

**Developing an Accessible, Evidence-Based Resource for PTSD Symptom  
Self-Management Through Tailored Vocal Pedagogy.**

**By**

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## Table of Contents

### Part 1

|                                               |    |
|-----------------------------------------------|----|
| 1. Introduction .....                         | 1  |
| 2. Planned Programme of Study .....           | 2  |
| 2.1. Theoretical Influences .....             | 2  |
| <i>Self-Determination Theory</i> .....        | 2  |
| 2.2. Best Practice Influences .....           | 5  |
| <i>Technical Best Practice</i> .....          | 6  |
| <i>Vocal Pedagogy Best Practice</i> .....     | 7  |
| 2.3. Methodological Influences .....          | 7  |
| <i>Literature Review</i> .....                | 8  |
| <i>Artefact Development</i> .....             | 8  |
| <i>Ethical Considerations</i> .....           | 9  |
| 2.4. Aims and Objectives .....                | 9  |
| 2.5. Expected Learning Outcomes .....         | 10 |
| 2.6. Activities and Assessment Criteria ..... | 10 |
| <i>Assessment Criteria</i> .....              | 11 |
| 2.7. Timescale and Review Dates .....         | 11 |
| 3. Critical Review .....                      | 12 |
| 3.1. <i>Concrete Experience</i> .....         | 12 |
| 3.2. <i>Reflective Observation</i> .....      | 13 |
| 3.3. <i>Abstract Conceptualisation</i> .....  | 14 |
| 3.4. <i>Active Experimentation</i> .....      | 14 |
| 4. Conclusion .....                           | 15 |

### Part 2

|                                  |    |
|----------------------------------|----|
| 1. Introduction .....            | 16 |
| 2. Literature Review .....       | 17 |
| 2.1. Know That .....             | 17 |
| 2.1.1. <i>Breathing</i> .....    | 19 |
| 2.1.2. <i>Movement</i> .....     | 21 |
| 2.1.3. <i>Vocalisation</i> ..... | 22 |
| 2.2. Know How .....              | 23 |

|                                   |    |
|-----------------------------------|----|
| 2.2.1. <i>Design</i> .....        | 23 |
| 2.2.2. <i>Functionality</i> ..... | 25 |
| 2.2.3. <i>Usability</i> .....     | 27 |
| 2.3. Know What .....              | 29 |
| 3. Conclusion .....               | 31 |

|                         |           |
|-------------------------|-----------|
| <b>References</b> ..... | <b>33</b> |
|-------------------------|-----------|

### List of Tables

|                                                              |    |
|--------------------------------------------------------------|----|
| Table 1. Possible States in Flow Theory .....                | 4  |
| Table 2. Keyword Literature Search .....                     | 11 |
| Table 3. Timeline for Completion of Project Activities ..... | 12 |

### List of Figures

|                                                                           |    |
|---------------------------------------------------------------------------|----|
| Figure 1. Agile Mobile Development Cycle .....                            | 6  |
| Figure 2. Mechanisms Underpinning Psychological Benefits of Singing ..... | 18 |
| Figure 3. Artefact - Design Elements .....                                | 25 |
| Figure 4. Artefact - Functionality Elements .....                         | 27 |
| Figure 5. Artefact - SUDS Rating .....                                    | 28 |
| Figure 6. Artefact - Usability Elements .....                             | 29 |

### Appendix

|                                                             |    |
|-------------------------------------------------------------|----|
| Appendix 1. Comprehensive GANTT Chart .....                 | 55 |
| Appendix 2. Link to Online Artefact (Wireframe) .....       | 56 |
| Appendix 3. Iterations of Artefact Wireframe .....          | 57 |
| Appendix 4. WellSing Build Review Checklist .....           | 60 |
| Appendix 5. Application - Content Examples .....            | 68 |
| Appendix 6. Application - Colour Scheme .....               | 75 |
| Appendix 7. Subjective Units of Distress Scale (SUDS) ..... | 76 |
| Appendix 8. Engagement and Privacy Policy .....             | 77 |
| Appendix 9. How to Guide .....                              | 80 |
| Appendix 10. Support Services .....                         | 83 |

## 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 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 conventional 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 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**

