

THE IMPACT OF FACIAL EXPRESSION ON SINGERS' EXPERIENCES

Strategies for practical implementation in group settings

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Do singers' facial expressions impact their experiences? Strategies for practical implementation in group settings.

INTRODUCTION

Engaging in group singing has been shown to elevate mood, strengthen social connections, and alleviate stress (Tamplin et al., 2013; Good & Russo, 2022). These benefits are linked to positive neurochemical changes, including a reduction in cortisol levels (associated with stress) and an increase in oxytocin (related to social bonding) (Fancourt et al., 2016; Good & Russo, 2022).

In my professional career as a music and theatre educator, voice teacher, and choir director, I work with diverse multi-cultural groups of children, teenagers and adults. In these groups, despite the numerous positive effects of group singing and a willingness to participate, some participants display furrowed brows while singing. This suggests that their experience may not be entirely enjoyable and seems to inhibit the production of appropriate facial expressions (FEs) required for performance of positive repertoire.

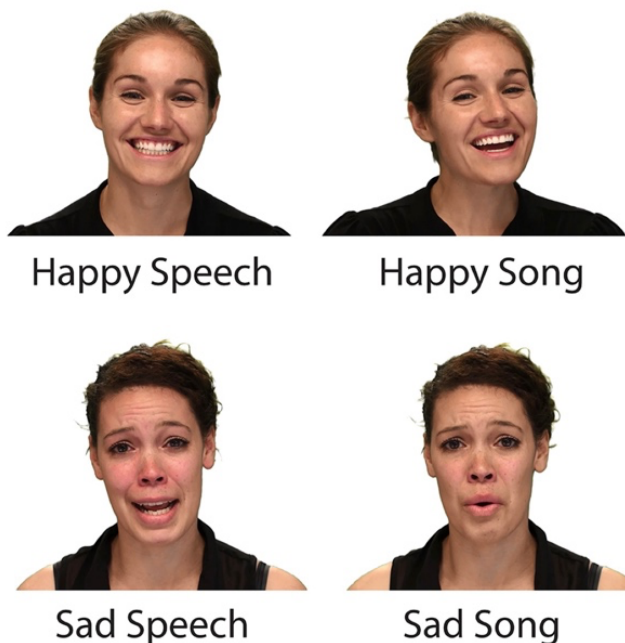


Figure 1. Positive (above) and negative (below) singer expressions, from RAVDESS (Livingstone and Russo, 2018).

Several questions arise after reflection on this observation:

1. Do negative FEs have a negative effect on singers' experiences?
2. Could implementing voluntary positive FE improve singer enjoyment?
3. Which strategies could be implemented in group settings to help singers gain control of their FE and release habitual muscle actions?
4. Could FE exercises be valid for use in multi-cultural group settings?

This essay seeks to clarify, therefore, whether voluntary or subconscious FEs can affect singers' experiences (positively/negatively). After critically evaluation of the research, followed by discussion of my reflective journey (models employed, study journal, personal development and learning), I will provide recommendations for FE exercises designed for group settings, with some exercises also suitable for individual practice. Areas requiring further research are added to my Personal Development Plan (*See Appendix 8, Table 5*).

Inclusion/Exclusion

A broad approach to inclusion dates has been taken, resulting in an historical view of research on this topic and allowing inclusion of seminal papers from leading researchers in the field. Both quantitative and qualitative papers, as recent as possible, have been included. Grey literature and anecdotal practitioner articles, otherwise excluded in favour of peer-reviewed literature, were included when developing practical strategies, supporting reflective practice, or when recognized as experts in the field. It is worth noting that effects of FE and emotion on singing are considerably less researched than general facial and vocal expressions of emotion and, therefore, it is most certainly an area warranting further research.

EMOTIONAL FACIAL EXPRESSIONS

Cultural Similarities

Vocal expressions of emotion are universally recognized, and bodily sensations of emotions experienced similarly across cultures (Juslin & Laukka, 2003; Nummenmaa et al., 2014; Volynets et al., 2020). Emotion-based FEs, however, display subtle cultural differences owing to social norms (Hareli, Kafetsios & Hess, 2015; Saha et al., 2015). Nevertheless, despite these subtle variations, FEs of emotion are likely evolutionary and rooted in biology; therefore, significant intercultural similarities exist (Ekman, 1992; Elfenbein and Ambady, 2002). Emotional FE exercises could, therefore, be validly employed even in multicultural settings.

Muscle involvement

Singers' FE, emotions, and experiences can be interpreted along a valence continuum, ranging from positive to negative (Bestelmeyer, Kotz & Belin, 2017) and then categorized into positive, neutral, and negative (Kreibig, 2010) (See *Appendix 2, Table 1*).

Expression of positive emotions (smile) involves the zygomaticus muscles. A genuine 'Duchenne' smile, however, additionally activates the orbicularis oculi muscles and involves greater zygomatic muscle action than the 'non-Duchenne' smile—used in conversation, embarrassment or submissiveness (Ekman, Davidson & Friesen, 1990; Soussignan, 2002; Jaffer, Ichesco & Gerstner, 2016).

Negative emotions, particularly disgust and anger, engage the corrugator supercilii muscles (Bassili, 1979; Kuramoto et al., 2019; Kraft-Feil et al., 2023), thereby inhibiting the zygomaticus muscles and involve greater levator muscle activity (Zajonc, Murphy & Inglehart, 1989; Niedenthal et al., 2009) (See *Appendix 3, Table 2*).

