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PROJECT PROPOSAL

Project Title: Exploring whether a mindful body scan, performed at the beginning of a voice lesson, can stimulate interoceptive awareness and lead to a more productive lesson.

The Context

Singing is a complex motor activity (Crocco, Madill and McCabe, 2015; Maxfield, 2011), and Motor Learning Principles (MLP) are particularly relevant to teaching voice (Crocco, Madill and McCabe, 2015; Maxfield, 2011; Verdolini, 2000). Interest in the application of MLP to voice training has been growing (Crocco, McCabe and Madill, 2020; Holding, 2016; Leal *et al.*, 2022; Verdolini-Abbott, 2022). Much of the research into MLP, however, has been devoted to sports which use large muscle groups (Schmidt, 1991; Utley, 2019; Verdolini, 2000) and utilize multiple mechanisms for learning (Leech *et al.*, 2022). Due to the fact that many of the mechanisms involved in singing, such as the diaphragm and the larynx, cannot be seen or sensed (Crocco, Madill and McCabe, 2015; Maxfield, 2011; Verdolini, 2000), and that singing occurs without conscious control (American Academy of Teachers of Singing, 2014; Friedlander, 2018), singing depends on Perceptual Motor Learning (Leigh-Post, 2021; Verdolini, 2000). This is a form of Motor Learning that is dependent on interoception, primarily kinesthesia and proprioception (Aura *et al.*, 2022; Blackhurst, 2021; Fletcher, Davidson and Kraue, 2021), which are the largely unconscious perceptions of physical placement and movement in space (Allen, 2020; Heroux *et al.*, 2022; Leal *et al.*, 2022; Mukhopadhyay, 2021). The challenge for voice teachers is how to enhance a learning process based on perceptions that are generally unconscious. One possibility is mindfulness training, which has been shown to increase sensory awareness (Bargh, 2022; Blyskal, 2022). In recent years there has been a surge in research into the benefits of mindfulness training, in general and in relation to singing (Blyskal, 2022; Czajkowski and Greasley, 2015; Galante *et al.*, 2020; Gan, Zhang and Chen, 2022). This study is, to my knowledge, the first to examine using a body scanning exercise in a voice lesson to stimulate interoception.

What is the organization/setting for this project?

I am a professor of voice at a university, and I also run a private studio. My students at the university range in age from 18 to 40, while private students range in age from 12 to 72.

Investigations undertaken in module BMPF7008 led me to conclude that finding a way to stimulate interoception would improve the quality of lessons. This research will utilize university students to explore an exercise designed to achieve that goal.

The Justification

Mindfulness training is thought to create changes in brain chemistry that enhance information processing (Vekety, Logemann and Takacs, 2022) (Vekety, Logemann and Takacs, 2022). Mindfulness practices create increased alpha waves, which suppress distractions and aid selective attention, leading to more efficient learning (Abraham, 2018; Septantiningtyas *et al.*, 2020), and specifically motor learning (Kee and Liu, 2011; Sidhu, 2013). Unconscious influences, like interoception, are better integrated when the subject is in an experiential state (Bargh, 2022; Blyskal, 2022), so a mindfulness exercise could be a tool to enhance a student's unconscious learning.

In module BMPF7008 I presented a body scan exercise to a focus group of experienced voice teachers who were also professional singers. The small group was unanimous in support of continued research. That exercise, which will be adapted for the current study, also included elements of body mapping, since an accurate body map is essential for the brain to interpret interoceptive information it receives (Allen, 2020; Nichols, 2020; Vekety, Logemann and Takacs, 2022).

The Intended Impact

1. To create one ten-minute exercise to be introduced at the beginning of a voice lesson in such a way as to enhance unconscious perceptions throughout the lesson, which could enhance my student's learning.
2. To investigate the impact of the exercise to determine its effectiveness. If it proves effective, it would not only add to my practice, it could be made available to other voice teachers to support their teaching.
3. To lay the groundwork for further research that could add to the current literature on mindfulness and voice training.

The outlined intention

The researcher's ontological position is pragmatic. There are areas of the study of voice that can be measured quantitatively (Esposito and Khan, 2020; Guzman *et al.*, 2013; Perta, Bae and Obert, 2021), however the invisible nature of the mechanism leads to different subjective experiences by the singers (Black, 2015; Bänziger, Hosoya and Scherer, 2015; Holding, 2017). These perceptions of different realities can best be addressed qualitatively (Cohen, Manion and Morrison, 2007; Easterby-Smith, Thorpe and Lowe, 1991; Kawulich, 2012), so this will be a qualitative study.

The study will begin with a literature review covering MLP concentrating on focus of attention, priming, and interoception. Mindfulness training, particularly the use of body scanning exercises, will also be examined. Based on this review and earlier research, a previously designed exercise including the above-mentioned strategies will be refined and shortened to no more than 10 minutes in length. Students will be invited to participate, after being presented with an information sheet detailing what their involvement would entail. Ethical considerations have been taken (see Ethics below).

Five to seven students are expected to participate. Information gathering will occur over five lessons for each student. The first lesson will follow the researchers normal teaching plan. The instructor will catch up with the weeks progress, do a brief physical warm up, then proceed to vocalizing, skill acquisition exercises, and working on music. Students will take a short survey, consisting of one multiple choice and three open ended questions (Cohen, Manion and Morrison, 2007; Easterby-Smith, Thorpe and Lowe, 1991; Kawulich, 2012; Denscombe, 2014) after the first lesson. Surveys will be conducted using Survey Monkey. Lessons are normally recorded using Zoom, and this will continue. The next two lessons will begin with catching up and the brief physical warm up, then include the exercise before vocalizing. For the last two lessons the students will choose whether to include the mindfulness exercise. They will then fill out a final anonymous survey made up of seven open ended questions (Denscombe, 2014).

Data will be gathered from my observations and notes, in-class comments by the students, survey responses, and student choices of whether to include the exercise (Bell and Waters, 2018; Creswell, 2014). The data will then be coded and, using content analysis, examined for patterns and divergences.

Projected Timeline

June	July	August	September	October	November	December	January	February	March
Ethics Form									
	Agree on Topic, Aims and Objectives Methodologies								
	Literature Review								
		Invite Participants							
		Write Intro and program of study							
			Gather data from students						
				Code Data					
					Analyze Data				
						Write first draft			
								Rewrites	

Projected Timeline

Ethics and insider research.

The subjects for the study will be students at the University where the researcher teaches. Working with students raises ethical issues which must be carefully considered and addressed. A college student might feel pressure to agree to participate in the study (Berg, 2001; Ferguson, Yonge and Myrick, 2004). They might fear declining would affect their grade, or that our relationship would change (Berg, 2001; Ferguson, Yonge and Myrick, 2004; Herrmann, 1989). Steps must be taken to ensure that participation is truly voluntary.

Prospective participants will be given a consent form that will explain the research plan in full. It will detail what will be done and what will be expected of the students, including how much time will be involved (Berg, 2001; Denscombe, 2014). The form will assure students that they do not need to consent and, if they do consent, that they may withdraw at any time (Berg, 2001; Cohen, Manion and Morrison, 2007; Denscombe, 2014; Shen, 2021). It explains that lessons will be the same for students not in the study as for students in the study. It will describe the steps the researcher will take to preserve the student's confidentiality.

As Sexton (2022) and Shen (2021) suggest, it is important that students understand that choosing not to participate in the study will not have a negative impact on their grades or their relationship with me. In addition to the written form, I will personally assure each student that our positive relationship will not be affected (Ferguson, Yonge and Myrick,

2004). The students will be sent the form in an email invitation and will be given ample time to ask questions and to consider their response.

Another issue that can arise is confirmation bias. The urge to seek results that confirm our beliefs appears to be inherent and ubiquitous (Peters, 2022; Rollwage *et al.*, 2020). I have used a mindfulness exercise intermittently for some time, and I am confident in its usefulness, and confirmation bias is especially strong when there is confidence in the expected result (Rollwage *et al.*, 2020). Additionally, the student participants may, consciously or unconsciously, wish to give their teacher the results they want to hear (Ferguson, Yonge and Myrick, 2004). I will need to actively search for results that might contradict expectations and include all divergent opinions and indications in the final research.

Finally, focusing attention on internal sensations can be triggering for trauma survivors and those with certain mental conditions such as depression or anxiety disorders (Gibson, 2019). I will be attentive and, though I am not a trained psychologist, I have experience leading this kind of exercise and will be prepared to stop, provide personal support, and refer if necessary.

This project has passed through ethical review at both the University of Bridgeport and the University of Wales Trinity Saint David.

Personal learning outcomes

- ☐ To better understand the links between mindfulness training, interoceptive awareness, and MLT.
- ☐ To develop a demonstrably effective exercise that might improve voice lessons for students and be a tool for other teachers.
- ☐ To continue to improve my researching and writing skills.

Exploring whether a mindful body scan, performed at the beginning of a voice lesson, can stimulate interoceptive awareness and lead to a more productive lesson.

INTRODUCTION

Background

This qualitative research study will examine whether performing a short mindfulness body scan at the beginning of a lesson could help voice students develop Interoceptive Awareness (AI). Interoception is a general term for the perception and processing of internal physical sensations (Chen *et al.*, 2021; Gibson, 2019; Schroter, Siebertz and Jansen, 2023). Some leading voice researchers and teachers have concluded that increasing awareness of feelings within the body should be an important part of voice training (Aura *et al.*, 2022; Hakanpää, Waaramaa and Laukkanen, 2021; Crocco and Meyer, 2021; Tarvainen, 2018). The goal of this study is to determine if a body scan exercise might help achieve this.

Context

I am a voice teacher working at university level, with singers who range in age from 18 to 40. Additionally, I have a private studio where the age range extends from 12 to 72. I am solely responsible for the format and content of my lessons. In my continuing education, my preliminary research into Motor Learning Principles (MLP) (BMPF7003) found consensus for the idea that giving a student mechanical instructions, for example ‘expand your ribcage’, or focusing the student’s attention on internal sensations as they sing, as in ‘feel the lift in your soft palate’, can interfere with learning (Helding, 2008; Song, 2019; Verdolini, 2000; Wulf, Gabriele and Lewthwaite, 2016). If giving instructions impedes learning, how can we guide our students? Reflecting on this question led me to this practice-led, action research study.

Justification

Singing is a complex motor activity governed by MLP and, since many of the mechanisms of singing, such as the muscles of the larynx, are beyond conscious awareness or control, (Black, 2015; Blackhurst, 2021; Friedlander, 2018), learning to sing is largely dependent on

unconscious sensory perceptions (Crocco and Meyer, 2021; Reed, 2022; Verdolini, 2000). As stated in my earlier research,

“The goal is to train the student to recognize the sensations of correct technique so that singing becomes automatic (Verdolini, 2000; Winter, MacPherson and Collins, 2014). The challenge becomes how to stimulate the students’ sensory perceptions.” (Hannon, 2022)

In my workplace the students are mostly beginners to beginning-intermediate level singers. Beginning singers, as Fletcher, Davidson and Kraue (2021) tell us, often have little awareness of the sensations of singing, yet more advanced singers rely on those same sensations. I contend that actively developing IA in beginners could move them more quickly to the next level. The question is, how can we develop this awareness?

One possible strategy to achieve this is to introduce a mindfulness body scan, which has been shown to produce greater sensory clarity and physical awareness (Blackhurst, 2021; Blyskal, 2022; Czajkowski and Greasley, 2015; Gibson, 2019). In a study of four different mindfulness meditations Kok (2016) found that ‘body scans led to the greatest increase in interoceptive awareness. Although there has been increased attention to the interaction between mindfulness and interoceptive awareness (Farb, Segal and Anderson, 2013; Gibson, 2019), and to the use of mindfulness in voice training (Blackhurst, 2021; Blyskal, 2022; Czajkowski and Greasley, 2015; Tarvainen, 2018), this is, to my knowledge, the first investigation to integrate all three areas. This work-based study will examine whether a mindfulness body scan, performed at the beginning of a lesson, can stimulate a student’s IA.

Intended Impact

- To create one ten-minute exercise to be introduced at the beginning of a voice lesson in such a way as to enhance unconscious perceptions throughout the lesson, which could enhance my student’s learning.
- To investigate the impact of the exercise to determine its effectiveness. If it proves effective, it would not only add to my practice, it could be made available to other voice teachers to support their instruction.
- To lay the foundation for further research that could add to the current literature on mindfulness and voice training.

