

TURNITIN CHECK COPY

Part 1. Project Portfolio

1. Introduction

Post-traumatic Stress Disorder (PTSD) is a consequence of severe emotional trauma arising from prolonged and systematic exposure to traumatic events, often associated with military and emergency service personnel (Pezzin *et al.*, 2018). According to the Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (2013), the diagnosis of PTSD is characterised by four broad symptom clusters including the intense re-experiencing of traumatic events through disruptive memories and nightmares (Hegberg *et al.*, 2019); avoidance of trauma related stimuli; negative cognitions and mood (Pant *et al.*, 2022); difficulty concentrating and hyperarousal (Ophir *et al.*, 2020). It is reported that PTSD affects 7.6% of veterans and 3.5% of adults in the general population (Hedberg *et al.*, 2019). Whilst there are evidence based psychological interventions available, including Cognitive Behavioural therapy (CBT) (Foa *et al.*, 1999), Eye Movement Desensitisation and Reprocessing Therapy (EMDR) (Pitman *et al.*, 1996), they are time intensive, requiring highly specialised training and experience attrition rates between 20-30% (Hembree *et al.*, 2003). The resultant case management burdens and clinician accessibility challenges present an opportunity for active music participation (Baker *et al.*, 2018) to offer a practical, accessible and less stigmatising tool for self-management of symptoms relating to arousal and reactivity associated with PTSD (Landis-Shack *et al.*, 2017).

Barriers to treatment initiation for individuals with PTSD include stigma, lack of motivation, cost, and accessibility (Sayer *et al.*, 2009). In contrast, active music participation is a broadly accessible, low-cost intervention that may circumvent negative connotations associated with traditional mental health treatment approaches (Dickstein *et al.*, 2010). Kim *et al.* (2013) found that 39% of individuals with PTSD utilised complementary therapies, including mind-body practices, which positively impacted quality of life, reduced stress, and improved health outcomes. Singing, in particular, may benefit individuals with PTSD by engaging the parasympathetic nervous system (Perry *et al.*, 2023) and normalising cortisol levels (Fancourt *et al.*, 2016), thereby reducing psychological stress and enhancing cognitive and emotional control through disengagement from automatic thoughts (Sauer *et al.*, 2013; Perry *et al.*, 2023).

The artefact is a conceptual design (wireframe) of a mobile application offering evidence-based vocal pedagogical exercises aimed at supporting mental health and well-being along with improved vocal agency (Hogle, 2021). With an educational focus on breathing, movement, and vocalisation, the concept is framed through the lens of self-determination theory (Deci and Ryan, 2000) within a field of play (Eyre, 2021). The artefact is influenced by my lived experience with PTSD from more than two decades in law enforcement in Australia and the protective benefits associated with holding a professional singing career alongside. Understanding the intersection at which the psychological, cognitive and physical benefits of singing intersect with the challenges of PTSD has been the focus of my research with a future aim of providing practical, safe and ethical solutions for others (Yehuda, 2015). Whilst I do not currently operate a vocal studio, this project is approached through the lens of a researcher, and in practice, the artefact serves a dual purpose for development needs: it provides a conceptual framework for the development of a mobile application in support of individuals with PTSD and, provides further context and content in support of subscribers to a website that I manage which serves this population.

2. Planned Programme of Study

In the initial design phase, the theoretical, best practice and methodological influences relevant to the development of this artefact are explored.

2.1. Theoretical Influences

The theoretical frameworks that have influenced the design of this artefact are Self-Determination Theory and Flow Theory.

Self-Determination Theory

Self-Determination Theory, posited by Deci and Ryan (2000), maintains that individuals have innate psychological needs that must be met in order to thrive, driven by the desire to actively grow and improve (Deci and Ryan, 1996). Achieving mastery over one's challenges is essential for developing a cohesive sense of self, and independence is crucial to well-being and psychological health (Lopez-Garrido, 2023). This theory focuses on the internal sources of

motivation in pursuit of growth, wherein motivation is considered *intrinsic* when a pursuit is driven primarily by the satisfaction elicited from the activity itself rather than external rewards, be they positive or negative (Deci and Ryan, 2000; Davidson and Garrido, 2019). The concept of intrinsic motivation is critical to the development of this artefact as, in practice, engagement will primarily be self-governed, to the exclusion of traditional and immediate external rewards ie. grades, money, acclaim (Lopez-Garrido, 2023). It is anticipated that individuals will use it as an opportunity to explore, learn and actualise their potential (Coon and Mitterer, 2013) and improve their well-being over time and with practice.

In order to foster intrinsic motivation, three basic psychological needs must be met: *autonomy*, *competence* and *relatedness*. The first psychological need, autonomy, relates to the opportunity to self-govern in the absence of external forces (Deci and Ryan, 2000). As posited by van der Kolk (2006: p.277) individuals with PTSD may 'lose their way in the world' heightening the need to maintain control over one's destiny and the freedom to self-regulate, which is vital for learning (Davidson and Garrido, 2019) and recovery (van der Kolk, 2006). Autonomy is aligned with self-regulation, as the more individuals regulate themselves, the more they become intrinsically motivated and consider their actions are under their control (Deci *et al.*, 1996). Autonomy also influences the achievement of competence and relatedness and the degree to which one is satisfied from fulfilling their psychological needs (Davidson and Garrido, 2019).

The second psychological need, *competence*, relates to the experience of undertaking activities within reach of one's capacity (Deci and Ryan, 2000). An examination of competence highlights the connection to Flow Theory, the experience one has of being completely absorbed in an activity and losing track of time and things around them (de Brabander and Martens, 2014). Flow state represents a sense of complete immersion in the activity, deepened concentration and heightened alertness that is satisfying and pleasant (Csikszentmihalyi, 1991) and is characterised by a loss of self-consciousness. Csikszentmihalyi (1991) theorised that flow arises where the performance of an activity presents a challenge to the individual, yet is within reach of their competence. Level of challenge and level of competence are defined in four states in Table 1. Where no challenge is present and the level of competence is low, the person experiences *apathy* (Csikszentmihalyi, 1991). When the challenge is low but the level of competence is high, the person is likely to experience *boredom* (Csikszentmihalyi, 1991). Whilst a high challenge and low level of competence is an *anxiety*-provoking combination (Csikszentmihalyi, 1991). Thus, the aim is to create an artefact that offers content and activities at the optimal level of

challenge to match personal capabilities and a progression pathway as the individual advances, particularly as the intended user is likely new to singing and due to the importance of ensuring anxiety and apathy are minimised.

Table 1. Possible states produced by level of challenge and level of competence (adapted from de Brabander and Martens, 2014).

Four States Challenge and Competence		Challenge	
		Low	High
Competence	High	<i>Boredom</i>	<i>Flow</i>
	Low	<i>Apathy</i>	<i>Anxiety</i>

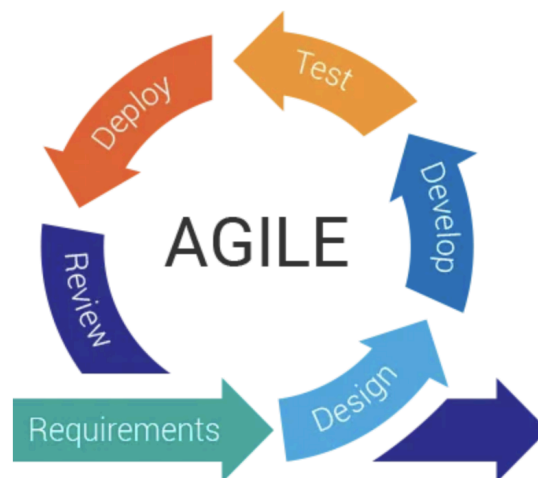
This state of flow also aligns with the emotion regulation strategies outlined in music-related emotion regulation literature, in particular *distraction* whereby an individual refocuses their attention away from a situation (Sakka and Juslin, 2018). Noteworthy, is that distraction may be either adaptive or maladaptive as an emotion regulation strategy depending upon whether it is combined with an attitude of acceptance or avoidance (Wolgast and Lundh, 2017). Whilst the exploration of Cognitive Behaviour Therapy and Acceptance Commitment Therapy are outside scope for this project, Wolgast and Lundh (2017) found that distraction strategies may be beneficial where it is used to redirect attention toward something else for a short period of time, but not as a means of avoiding aversive experiences altogether (Gratz, 2010). The aim therefore, is to identify the optimal arousal zone to cultivate positive adaptive reactions to beneficial stressors through singing, and avoid distress triggered by harmful stimuli (Saarikallio and Erkkilä, 2007; Van den Tol *et al.*, 2016; Reybrouck *et al.*, 2020).

