

MODULE 4

BMPF 7013: Independent Study Module

An investigation into the impact of various Semi Occluded Vocal Tract Exercises on female adolescent singers in the Musical Theatre Genre.

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COMPONENT 1

Introduction

As a singing teacher working within a Performing Arts College in the North West of England, the majority of my students are adolescent female Musical Theatre singers aged between 13 and 19. I have been teaching for 15 years and, whilst I continually strive for ongoing professional development, I am aware that there have been many advances within the field of voice pedagogy which go beyond the scope of my initial training. This gives me the impetus to learn new skills and heighten my understanding of areas of vocal pedagogy that were not part of my initial training. During my previous study I recognised a gap in my knowledge around Semi-Occluded Vocal Tract Exercises (SOVTEs). SOVTEs allow for a coordination of breathing, phonation and resonance, seeking to promote efficient voice production by balancing air flow and pressure using water or air for resistance (Story, Laukkanen & Titze, 2000; Guzman et al., 2013a). Different exercises work for individual voices and a knowledge of various SOVTEs is a vocal pedagogue's best tool for utilising the wide range of benefits (Balandat, 2017). Some commonly occurring reported benefits of SOVTEs include: increased acoustic impedance, greater vocal economy, decreased phonation threshold pressure and a lower laryngeal position (Titze and Laukkanen, 2007; Titze, 2009; Guzman et al., 2013a). Most reference to these benefits are noted in the field of Voice Therapy and classical and choral voice pedagogy (Guzman et al., 2013b; Verdolini Abbott, 2008) with little reference to their use in Musical Theatre (MT) and Contemporary Commercial Music (CCM) music styles (Manternach, Maxfield and Manternach, 2021). There is wider research into the use of SOVTEs with singers who are suffering from Vocal Dysphonia (Asadollahpour et al, 2025; Kaneko et al., 2020). Vocal Dysphonia is defined as a negative change in the overall quality of the voice through a change in speech quality, vocal effort or changes in pitch and volume. It is characterised by a reduction in overall quality of life due to these changes (Pozzali et al., 2024). In order to best inform my practise, I am keen to better understand how the inclusion of SOVTEs can benefit a voice teacher working with students who do not present with vocal issues such as vocal dysphonia as if any issues were suspected this would be referred to a Voice Therapy Specialist for further investigation and would be outside the scope of my role. This study, therefore, aims to enhance my understanding of SOVTEs and how the inclusion of these exercises can be used in the training of adolescent female Musical Theatre singers who do not present with vocal issues in their training. Do SOVTEs provide a useful everyday technique in the voice pedagogues

tool kit for general vocal health and efficiency or are they only of benefit when singers are experiencing vocal issues? This strive for a deeper understanding that is student focused is in line with the institutional aims of the college where I am employed: to provide high level vocal training, giving students the skills required to apply to University and Conservatoire level Performing Arts training.

Programme of Study

Aims:

- To develop a deeper understanding of how SOVTE can be utilised within my personal practise as a voice teacher working with adolescent singers in the Musical Theatre/ CCM genre.
- To understand the best options of SOVTE from the wide range of techniques that are often cited that are accessible to students in the environment of a Performing Arts college.
- To develop my understanding of the difference between SOVTE that use equipment; such a Water-Resistant Tube Phonation Exercises (WRTPE), and lip trill, buzzing type exercises.

Objectives:

- To develop my understanding of literature review styles by selecting strategies that are most appropriate for the material and constraints of the project.
- To develop my critical analysis and understanding of bias when completing research through self-reflection.
- To develop time management skills in terms of balancing research and writing tasks by developing a GANTT chart for the project.

Literature Review Methodologies

The aim of this project is to gain a wider understanding of my chosen topic to address a gap in my knowledge. This project is highly personal to my practise and it is therefore important that I take into consideration my positionality as this is often overlooked by researchers conducting literature reviews (Pascoe, 2022). This research is grounded in the pragmatic

paradigm, working within a philosophy with an emphasis on practicality, answering the research question appropriately and drawing on mixed methodology as required (Morgan, 2014). My focus is on the use of SOVTEs in female adolescent singers within the field of Musical Theatre/ CCM vocal training and an initial first look at the research shows a lack in current peer reviewed articles on this specific topic. A scoping review would therefore be appropriate for this purpose given its ability to clarify key concepts, analyse knowledge gaps and map the available evidence (Arksey & O'Malley, 2005; Anderson, Peckham & Goodwin, 2008; Munn et al, 2018). A scoping review is particularly useful where a specific topic has not been extensively reviewed (Mays et al., 2001). Arksey and O'Malley published a six-stage process as a means of providing a framework for a Scoping Review methodology:

- 1 - Identify the research question
- 2 - Identify relevant studies
- 3 - Study selection
- 4 - Charting the data
- 5 - Collating, summarizing and reporting the results
- 6 - Optional consultation exercise

(Arksey and O'Malley, 2005).

