

Module 1 - Cohort N

Lai Man CHIN (Cloris)
2333287

What strategies should singers employ to improve voicing efficiency from breathy phonation to flow phonation?

(4290 words)

Content

I. Introuduction	3
II. Literature Review	3
1. Breathy phonation	3
1.1 Factors Contributing Breathy phonation	3
1.2 Who may have a higher possibility of singing with a breathy voice?	4
1.3 Is breathy phonation a problem?	5
2. Flow Phonation	5
2.1 How can one achieve flow phonation?	6
III. Strategy: Semi-occluded Vocal Tract Exercises - Straw phonation with water	7
1. Semi-occluded Vocal Tract Exercises	7
2. Straw phonation exercises in water	8
2.1 Factors affecting effectiveness of straw phonation	8
2.2 Benefits of Straw phonation exercise	9
2.3 Progression of practicing straw phonation exercise in a music studio	10
IV. Critical Reflection	10
V. Conclusion	13
Appendix 1: Activites of progression	14
Appendix 2: Excerpt of The Ash Grove	14
Appendix 3: Personal development plan	15
Reference List	16

I. Introduction

I have observed in my music studio that it is quite common to have young students, especially girls aged 5 to 10, singing in a breathy voice. These girls often speak softly. Some of them try to sing forcefully which leads to tiredness and discomfort in their voices. As their singing teacher, I feel the need to provide practical strategies to help these students improve their voicing efficiency. Along the way of searching and evaluating various approaches, straw phonation in water—one of the semi-occluded vocal tract exercises (SOVTEs)—can be an effective strategies suitable for practice in my studio and meet the needs of students with breathy phonation. In the final part of this essay, I will review the process of finding solutions for improving voicing efficiency using Gibbs' reflective cycle.

II. Literature Review

1. Breathy phonation

1.1 Factors contributing breathy phonation

(a) Glottal adduction

Phonation refers to the process by which a flowing column of air causes the vocal folds to vibrate, thereby generating sound; these vibrations and the length of time the vocal folds remain closed during each vibration cycle determine the voice quality (McCarther and Arneson, 2023). Phonation can be affected by various elements within the voice-producing mechanism (Kiesgen, 2006). One of the controlling factors is glottal adduction (Sundberg, 2022).

By controlling the adduction of cartilaginous glottis, the voice quality can vary from breathy voice to pressed voice (Herbst and Švec, 2014). When the cartilaginous glottis is highly adducted, it allows the creation of radiated sound with stronger high frequency components (Herbst and Švec, 2014). On the other hand, when the cartilaginous glottis is not fully adducted, a posterior glottal chink often exists (Kadiri, Alku and Yegnanarayana, 2020; Herbst and Švec, 2014). A partially closed glottis or posterior glottal chink results in breathy phonation (Kadiri, Alku and Yegnanarayana, 2020; Shiba and Chhetri, 2016). The glottal gap reduces the contact area of vocal folds (Kadiri, Alku and Yegnanarayana, 2020), allowing tracheal airflow to enter the vocal tract at all times (Brandner et al., 2023) and generate noise into the voice source (Herbst and Švec, 2014). As a result, when vocal folds are not completely adducted, a breathy voice with aspiration noise is created (Brandner et al., 2023) and the tone produced is relatively weak, diffuse or airy (McCarther and Arneson, 2023).

(b) Subglottal pressure, glottal airflow and glottal resistance

Subglottal pressure, glottal airflow and glottal resistance are crucial and interdependent factors affecting phonation modes (Sundberg, 2022). Glottal resistance is defined as the quotient of subglottal pressure to glottal airflow; the ratio between subglottal pressure and airflow resistance affects airflow (Proutskova et al., 2013; Sundberg, 2022). High subglottal pressure with low glottal airflow results in high glottal resistance, leading to pressed phonation; in contrast, low subglottal pressure with high glottal airflow results in low glottal resistance, leading to breathy phonation (Proutskova et al., 2013; Sundberg, 2022). By controlling these parameters, singers can switch between different phonation modes for different music styles (Proutskova et al., 2013).

(c) Efficiency of setting phonatory posture

The timing of setting phonatory posture determines the types of phonation (Shiba and Chhetri, 2016). Voice production is a series of coordinated events beginning with setting prephonatory glottal posture, followed by aerodynamic energy rising from the lungs which triggers vocal fold oscillation to generate sound (Shiba and Chhetri, 2016). In breathy phonation, the speed of glottal closure is relatively slow indicating that there are hesitations and complex tasks involved in achieving the final phonation posture; therefore the phonation onset latency time, defined as the duration from onset of glottal adduction to voice production, is longer for breathy phonation and shorter for modal phonation (Shiba and Chhetri, 2016). When the coordination of phonatory posture and phonation onset is not functioning optimally, it results in decreased vocal efficiency and a breathy tone quality (Shiba and Chhetri, 2016).

(d) Pathological reasons

A breathy voice can be caused by pathological reasons, such as vocal fold nodules, polyps, or laryngeal cysts which may lead to the change or impairments in the vocal fold structure (Herbst, Howard and Schlömicher-Thier, 2010; Abdelgoad and Alrusayyis, 2022). Continuous excessive use of voice without adequate recovery period causes vocal fatigue, which may promotes breathiness in voice (Daugherty, Manternach and Price, 2011).