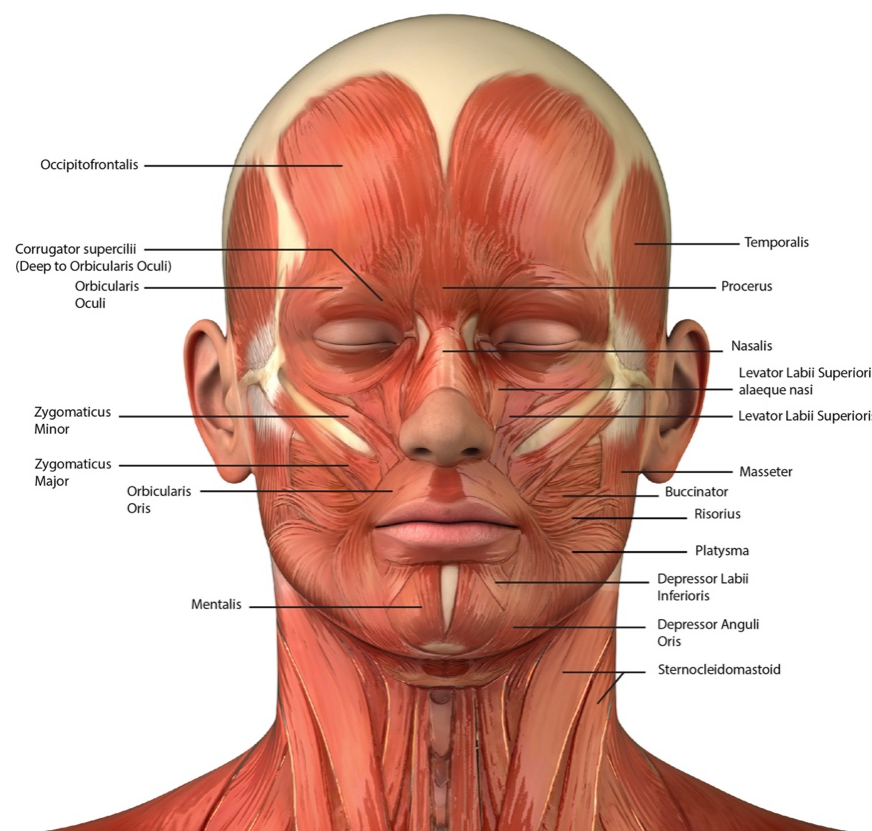


Figure 2 Superficial muscles of the face and neck (Zachary, Gruschchak & Newman, 2023)

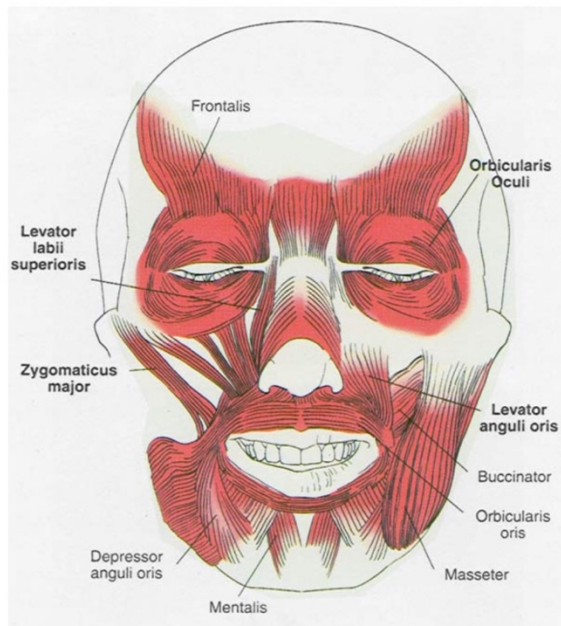


Figure 3 Primary Muscles used in a smile (Terry and Pirtle, 2001).

Effects on Autonomic Nervous System (ANS) and Subjective Feeling

The term ‘subjective feeling’ (SF) is used to describe the personal, internal interpretation of emotions and is measured through self-reporting, arising from an individual’s evaluation and understanding of their own emotional state (Scherer, 2005).

FEs influence the autonomic nervous system (ANS), triggering physiological responses such as changes in heart rate and respiration, thereby affecting SFs (Levensen, Ekman & Friesen, 1990; Levenson et al., 1992; Boiten, 1996; Soussignan, 2002; Kret, 2015). The resulting effects occur even when:

- Voluntary facial action (FA) is not generated by felt emotion (Ekman, Levenson and Friesen, 1983; Strack, Martin & Stepper, 1988; Levensen, Ekman & Friesen, 1990; Larsen, Kasimatis and Frey, 1992; Soussignan, 2002).
- Individuals are unaware of any change in their expression (Strack, Martin and Stepper, 1988).

Therefore, negative FEs during singing—whether conscious or subconscious—could potentially trigger corresponding ANS responses, leading to emotion-related physiological changes and resulting in negative SFs.

Facial Feedback Hypothesis

The Facial Feedback Hypothesis (FFH) suggests that the nerves in our skin and muscles send information from our FAs to the brain, which subsequently influences our SFs (Buck, 1980; Izard, 1981; Strack, Martin and Stepper 1988; Larsen, Kasimatis, Frey, 1992; McIntosh, 1996; Soussignan, 2002; Flack, 2006; Davis, Senghas, Ochsner, 2009; Coles et al., 2022).

FFH has two main variations, both implying that alterations in FE could affect singers' subjective states:

1) Strong: FE initiates emotions.

2) Weak: FE influences emotions.

(Zajonc and McIntosh, 1992; Soussignan, 2002; Coles et al., 2022)

Keillor et al. (2002) argued that FF is not essential for experiencing or processing emotions, after studying a participant with facial paralysis who reported normal emotional experiences despite the inability to produce FEs. However, because singers typically do not suffer from paralysis, it is reasonable to theorise that FF could impact singers' SF.

Strong supporting evidence for FFH comes from a large adversarial global study across 19 countries. Coles et al. (2022) found voluntary FA (either through instruction to move certain facial muscles or employment of 'pen-in-mouth' strategies) and mimicry (of actor images expressing happiness) can both increase and initiate happiness. Mimicked expressions were perceived more genuine than posed expression, perhaps as they evoked a natural empathetic emotional reaction to another's expression (Soussignan, 2002). This suggests, therefore, that not only voluntary positive FEs might enhance singers' experiences, but that spontaneous mimicry of others' FEs might be a particularly effective strategy.

Vascular Theory of Emotional Efference (VTEE)

According to Zajonc, Murphy and Inglehart (1989), Zajonc and McIntosh (1992), and McIntosh, Zajonc and Peter (1997), the theory originally proposed in 1907 by Israel Waynbaum suggests:

1. FEs change breathing patterns (oral/nasal).
2. Breathing modes (oral/nasal) influence emotional responses to stimuli.
3. Nasal air intake cools venous flow of blood to the cavernous sinus, thereby cooling the brain.

4. Constriction of facial muscles, pressing against the veins, restricts venous flow, raising brain temperature and increasing negative SF.
5. Cooling is perceived positively, heating negatively.
6. FEs may serve a regulatory function.
7. Changes in brain temperature could trigger the release or inhibition of neurotransmitters associated with emotion, thereby influencing SF.

Phonemes [y], [ɑ], [e] and [o]

Some VTEE studies employed phonemes (ü [y], o [ɑ], a [ɑ], and e [e]) to generate emotion-related FEs without linking them to real emotions (Zajonc, Murphy & Inglehart, 1989; McIntosh, Zajonc & Peter, 1997) (*See Appendix 4, Table 3*).