Personal Learning Objectives

- To gain a better understanding of interoceptive awareness, and its relation to MLP, mindfulness training, and singing.
- To create a demonstrably effective exercise which could improve skill acquisition in voice lessons, both for my students and those of other teachers.
- To continue to build my skills in researching, analyzing, writing, and reflection.

LITERATURE REVIEW

This literature review covers three subjects, which earlier studies indicated underlie this research. It begins with Motor Learning Principles (MLP), focusing on priming and focus of attention. Next it will examine interoception and interoceptive awareness (IA). Finally, it will look at mindfulness training, particularly the use of body scans. The review will also attempt to explore how these various subjects interact.

Motor Learning Principles

MLP show that there are two types of memory and learning (Janacsek and Nemeth, 2022; Zhang, 2020). The first, declarative memory, is memory of facts or experience, which can be recalled and verbally described (Janacsek and Nemeth, 2022; Utley, 2019; Zhang, 2020). The second, procedural memory, governs motor learning, and is dedicated to skills and procedures (Janacsek and Nemeth, 2022; Zhang, 2020). Procedural learning is often unconscious, and is demonstrated by performance of a task rather than by verbal knowledge (Janacsek and Nemeth, 2022; Titze and Verdolini-Abbot, 2012). Crucial to this study, is that perceptual processes govern procedural learning (Knowlton and Schorn, 2022; Zhang, 2020).

Training perceptions is influenced by focus of attention, a MLP which is integral to singing. Attention can be directed either externally, towards goals, or internally, towards movements (Crocco and Meyer, 2021; Nix, 2017; Song, 2019; Watson, 2019). It has been found that directing a subject's attention inward to the mechanics of what they are doing, instead of outward towards results, can interfere with learning.

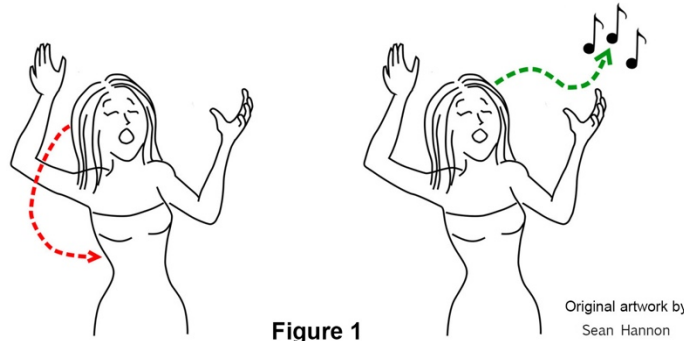


Figure 1
Singer's Focus of Attention

As shown above, for a singer this can mean focusing on anatomy to feel the ribcage expand, like the girl on the left, rather than attending to the sound they wish to make (Crocco and Meyer, 2021; Nix, 2017), like the girl on the right, which has proved to be more successful.

This may be due to the constrained action hypothesis, which says that focusing inward encourages conscious control, which interferes with automaticity (Wulf, G., Höß. and Prinz, 1998; Wulf, Gabriele, McNevin and Shea, 2001). Since the physical and cognitive interactions that control vocalization are too fast for conscious control, automaticity is the goal for optimal singing (American Academy of Teachers of Singing, 2014; Moss-Erickson, 2023; Winter, MacPherson and Collins, 2014).

There is still disagreement on focus of attention (Treinkman, 2021), with some researchers contending that for beginners an internal focus is appropriate (Titze and Verdolini-Abbot, 2012; Treinkman, 2021). This may come from the Fitts-Posner theory of motor learning stages which states that verbal, often mechanical, instructions are most useful in the first stage of learning (Utlely, 2019; Titze and Verdolini-Abbot, 2012). That theory, however, was designed for sports, which use large muscle groups (Treinkman, 2021; Verdolini, 2000), and may not apply to singing (Treinkman, 2021). My experience shows that asking my beginning students to direct attention inward *while they are singing* leads to no improvement. This observation is supported by recent research (Titze and Verdolini-Abbot, 2012)

Singing involves hundreds of muscles (Black, 2015; Maxfield, 2011; Moss-Erickson, 2023), and multiple areas of the brain (Leigh-Post, 2021; Moss-Erickson, 2023; Verdolini-Abbott, 2022), making it is one of the most complex motor tasks the human body undertakes. Adding to the challenges of teaching voice is the fact that many of the mechanisms, such as the vocal folds, the diaphragm, and the brain itself, are not visible (Crocco and Meyer, 2021; Maxfield, 2011)

and many of the processes involved in singing are automatic and without conscious control (American Academy of Teachers of Singing, 2014; Friedlander, 2018; Moss-Erickson, 2023). This makes the impact of internal perceptions crucial, and many pedagogues have stressed the importance of teaching perceptual awareness to voice students (Aura *et al.*, 2022; Crocco and Meyer, 2021; Fletcher, Davidson and Kraue, 2021). This returns us to the question, if directing their attention inward as they are singing interferes with learning, how do we teach perception?

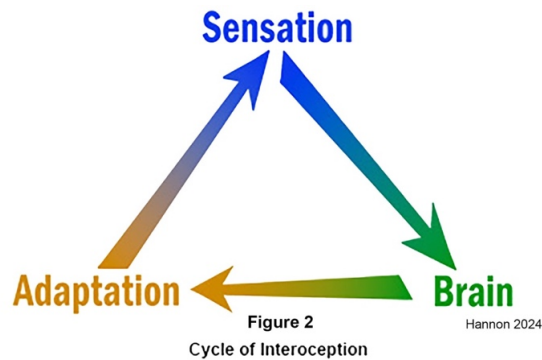
Priming

We may accomplish it by utilizing another MLP, priming, where once a subject is exposed to something, they unconsciously recognize that thing when they encounter it again (Schacter and Buckner, 1998), particularly if they are in a passive state when exposed (Bargh, 2022). In the case of this exercise the hope is that directing attention to internal physical sensations before they sing will prime them to notice any sensations that occur during singing. The process of noticing sensations, consciously or unconsciously, is interoception.

Interoception

Interoception is the mechanism by which we sense, interpret, and integrate what is happening within the body (Berntson and Khalsa, 2021; Chen *et al.*, 2021; Schroter, Siebertz and Jansen, 2023). Interoception includes sensing the movement and position of muscles and joints, the functional state of organs, taste, temperature, pain, and more (Mirams *et al.*, 2013; Gan, Zhang and Chen, 2022; Schroter, Siebertz and Jansen, 2023). In this research, interoception is used exclusively to cover proprioception, kinesthesia, and somatosensory perceptions (see *Terminology* p. 17).

There has been growing interest in interoception in recent years (Chen *et al.*, 2021) partly because of advances in tools for investigating these processes (Chen *et al.*, 2021), and also because interoception allows for self-regulation, both physical and emotional ((Berntson and Khalsa, 2021; Chen *et al.*, 2021; Fazekas *et al.*, 2021). Interoception often operates on an unconscious level. However, those who have more conscious awareness of these signals are better able to process and regulate them (Fischer, Messner and Pollatos, 2017; Gibson, 2019), leading to growing interest in stimulating IA (Fischer, Messner and Pollatos, 2017; Gibson, 2019; Price and Hooven, 2018).



As shown in Figure 2, interoception works as a cycle. Sensations are sent to the brain, which interprets them; the brain then sends signals back to make adaptations to change any undesirable state (Berntson and Khalsa, 2021; This creates new sensations, and the cycle continues.

In the study of voice, it has been observed that beginners have little IA, while more expert singers have heightened awareness of internal sensory perceptions, which allows for greater automaticity (Cohen, Manion and Morrison, 2007; Tarvainen, 2018). There is evidence that giving beginning students feedback based on expert performance can enhance their learning (Wulf, G., Höß. and Prinz, 1998), which is further support for working to create IA, but how to do it?

Fletcher, Davidson and Kraue (2021) surveyed twenty-seven Australian singing teachers, asking how they developed interoception in their students, and Crocco and Meyer (2021) also addressed the question in the Journal of Singing. As shown below, there are many methods to encourage interoception. This study explores the effectiveness of adding a mindfulness bodyscan as an additional tool.

Fletcher, Davidson and Karue (2021)	Both	Crocco and Meyer (2021)
Physical touch	Asking students what they feel	Asking students to direct attention to sensations
Muscle release work		Asking students to self-assess a perception before giving feedback
External tools – resistance bands		Defining or explaining a sensation
Breathwork		

Figure 3

Mindfulness

The use of mindfulness training (MT), and body scans in particular, promises to be useful in developing IA (Czajkowski and Greasley, 2015; Gibson, 2019; Treves *et al.*, 2019). Mindfulness has been practiced in the far east for at least 2500 years (Blyskal, 2022; Ornoy and Cohen, 2021). It spread to the west in the mid 20th century, but only gained acceptance by the scientific community when Jon Kabat-Zinn introduced a secularized version, Mindfulness Based Stress Reduction (MBSR) in 1979 at the University of Massachusetts Hospital (Blyskal, 2022). As a Buddhist, Kabat-Zinn rooted his program in the ethical underpinnings of Buddhism, but used a western scientific approach, which has been well researched and tested (Kabat-Zinn, 2019; Luberto *et al.*, 2020). Since the success of MBSR other methods have been developed as clinical interventions, as well as in education, and even in corporate workplaces (Czajkowski and Greasley, 2015; Kabat-Zinn, 2019; Qiu and Rooney, 2019).

Mindfulness is often described as “paying attention, on purpose, in the present moment, and nonjudgmentally” (Kabat-Zinn, 2017: 1126). Mindfulness practices can improve self-regulation, cognitive performance and control, and focused attention, can decrease anxiety, depression, and stress, and can generally improve health, wellbeing, and quality of life (Blackhurst, 2021; Elliot, 2010; Gibson, 2019; Vidic and Cherup, 2019). For singers it can reduce performance anxiety and encourage greater focus, leading to improvements in technique, greater expression, creative exploration, and greater depth of learning (Blackhurst, 2021; Blyskal, 2022). Most importantly for this study, mindfulness practice has been shown to increase IA (Blackhurst, 2021; Blyskal, 2022; Czajkowski and Greasley, 2015; Gibson, 2019).

Body Scan

This is particularly true of body scans (Kok and Singer, 2017). In body scans, the participant lies on the floor or stands, then directs their attention to specific body parts, either from head to toe or the reverse. Different mindfulness exercises have slightly differing effects, and a large gap in the literature is that little research has been done to determine the characteristics of different practices (Ditto, Eclache and Goldman, 2006; Gan, Zhang and Chen, 2022). Kok and Singer (2017) conducted an experiment where 4 different, secularized, meditation techniques were taught to three groups of approximately 80 participants each. Each group learned the meditations in a different order, in 13-week sessions over nine months. They completed questionnaires before and after each practice, which assessed different qualities, such as

positive thoughts and cognitive awareness. The results of this rigorous study, which identified characteristics of each of the techniques investigated, showed that body scans led to the highest increase in IA (Kok and Singer, 2017), making it the perfect vehicle for this research.

Autonomic Nervous System

Body scans, and other mindfulness practices, have been shown to change the brain functionally and physically (Blackhurst, 2021; Gibson, 2019; Mirams *et al.*, 2013). It affects the autonomic nervous system (ANS) (Blyskal, 2022), which is integral to stress response (Weissman and Mendes, 2021). ANS is made up of two divisions: the sympathetic system (SNS), which governs 'fight or flight' stress reactions, and results in increased heart rate and blood pressure (Donkelaar *et al.*, 2020; Jung and Lee, 2021), and the parasympathetic, 'relax and restore', system, which lowers heart rate and blood pressure, quiets breathing, and leads to a stable, relaxed state (Jung and Lee, 2021; Weissman and Mendes, 2021).

Brain Waves

In addition to these physiologic changes, shifts in the autonomic nervous system are associated with different types of brain waves (Blyskal, 2022; Dobrakowski, Blaszkiewicz and Skalski, 2020; Jung and Lee, 2021). The three types of brainwaves that concern this research are alpha, beta, and theta waves, each of which has its own characteristics.