1.2 Who may have a higher possibility of singing with a breathy voice?

The posterior glottal chink, one of the reasons for breathy phonation, is often found in aging individuals due to inadequate respiratory support, which prevents the vocal folds from fully adducting, indicating a hypofunction of voice production (Miller, 1995; McCullough et al., 2012; Sliiden, Beck and MacDonald, 2017). Additionally, during puberty, hormonal influences cause females' vocal muscles to thicken slightly and vocal folds to lengthen, affecting the

coordination of airflow and the approximation of the vocal folds (Miller, 1995; Abitbol, Abitbol, and Abitbol, 1999; Dienerowitz et al., 2021). Occupational voice users, such as teachers and singers, who have high demand of voice usage, are at risk to suffer from minimal associated pathological lesions due to long period of voice misuse or hazardous phonation behaviours; these issues may lead to irregularities in the vocal folds, causing an increase in airflow and decrease in breath efficiency, often resulting in a breathier voice (Sliiden, Beck and MacDonald, 2017; Abdelgoad and Alrusayyis, 2022).

1.3 Is breathy phonation a problem?

Breathy phonation is not necessarily a problem or a symptom of vocal illness; it can be a singing style at singer's choice to create an intimate sound for jazz or pop music (Sliiden, Beck and MacDonald, 2017). However, Phonation with obviously abducted vocal folds may require more effort and could lead to vocal fatigue, with symptoms including vocal discomfort, a narrowed pitch range and flexibility, weakened voice projection and power, and loss of control over tone quality (Cleveland, 1999; Solomon, 2008; Düzenli-Öztürk, Ünsal and Uz-Hasirci, 2023). Prolonged misuse of voice may develop into voice disorders, such as Minimal associated pathological lesions; voice disorders can negatively impact on individual's physical health and emotions; their working performance may lower, leading to more time off (Abdelgoad and Alrusayyis, 2022; Bhatt et al., 2023).

Aside from health issues, breathy phonation limits volume, range of dynamic change and timbral variation; it can rarely fulfil the desirable tone quality—specifically, a rich and strong sound with well-adjusted resonance—in classical singing (Kiesgen, 2006; Herbst and Švec, 2014).

Breathy phonation is characterized by a combination of low glottal resistance and high glottal flow (Sundberg, 2022 ;Proutskova et al., 2013), resulting in shorter maximum phonation time and a high noise-to-harmonic ratio (Sliiden, Beck and MacDonald, 2016; Kadiri, Alku and Yegnanarayana, 2020, Brandner et al., 2023). These parameters indicating breathy phonation needs more physical effort but generate lower sound output; in other words, voicing efficiency and economy of breathy phonation is lower; to improve voicing efficiency, flow phonation is highly recommended (Proutskova et al., 2013).

2. Flow Phonation

Flow phonation is a singing technique that emphasises maintaining a gentle airflow, which allows air to rush between the vocal folds; the reduced pressure pulls the vocal folds together, similar to the Bernoulli Effect, causing them to adduct and abduct without direct

manipulation; without excessive muscle control, the vocal folds remain flexible and responsive (Kiesgen, 2006). When airflow and the vocal folds oscillate simultaneously, the closure of vocal folds is firm yet gentle without excessive resistance; this creates an ideal onset (Kiesgen, 2006) and facilitates tone clarity (McCullough et al., 2012).

Flow phonation promotes vocal economy; the Bernoulli Effect facilitates complete closure of the vocal folds with less effort, resulting in a clear voice quality (Kiesgen, 2006). Compared to breathy and pressed phonation, subglottal pressure in flow phonation is lower than in pressed phonation, while glottal airflow is lower than in breathy phonation; this may be due to closure of vocal folds, resulting in reduced glottal leakage; flow phonation requires less physical effort while enabling singers to reach higher sound levels, making it more economical than the other phonation modes (Proutskova et al., 2013; Kadir, Alku and Yegnanarayana, 2020).

2.1 How can one achieve flow phonation?

There are two criteria for flow phonation to occur; one criterion is to control an appropriate amount of airflow and breath pressure to achieve an proper balance among the muscles controlling phonation; the other criterion is that both the cricothyroid and thyroarytenoid muscles need to be actively engaged, with a well-maintained balance between them (Kiesgen, 2006). This essay will focus primarily on the first criterion: maintaining an appropriate balance of airflow and breath pressure to achieve flow phonation.

To achieve flow phonation, it is advisable to avoid controlling the larynx directly, as this may cause excessive tension in the throat muscles (Kiesgen, 2006). Phonation exercises may enhance voicing efficiency by balancing glottal resistance and glottal flow (Diaz et al., 2023). There are a variety of vocal exercises, such as Semi-occluded Vocal Tract Exercise (SOVTEs), Vocal Function Exercise, Resonant Voice Treatment, Accent Method, Flow Phonation Voice Exercises, Water Resistance Therapy, and Stretch-and-flow, which have evidence showing their effectiveness in enhancing vocal function and quality (Guzman et al., 2013; Kaneko, 2014; Kapsner-Smith et al., 2015; Watts et al., 2015; Angadi, Croake and Stemple, 2017; Guzman et al., 2021; Abdelgoad and Alrusayis, 2022).