One study by Zajonc, Murphy, and Inglehart (1989), involving rapid alternation of phonemes in stories and vocal exercises—as they would occur in sung lyrics—describes the resulting FA as follows:

Negative Emotions (Disgust) [y] – Engages corrugator muscles while extending and inhibiting zygomaticus muscles; nostrils are constricted.

Positive Emotions (Smile) [ɑ] and [e] – Contracts the zygomaticus muscles; nostrils are distended.

Findings from this study reflected a rapid rise in forehead temperature and negative feelings when listening to or generating an [y]. Additionally, [ɑ] and [e] elicited the most positive feelings, while [y] elicited the most negative. Moreover, in alternation between the two phonemes, [ɑ] was considered more relaxed and pleasant than [y]. Singer exercises alternating between [ɑ] and [y] and [y] and [ɑ]/[e] phonemes could foster proprioceptive awareness of FEs and help retrain habitual muscle actions.

As inhibiting nasal breathing amplifies negative emotions, while facilitating it promotes positive feelings (McIntosh, Zajonc, & Peter, 1997), employing nasal breathing techniques, such as Buteyko breathing, may be useful to promote calmness (Subramanian et al., 2023), and regulate brain temperature, thereby increasing positive experiences during singing. However, although nasal breathing is physiologically beneficial, it could be challenging while singing (Moss Erickson, 2022). Raising the soft palate, for example, may be hindered as it is normally lowered during nasal breathing (Matsuo et al., 2010). Therefore, how to best apply nasal respiration techniques to singing and develop appropriate nasal/oral awareness exercises requires careful consideration and is an area warranting further study.

Stimuli

Physiological changes occur in the face in response to emotional stimuli (Nummenmaa et al., 2014), with electromyographic measurements reflecting effects of positive stimuli on the zygomaticus muscles and negative on the corrugator muscles (Larsen, Norris & Cacioppo, 2003).

Smiling produces noticeable changes in the voice (Arias, Belin, & Aucouturier, 2018), allowing listeners to differentiate between types of smiles from the sound alone, even when FEs are not visible (Drahota, Costall, & Reddy, 2008). Listeners then track these auditory smiles with their own zygomatic muscles (Arias, Belin, & Aucouturier, 2018), suggesting that stimuli in the form of live or recorded smile-based spoken/sung phrases could be beneficial. Therefore, teachers' use of positive FEs while communicating or singing would be important, as it would result in the production of favorable vocal changes, triggering the zygomatic muscles of participants.

In addition to vocal/facial mimicry, a variety of emotional stimuli could be employed to support students with aural, visual and kinesthetic learning preferences to evoke emotion-related FE. For example:

- a) Musical (Tiller, 2019; Roes, Pessanha and Salah, 2022).
- b) Sensory (Shirley, 2016).
- c) Reactions to other performers (Durham, 2004).

Dimberg, Thunberg & Grunedal (2002), challenged the effectiveness of voluntary FEs on SF, but supported the use of stimuli. In this study, participants responded to an image with an appropriate FE, subsequently being asked to react with an opposite expression. Findings showed that involuntary FEs from the visual stimuli interfered with voluntary control.

Employing positive images or videos as stimuli could, therefore, override negative stimuli and promote positive FEs, while benefiting visual learners. However, this suggests conversely, undesirable external stimuli—from the environment, musical cues, or other performers' expressions—might hinder singers' control of FEs.

Moreover, Coles et al. (2022) assert that FF effects can arise from FA, both with and without stimuli, and that effects are not significantly diminished when stimuli are absent. Therefore, further observation would be necessary to evaluate this strategy's effectiveness.

Inhibition or Facilitation of Muscles

Darwin theorized that bodily expressions intensify emotions, while suppression softens them (Darwin, C, 1872; Zajonc, Murphy & Inglehart, 1989). Studies supporting this find that inhibiting or facilitating emotional FEs influences emotional intensity (Strack, Martin & Stepper, 1988; Soussignan, 2002; Davis, Senghas & Ochsner, 2009). This implies that singers could control their emotional experiences through FA inhibition, potentially managing distress and improving well-being (Coles et al., 2022).

More so than body posture or vocal expression, FEs significantly impact SFs (Flack, 2006). Additionally, inhibition of negative corrugator muscle action through Botox has been shown to improve symptoms of depression and reduced emotional responses (Davis, Senghas & Ochsner, 2010; Axel Wollmer et al., 2015). Corrugator muscle inhibition, therefore, may help singers seeking to suppress undesirable emotions related to performance anxiety or psychological states.

FA and SF have a close relationship, and mimicking others' FE may lead to experiencing corresponding emotions – an important factor in emotional empathy (Andréasson & Dimberg, 2008). Inhibition of facial responses, thus, hinders social bonding—reducing processing and matching of other people's emotions (Hawk, Fisher & Van Kleef, 2012). Additionally, individuals with depression have a reduced ability to mimic FEs, and the resulting social exclusion can have effects on both their mental and physical health (Kraft-Feil et al., 2023). Consequently, a lack of awareness and control over FEs may similarly hinder singers' social connections, creating a perception by others of diminished empathy. Further research is, therefore, needed to ensure social inclusion of group members suffering from depression.

Facilitation of the zygomatic smile muscles, by placing a pen in the mouth, intensifies SF even when unattached to a cognitive emotion (Strack, Martin & Stepper, 1988). Therefore, pen-in-mouth genuine smile exercises, engaging the zygomaticus muscles and orbicularis oculi/cheek raising, could be particularly beneficial to improve singers' experience and foster social bonding (Soussignan, 2002). Although this strategy could support kinesthetic learners, Coles et al. (2022), however, did not find clear support for the pen-in-mouth method. Monitoring its effectiveness over time would, therefore, be advisable.

Whether effects arising from FEs are due to effort of creating a FA was questioned by Boiten (1996), categorizing emotions correspondingly into two groups (Anger, Fear, Sadness – more effort vs. Disgust, Happiness, Surprise – less effort). In response Levenson & Ekman

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(2002) concluded that effort did not explain heart rate changes associated with emotion. Whether changes relate to effort or not, it is worth noting that Boiten's effortful group consists entirely of negative emotions, suggesting effortful/negative FEs employed by singers could produce negative SF.

A study by Damree et al (2006), found voluntary controlling FAs can suppress or exaggerate emotions, with positive FEs linked to positive emotional experiences (although negative expressions showed a lesser impact). Additionally, changes in heart rate were observed in response to alterations in FEs, suggesting that managing expressions may have beneficial applications for singers and performers by reducing heart rate arising from performance anxiety.