Avoidance may be addressed through the third psychological need, *relatedness*. Relatedness is the ability to feel a sense of connection and belonging within a social group (Lopez-Garrido, 2023). However, individuals with PTSD experience a range of symptoms including avoidance of proximity to people, activities and places (Ophir *et al.*, 2020) presenting both a challenge and an opportunity in the development of this artefact. Whilst the inclusion of a community in a mobile application may be interpreted as an enactment of relatedness, where engagement is perceived

to be burdensome, autonomy may be negatively impacted (Arnold and Schneider, 2017). Similarly, notification features may be linked to competence as they enable negotiation of relationships, which then impact relatedness, but may adversely impact autonomy where individuals prefer privacy (Arnold and Schneider, 2017). Therefore, the need for relatedness may be addressed through the availability of support services, online community and personal messaging, with the user in complete control over the level of engagement through personalisation of settings (Alqahtani *et al.*, 2021).

Active participation in singing activities can fulfil the psychological needs for autonomy, competence, and relatedness. Singing has been shown to elevate mood (Dingle *et al.*, 2021), promote relaxation (Besk-Gernsheim *et al.*, 2000), and enhance mental alertness and cognitive performance (Schellenberg, 2004). Although considerable literature exists highlighting the well-being benefits of group singing (Williams *et al.*, 2018; Clift *et al.*, 2010; Clift *et al.*, 2017), singing alone allows individuals to avoid confronting the fear of singing with others (Hogle, 2021). This private practice enables full emotional expression without fear of judgement (Davidson and Garrido, 2019). Given that singing influences emotional processes (van der Kolk, 2000), the artefact must tailor the learning environment to meet individual needs and foster singing agency (Hogle, 2021). Singing agency refers to one's belief in their capacity to sing aloud, which is closely linked to autonomy, competence, and relatedness. Development of singing agency occurs in a safe, inclusive environment where individuals can set personal goals for vocal improvement and engage with supportive peers (Hogle, 2021).

In addition to autonomy, competence, and relatedness, Ruud (2012) identified four dimensions of quality of life that are enhanced by making music: vitality (emotional life, aesthetic sensibility, pleasures), agency (sense of mastery and empowerment, social recognition), belonging (networks and social capital), and meaning (continuity of tradition, transcendental values, and hope). The artefact aims to emphasise these dimensions in its design. Agency is the freedom to act independently and make decisions and is closely linked to autonomy (Davidson and Garrido, 2019). A lack of agency can lead to helplessness and depression, often co-occurring with PTSD (West and George, 2002; Ophir *et al.*, 2020). Promoting agency through singing enhances autonomy by facilitating self-monitoring which is essential for skill development and self-expression, thereby empowering individuals who may feel helpless in other aspects of their lives (Davidson and Garrido, 2019).



One principle of Agile is the joint elaboration of requirements (Sharma, 2020), which may be implemented through participatory design (Aryana and Brewster, 2021). This approach enhances mobile application design by considering subjective, hard-to-measure, and tacit aspects such as user experience (Aryana and Brewster, 2021). User involvement from inception is crucial, as poor design can negatively impact dropout rates and help-seeking behaviour (Brownell *et al.*, 2015). This iterative process has influenced the development of this artefact, drawing on mobile applications like 'PTSD Coach'. Developed by the Veterans Administration (USA) using participatory design and iterative input, PTSD Coach serves as a stand-alone psychoeducation resource based on cognitive behavioural therapy (C4TBH, 2024). Its four components - Learn, Self Assessment, Manage Symptoms and Find Support - are integrated into the Dynamic-Information-Motivation-Behavioural Skill Health Behavior Model, which comprises three constructs influencing behaviour change: information, motivation, and behaviour (Hides *et al.*, 2019). These constructs are vital for self-management in chronic illness, including PTSD (Deakin *et al.*, 2005), and are key considerations in the artefact's development.

Vocal Pedagogy Best Practice

The proposed artefact incorporates vocal pedagogical content across three domains: (1) breathing, (2) movement, and (3) vocalisation. These domains have been researched through the lens of evidence-based vocal pedagogy and trauma informed practice.

Ragan (2018) defines evidence-based vocal pedagogy as a framework that, 'acknowledges the importance of both scientific voice research and anecdotal evidence, along with consideration of the experience acquired by the teacher and the importance of individual student needs' (Ragan, 2018, p.1). With respect to each educational domain within this artefact, evidence-based research has been sought to identify effective exercises that support both vocal and mental health of the user. A trauma-informed approach has also been adopted. Characterised by an awareness of the impact of trauma, the various pathways to recovery and that experience of trauma may be accompanied by signs and symptoms, efforts are made to prevent re-traumatisation (Monti *et al.*, 2024; Tebes *et al.*, 2019). The artefact, therefore, emphasises core principles of safety, trustworthiness, choice, collaboration, empowerment, and respect for diversity (Kezelman, 2021). These principles are enacted through: strict engagement and privacy policy to protect users; availability of support services for urgent and non-urgent psychological care; provision of robust, evidence-based exercises proven effective for managing

PTSD and anxiety symptoms; offering a flexible user experience with customisation to opt in or out of features like community interaction, notifications, and gamification; inclusive language and accommodating various learning styles via visual, audio and written content.

2.3. Methodological Influences

Methodological influences are considered based on the integration of theory and practice through narrative literature review and artefact development.

Literature Review

A narrative literature review will examine three educational domains - breathing, movement and vocalisation - to identify methods and exercises that provide evidence-based support of mental health and well-being. The review will also assess the design, functionality, and usability requirements for mobile applications supporting both mental health and vocal pedagogy, incorporating insights from participatory design. The central research question is: *How might individuals with PTSD be effectively supported in self-managing symptoms through well-being-focused vocal pedagogy delivered via mobile application?* This question allows for the integration of diverse data sources, reflecting a mixed-methods approach (Efron and Ravid, 2019) that values both quantitative and qualitative perspectives (Creswell, 2009). The focus of the review will be pragmatic and practical with the research question the central focus (Creswell, 2009).

Bruce (2001) offers eight considerations - topicality, comprehensiveness, breadth, relevance, currency, exclusion, authority, and availability - which provide a framework for determining inclusion and exclusion criteria. *Topicality* involved scanning abstract and discussion sections to ensure the literature addressed the review topic. *Comprehensiveness* led to a broadening of keywords in search of literature related to breathing, movement and vocalisation along with mobile application development in support of mental health. *Breadth* allowed for sources beyond the specific review topic for context, such as technical aspects of mobile application development. *Relevance* included interdisciplinary sources in vocal pedagogy, education, psychology and technology, whilst *currency* favoured research from the past 10 years, with historical references for context. *Exclusion* criteria eliminated studies related to individuals under 18, non-English sources or those without English translation, and studies related to spiritual

practices ie. Pranayama, Yoga and Qigong. Limited *availability* restricted access to some relevant but subscription-based sources.

Artefact Development

Knowledge gleaned from the literature review will inform the Agile development methodology at its entry point: requirements (Figure 1). This review will elucidate not only the technological needs in design, functionality, and usability but also content requirements related to vocal pedagogy and mental health through participatory research (Aryana and Brewster, 2021). Participatory research is essential for this artefact, as it values inclusivity and engages those intended as beneficiaries, users, and stakeholders, enhancing the artefact's relevance (Macaulay, 2017). Requirements will shape the design of a wireframe - a visual guide for the mobile application framework (Gemayel, 2019). Tools considered for design included Affinity Designer, SquareSpace, Adobe XD, Figma, Balsamiq and Canva. With the exception of SquareSpace, each program required specialised skill and financial resources. Whilst SquareSpace was familiar, it did not possess the flexibility and functionality required to design this artefact, even through a third party progressive web application (PWA) like Progressier. Canva was deemed the most suitable tool as it possessed the requisite flexibility to design a wireframe with sufficient detail to visualise the mobile application.

Ethical Considerations

Several ethical frameworks govern this review and artefact development. The *Australian Code for the Responsible Conduct of Research* (2018) outlines principles for honest, ethical and conscientious research within Australian academic contexts. Although my research is not conducted under the auspices of an Australian institution, the code provides relevant guidelines for responsible research in a local context. Additionally, the *University of Wales Trinity Saint David Research Ethics and Integrity Code of Practice* (2022) governs this desktop review and artefact development, emphasising honesty, rigour, transparency, respect, and accountability (UWTSD, 2022). Furthermore, the ethical frameworks of the *Australian National Association of Teachers of Singing* (2023), the *Australian Music Therapy Association* (2021), and the *Australian Psychological Society* (2007) offer guidance. Whilst a clear distinction exists between vocal pedagogy and music therapy or psychology, these frameworks provide a broad foundation for ethical practice relevant to this research and artefact development.

2.4. Aims and Objectives

This artefact aims to provide an accessible, evidence-based and cost-effective resource for individuals with PTSD, facilitating the self-management of symptoms through vocal pedagogy specifically tailored to their unique needs, by:

1. Evaluating the effectiveness of singing for well-being and in support of mental health.
2. Exploring potential methods for breathing, movement and vocalisation that may provide symptomatic support to individuals with PTSD.
3. Analysing the technical mobile application requirements across vocal pedagogy and mental health to inform design of the artefact.