In this essay, straw phonation in water, one of the SOVTE techniques, is selected as the strategy for improving voicing efficiency for several reasons. Firstly, straws are easily accessible and can be modified in length and diameter; Immersing them in water may adjust the level of resistance and oral pressure, thereby influencing the intensity of the exercises (Titze, 2006; Andrade et al., 2016). Moreover, due to hygiene concern arising from the

COVID-19 pandemic, straw phonation in water poses a lower risk of spreading viruses and bacteria through aerosolized saliva (Manternach, 2020). Additionally, it may generate higher oral pressures among SOVTEs, suggesting that the efficacy of this exercise may be higher than that of others (Maxfield et al., 2015).

III. Strategy : Semi-occluded Vocal Tract Exercises - Straw phonation in water

1. Semi-occluded Vocal Tract Exercises

SOVTEs are a group of interventions designed to enhance voicing efficiency and economy in speaking and singing, as well as to rehabilitate patients with voice disorders (Titze, Maxfield and Cox, 2022; Bhatt et al., 2023). A wide range of SOVTE varies by type and the extent of occlusion, including lip and tongue trills, phonation into tubes and straws submerged in water or held in air, phonation with hand covering the mouth, bilabial fricative sounds, nasal sounds and others (Titze, 2006; Andrade et al., 2016; Bhatt et al., 2023).

Partially occluding the vocal tract creates additional airflow resistance and thereby increases the supraglottal pressure, which helps spread the vocal folds apart (Titze et al., 2002; Nix, 2016). With reduced vocal fold collision, phonation threshold pressure (PTP)—which refers to the minimum subglottal pressure needed to initiate vocal fold vibration (Enflo et al., 2013; Manternach, 2020)—and the amplitude of the vocal fold vibration decrease, therefore requiring less effort for phonation to occur and lowering the risk of voice disorders (Titze et al., 2002; Nix, 2016).

SOVTEs can influence vocal tract configuration and muscle contraction by lowering the position of the larynx, widening the pharynx, and narrowing the opening of the aryepiglottic fold (Guzman et al., 2013; Andrade et al., 2016). When the vertical laryngeal position is lowered, the vocal folds become thicker, allowing for better glottal closure (Guzman et al., 2013). Rapid glottal closure with low amplitude of vocal fold vibration produces a higher maximum flow declination rate, which excites stronger high frequencies and contributes to increased vocal output without requiring extra vocal effort; thus, voicing efficiency is enhanced (Guzman et al., 2013; Nix, 2016). A widened pharynx enlarges pharyngeal cavity, acoustically enhancing the first formant for a more desirable tone described as rounded, free, warm and effortless (Guzman et al., 2013). Aryepiglottic narrowing helps produce the cluster of the singer's formant, including the third to fifth formants (Guzman et al., 2013; Croake, Andreatta and Stemple, 2017). This formant cluster enables singers to achieve a louder and brighter tone quality (Guzman et al., 2013; Nix, 2016; Croake, Andreatta and Stemple, 2017). This narrowing results in a narrowed epilarynx; when combined with a widened pharynx, the vocal tract becomes inertial for all potential fundamental frequency values, creating a strong source-and-filter interaction that

facilitates vocal fold oscillation due to the decrease of PTP (Guzman et al., 2013). Consequently, the impact stress on the vocal folds is reduced with elevated voice output, enhancing the efficiency of phonation (Croake, Andreatta and Stemple, 2017; Mendes et al., 2017; Bhatt et al., 2023).

2. Straw phonation exercises in water

Phonation into tubes in water is one of the SOVTEs that has a long history of research and development (Titze, 2006). This exercise can be varied by using different instruments, such as resonance tubes (a glass tube with a 9mm inner diameter), Lax Vox (a silicon tube with a 10mm diameter), and drinking or stirring straws in various lengths and diameters (Andrade et al., 2016). Straw phonation in water is used in my strategy, due to easy access of instruments, adjustable intensity of the exercise (Titze, 2006; Andrade et al., 2016), lower risk of spreading aerosolized saliva (Manternach, 2020) and its ability to generate higher levels of oral pressure compared to other SOVTEs, suggesting that the efficacy of this exercise may be greater than that of others (Maxfield et al., 2015).

The straw serves as an artificially elongated vocal tract resonator providing additional airflow resistance at the mouth (Titze, 2006). Submerging the end of the straw in water can facilitate the modulation of oral pressure caused by bubbling the water (Andrade et al., 2016). An air bubble can be ejected when the oral pressure exceeds the water pressure at the tip of the straw, allowing airflow to push the water out (Enflo et al., 2013; Andrade et al., 2016; Wistbacka et al., 2018). As the oral pressure increases to eject the bubble, both the amplitude of vocal fold vibration and the PTP decrease; after the bubble is ejected, the oral pressure drops, causing both the amplitude and the PTP to increase (Enflo et al., 2013). By repeating this bubbling process, a pulsating oral pressure is created, generating a massage-like sensation on the walls of the vocal tract (Enflo et al., 2013).