Furthermore, emotions such as anger and fear are tied to somatic fight or flight responses (Levenson & Ekman, 2002) and freezing (Roelofs & Dayan, 2022). Therefore, emotions arising from negative FEs could impact a singer's experience in this manner, further implying the benefits of voluntary positive FEs.

Some researchers in the Coles et al. study (2022), however, doubt the benefits of using voluntary FEs to improve mood. It would be important, therefore, to monitor the effectiveness of this strategy.

Conclusions

FE has an emotion-specific effect on the ANS (Levenson, Ekman & Friesen, 1990) producing distinct emotional patterns of physiological changes (Kreibig, 2010), discernible not only between positive and negative emotions, but also among different negative emotions (Ekman, Levenson and Friesen, 1983; 1990; Boiten, 1996).

There is sufficient research to support the notion that singers positive/negative experience might be affected by FEs used while singing. Namely, that expressions involving contraction of the corrugator muscles would have a negative effect on singer experience (through increased brain temperature or FF) and that the engagement of the zygomaticus and orbicularis oculi muscles a more positive one.

FF arising from FE, particularly of anger and disgust, appears to have stronger effects on SF than do body posture or vocal expressions (Flack, 2006). Therefore, developing proprioceptive and interoceptive awareness of facial muscle actions and subjective emotions would be important for singer to gain control over their FEs and thereby emotional their states.

REFLECTION AND LEARNING

Reflective Models

During my research, I maintained a learning journal to help me reflect upon:

- Beliefs, values and biases.
- Emotions and feelings.
- Personal learning and teaching styles.
- Arising questions and obstacles.
- Potential applications for teaching.
- Gaps in knowledge and areas requiring further research.

To help me in this process, I employed two reflective models:

Kolb Experiential Learning Cycle (Kolb, 1984):

Comprised of 4 recurring steps this model creates an endless spiral based on experiential learning (Kolb and Kolb, 2018):



Figure 4 The Kolb Experiential Learning Cycle (Kolb and Kolb, 2018).

Kolb's cycle could be a useful tool for teaching, creating clear structure during lesson planning. Resulting pupil self-reflection and analysis by employing this model would support continued learning and help deepen understanding (Kolb and Kolb, 2018).

DEBRIEF (Allan, 2011)

An extension of the Kolb mode, DEBRIEF includes bridging stages in the reflection cycle, acknowledging that emotion influences learning, evaluating bias through beliefs and assumptions, considering previous experience and assessing feedback after action (Kolb and Kolb, 2018):

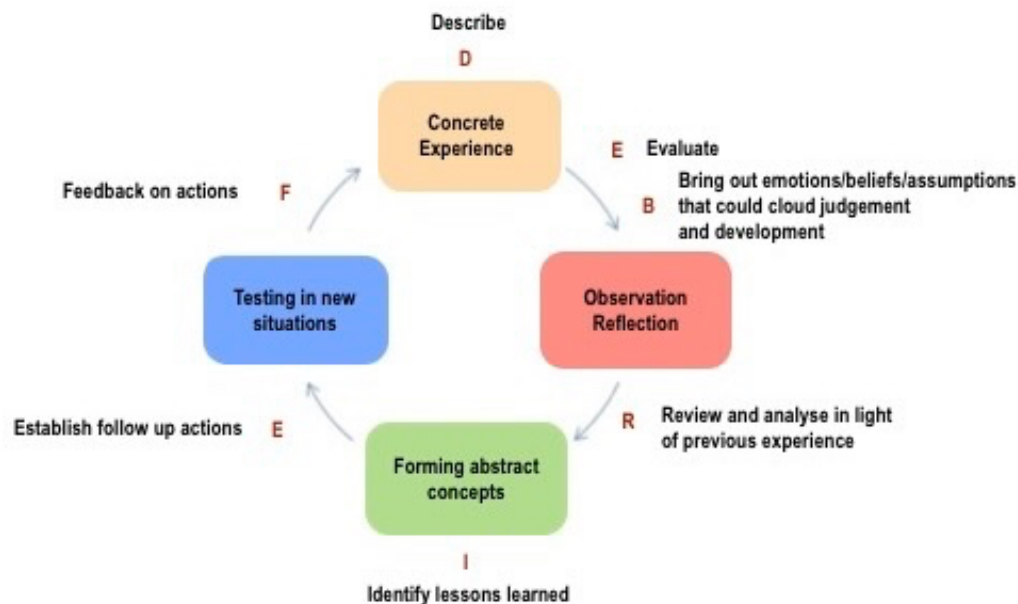


Figure 5 The additional stages of the DEBRIEF model of reflection synthesised from Allan (2011).

Learning Preferences

Fahim et al (2021), suggest defining individual student's single or multiple learning preferences can:

- Shift teaching from teacher-centered to student-centered learning.
- Help teachers employ multiple learning modalities.
- Enhance student motivation, engagement and performance.
- Reduce learning time while increasing outcome and efficiency.

To explore my own learning preferences, I completed an online VARK survey (VARK Learn Ltd, 2024), which assesses aural, visual, read/write, and kinesthetic modalities. My personal growth and development, arising from reflection, was supported by using DEBRIEF stages as headings in my learning journal.

The corresponding journal entry is summarized below:

Date: 15.08.24

Describe: *I completed a VARK learner questionnaire (<https://vark-learn.com>) to define my personal learning preferences.*

Evaluate: *This was a positive experience which helped me understand various learning preferences and discover my own personal preference for read/write, followed by aural and kinesthetic.*

Beliefs: *I had not previously considered learning preferences while teaching, believing a uniform approach was appropriate for most students.*

Review and Analyse: *My teaching has been primarily didactic, which may have limited student ownership of their learning and disregarded individual preferences— perhaps influenced by my past teachers from a different educational era.*

Identify lessons learned: *I should reflect on diverse strategies to support various learner profiles and foster student autonomy.*

Establish follow-up actions: *While developing new methods and exercises, I should aim to include supporting material for different VARK learning modes.*

Feedback: *(11.10.24) This reflection has led to professional growth, allowing me to enhance my teaching methods and develop a diverse program of VARK FE exercises for module 1.*

Additionally, this has led to double loop learning by examining my underlying values and beliefs in my personal development and influencing actions (Argyris, 2002). Moreover, I am exploring new teaching strategies to promote student autonomy and reflective learning (Allan, 2011). This new approach aims to enhance the learning experience in my classes and fostering self-driven learning (Sundararajan et al., 2023; Gangashetti and Kirte, 2024).