Reviewing the stages above and understanding that a scoping review is intended to be exhaustive (Randolph, 2009) I soon came to realise that this process would be time consuming and detailed. Given the restrictions of this project: a short time scale of a few months, working as an independent researcher in a distance learning setting, I have chosen to look at a rapid review. Rapid review is an emerging methodology which focuses on a streamlined approach to gathering and synthesising evidence in a timely manner (Khangura et al., 2012). A focus on appropriate inclusion and exclusion criteria is key to create an effective rapid review (Tricco et al., 2015).

Following an initial search of general literature to contextualise the project and gain an understanding of key themes, I began a 'Berry-picking method' (Zwakman et al. 2018, p3) using the University of Wales Trinity Saint David (UWTSD) online library using the key words 'SOVTE', 'Semi Occluded Vocal Tract Exercises', 'Water Resistant Tube Phonation

Exercises (WRTPE)', Tube Phonation' and 'Lax Vox'. This was based on my general understanding of the topic and lead to a plethora of peer reviewed literature. I refined this further, using key word searches looking for 'SOVTE in adolescent female voices', 'SOVTE in Musical Theatre and CCM music styles', 'SOVTE in non-dysphonic voices,' and 'SOVTE in general voice pedagogy'. I continued my search using google scholar and online journals. I began looking through citations from key articles to assist me in finding useful papers, forward and backward chaining to assist in the search for key information (Winter, 2022). This led to the discovery of my 'pearls' a key article by Manternach, Maxfield and Manternach (2021) which addressed the inclusion of SOVTEs for Musical theatre singers and an article by Manternach, Clark and Sweet (2024) which examined the effects of SOVTEs on adolescent female singers. This created a focus for my research and a guideline for my inclusion and exclusion criteria.

My initial inclusion criteria was based on publication year. I was keen to focus on studies from 2010 onwards. This enabled me to gather information post completion of my Bachelor of Arts (BA) degree. It also enabled me to ensure I was accessing relevant and current information, recognising the advances in understanding of voice science impacting vocal pedagogy (Velarde, 2013). As my focus is to enhance my own practise and meet the organisational aims of the college where I am employed, I was keen to target my research on adolescent voices. I have therefore chosen to exclude papers researching menopausal and mature voices such as Fiuza et al. (2023). Whilst this may have led to some extended research on the understanding of SOVTE in relation to hormonal voice changes it was too large a scope for this project. I have also chosen to exclude papers where the participants have reported vocal issues and dysphonia, such as Pozzali et al. (2024). My rationale for this is that this would be referred beyond the scope of my role. I will also be excluding papers working with non-singers, such as Kaneko et al. (2020) so I can prioritise in line with my planned review methodology. I will be excluded studies which use vibration simulators and digital kymography such as Ji-sung et al. (2021), as I am keen to keep my research client focused in line with my personal and institutional aims.

I recognise that I am acting as an insider researcher – where the topic is of direct benefit to the researcher. This provides some positives: studies conducted by insider researchers can be diligent and committed due to the desire to acquire knowledge that is of direct benefit (McClintock et al., 2003). It also provides some challenges that must be considered: a greater risk of bias in inclusion and exclusion criteria and a lack of explicit dissection of key

topics (Ross, 2017). From my anecdotal experience I am approaching my research from the understanding that SOVTEs will be of benefit to my practise. I need to ensure I work systematically, working through all papers that meet the inclusion criteria to ensure I do not actively seek those that confirm by belief through conformation bias - 'People's tendency to search for information that supports their beliefs and ignore or distort data contradicting them' (Peters, 2022, p1351). Confirmation bias is believed to be an unconscious and automatic tendency to search for data that corroborates the researchers' preconceived beliefs and is therefore difficult, if not impossible, to irradiate (Palminteri et al., 2017, p14). It is important therefore that I accept I will not irradiate the bias, rather find ways to minimise and critically reflect on its potential impact.

Critical Reflection

I have chosen to focus my reflection using Gibbs Reflective Cycle. This enabled me to focus my reflections into distinct areas and focus on how this would lead into an 'action plan' – a way to apply this learning in my practise. I chose this model as I have worked with it previously and found the six stages accessible and logical.

Figure 1: Gibbs Reflective Cycle (Gibbs, 1988)



Description

This process began by identifying gaps in my knowledge and assessing areas for development that met the scope of the module. My focus was on how I could use this learning experience to best inform my current practise. Once my topic was decided and my question refined to a specific community, I began to consider literature review methodology. Once I was decided on a rapid review I adhered to inclusion and exclusion criteria to select appropriate research papers. I utilised the University library and some books I had purchased for a previous module. I created a GANTT chart (Appendix 1) to work towards developing my time management as this was a learning objective I was keen to achieve. I balanced the written elements of the paper alongside reading and watching online content provided by Voice Study Centre. Once my written component was drafted, I sought feedback, took time to edit and am now reflecting on the full process.

