Module 5: Jae Carelli

Project Portfolio:

Context and Justification

One of the main challenges transgender singers face is being perceived as the gender they identify with, especially since the field of singing utilizes strict gender binaries to describe and cast singers in roles and voice types (Sauerland, 2022). HRT and gender affirming healthcare is jeopardized (Trans Legislation Tracker, 2025). It is a crucial time to determine ways to support trans singers in the voice studio, especially for transfemme singers, HRT does not alter fundamental pitch of their speaking voice, unlike transmasculine singers who are on testosterone, which does cause the vocal folds to thicken and therefore drop in fundamental pitch (Saureland 2022). While fundamental frequency of pitch is the primary indicator of gender perception in the voice, there are many studies done to show that formants as well as other speech patterns and characteristics play a large role in gender perception of the voice. (Hero and Houston, 2023; Ghorshi, Vaseghi, and Yan 2008; Schmid and Bradley 2019; Manny, 2014; Houle & Levi, 2021; Kim, 2020).

This artefact is a lesson plan for teachers introducing the concept of formant tuning for transgender singers who are often overwhelmed with the information they are initially presented with. This leaves many singers feeling disheartened, and unaffirmed- which is the whole point of GAVT. My approach in the studio connects concepts the student is familiar with such as accents and different genres/styles to new concepts such as vowel modification and formant tuning. The lesson plan is designed to utilize multi sensory learning and scaffolding methods to assist the student in accomplishing the objectives, which broadens the typical pedagogical approach of mimicry and modeling with just words. By broadening the scaffolding tools to encompass cross genre singing and accents, it provides extra reinforcement and connection to create a holistic perspective to formant tuning in gender affirming voice therapy/training.

Planned Program of Study:
Theoretical and Practical Influences

First and second formant frequencies are play a significant role in gender perception of the human voice, especially when F0 is at an intermediate pitch, and may not be classified as “high” (female) or low (male) (Gelfer & Bennett, 2013; Hillenbrand & Clark, 2009; Gallena, Stickels & Stickels, 2018). Raising the vowel formant frequencies, especially the second formant, directly changes how voices can be perceived as “not male,” which is more feminine or androgynous, which correlates to the study by Schmid and Bradley (2019). F2 is also a significant predictor of gender in voice. The higher the fundamental frequency and the F2, the voice is perceived as more feminine (Manny, 2014; Houle & Levi, 2021). Babel, McGuire, and King (2014) found that “for female voices, the largest contributor (of vocal attractiveness) was a principal component associated with higher second formant frequencies for /u/.”

Ghorshi, Vaseghi, and Yan (2008) conducted a study comparing evaluations on cross-gender speech recognition. The results indicate that accent differences influence speech models to an extent comparable to gender differences. Additional findings indicate that the second formant (F2) is the most influential resonant frequency in accent perception, with male speakers showing a similar pattern. This supports the argument by Weber et al. (2001) that F2 plays a critical role in accurately classifying accents. Using the auditory/kinesthetic framework of accents to introduce a complex topic such as formants will be utilizing scaffolding and multiple sensory input to reinforce the newly formed concepts.

A study by Kawitzky and McAllister (2018) investigates the use of visual-acoustic biofeedback to assist transgender women in achieving formant frequencies typical of cisgender women, specifically focusing on the second formant (F2). Using a visual aid such as the genderfluent app enables students to visually see the formant values shift in real time as they speak or sing. Boyesen and Hide (2024) investigate how twang and medialisation can be utilized to achieve a more feminine sounding voice by raising the F2 value. I have already been using these techniques in the studio for vowel modification and resonance tactics, and now can use this in another context to solve an issue I am facing in the voice studio.

This can be used as a means of scaffolded learning, as the app can provide a visual representation of formants. Laird (1985) found 75% of an adult's knowledge was obtained by seeing. 13% was through hearing, the remaining 12% was learned through touch, smell and taste combined, so the visual aid will greatly help trans women. However, Mayer (1998) investigated if recall would be improved if instructions were given visually and aurally, and the integration of the two means of learning helped recall improve rather than just visual information alone. Results indicate that multisensory learning is even more effective.

Throughout my decade of teaching voice, I have learned connecting abstract concepts and connecting them to concepts the student is already familiar with is one of the most effective manners of teaching. This method is a type of scaffolded learning (Williams, 2021). I utilize this concept by taking accents and various genres of vocal music which are topics singers have been introduced to at some point in time, to newer concepts. I then ask them to reflect upon those experiences, as we build upon the acquired knowledge. This references Kolb's cycle of experiential learning. I also utilize Bloom's domains of learning and levels of learning with associated objectives (Gravells, n.d.). The theories framing this research are Kolb's cycle of experiential learning, scaffolding techniques, and sensory learning. This will be discussed more in section two.

Methodology:

This project is grounded in the framework of gender perception- and perception cannot be controlled, it can only be constructed (Johnson and Sjerps, 2017). Perception can be altered by how the subject presents, and is inherently subjective. While that does remain to be true, in my work in the last module I discovered how perception can correlate with positivism - the numbers and data will often correlate with subjective findings. While many find positivist and constructivist

perspectives to be irreconcilable (Lincoln and Guba, 2000), Cupchik (2001) argues that the quantitative and qualitative methodologies correlating with both perspectives results that you cannot use mixed methodology in those perspectives, so he coins the term constructivist realism which "*acknowledges a social world (or worlds) that is reflected in the natural attitude of daily life and exists prior to and independent of either positivist or constructivist analysis; hence realism."* Therefore I position myself within this constructivist realist ontology. I utilize and position myself in the constructivist theory which claims that learners acquire new skills and knowledge not by direct instruction but experiences, interaction, and integration. There are advantages and disadvantages of constructivism within pedagogy, but the disadvantages are often only present in large classroom settings, and with standardized objectives (Gleeson, 2017). The advantages shine through in the voice studio application, where the setting for teaching voice in a musical context is one on one or small group learning. This ontological stance informs my methodology by building upon the research that I began in module 4 and synthesizing that literature to create this artifact, which consisted of mostly quantitative data surrounding formants. However, perception is a topic which is inherently subjective so I drew upon some findings from my module 3 work which delved into the perspective of trans women/femmes, which would work with data from empirical testing, as well as drawing upon my own experiences teaching in the studio. Utilizing both white and grey literature is informed by constructivist realism because it acknowledges the social world which "exists outside of positivist and constructivist analysis," and therefore, I use grey literature from forums and websites which is valuable insight to this social world.

As I began my research I built upon my work in the previous module, and searched for key terms broadly to gain insight such as pedagogy, and design methodology as opposed to research or testing methodology. I then narrowed by search to specific learning methods, sensory feedback, scaffolding techniques, reflective and reflexive methods. I used google scholar for white literature and google search for grey literature. I utilized white literature in order to situate this project in peer reviewed theories then I incorporated grey literature where I can gather perspectives and knowledge from credible sources that may or may not be peer reviewed. Grey literature also includes personal perspectives which is a crucial part of understanding the full scope of gender perception.