2.1 Factors affecting the effectiveness of straw phonation in water

Length The length of the straw is positively related to oral pressure; a longer straw produces greater oral pressure (Andrade et al., 2016). Additionally, increasing the length of a narrow straw (2-3 mm stirring straw) significantly raises resistance, leading to higher oral pressure (Titze, Maxfield and Cox, 2022). In contrast, increasing the length of a drinking straw with a diameter of 5 mm or more results in a marginal increase in resistance and oral pressure (Titze, Maxfield and Cox, 2022). Therefore, the effectiveness of influencing oral pressure through changes in straw length depends on the straw's diameter (Titze, Maxfield and Cox, 2022). Compared with changes in diameter, changes in length are less effective for increasing resistance and oral pressure (Andrade et al., 2016; Titze, Maxfield and Cox, 2022).

Diameter The diameter of the straw affects airflow resistance and influences oral pressure (Titze et al., 2002; Wistbacka et al., 2018). Changes in straw diameter have a more pronounced impact on flow resistance compared to changes in length (Titze, Maxfield and Cox, 2022). A narrower straw creates higher flow resistance, increasing oral pressure, allowing for higher acoustic output, and reducing the collision of the vocal folds, which promotes voicing efficiency (Horáček, Radolf, and Laukkanen et al., 2018; Titze, Maxfield and Cox, 2022). Conversely, a larger diameter straw produces lower bubble frequency with greater amplitude of vibration, creating a stronger massage-like sensation and increasing inertance in the vocal tract (Guzman et al., 2021; Titze, Maxfield and Cox, 2022). Larger diameter straw is particularly beneficial for individuals new to SOVTEs who may feel uncomfortable with high-resistance exercises (Titze, Maxfield and Cox, 2022).

Water depth Water pressure increases with depth; a straw submerged deeper in water requires greater oral pressure to overcome the water pressure for bubbling to occur (Andrade et al., 2016). Depth of water is positively related to oral pressure (Manternach, 2020). However, the change in the massage effect provided by bubbling is more pronounced at a water depth up to 3 cm; the increase in amplitude of oral pressure oscillation is less significant when the straw is immersed deeper than 3 cm (Wistbacka et al., 2018). The submersion of straws in water can be adjusted to various depths to meet different training purposes (Wistbacka et al., 2018). For individuals with hyperfunction, it is recommended to continue phonation with a straw submerged 1-2 cm in water; to enhance vocal fold closure, short phonation with deeper submersion of up to 15 cm is advised; for individuals with hypofunction, it is recommended to phonate continuously while keeping the end of the straw near the water surface and partially open (Wistbacka et al., 2018).

2.2 Benefit of Straw phonation exercise

The straw phonation exercise is more accessible than the other forms of SOVTE, as it does not require specific skill sets, such as lip trills or tongue trills, making it suitable for individuals at all skill levels (Bhatt et al., 2023). Moreover, a study shows that warming up with straw phonation can boost overall energy due to the configuration of vocal tract, which allows for increased vocal output and lowered PTP, leading to a perception of easy phonation (Manternach, Schloneger and Maxfield et al., 2019).

Straw phonation creates a vibration sensation in the palate and the frontal part of the oral cavity, confirming that the singer is practicing the exercise correctly (Bhatt et al., 2023). The bubbles produced during straw phonation indicate the level of airflow; a higher frequency of bubbles and larger bubbles correspond to a higher airflow rate (Manternach, 2020; Guzman et al., 2021). However, larger bubbles may also indicate a larger back cavity

caused by abducted vocal folds, allowing more air to pass freely from the subglottal tract to the supraglottal tract (Wistbacka et al., 2018). Bubbles provide visual feedback to singers, enhancing their awareness of airflow control (Manternach, 2020). Maintaining a high and steady bubble frequency with small bubbles may indicate positive oral pressure and well-adducted vocal folds with low amplitude of fold vibration, contributing to efficient phonation.

2.3 Progression of practicing straw phonation exercise in a music studio

Based on the activities outlined by McCullough et al (2012), I have designed a strategy for practising straw phonation exercises (see Appendix 1). Establishing a free airflow is crucial for singers in any genre (McCarther and Arneson, 2023); therefore, the exercise starts with bubbling without phonation, followed by adding random sound into bubbling. After that, more musical elements are incorporated into the exercises, starting with gliding up or down to explore the comfortable range of pitch, followed by simple scale-like vocal exercises that combine the use of straw and vocalisation with it. Lastly, straw phonation is applied to a melody by starting with singing the melody through a straw, then progressing to alternating phrases with and without the straw (see Appendix 2) and finally, singing the entire song without the straw; this process helps transfer the sensations of straw phonation into normal singing (Nix and Simpson, 2008).

IV. Critical Reflection

Throughout the journey of studying breathy phonation and exploring strategies to improve voicing efficiency, the process and experiences are worth systematically reviewing for future research. This reflection applies Gibbs' Reflective Cycle, as the framework is well-structured with defined sections; it helps me reframe my experience, feelings, ideas and observations into a structured reflective journal, which may encourage new insights and allow for revisiting and reconsidering the writing in the future (Adeani, Febriani and Syafryadin, 2020). There are six steps in Gibbs' Reflective Cycle (Pitts, 2023; Sekarwinahyu et al., 2019).

1. Description

At the stage of defining research question, I observed my students' performance during lessons and noted some technical issues I could not find a way to improve. Initially, I identified the problem as weak voice projection or a soft tone, but I later realised that these were actually outcomes of ineffective phonation. The cause-and-effect relationship was inverse.

