NCVS Second International Conference: The Physiology and Acoustics of Singing, Denver, Colorado 2004

Titze, I. R. (1994). *Principles of Voice Production*. Englewood Cliffs, NJ.: Prentice- Hall.

Titze, I, *Lip and Tongue Trills – What Do They Do For Us?* Reproduced from Journal of Singing

Titze, I (2013) *One More Small Step in Solving the Mystery of the Benefits of Semioccluded Vocal Tract Exercises*, Journal of Singing, Vol 69, No. 3

Vennard, W. (1967). *Singing, the Mechanism and the Technic*. New York, NY: Carl Fischer.

Website references

Wikipedia contributors. (2023, December 12). Vocal register. In *Wikipedia, The Free Encyclopedia*.

Retrieved 20:44, December 1st, 2023, from https://en.wikipedia.org/w/index.php?title=Vocal_register&oldid=1189547660