Kolb and Kolb (2018) identify 9 additional learning styles in the cyclic learning process (See Appendix 5, Table 4) and further research into these styles could help me tailor exercises for my students.

ACTION STRATEGY

After evaluating my research, I have developed recommendations for FE exercises tailored for group singing settings.

Goals for Singers

1. Increased awareness of FEs, facial muscle actions and emotions.
2. Increased positive experience/enjoyment.
3. Increased social inclusion and group bonding.
4. Alignment of emotion and FE with mood of music performed.

Possible Individual Impediments

- Variation in meaning of emotion-related words and subtle differences in FEs (Young et al., 2002).
- Personality, prior experiences, current emotional states (Moody et al., 2007) and character portrayal requirements.
- Challenges in emotion recognition and response; affecting mimicry e.g. autism, schizophrenia (Magnée et al., 2007; Moody et al., 2007).
- Impairments in mimicking emotional FEs related to depression and negative moods (Kraft-Feil et al., 2023).

Exercise Recommendations

Visual (V), Read/Write (R), Aural (A), Kinesthetic (K),

Muscle retraining exercises (VK)

Smile muscles can be trained through daily conditioning and strengthening exercises (D'Souza et al., 2014) and combining these with visual feedback, such as using a mirror, could lead to long-term improvements (Terry and Pirtle, 2001).

Mimicry (V)

Observing an emotional FE prompts corresponding expressions in observers (Hawk, Fisher, Van Kleef, 2012). Teacher and peer modelling, photos or videos could be tools in mimicking exercises.

Vocalisations (A)

Vocalizations of emotion elicit similar facial behaviors and subjective states in listeners (Hawk, Fisher, Van Kleef, 2012). Teacher modeling of smile-based vocalizations or audio recordings could help evoke similar responses in singers.

Pen-in-Mouth Exercises (K)

Placing a pen gently between the front teeth, without touching the lips, could help singers engage their zygomaticus muscles (Strack, Martin & Stepper, 1988). Singers should also be guided to raise their cheeks to activate the orbicularis oculi muscle (Duchenne smile) (Soussignan, 2002) while avoiding biting muscles to prevent negative effects (Coles et al., 2022). Additionally, a variation exercise from my former teacher, W.A. Palm, involving placing two fingers on the front teeth, warrants further study for effectiveness.

Proprioceptive and Interoceptive Reflection (VRK)

- *Body Mapping (R)*

Using basic body outline drawings could assist visual learners in mapping and identifying their personal emotional sensations, thereby enhancing interoception (Nummenmaa et al., 2014; Volynets et al., 2020).

- *Touch and Massage (K)*

Massage and touch could help build proprioceptive awareness of the muscles involved in FEs and is an area for further research.

Repetition

Repetition is important for small improvements to cumulate over time. For example, smiling in the mirror for five seconds daily may help manage distress, improve well-being, and reduce depression (Funder and Ozer, 2019).

Stimuli (VAK)

Various emotion-evoking stimuli could support different learning modes:

- Visual: mirror, mimicry of video, photos or teacher/peers.
- Aural: audio, music, teacher/peer vocalisations.
- Kinesthetic: touch.

As FE are moving rather than static images from the Facial Action Coding System (FACS) (Ekman and Friesen, 1978), consisting of 46 action units, could be used for visual stimulus. Alternatively, the reduced 60 Ekman and Friesen still photographs of FE could be employed (Young et al., 2002) (See Appendix 5, Figure 1). Some authors of the Coles et al. paper (2022) suggest, however, that somewhat positive photos do not significantly impact happiness and therefore do not represent a serious tool for improving well-being. It would, therefore, be important to monitor the effects of image stimuli strategies over an extended implementation period.

Self-reflection worksheets and questionnaires (R)

Questionnaires, journals and drawings could benefit students with read/write learning preferences and help promote self-reflection (Lew and Schmidt, 2011).

Vowel alternation (K)

Exercises using phonemes alternating from [y] to [e]/[a] or [o] would be useful in promoting awareness of facial muscles and release of habitual FA (Zajonc, Murphy and Inglehart, 1989) (See Appendix 7, Figure 2).

Positive Teacher/Peer Modeling (VA)

Modelling positive FE and vocal expression could help support a positive experience for students. Incorporating exercises with peer modeling may also be beneficial (Seibt et al., 2015).

Monitoring

To gauge the effectiveness of the exercises recommended, it will be important to monitor the results over time. This could be through self-reports from singers (written or verbal) or from teacher observations and could be a possible topic for my research during Module 3.

LONGTERM GOALS

My long-term goal is to develop a workbook and/or app which could be implemented with groups or individuals to help students:

- Develop proprioceptive and interoceptive awareness of emotions.
- Gain awareness of general and daily emotional states.
- Receive real-time feedback on:
 - 1) Acoustics and accuracy of emotional vocal expressions.
 - 2) Expressive body posture, gesture and FEs.
- Track improvements in experience and learning.

There is currently rapid development of technology, Apps, AR and AI which could provide real-time biofeedback and speed up accuracy and speed of analysis (Cohn et al., 1999a; Vogt, André & Bee, 2008; Moss Erickson, 2021; Siddiqui et al., 2021; Szelogowski, 2021; Zhao et al., 2023).

To achieve my objective, further research is needed in the areas of technology, emotional acoustic analysis, and the effects of emotion on vocal quality in singing — particularly regarding respiratory changes like subglottal pressure, attack, and breath control. My personal development plan (See *Appendix 8, Table 5*) will be particularly useful in reaching this goal.

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APPENDICES

Glossary

Appendix 1 Glossary

Action Unit (AU) in FACS: Action units correspond to a particular muscle or combination of muscle movements used in creating facial expressions. The term comes from the Facial Action Coding System (FACS), devised by Paul Ekman and Wallace V. Friesen.

Artificial Intelligence (AI): Refers to the simulation of human intelligence processes by computers.

Augmented Reality (AR): A technology that superimposes digital elements, such as images, sounds, or text, onto the physical world through devices like smartphones, tablets, or AR glasses.

Autonomic Nervous System (ANS): Part of the peripheral nervous system responsible for regulating involuntary bodily functions such as heart rate, digestion, and respiration. It includes the sympathetic nervous system, which prepares the body for stress, and the parasympathetic nervous system, which supports rest and recovery.

Biofeedback: A therapeutic method that helps individuals gain physiological control by providing real-time data from monitoring devices.