1. Beta waves indicate an active busy mind. This state consumes a lot of energy and, if it continues for long, concentration and information processing become limited. Increased beta waves are associated with anxiety and stress (Abhang, Gawali and Mehrotra, 2016; Jung and Lee, 2021).
2. Alpha waves "reflect the neuro-physiologically stable state of the brain" (Jung and Lee, 2021: 2). They are characterized by a relaxed state, concentration, and stress reduction, and seem to be integral to learning and memory processes (Jung and Lee, 2021; Schubert *et al.*, 2021). Alpha waves strengthen selective attention, which is essential to learning, by reducing distracting inputs and noise (Abraham, 2018; Foxe and Snyder, 2011; Klimesch, 2012).
3. Theta waves are seen during the transition in and out of sleep, and produce deep relaxation and stress relief (Gruzelier, 2008; Jung and Lee, 2021). When balanced with

alpha waves (alpha-theta waves) they enhance the alpha waves effect on working memory, enhanced cognition and creativity, and motor learning (Gruzelier, 2008; Jung and Lee, 2021; Schubert *et al.*, 2021).

Mindfulness has been shown, in systematic reviews, to increase alpha-theta waves and decrease beta waves (Jung and Lee, 2021; Septantiningtyas *et al.*, 2020), which can lead to an experiential state.

Insula

Among the several areas of the brain effected by mindfulness practice, one of the least understood is the insula (Molnar-Szakacs and Uddin, 2022; Uddin *et al.*, 2017). With recent increases in research, however, its importance and role in sensorimotor, affective, and cognitive processing is being recognized, and interest is growing. This may be because across human neuroimaging studies the insula is the most consistently, widely activated region of the brain (Centanni *et al.*, 2021; Molnar-Szakacs and Uddin, 2022).

Recent theories regarding the insula indicate that the posterior insula gathers and processes sensory and motor inputs which are then forwarded to the anterior insula for integration with awareness, emotion, and cognition inputs (Centanni *et al.*, 2021; Namkung, Kim and Sawa, 2018; Uddin' *et al.*, 2017). Additionally there is the middle insula, which is important to processing IA and interoceptive recall (Centanni *et al.*, 2021). Building on this and other models, Molnar-Szakacs and Uddin (2022) hypothesize that the insula acts as gatekeeper between large scale brain networks involved in functional control processes at the highest levels, and is crucial to sensory processing (Centanni *et al.*, 2021; Molnar-Szakacs and Uddin, 2022).

Although we cannot yet define how it functions, it is clear that the insula is central to processing interoceptive and motor perceptions and cognition, and is integral to IA (Gibson, 2019; Namkung, Kim and Sawa, 2018). There are strong indications that mindfulness training improves function of the insula (Farb, Segal and Anderson, 2013; Gibson, 2019). This is yet another indication of the interrelationship between MLP, MT, and IA.

METHODOLOGY

This practice-led action research study investigates whether interoceptive awareness (IA) can be activated using a body scan exercise at the beginning of a lesson. I approach research from a pragmatic position, where the design is governed by the research question, rather than a philosophical position. The two primary ontological philosophies, realism, and subjectivism, are often presented as being mutually exclusive (Feilzer, 2010; Patton, 2002). While realism sees reality as fixed, objective, and verifiable (Berryman, 2019; Patton, 1990), subjectivism believes there are multiple realities created by social constructions and individual cognition (Berryman, 2019; Cohen, Manion and Morrison, 2007; Guba, 1990). I contend, however, that the two can coexist, and concur with Patton (2002) that the debate is no longer relevant.

I attempt to follow these principles:

- an emphasis on actionable knowledge,
- recognition of the interconnectedness between experience, knowing and acting and
- a view of inquiry as an experiential process.

(Kelly and Cordeiro, 2020: 3)

Action research projects are often constrained by their necessarily small scale (Denscombe, 2014). There are aspects of this subject where quantitative methods could provide useful data; for example, acoustic changes could be measured with a spectrogram (Moss-Erickson, 2023). Given, however, constraints of time and resources, and my lack of familiarity with such measurement tools, other methods of assessment must be created (see *Measurements* p. 23).

Measurements

This study grew out of questions raised in my practice (Denscombe, 2014). The measurements are, necessarily, subjective, however their interpretation is informed by 17 years of teaching voice, as well as almost 50 years' experience as a professional singer and actor (Bozeman, 2022).

The currently accepted methods of measuring interoception are Heartbeat Detection and the Rubber Hand Illusion (Schroter, Siebertz and Jansen, 2023; Suksasilp and Garfinkel, 2022), in which a participants' hand is put into a box so they cannot see it, while an anatomically similar

rubber hand of is visible to them. Both are stroked, and the participant must try to identify when the real hand is being touched (Suksasilp and Garfinkel, 2022). Unfortunately, the differences in perceptions when detecting the action of a single internal organ, a touch on the skin, or the complexity of sensations involved in singing, make these methods ineffective (Gibson, 2019). Gibson (2019) goes on to cite multiple studies on mindfulness and interoception which, although they could not measure interoception objectively, inferred its presence from measurable changes to stress management, cognitive insights, and self-regulation. This validates the idea that examining changes in attentional focus, relaxation and vocal technique after a mindfulness exercise may yield insights into its potential success at improving interoception.

Based on the literature review and observations, markers of development will be developed considering:

1. As the parasympathetic nervous system engages, physical responses are triggered which include visible muscular relaxation (Jung and Lee, 2021; Weissman and Mendes, 2021). Observing these changes, therefore, could indicate an experiential state.
2. A more passive, focused state is conducive to IA and learning (Czajkowski and Greasley, 2015; Gibson, 2019). Observation of changes in student's level of physical tension, mindset, and focus during and after the exercise, and students' stated impression of the effect of the exercise could also indicate the experiential state.
3. Interoception leads to adaptations in motor activities and is often unconscious (Crocco and Meyer, 2021; Kleber and Zarate, 2019). A dramatic improvement in technique could indicate increased interoception, even if it did not reach consciousness, so technical improvement was considered as a measure of interoception.
4. Although beginning students often have little awareness of internal sensations (Brown *et al.*, 2023; Fletcher, Davidson and Kraue, 2021; Tarvainen, 2018), IA is something that can be developed (Crocco and Meyer, 2021; Holding, 2017; Leal *et al.*, 2022). The most straightforward measures could be signs of improvement in IA as evidenced by student's ability to identify and verbally describe their sensations.

Literature Search

The literature review covers interoception, MLP focusing on priming and feedback, and mindfulness focusing on body scans. These choices were based on a previous study, BMPF7008, which indicated the most relevant subjects. For all searches I used EBSCO and Google Scholar. I

looked for articles issued after 2018, then extended searches by backward chaining. For interoception I started with the keywords “senses” and “interoception”, then added “proprioception”, “somatosensory”, and “kinesthesia”. For MLP I built on previous research by searching articles published since 2022, using additional keywords “priming”, “focus of attention”, and “feedback”. For mindfulness I added to previous research by focusing on the keyword “body scan”.

Methods

Based on the literature review, and results of previous research, I refined the body scan exercise (see Appendix 1, p. 60).

Seven student participants were selected using purposive sampling. The students were all females between the ages of 18 and 33 (hereafter known as P1, P2, and so forth), who have studied with me for at least one year. The intent was that the only variable introduced into lessons would be inclusion of the exercise (Creswell, 2014). One student did not complete the study due to illness.

Week One	Week Two	Week Three	Week Four	Week Five
No Exercise	Exercise	Exercise	Student Choice	Student Choice

Figure 4
Exercise Inclusion

The study commenced one month into the semester and took place over five lessons. As outlined in Figure 4, the study began with one class where the body scan exercise was not included. This lesson followed my normal format of physical warm-ups, vocalizing, and work on songs. The second and third lessons introduced the exercise at the beginning of the lesson. In the final two lessons the students chose whether to include the exercise. The students were asked to complete brief surveys after the first and fifth lessons. (See surveys in Appendix 2 p. 63).

Terminology

Multiple terms are used for systems for perceiving internal sensations, which creates a challenge for researchers. Interoception and somatosensory are used interchangeably (Gibson, 2019), as

are proprioception and kinesthesia, the terms for the sensing of position and movement of body parts (Mukhopadhyay, 2021; Tarvainen, 2018). Somatosensory is an all-encompassing term for internal sensations (Mukhopadhyay, 2021), while interoception is a general term for the system by which the body senses and interprets internal physical sensations (Berntson and Khalsa, 2021; Chen *et al.*, 2021). For the purposes of this paper, the general term 'interoception' will be used only to define internal bodily sensations related to singing, and 'interoceptive awareness' will refer to conscious perception of these sensations.

Focus is used in two contexts, 'focus of attention' referring to directing attention to internal or external feedback, and 'focus' referring to the ability to direct and maintain attention.

Analysis and Validity

To increase validity, I used triangulation. Triangulation is using multiple sources of data to add perspective (Cohen, Manion and Morrison, 2007). Data was gathered from

- Surveys (S1 and S2)
- Student Journals (SJ)
- Observations and Field Notes (FN)
- Literature Review

All data was coded eclectically and analyzed using Delve (Twenty to Nine, 2023) online qualitative analysis software and Survey Monkey was used to collect and store data.

Projected Timeline

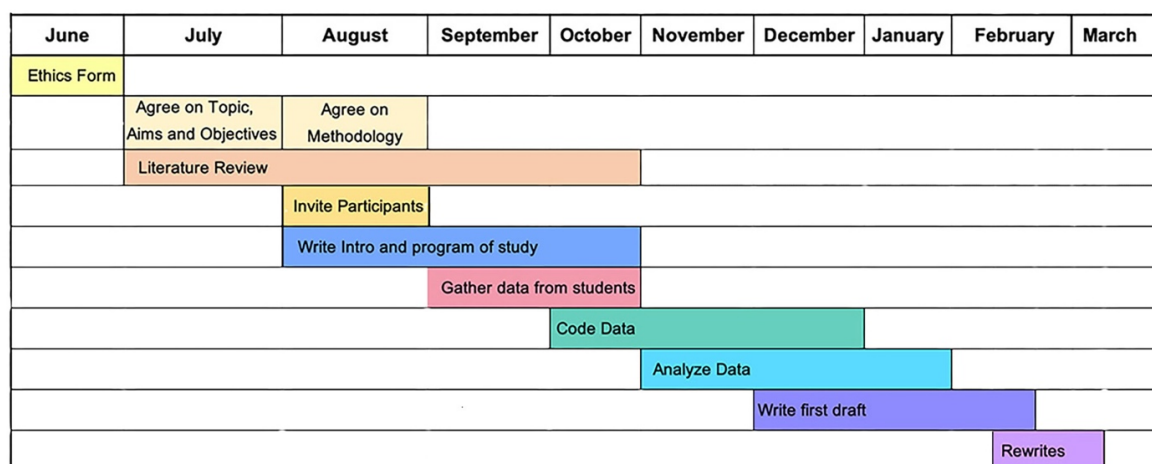


Figure 5
Projected Timeline

Ethics

Personal Bias

I have used similar exercises in the past and believe them to be extremely effective, so I came to this research with a bias (Abraham, 2018; Peters, 2022; Rollwage *et al.*, 2020). I have not, however, attempted to determine if the exercise would contribute to developing IA. My analysis must focus on tangible evidence of changes in affect, performance, and perception. I must be alert to any contradictory indications and strive for impartiality.

Working with Students

There are many ethical issues involved in working with students. College students may fear negative repercussions if they choose not to participate (Berg, 2001; Herrmann, 1989). There can be concerns that a researcher might put the interest of the research ahead of the interest of the students (Berg, 2001; Shen, 2021). There may be confirmation bias in students who wish to please or impress their teacher (Ferguson, Yonge and Myrick, 2004). All these issues must be addressed in the planning of the study.

Voluntary Participation and Informed consent

Prospective participants were given a consent form (Appendix 6, p. 212) which explained, in detail, what would be involved in the research. In addition to assurances in the form that participation was voluntary, I used our relationship of trust (Ferguson, Yonge and Myrick, 2004), to personally emphasize to each student that their choice to of whether to participate would not affect their grades, our relationship, or the success of my research. I reiterated the information from the consent form that lessons would be the same for participants and non-participants, to minimize the impact on the student's experience.