Once I have gathered all the necessary literature I will complete two rounds of coding, one to organize the literature in theoretical and practical applications, and categorize the information accordingly. Then I will analyze the various applications and do another round of coding to determine the most effective patterns of learning and designing lesson plans. Utilizing the information I acquired and analyzed, I will apply it to justify the methods I am already currently employing in the voice studio, and then design a framework for other teachers to utilize with their students. I will then take the lesson plan, format it in Canva design, then reflect upon the process using Kolb's model. The teaching methods I have employed unintentionally used Kolb's model to reflect, learn, and then apply in practice. The development of this artefact then led me to reflect with intention and justify the purpose, methods, and frameworks I have been utilizing so others can use it as well. To ensure the lesson plan framework is aligned with best practices and theories, I have also provided an annotated version highlighting the correlating concepts.

Aims:

- develop a lesson plan utilizing accents and cross genre training as a framework for formant tuning in the context of gender perception

Objectives

- Correlate formant tuning with vowel modification in accents and genre/style of vocal music for the purpose of gender presentation and perception within the format of an hour lesson plan.
- Explore the application of metacognitive, strategic, procedural, and conceptual scaffolding practices for complex abstract concepts
- Investigate how sensory learning can be used as an effective teaching strategy
- Utilize gathered knowledge to a practical application of lesson plan creation

Expected learning outcomes*:*

- Understand best pedagogical strategies for introducing abstract concepts
- Understand the components in creating a successful lesson plan that can be applied in any voice studio

Activities and 'assessment criteria'*:*

- Assessing the viability of utilizing the lesson plan in the voice studio by obtaining feedback from colleagues and peers
- Utilizing Kolb's reflective model to assess my work

***Timescales and review dates**:*

	August	September	October	November
Select a topic and research design	x			
Begin project portfolio		x	x	
Gather literature and organize information		x	x	
Develop artefact			x	x
Draft project report			x	x
Submit rough draft				x
Edit and submit final draft				x

COMPONENT 2:

KNOW THAT:

Fundamental frequency (F_0) which tends to be correlated to perceived pitch—has been identified as the primary acoustic cue in gender perception. Voices with higher F_0 values are typically perceived as more feminine, while lower F_0 values correspond to masculinity. Knowles and Little (2016) found that listeners rated speakers with feminine-range F_0 as more cooperative, regardless of the speaker's sex assigned at birth. Similarly, Gelfer and Schofield (2000) observed that voices perceived as female had higher speaking fundamental frequencies (SFF) than male-perceived voices. In transgender participants, greater femininity ratings correlated with higher pitch limits. Houle and Levi (2021) reinforced the centrality of F_0 by showing that whispered speech, which lacks F_0, blurs gender perception. Schmid and Bradley (2019) reported that nonbinary speakers' F_0 averages fell between cisgender men and women, with more feminine identities showing higher SFF and more masculine identities showing lower ones. These studies establish F_0 as the first perceptual anchor for gender identification, but not the only determinant.

While F_0 establishes initial gender perceptions, formant frequencies—the resonant frequencies of the vocal tract can further refine perception. F_1 is correlated to tongue height, and F_2 to tongue front-back positioning. When F_0 is ambiguous, formants become the key determinants of whether a voice sounds masculine, feminine, or androgynous (Gelfer & Bennett, 2013; Hillenbrand & Clark, 2009). Raising vowel formants, especially F_2, produces a more feminine or androgynous sound (Schmid & Bradley, 2019). Numerous studies (Manny, 2014; Houle & Levi, 2021) confirm that higher F_0 and F_2 together yield greater femininity ratings. Babel, McGuire, and King (2014) identified that higher F_2 values in the vowel /u/ strongly predicted vocal attractiveness for female voices.

Assmann, Nearey, and Dembling (2006) manipulated F_0 and formant frequencies using a vocoder and found that consistency between the two was crucial for perceived naturalness. Voices with higher F_0 and formants were judged more feminine; lower values were judged masculine. Mixed configurations produced ambiguous results, demonstrating that both pitch and resonance jointly define gender perception. Hardy et al. (2020) echoed these findings, showing that F_0 primarily determines perceived gender, but F_2 also contributes to judgments of femininity in transgender women's voices.

Gallena, Stickels, and Stickels (2018) experimentally raised the F_1–F_3 formants of a male speaker's vowels while keeping F_0 constant. Listeners' perceptions shifted progressively from masculine to feminine as formants increased. Vowels like /a/ and /æ/—naturally high in F_1—illustrated that resonance patterns, not only pitch, drive gender perception. Idsardi and Zetland (2019) explained that formant spacing arises from vocal-tract length and vowel constrictions; even different tract lengths can yield similar F_1 resonances in high vowels. This flexibility allows for formant tuning—altering vocal-tract shape to achieve gendered resonance.

Cartei and Reby (2015) noted that formant spacing, particularly between F_1 and F_2, predicts perceived gender in pre-pubertal voices, where F_0 differences are minimal. AMAB children's

wider spacing (reflecting larger tracts) was perceived as more masculine, while AFAB children's narrower spacing was perceived as feminine. Deepawale et al. (2008) corroborated these sex-based spectral energy differences, especially between F_2 and F_3.

Mount and Salmon (1988) showed that increasing both F_0 and F_2 via tongue-placement changes during gender-affirming voice therapy (GAVT) improved feminine perception over time. As F_2 rose, listeners began perceiving the speaker as female. However, Schwarz et al. (2018) noted that even after feminization, transgender women's voices often differ acoustically from cisgender women's, especially in F_0 and resonance quality. Doyle et al. (2024) found that adjusting formant spacing during therapy did not compromise intelligibility, confirming the clinical feasibility of such modifications.

Cultural and linguistic differences shape typical F_0 ranges and therefore influence how gender is perceived. Natour and Wingate (2009) found Jordanian Arabic speakers' F_0 values were comparable to Western speakers, though Jordanian AFAB individuals had slightly higher SFFs. English speakers' average speaking pitches are about 125 Hz for AMAB and 182 Hz for AFAB individuals, while Chinese AFAB speakers average significantly higher (around 297 Hz). Altenberg and Ferrand (2005) observed that Russian/English bilinguals produced higher F_0 in English, whereas Cantonese/English bilinguals had slightly lower F_0 in Cantonese. These findings suggest that fundamental frequency varies by language and culture, and cultural expectations shape pitch norms. Van Bezooijen (1995) further showed that Japanese women's higher pitch levels correspond to social ideals of feminine attractiveness, contrasting with lower-pitched Dutch women.

Accents inherently modify vowel formants, which affects both accent recognition and gender perception. Hero and Houston (2023) emphasize that practicing varied accents alters mouth shape and vowel resonance, providing a useful exercise for trans speakers exploring new resonance strategies. Ghorshi, Vaseghi, and Yan (2008) found that accent differences affect speech recognition almost as much as gender differences, with F_2 as the strongest acoustic cue for accent classification, followed by F_1. Weber et al. (2001) and Babel et al. (2014) similarly noted that F_2 variation—especially in /u/-fronting—correlates with both regional accent and perceived attractiveness.