2.5. Expected Learning Outcomes

The expected learning outcomes include:

1. Knowledge, insight and understanding of the benefits of singing in promoting well-being and supporting mental health.
2. Identification of potential evidence-based breathing, movement, and vocalisation exercises tailored to individuals with PTSD for effective symptom management.
3. A comprehensive understanding of the technical requirements for mobile applications focused on vocal pedagogy and mental health.

2.6. Activities and Assessment Criteria

The activities to be undertaken reflect the structure outlined by Efron and Ravid (2019). Initially, the literature review will confirm the research topic and refine its scope based on constraints such as time, purpose, access, and audience. Next, a review question will be developed to ensure it is sufficiently narrow for in-depth understanding while remaining broad enough to encompass various research approaches and methods. Appropriate terms and keywords (see Table 2) will then be identified for literature searches, and the literature will be analysed by documenting themes and summarising content. Finally, the review will be organised and synthesised into a coherent narrative that demonstrates the integration of theory and research,

reflecting a thorough understanding of the topic (Efron and Ravid, 2019). The literature has been examined through searches in the University of Wales Trinity Saint David digital library and platforms such as PubMed, Elsevier, Science Direct, Sage, Research Gate, and Google Scholar, primarily relying on white literature while considering grey literature for insights into technological concepts.

Table 2. Keywords for Literature Search.

Keywords for Literature Search			
Breathing	Movement	Vocal Pedagogy	Technology
Breathing Techniques for Singers	Movement and Singers	Vocal Pedagogy	Mobile Applications and Singing
Breathing Techniques for Anxiety	Movement and Anxiety	Vocal Pedagogy and Mental Health	Mobile Applications and Vocal Pedagogy
Breathing and Vocal Pedagogy	Movement and Vocal Pedagogy	Singing and Mental Health	Mobile Applications and Mental Health
Breathing and Emotion	Movement and Emotion	Singing and Well-Being	Mobile Applications and Education
Breathing and Emotion Regulation	Movement and Emotion Regulation	Singing and Emotion Regulation	Mobile Application Design

Assessment Criteria

A Build Review Checklist will assess how well the artefact meets its aims and objectives. This checklist, informed by the literature review, will outline the design, functionality, and usability requirements for vocal pedagogy and mental health mobile applications based on participatory design principles. In Part 2, the artefact will be evaluated against the technical requirements specified in the Build Review Checklist (see Appendix 4).

2.7. Timescale and Review Dates

For a condensed version of the timescale for project activities see Table 1.1. For a detailed GANTT chart for project activities see Appendix 1.

Table 3. Timeline for Completion of Project Activities.

ACTIVITIES	JUN 2024	JUL 2024	AUG 2024	SEPT 2024	OCT 2024	NOV 2024
Definition Phase						
Research Phase						
Content Phase						
Design Phase						
Review Phase						
Submission Phase						

3. Critical Review

A critical review of the learning experience across Part 1 and Part 2 is undertaken using Kolb's Theory of Experiential Learning (ELT) (Kolb, 1984; Duinker, 2023). Kolb (1984) describes experiential learning as 'the process whereby knowledge is created through the transformation of experience' (Kolb 1984, p. 41) and constitutes a four stage learning cycle: concrete experience, reflective observation, abstract conceptualisation and active experimentation (Akella, 2010).

Concrete Experience

During the conception phase, the goal was to develop a live, interactive mobile application featuring curated video and audio content across three educational domains: breathing, movement, and vocalisation. Extensive preparatory research assessed the viability of three development methods: native, web, and hybrid applications (Soegaard, 2024). Each method presented distinct advantages and disadvantages, proving complex in synthesis. Although a native application would ideally serve the project best, it was beyond my technical expertise and financially prohibitive. Consequently, a hybrid application emerged as a viable alternative using platforms like Passion.io, BuildFire and Bubble.io. These Software Development Kit (SDK) platforms offer design flexibility, robust functionality, and a strong user experience, albeit at a significant monthly maintenance cost. Progressive Web Applications (PWAs), such as those provided by Progressier, were also considered for their cost-effectiveness and web browser

accessibility (Mendes, 2024); however, their functionality limitations made them less suitable for development of this artefact.

During the research phase, it became clear that the educational domains of breathing, movement and vocalisation required more extensive attention than the module allowed. Part 2 reviews one method per domain, but preparatory research also examined additional techniques, such as the Accent Method (Chapman, 2006), Diaphragmatic Breathing Method (Devi, 2021), Pilates (Mezzedimi, 2019), and the Alexander Technique (Schlinger, 2006). Finding literature linking these vocal pedagogy techniques to mental health benefits proved challenging, necessitating broader search terms. Additionally, limited participatory research in mobile application development within vocal pedagogy and mental health hindered the creation of a comprehensive Build Review Checklist for assessing the artefact. Furthermore, the artefact could not be iteratively reviewed and refined by beneficiaries without ethics approval, leading to assessment based solely on insights from participatory research in vocal pedagogy and mental health.

Reflective Observation

Upon reflection, delivering an interactive live mobile application proved overly ambitious within the module's timeframe and scope. While the initial focus was on the educational content, it quickly shifted to the vast technical development aspects necessary to support that content. Consequently, the research phase extended beyond the allocated time frame, delaying the design phase. Although participatory design in vocal pedagogy and mental health mobile applications offered useful guidance, it lacked the specificity required to ensure the mobile application would be fit for purpose for individuals with PTSD. This highlights the need for further participatory design research focused on this artefact and the intersection of vocal pedagogy, mental health and mobile learning (Shi, 2020).

Engaging with this project as an insider researcher presented unique personal challenges. My background as a professional singer and experience with PTSD informed the artefact's design, offering valuable insights into potential solutions. However, a continual focus on a personally relevant 'problem' risked maladaptive emotion regulation strategies, such as rumination, which can exacerbate negative emotions (Sakka and Juslin, 2018). This created an ethical challenge, necessitating the implementation of risk mitigation strategies and a commitment to self-care. To maintain balance, I documented reflections in a journal, stayed physically active, adhered to a

sleep schedule and engaged in singing as a mindfulness practice. Additionally, I ensured access to psychological support services, prioritising my well-being throughout the research process (Chammas, 2020).

Abstract Conceptualisation

To actualize this artefact as a live mobile application, several critical steps must be undertaken. Firstly, the efficacy of selected evidence-based exercises in breathing, movement, and vocalisation should be assessed specifically for individuals diagnosed with PTSD. Additionally, it is essential to identify the technical requirements of users with PTSD to ensure the application is appropriately and specifically tailored to their needs. Furthermore, the development of the application will necessitate either advanced technical expertise or external funding. These components will further collectively inform the iterative design process within an agile methodological framework. The realisation of this artefact holds personal significance, as it contributes to my overall research focus and fulfils my desire to assist those suffering from PTSD. The exercises explored have been beneficial to me over the years and, if further examined for this population, can provide others with an accessible, cost-effective, and non-stigmatizing tool for self-management of symptoms.

Active Experimentation

This artefact underscores the potential of a mobile application designed to support individuals with PTSD through evidence-based vocal pedagogical exercises. Recognizing the complex nature of PTSD - characterised by symptom clusters such as re-experiencing traumatic events, avoidance, and hyperarousal (Hegberg *et al.*, 2019; Pant *et al.*, 2022) - this artefact aims to provide a practical and accessible resource that addresses common barriers to traditional treatments, including stigma and cost (Sayer *et al.*, 2009). The application, focusing on breathing, movement, and vocalisation, aligns with self-determination theory to empower users in managing their symptoms. By leveraging personal experiences from over two decades in law enforcement and the therapeutic benefits of singing, the artefact seeks to create a safe, ethical, and effective tool that bridges the gap between psychological support and accessible self-management strategies, ultimately enhancing the quality of life for those affected by PTSD.

4. Conclusion

Part 1 has outlined the rationale for the artefact, identified theoretical, best practice and methodological influences, and specified the aim, objectives and timeframe for the study. In Part 2, the focus will shift to examining the role of singing in promoting mental health for individuals with PTSD, emphasising the benefits of breathing, movement, and vocalisation. Additionally, it will explore the design, functionality, and usability requirements for developing a mobile application that integrates vocal pedagogy and mental health support, addressing the review question: *How can individuals with PTSD be effectively supported in self-managing symptoms through well-being-focused vocal pedagogy delivered via mobile application?*

Part 2

1. Introduction

Active participation in singing, with its capacity for social, emotional, cognitive and physical engagement, demonstrates potential as a complementary intervention for a range of mental health disorders in a variety of settings (Clark and Harding, 2012). Emergency service personnel experience diminished mental well-being, heightened psychological distress and are diagnosed with PTSD at twice the rate of the general adult population (Kyron *et al.*, 2023). Prevalence of PTSD in active emergency service personnel is estimated at 10% and significantly higher amongst retired personnel (Phoenix, 2020). Barriers to mental health help-seeking include lack of motivation, cost and accessibility, compounded by the perception of stigma and weakness (Haugen *et al.*, 2017; Jones *et al.*, 2020), with departmental psychological services being the least preferred option (Tamraker *et al.*, 2020). This review and accompanying artefact are grounded in my own experience with PTSD, acquired from more than two decades in law enforcement with a professional singing career alongside. Singing has been integral to my psychological, physical and cognitive recovery, inspiring a deeper exploration into the mechanisms behind its therapeutic benefits.