Confidentiality & Security of Data

In order to preserve participants confidentiality, each student was randomly assigned a number, and the list of numbers kept in a secure location (Berg, 2001). Surveys were distributed through Survey Monkey, and accompanied by anonymous consent forms. The hard copy consent forms were also kept in a secure location (Bell and Waters, 2018). All digital files were kept on a secure external hard drive (Berg, 2001). Lessons are habitually video recorded for the student's benefit

(Manternach, 2020). The students were aware that I would be reviewing the recordings to confirm and expand on my field notes. Videos are automatically deleted after 180 days.

Mindfulness concerns

Mindfulness is a broad term that covers many areas. Most of the risks involved are not relevant to such a short exercise. The most serious risks come when people use mindfulness to treat serious medical or psychological conditions instead of seeking medical treatment (Gibson, 2019; Van Dam *et al.*, 2018). This issue does not apply to this study, as it does not purport to treat ailments. Additionally, many feel that mindfulness training is problematic when it is separated from the ethical anchors of Buddhism, particularly in the case of western workplace mindfulness programs, often aimed at worker productivity (Kabat-Zinn, 2017; Qiu and Rooney, 2019). In this case we are simply noting internal perceptions, which is an ethically neutral goal (Kabat-Zinn, 2017). The deeper philosophical question about whether meditation is ethical if it is goal oriented for individual improvement in learning and skill building, instead of for the subsuming of the self to approach an egoless state, is beyond the scope of this research.

One risk mentioned in my previous research, is that standing with closed eyes for ten minutes can lead to a loss of equilibrium (Hannon, 2022). Subjects were informed of that risk before commencing the exercise and had a chair within easy reach. They were instructed to open their eyes and grasp or sit in the chair if needed.

Trauma or Illness

One serious risk that can arise is that, for someone who has experienced trauma or addiction, meditative body scans may trigger flashbacks or re-experiencing unwanted memories (Gibson, 2019; Linder, 2021; Van Dam *et al.*, 2018). Another risk is that, if a subject has a physical or psychological ailment, focusing attention on internal perceptions may amplify or reinforce negative sensations (Gibson, 2019; Linder, 2021; Mirams *et al.*, 2013). Subjects in this study were warned of these risks and told that, if they felt uncomfortable in any way, they should open their eyes and do whatever made them feel safe. They were reminded that, if it became too distressing, they could withdraw from the study at any time. The exercise itself frequently uses words like 'safe' and 'comfortable' to minimize unexpected stress (Mapes, 2022). Most important, however is that anyone leading this sort of exercise should understand how to lead mindfulness practices (McCown, Reibel and Micozzi, 2010), and must pay close attention to the reactions of the subjects, so that the exercise can be terminated if there are any signs of distress (Qiu and

Rooney, 2019). It should not be left to the participant to inform the instructor of their discomfort, as the student may choose to continue the exercise for the reasons cited in the '*Working with Students*' section (p. 19). I was prepared to stop the exercise, and was ready to support students as needed. Although not a trained psychologist, I have experience with these exercises in different contexts, and was also prepared with a list of resources such as counseling and hotline numbers at hand.

Priming

Unconscious priming has come to be thought of as a method to secretly influence the thoughts and actions of others (Bargh, 2022), which would not be ethical if it did not align with the subjects' goals, as when advertisers attempt to manipulate buyers (Bargh, 2022; Tanasic, 2021). In this study the exposure is not subliminal (below conscious awareness) (Tanasic, 2021). The exercise takes 10 minutes, and the students are aware that the purpose of the exercise is to direct their awareness to internal sensations – thereby priming that same awareness for the entire lesson. This exercise will not be used to trick or mislead the students in any way.

This research has received ethics approval from both the University of Wales Trinity Saint David, and the University of Bridgeport.

INTRODUCTION TO FINDINGS

This research explores the effects of a mindfulness body scan in a voice lesson, in hopes of stimulating interoceptive awareness.

Exercise Design

Building on earlier research (Hannon, 2022a), personal experience, and the information gathered in the literature review, a body scan exercise was designed which was specifically targeted to stimulate IA. The logic was that, since directing attention to internal sensations while singing impedes learning (Crocco and Meyer, 2021; Holding, 2008), drawing student's attention to internal perceptions at the beginning of the lesson, away from singing, could prime their unconscious sensitivity to these feelings (Bargh, 2022). Body scan exercises guide participants to draw their attention inward and move it sequentially through the body, either from head to toe or toe to head, observing sensations as they are encountered (Blyskal, 2022; Gan, Zhang and Chen, 2022; Mirams *et al.*, 2013).

This exercise, henceforth referred to as ‘the exercise’, is a relaxation body scan, which asks the participant to notice any tension as their awareness moves through the body and to release it (Blyskal, 2022). Because the mechanisms of the voice are in the head, neck, and upper torso (Bennett, 2017; Malde, Zeller and Allen, 2013), I chose to begin the exercise at the top of the body and work downward. The scan is more detailed in the areas where tension can impede vocal production, such as the tongue and neck (Blyskal, 2022; Kadiri, Alku and Yegnanarayana, 2020; McKinney, 1994). Additional focus is also directed to noticing breathing when the scan passes through the ribcage and the abdominal area (Chapman, 2017). The scan becomes more general as it passes down the lower back and legs. Once the subject reaches the feet and imagines the tension draining away, the students visualize drawing in energy and feeling it fill their bodies. This is to counter the idea that too much relaxation is inimical to singing (Hemsley, 1998; Reid, 1965), and to encourage an invigorating balance of energized relaxation (Czajkowski and Greasley, 2015; Elliot, 2010; Vennard, 1968). (See the exercise in Appendix 1, p. 60).

Coding and Analysis

Utilizing content analysis (Erlingsson and Brysiewicz, 2017), the first cycle used Holistic Coding, as I already had a general idea of what to look for in the data and had chosen keywords as guides (Naeem *et al.*, 2023; Saldaña, 2016). As coding continued, it became apparent that much of the data was outside the scope of the chosen codes so, using Descriptive and In Vivo Coding (Saldaña, 2016), the list was expanded. Next came a search for patterns, connections, and divergences within the data (Erlingsson and Brysiewicz, 2017; Vaismoradi *et al.*, 2016).

Lessons are normally video recorded so the students can review them (Manternach, 2020). The initial plan was to review the videos once to solidify my impressions and observations. As coding continued, however, patterns were uncovered in areas that had not attracted my attention at the time, such as mental health, and issues I had expected to be relevant, such as posture, were not, and were therefore removed (Erlingsson and Brysiewicz, 2017; Saldaña, 2016). The videos were then reviewed to reinforce my recollections and to fill in gaps in the field notes accurately.

There followed several runs of Eclectic coding, using Attribute, Descriptive, and In Vivo coding to create subcodes (Saldaña, 2016). I identified categories to guide analysis (Erlingsson and Brysiewicz, 2017; Naeem *et al.*, 2023; Saldaña, 2016). I used a mix of approaches to organize the coding and search for themes - Delve, index cards, color coding the transcripts, and Survey Monkey. (See Appendix 4, p. 67).

My primary goal is pragmatic (Al-Ababneh, 2020; Kelly and Cordeiro, 2020). I am interested in some measurable phenomena, for example, when a student identified feeling vibration in her teeth, or kept her dynamics even on an ascending scale. On the other hand, as a participant I am observing from my individual perspective (Johnson, Adkins and Chauvin, 2020), and much of what I'm measuring can only be inferred, so this remains a qualitative study. I have, however, decided not to work with themes, but rather to examine "the value and meaning of research data through examination of its practical consequences" (Kelly and Cordeiro, 2020: 1; Morgan, 2014). Although the unique and individual responses of the students are of interest (Bell and Waters, 2018), this study is aimed at answering the question "Does the exercise work?" (Feilzer, 2010; Morgan, 2014).

FINDINGS

The study took place at the University of Bridgeport, a non-profit private university in Bridgeport, Connecticut, USA. This is not a conservatory level program, and many of the voice students are beginners and early intermediate level singers. Seven students agreed to participate in the study, though one student did not complete the study due to illness. The students were all women between the ages of eighteen and thirty-three. They are predominantly Musical Theatre or Contemporary Commercial singers, but work on Classical pieces as well, as part of developing and balancing their voices (Hoch, 2018). The study took place over the course of five voice lessons, with the exercise introduced in the second lesson and repeated in the third. For the fourth and fifth lessons the students could choose whether or not to include it. The students took two surveys: a four-question survey after the first lesson, and a seven-question survey after the final lesson. Surveys were done through Survey Monkey, using the Anonymous Responses collector to maintain anonymity and encourage fuller disclosures (Murdoch *et al.*, 2014). They kept weekly journals which were added to the data. The primary source of data was observations which were kept in the form of field notes.

Measurements

This study will be concentrating on four areas; relaxation, focus and productivity, technique, and interoceptive awareness (IA). Based on observations and the literature review, a system of measurements has been designed for each of these areas that should show the progression of development of IA. The terminology used has been extracted from the lesson observations and student journals. They are general terms, and greater detail will be given as we examine the progress of the individual participants.

Relaxation represents the physical release of tension in the body. As the body scan exercise engages the parasympathetic nervous system (as discussed on p. 13), muscular tensions release, the heartbeat slows, and alpha and theta brainwaves increase (Jung and Lee, 2021; Weissman and Mendes, 2021), which can lead to the desired experiential state (Gibson, 2019). Observing the body relaxing can be an indication that the more existential state is being created (Jung and Lee, 2021), as can mitigation of stress (Gan, Zhang and Chen, 2022; Gibson, 2019). This passive state makes a person more susceptible to unconscious priming so exposure to internal sensations would be more likely to influence later perceptions (Bargh, 2022). The measures for relaxation in the tables are as follows:

- Tension - There is noticeable physical tension present, for instance a tight jaw, clenched fists, or shoulders raised by tension.
- Less Tension - The previously mentioned tension eases with the exercise and that relaxation is maintained throughout the lesson.
- Relaxed - There is no visible tension. The student demonstrates ease of movement.
- Stress - Student identified life stress.
- Stress Relief - Student identified feelings of relief of stress. This often happens without them having said they were stressed (e.g. at the end of the exercise a visible release of tension, a big sigh, and saying “That’s much better.”

Technical improvement, especially when maintained over time, is a sign of motor learning (Crocco and Meyer, 2021; Leigh-Post, 2021; Treinkman, 2021). It is an indicator of interoception, since perceptual motor learning is dependent on interoception, with or without awareness (Aura *et al.*, 2022; Blackhurst, 2021; Leal *et al.*, 2022; Tarvainen, 2018). Raising interoception to a level of conscious awareness, however, appears to have an even greater effect on perception (Craig, 2009; Gibson, 2019). Automaticity, which is when sensory feedback triggers an adaptation to align with a previously set mental model of the desired sound (Blyskal, 2022; Leal *et al.*, 2022), is the ultimate goal in singing. Measures of technical improvement will be:

- Problems - this will represent any vocal problem, from poor pitch matching to lack of vibrato to register breaks. The instructor identifies one specific problem to address which varies by individual student.
- Improvement - noticeable improvement in the previously identified problem.

- Maintained - improvement was maintained - not advanced and not reduced (e.g. consistently sustaining an even dynamic level in a designated passage from week to week.)
- Self-Corrected - previous improvement becomes automatic - (e.g. using even dynamic levels in new songs without instructor prompting).

Focus and productivity are further evidence of the experiential state (Abraham, 2018; Farb, Segal and Anderson, 2013; Gibson, 2019; Schubert *et al.*, 2021). A decrease in distraction and an increase in focused attention are benefits in themselves (Blyskal, 2022; Czajkowski and Greasley, 2015), as well as a possible way to infer improvement in interoception. This is the area where the participants identified the greatest effects of the exercise, as indicated in Student Journals. The measures are as follows:

- Unfocused - The student is disorganized and distracted. They have difficulty finding their music, have more trouble with counting and pitch. They often appear restless.
- Neutral - There is no evidence of distraction or lack of attention, but neither do they appear focused and attentive.
- Focused - Student shows noticeable energized attention. Music is in order and ready to go.
- Productive - Students show energized attention. They are receptive to feedback and readily make successful adjustments. They are more engaged and excited about their work.

Interoceptive Awareness is when the student can consciously identify sensations associated with an action (Berntson and Khalsa, 2021; Blyskal, 2022; Farb, Segal and Anderson, 2013; Gibson, 2019; Price and Hooven, 2018). Although interoception often functions below the level of consciousness (Berntson and Khalsa, 2021; Gibson, 2019; Price and Hooven, 2018), awareness allows for conscious interpretation of internal signals, and can lead to greater automaticity (Berntson and Khalsa, 2021; Blyskal, 2022). As awareness of sensations strengthens, I've observed that students begin to be able to describe them. The most advanced stage of IA is automaticity, which here is referred to as 'self-correction'. The measures follow.