Chan, Hall, and Assgari (2016) manipulated vowel formants in synthesized English and Spanish-accented speech and found that variations of F_2 affected comprehension and perceived accent strength. Yan et al. (2007) compared British, American, and Australian English vowels: Australian vowels had lower F_1 and higher F_2, while British vowels showed intermediate values. Altering formants toward another dialect's patterns produced perceptual accent shifts, paralleling how formant tuning influences gender perception. Thus, accent training techniques can serve as frameworks for modifying F_1–F_2 spacing in gender-affirming contexts.

Boysen and Hide (2024) utilized techniques such as twang and medialisation to help participants in the study modify their vowels to alter gender perception in the voice. Medialization and twang techniques were introduced in the first session. The participants were prompted to use pitch high above their typical speaking register and reconfigure their tongue

position to result in a twangy forward resonance placement. Once this concept was incorporated successfully then the medialization method was introduced where the aim was to establish an adequate onset in the targeted range of frequency.

The first goal was for the participants to navigate their voice and its capabilities so they could understand and execute these resonance techniques. They learned by utilizing isolated vowels and diphthongs before moving onto words. The techniques were taught with scaffolding techniques so that the trans women could practice independently. The clinician utilized sensory learning techniques to highlight the importance of feeling and distinguishing sympathetic resonance vibrations in the lips, teeth, nostrils and hard palate. They were prompted to listen to the recordings to distinguish the various sounds and correlate them to the kinesthetic sensations.

While kinesthetic and auditory sensory learning is a significant aspect of singing Laird (1985) found 75% of an adult's knowledge was obtained by seeing, 13% was through hearing, the remaining 12% was learned through touch, smell and taste combined. However, Mayer (1998) investigated if recall would be improved if instructions were given visually and aurally, and the integration of the two means of learning helped recall improve rather than just visual information alone. Results indicate that multisensory learning is even more effective.

Another sensory learning tool that aids in visual learning are Automation and biofeedback technologies that offer promising applications in gender-affirming voice therapy. Kumar et al. (2011) and Deepawale et al. (2008) describe how pitch and formant data classification can guide therapy by giving real-time visual feedback. Kawitzky and McAllister (2018) tested visual-acoustic biofeedback to help transgender women achieve cis-female-typical formant frequencies, focusing on F_2. Participants trained to raise F_2 toward feminized targets showed significant acoustic shifts, and blinded listeners rated higher F_2 values as more feminine. Although the sample was small, the study supports biofeedback as an effective short-term intervention for adjusting formant patterns in transfeminine voices.

Different musical genres emphasize distinct resonance strategies that inherently alter F_1 and F_2 (Sundberg & Thalen, 2015). Wilson (1997) and Latimerlo & Popeil (2012) describe how pharyngeal width and laryngeal height differ across genres: classical and R&B favor wider pharyngeal space, country and rock use narrow, more constricted ones, and pop or musical theater maintain neutrality of varying degrees. These shapes of the vocal tract can be correlated with perceived gender qualities—low, wide configurations yield darker, "masculine" timbres, while higher, narrower settings sound brighter or more "feminine."

Vowel modification, a standard technique for achieving resonance balance across registers (O'Connor, 2022), can also aid in gender exploration. Closed vowels like /u/ and /i/ have low F_1, while open vowels like /ɑ/ have high F_1. Front vowels (/i/, /æ/) produce high F_2 values and are perceived as brighter or more feminine; back vowels (/ɑ/, /u/) yield lower F_2 and a darker tone. Adjusting laryngeal height and pharyngeal width allows singers to manipulate these spectral qualities.

In classical singing, darker vowels and a lowered larynx enhance “scuro” resonance, associated with masculine qualities. Transmasculine singers may therefore benefit from classical repertoire emphasizing rounded vowels such as /o/, which lowers F_1 and F_2, deepening perceived resonance. Conversely, musical-theatre belting emphasizes brightness and forward resonance: vowels like /æ/ raise F_2, and the “molar mouth” technique widens oral space for a brassy, feminine sound (Popeil & Latimerlo, 2012; Cardon, 2021). Encouraging transfeminine singers to perform such repertoire can provide a sensory and acoustic framework for achieving higher F_2 resonance and thus greater vocal femininity. In order to utilize these findings in a practical application, various pedagogical techniques were determined to be the most effective. Sensory learning has already been discussed as a viable option.

Another technique that is extremely useful in pedagogy is scaffolding. Gregory (2023) describes various types of scaffolding which accomplish different aims to help the student become well versed and competent in a subject. Procedural scaffolding aids students in utilizing the available tools. This would be evident in providing instructions on how to use various techniques to accomplish their goals. Conceptual scaffolding aids in students grasping new concepts, and ways to accomplish this would be connecting new material to familiar concepts, or chunking the information in themes. Strategic scaffolding is a method which helps students consider multiple viable strategies to address any issues that may arise. This can be accomplished by citing other examples where a similar issue occurred and how the issue was resolved, or providing alternative options for resolution. Metacognitive scaffolding prompts students to consider their own learning and self assess. Blummer, (2014) notes that meta cognitive learning can be done with a variety of reflective tools and prompts.

While the literature I have used in previous modules draws fairly consistent conclusions, it must be acknowledged that perception is subjective, students all have individual learning styles and needs, and these conclusions from literature will vary across different manners of speech and languages (Zimman, 2017; Van Bezooijen,1995; Altenberg and Ferrand, 2006)

KNOW HOW:

Given all the information based upon previous findings, I designed the artefact accordingly. I embedded conceptual scaffolding in the lesson plan by chunking and ordering the information intuitively, by using approachable exercises as “stepping stones” to then incorporate abstract complex subjects later, ensuring that I incorporated new concepts by connecting it with familiar concepts. Then apply it to a song that the student chose with guidance, which helps the student reach their goals, and finish the session with reflective questions to help them synthesize their experience and set their practice at home up for success.

Since accent training techniques can serve as frameworks for modifying F_1–F_2 spacing in gender-affirming contexts, I decided to utilize this as an introduction to the concept. Various accents and dialects are a concept most people would be aware of, even if they do not know the intricacies of accents, or know how to accurately utilize them in speech and singing. Taking this familiar concept and then building upon it would be a good way to introduce the new concept of

vowel modification. This would be an example of conceptual scaffolding. The lesson plan prompts the teacher to ask the student to mimic an accent and repeat after the instructor. This mimicry would be a modeling approach which aids the student in seeing an example which is beneficial before beginning to introduce the main concepts of the lesson. It also establishes a sense of trust in the student teacher relationship, where the teacher leads and the student follows. Once they receive affirmation that they accomplished the mimicry, the student can feel empowered to try new things. This is an example of how scaffolding is effective for growth.