This study addresses barriers to help-seeking by developing an artefact for the self-management of PTSD symptoms through vocal pedagogy, utilising accessible, low-cost, and less stigmatising digital technologies. To achieve this, an examination will be conducted of breathing, movement and vocalisation exercises relevant to vocal pedagogy that demonstrate benefits for mental health. Additionally, the study will investigate the design, functionality, and usability requirements of mobile application users within vocal pedagogy and mental health contexts. The artefact, a conceptual wireframe of a mobile application, will provide evidence-based educational content related to vocal pedagogy that supports mental well-being (Ghordadekar *et al.*, 2020). Grounded in self-determination theory, the artefact promotes singing agency and the element of play (Eyre, 2021) whilst drawing upon both research and personal experience, reflecting my work at the intersection of singing and trauma. This exploration will adopt a multidisciplinary approach using the Practice as Research Framework proposed by Nelson (2013): Know That, Know How, Know What.

2. Literature Review

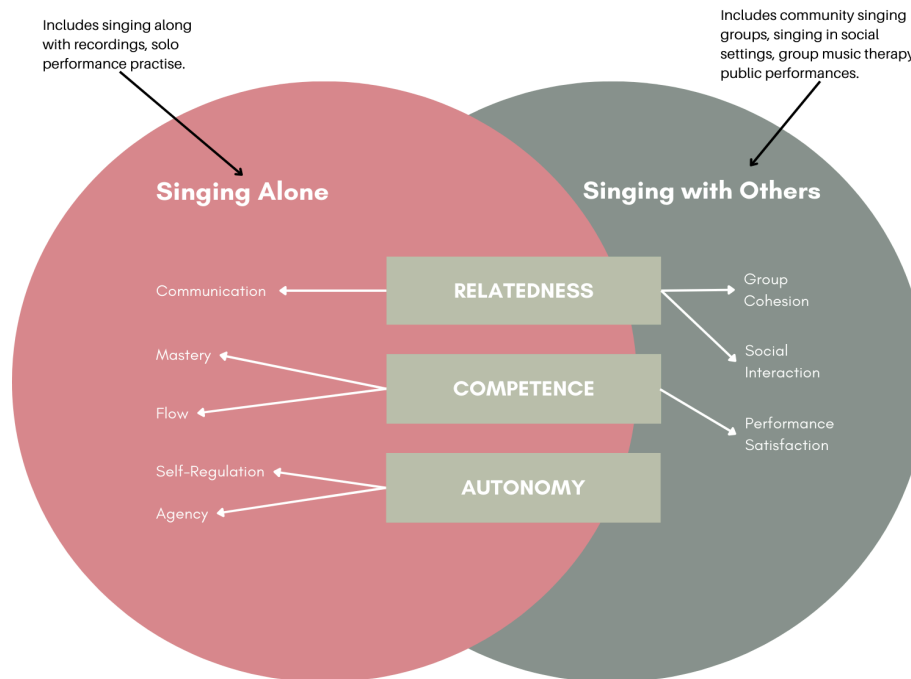
2.1. Know That

The process by which music influences and regulates human affect is complex (Brattico *et al.*, 2013) and yet, music remains the most commonly reported means of inducing, regulating (Schafer *et al.*, 2013) and managing emotions (Hides *et al.*, 2019). Active participation in singing may provide a mode for self-management of symptoms for a range of mental health disorders (Hides *et al.*, 2019; Williams *et al.*, 2018). Singing may enhance psychosocial factors, improve mood, reduce anxiety and increase motivation through meaningful experience (Clark and Harding, 2012). Physiological health benefits include reduction in cortisol and increased levels of salivary immunoglobulin A, which boosts the immune system (Beck *et al.*, 2000; Beck *et al.*, 2006; Kreutz *et al.*, 2004). Additionally, singing provides physical relaxation, emotional release, stress reduction and a sense of emotional and physical well-being (Bailey and Davidson, 2002; Bailey and Davidson, 2005; Clift *et al.*, 2010; Clift *et al.*, 2017). Cognitive benefits include improved concentration, orderly thought processing and spatial-temporal reasoning (Rauscher and LeMieux, 2003; Davidson and Garrido, 2019), cognitions which are often impaired in PTSD (Ophir *et al.*, 2020). Improvements in problem solving, language skills and mental reasoning resulting from active participation in singing may flow into other life domains (Davidson and Garrido, 2019).

Singing enhances psychological and social well-being by fulfilling the psychological needs of autonomy, competence and relatedness (Figure 1) (Davidson and Garrido, 2019). According to Self-Determination Theory (Deci and Ryan, 2000), psychological needs must be met alongside physiological needs for individuals to thrive. The theory emphasises fostering intrinsic motivation, which contrasts with traditional educational practices that often rely on extrinsic rewards, such as grades or awards (Deci *et al.*, 2001). These external incentives may inadvertently diminish intrinsic motivation (Davidson and Garrido, 2019). Intrinsic motivation represents a 'drive from within' rather than via external pressure (Deci and Ryan, 2000). Motivation is driven by the inherent satisfaction derived from the activity itself rather than external reward. It is this intrinsic motivation, this 'drive from within' that is sought to be encouraged in the user experience of this artefact. Briefly, *autonomy* involves the ability to self-govern in the absence of external pressures (Davidson and Garrido, 2019), *competence* pertains to the engagement in activities aligned with their capabilities and, *relatedness* refers to the sense of connection with others in the context of the activity (Deci and Ryan, 2000). When

autonomy, competence and relatedness are achieved, individuals experience enhanced well-being and positive health outcomes (Ryan and Deci, 2000).

Figure 1. A Model of the Mechanisms Underpinning the Psychological Benefits of Singing (Adapted from Davidson and Garrido, 2019).



Singing offers individuals with minimal musical experience the satisfaction of mastering a skill and the potential to achieve a *flow* state, providing an escape from daily concerns (Davidson and Garrido, 2019). It promotes healthy emotion regulation strategies (Hides *et al.*, 2021) and fosters singing agency, which is linked with psychological processes that influence emotions (Hogle, 2021). While literature highlights the well-being benefits of group singing (von Lob *et al.*, 2010; Coulton *et al.*, 2015; Clift *et al.*, 2017; Williams *et al.*, 2018), this approach may not suit individuals with PTSD, due to the expression of avoidant and isolating behaviours (Hopper *et al.*, 2007). Singing alone facilitates emotional expression without performance pressure, enhancing cathartic effects and promoting singing agency (Hogle, 2021). Barriers to singing agency may be mitigated by creating supportive learning environments focused on enjoyment (Pascale, 2005; Hoover, 2005; Hogle, 2021) encouraging individuals to set personal musical

goals while engaging in metacognitive assessment of their progress (Richards and Durrant, 2003).

Eyre (2021) posits that the experience of *being in* the music rather than *doing* something with the music creates a 'field of play', that is powerful for traumatised individuals when imagery, body and voice are unified in music (Kenny, 1987). The concept of 'field of play' has influenced the design of the artefact through focusing on mind-body practices including breathing, movement and vocalisation. Interestingly, 39% of individuals with PTSD use complementary and alternative medicine interventions that include breathing and movement (Kim *et al.*, 2013). Kim *et al.* (2013) argues that normalisation of cortisol negative feedback inhibition in the HPA axis is associated with symptom improvement through mind-body exercises. The literature offers substantial evidence that mind-body interventions positively impact quality of life, reduce stress and improve health outcomes amongst individuals with PTSD (Goodridge *et al.*, 2013). Therefore, singing offers integration of mind, body and emotion in one modality.

Deficits in emotion regulation, being the ability to identify, evaluate, express and modify emotions, are important risk and maintaining factors for PTSD (Hides *et al.*, 2019). Emotion regulation requires the development of emotion skills such as awareness of one's emotional state, directing one's attention away from the cause of a negative emotion, cognitively appraising the cause of the negative emotion and accepting, discharging or suppressing a negative emotional state (Hides *et al.*, 2019). Although healthy individuals successfully use various genres and types of music for emotion regulation, research suggests that the use of music-related interventions in self-regulation strategies may differ between healthy and clinical populations (Carlson *et al.*, 2015). This artefact considers the use of *distraction* as an adaptive emotion regulation strategy through vocal pedagogical instruction. In addition, duration of singing interventions is an important variable associated with greater therapeutic outcomes. McNaughton *et al.* (2017) claims that a dose-response relationship exists between singing and physiological indicators. Goodridge *et al.* (2013) offers that after three months of singing training, a plateau in physical function is reached, after which, there would be minimal increase in benefits even if the intervention or dose is increased. This may explain why no significant physical changes may be found after singing interventions in professional singers (Goodridge *et al.*, 2013; Kang *et al.*, 2017), however, this may not be representative of clinical populations where the purpose is emotion regulation not performance.