When I began conducting preliminary research on phonation, I realised that, due to my limited understanding of the physiology of voice and the fact that English is my second language, I spent a significant amount of time trying to grasp the terminology, the anatomy of voice, the mechanism of phonation and so forth. In addition to reading academic journals, I sought to understand the topic better by searching for the terminology using search engines, watching related videos on the Voice Study Centre's video library and YouTube, and asking questions on AI platforms.

After gaining a brief understanding of the phonation system and the causes of breathy phonation, I explored strategies to address the inefficiency of voice. Various methods and practices have been suggested as effective in improving voicing efficiency. From the academic reading I collected from the library, SOVTEs are well-represented, while straw phonation was completely new to me. As I reviewed other phonation exercises, I recalled having practiced those before, although the rationale was not explained at the time. While examining these different methods, I found myself with many questions, such as whether these methods are based on the same principles and whether they address the same underlying issues.

To better understand the effects of practicing SOVTE and straw phonation in water, I tried to practice with straws of various lengths, diameters, and materials. I found the practice enjoyable and easy to incorporate. After a month of practicing, I noticed a significant reduction in vocal fatigue at the end of long teaching days.

Every step of this assignment took more time than I expected, particularly the writing process, which meant that I fell behind the schedule.

2. Feelings

During the process of reviewing articles and relevant studies, I felt excited to acquire new knowledge, such as the factors that affect phonation modes, and various vocal exercises effective for wide range of singer, from beginners to professionals and young children to elderly students. Some gaps in my knowledge about singing were filled in this process and I felt a sense of satisfaction.

However, this process was very challenging due to the terminology related to anatomy, aerodynamics and acoustics. Although I have translated the terminologies into my native language, these terms were difficult to understand, and took time to digest.

In the course of writing this essay, I faced another challenging moment in my research. I felt a lack of confidence in presenting the new knowledge I had acquired, particularly due to the unfamiliar terminology related to anatomy. I discovered many variations of terms that refer to the same body parts, such as 'velum' or 'soft palate' and 'ventricular' or 'vestibular' folds, which often led to uncertainty about whether I was using the correct terminology.

I was pleasantly surprised to experience less vocal fatigue after practicing the straw exercise. This experience confirmed that the learning process was practical and effective, motivating me to continue enriching my knowledge through reading and writing.

3. Evaluation

On the positive side, throughout this assignment, I observed and discovered the needs of the students in my music studio. I also found and reviewed numerous studies and academic literature that addressed my questions and filled the gaps in my knowledge. I practiced straw phonation and the outcomes, including relief from vocal fatigue and enhanced resonance, were evident.

On the negative side, studying scientific content was both demanding and burdensome. Although I understood the ideas presented in this article, the writing process was fraught with doubt and frustration.

4. Analysis

There are several reasons for my negative experience while studying scientific content. Firstly, I underestimated the time needed to grasp the material. With such limited time and the challenges of understanding the content, I faced considerable stress and frustration which further lowered my learning efficiency and led to a vicious cycle. Secondly, my scientific knowledge is insufficient due to a lack of familiarity in reading related materials. Lastly, I was not proactive enough in seeking advice from professionals.

5. Conclusion

I was excited about acquiring new knowledge, but the stress to figure out the unknown within a limited time overshadowed the positive outcomes. From this experience, I have learned to take a proactive approach in seeking out materials that interest me and that I may need to work on in the future, rather than trying to learn new material under time constraints.

6. Action

By critically reflecting on this learning experience, I realized there are several areas I need to improve to support my further studies. Firstly, having a concrete study plan and schedule is essential, outlining the topics that interest me the most. Secondly, establishing a reading habit is important to widen my knowledge base. Thirdly, take initiative action to seek advice from professionals.

V. Conclusion

This essay suggests that straw phonation in water is an effective strategy to improve voicing efficiency from breathy phonation to flow phonation (McCullough et al., 2012; Andrade et al., 2016; Nix, 2016; Titze, Maxfield and Cox, 2022). In the process of finding the strategy for problem-solving, this learning experience has revealed the challenges I am facing in my studies. Learning is a repetitive process; by reflecting on my experiences using Gibbs' reflective cycle (Adeani, Febriani, and Syafryadin, 2020), I have identified several challenges to address, particularly insufficient time for learning and a lack of familiarity with reading scientific materials. To prevent these issues from recurring, I am taking actions by establishing a personal development plan (see Appendix 3).

Appendix 1: Activities of Progression

Activities of Progression	
Step 1	Put a straw into a cup with a water depth of 3cm
Step 2	Blow air into the straw to make some bubbles
Step 3	Lengthen the bubbling time and aim for a steady flow of the bubbles
Step 4	Create some sounds freely while blowing air into the straw
Step 5	Gliding down, Gliding up , Gliding up and down
Step 6	Sing (d, r, m, f, s, f, m, r, d) with a straw
Step 7	Sing (s——) with a straw and then sing (f, m, r, d) in /u/ vowel without a straw
Step 8	Sing the melody of a song (The Ash Grove) while blowing air into a straw
Step 9	Sing with a straw and sing /u/ in alternative phrase.
Step 10	Sing without a straw