When I teach, I utilize Bloom's levels of learning objectives when I ask students questions within Kolb's reflective model. First, I ask them to recall what they previously knew as well as recall their concrete experience of how the introduction felt for them in their body. This reflective kinesthetic prompt helps the student become aware of how their body is incorporated into these abstract concepts that will be introduced next. Next, when the first concept is introduced, there is a visual aid with the instructor there to explain how vowels are formed in the mouth, and shaped with the tongue and lips. This visual aid needs to be introduced first since according to Laird (1985) seventy five percent of the information adults obtain is through visual means. The specific graphic I provided shows examples of words, because the student may not be familiar with the International Phonetic Alphabet, which is how the vowel cone graph is typically displayed.

For the next stage of Kolb's experiential learning, I introduce the concept of kinesthetic sensory mapping- making physical adjustments and being aware of how that felt in the body. I witness singers do get "stuck in their head" and approach singing abstractly, because it is often taught abstractly. What does "support" mean? What does "approach the note from above" mean? Singing is not just in the mind, but it is enacted with the body. Kilpatrick (2020) notes the importance of movement in voice pedagogy, and with movement, one needs to be aware of the body, and what parts are utilized to attain the task at hand. Identifying the tongue and lips which shape the vowels and vocal tract is crucial so the student can understand the physical tools at their disposal. I also incorporate Bloom's next level of understanding and prompt them to describe not just where but how that felt in their body, and identify where they felt sympathetic resonance, reflecting upon their experience. This next component helps the student with procedural scaffolding- direct instructions on how to move the tongue and lips combined with the procedural approach of mimicking.

The vocal warm ups are an example of how to aid trans-femme and trans-masc people to incorporate various vowel shapes which will then provide a general framework for how those vowels can be applied to the next concept formant tuning. Allowing the brightest most forward vowel [i] will help trans-femme students to set up modifications for the following vowels to be brighter. This is an example of medialisation that Boysen and Hide (2024) utilize. Rounding of the lips for the other exercise for trans-masculine singers will aid in rounding the lips, therefore lowering the fourth formant, and elongating the vocal tract to get more of a "boom" quality which is often associated with masculine voices. (Mount and Salmon 1988; Zimman, 2017)

The next stage in Kolb's reflective cycle is abstract conceptualization, where I now have the framework to introduce the concept of formants. Formants can be a very confusing concept, so laying proper framework to introduce the subject is very important. Also explaining how this is useful for transgender students is crucial. Students may become disengaged when they are being taught complex subjects without knowing how they can make use of these new tools and techniques (Nicholson and Putwain, 2015). Often the assumption is that pitch is the only means to alter gender perception, so sharing how formant spacing influences gender perception even when F0 values are the same can show the student why this subject is crucial to gender affirming voice training. (Gelfer & Bennett, 2013; Hillenbrand & Clark, 2009; Schmid & Bradley, 2019; Manny, 2014; Houle & Levi, 202; Babel, McGuire, and King 2014; Assmann, Nearey, and Dembling 2006). The next concept that is introduced is on vowel modification which was already touched upon in the sympathetic resonance mapping exercise. This example of building upon concepts is a very useful method of conceptual scaffolding.

The next stage in Kolb's reflective cycle is active experimentation, which is where I present the next level of learning in Bloom's model, which is application. First, the student observes another singer in a video and watches how they apply these concepts. This is an example of modeling, and shows that wherever the student receives information about the subject, such as a live performance, watching videos, or even listening to others speak or sing, is a viable connection to make to the work studio. I then prompt the student to apply the discoveries they have experienced, recalled, and reflected upon to a vocalise, or a piece. Sauerland (2022) notes that giving the student agency in choosing a song is crucial, especially since repertoire currently exists in a strict gender binary, especially with roles in opera or musical theater. I have found that giving the student agency in their musical education strengthens their "inner voice" and confidence, which strengthens their physical vocal apparatus. (Cardon, 2021) This is especially crucial for transgender singers, who may have a complex relationship with identity, presentation, and perception from those around them. The song can be transposed to fit the students vocal register appropriately, and the application process is guided by the discernment of the instructor. It is important to ensure that the repertoire is a song that meets the student at an appropriate level, so making a list of suggestions, or finding a proper fit for a song once the student gives some parameters on genre, or artist can help. This is another reason why introducing the new concept by connecting it with a familiar concept is a significant aspect of scaffolding.

At the end of the lesson I go on to the next three levels of Bloom's learning objectives which are analysis, synthesis, and evaluation. I combine those aims when prompting the student to compare how they initially felt in the beginning of the lesson vs how they felt at the end; summaries the concepts they learned; and evaluate how the application helps them reach their personal goals with singing and voice training. These reflective questions on experience would fall under a technique known as meta cognitive scaffolding. In reflection, the student and teacher can assess together what they are going to do moving forward, strengthening the student-teacher relationship. I have found that trust is crucial in the voice studio, and beginning and ending the session is reassuring that trust sets up the lessons for success.

I chose to use multi-sensory learning as a way for students to have various tools to incorporate. My experience with grapheme-color synesthesia as a means of compensation for the aural phonetic processing delay/disconnect struggle shows how other senses will compensate for the others if there is a lack in sensory processing or input. Using this finding from my own experience, I ensured that there are multiple means of sensory learning so if a student struggles with one, the instructor can adapt and focus on the others. Other challenges of implementation are if a student is not familiar with accents, or are not interested in singing or listening to other genres. In that event, the teacher can adapt and connect the concepts to things that will engage the student, such as songs they do enjoy, or pointing out the different speech and singing sounds of various artists they do enjoy listening to.

KNOW WHAT:

I integrated all of the subject matter from my first module to my fifth module together, for it helped me grow not just as a voice teacher and pedagogue, but as a performing artist, and also as a person who has struggled with phonetic aural processing, especially with accents. I utilized gathered knowledge from all my previous modules. Module 1 was understanding how vowel modification works for various styles and genres of vocal music, as I was beginning my cross training journey, by researching literature that is currently available. Module 2 was investigating how various methodological perspectives inform how one researches and how that might be applied to the field of teaching transgender singers. Module 3 was conducting a study where I interviewed four trans-femme participants and learned their perspective on how they as individuals relate to their voice in today's world of increasing oppression towards transgender people. In Module 4 I surveyed existing literature and drew connections between formant tuning and accents as well as genre-stylistic vowel modification. I correlated those findings with formant tuning and gender perception. So for this module I found a practical application to draw upon all of these findings and create a lesson plan to help other teachers support their transgender students. There is a need for this in a time when trans voices are silenced and oppressed in our world today, especially in social and political contexts.

I explored the best scaffolding practices for complex abstract concepts, and found other pedagogical frameworks, such as Kolb's reflective cycle, Bloom's levels of learning and associated objectives, modeling approaches, and sensory learning techniques that can be used as effective teaching strategies. Then I developed a lesson plan utilizing accents and cross genre training as a framework for formant tuning in the context of gender perception. However, after learning more about scaffolding methods, and learning how broad and complex the topic of accents can be, I decided to utilize accents as an introductory method rather than a whole framework to inform the design. I correlated formant tuning with vowel modification in accents and genre/style of vocal music for the purpose of gender presentation and perception within the format of an hour lesson plan. I accomplished all of my aims, goals, and objectives.