2.1.1. Breathing

Slow breathing has been shown to have a balancing effect on the autonomic nervous system via enhanced parasympathetic activation and stimulation of stretch-induced inhibitory signals (Kim *et al.*, 2013) which reduce the prevalence of symptoms in individuals exhibiting subclinical features of PTSD. It also enhances vagal activity, leading to reduced psychophysiological arousal, decreased sympathetic activity and stress responses associated with reduced PTSD symptom severity (Kim *et al.*, 2013). By activating both the parasympathetic and sympathetic nervous system, breathing exercises may produce a state of both alertness and calm (Seppälä *et al.*, 2014). Since engaging in traditional mindfulness practices may be challenging for individuals with a high degree of physiological arousal, structured breathing exercises may be preferable because it engages the participant in a structured activity that leads to immediately observable calming effects (Brown and Gerbarg, 2005). Given that changes in respiration can alter emotional states (Boiten *et al.*, 1994), manipulation of the breath may offer control over anxiety, further underscoring the applicability of respiration-based interventions for anxious populations (Arch and Craske, 2006; Seppälä *et al.*, 2014). A week long study of breathing based meditations conducted by Seppälä *et al.* (2014) demonstrated promise as a viable alternative for addressing PTSD and suicide in returning veterans. The study resulted in reduced PTSD symptoms, anxiety and respiration rate with the strongest effect on hyperarousal and re-experiencing symptoms (Seppälä *et al.*, 2014). These findings are promising given that of the many PTSD symptoms, hyperarousal yields the strongest influence on health-related quality of life (Doctor *et al.*, 2011).

Emotional extremes like anxiety, fear or stress leading to hyperventilation is a common response in PTSD (Nardi *et al.*, 2009). Exercising low volume breathing aimed at altering CO₂ tolerance has proven to provide curative benefits (Roth, 2005; Ghordadekar *et al.*, 2020). These efforts result in minimal accumulation of CO₂ in the brain, conditioning it to tolerate higher levels of the gas. Additionally, short-term exposure to the sensation of air hunger reduces the body's panic response, thereby decreasing the likelihood of hyperventilation (Jain, 2021). Practising the process of monitoring, regulating and slowing down one's breath, whilst creating a sense of introspection has been found to help people relax and cope better in stressful circumstances (Jain, 2021).

A practical example of a breathing technique that integrates vocal pedagogy and mental health is the Buteyko Method, developed by Ukrainian Doctor Konstantin Pavlovich Buteyko in the 1950's. This method employs apnea exercises to regulate respiratory rate and tidal volume, aimed at optimising the oxygen and carbon dioxide ratio in the bloodstream in a healthy way (Subramanian *et al.*, 2023). The technique is based on three core principles: nasal breathing, reduced breathing, and relaxation (Singh and Raghavendran, 2021). Nasal breathing protects the airways by heating and purifying the air (Singh and Raghavendran, 2021). Reduced breathing introduces the Control Pause (CP), which is a pause between breaths that helps lower respiratory rate and restore normal carbon dioxide levels in the lungs (Singh and Raghavendran, 2021). A slight breathlessness is maintained through the relaxation of breathing muscles, an erect posture, and mild abdominal tension (Subramanian *et al.*, 2023). This sensation of air hunger, which is natural during exercise and singing, does not necessitate a fear response (Jain, 2021). Subramanian *et al.* (2023) found that nursing staff reported benefits from this technique such as reduced stress, enhanced awareness of internal and external experiences and improved attention and activity. This artefact incorporates simple Buteyko Method breathing exercises as educational content.

2.1.2. Movement

Individuals with PTSD exhibit reduced engagement in regular physical activity compared to pre-injury levels (de Assis *et al.*, 2008) which may contribute to medical, cognitive and neural co-occurring diseases (Voss *et al.*, 2014; Vaynman *et al.*, 2006). Although the precise mechanisms by which exercise benefits PTSD remain unclear, various psychological, cognitive, and neurobiological pathways may explain the improvements (Hegberg *et al.*, 2019). Anxiety reductions associated with exercise may not arise from the exercise itself but from the diversional aspects of the activity, which offer a *distraction* from daily stressors (Kolt and McConville, 2000). Regardless of the mechanisms, movement interventions have been shown to enhance body awareness by integrating sensory information, thus supporting affect regulation (Malviya, 2022). Interoceptive, body-oriented therapies can address a core issue in PTSD: individuals often experience the present through physical sensations and emotions linked to past trauma (van der Kolk, 2006). Movements that enhance self-awareness and self-regulation may lead to the discovery of new action patterns and novel ways of engaging with their surroundings, fostering mastery and enjoyment (van der Kolk, 2006).

The Feldenkrais Method (FM) is a form of somatic education that employs a mind-body approach to learning that enhances psychological and physical well-being through interoceptive mechanisms (Ahmadi *et al.*, 2020). FM has diverse applications, including instruction for musicians, promoting self-acceptance, reducing stress and anxiety, and offering strategies to manage depressive thoughts (Martin *et al.*, 2024). A central tenet of FM is to facilitate enhanced emotional expression, creating a potential positive feedback loop (Feldenkrais, 2013). FM emphasises the strong interconnection between action patterns, bodily sensations, and cognitive processes (Martin *et al.*, 2024). Research by Kolt and McConville (2000) found that FM effectively reduces anxiety in female participants by providing temporary distractions from negative thoughts and emotions. Additionally, FM can lower perceived exertion during movement, induce relaxation, elevate mood, enhance learning ability, and reduce anxiety (Kolt and McConville, 2000).

Feldenkrais posited that liberation from compulsive behaviours relies on cultivating self-awareness and adopting more adaptive behavioural patterns (Martin *et al.*, 2024). Martin *et al.* (2024) conducted a systematic literature review on the application of FM for psychological issues, psychiatric disorders and emotional dysregulation. One advantage of FM is its role as a learning framework, which reduces the stigma associated with disease-centric interventions (Martin *et al.*, 2024). The lessons are not specific to anxiety, depression, PTSD, or vocal pedagogy. Instead, they are generalizable and focus on alleviating symptoms by encouraging individuals to observe their sensations with curiosity and neutrality, engage in simple bodily experiments, and foster a secure feedback loop between sensations while reducing effort intensity and expanding freedom from restrictive patterns (Martin *et al.*, 2024). This metacognitive awareness of the mind-body connection is believed to enhance growth, learning and mastery (Wallman-Jones, 2023). This artefact will incorporate FM exercises for vocal health, addressing the interplay between physical and psychological well-being (Martin *et al.*, 2024).

2.1.3. Vocalisation

A study by Scherer *et al.* (2013), found that participants with PTSD demonstrated significantly different voice quality characteristics to control participants, particularly in terms of tense voice qualities. Further, reduced frequency range in vowel production, and reduced expressivity, result from the impact on motor control in speech production (Scherer *et al.*, 2016). These issues may

be addressed through appropriate vocalisation exercises which are essential for warming up the voice, correcting vocal faults (ie. poor breath support causing pitch intonation and pressed phonation issues) (Ter *et al.*, 2022), extending vocal range, and acquiring vocal technique (eg. learning to sing intervals, legato, staccato and control of dynamics) (Gish *et al.*, 2012). Generally these exercises include: (1) stretching, (2) breathing, (3) semi-occluded vocal tract exercises (SOVT), and (4) resonant voice exercises (Ragan and Kapsner-Smith, 2019). Vocal warm-up increases blood flow and oxygenation, promotes muscle flexibility, improves vocal projection and articulation (Sousa *et al.*, 2020). Singing teachers broadly apply traditional vocal warm-ups (TVW) to optimise breath support, voice placement and vocal timbre (Portillo *et al.*, 2018) whilst speech-language pathologists commonly deploy physiological vocal warm-up exercises as vocal rehabilitation exercises. Vocal warm-up is vital to prevent vocal fold injury and achieve optimal voice function in both untrained and professional singers (Gish *et al.*, 2012). Given that the intended user of this artefact is likely to be a non-singer and a goal is to foster competence, the artefact will initially offer simple vocal warm-ups using SOVT exercises with a view to extending the offering to include TVW.

Semi-occluded vocal tract exercises are a well known method used by vocal pedagogues for centuries in support of the healthy and economical production of voice (Orhon *et al.*, 2022). In particular, SOVT exercises are used to reduce excessive tension in the vocal tract and improve the quality of the resonant voice (Nam *et al.*, 2019; Sahin, 2020; Orhon *et al.*, 2022). The aim is to achieve normal voice intensity and power with less mechanical stress to the laryngeal tissue, less effort for the muscles and less energy loss (Orhon *et al.*, 2022). With SOVT exercises, a wide range of pitches and volumes may be produced without too much impact on the vocal folds, which is helpful for new singers. SOVT exercises are designed to improve vocal fold vibration efficiency and physiological conditions and enhance phonation efficiency to achieve resonant voice (Christmann and Cielo, 2017; Portillo *et al.*, 2018). Straw phonation (SP) and humming are instances of exercises with a single source of vibration into the vocal tract (i.e., vocal folds), while lip trills and tongue trills are examples of exercises with a secondary source of vibration that should exert a massaging effect on vocal organs (Saldías *et al.*, 2020). According to Titze (2006), in comparison to the other five progressive exercises (i.e., tongue trills, lip trills, bilabial fricatives, phonation into tubes and humming), SP is the most efficient and easiest to master (Titze, 2006). Untrained singers may consider SP as a starting point and progress to TVW as competency improves (Ter *et al.*, 2022). SOVT exercises have been

incorporated into the content of this artefact as a starting point for untrained singers to develop competence.