Feelings

My initial feelings at the start of this process were of excitement, with a rush of enthusiasm to search all papers discussing SOVTE and understand all aspects of the subject. Once I began my initial scope of the literature however, I felt overwhelmed by the level of research available and a feeling of demotivation from not knowing how to begin. I felt disheartened by my inability to conduct a scoping review, but determined to conduct an effective rapid review. When in the depths of research into single and double source SOVTE I felt exhilarated by the new information I was learning, but often felt uncertain how to synthesise this information to inform my practise at a practical level. When researching applications for SOVTE in the specific field of adolescent voice and Musical Theatre/ CCM I felt engaged and focussed, diligently seeking additional research and critically evaluating what I was reading. In the final stages of this process, and particularly in this reflective stage, I feel satisfied with the knowledge I have acquired and confident in demonstrating my understanding in a practical sense within my practise. I feel I have more questions around the topic and have circled back round to those initial feelings of excitement that new knowledge brings.

Evaluation

The best part of this process was the knowledge gained in classifying single source and double source SOVTE. I found understanding the varying exercises and their physiological impact particularly useful to my practise. The most challenging part of the experience was being strict with my literature review methodology, most notably adhering to the inclusion

and exclusion criteria needed to create an achievable rapid review. I understand the importance of creating robust criteria, but I often found I would come across an interesting paper which was working with dysphonic voices or written before my decided dates. This provides areas of additional research to continue once this project is complete. Another challenging aspect was the time management of the project. Creating the GANTT chart (appendix 1) was helpful, but I found other work commitments often interrupted the planned programme of study which left pressure on some weeks, leading to additional stress and feeling of pressure. Another challenge of this process has been this critical reflection. Whilst I found the Gibbs cycle accessible and familiar, I have found the stages a little uninspiring. I am keen to develop my understanding and experience of other reflective cycles to develop my professional skills moving forward.

Analysis

When attempting to make sense of the experience during this module and analyse the process I am first keen to articulate why I focused on this area of research. I chose SOVTEs for adolescent female singers in the MT/ CCM genre as it is beneficial to my current practise and fills a knowledge gap previously identified. On my initial literature search to contextualise my research I found a key article by article by Manternach, Maxfield and Manternach (2021) which addressed the inclusion of SOVTE for Musical theatre singers and an article by Manternach, Clark and Sweet (2024) which examined the effects of SOVTE on adolescent female singers. I found additional conflicting evidence, particularly with reference to the benefit of SOVTEs for MT/ CCM singers and this was helpful to encourage critical thinking in this topic. I used inclusion and exclusion criteria to evaluate sources in an attempt to minimise confirmation bias.

Conclusion

When thinking of what else I could have achieved during this project, I am drawn to think about the synthesise of theoretical principles and practical applications. I found there was a lack of current research detailing which SOVTE would be most appropriate when working with the community of adolescent female MT/ CCM voices. I have made attempt to integrate my theoretical understanding of single and double source SOVTE and their physiological benefits, with practical pedagogical considerations. This was focussed around the sometimes-conflicting benefits of SOVTE, specifically a lowered larynx and reduced pressure which counters the desired higher laryngeal position and high subglottal pressure

required stylistically for MT/ CCM. Whilst I have begun this synthesis, more could have been done in a larger project to work with participants to further investigate the inclusion of SOVTE for this community.

Action Plan

If I was to complete a similar project, I would make effort to complete a more detailed GANTT chart that enabled me to break down tasks more specifically. I would also begin synthesising ideas and forming the written component sooner to relieve stress closer to the deadline. If researching this topic again, I would look to create a resource for active use in the field of voice pedagogy that outlines the benefit of each SOVTE in an attempt to understand which exercises to include for individual students. I would also like to continue working in this research area to design and conduct a participant study focusing on qualitative research methods to gain understanding into the lived experience of adolescent female MT/CCM students and their personal evaluation of the impact of SOVTEs. I feel this study would inform my practise in a positive way, completing the circle of learning, gaining the knowledge and directly applying it in an informed way.

COMPONENT 2: WRITTEN ASSIGNMENT

Which Semi Occluded Vocal Tract Exercises are most useful in the field of voice pedagogy when working with female adolescent singers in the Musical Theatre Genre?

Introduction

This paper seeks to assess the potential benefit of including Semi Occluded Vocal Tract Exercises (SOVTEs) in the teaching of female adolescent singers in the Musical Theatre (MT) and the broader Contemporary Commercial Music (CCM) genre. It will begin by defining and categorising SOVTEs before researching single source/ steady SOVTE and double source/ fluctuating SOVTEs. It will seek to understand the potential benefit of their inclusion in the community of adolescent female voice pedagogy, discussing genre specific considerations and synthesising theoretical understanding with practical application.

SOVTE have a long-established history in the field of voice pedagogy (Manternach, 2024; Simberg and Laine, 2007). Reported benefits of the use of lip and tongue trills, humming, and phonation into tubes or straws have been reported for decades for voice training and rehabilitation (Titze, 2006). Years of anecdotal reports from the fields of Vocal Pedagogy and Speech and Language Therapy have been underpinned by rigorous scientific research leading to a common understanding of the benefit of SOVTEs where their efficacy is no longer challenged (Titze, 2018). Developments in scientific and investigative equipment, such as the emergence of Laryngeal Videostroboscopic equipment have enabled greater understanding of the physical phenomena occurring during SOVTEs (Barlow & Howard, 2002; Sweet 2015). Research highlights a greater level of vocal economy, a lower laryngeal position and decreased phonation threshold pressure (Titze and Laukkanen, 2007; Titze, 2009).