Buteyko Breathing: A breathing technique, created by Ukrainian physician Konstantin Buteyko, aimed at improving respiratory function by encouraging shallow, nasal breathing and reducing hyperventilation.

Cavernous Sinus: A large venous channel which is responsible for brain cooling, located at the base of the skull and surrounding the pituitary gland.

Corrugator Supercilii Muscles: A pair of muscles located above the eyebrows that pull them downward and together. These muscles are involved in expression like frowning or scowling or for emotions like anger, and sadness.

Duchenne Smile: A genuine smile, reflecting true happiness and warmth, involving not only the zygomaticus muscles but also engagement of the orbicularis oculi muscles around the eyes and resulting in crow's feet. This smile differs from less genuine non-Duchenne smile, which involves only the mouth.

Facial Action (FA): The movement or contraction of facial muscles that create different expressions.

Facial Expression (FE): The outward display of emotions through facial muscle activity.

Facial Feedback (FF): The concept that facial muscle activity can send signals back to the brain, influencing subjective feeling. (*See Facial Feedback Hypothesis*)

Facial Feedback Hypothesis (FFH): The theory that facial expressions send signals from the face's muscles and nerves to the brain, thereby influencing the neurological response and affecting the resulting subjective emotional experience.

Interoception: The sensory perception of internal physiological states, such as hunger, thirst, heart rate, and pain. Interoception involves awareness of internal bodily conditions and enables emotional and physical awareness.

Kinesthetic: Refers to the awareness of the body movements and position, playing an important role in coordination, balance, and motor skills. Kinesthetic awareness is important in activities that involve physical movement and hands-on learning.

Levator Muscles (facial): Levator facial muscles include the levator labii superioris, which raises the upper lip and helps in expressions of sadness or disgust, and the levator anguli oris, which lifts the corners of the mouth, contributing to a smile.

Orbicularis Oculi: A circular muscle surrounding the eye that controls eyelid closure and blinking. It also contributes to facial expressions, such as squinting or winking, and is activated during a genuine (Duchenne) smile.

Proprioception: The body's ability to sense its own position, movement, and orientation in space. This sensory feedback, provided by receptors in muscles, tendons, and joints, enables coordination, balance, and fine motor control during physical activities.

Somatic Nervous System: This system controls voluntary movements of skeletal muscles and processes sensory information from the body such as touch, pain, or temperature, sending it to the brain for interpretation.

Subglottic Pressure: The air pressure that builds up beneath the vocal folds during sound production.

Subjective Feelings (SF): The internal, conscious experiences that accompany emotions, reflecting an individual's personal appraisal of a situation. Unlike external behavioural or physiological changes arising from an emotion, these feelings are difficult to measure as they involve how a person interprets and experiences their own emotional state.

Vascular Theory of Emotional Efference (VTEE): A theory suggesting that voluntary facial actions can influence nasal breathing and, in turn, regulate brain temperature, ultimately affecting subjective feeling.

Voluntary Emotional Facial Action: The intentional employment of facial muscles to create expressions that resemble those normally associated with emotions.

Valence: A measure of emotional responses along a continuum, ranging from positive (pleasant) to negative (unpleasant) emotions.

Zygomaticus Muscles: The facial muscles zygomaticus major and minor are involved in smiling and play an important role in expressing emotions.

- **Zygomaticus major:** runs from the cheekbone (zygomatic bone) down to the corners of the mouth helping to lift the corners of the mouth.
- **Zygomaticus minor** is located above the zygomaticus major, and runs from the cheekbone to the upper lip. It elevates the upper lip in to facial expressions like smiling or showing teeth.

Figures and Tables

Appendix 2 Emotions Categorised in Valence

Table 1

<i>Negative</i>	• Anger • Anxiety • Disgust • Embarrassment • Fear • Sadness
<i>Positive</i>	• Affection • Amusement • Contentment • Happiness • Joy • Anticipatory pleasure • Pride • Relief
<i>Without Clear Valence</i>	• Surprise • Suspense

Emotions grouped by valence, synthesised from Kreibig (2010 p. 399).

Appendix 3 Facial Muscle Actions of Emotions

Table 2

NEGATIVE EMOTIONS

Sadness	Upward displacement in the area of the chin. Forehead in an inward and upward movement of the eyebrows
Fear	Downward and outward movement of the mouth area. Forehead similar to sadness but with brows raised higher
Anger	Downward movement of forehead area (frown) with pinching of the lips
Disgust	Wrinkling the nose causing upward movement on its sides as well as cheeks. Can involve an upward movement of the chin

POSITIVE EMOTIONS

Happiness	Upward displacement of each side of the mouth and cheeks - smile
Surprise	Strong upward displacement of brows and downward displacement of jaw

Facial actions of emotions as synthesised from Bassili (1979).

Appendix 4 Phonemes Effects

Table 3

[y] (scowl/disgust)	Perceived negatively
Muscle action	Corrugator engaged. Constricts the angular and ophthalmic veins. Zygomatic muscle extended
Effect on air flow	Reduction of air to the nasal cavity resulting in impairment of cooling of blood flowing to the brain
Forehead (brain) temperature – perceived sensation	Higher temperature - discomfort
[e] (smile)	Perceived positively
Muscle action	Distension of nostrils. Similar muscle movement to a smile contracting zygomatic muscle
Effect on air flow	Does not restrict venous flow to the cavernous sinus thereby cooling blood in ophthalmic veins that feed cavernous sinus
Forehead (brain) temperature – perceived sensation	Lower temperature - pleasant
[a] (delight and surprise)	Perceived positively
Muscle action	Similar to smile and involving zygomatic muscle
Effect on air flow	As [e]
Forehead (brain) temperature – perceived sensation	Lower temperature - pleasant
[o]	Neutral and relaxing
Perceived sensation	Perceived as pleasant

Phonemes resembling emotions and results from muscle action synthesised from Zajonc, Murphy and Inglehart (1989) and McIntosh, Zajonc and Peter (1997)