2.2. Know How

Nelson's (2013) 'Know How' considers how that propositional knowledge gained through literature review in 'Know That', is now embedded within the artefact. The artefact is a wireframe for a mobile application called 'WellSing' (Appendix 4) with embedded knowledge considered across three interconnected domains: (1) design, the aesthetic aspects including colour and layout (Appetiser, 2024), (2) functionality, capabilities that are meaningful to the user (McNamara *et al.*, 2006) and, (3) usability, the extent to which the artefact may be used to achieve goals with effectiveness, efficiency and satisfaction (ISO, 2018).

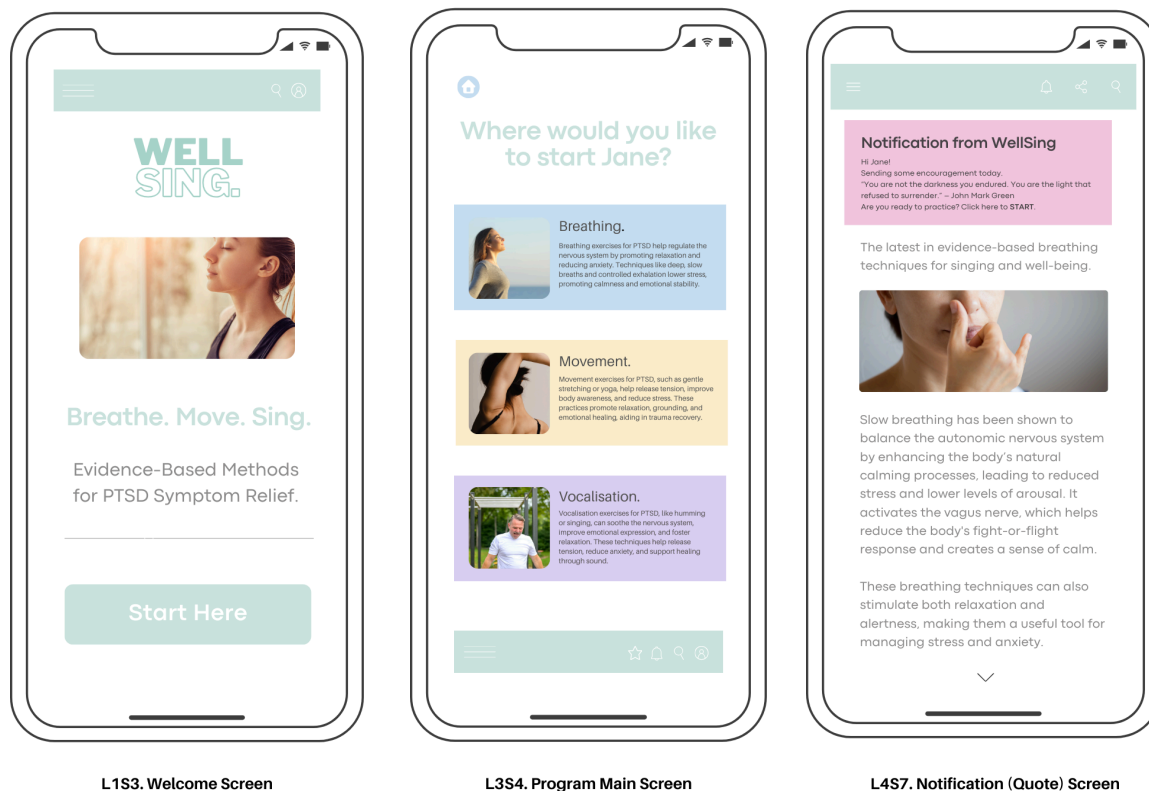
2.2.1. Design

The design of the artefact is informed by participatory design studies primarily focused on development of mental health applications (Alqahtani *et al.*, 2021; McClelland *et al.*, 2018). The aesthetic characteristics preferred by users was simple navigation with personalised features, including images, background, colour and text options (McClelland *et al.*, 2018). A preference for a name that did not refer to ill-health and universally simple language organised in a non-overwhelming fashion was articulated (Alqahtani *et al.*, 2021). Colour preferences included bright, happy and calm tones (Appendix 6). As studies postulate that certain colours correlate with specific moods and can determine psycho-emotional states (Hussain, 2021; Hettiarachchi and Perera, 2022), careful consideration was afforded the standard colour scheme of this artefact, along with user customizability across colour, text and background options.

Whilst bright colours were preferred, low saturation levels have been found to aid in decreasing anxiety as they have limited power to stimulate (Ireland *et al.*, 1992; Mahnke, 1996) and cool colours alleviate mental distress (Bandara and Hettiarachchi, 2022). Green, considered a cool pacifying colour, was found to manage depression, anxiety and stress levels (Bandara and Hettiarachchi 2022; Gul *et al.*, 2015) and evokes a strong experience of hope (Edwards, 2023). Generally recognised as a peaceful colour, blue has been found to reduce stress in students (Azeemi *et al.*, 2018) albeit an earlier study found blue to be negatively associated with depression (Oslie, 2000). Yellow has also been found to lower anxiety (Hefling, 2001) and pink

has demonstrated far less anxiety provoking outcomes than red (Profusek and Rainey, 1987). Notably, whilst red may trigger feelings of anxiety, danger, avoidance or failure (Elliot *et al.*, 2007), in the general population this may improve intrinsic motivation and the desire to continue learning (Heidig *et al.*, 2015). However, this artefact seeks to avoid these psychological outcomes and negative interactions. As research has found that preference for blue, green and white persisted cross-culturally (Kimmons, 2020) these colours form the basis for the artefacts aesthetic, in low saturation, to optimise feelings of hope and peace whilst being bright enough to be engaging and playful (Figure 3). Due to the colour variations, the design is offset with ample white space (Kimmons, 2020).

Figure 3. Mobile Application Screens Depicting Colour Scheme, Application Name and Simplicity of Design.



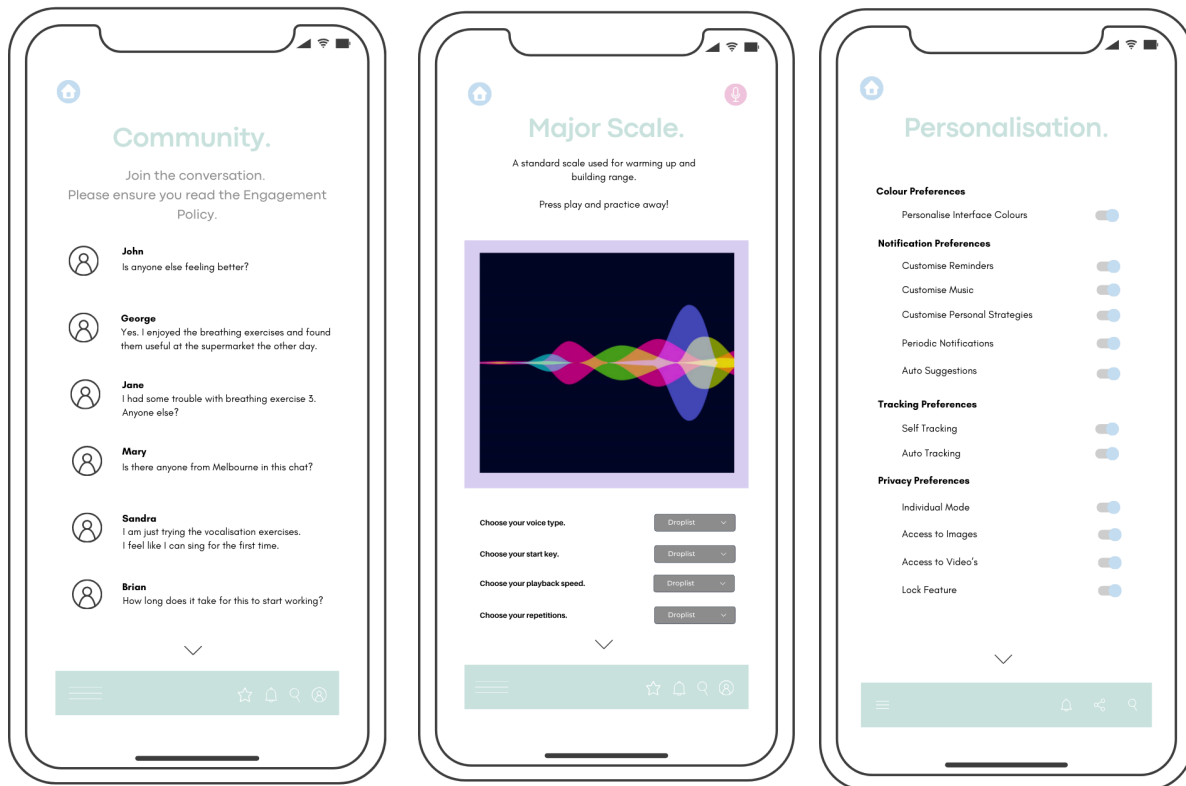
2.2.2. Functionality

In synthesising functional requirements across mental health and vocal pedagogy, three primary themes emerged: community, personalisation and motivation. The desire to connect with a