To be quite honest, for both module 4 and module 5, I did do significant research to inform the artefact's design, but since I was also building upon concepts and methods which I already have been employing, I had to often work in reverse and find sources to justify why my current pedagogical methods were effective in practice. In module 4 I found so much evidence about

formants, accents, and vowel modification in various genres which broadened my knowledge and solidified my approach. I utilized those findings to inform module 5, where I justified my current methods with other sources in white and grey literature. Then I identified these methods as established pedagogical tools, such as various types of scaffolding, modeling approaches and reflective approaches within the framework of Bloom's levels of learning and their correlating objectives. I did alter some aspects while I was creating the artefact, such as designing a deliberate plan, finding suitable graphics which were more approachable for students, and ordering the concepts in a systematic manner. This was effective because it strengthened my pedagogy, and broadened my framework of how to teach in the voice studio as an informed instructor on recent developments and research, rather than merely relying on my problem solving analytical-diagnostic approach. As I enacted my reflective approach, I recognized how a backwards approach can be beneficial in furthering justification on what was working well, but I also recognized how I learned things from other coaches and teachers that were either incorrect after doing more informed research.

I plan on testing this lesson plan out for my thesis, and finding willing and informed participants to take a free lesson with me where I follow this lesson plan. After testing this new format of techniques and concepts I have already been utilizing in the studio, I can continue to assess the viability of utilizing the lesson plan in the voice studio by obtaining feedback from colleagues and peers. While I am currently limited in my knowledge of acoustics and since gender perception is influenced by many other factors aside from formants, I can objectively test the results of the student by utilizing this "GenderFluent" app, which is similar in form to the analyzer that McAllister (2018) uses in their study. I also plan on surveying student satisfaction and perception of how they present, to humanize the study, and gain qualitative information. A mixed method approach will strengthen my aims, as I seek to not just employ effective strategies which provide quantitative data, but it considers the complexity of what gender presentation and perception entails.

Successful application of this lesson plan would consist of the student grasping the concept of formants clearly, and exercising the ability to modify vowels to achieve different sounds, and play with various sounds to see which sounds suit the application and how they wish to present in that application. For instance a singer might want to sound more masculine for a specific role, or sound brighter for a specific acoustic setting they will be performing in. Using "play" and experimentation as a means of presenting how flexible the voice presents is a crucial concept for successful application. It is difficult to garner feedback about perception since there are so many other factors influencing gender perception that are often outside of one's control. (Burgering, M.A. et. al, 2020) However, if the student feels confident in the flexibility in their voice and tools they can utilize to present in the way they choose, I would consider that a successful application. This is why I integrate so many questions the teacher asks the student on how they feel, so the instructor can gauge how the student is feeling in the process.

Conclusion:

There are limitations to this study. While I have used these techniques in the studio, this specific lesson plan has not been refined through iterative professional practice. I also narrowed my

scope of the research to English speaking studies, and while I did include studies about other languages and their formant patterns, I did not have enough time to broaden the scope to dive deeper, especially considering the previous module's literature review was a rapid scoping review.

It is important for educators to serve their clients and students as a whole person, and understand how so many parts of the individual show up in the voice and in the voice studio. Future research could benefit from studying the holistic approach to trans-voice pedagogy. In Module 3 I surveyed and interviewed four trans-femme people and sought to find out how they related to their voice. The findings concluded that systemic oppression silences their "inner" emotional voice as well as creating dissonance in using their physical vocal apparatus, and only when they have support around them, are they able to use their voice freely. This lesson plan is a tool in empowering transgender singers to use a voice that is most authentic to how they identify and want to present to the world, however, there is much more work to be done, especially as there are increasing cases of discrimination, violence, and oppression of transgender and gender non-conforming people everywhere (Trans Legislation Tracker, 2025). The holistic approach considers not just the objectives and goals but the human who is the student, and their journey as they go on to meet their goals, not just within the context of the studio but also as they navigate their lifelong relationship with their voice.

Educators also have a significant academic voice by sharing their experiences, which help shape individual students and society. While there are significant cuts to funding in the United States, this also is a call for teachers to cite their findings and experiences in the studio in grey literature, share it on forums, and document their discoveries working with trans singers in the studio. While systemic and social oppression silences many, the power of knowledge and education is crucial to laying the foundation for acceptance, kindness and dismissing uninformed prejudiced phobias. While perception and presentation are influenced by many factors, such as prior experience, unintentional bias, environmental surroundings, and contextual motivation, these first hand accounts are stories about humans in their journey with their voice during a significant transition that impacts not just the body but the mind. Utilizing our narrative and academic voice as vocal pedagogues to share our accounts witnessing these stories, is what will strengthen us to continue to empower all voices to speak and sing their truth.

Critical Review:

Concrete Experience:

This review is based upon Kolb's (2015) reflective model, which contains four components: concrete experience, reflective observation, abstract conceptualization, and active experimentation. According to Kolb (2015) these stages are for the learner to experience, reflect, think, and act, where the learner takes on the role as both an actor and observer. According to Kolb (2015), the foundation for experiential learning is the initial concrete experience. My experience leading me to this topic began with multiple reflective cycle's worth of experiences. The initial cycle began five and a half years ago after graduating undergrad, during the pandemic. As a classically trained vocalist, I found it difficult to translate my technique for classical repertoire and apply it to my work singing in other CCM genres, which was the only viable means for work during lockdown and social distancing. A reflective observation I had was when I remembered how I was able to find resonance using the [i] vowel during my 6th semester, and it was the easiest vowel for me to find resonance with, and help me navigate register shifts.

The abstract concepts that I was taught in diction such as the vowel cone diagram began to make sense, especially after beginning to learn Korean in my adoptee heritage language class where Hangul is modeled after how articulators are shaped to create those sounds. I have struggled to distinguish different phonetic sounds from each other, due to an auditory processing delay. Health care providers assessed that my international adoption is most likely the cause of this, since my aural phonetic recognition finished developing when I was an infant in Korea, then when I was adopted to the United States, there was a whole new set of of phonetic sounds and resonance used in speech, especially in the New Jersey area where I was raised. As a result I have grapheme-color synesthesia, since my visual learning aids are very strong to compensate for the aural phonetic processing difficulties.

I began to actively experiment and explore kinesthetically with vowel shapes and sensing resonance, and the classes in diction where I struggled in undergrad finally made sense. I found different sensations of resonating vibrations in different places that would suit different genres that I was singing. This led me to my cross genre training journey which reached its height during this Master's program.

Reflective Observation

When I began designing this module I situated myself in the constructivist theory which claims that learners acquire new skills and knowledge not by direct instruction but experiences, interaction, and integration. This is reinforced by Kolb's approach. I also took my experience struggling with aurally processing phonetic sounds, which I overcame with visual and kinesthetic learning aids. I took my experience learning and experimenting with vowel modification for various applications in the voice studio, passing on my own discoveries to my students. I then got involved with teaching trans-gender non conforming voices, and found that vowel modification had even more applications as I continued to learn more about formants. I

continued this reflective cycle throughout the various modules, building upon them and tying them together. I took my experiences with sensory learning and utilized them in the studio, and also as an intentional component of this module to help embody these abstract concepts. Titze (1982), advocates for sensory learning, citing that it is a significant practice to use in the studio.