Classification of SOVTE

SOVTE can be classified into two groups based on their distinct physiology; those with a single or a double vibration source (Andrade et al., 2014). Single source exercises can include humming, hand over mouth, and straw (in air), with double source vibration coming

from lip and tongue trills and Water-Resistant Tube Phonation Exercises (WRTPE) (Andrade et al., 2014; Hijleh and Pinto, 2021). This classification is further defined by Dhruw et al. (2020) as steady and fluctuating exercises, with steady SOVTEs having a single source of vibration (such as a humming or hand over mouth) and fluctuating exercises using a secondary source of vibration (such as a lip trill and WRTPE) into the vocal tract (Dhruw et al., 2020). Several papers note that a secondary source of vibration creates a fluctuating vocal fold vibration pattern, due to changes in supraglottal pressure, creating a massage effect (Randolf et al., 2013; Andrade et al., 2014).

Single Source/ steady SOVTE

Humming and hand-over mouth (HOM) exercises are extremely accessible forms of SOVTE which are widely used to facilitate effective vocal fold adduction, ease of phonation and encourage soft initiation (onset) of phonation (Iwahashi et al., 2017). These are performed without the need for equipment which can lead to additional risk of tension and added potential expense (Andrade et al., 2014). Humming facilitates proprioceptive feedback due to the vibratory sensations in the face (Andrade et al., 2014). Proprioceptive feedback enables a singer to not only rely on external auditory feedback, but perceive internal sensations supporting effective intonation and resonance (Bottalico et al., 2017). Research conducted by Zenari et al. (2023) looked at the impact of five repetitions of humming exercises, each followed by five seconds of silence. Acoustic measurements and spectrographic data were analysed and results showed a benefit in the inclusion of humming exercises to facilitate balanced and economical voice production through an increase in vocal tract impedance and a reduction in Phonation Threshold Pressure (PTP). This research recognises a limitation in the study in assessing the medium and long-term impact of humming as a SOVTE. This is also noted in a study by Oliveira et al. (2024) who, on conducting a scoping review into steady single source SOVTE for healthy voices, found that whilst immediate positive effects are often noted, no evidence is provided for medium and long term effects, highlighting a lack of research in this area (Oliveira et al., 2024).

Straw Phonation (in air) has long been used in the field of Voice Rehabilitation and Speech and Language Therapy and is increasingly being seen in the field of voice pedagogy (Simberg and Laine, 2007). Phonating through a tube or straw alters the effective length and diameter of the vocal tract, which can improve vocal economy; where vocal output is high while intraglottal impact stress remains low (Master et al., 2013). The lengthening of the vocal tract increases vocal efficiency, through the conversion of 'subglottal energy to

acoustic energy' (Mills et al., 2018, p22). Research by Manternach, Clark and Sweet (2024) looked to assess the effects of Straw phonation on adolescent female voices. A participant study of 12 female singers aged 12-13 years were asked to sing both on an open /a/ vowel and then using a SOVTE of straw phonation. The findings of this research was a strong indication that the straw phonation provided acoustic improvements and self-reported reduction in vocal discomfort with enhanced vocal efficiency. A study conducted by Holm et al. (2025) looked at the effect of straw phonation (in air) in non-disordered voices ('normophonic') and was seeking to explore whether differing straw length had an effect on Phonation Threshold Pressure (PTP), Mean Flow Rate, Subglottic Pressure, Laryngeal Resistance and Phonation Power (Holm et al., 2025). This participant study resulted in no significant change being seen due to varying straw length, all straw lengths delivered a significant reduction in PTP and ease of phonation both immediately after the exercises and up to 5 weeks post therapy. The results of this study suggest that SOVTE straw phonation is effective in normophonic voices for reducing PTP, negating the need to assess straw length in this population (Holm et al., 2025). This is countered by Gaskill and Quinney (2012) who, when researching the impact of straw phonation on trained and untrained voices, highlighted the importance of the tube length and diameter. Their research used Electrolaryngography to assess contact quotient (CQ) before, during and after tube phonation at varying lengths. They found a notable difference for each individual at differing lengths, but concluded that the data did not represent a clear trend and discussed the need for individual assessment to determine an optimal straw length and diameter for each singer (Gaskill and Quinney, 2012). This is also noted by Dargin (2016) who recognised a need for individuality in tube length, but highlighted that an efficient means of a voice teacher assigning the optimal tube length had not been achieved. (Dargin, 2016).