Appendix 2 : Excerpt of The Ash Grove

70. THE ASH GROVE

Welsh traditional tune, with words

(With straw) *lant*

VOICE *Gently*

p s, d m s t m d d

1. Down yon - der green val - ley where
2. Still flows the bright sun - shine o'er

r f m r d t, s, l s, d m r d t, l, f, l,

stream - lets me - an - der, When twi (With straw) fa - ding, I
val - ley and moun - tain, Still war black - bird its

s, d t, d l s, d m s f m d d r f m r d

pen - sive - ly rove; Or at the hight moon - tide, in sol - i - tude
notes from the tree; Still trem (With straw) moon - beam on stream - let and

t, s, l s, d m r d t, l, f, l, s, d t,

wan - der A - mid (With straw) shades of the lone - ly Ash
foun - tain, But what beau - ties of na - ture to

Appendix 3

Personal Development Plan

Objective	Potential Benefit	Activity	Resource and support needed	Target date of completion
effective Vocal warm-up exercise for children	enhance the performance of choir	Watch videos, academic journal	VSC video resources, university library	2024 Dec
Learn about the anatomy of the voice	better understanding about physiology	watch videos	VSC video resources	2025 Apr
enhance reading and writing skill;	Know more about up-to-date research about voice	read an article from the latest journal every week and write a short reflection	university library, Journal of singing	Ongoing
Keep a teaching journal	review and reflect the quality and effectiveness of teaching	taking notes on particular effective or ineffective teaching method	-	Ongoing
Keep a learning journal	collect the effective instruction give by my voice teacher	Recording the vocal lesson and review with note taking	Voice teacher	Ongoing

Reference List

- Abdelgoad, A. and Alrusayyis, D. (2022) 'Efficacy of the Accent Method of Voice Therapy in Professional Voice Users with Minimal Associated Pathological Lesions of the Vocal Folds', *Indian journal of otolaryngology, and head, and neck surgery*, 74(Suppl 3), pp. 5151–5159. Available at: <https://doi.org/10.1007/s12070-021-03035-4>.
- Abitbol, J., Abitbol, P and Abitbol, A. (1999) Sex hormones and the female voice. *Journal of voice*. [Online] 13 (3), 424–446.
- Adeani, I.S., R., Febriani B. and Syafryadin S. (2020) 'USING GIBBS REFLECTIVE CYCLE IN MAKING REFLECTIONS OF LITERARY ANALYSIS', *Indonesian EFL journal (Online)*, 6(2), pp. 139–148. Available at: <https://doi.org/10.25134/ieflj.v6i2.3382>.
- Andrade, P.A., Wistbacka, G., Larsson, H., Södersten, M., Hammarberg, B., Simberg, S., Švec, J.G., and Granqvist, S. (2016) 'The Flow and Pressure Relationships in Different Tubes Commonly Used for Semi-occluded Vocal Tract Exercises', *Journal of voice*, 30(1), pp. 36–41. Available at: <https://doi.org/10.1016/j.jvoice.2015.02.004>.
- Angadi, V., Croake, D., and Stemple, J. (2019) 'Effects of Vocal Function Exercises: A Systematic Review', *Journal of voice*, 33(1), p. 124.e13-124.e34. Available at: <https://doi.org/10.1016/j.jvoice.2017.08.031>.
- Bhatt, S., Scarce, L., Frank-Ito, D., Nixon, T. and Umstead, K.T.(2023) 'A Human-Centered Design Approach to SOVTE Straw Phonation Instruction', *Journal of voice* [Preprint]. Available at: <https://doi.org/10.1016/j.jvoice.2023.01.023>.
- Brandner, M., Bereuter, P., Kadiri, S.R. and Sontacchi, A. (2023) 'Classification of Phonation Modes in Classical Singing using Modulation Power Spectral Features', *IEEE access*, 11, pp. 1–1. Available at: <https://doi.org/10.1109/ACCESS.2023.3260187>.
- Cleveland, T. F. (1999) 'A Physiological Description of a Debilitating Singing Style', *Journal of singing*, 56 (2), p. 33–34.
- Croake, D.J., Andreatta, R.D. and Stemple, J.C. (2017) 'Immediate Effects of the Vocal Function Exercises Semi-Occluded Mouth Posture on Glottal Airflow Parameters: A Preliminary Study', *Journal of voice*, 31(2), p. 245.e9-245.e14. Available at: <https://doi.org/10.1016/j.jvoice.2016.08.009>.

Daugherty, J.F., Manternach, J.N. and Price, K.K. (2011) 'Student Voice Use and Vocal Health During an All-State Chorus Event', *Journal of research in music education*, 58(4), pp. 346–367. Available at: <https://doi.org/10.1177/0022429410387145>.

Diaz, J.A. Rangarathnam, A. B., Medina, A., Khare, V. D., and Fisher, H. R. (2023) 'Preliminary Perceptual Findings of Singing After Flow Phonation Voice Exercises for Singers in Training', *Journal of voice* [Preprint]. Available at: <https://doi.org/10.1016/j.jvoice.2023.08.014>.

Dienerowitz, Peschel, T., Vogel, M., Poulain, T., Engel, C., Kiess, W., Fuchs, M., and Berger, T. (2021) 'Establishing Normative Data on Singing Voice Parameters of Children and Adolescents with Average Singing Activity Using the Voice Range Profile', *Folia phoniatrica et logopaedica*, 73(6), pp. 565–576. Available at: <https://doi.org/10.1159/000513521>.