Appendix 5 Learning Modes

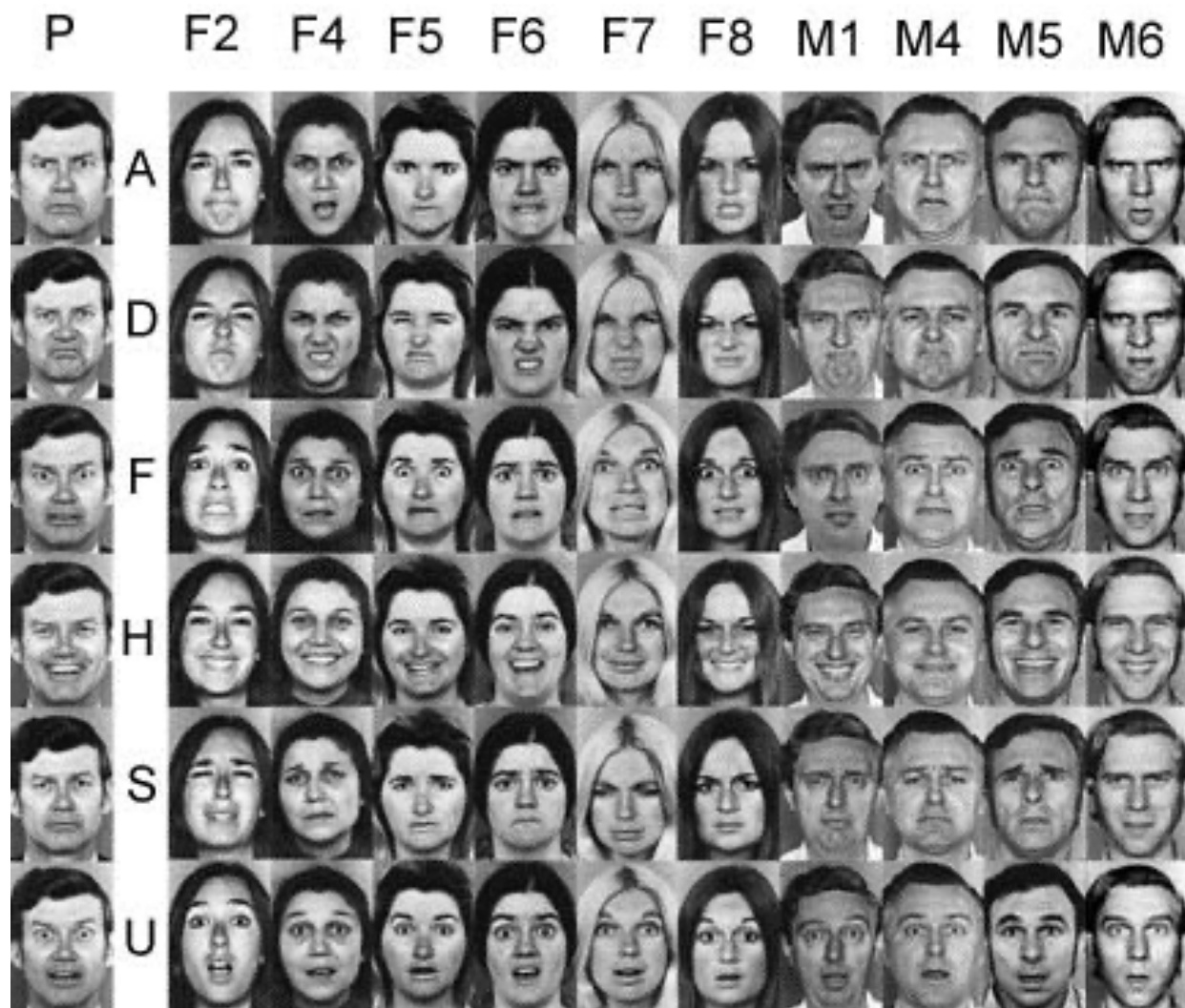
Table 4

The Initiating style	Initiating action to deal with experiences and situations.
The Experiencing style	Finding meaning from deep involvement in experience.
The Imagining style	Imagining possibilities by observing and reflecting on experiences.
The Reflecting style	Connecting experience and ideas through sustained reflection.
The Analysing style	Integrating ideas into concise models and systems through reflection.
The Thinking style	Disciplined involvement in abstract reasoning and logical reasoning.
The Deciding style	Using theories and models to decide on problem solutions and courses of action
The Acting style	A strong motivation for goal-directed action that integrates people and tasks
The Balancing style	Adapting by weighing the pros and cons of acting versus reflecting and experiencing versus thinking.

Kolb 9 Learning Styles (Kolb and Kolb, 2018).

Appendix 6 Facial Expressions of Emotions

Figure 1



Photographs of facial expressions used in the Ekman 60 Faces Test. (Young et al., 2002).

Appendix 7 Vowel Alternation Sample Exercise

Figure 2



Alternation of [y] – $\dot{u}$, [e] – e, [a] – a, and [o] – o vowels. To encourage release of negative corrugator and engagement of positive zygomaticus and orbicularis oculi muscles (cheeks raised with [e] and [a]).

Appendix 8 Personal Development Plan

Table 5

Personal Development Plan (PDP)
Why I chose this topic.
Facial expressions generated by my pupils sometimes do not correspond appropriately with the mood of the song being performed. While rehearsing or teaching, I have often asked myself how incongruous negative expressions might affect singer enjoyment and correspondingly, how would this change the arising sound quality? By studying the effects of emotional FE while singing, I hope to help singers have a more positive experience and improve vocal quality of singing. Additionally, I would like to help them gain increased awareness of their facial expressions and emotions while singing, help them to increase social bonding, reduce depression and successfully communicate desired emotions with an audience,
How what I have learned has benefited me.
My research has challenged my beliefs and lead to double-loop learning (Argyris, 2002). This has as enabled me to develop and grow as a teacher, questioning previously utilised methods and preconceptions. I was surprised to learn that FA alone can influence both brain temperature (VTEE) and subjective feeling (FFH). This has highlighted the importance of singers' awareness of facial expressions while singing. The ramifications of FF and how it might potentially influence singer subjective feeling facinate me. Additionally, I now have increased understanding of potential issues affecting individual singers, limiting their ability to create, mimic and decode facial expressions of emotions e.g. depression, autism, schizophrenia. Moreover, learning and reflecting on how my own facial and voice expressions might influence singers while they watch or listen to me has led me to understand the importance of being aware of my own FEs and vocalisations while teaching. Furthermore, I have learned to consider including a variety of exercises in my tuition to support varying learning mode preferences of students; visual, aural, read/write and kinesthetic. This will help my pupils become autonomous and proactive in their learning journey.

By employing the DEBRIEF(Allan. H.S., 2011) and Kolb (Kolb D. A., 1984) reflective models throughout the process, I have understood the importance of reflection for both my own and my students' learning journeys. I aim, therefore, to ensure to provide self-reflective opportunities, both oral and written, during my lessons.