Seeing how I utilized Kolb's reflective cycle intuitively before even knowing about the framework, I realized this manner of instructor guiding the student through this reflective process would be impactful in achieving the objectives for the lesson, so I incorporated this cycle into the lesson plan framework with prompting the teacher to ask questions guiding the student through this reflective process.

Abstract Conceptualisation

I took the existing findings from my Module 4 literature review which correlated formant tuning and vowel modifications' role in accents, genre suitability, and gender perception and presentation in the voice. The conclusion is that all of these areas are significantly impacted by formant tuning, which can be accomplished through vowel modification. I also later found a specific study by Boysen and Hide (2024) through the Voice Study Centre offerings, which used twang and medialisation to impact gender perception for trans-femme folk. This study justified my previous correlations that I drew in my research.

New areas of learning I explored were identifying other viable pedagogical structures to give these methods clear objectives. As I was researching, I found Bloom's levels of learning with correlated objectives. These gave clear aims for the methods of scaffolding, modeling, reflection, and sensory learning I was employing already in the studio. I then had to justify why I was utilizing those pedagogical methods. I incorporated sensory learning and Kolb's reflective cycle into the design of this artefact, but also recognized the types of scaffolding and methods of modeling I was already utilizing in the voice studio.

Active Experimentation

I used white and grey literature in the review, summarizing my findings from Module 4. A comprehensive literature search was conducted between March and May 2025 using Google Scholar. Search terms included combinations of keywords such as "fundamental frequency," "pitch," "formant frequencies," "gender perception," "voice feminization," "transgender voice," and "voice therapy." Boolean operators (AND, OR) were used to refine searches, for example: ("fundamental frequency" OR "pitch") AND ("gender perception") AND ("transgender"). I also searched for formants and singing. While I could have expanded the search terms in the initial search, I was able to continue to inquire about topics and themes as I gathered data from the initial search using keywords such as ("cultural speech gender cues") and ("vocal tract resonance") AND ("accents"). I used sources published in peer-reviewed journals between 2000 and 2025, written in English, focused on quantitative acoustic analysis of voice characteristics related to gender perception. Some earlier studies were included to contextualize the importance of this subject throughout history. The grey source literature utilized in previous modules is referenced to explain and contextualize the white literature. There was also some

grey source material I found from social media websites that proved to be insightful but quality control was necessary to deem its validity to build an artefact based on these sources.

Then to investigate and justify the pedagogical methods I was employing, I searched for literature between October and November of 2025 using Google Scholar and Google. Search terms included combinations of keywords such as “scaffolding,” “educational methods,” “sensory learning methods,” and “modeling techniques.” Boolean operators (AND, OR) were used to refine searches, for example: (“scaffolding” OR “sensory”) AND (“pedagogical methods”) AND (“transgender”). I found some blogs from educators that proved to be useful. While these sources would be considered grey literature, they were clear and concise in relaying this information which aided in my structuring of the artefact and informing my methods.

REFERENCES:

Altenberg, E.P. & Ferrand, C.T., 2006. Fundamental frequency in monolingual English, bilingual English/Russian, and bilingual English/Cantonese young adult women. *Journal of Voice*, 20(1), pp.89–96. doi:10.1016/j.jvoice.2005.01.005

Amir, N., Badour, C.L. and Freese, B. (2009). The effect of retrieval on recall of information in individuals with posttraumatic stress disorder. *Journal of Anxiety Disorders*, 23(4), pp.535–540. doi:https://doi.org/10.1016/j.janxdis.2008.10.012.

Assmann, P.F., Nearey, T.M. and Dembling, S., 2006. Effects of frequency shifts on perceived naturalness and gender information in speech. *Proceedings of Interspeech 2006*, pp.1–4. Available at: https://www.isca-archive.org/interspeech_2006/assmann06_interspeech.html [Accessed 28 May 2025].

Babel, M., McGuire, G. & King, J., 2014. Towards a more nuanced view of vocal attractiveness. *PLoS ONE*, 9(2), e88616. Available at: https://doi.org/10.1371/journal.pone.0088616researchgate.net+2pmc.ncbi.nlm.nih.gov+2mendeley.com+2

Blummer, B. (2014). Promoting metacognition. doi:https://doi.org/10.1533/9781780634623.89.

Brown, K.M., Dahl, K.L., Cler, G.J. & Stepp, C.E., 2020. Listener age and gender diversity: Effects on voice-based perception of gender. *Journal of Voice*, 35(5), pp.739–745. https://doi.org/10.1016/j.jvoice.2020.02.004.

Burgering, M.A., van Laarhoven, T., Baart, M. and Vroomen, J., 2020. Fluidity in the perception of auditory speech: Cross-modal recalibration of voice gender and vowel identity by a talking face. *Journal of Experimental Psychology: Human Perception and Performance*, 46(6), pp.1007-1019. https://doi.org/10.1037/xhp0000739.

Bozeman, K. (2013) 'Chapter 4: Formants Primer', in *Practical vocal acoustics: Pedagogic applications for teachers and singers*. Lanham, MD: Rowman & Littlefield, pp. 13–16.

Cardon, K. (2021). *Vocal Gymnastics: Singing Multiple Styles | Cardon Voice*. [online] Available at: https://cardonvoice.com/vocal-gymnastics-singing-multiple-styles/ [Accessed 25 Apr. 2024].

Cartei, V. and Reby, D., 2015. Effect of formant frequency spacing on perceived gender in pre-pubertal children's voices. *Journal of the Acoustical Society of America*, 138(5), pp. 2890-2898. DOI: 10.1121/1.4935167.

Chan, K.Y., Hall, M.D. & Assgari, A.A., 2016. The role of vowel formant frequencies and duration in the perception of foreign accent. *Journal of Cognitive Psychology*, 29(1), pp.23–34. Available at: https://doi.org/10.1080/20445911.2016.1170746.

Cupchik, Gerald (2001). Constructivist Realism: An Ontology That Encompasses Positivist and Constructivist Approaches to the Social Sciences [33 paragraphs]. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research*, *2*(1), Art. 7, http://nbn-resolving.de/urn:nbn:de:0114-fqs010177.

Deepawale, D.S., Bachu, R. & Barkana, B.D., 2008. Energy estimation between adjacent formant frequencies to identify speaker's gender. *Proceedings of the 5th International Conference on Information Technology: New Generations (ITNG)*, pp.772–776.

Donai, J.J. & Lass, N.J., 2015. Gender identification from high-pass filtered vowel segments: The use of high-frequency energy. *Attention, Perception, & Psychophysics*, 77(8), pp.2452–2462. Available at: https://doi.org/10.3758/s13414-015-0945-y.

Doyle, K.A., Harel, D., Feeny, G.T., Novak, V.D. & McAllister, T., 2024. Word and gender identification in the speech of transgender individuals. *Journal of Voice*, [online] Available at: https://doi.org/10.1016/j.jvoice.2024.06.007 [Accessed 28 May 2025].