Double Source/ Fluctuating SOVTE

Lip trills and tongue trills provide a double source/ fluctuating SOVTE as they involve a secondary source of vibration. To perform an accurate tongue trill, the tip of the tongue must be controlled on the palate, with the rest of the tongue free to vibrate, this vibration then occurs down the length of the vocal tract (Schwartz and Cielo, 2009). For a lip trill, the lips must be relaxed enough to vibrate whilst simultaneously being firm enough to promote occlusion of the airway, as the resistance breaks, vibration occurs (Gaskill and Erickson, 2008). Voiced lip and tongue vibrations increase the impedance of the vocal tract, enabling efficient vibration of the vocal folds without intense glottal closure, whilst releasing tension in the pharynx (de Vasconcelos et al., 2016). The massage effect obtained through lip and

tongue trills mobilise the vocal folds and improve circulation to the fluid in the vocal fold tissue, promoting efficient closure (Randolf, Laukkanen and Horacek, 2014; Dargin and Searl, 2015). A participant study carried out by Cordeiro et al., (2015) used electroglottography (EGG) to compare the vocal fold vibration of a sustained /ε/ vowel in comparison to lip and tongue trills at the same frequency and intensity in fourteen professional singers. The EGG waveform; the visual representation of the vocal fold contact (Herbst, 2020), was assessed during the exercises in terms of its periodicity and the amplitude of signal. On evaluation of the data, researchers found that the sustained /ε/ vowel produced a periodic waveform; a waveform that repeats itself at regular intervals, whilst the lip and tongue trills produced a quasi-periodic waveform; 'a waveform that does not repeat itself in the shorter term but does so in the longer term' (Cordeiro et al., 2015, p231). This was attributed to the variation in glottal airflow required to maintain vocal fold, lip and tongue vibration (Cordeiro et al., 2015; Titze, 1992). The amplitude of vocal fold vibration, which is associated with vocal intensity, was found to oscillate in the lip and tongue trills, representing a variation in contact area. This process was hypothesised to give scientific evidence for the 'massage effect' associated with double source SOVTE (Cordeiro et al., 2015, Story, Laukkanen and Titze, 2000).

Water bubbling or WRTPE produces a varying back pressure and the reported massage like effect (Guzman et al., 2016). This creates fluctuations in the focal fold contact and the vertical position of the larynx. Hijleh and Pinto (2021) note that a lower vertical Larynx position (VLP) is one of the potential benefits of SOVTE, citing Guzman's 2013 study, which examined eight differing SOVTE and their impact on VLP. It concluded that double source exercises produced the most significant results on vocal tract length and therefore VLP. This lowering of the Larynx is reported to be an important aspect of efficient vocal production, reducing tension in extrinsic laryngeal muscles, lengthening the vocal tract and enabling better glottal closure, leading to increased intensity without additional vocal effort (Guzman, 2013a). A study conducted by Keltz and McHenry (2022) assessed the effectiveness of WRTPE as a vocal warm up strategy aiming to reduce PTP. The reported results show high variability for each individual and it was concluded that the results did not provide a meaningful evaluation of the effectiveness of SOVT exercises as a warm up strategy. The paper highlights the importance of teaching proper SOVT technique to avoid unwanted additional tension; 'even blowing bubbles into a cup of water with phonation can be done poorly' (Keltz and McHenry, 2002, p734). A study by Bhatt et al. (2023) looked at the issue of straw phonation (with water) instruction. This Human Centred research created a workshop setting which evaluated the teaching techniques for SOVTEs. The results found that positive

teaching of straw phonation included a clear justification for the inclusion of straw phonation, a clear demonstration and an ability to adapt the exercise; with rationale, when required. The research noted the following important factors in demonstration: The positioning of the straw relative to the body, in a horizontal or slightly angled down position with a firm grip close to the lips, preventing additional tension in the lips in an attempt to balance the straw. This research recognises inconsistencies in the study based around water volume and straw depth, and highlights this as an area for additional research (Bhatt et al., 2023).

SOVTE for adolescent female voice

Adolescence in females is marked by the start of puberty and the changing hormones within the body which lead to a cascade of physical changes (Sweet, 2015; Thurman, 2012; Lebourgne, 2016). The larynx grows, rounding in height and width, which results in a lack of motor skill from periods of sudden growth leading to reduced muscular control of the posterior cartilage and reduced control over the vocal folds, decreasing efficient adduction. This creates the characteristic breathy tone, passagio problems and inconsistent pitching (Gackle, 2000; Mercado and Draut, 2023; Abitol and Abitol, 2014). Research suggests that SOVTEs could provide a solution to some of the voice challenges encountered in puberty and adolescence (Davids and LaTour 2021), but an understanding of the theoretical principles of each SOVTE must be sought by voice pedagogues to best inform their inclusion when working in their chosen community (Keltz and McHenry, 2002). A phenomenological study by Sweet (2015) used qualitative data gathering to understand the experience of voice change associated with adolescence from the perspective of 14 female participants. Open questioning, interview techniques and subsequent thematic analysis revealed that breathy phonation as one of the primary areas for concern. A recent study by Baker (2022) sought to investigate this through quantitative data gathering, using long-term average spectra (LTAS) and inverse filtering techniques to assess vocal characteristics in healthy cis-gender female adolescent singers (a person whose gender identity corresponds with their sex assigned at birth). Results found a great variability in subglottal pressure and vocal fold adduction amongst the participants who presented with no vocal issues, it was concluded this lack of control of phonatory mechanisms was due to the physical changes occurring in adolescence (Baker, 2022).