- No IA - The student is unable to recognize any sensations, even when questioned.
- Some IA - Student senses that something is happening, but is unable to identify what, for example, "It seems easier".
- Can Describe - Student can verbally describe sensations, for example "I feel buzzing in my teeth" or "I feel my palate lift".

- Self-Corrected - The student used sensations to inform corrections. This happens automatically, without instructor prompting. It requires interoception, either conscious or unconscious.

Progress in Relaxation

“It’s like an energized relaxation. It’s like I’m energized but I don’t feel like I need to fly around the room and do laps and stuff, it’s just relaxed.”

P2 (FN)

Student #1	Tension	Less Tension	Tension	Tension	Less Tension
Student #2	Tension	Tension	Tension	Less Tension	Tension
		Stress Relief		Stress Relief	Stress Relief
Student #3	Relaxed	Less Tension	Less Tension	Stress	Relaxed
Student #4	Tension	Stress Relief	Stress	Stress	Tension
Student #5	Stress	Stress Relief	Stress Relief	Stress	Relaxed
Student #6	Tension	Tension	Less Tension	Relaxed	Relaxed

No Exercise
Exercise

Figure 6

Lesson Progress in Relaxation

Stress – Student identified stress

Tension – visible physical tension e.g. raised shoulders, clenched jaw

Less Tension – previously mentioned tension eased with exercise

Relaxed – no visible tension, ease of movement

Stress relief – student identified feelings of stress relief

Physical reactions were observed during the exercise, to see if the body responded to instructions to release tension, as this could indicate a change of state (Farb, Segal and Anderson, 2013; Jung and Lee, 2021; Septantiningtyas et al., 2020). All students who did the exercise showed visible signs of releasing tension as the exercise went on. The head drooped forward, shoulders softened, any obvious tension in the hands released, and the entire body appeared to sink. Most students seemed to expand during the part of the exercise where they imagined energy entering their bodies, returning to their best energized postures. All showed some evidence of increased relaxation at the end of the exercise. This could indicate the development of an experiential state (Jung and Lee, 2021).

Whether relaxation was maintained in the rest of the lesson was more ambiguous. While in six lessons easing of tension, evidenced by visible relaxation of physical tension in the face, neck, or shoulders, remained relaxed throughout the lesson, on five days the exercise had no clear lasting impact. In addition, although there was a clear effect on certain types of tension, such as tight shoulders, there was no evidence that chronic tensions such as a habitually tight jaw (Osman,

2023) would be affected. This is in line with Liang et al. (2023), which showed that mindful breathing exercises had no effect on muscular tension, but contradicts Osman (2023), who states that meditation and mindful movement are useful in treating serious muscular jaw conditions. It is possible that longer term mindfulness practice would have an effect on chronic tension, but further research is needed.

It should be noted that P1 developed cold sores, which she had during her third and fourth week. Cold sores are painful ulcers occurring in the mouth and on the lips, caused by the herpes simplex 1 virus (Ramchandani et al., 2019; Zhu and Viejo-Borbolla, 2021). A prominent ENT (Sataloff, 1981) highlighted the impact of cold sores on singing some 30 years ago, and the discomfort and interference with articulation they cause call into question any meaning that might be attributed to the presence of tension during those lessons. P1's data was therefore excluded from any conclusions in this section.

Stress relief occurred only in lessons where the exercise was performed. Mindfulness practices have long been known to decrease stress (Amanvermez et al., 2023; Gibson, 2019; Kabat-Zinn, 2019), so this was an expected result. The more experiential state created, which is what aids in unconscious management of stress (Blyskal, 2022; Gan, Zhang and Chen, 2022; Gibson, 2019; Rigg, 2017), would also aid priming and the development of IA (Bargh, 2022; Fischer, Messner and Pollatos, 2017; Guthrie et al., 2022). As mentioned above, however, there were days when the exercise was done when tension and stress remained, so a deeper investigation is required to determine if the exercise is consistently effective.

Progress in Technique

“The exercise did make me more receptive to learning during my vocal warm-ups and whatever we did first that day.”

P3 (S2)

Student #1	Problem	Problem	Improved	Maintained	Self Corrected **
Student #2	Problem	Problem	Improved	Improved	Self corrected
Student #3	Problem	Problem	Problem	Problem	Problem
Student #4	Problem	Problem	Improved	Improved	Problem
Student #5	Problem	Improved	Maintained	Problem	Self Corrected
Student #6	Problem	Improved	Improved	Problem	Self Corrected **
No Exercise	Figure 7				
Exercise					

Lesson Progress in Technique

Problem – any vocal problem, from register change to pitch

Improvement in previously identified problem

Maintained – improvement was maintained. Picked up where last lesson left off

Self Corrected – previous improvement became automatic – corrected without instructor prompting.

With one exception, there was clear improvement in technique, beyond what would normally be anticipated. For each student one primary vocal problem was addressed. With the exception of student P3 the problems began to improve, either immediately or after the second time doing the exercise. For two students the problem returned when they did not use the exercise. One student maintained the improvement even without the exercise. Four of the six students advanced enough to self-correct automatically, so the problem was resolved. For two of those it was the first time they achieved automaticity. Although it is not possible at this stage to assign causality to this outcome, there are positive indications that interoception was improved, and that further research would be beneficial.

Progress in Focus

"As someone who struggles with focus it helped me to center myself for the lesson"
P2 (S2)

Student #1	Unfocused	Neutral	Neutral	Unfocused	Focused
Student #2	Focused	Focused	Focused	Productive	Productive
Student #3	Neutral	Focused	Focused	Focused	Focused
Student #4	Focused	Focused	Focused	Productive	Focused
Student #5	Unfocused	Neutral	Productive	Unfocused	Productive
Student #6	Unfocused	Neutral	Neutral	Unfocused	Neutral

Figure 8
Lesson Progress in Focus

Unfocused –
disorganized,
distracted

Neutral – No evidence of
distraction, nor of
attention

Focused – energized
attention
Strong concentration

Productive – energized,
organized, efficient,
receptive to feedback

Focus is the area where the results are most clear, and is also the area most mentioned by students. Every student appeared more focused on days when they used the exercise and less focused when they did not. P2 and P4, who were naturally focused, improved slightly with the exercise, while the P1 and P5, who were not inherently focused, became much more so on the days the exercise was used. This could indicate a shift in mental state, possibly including an increase in alpha waves, which act as inhibitors, quieting noise and distractions and allowing greater concentration (Abraham, 2018; Foxe and Snyder, 2011; Klimesch, 2012), as well as improved working memory and learning (Gruzelier, 2008; Jung and Lee, 2021; Pollok *et al.*, 2014; Schubert *et al.*, 2021). This is the clearest indication that use of the exercise resulted in the more experiential state that research shows can lead to better cognition and increased IA (Fischer, Messner and Pollatos, 2017; Gibson, 2019; Mirams *et al.*, 2013).

Progress in Interoceptive Awareness

I'm feeling a little sensation in my head when I do it how I did it today
versus how I did it before. It's interesting.

P2 (FN)

Student #1 Beginner	No IA	No IA	No IA	No IA	Self Corrected**
Student #2 Adv. Beg	Some IA	Some IA	Can Describe	Maintained	Self Corrected
Student #3 Adv. Beg.	Some IA	Some IA	Can Describe	Can Describe	Maintained
Student #4 Adv. Beg.	Some IA	Some IA	Can Describe	Self Corrected	Can Describe
Student #5 Beg. Inter.	Some IA	Can Describe	Can Describe	Can Describe	Can Describe
Student #6 Beginner	No IA	No IA	Some IA	No IA	No IA
No Exercise	First Time**				
Exercise					

Figure 9

Progress in IA

No IA – cannot
recognize any
sensations.

Some IA – can tell
note sensations but
not describe e.g. 'It
seems easier'.

Can Describe – for
example "I feel
buzzing in my teeth.

Self-Corrected –
automatically
performed a
correction

These were perhaps the most unexpected findings. Developing IA takes place over time (Fischer, Messner and Pollatos, 2017; Gibson, 2019; Price and Hooven, 2018), so it was not anticipated that, even if the exercise worked, all but one student would develop awareness, much less self-correction. Paying attention to sensations was not a new concept for these students, and the body scan intervention was the only novel element in their training. These findings clearly show an increase in IA for five of the six students, with a dramatic improvement in three of that five. This is the most explicit indication of the efficacy of the exercise so far.

Excepting student P6, changes are least evident in the more advanced students who started with varied amounts of IA. The more advanced the student, the less change there was, with #5 changing very little. This may be because, since they already have awareness, they are simply learning how to verbalize sensations they were already partly conscious of (Leigh-Post, 2021). In the case of P5, she had previously established automaticity in her singing, and was now discovering what was triggering her subconscious reactions. It may be that, while all singers benefit from strengthening IA, it is most important, for beginners (Cohen, A. J., Levitin and

Kleber,2020; Kleber and Zarate,2019; Wulf, Höß. and Prinz, 1998), as it leads to the automaticity we are striving to create (Blyskal, 2022; Leal *et al.*, 2022; Leigh-Post, 2021).

Student Perceptions

““I noticed that when doing the mindfulness exercises, I was able to be more present during the lesson and I was a lot more aware of the subtle differences that can affect my voice. I also preferred the exercises because they gave me a set time to reset my mindset”

P4

Two surveys were performed to investigate the student’s perspectives (Jansen, 2010; McClintock, Brannon and Maynard-Moody, 1979). Although they were submitted anonymously, I became aware of who submitted which survey, because they submitted them at different times dependent on when they had their lessons. This was unintentional, but allows attribution of their responses which may prove informative.

Survey #1

1. How did you feel at the beginning of class? For example: relaxed, slightly tense, anxious	Relaxed P1, P2	Tense P4, P5	Anxious P6
2. As class progressed did you feel better, worse, or the same?	Better P2, P4 P5, P6	Same P1	Worse
3. Did you feel able to focus clearly on your lesson?	Yes P1, P2 P4, P5, P6	No	Not Sure
4. Did you notice many physical sensations during singing?	Yes P1, P4, P5	No P6	Sometimes P2

Figure 10
Survey #1 Results

The first survey was filled out after their first lesson, when the exercise was not used. It is primarily useful in showing the students perceptions of their normal state, without the mitigating effect of the exercise (Denscombe, 2014). The students were almost evenly divided on how they felt at the beginning of class, with two students feeling relaxed, two feeling tense, and one feeling anxious. P3 did not take the survey. Regardless of how they felt coming in, all students believed that they

were able to focus well in their lessons. For P1, P5, and P6 this did not agree with my observations. P1 fidgeted constantly. P5 was distracted and lost pages of her music. P6 was distracted. Four students felt better as the lesson progressed, while one felt the same. All of them thought that they had some level of IA, though one was not certain.

An additional purpose of the first survey was to introduce the participants to the important concepts that were being examined, primarily IA and focus. It is likely that the divergence between student responses and instructor observations was due to student's lack of familiarity with the ideas as presented. Students were given a copy of the final survey questions, which laid the foundation for the lessons to come. They were encouraged, but not required, to keep the questions in mind when writing their practice journals.

Survey #2

1. Do you like doing the mindfulness exercise?		Yes P1, P2 P3, P4, P5	No P6 ("It's okay")	Not Sure	
2. Do you notice a change in your receptiveness to learning after the exercise?		Yes P1, P2 P3, P4, P5	No P6	Not Sure	
3. Do you notice sensations when you sing after doing the exercise, versus when you do not do the exercise?		Yes P1, P3 P4, P5	No P6	Other P2 I feel a more focused energy after the exercise	
4. Do you perceive a change in your ability to focus after the exercise?		Yes P1, P2 P4, P5	No P6	Not Sure P3 I try to focus mostly on what I need to do and just get through warm-ups	
5. When given the choice, did you choose to do the exercise or not? Why?		Yes P1, P2 P4, P5	No P6 No, i didn't really think it did much for me	Sometimes P1 Once I chose not to because I felt as though I was already focused enough	
6. Would you do the exercise on your own if it were available?		Yes P1, P2, P3, P4, P5	No P6	Not Sure	
Question #7 How do you feel the mindfulness exercise affected your lesson?	Focus and Attention P1, P2	Mental Health, Stress and Relaxation P3, P5	Receptive P4	Breathing P5	No Effect P6

Figure 11
Survey #2 Results

The results of the second survey are more directly informative. In Question 1, the first conclusion is that five of the six students enjoyed doing the exercise and found it helpful, while one did not. This aligns with my observations, and is reflected in the quotes from students found throughout the findings section. This could also be a gauge of the exercise's potential usefulness, as motivation is a powerful element for motor learning (Crocco, Madill and McCabe, 2015; Meyer and Holding, 2021; Wulf, Höß. and Prinz, 1998). I had not considered motivation as significant to this study, but repeated comments in journals, lessons, and on the surveys indicate that it is an avenue that should be investigated.