Düzenli-Öztürk, S., Ünsal, E. M., Tetik-Hacitahiroğlu, K., and Uz-Hasırcı, S. (2023) 'Investigation of the Relationship Between Vocal Fatigue, Quality of Life, and Compliance With Vocal Hygiene in Professional Voice Users', *Journal of voice* [Preprint]. Available at: <https://doi.org/10.1016/j.jvoice.2023.10.013>.

Enflo, L., Sundberg, J., Romedahl, C., and McAllister, A. (2013) 'Effects on Vocal Fold Collision and Phonation Threshold Pressure of Resonance Tube Phonation with Tube End in Water', *Journal of speech, language, and hearing research*, 56(5), pp. 1530–1538. Available at: [https://doi.org/10.1044/1092-4388\(2013/12-0040\)](https://doi.org/10.1044/1092-4388(2013/12-0040)).

Guzman, M., Castro, C., Testart, A., Muñoz, D., Gerhard, J. (2013) 'Laryngeal and Pharyngeal Activity During Semioccluded Vocal Tract Postures in Subjects Diagnosed With Hyperfunctional Dysphonia', *Journal of voice*, 27(6), pp. 709–716. Available at: <https://doi.org/10.1016/j.jvoice.2013.05.007>.

Guzman, M., Castro, C., Acevedo, K., Moran, C., Espinoza, V., and Quezada, C. (2021) 'How Do Tube Diameter and Vocal Tract Configuration Affect Oral Pressure Oscillation Characteristics Caused by Bubbling During Water Resistance Therapy?', *Journal of voice*, 35(6), p. 935.e1-935.e11. Available at: <https://doi.org/10.1016/j.jvoice.2020.03.004>.

Herbst, C.T., Howard, D. and Schlömicher-Thier, J. (2010) 'Using Electroglottographic Real-Time Feedback to Control Posterior Glottal Adduction during Phonation', *Journal of voice*, 24(1), pp. 72–85. Available at: <https://doi.org/10.1016/j.jvoice.2008.06.003>.

Herbst, C.T. and Švec, J.G. (2014) 'Adjustment of glottal configurations in singing', *Journal of singing*, 70(3), pp. 301–308.

Horáček, J., Radolf, V. and Laukkanen, A.-M. (2019) 'Impact Stress in Water Resistance Voice Therapy: A Physical Modeling Study', *Journal of voice*, 33(4), pp. 490–496. Available at: <https://doi.org/10.1016/j.jvoice.2018.01.025>.

Kadiri, S.R., Alku, P. and Yegnanarayana, B. (2020) 'Analysis and classification of phonation types in speech and singing voice', *Speech communication*, 118, pp. 33–47. Available at: <https://doi.org/10.1016/j.specom.2020.02.004>.

Kaneko, M., Hirano, S., Tateya, I., Kishimoto, Y., Hiwatashi, N., Fujiu-Kurachi, M., & Ito, J. (2015) 'Multidimensional Analysis on the Effect of Vocal Function Exercises on Aged Vocal Fold Atrophy', *Journal of voice*, 29(5), pp. 638–644. Available at: <https://doi.org/10.1016/j.jvoice.2014.10.017>.

Kapsner-Smith, M. R., Hunter, E. J., Kirkham, K., Cox, K., and Titze, I. R. (2015) 'A Randomized Controlled Trial of Two Semi-Occluded Vocal Tract Voice Therapy Protocols', *Journal of speech, language, and hearing research*, 58(3), pp. 535–549. Available at: https://doi.org/10.1044/2015_JSLHR-S-13-0231.

Kiesgen, P. (2006) 'Voice Pedagogy: Phonation', *Journal of singing*, 62(3), pp. 285–287.

Manternach, B. (2020) Straw in Water: A Low 'Spit Factor' Alternative to Lip Trills and Raspberries. *Voiceprints (New York, N.Y.)*. 17 (5), pp. 71–75.

Manternach, J.N., Schloneger, M. and Maxfield, L. (2019) 'Effects of Straw Phonation and Neutral Vowel Protocols on the Choral Sound of Two Matched Women's Choirs', *Journal of research in music education*, 66(4), pp. 465–480. Available at: <https://doi.org/10.1177/0022429418809976>.

Maxfield, L., Titze, I., Hunter, E., Kapsner-Smith, M. (2015) 'Intraoral pressures produced by thirteen semi-occluded vocal tract gestures', *Logopedics, phoniatrics, vocology*. Available at: <https://doi.org/10.3109/14015439.2014.913074>.

McCarthy, S. and Arneson, C. (2023) 'Reorganizing the Pillars of Voice Pedagogy: A Tiered Approach to Teaching Voice', *Journal of singing*, 80(2), pp. 135–143. Available at: <https://doi.org/10.53830/JAYS8662>.

Mansell, S. K., Parry, R., Shah, A., Gowing, F., Greenfield, C., Bhatt, Y., and Mandal, S. (2024) 'Pilot observational cohort study to determine whether waveform and flow traces from mechanical insufflation–exsufflation (MI-E) can be used to identify laryngeal responses to MI-E and thus optimise treatment algorithms in neuromuscular patients in a tertiary centre: a protocol description', *BMJ open respiratory research*, 11(1), pp. e001599-. Available at: <https://doi.org/10.1136/bmjresp-2022-001599>.