Ehrick, C. (2015) *Vocal gender and the gendered soundscape: At the intersection of Gender Studies and Sound Studies*, *Sounding Out!* Available at: https://soundstudiesblog.com/2015/02/02/vocal-gender-and-the-gendered-soundscape-at-the-intersection-of-gender-studies-and-sound-studies/ (Accessed: 10 January 2025).

Emmons, Shirlee (n.d.). *Shirlee Emmons: The Tongue as Master of Your Singing: Vowel Modification"*. [online] Available at: https://www.sci.brooklyn.cuny.edu/~jones/Shirlee/tongue.html [Accessed 10 Apr. 2024].

Gallena, S.J.K., Stickels, B. and Stickels, E., 2018. Gender perception after raising vowel fundamental and formant frequencies: Considerations for oral resonance research. *Journal of Voice*, 32(5), pp.592–601. https://doi.org/10.1016/j.jvoice.2017.06.023

Gelfer, M.P. and Schofield, K.J., 2000. Comparison of acoustic and perceptual measures of voice in male-to-female transsexuals perceived as female versus those perceived as male. *Journal of Voice*, 14(1), pp.40–46. https://doi.org/10.1016/S0892-1997(00)80092-2

Gelfer, M.P. and Bennett, Q.E., 2013. Speaking fundamental frequency and vowel formant frequencies: Effects on perception of gender. *Journal of Voice*, 27(5), pp.556–566. https://doi.org/10.1016/j.jvoice.2012.11.008

Gelfer, M.P. and Mikos, V.A., 2005. The relative contributions of speaking fundamental frequency and formant frequencies to gender identification based on isolated vowels. *Journal of Voice*, 19(4), pp.544–554. https://doi.org/10.1016/j.jvoice.2004.10.006

Ghorshi, S., Vaseghi, S. & Yan, Q., 2008. Cross-entropic comparison of formants of British, Australian and American English accents. *Speech Communication*, 50(7), pp.564–579. Available at: https://doi.org/10.1016/j.specom.2008.03.013.

Gibbs, G. (1988). *Learning by doing: a Guide to Teaching and Learning Methods*. Oxford: Further Education Unit.

Gleeson, P. and D, P. (n.d.). *The Advantages & Disadvantages of Constructivism in the Classroom*. [online] The Classroom | Empowering Students in Their College Journey. Available at:https://www.theclassroom.com/advantages-disadvantages-constructivism-classroom-7966699.html#google_vignette.[Accessed 12 Sep. 2025].

Gravells, A. (no date) *Learning theories*, *Learning Theories*. Available at: https://www.anngravells.com/information/learning-theories (Accessed: 05 November 2025).

Gregory, B. (2023). *Scaffolding online learning | Nottingham Trent University*. [online] Ntu.ac.uk. Available at: https://www.ntu.ac.uk/about-us/teaching/academic-development-and-quality/cadq-blogs/scaffolding-online-learning [Accessed 12 Sep. 2025].

Gorham-Rowan, M. and Morris, R., 2006. *Aerodynamic analysis of male-to-female transgender voice*. Journal of Voice, 20(2), pp.251–262. https://doi.org/10.1016/j.jvoice.2005.03.004

Hancock, A., Colton, L. and Douglas, F., 2014. Intonation and gender perception: applications for transgender speakers. *Journal of Voice*, 28(2), pp.203–209. https://doi.org/10.1016/j.jvoice.2013.08.009

Hardy, T.L.D., Rieger, J.M., Wells, K. & Boliek, C.A., 2020. Acoustic predictors of gender attribution, masculinity-femininity, and vocal naturalness ratings amongst transgender and cisgender speakers. *Journal of Voice*, 34(3), pp.300.e11–300.e26. Available at: https://doi.org/10.1016/j.jvoice.2018.10.002.

Hero, P. and Houston, S. (2023). *'You Say, I Say': Navigating Accent in Phonics Instruction | Phonics Hero*. [online] phonicshero.com. Available at: https://phonicshero.com/accents-and-phonics/ [Accessed 9 Apr. 2024].

Hillenbrand, J. and Clark, M., 2009. The role of f_0 and formant frequencies in distinguishing the voices of men and women. *Attention, Perception, & Psychophysics*, 71(5), pp.1150–1166. https://doi.org/10.3758/APP.71.5.1150

Houle, N. & Levi, S.V., 2021. Effect of phonation on perception of femininity/masculinity in transgender and cisgender speakers. *Journal of Voice*, 35(3), pp.497.e23–497.e37. https://doi.org/10.1016/j.jvoice.2019.10.011.

Idsardi and Zetland, 2019. *What do formants (F1, F2, F3, F4) actually correspond to?* Reddit. Available at:

https://www.reddit.com/r/linguistics/comments/azgyaw/what_do_formants_f1_f2_f3_f4_actually_correspond/ [Accessed 2 June 2025].

Irene, L. and Harris, D. (no date) *Harmonics vs. Formants*, *VoiceScienceWorks*. Available at:https://www.voicescienceworks.org/harmonics-vs-formants.html#:~:text=Simple%20answer%3A,come%20from%20the%20vocal%20folds.&text=Harmonics%20are%20considered%20the%20source,size%20and%20shape%20of%20opening. (Accessed: 12 December 2023).

Johnson, K. and Sjerps, M.J., 2013. Speaker normalization in speech perception. In: *The Oxford Handbook of Laboratory Phonology*. Oxford University Press, pp. 145-176.

Kayes, G. (2015) 'Structure and function of the singing voice', *The Oxford Handbook of Singing*, pp. 18–20. doi:10.1093/oxfordhb/9780199660773.013.019.

Kawitzky, D. and McAllister, T., 2018. The effect of formant biofeedback on the feminization of voice in transgender women. *Journal of Voice*, 34(1), pp.53–67. https://doi.org/10.1016/j.jvoice.2018.07.017

Kilpatrick, C.E. (2020). Movement, Gesture, and Singing: A Review of Literature. *Update: Applications of Research in Music Education*, 38(3), pp.29–37. doi:https://doi.org/10.1177/8755123320908612.

Kim, H.T., 2020. Vocal feminization for transgender women: Current strategies and patient perspectives. *International Journal of General Medicine*, 13, pp.43–52. https://doi.org/10.2147/IJGM.S205102

Knowles, K.K. and Little, A., 2016. Vocal fundamental and formant frequencies affect perceptions of speaker cooperativeness. *The Quarterly Journal of Experimental Psychology*, 69(9), pp.1657–1675. https://doi.org/10.1080/17470218.2015.1091484

Kolb, D.A. (2015) Experiential Learning: experience as the source of learning and development. 2nd edn. Upper Saddle River, New Jersey, Pearson Ed.

Kumar, P., Jakhanwal, N., Bhowmick, A. and Chandra, M., (2011). Gender Classification Using Pitch and Formants. *Journal/Conference Name*, [online] Available at: [URL or DOI if available] [Accessed 28 May 2025].

Latimerlo, G. and Popeil, L. (2012). *Sing anything : mastering vocal styles*. G. Latimerlo And L. Popeil.