In Question 2 the students believed, with one exception, that they were more receptive to learning, as is supported by the literature (Blackhurst, 2021; Blyskal, 2022; Czajkowski and Greasley, 2015), and two related this to increased focus. For Question 3 most students reported an increase in sensations after doing the exercise. Two students cited specific sensations they felt, although one mentioned "a more focused energy" which is a generalized sensation that does not fit our definition of interoception.

A similar instance of not understanding the question arose in Question 4 about the change in ability to focus. While four students said yes, with P2 referring to "a relaxed more concentrated focus", and one said "no", P3 said, "After the exercise, I try to focus mostly on what I need to do and just get through warm-ups". This indicates a misunderstanding of what was meant by "focus", possibly due to a lack of specificity in the question (see p. 45 for discussion of survey design).

In Question 5, the choice of whether or not to do the exercise which are represented in the survey responses does not accurately reflect what happened in class. Looking at the tables of weekly student progress (see p. 35-40) shows that the exercise was left out three additional times, twice by student choice and once by my choice (see p. 38). It is possible that the students forgot, or that they wrote what they had intended to do rather than what they actually did. Interestingly, this was the first question to elicit long responses from all students. The two students that acknowledged not choosing to do the exercise had very different reasons; P1 felt she was already focused that day, while P6 said, "I don't think it did much for me". The students that claimed to have chosen the exercise pointed to it "being helpful" (P2) or "having a positive effect" (P5). They said it "got their mind off stressful things" (P3), "reset their mindset" (P4), and allowed them to be more "present and focused" (P4).

Question 6 is an important predictor of the success of the exercise over time. Doing the exercise regularly outside of class could serve to reinforce its positive effects (Kropp and Sedlmeier, 2019; Schroter, Siebertz and Jansen, 2023). All but one participant said they would do it outside of class, and three reported already doing so. P4 said, “I have begun implementing them in the beginning of my day to start off with the right mindset, as well as before I start practicing.” P5, who is a graduate student in Music Education, said she would use it in her teaching.

Question 7, the final open-ended question, generally reinforced and expanded on previous responses. The student who did not like the exercise did not respond. Most of the other students had positive responses, saying,

“I feel as though I can use this exercise outside of my lessons.” P1

“I think the mindfulness exercise is really helpful and should be done before going into something where focus is required” P2

“I enjoyed doing the exercises throughout the lessons. I have begun implementing them in the beginning of my day to start off with the right mindset, as well as before I start practicing. I find I have much more productive practice when I have used the mindfulness exercises.” P4

“I really enjoyed the mindfulness exercise. I will use it in my future teaching. I think it is important to mental health to take a moment of mindfulness. It cleared my mind and helped me breathe and focus better.” P5

P3 gave a much more ambiguous response, which is analyzed on page 45.

The final measure of student perception was the students practice journals. Only three students completed their journals, and these seldom referenced IA. P1 repeatedly referred to doing, “a well needed mindfulness exercise”, and stated that it helped her “get in tune” with herself and be ready to sing. P3 did not mention any effects of the exercise. P4 referred in four entries to productivity and “getting a lot done”. That included the final lesson when she did not do the exercise due to a shortened lessons time, and said, “We did not have a lot of time to sing but I think we got a lot done.” She also talked about stress. She was interested to watch herself doing the exercise because, “...when it happens I can feel my body relaxing but now I see it too”.

Individual Student Results

Four of the students provided straightforward and positive results. In the tables that follow color coding is:

Yellow = Interoceptive Awareness

Blue = Focus

Orange = Technique

Green = Relaxation

"I was able to get in tune with myself and I was prepared to sing"

P1 (SJ)

	Lesson 1	Lesson 2	Lesson 3	Lesson 4	Lesson 5
Student #1	Beginner				
IA	No IA	No IA	No IA	No IA	Self Corrected*
Focus	Unfocused	Neutral	Neutral	Unfocused	Focused
Technique	Problem	Problem	Improved	Maintained	Self Corrected*
Relaxation	Tension	Less Tension	Tension	Tension	Less Tension
	No Exercise	Exercise	Exercise	No Exercise	Exercise

first time **

Figure 12

P1 Lesson Progress

RELAXATION		TECHNIQUE		FOCUS		IA	
Tension	Visible physical tension						
Less Tension	tension released after exercise	Problems	noted vocal problem	Unfocused	distracted	No IA	can't recognize
Relaxed	No visible tension	Improvement	in previously noted problem	Neutral	neither distracted nor attentive	Some IA	can't explain
Stress	student identified	Maintained	no change	Focused	energized attention	Can Describe	can explain feelings
Stress relief	relief of stress	Self-corrected	became automatic	Productive	efficient, receptive	Self-corrected	automaticity

P1 made the most progress in observable IA, and her technique and focus improved dramatically on the days when she did the exercise. She is a basic beginning singer who three years ago had a very weak voice, with a range of only a major third, beyond which she could phonate but not match pitch. She has been making steady progress strengthening the instrument, and now can match pitch over two and a half octaves, although she only does so when working on scales, not on songs. This is possibly because she has an external focus on communicating ideas, and beginners often require a more internal focus (Song, 2019). Pitch matching was not our technical goal, but did improve over the five lessons, although this cannot be attributed definitively to increased interoception. Singers depend on both interoceptive and auditory feedback (Angelakis,

Andreopoulou and Georgaki, 2021; Cohen, A. J., Levitin and Kleber, 2020; Ohrenstein, 2003), and beginners tend to rely more on what they hear (Cohen, A. J., Levitin and Kleber, 2020).

We set our technical goal as smoothing the register change at G above middle C, and from the second day we did the exercise her technique improved significantly, with improvements carrying over to the next lesson. By the fifth lesson she negotiated the transition smoothly, and made an adjustment to do so, which was novel for her. She noted that it felt different, although she was not able to describe the sensations.

On days when the exercise was not done, she had trouble keeping music in order and fidgeted constantly, but with the exercise she was more attentive and organized. During the course of the study she went from being unaware of any sensations to initiating an adjustment and being able to identify the difference before and after, going from no awareness to automaticity.

“I feel more attentive and focused on the lesson”
P2 (S2)

	Lesson 1	Lesson 2	Lesson 3	Lesson 4	Lesson 5
Student #2	Advanced Beginner				
IA	<i>Some IA</i>	<i>Some IA</i>	<i>Can describe</i>	<i>Maintained</i>	<i>Self Corrected</i>
Focus	Focused	<i>Focused</i>	<i>Focused</i>	<i>Productive</i>	<i>Productive</i>
Technique	Problem	<i>Problem</i>	<i>Improved</i>	<i>Improved</i>	<i>Self corrected</i>
Relaxation	Tension	<i>Tension</i>	<i>Tension</i>	Less Tension	<i>Tension</i>
		<i>Stress Relief</i>		<i>Stress Relief</i>	<i>Stress Relief</i>
	No Exercise	<i>Exercise</i>	<i>Exercise</i>	<i>Exercise</i>	<i>Exercise</i>

RELAXATION		TECHNIQUE		FOCUS		IA	
Tension	Visible physical tension						
Less Tension	tension released after exercise	Problems	noted vocal problem	Unfocused	distracted	No IA	can't recognize
Relaxed	No visible tension	Improvement	in previously noted problem	Neutral	neither distracted nor attentive	Some IA	can't explain
Stress	student identified	Maintained	no change	Focused	energized attention	Can Describe	can explain feelings
Stress relief	relief of stress	Self-corrected	became automatic	Productive	efficient, receptive	Self-corrected	automaticity

Figure 13
P2 Lesson Progress

P2 is a strong beginner, with an excellent Musical Theatre sound. She was enthusiastic about the exercise, and reported doing it outside of class. We focused on evening out the dynamics of her scales during vocalizing, and this carried over into more control of dynamics in her music, which was maintained from week to week. She is generally focused, but her lessons became more productive. The exercise did not appear to have an impact on the tension she habitually carries in her mouth. It is possible that this would require a longer-term mindfulness intervention (Kropp and

Sedlmeier, 2019; Schroter, Siebertz and Jansen, 2023), or that deep seated, habitual, muscular tension is not impacted by mindfulness practice. This is a question which needs more investigation. She reported a great release in stress whenever she did the exercise, always following it with a smile, a sigh, and a positive comment such as “That’s better, I needed that.” My observations confirmed a general improvement in ease of motion and sense of calm. P2 made observable progress in IA. Initially, she noticed sensations only when her attention was directed to them. Although there was still some inconsistency, by the end of the study she had improved and achieved some automaticity. She did the exercise for the last 4 classes and her focus and technique improved significantly

“The mindfulness exercise helps me relax and move my
focus from the stress of my day”

P3 (S2)

	Lesson 1	Lesson 2	Lesson 3	Lesson 4	Lesson 5
Student #3	Advanced Beginner				
IA	Some IA	<i>Some IA</i>	<i>Can describe</i>	<i>Can describe</i>	Maintained
Focus	Neutral	<i>Focused</i>	<i>Focused</i>	<i>Productive</i>	<i>Productive</i>
Technique	Problem	Problem	Problem	Problem	Problem
Relaxation	Relaxed	<i>Less Tension</i>	<i>Less Tension</i>	<i>Stress</i>	Relaxed
	No Exercise	<i>Exercise</i>	<i>Exercise ***</i>	<i>Exercise</i>	No Exercise

Dizzy ***

Figure 14
Student 3 Lesson Progress

RELAXATION		TECHNIQUE		FOCUS		IA	
Tension	Visible physical tension	Problems	noted vocal problem	Unfocused	distracted	No IA	can't recognize
Less Tension	tension released after exercise	Improvement	in previously noted problem	Neutral	neither distracted nor attentive	Some IA	can't explain
Relaxed	No visible tension	Maintained	no change	Focused	energized attention	Can Describe	can explain feelings
Stress	student identified	Self-corrected	became automatic	Productive	efficient, receptive	Self-corrected	automaticity
Stress relief	relief of stress						

P3's results are less straightforward. She is primarily a jazz or pop singer and we have been working on Musical Theatre songs that carry the belt sound higher in her mix. Although she physically responds to the exercise, with her head falling slowly forward and shoulders slumping as she relaxes and returning to upright energized posture as she imagines energy entering her body, there is no evidence that there is any further effect, perhaps because she is normally physically loose and relaxed. She had a crisis of confidence during the study, and became timid, shying away from the support needed for a clear sound (Hoch, 2018), and this did not improve. However, she has an extensive range, and in her classical piece her voice achieved a freedom and ease she had never had before, so her

technique improved in some areas and declined in others. Her focus varied day to day, regardless of whether or not the exercise was done. She appears to enjoy the exercise, choosing it every time (though for one lesson I overruled her because the lesson was shortened, and we needed time to work on music for final assessments). She had already developed some IA, and can usually describe sensations, but does not automatically make adjustments.

P3 had one instance of becoming dizzy during the exercise and had to stop (see p. 43 for further discussion). In spite of her enthusiasm for doing the exercise, there is no evidence that it had an impact on any aspect of her lessons.

“I felt very grounded after this exercise and ready to work.”