community of users and the ability to share experiences was common, satisfying the need for relatedness (Deci and Ryan, 2000; Shi, 2021). Enactment requires connectivity to social media platforms, messaging, video calling and image sharing (Alqahtani *et al.*, 2021). The desire for comprehensive *personalisation* was articulated including: communication customisation; self-tracking through notes or diary linked to activities and reminders (McClelland *et al.*, 2018); psychological scale for self-assessment; auto-track biometrics (Alqahtani *et al.*, 2021); microphone recording and playback; pitch detection and adjustment; video, audio and track playback capabilities (Shi, 2021). Noteworthy, was the aversion to alarms with preference for notifications via music or vibration (McClelland *et al.*, 2018). As a key factor for any intervention, *motivation* may require incentives (Rosser *et al.*, 2009) to reinforce healthy behaviours and reduce risk behaviours in line with the Dynamic-Information-Motivation-Behavioural Skill Health Behaviour Model (Hides *et al.*, 2019) addressed in Part 1. The desire for behaviour and skill building games with increasing difficulty, where users can gain rewards and compare progress with other users was highlighted, along with the need for activities that activated curiosity (Alqahtani *et al.*, 2021). This may be enacted through gamification (Çeker and Özdamlı, 2017) but must support user autonomy through an opt in/out feature. Further, the need for a customised learning experience was articulated in which the user may curate favourite lessons, scales and motivational material (Shi, 2021). These features are depicted in Figure 4.

Whilst privacy preservation was the least requested feature (Alqahtani *et al.*, 2021; McClelland *et al.*, 2018) the capability to preserve a safe distance or anonymity is essential to fostering a safe environment. Defined by Lewis *et al.* (2015) a safe environment is one that allows the user to be themselves, to talk and be listened to, learn and improve intellectually and express emotions freely. Moderation of community interactions along with strict engagement and privacy policy may support a safe user experience (Appendix ?). Whilst two-factor authentication (2FA) protects privacy and defends against account compromise (Reese *et al.*, 2019) it may adversely impact user experience (Abbot and Patil, 2020). The tension between protection of privacy and delimiting access to functionality is challenging to navigate. Given that users may need swift access to the application in times of distress, 2FA may impose unnecessary limitations. Within the artefact, this has been addressed through the addition of a 'guest login', providing swift access to select functionality including exercises and support services.

Figure 4. Depicting Functionality including Video, Audio, Pitch Adjustment; Microphone Recording; Share Connectivity and Personalisation Options..



L5S4. Community Noticeboard Screen

L3S9.1. Major Scales Screen

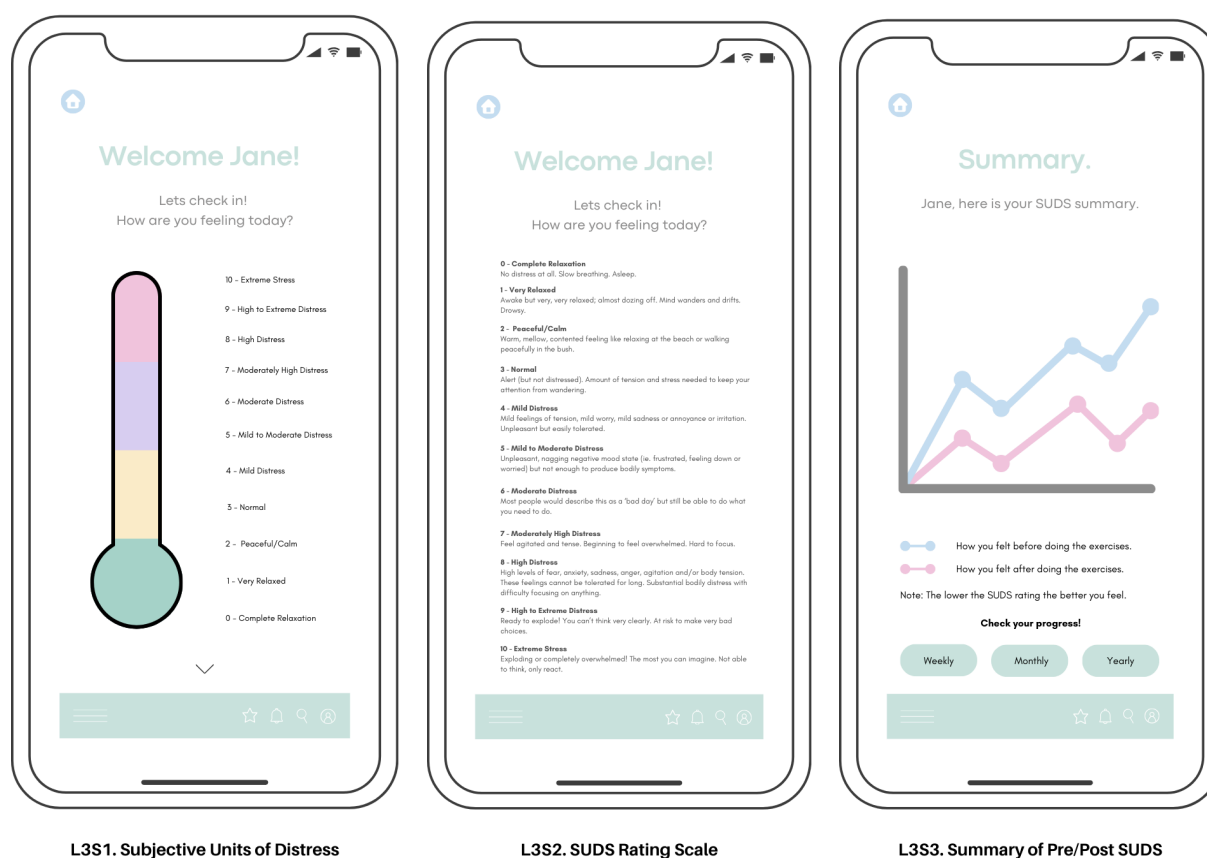
L2S8. Personalisation Screen

2.2.3. Usability

The perceived usability and usefulness of the application (Holzinger, 2016) is critical to the effectiveness and efficiency of its intended purpose. Simplicity embedded in design, structure and navigation ensure users can find relevant information directly and swiftly (Alqahtani and Orji, 2020) and the ability to maintain control over the amount of information received is essential to avoid overwhelm (Proudfoot *et al.*, 2010). Practical, simple tutorials on how to use the application, along with ongoing support were identified as key requirements (Ahmed *et al.*, 2021; McClelland *et al.*, 2018) along with language options (Peter *et al.*, 2018). Feedback from a review by Kuhn *et al.* (2014) on a mobile application called PTSD Coach emphasised the need for improved rationales for breathing exercises which are a key feature of this artefact (Appendix 5) (Cernvall *et al.*, 2018). Methods of self-assessment were expected to be simple and swiftly executed. The Subjective Units of Disturbance Scale (SUDS) is frequently used in mental health applications (Kim *et al.*, 2008). Whilst not without criticism, this likert-type scale, designed by Wolpe *et al.* (1991), provides a simple measure to use in this context in visual format. The use of SUDS may foster a sense of autonomy and competence as one progresses

and an evaluation tool for the efficacy of specific exercises (Appendix 7). Figure 6 depicts the SUDS as presented in the artefact.