SOVTE for Musical Theatre and Contemporary Commercial Music

Whilst the benefits of SOVTEs are commonly reported in the field of Voice therapy (Simberg and Laine 2007; Verdolini and Abbott, 2008) and choral and classical singing styles (Brinson and Demorest, 2014) there has been little research into their effect on Musical Theatre (MT) and Contemporary Commercial Music (CCM) singing styles. The varying physical demands of these 'athletically-oriented styles' (Nix, 2016, p37) may make it unlikely that acoustic and perceptual benefits are universally applicable across varying styles (Manternach, Maxfield and Manternach, 2021). CCM and, in particular Musical Theatre singing is characterised by a diverse range of vocal challenges and synthesis of musical genres from classical legit to contemporary belt. Contemporary Musical theatre may include extended range, speech quality, chest dominant phonation and athletic dynamic shifts (Edwin, 2007; LeBorgne & Rosenberg, 2014). The inclusion of 'twang' and 'belt' techniques are often expected even from adolescent roles and if produced without adequate training and sufficient technique there is a risk of vocal injury, especially during puberty when the larynx and vocal folds are still developing (Cleveland & Stack, 2019). Thus, Musical Theatre singers have often been trained using classical vocal techniques, with contemporary vocal qualities considered dangerous (Bourne and Kenny, 2016). Twang is characterised by a perceptually bright sound, anatomically associated with an alteration to the epilaryngeal tube and a narrowing of the pharynx and an elevation in the larynx (Saldias et al., 2020; Petra, Bae and Obert, 2020). Belt is typified by a high laryngeal position, high and forward tongue position, high subglottal pressures and strong glottal adduction (Sundberg and Thalen, 2015; Burdick, 2005).

MT and CCM therefore, require the ability to move the larynx in line with the stylistic goals rather than seek to maintain a low larynx position. Titze (2000), noted that the elevated laryngeal position which produces the bright timbre most sought in MT is not a product of SOVTE which results in a darker tone quality from an elongated vocal tract (Titze, 2000). This is countered by Kayes (2019), who highlights that using SOVTE in teaching belt and twang is a way of creating back pressure to reduce strain and facilitate proprioceptive awareness. The frequent use of the larynx in an elevated position and the shortening of the vocal tract can lead to unwanted tension (LeBorgne & Rosenberg, 2014), using SOVTEs as a vocal 'reset' can return the larynx to a neutral position, passively expanding the airway and reducing supraglottic constriction making them beneficial after singing with excessive laryngeal elevation, often seen in students developing belt technique (Manternach, 2024). Portillo et al. (2018) assessed 30 CCM singers, using Electrographic measurements to assess the impact of Traditional Vocal Warmups (TVW) and SOVTEs. Participants were

randomly assigned either physiological warm-ups based on SOVTEs or traditional open vowel warm-ups. Results showed no evidence of difference in aerodynamic or electroglottographic variables between the groups. There were self-reported improvements in vocal quality in both groups, with no significant data to show SOVTE provided additional benefit to CCM singers.

Pedagogical synthesis

With a lack of clarity and definitive research into the use of SOVTE in the community of adolescent female musical theatre/ CCM singers, pedagogues must balance the physiological benefits of SOVTE with stylistic requirements. This could be achieved through evidence-informed protocols. One such approach, outlined by Manternach et al. (2020), is sequenced progression: beginning a lesson with SOVTE to promote efficient phonation, lower the larynx and reduce subglottal pressure, then gradually removing the occlusion and adding additional stylised technique appropriate to MT/CCM whilst aiming to preserve the vocal efficiency. In practise this could look as follows:

WRTPE (double source SOVTE) → humming (single source SOVTE) → nasalised phrase (twang – elevating the larynx) → sing a phrase from the song

OR

Lip Trill (double source SOVTE) → HOM vowel glide (single source SOVTE) → belt phrase on an open vowel → sing a phrase from the song

This process enables healthy voicing from SOVTE before gradually transitioning into style specific vocal exercises (Manternach et al., 2020). Pedagogues may also choose to encourage the synthesis of theoretical physiological understanding with genre specific goals through encouraging laryngeal flexibility. In practise, this may include the use of SOVTEs such as straw phonation (in and out of water) with sliding pitch followed by vowel glides to raise proprioceptive awareness and flexibility in laryngeal height to enable the singer to alter the vocal tract and larynx height rather than focusing on a single position (LeBorgne and Rosenberg, 2021). Pedagogues may find the inclusion of SOVTEs beneficial as a vocal reset, returning the larynx to a neutral position after working on a song with twang and belt

techniques (Manternach, 2024). Practically, this may include following a sing through of a belt phrase with a lip trill or voiced fricative to reduce supraglottic tension and lengthen the vocal tract. A student could then return to the phrase assessing if the alteration of laryngeal position has increased vocal efficiency and ease of phonation. This could be assessed through self-reported benefits from the student and audio reflection by the pedagogue. A greater level of participant research into the use of SOVTEs within this community could inform future development of such protocols and pedagogues could work towards an effective framework to scaffold their inclusion and assess the benefit at an individual level.