P4 (S2)

	Lesson 1	Lesson 2	Lesson 3	Lesson 4	Lesson 5
Student #4	Beginning Intermediate				
IA	Some IA	<i>Some IA</i>	<i>Can describe</i>	<i>Self Corrected</i>	Can describe
Focus	Focused	<i>Focused</i>	<i>Focused</i>	<i>Productive</i>	<i>Focused</i>
Technique	Problem	Problem	<i>Improved</i>	<i>Improved</i>	Problem
Relaxation	Tension	<i>Stress Relief</i>	<i>Stress</i>	<i>Stress</i>	Tension
	No Exercise	<i>Exercise</i>	<i>Exercise</i>	<i>Exercise</i>	No Exercise

RELAXATION		TECHNIQUE		FOCUS		IA	
Tension	Visible physical tension						
Less Tension	tension released after exercise	Problems	noted vocal problem	Unfocused	distracted	No IA	can't recognize
Relaxed	No visible tension	Improvement	in previously noted problem	Neutral	neither distracted nor attentive	Some IA	can't explain
Stress	student identified	Maintained	no change	Focused	energized attention	Can Describe	can explain feelings
Stress relief	relief of stress	Self-corrected	became automatic	Productive	efficient, receptive	Self-corrected	automaticity

Figure 15
P4 Lesson Progress

P4 is a beginning-intermediate singer primarily focused on contemporary commercial music (CCM) and musical theatre, though we worked on classical as well. She has been overextended, between a full course load and outside jobs (Amanvermez *et al.*, 2023), and in the semester before the study hadn't made as much technical progress as she had in previous years. During the weeks of the research there was great improvement. We have long been working on freeing her voice, which is slightly pressed, resulting in a straight tone (Esposito and Khan, 2020; Kadiri, Alku and Yegnanarayana, 2020). This is particularly noticeable in her classical pieces. By the second week of doing the exercise there was dramatic improvement, and in the fourth lesson she sang an entire aria with free vibrato for the first time. The problem reflected on the chart for the fifth lesson was vocal fatigue from overwork, not an ongoing technical problem, so indications

are that the exercise contributed to technical improvements. When she did not do the exercise her higher levels of stress and tension impacted her work. There was a visible lessening of tension with the exercise, and she reported strong relief of stress. After the exercise she was more relaxed and much more focused and productive, and reported making the exercise part of her daily routine. P4 made observable progress in IA which grew steadily, from sometimes identifying sensations to consistently identifying them. She achieved some automaticity, reporting having sensed that her sound was too heavy, and making an adjustment based on a twang exercise which corrected the problem.

“I will use it in my future teaching. I think it is important to mental health to take a moment of mindfulness. It cleared my mind and helped me to breathe and focus better.

P5 (S2)

	Lesson 1	Lesson 2	Lesson 3	Lesson 4	Lesson 5
Student #5	Beginning Intermediate				
IA	Some IA	<i>Self Corrected</i>	<i>Self Corrected</i>	<i>Can describe</i>	<i>Self Corrected</i>
Focus	Unfocused	<i>Neutral</i>	<i>Productive</i>	Unfocused	<i>Productive</i>
Technique	Problem	<i>Self Corrected</i>	<i>Self Corrected</i>	Problem	<i>Self Corrected</i>
Relaxation	Stress	<i>Stress Relief</i>	<i>Stress Relief</i>	Stress	Relaxed
	No Exercise	<i>Exercise</i>	<i>Exercise</i>	No Exercise	<i>Exercise</i>

RELAXATION		TECHNIQUE		FOCUS		IA	
Tension	Visible physical tension						
Less Tension	tension released after exercise	Problems	noted vocal problem	Unfocused	distracted	No IA	can't recognize
Relaxed	No visible tension	Improvement	in previously noted problem	Neutral	neither distracted nor attentive	Some IA	can't explain
Stress	student identified	Maintained	no change	Focused	energized attention	Can Describe	can explain feelings
Stress relief	relief of stress	Self-corrected	became automatic	Productive	efficient, receptive	Self-corrected	automaticity

Figure 16

P5 Lesson Progress

P5 is an intermediate singer, focusing on musical theatre and classical. In the second lesson, after the exercise, she reported having difficulty with flexibility and accessing higher notes. I suggested to her that she might be singing too heavily and she immediately self-corrected, and the problem never recurred. She has ongoing difficulties keeping the beat, and that is where we next focused our work. We determined it to be an issue of focus of attention for, when she worried about the rhythm, she directed her attention inward to aural feedback and whether she was matching what she heard. When she focused on the ideas she wanted to convey and the sound she wanted to make she was more successful (Nix, 2017; Treinkman, 2021). She suffers from ADHD and, on days where she did the exercise, she was able to stay on the beat consistently. On the one day we did not do the exercise she was not able to. The days with the exercise she was focused and productive and both her counting and her general technique were more solid. Days without the

exercise she was distracted and unfocused, losing her music or finding it out of order. This could support the usefulness of mindfulness practice for ADHA (Cairncross and Miller, 2020; Janssen et al., 2020). P5 already had IA, but refined her awareness and developed the ability to use it for automatic self-correction. The student has used the exercise outside of class.

“I don’t think it had much effect”

P6 (S2)

	Lesson 1	Lesson 2	Lesson 3	Lesson 4	Lesson 5
Student #6	Beginner				
IA	No IA	No IA	Some IA	No IA	No IA
Focus	Unfocused	Neutral	Neutral	Unfocused	Neutral
Technique	Problem	Improved	Improved	Problem	Self Corrected
Relaxation	Tension	Tension	Less Tension	Relaxed	Relaxed
	No Exercise	Exercise	Exercise ***	No Exercise	Exercise *

Would not choose *

Dizzy ***

RELAXATION		TECHNIQUE		FOCUS		IA	
Tension	Visible physical tension	Problems	noted vocal problem	Unfocused	distracted	No IA	can't recognize
Less Tension	tension released after exercise			Neutral	neither distracted nor attentive	Some IA	can't explain
Relaxed	No visible tension	Improvement	in previously noted problem	Focused	energized attention	Can Describe	can explain feelings
Stress	student identified	Maintained	no change	Productive	efficient, receptive	Self-corrected	automaticity
Stress relief	relief of stress	Self-corrected	became automatic				

Figure 17

P6 Lesson Progress

P6 is the one student who was not enthusiastic about the exercise. The other students generally elected to do it when offered the choice, asked to have a recording to use outside of lessons and, when a recording was provided, most of them did use it. P6 was never negative or resistant, but neither was she positive in her responses.

This student is a naturally talented Musical Theatre singer with little formal training. She is very shy and quiet, and it has taken three semesters for her to be comfortable enough to smile. She seldom states an opinion, and has accepted all suggestions pleasantly but passively. I find it difficult to determine the thoughts and feelings behind her reactions. An example of the challenges in our communication was in the fourth lesson of the series when I asked her to choose whether to include the exercise or not.

P6: I don’t care.

Prof: You can choose either way, it’s up to you.

P6 I guess not then.

Prof: That's fine. Am I permitted to ask why?

P6: Yes.

(Pause)

Prof: Why?

P6: I don't know.

I was unable to determine if she was joking about the awkwardness of my questions, although that was my suspicion. There was no hint of a smile. It is possible that my inability to read her reactions impacted my observations in her case. However, although the student never identified a sensation beyond "It seemed easier", there was evidence of progress towards IA, due to using the exercise. Both her focus and her technique were observably stronger on the days when we used it. She was able, for the first time without prompting, to lighten her voice to make a seamless register transition. I take these facts as clear indications of an increased connection to interoception, albeit unconscious.

Student distress

There were two instances of dizziness during the exercise. Previous research (Hannon, 2022a), included a focus group which expressed concerns about standing with closed eyes for extended periods, so the student's attention is always drawn to the music stand and a nearby chair to use in case of dizziness or loss of equilibrium (Balasubramaniam and Wing, 2002). These two instances underscore the need to be attentive to a student's reactions to mindfulness practice (Linder, 2021). With P3 there was no sign during the exercise, but in with P6 I observed slight swaying before the student opened her eyes and was able to grab the chair and help her sit. That student wished to continue with the exercise, and I allowed it, with her sitting, but I now suspect it was due to her desire to help me, not a desire to do the exercise (Ferguson, Yonge and Myrick, 2004; Herrmann, 1989; Shen, 2021).

DISCUSSION

Complexity of interactions

An inherent problem in determining growth in learning and interoception in singing is the complex interactivity of the systems involved.

“We know a tremendous amount about neurology, innervation, emotions, and vocal anatomy. And still, with all the information we have, we struggle to understand how all these parts work together, where is the cause and where is the effect?

(Blackhurst, 2021p. 61)

Singing is often thought of as an interactive system, much like the cycle of sensations (Figure 2 p. 20). As the figure below indicates, the first step is creating a mental image of the sound (Blyskal, 2022; Cohen, A. J., Levitin and Kleber, 2020; Fields, 1972; Reid, 1965), which is then translated into instructions to the vocal system which includes the breathing, phonating, and articulating mechanisms (American Academy of Teachers of Singing, 2014; Cohen, A. J., Levitin and Kleber, 2020; Fields, 1972; Reid, 1965). Those systems are activated before any sound is made (American Academy of Teachers of Singing, 2014; Moss-Erickson, 2022). Once the sound has been made, sensory feedback, both auditory and interoceptive, is sent to the brain, where new motor commands are formed to adapt as needed to align the sound with the original mental image (Angelakis, Andreopoulou and Georgaki, 2021; Aura *et al.*, 2022; Cohen, A. J., Levitin and Kleber, 2020; Kleber and Zarate, 2019; Leal *et al.*, 2022; Tarvainen, 2018). From there it continues, completing each cycle almost instantaneously (American Academy of Teachers of Singing, 2014; Leigh-Post, 2021; Moss-Erickson, 2023).

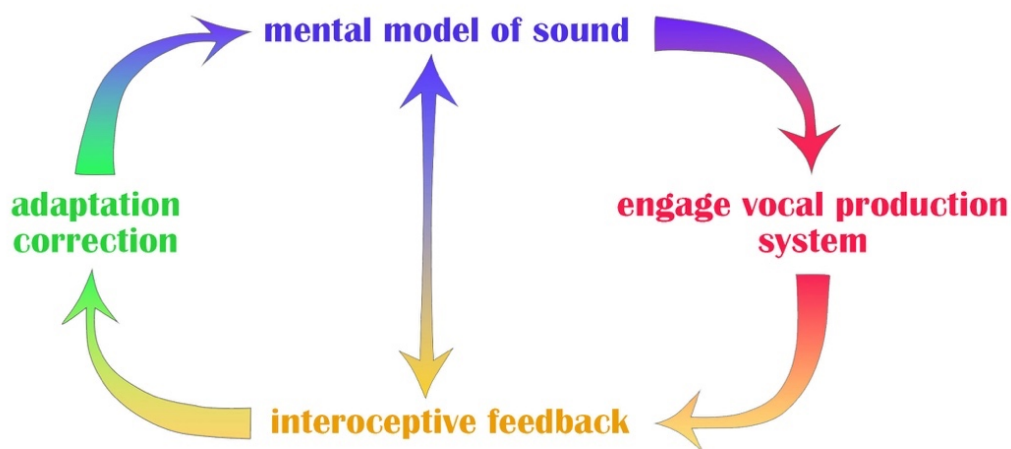


Figure 18

The control center for all of the actions shown in Figure 18 is the brain, and our understanding of how its structures interact is changing rapidly (Chen *et al.*, 2021). While early literature on higher executive functions, including singing, focused on the cerebral cortex, particularly the temporal

lobe (Cohen, A. J., Levitin and Kleber, 2020; Molnar-Szakacs and Uddin, 2022; Verdolini, 2002), current understanding of executive and sensory processing shows it to be distributed over many areas of the brain (Cohen, A. J., Levitin and Kleber, 2020; Leal *et al.*, 2022). Interoception is receiving increased attention (Chen *et al.*, 2021; Price and Hooven, 2018; Suksasilp and Garfinkel, 2022), and there are multiple studies on the Insula as a powerful factor in sensory processing and executive function (Centanni *et al.*, 2021; Molnar-Szakacs and Uddin, 2022; Namkung, Kim and Sawa, 2018; Uddin *et al.*, 2017). There is also increased interest in the interactions between interoception and mindfulness (Farb, Segal and Anderson, 2013; Fischer, Messner and Pollatos, 2017; Gibson, 2019; Guthrie *et al.*, 2022; Schroter, Siebertz and Jansen, 2023).

We have broken down these complex processes into their component parts, even though they are an interactive system (Hannon, 2022b; Zhang, 2016). We looked separately at relaxation, technique, focus, and IA, in order to determine if the outcome of one element, a mindfulness body scan, will lead to the enhancement of another - increased interoception, in the hope that this will improve the function of the system as a whole.