Linville, S.E., 1996. The sound of senescence. *Journal of Voice*, 10(2), pp.190–200.

Lloyd, E. (2023). Empathy, compassion & AIMIcare: Barry Kerzin…Dalai Lama. *PittMed*. [online] Available at: https://www.pittmed.pitt.edu/news/empathy-compassion-aimicare-barry-kerzin-student-health-advocacy-resource-program-dalai-lama [Accessed 30 June 2025].

Manny, E. (2014). The Male-to-Female Transgender Voice: Most Salient Voice Parameters in Perceived Gender Identification. *Journal of Voice*, 28(6), 725-731. https://doi.org/10.1016/j.jvoice.2014.02.003

Martinho, D.H.C., Lopes, L.W., Dornelas, R. and Constantini, A.C., 2024. Can acoustic measurements predict gender perception in the voice? *PLOS ONE*, 19(11), p.e0310794. Available at: https://doi.org/10.1371/journal.pone.0310794.

Moisik, S.R. Esling, J.H, Crevier-Buchman, L, & Halimi, P.. (2019) *PUTTING THE LARYNX IN THE VOWEL SPACE: STUDYING LARYNX STATE ACROSS VOWEL QUALITY USING MRI*. Available at: https://assta.org/proceedings/ICPhS2019Microsite/pdf/full-paper_262.pdf (Accessed: 11 December 2023).

Movement Advancement Project: New map report: Recent political attacks on transgender youth are the tip of the iceberg in broader effort to eliminate transgender people from public life (2023) *Movement Advancement Project | New MAP Report: Recent Political Attacks on Transgender Youth Are the Tip of the Iceberg in Broader Effort to Eliminate Transgender People from Public Life*. Available at: https://www.mapresearch.org/2023-press-release-under-fire-report-5 (Accessed: 10 January 2025).

Natour, Y.S. & Wingate, J.M., 2009. Fundamental Frequency Characteristics of Jordanian Arabic Speakers. *Journal of Voice*, 23(5), pp.560–566. doi:10.1016/j.jvoice.2008.01.005.

Nicholson , L. and Putwain, D. (2015). Facilitating re-engagement in learning: a disengaged student perspective. *The Psychology of Student Education Review*, [online] 39(2), pp.37–41. Available at: https://research.ebsco.com/c/onvpsy/viewer/pdf/ql4tm6yigj [Accessed 15 Nov. 2025].

Parker, K., Horowitz, J.M. and Brown, A. (2022) *Americans' complex views on gender identity and transgender issues*, *Pew Research Center*. Available at: https://www.pewresearch.org/social-trends/2022/06/28/americans-complex-views-on-gender-id e ntity-and-transgender-issues/ (Accessed: 10 January 2025).

Pernet, C.R., Belin, P. and Jones, A., 2014. *Behavioral evidence of a dissociation between voice gender categorization and phoneme categorization using auditory morphed stimuli*. Frontiers in Psychology, 4, p.1018. https://doi.org/10.3389/fpsyg.2013.01018

Quinn, F.M. (1988/2000) Reflection and reflective practice. In C.Davies, L.Finlay and A. Bullman (eds.) Changing practice in health and social care. London: Sage. (Original work published in 1988 and reproduced in 2000).

Ragan, K. and Popeil, L. (2017) '"Moving to the Dark Side: Transitioning from Classical to CCM Vocal Styles"', NATS.org. Inside View Press.

Redfield, E., Conron, K.J. and Mallory, C. (2024) *The impact of 2024 anti-transgender legislation on Youth*, *eScholarship, University of California*. Available at: https://escholarship.org/uc/item/6sd0q2d6 (Accessed: 10 January 2025).

Sauerland, W. (2022). *Queering Vocal Pedagogy*. Rowman & Littlefield.

Schmid, M. & Bradley, E., 2019. *Vocal pitch and intonation characteristics of those who are gender non-binary*. In: *Proceedings of the 19th International Congress of Phonetic Sciences*, pp. 2685–2689.

Schön, D.A. (1983). *The Reflective Practitioner: How Professionals Think in action.* London: Temple Smith.

Schwarz, K., Fontanari, A.M.V., Costa, A.B., Soll, B.M.B., da Silva, D.C., de Sá Villas-Bôas, A.P., Cielo, C.A., Bastilha, G.R., Ribeiro, V.V., Dorfman, M.E.K.Y. and Lobato, M.I.R., 2018. Perceptual-auditory and acoustical analysis of the voices of transgender women. *Journal of Voice*, 32(5), pp.602–608. https://doi.org/10.1016/j.jvoice.2017.07.003

Södersten, M., Hertegard, S. & Hammarberg, B., 1995. Glottal closure, transglottal airflow, and voice quality in healthy middle-aged women. *Journal of Voice*, 9(2), pp.182–197.

Titze I. (1982) Sensory feedback in voice production, Journal of Singing, 38(4) pp. 32-33

Titze, I.R., Maxfield, L. & Walker, M., 2017. A formant range profile for singers. *Journal of Voice*, 31(3), pp.382.e9–382.e13. Available at: https://doi.org/10.1016/j.jvoice.2016.08.014.

Trans Legislation Tracker (2025). *Tracking the rise of anti-trans bills in the U.S.* [online] translegislation.com. Available at: https://translegislation.com/learn.

Vala, M. (2021). *TRAINING THE HYBRID SINGER: MIXED VOICE FOR THE BEL CANTO AND MUSICAL THEATRE SINGER*. [online] Available at: https://digital.library.unt.edu/ark:/67531/metadc1833442/m2/1/high_res_d/VALA-DISSERTATION-2021.pdf [Accessed 3 Mar. 2024].

Van Bezooijen, R., 1995. Sociocultural aspects of pitch differences between Japanese and Dutch women. *Language and Speech*, 38(3), pp.253–265.

Warwick, P. (2007) 'Reflective practice: some notes on the development of the notion of professional reflection', *ESCalate*, [online] Available at: https://dera.ioe.ac.uk/id/eprint/13026/ (Accessed: 12 June 2025)

Williams, A. (2021) *What is a constructivist approach to teaching?*, *The Classroom | Empowering Students in Their College Journey*. Available at: https://www.theclassroom.com/constructivist-approach-teaching-8455246.html (Accessed: 05 November 2025).

Wilson, L.C. (1997) *Bel Canto to Punk and Back: Lessons for the Vocal Cross-Training Singer and Teacher*. dissertation. ProQuest Dissertations Publishing.

Yan, Q., Vaseghi, S., Rentzos, D. & Ho, C.-H., 2007. Analysis and synthesis of formant spaces of British, Australian, and American accents. *IEEE Transactions on Audio, Speech, and Language Processing*, 15(2), pp.676–689. Available at: https://doi.org/10.1109/TASL.2006.885923.

Zimman, L. (2017) 'Gender as stylistic bricolage: Transmasculine voices and the relationship between fundamental frequency and /s/', *Language in Society*, 46(3), pp. 339–370. doi:10.1017/S0047404517000070