Gaps identified in my knowledge and questions raised.

1) *Depression*

How does depression affect FE and how can this affect singers' social inclusion in a group?

2) *Nasal vs Oral Breathing*

What are possible nasal/oral breathing strategies which could be employed while singing? Could increased nasal breathing help singers' experiences? How might these methods be best employed while singing (oral breathing technique is often preferred by singers for speedy intake, elevation of the soft palate and to create the required vowel shapes ahead of phonation)? Could breathing techniques involving nasal/oral breathing offer interesting strategies as a teaching tool for accessing or controlling emotion and emotional expression in singers/performers? How might breathing mode choice affect tone quality?

3) *Respiration*

How do subtle changes in respiration affect subglottic pressure, attack and breath control while singing and thereby vocal quality?

4) *Learning Styles*

How could the 9 learning styles, as mentioned by Kolb and Kolb(2018), be used to better support learning preferences in my groups and classes?

5) *Smile*

Is the smile technique of placing two fingers on the front top teeth, as taught by W.A Palm, an effective strategy for engaging the zygomaticus and/or orbicularis oculi muscles? How does baring of the teeth change the acoustical properties of vocal sound? Does a smile encourage raising of the soft palate even though the same muscles are not involved, and would this affect the colour of the sound?

6) *Technology*

How could I use technology such as Apps, AR and AI to support my teaching?

7) Questionnaires and Images

How could I use questionnaires and images/drawings to aid participant self-reflection and support read/write learning preferences?

8) Effectiveness of Recommendations

Do my recommended exercises produce effective results and how can I monitor this?

9) Stimuli

How could I use stimuli to help my students improve control of their FEs and experience while singing?

10) Vocal Quality – Acoustical Changes

How do physiological changes from FF affect the acoustics of the vocal sound? What tools could be used to measure acoustical changes through FE of singers? How would I employ tools and interpret the results?

11) Possible Exercises

What possible facial exercises could help develop awareness of FE and build muscle strength? Which touch and massage exercises could be useful to employ?

What are the next steps?

Steps (from above)	Action	What success looks like	Date of completion
1) Research the topic of depression and its effects on FE. Research how FE affects social inclusion.	Identify peer-reviewed literature on this topic. Read and summarise research.	I will create a summary of my findings which I can refer to in the future.	Nov 4 th , 2024.
2) Research nasal/oral breathing techniques from Buteyko Breathing and	View VSC lecture “An Introduction to the Buteyko Breathing Method” Jan 2024 with Kate Cubley and read in depth (H.	Viewed lecture and reflected on applications for my teaching.	Nov 24 th , 2024.

identify other methods.	Subramanian et al., 2023). Research other possible methods.	Sourced peer-reviewed literature on nasal breathing techniques.	
3) Research effects of respiration changes on subglottic pressure and how this affects vocal quality.	Read paper "Glottal Adduction and Subglottal Pressure in Singing" (Herbst et al., 2015). Identify other possible peer-reviewed literature.	Read and understood paper. Created a list of possible additional literature.	Dec 1 st , 2024.
4) Research the 9 Kolb and Kolb learning modes.	Read paper and reflect on implications (Kolb & Kolb, 2018). Read related papers on applications of 9 modes.	Read and reflected, creating a strategy for implementation in my teaching. Created a list of possible related research.	Dec 15 th , 2025.
5) Develop a method to measure effectiveness of two-finger smile strategy.	This will involve synthesising my learning from module 2 with learning on acoustics and other scientific methods for measuring changes.	I will have developed a clear experiment with measurable results to determine the strategy's effectiveness. I will have conducted an experiment and collated results, developing conclusions and recommendations.	Module 3 possible (part) topic.

6) Reserarch applications of AI, AR, Apps	Read literature in depth (Cohn et al., 1999; Gilroy et al., 2008; Vogt et al., 2008; Soleymani et al., 2012; Wickramasuriya et al., 2019; Szelogowski, 2021; Zhao et al., 2023). Discuss with contacts in field: Ilya Tolchinsky (AI) and Adrian Clayton (Apps/Coding).	Read, understood, summarised and defined possibilities for future reading. Met and discussed with contacts and defined areas for more research.	Jan 30th, 2025. Jan/Feb 2025.
7) Develop a questionnaire for self-reflection: measuring emotional state and reflecting on FE.	Combine FACS/ 60 Ekman photos and FEEST (Young et al., 2002) and Numenmaa et al images to develop self-reflection questionnaire (2014).	Created an easy-to-follow and useful tool for use in the voice studio to help students develop awareness of FEs and emotions. Could also potentially be a useful tool for employment in Module 3.	March 2025.
8) Measure effects of exercises.	Develop a strategy to measure effects and apply in practice.	Could be employed as part of Module 3 as longer-term/larger sample monitoring required	April 2025.

		to gain clear picture of effects.	
9) Develop stimuli tools to aid students to develop new FEs and increase enjoyment.	Develop database of positive: Videos Music Sentences Audio Facial images Images. Reflect on ways to use mimic strategies to stimulate production of smile Re-read Dimberg, Thunberg and Grunedal (2002).	A comprehensive collection of possible tools will have been created which I can then employ in my teaching.	May,2025 but should be added to on an ongoing basis.
10) Learn about tools for measuring acoustics and how to measure and interpret acoustics – Spectral analysis	Learn about VoceVista by viewing VSC lectures “An Introduction to VocaVista” and “Scaffolding Voice Acoustics into Your Teaching with Voce Vista” with Dana Zenobi. Install app VoceVista. and learn how to use and practice using it.	I will have viewed both lectures, downloaded the app and started to use it in my teaching.	Dec 2024.

11) Research facial exercises and facial massage techniques.	Synthesise exercises and methods from research and develop a list for use with singers (Terry and Pirtle, 2001; D'Souza et al., 2014). Identify research on facial massage.	A list of exercises will have been developed and I will have a strategy for employment in my teaching. I will have a list of reading on facial massage.	April 2025 but added to on an ongoing basis.
Ethical Considerations			
As singers' wellbeing and psychological states could be affected by exercises, it will be important to define the ethical considerations for students in application of devised exercises and during involvement in my ongoing research.			
Long-Term Goal			
To develop an exercise workbook and/or app to help singers and other non-singing users develop proprioceptive and interoceptive awareness of emotions and emotional FEs while vocalising. For use in workshops, group rehearsals and individual lessons. The aim is to increase enjoyment of singing, enhance social bonding, and improve control over emotional expression—thereby aiding the audience's decoding of emotional cues.			