Practical considerations for the voice pedagogue

A voice pedagogues' decision on the inclusion of various SOVTEs may be influenced by financial restrictions. Many 'singing straws' and 'vocal tubes' are available on the market with the ability to adjust length and diameter to enable individualisation or the equipment to benefit on a bespoke level. These straws and tubes are available commercially, ranging in price from £9.99-£139 (appendix 2). This initial investment is much greater than purchasing generic alternatives such as single use paper straws, and may have a lower environmental impact with being reusable. They do provide challenges around hygiene as need to be cleaned regularly. This may be environment specific, pedagogues working within an educational establishment may be unable to access budget for such equipment and may find disposable alternative or SOVTEs that require no equipment may prevent a barrier to access across a wide demographic. A voice pedagogue would need to decide which system to recommend within their studio or setting as a cost to benefit trade off.

There are times when the inclusion of certain SOVTE should be carefully considered due to the risk of spread of infection, particularly in the case of upper respiratory infection which can easily be spread through droplets of saliva from lip trills and raspberries, a concept which has gained widespread understanding following the as SARS-CoV-2 (Covid-19) pandemic (Manternach, 2020). A research paper by Giovanni et al. (2020) used Computational Fluid Dynamic measurements to measure airflow velocity from long exhalation, sustained /a/ vowel and vocal exercises which included SOVTEs. The results show the vocal exercises generated higher velocities than loud speech, emitting large numbers of droplets. This was hypothesised to be caused when vocal fold vibrations create microscopic ruptures in the lubricating mucus. This emission of droplets is one way in which viruses such as SARS-CoV-2 are spread (Giovanni et al., 2020). This study highlighted its limitations; it was small scale with only 2 participants and individual vocal exercises were not assessed so whilst it

suggests that SOVTEs produce less airflow velocity and emission of droplets, no specific data was provided. This limitation was discussed by Manternach (2020) who suggested that closed mouth humming and WRTPE could provide effective SOVTEs whilst minimising the risk of infection. (Manternach, 2020). This study also articulated the need for additional research in this area.

Conclusion

This paper began by briefly defining SOVTE and highlighting the perceived efficacy of their inclusion in voice pedagogy. It continued to outline the classification of SOVTE into single source/ steady exercises and those with a double or fluctuating vibration source. Single source SOVTE, such as humming, HOM and straw (in air) exercises have been found to facilitate proprioceptive feedback as well as improve efficient voice production through an increase in vocal tract impedance and a reduction in Phonation Threshold Pressure (Bottalico et al., 2017; Zenari et al., 2023). Straw (in air) exercises increase the effective length and diameter of the vocal tract, keeping vocal output high while intraglottal impact stress remains low (Master et al., 2013). Conflicting research on straw length highlights a gap in research about the impact of this in voice pedagogy. Gaskill and Quinney (2012) recognise the need for adjustments to be made at the individual level whilst Dargin (2016) articulates the lack of clear guidance for voice teachers to do this efficiently. Double source SOVTE such as lip and tongue trills allow for vibration down the vocal tract, increasing impedance, enabling efficient vibration of the vocal folds with efficient glottal closure (Schwartz and Cielo, 2009; de Vasconcelos et al., 2016). Lip and tongue trills lip produce a quasi-periodic waveform, oscillating due to varied glottal airflow, resulting in a variation in contact quotient producing a massage like effect (Cordeiro et al., 2015, Story, Laukkanen and Titze, 2000). The varying back pressure from WRTPE has also been reported to create this massage effect through fluctuations in the focal fold contact along with impacting the vertical position of the larynx, reducing tension in extrinsic laryngeal muscles, lengthening the vocal tract and enabling better glottal closure (Hijleh and Pinto, 2021; Guzman et al., 2016). WRTPE can provide an effective vocal warm which aims to reduce PTP, aiming to increase intensity without additional vocal effort (Keltz and McHenry, 2022). In order for voice pedagogues to utilise this method of SOVTE as a vocal warm up there must be an understanding of the theoretical ideas underpinning the exercise, clear demonstration and ability to adapt techniques for individual students (Bhatt et al., 2023).

This is particularly true in the case of female adolescent voice where physical changes brought about by hormone changes lead to a lack of muscular control of laryngeal muscles, reduced adduction and an impact on vocal tone and intonation (Gackle, 2000; Mercado and Draut, 2023; Abitol and Abitol, 2014). SOVTEs are one way a voice pedagogue can mitigate these issues; results from research show great variability in subglottal pressure and vocal fold closure, individual to each singer and without clear correlation (Davids and LaTour 2021; Keltz and McHenry, 2002). The inclusion of SOVTEs in this community needs to be assessed at an individual level and more research in this area would be needed to provide definitive guidance and structure.