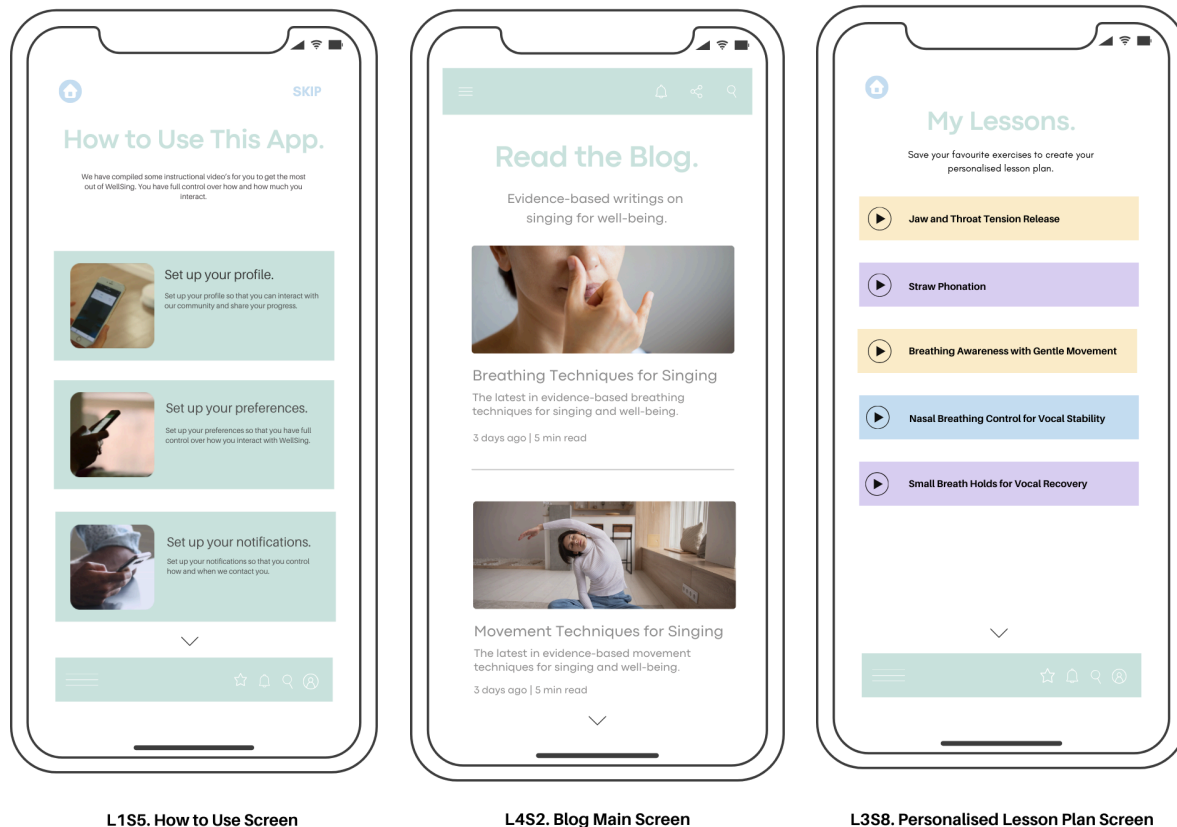
Figure 6. Wireframe Depiction of Subjective Units of Distress Scale with Rating Descriptive and Rating Summary.



Quality content is fundamental to user outcomes. Generally, content that shifts attention away from current issues and aids behaviour change (Aryana and Brewster, 2020) was preferred including positive quotes, pictures, blogs, articles and relaxation exercises (Alqahtani *et al.*, 2021). Specific to vocal pedagogy were requirements including: a sense of continuous play with increasing difficulty; lessons categorised by complexity with unlimited training variations; video tutorials and professionally recorded audio tracks; short hints for vocal skill acquisition and the ability to create personalised scale patterns (Shi, 2021). Allowing users to customise the application to suit their individual needs and preferences improves user satisfaction,

engagement and reduces attrition rates (Arean *et al.*, 2016; Roepke *et al.*, 2015). These preferences have been embedded into the artefact, depicted in Figure 7.

Figure 7. Wireframe depiction of User Tutorials, Blog and Personally Curated Lessons.



2.3. Know What

Through reflection and evaluation we learn to criticise the tacit understandings that exist within the repetitive experience of specialised practice (Nelson, 2013). Guided by this approach, I reflexively sought to evaluate the artefact (Jamieson *et al.*, 2023), the aim of which was to conceptualise an accessible, evidence-based, cost-effective resource for individuals with PTSD to self-manage symptoms through vocal pedagogy, utilising digital technology. Originally intended as a live mobile application, the scope proved unfeasible given the complexities identified in the literature, resulting instead in a detailed conceptual wireframe.

Synthesising literature from vocal pedagogy and mental health in mobile application design presented considerable challenges. Effective mental health application design relies on behaviour change theories to enhance digital intervention outcomes (Direito *et al.*, 2014; McClelland *et al.*, 2018), while vocal pedagogy emphasises the optimization of technology to modernise music education (Shi, 2020). Although both fields prioritise human-centred design (IxDF, 2024), they involve distinct, sometimes conflicting requirements. For example, vocal pedagogy encourages constructive feedback and collaborative learning, both essential for skill-building in music but potentially counterproductive or unsuitable for users with PTSD, who may not wish to engage collaboratively or receive continuous performance critique. Thus, competence pathways must be distinct for users with PTSD. These opposing requirements also complicated assessment. A typical Agile Mobile Development Cycle would incorporate iterative testing and user feedback (Aryana and Brewster, 2021), yet ethical considerations prevented these steps in this project. Consequently, the assessment process relied on a checklist rather than agile testing protocols, to ensure design, functionality, usability and content requirements were embedded in the artefact. Notably, the mental health mobile application participatory design studies relied upon, may lack specificity in requirements for individuals with PTSD as participants represented broader mental health challenges. Although the requirements outlined in the Build Review Checklist have been integrated into the artefact, the feasibility of their technical implementation remains uncertain and will be subject to ongoing iterative process.

Whilst literature extensively discusses the mental health benefits of mind-body methods related to spiritual practices, studies linking non-spiritual vocal pedagogy techniques to positive mental health and well-being are underexplored. Singing and well-being research primarily focuses on group singing (Clift *et al.*, 2010; Coulton *et al.*, 2015; Clift *et al.*, 2017) where there is conjecture as to the mechanism by which well-being is elicited - the act of singing itself or from social bonding (Shakespeare and Whieldon, 2018). Moreover, methods and techniques utilised in vocal pedagogy are frequently adapted from other disciplines (Chapman, 2006), which may compromise the efficacy of the original exercises in support of mental health ie. Feldenkrais Method (Feldenkrais, 2013). These complexities offer opportunities for further exploration and indeed research.

Engaging as an insider researcher introduces nuanced ethical and methodological complexities. Being a member of the population I study allows for deeper insights but necessitates rigorous reflexivity to remain objective. Reflexivity is crucial in acknowledging how my own identity,

background, and lived experience as a former police officer with PTSD intersect with the literature and influence artefact development. Balancing empathetic understanding with critical detachment requires careful reflection and helps mitigate the influence of personal assumptions. The development of this artefact was further constrained by my limited technical expertise in software development, particularly given the customization required to meet both pedagogical and mental health needs. Existing platforms, including Passion.io, BuildFire, and Bubble.io, offered drag-and-drop functionality but lacked necessary adaptability. Collaborating with skilled developers or securing funding would support a rigorous, evidence-based application design.

3. Conclusion

The aim of this artefact was to provide an accessible, evidence-based and cost-effective resource for individuals with PTSD, facilitating the self-management of symptoms through vocal pedagogy, specifically tailored to their unique needs. While technical constraints limited the creation of a live application, the primary objectives were achieved conceptually. Extensive literature affirms the cognitive (Rauscher and LeMieux, 2003), physiological (Brown and Gerbarg, 2005), psychological (Williams *et al.*, 2018; Shakespeare and Whieldon, 2018), psychosocial (Clark and Harding, 2012), and physical (Ahmadi *et al.*, 2020) benefits of singing, though further research is essential to confirm these benefits are transferable to individuals with PTSD. An exploration of evidence-based breathing, movement, and vocalisation techniques for PTSD symptom support revealed promising methods, though a lack of studies in PTSD populations exist, underscoring the need for validation within PTSD specific populations. Analysis of mobile application requirements in vocal pedagogy and mental health presented challenges and highlighted the need for further research into human-centred design (IxDF, 2024), participatory design in PTSD populations and cognitive load (Parsazadeh *et al.*, 2018) as a usability metric with individuals with PTSD. Additionally, further research is needed into mobile application design within educational contexts, particularly in vocal pedagogy, to explore its relationship with motivation.

Due to ethical concerns regarding testing the artefact with individuals with PTSD, a departure from Agile design methodology was necessary. The artefact was evaluated using a build review checklist to ensure alignment with design, functionality, and usability requirements informed by participatory design studies in mental health and vocal pedagogy. Although adequate for initial exploration, this assessment method does not provide a solid foundation for Agile design (Sharma, 2020). Future participatory studies focused on the Well-Sing application within PTSD

populations are essential to assess its suitability and effectiveness. Further, the design was guided by Self-Determination Theory (Deci and Ryan, 2000), emphasising autonomy, competence, and relatedness. In practical terms, autonomy was promoted by allowing users to engage at their own pace, competence was nurtured through progressively challenging exercises, and relatedness was fostered via community features that facilitate user connection and support. Further research into how content could support the Dynamic-Information-Motivation-Behavioural Skill Health Behavior Model (Hides *et al.*, 2019) and encourage engagement and participation from clinical populations would be helpful. This review and the accompanying artefact represent preliminary steps toward addressing the research question: How can individuals with PTSD be effectively supported in self-managing symptoms through well-being-focused vocal pedagogy delivered via mobile application?