Mendes, A. L. F., Dornelas do Carmo, R., Dias de Araújo, A. M. G., Paranhos, L. R., da Mota, C. S. O., Schneiberg, S., Reis, F. P., and Aragão, J. A. (2019) 'The Effects of Phonation Into Glass, Plastic, and LaxVox Tubes in Singers: A Systematic Review', *Journal of voice*, 33(3), p. 381.e1-381.e9. Available at: <https://doi.org/10.1016/j.jvoice.2017.12.005>.

Miller, R. (1995) 'Breathy Young Female Voices', *Journal of singing*, 52 (2), pp. 37–39.

Nix, J. and Simpson, C.B. (2008) 'Semi-occluded vocal tract postures and their application in the singing voice studio', *Journal of singing*, 64(3), pp. 339-.

Nix, J. (2016) 'Closing your mouth to “open” your sound', *Journal of singing*, 73(1), pp. 35–41.

Pitts, R.T. (2021) 'Pinpointing Where to Start: A Reflective Analysis on the Introductory Evaluation Course', *Canadian journal of program evaluation*, 35(3), pp. 437–449. Available at: <https://doi.org/10.3138/cjpe.69697>.

Proutskova, P., Rhodes, C., Crawford, T., and Wiggins, G. (2013) 'Breathy, Resonant, Pressed - Automatic Detection of Phonation Mode from Audio Recordings of Singing', *Journal of new music research*, 42(2), pp. 171–186. Available at: <https://doi.org/10.1080/09298215.2013.821496>.

Saters, T. L., Ribeiro, V. V., Siqueira, L. T. D., Marotti, B. D., Brasolotto, A. G., and Silverio, K. C. A. (2018) 'The Voiced Oral High-frequency Oscillation Technique's Immediate Effect on Individuals With Dysphonic and Normal Voices', *Journal of voice*, 32(4), pp. 449–458. Available at: <https://doi.org/10.1016/j.jvoice.2017.06.018>.

Sekarwinahyu, M., Rustaman, N. Y., Widodo, A., and Riandi, R. (2019) 'Development of problem based learning for online tutorial program in plant development using Gibbs' reflective cycle and e-portfolio to enhance reflective thinking skills', *Journal of physics. Conference series*, 1157(2), pp. 22099-. Available at: <https://doi.org/10.1088/1742-6596/1157/2/022099>.

Shiba, T.L. and Chhetri, D.K. (2016) 'Dynamics of phonatory posturing at phonation onset', *The Laryngoscope*, 126(8), pp. 1837–1843. Available at: <https://doi.org/10.1002/lary.25816>.

Sliiden, T., Beck, S. and MacDonald, I. (2017) 'An Evaluation of the Breathing Strategies and Maximum Phonation Time in Musical Theater Performers During Controlled Performance Tasks', *Journal of voice*, 31(2), pp. 253.e1-253.e11. Available at: <https://doi.org/10.1016/j.jvoice.2016.06.025>.

Solomon, N. P. (2008). 'Vocal fatigue and its relation to vocal hyperfunction', *International Journal of Speech Language Pathology*, 10(4), pp. 254–266. Available at: <https://doi.org/10.1080/14417040701730990>

Sundberg, J. (2022) 'Objective Characterization of Phonation Type Using Amplitude of Flow Glottogram Pulse and of Voice Source Fundamental', *Journal of voice*, 36(1), pp. 4–14. Available at: <https://doi.org/10.1016/j.jvoice.2020.03.018>.

Titze, I.R., Laukkanen, A., Finnegan, E.M., and Jaiswai, S. (2002) 'Raising Lung Pressure and Pitch in Vocal Warm-Ups: The Use of Flow-Resistant Straws', *Journal of singing*, 58(4), pp. 329–338.

Titze, I.R. (2006) 'Voice Training and Therapy With a Semi-Occluded Vocal Tract: Rationale and Scientific Underpinnings', *Journal of speech, language, and hearing research*, 49(2), pp. 448–459. Available at: [https://doi.org/10.1044/1092-4388\(2006/035\)](https://doi.org/10.1044/1092-4388(2006/035)).

Titze, I.R., Maxfield, L. and Cox, K.T. (2022) 'Optimizing Diameter, Length, and Water Immersion in Flow Resistant Tube Vocalization', *Journal of voice* [Preprint]. Available at: <https://doi.org/10.1016/j.jvoice.2022.09.029>.

Watts, C. R., Hamilton, A., Toles, L., Childs, L., and Mau, T. (2015) 'A randomized controlled trial of stretch-and-flow voice therapy for muscle tension Dysphonia', *The Laryngoscope*, 125(6), pp. 1420–1425. Available at: <https://doi.org/10.1002/lary.25155>.

Wistbacka, G., Andrade, P. A., Simberg, S., Hammarberg, B., Södersten, M., Švec, J. G., and Granqvist, S. (2018) 'Resonance Tube Phonation in Water—the Effect of Tube Diameter and Water Depth on Back Pressure and Bubble Characteristics at Different Airflows', *Journal of voice*, 32(1), p. 126.e11-126.e22. Available at: <https://doi.org/10.1016/j.jvoice.2017.04.015>.