SOVTEs have long been established in the field of voice rehabilitation and classical voice, but less so in MT and CCM (Manternach, Maxfield and Manternach, 2021). The vocal demands on this genre are vastly different from traditional classical pedagogy; the inclusion of speech resonance, twang and belt provide additional challenges for voice teachers and singers, particularly adolescent female MT singers. The narrowing of the pharynx, elevation in the larynx and high subglottal pressures are in contradiction to the noted benefits of SOVTEs: a lower laryngeal position, lengthened vocal tract and reduced pressure (Sundberg and Thalen, 2015; Burdick, 2005; Saldias et al., 2020; Petra, Bae and Obert, 2020). Whilst Titze (2000) suggests the teaching of twang and belt is not benefited by SOVTEs, Kayes (2019) articulates that using SOVTEs in teaching belt and twang is a way of creating back pressure to reduce strain and facilitate proprioceptive awareness. SOVTEs as a vocal reset enable the larynx to return to a neutral position, passively expanding the airway and reducing supraglottic constriction (Manternach, 2024). SOVTEs provide many benefits for the adolescent female singer as a means of mitigating vocal issues caused by physical changes in the larynx. It acts as a warm up, encouraging effective adduction, reducing laryngeal tension and impacting vocal tract impedance. It can provide a method of vocal reset when working in the MT or CCM style, following a prolonged time with an elevation in the larynx to prevent the risk of vocal health issues and unwanted tension. There are some practical considerations in terms of SOVTE selection in terms of financial limitation and virus spread, but the overriding choice is dependent on the individual need of the student. Additional research is needed to make this accessible and efficient within the voice teacher community to ensure SOVTE are being used to best serve the singer.

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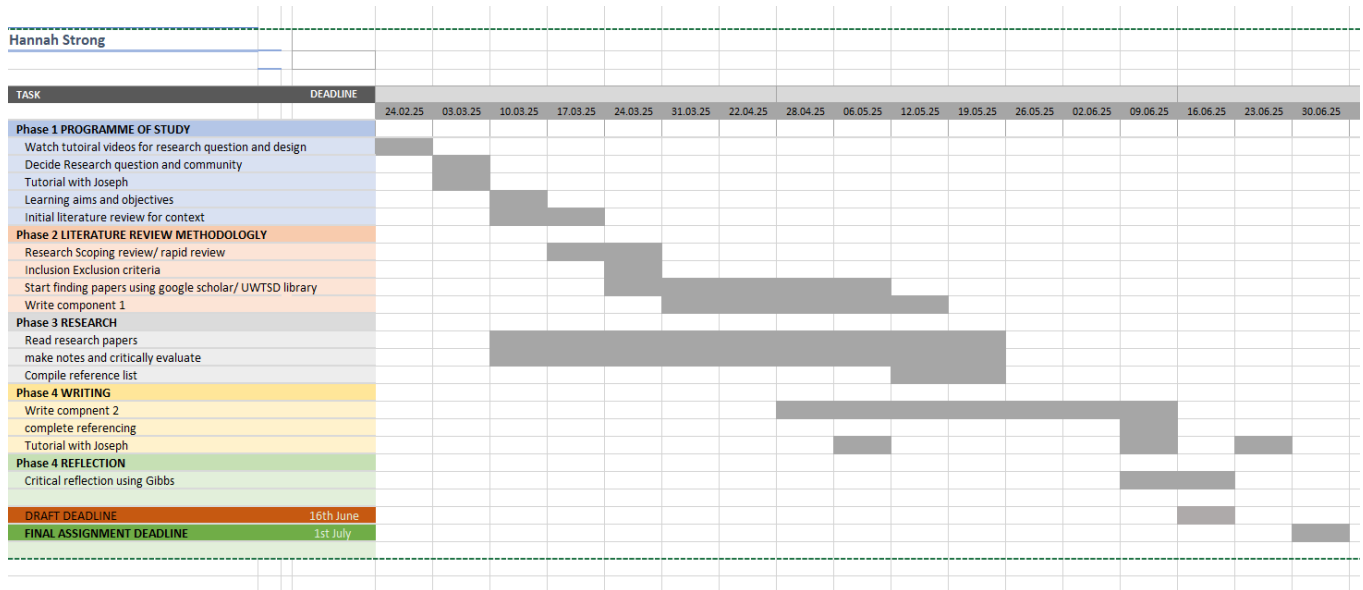
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Appendix 1 – GANTT chart



Appendix 2

Cost of 'Singing Straws'

Ray Vox Resono	£32.99-£39.99	www.rayvox.co.uk
Ray Vox Resono Flex	£9.99	www.rayvox.co.uk
Ray Vox Resono Pro	£79.99	www.rayvox.co.uk
Singing Straw	£38.58	www.singingstraw.com
Singing Straw Pro	£54.33	www.singingstraw.com
Oovo vocal Straw	£139	www.oovostraw.com