One determination we could make was that all participants had observable physical reactions to the relaxation exercise, visibly releasing tension for the relaxation and expanding with the image of energy entering their bodies. They all showed signs of increased relaxation, and many reported feeling a release of stress. This could be an indicator of the more experiential state that can lead to IA.

Every student evinced greater focus after the exercise. This was particularly noticeable in students with attentional challenges, supporting the literature which suggests that mindfulness practice improves executive function, including attention and cognition (Blackhurst, 2021; Blyskal, 2022; Gibson, 2019). This finding alone supports the use of a mindfulness exercise to enhance a voice lesson, as has been shown in multiple studies in recent years (Blyskal, 2022; Czajkowski and Greasley, 2015; Ornoy and Cohen, 2021).

All but one student had significant improvement in vocal technique. Several initiated self-corrections that indicated a use of automaticity dependent on interoceptive feedback (Blyskal, 2022; Leal *et al.*, 2022). Five of the six students not only showed signs of increased interoception, but achieved some level of awareness.

There still remain many questions about which actions control which outcomes and how the systems interact. For now, just as motor learning must be inferred over time (Helding, 2008), we can only infer changes in interoception as interactions between relaxation, ability to focus, and vocal technique outcomes. With that caveat, the results of this study are promising.

Limitations of the Research

Structure and measurements

The most obvious limitation to this research is the small sample size (Cohen, L., Manion and Morrison, 2007; Denscombe, 2014). An optimal situation would consist of more students, including a control group (Denscombe, 2014), as a larger sample size would allow for more verifiable results (Cohen, L., Manion and Morrison, 2007; Lakens, 2022; Sarfo *et al.*, 2021). It could, however, lay the foundation for future research.

A similar issue is the brief duration of the research. Several aspects of the inquiry would benefit from a longer study, of at least a full semester. This would allow more time for IA to develop (Kleber and Zarate, 2019), and would allow clearer measures of whether motor learning took place. Motor learning can only be inferred over time (Crocco and Meyer, 2021), so although the improvements in technique in this study were encouraging, no definite conclusion about learning can be made.

Bias

Confirmation bias was, as predicted, an issue with the study. The students want to please me (Ferguson, Yonge and Myrick, 2004; Herrmann, 1989; Shen, 2021), and there were clear indications in at least three instances of bias. The student who eventually gave all negative responses on her final survey gave no indications in lessons that she didn't like the exercise. Indeed, when she became dizzy during the exercise and had to sit down and drink some water, I expected that we would move on from the exercise, but she insisted that we complete it. Another made a point of praising the exercise, even in the first lesson when we had not done it. P3, who was very positive with all her comments, ended her final survey saying,

“For me, starting mindfulness exercises after not doing them for some time is awkward and I can't focus. However, I believe that incorporating this exercise into our daily routines would be beneficial.”

This self-contradictory statement exemplifies the inner conflict many students feel (Ferguson, Yonge and Myrick, 2004). I was very aware of this unconscious bias so, although I believe the positive responses were heartfelt, I used their statements only as a reflection of their opinions. These have value to a point, but the data that informed my conclusions about the efficacy of the exercise was strictly based on my direct observations of the student's actions and of the noticeable effects of the exercise (including student reports of sensations), not on their reports of their feelings about the exercise.

I found the desire to please a professor can have more potential dangers than simply risk of bias. The student who left the research is a case in point, and one I feel it is important for this study to address, although no data about her was gathered. A dedicated and enthusiastic student, she was dealing with an ongoing medical issue that was causing significant stress. As noted in the Ethics section (p. 20), focusing the attention on internal sensations, in someone who has suffered trauma or is ill, can exacerbate the negative situation (Gibson, 2019; Mirams *et al.*, 2013; Fischer, Messner and Pollatos, 2017; Qiu and Rooney, 2019). When we did the exercise in class I watched closely, and the student appeared to be working hard to maintain her focus, instead of gradually releasing tension and stress. In retrospect I wish I had stopped the exercise, and I would do so in the future. When we spoke about it, she confirmed that it had been difficult and upsetting. At that point I removed her from the study, though she would have willingly continued. The desire to please can overrule a student's judgement, and it is incumbent upon the teacher to act in the student's best interest (Ferguson, Yonge and Myrick, 2004).

Survey Design

Bell and Waters (2018) emphasize the skill required to create a good survey. I fear I was guilty of the arrogance they warn against in thinking that because I have common sense and can write I could design a survey (Bell and Waters, 2018: 179). There were several instances where my survey questions were not clear to the students, resulting in ambiguous responses (see p. 33). Most importantly, the surveys were not optimally designed to provide answers to the research question (Bell and Waters, 2018). Additionally, the surveys were only useful in showing the general opinions of the students in that one moment (Denscombe, 2014). Although they were informative I learned, during the course of my literature review, that there are surveys that have been carefully developed to measure mindfulness state, such as MAAS (Mindfulness Attention Awareness Scale) and FFMQ (Five Facet Mindfulness Questionnaire) as well as the PSS-10

(Perceived Stress Scale-10) which would have provided more reliable and useful data (Brown *et al.*, 2023; Schroter, Siebertz and Jansen, 2023; Sevinc *et al.*, 2018; Vidic and Cherup, 2019).

I find it difficult to separate the limitations of the research from my reflections, for I have spent a great deal of time reflecting on the many ways my inexperience limited the study. In addition to the survey design problems noted on p. 45, I had hoped there would be more responses in the student's practice journals that directly related to interoception. I now realize that this was unrealistic, given that they have very little awareness of their sensations, and therefore could not address them. I also didn't take into account the likelihood of student absences, so what was planned for five weeks turned into eight weeks of data gathering, which impacted my time for analysis.

This also created a problem with confidentiality and anonymity in the survey. I used Survey Monkeys anonymity settings so the participants identity would be shielded even from me (Bell and Waters, 2018), encouraging freer comments (Murdoch *et al.*, 2014). Due to absences, however, the students did not begin the study concurrently. Since surveys were turned in at different times, I easily identified responders. I informed the students and apologized, but in a different situation it could have presented a problem. Their general confidentiality remained intact, but the situation might have been avoided if I had masked the submission dates and waited until all lessons were completed to access the surveys.

Mindfulness and Relaxation

I did not realize until I was deep into this research and had already begun gathering data using the exercise, that mindfulness and muscle relaxation techniques, although closely related, are not the same (Luberto *et al.*, 2020). The major difference is that mindfulness aims for accepting one's current state as it is, without judgement, while the goal of relaxation exercises is to change the physical state by releasing muscular tension (Kabat-Zinn, 2019; Qiu and Rooney, 2019). In mindfulness training, noticing without judgement is crucial to developing acceptance of the current moment, and its practice takes a "no gain" approach (Kabat-Zinn, 2019; Qiu and Rooney, 2019), while relaxation has a specific goal. I contend that this is further muddled by the fact that secular uses of mindfulness such as MBSR are used as clinical interventions which all have goals.

Another element of confusion in relating this to my research is that in the literature "relaxation" usually refers to Relaxation Response therapies (RR), presented by Dr. Herbert Benson in the 1970s (Luberto *et al.*, 2020). The theory behind this is to move from the sympathetic "fight or flight"

component of the autonomic nervous system to the parasympathetic “rest and sleep” component, thereby relieving stress (Luberto *et al.*, 2020). RR involves progressive muscle relaxation by first tensing then releasing the muscles (Lancaster, Klein and Knightly, 2016; Luberto *et al.*, 2020). In my exercise the relaxation is more passive – the subject is asked to focus on an area and if they find tension to let it go. A cursory Google search brings up multiple mindfulness body scan exercises that include a similar gentle approach to releasing tensions, which come from sources connected to such reputable institutions as Harvard Medical School and UC Berkeley (see Appendix 3, p. 64).

Further research would be needed to determine if simply allowing the idea of relaxing tension changes the nature of a mindfulness body scan as much as RR does. If so, we would need to discover if that would be enough to affect the changes in brain waves that influence receptivity and cognition.

Next steps

I would like to see a further study that took place over a longer time frame and included more students, including a control group (Walser, 2019), as discussed above. There might be benefits to having multiple teachers involved so more students could participate, but that advantage could be offset by differences in presentation of the body scan (Kok and Singer, 2017; Sevinc *et al.*, 2018), so I conclude it’s best to have one teacher provide the exercise. With several teachers and their students participating, one teacher could provide the exercise at the beginning of each lesson, then the regular teachers could complete the lessons and make their own observations, providing more diverse points of view. Several studies have used recorded exercises (Guthrie *et al.*, 2022; Mirams *et al.*, 2013; Schroter, Siebertz and Jansen, 2023), but tailoring the exercise to the individual student is an essential element of this process. For example, in a student with persistent tension in the mouth or tongue, more time can be spent focusing on those areas, while with another student more attention could be given to breathing.

The measurements for this study were subjective observations, and not quantifiable. A mixed methods study, adding spectrographic analysis to confirm vocal changes, and EEGs to confirm changes in neural patterns would be fascinating, and would strengthen the validity of the results (Bell and Waters, 2018; Kelly and Cordeiro, 2020). Although such a study is far beyond my scope, I believe it could generate important and verifiable data that could be transferrable to a larger population (Morgan, 2014).

CONCLUSIONS

This study was successful on several levels, and there appear to be many indications that this is a subject worthy of further investigations. Many separate elements of this study have already been well researched. The goal of this investigation was to examine how these cognitive strategies could be interwoven to increase interoceptive awareness and enhance learning in a voice lesson.

- Singing is a complex perceptual motor learning activity (American Academy of Teachers of Singing, 2014; Crocco and Meyer, 2021; Maxfield, 2011), and many aspects of MLP apply.
- MLP shows that focus of attention should be externally directed, and feedback on mechanical functions is detrimental to learning (Crocco and Meyer, 2021; Holding, 2008; Bozeman, 2019; Song, 2019; Treinkman, 2021).
- Priming enhances memory and learning by unconsciously carrying over information from one exposure to the next (Bargh, 2022), but it is inhibited by instructions (Bargh, 2016; Verdolini, 2000).
- Priming happens best when the subject is in an experiential, more passive state (Bargh, 2022).
- It is widely accepted that interoception is a necessary component of singing (Angelakis, Andreopoulou and Georgaki, 2021; Aura *et al.*, 2022; Friedlander, 2018; Leal *et al.*, 2022; Tarvainen, 2018).
- Mindfulness training has been shown to increase memory, motor learning, cognition, and interoception (Blyskal, 2022; Gibson, 2019; Mirams *et al.*, 2013; Pollok *et al.*, 2014).
- Body scans, in particular, are shown to increase interoception (Fischer, Messner and Pollatos, 2017; Guthrie *et al.*, 2022; Kok and Singer, 2017; Schroter, Siebertz and Jansen, 2023).

I believe I have successfully connected these elements through the exercise I designed, although I could not hope to provide generalizable evidence of its effectiveness, given the time frame and the small sample. There were, however, strong indications of its positive effect. The results support

the existing research which shows the benefits of a mindfulness body scan to help manage stress and relieve tension, and to improve attentional focus (Blyskal, 2022; Gibson, 2019; Tarvainen, 2018; Rigg, 2017). Although there were positive signs, it was less definitive when addressing learning, as exemplified by improvements in technique, or development of IA, both of which must be inferred over time (Gibson, 2019; Holding, 2008; Treinkman, 2021). Since the study took place over a relatively short period, such inferences cannot be relied upon. However, five out of six participants showed improved technique that carried over from lesson to lesson. They also showed varied amounts of improvement in interoception or interoceptive awareness. The literature supports the contention that a body scan exercise will help develop IA (Kok and Singer, 2017; Mirams *et al.*, 2013), and improve cognition and motor learning (Blyskal, 2022; Gibson, 2019), and there were strong indications in this study that further validate that idea.

I have also reached two of my personal learning objectives. I have taken my researching and writing skills to a higher level, and improved my analytic skills, although they still have a long way to go. I have gained a much deeper understanding of interoception, although as Chen (2021) tells us, it is a nascent field. I also have a deeper understanding of the interactions between IA, mindfulness, and learning, which is informing my practice at every level.

Although more research is needed before we can reliably state that my exercise is an effective strategy to enhance IA, which was my third objective, this subject is ripe for further exploration. It most certainly has enriched my lessons, and I will continue to explore it in my practice.

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