### **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 fundamental 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 closely aligned to self-regulation; as individuals enhance their self-regulatory abilities, they increasingly experience intrinsic motivation and perceive their actions as being within 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 analysis of competence reveals its relationship with Flow Theory, which is the state of complete immersion in an activity, leading to enhanced concentration, increased alertness and accompanied by a loss of self-consciousness (de Brabander and Martens, 2014) and a sense of pleasure (Csikszentmihalyi, 1991). Csikszentmihalyi (1991) proposed that flow occurs when an individual's performance in an activity presents a challenge that is commensurate with their level of competence. The relationship between challenge and competence is outlined in four states, as detailed in Table 1. Specifically, when there is a low level of challenge combined with low competence, the individual experiences *apathy* (Csikszentmihalyi, 1991). Conversely, when the challenge is low but competence is high, the individual is likely to experience *boredom* (Csikszentmihalyi, 1991). Additionally, a high challenge paired with low competence may lead to *anxiety* (Csikszentmihalyi, 1991). Therefore, the objective is to develop an artefact that provides activities tailored to the optimal level of challenge, aligned with individual capabilities, and designed to facilitate a progression pathway as skills develop. This is particularly pertinent given that the intended user is likely to be new to singing, underscoring the need to minimise both anxiety and apathy throughout the learning process.

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

| Four States<br>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 serve as either an adaptive or maladaptive emotion regulation strategy, contingent upon whether it is accompanied by 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 (Reybrouck *et al.*, 2020) 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).

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).

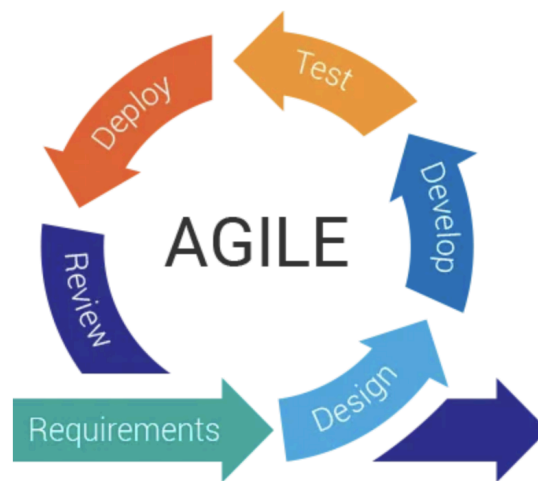
In addition to autonomy, competence, and relatedness, Ruud (2012) identified four dimensions of quality of life that are enhanced by making music: vitality (emotional life and pleasures), agency (sense of mastery and empowerment), belonging (networks and social capital), and meaning (transcendental values, 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 crucial for skill development and self-expression (Hogle, 2021). This process empowers individuals who may experience feelings of helplessness in other aspects of their lives (Davidson and Garrido, 2019).

## **2.2. Best Practice Influences**

Best practice frameworks influencing the development of this artefact are considered across two categories: technological best practice and vocal pedagogy best practice.

The proposed artefact utilises technology to develop a mobile application for small, low-power handheld devices like mobile phones (Flora *et al.*, 2014a; Flora *et al.*, 2014b). The mobile application development lifecycle typically follows these phases: (1) analysis of the application concept, (2) user interface design, (3) application development, (4) testing on various devices, (5) publishing on the target platform store, and (6) maintenance involving updates for successive versions (El-Kassas *et al.*, 2017). Although the deliverable artefact is a wireframe, it is expected to complete the first two phases of this lifecycle within this module. Agile methodology (Figure 1), recognised as best practice in mobile application development (Aldayel and Alnafjan, 2017), comprises an iterative process and structured approach that organises design, planning, development, and testing throughout the software lifecycle (Sharma, 2020).

**Figure 1.** Agile Mobile Development Cycle (Sharma, 2020).



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 diverse 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. The 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 is accessed through searches in the University of Wales Trinity Saint David digital library and platforms such as PubMed, Elsevier, Science Direct, Sage, ResearchGate and Google Scholar, primarily relying upon 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 3. 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 literature.

### *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

Singing, characterised by its capacity for social, emotional, cognitive and physical engagement, demonstrates significant potential as a complementary intervention for mental health disorders in a variety of contexts (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

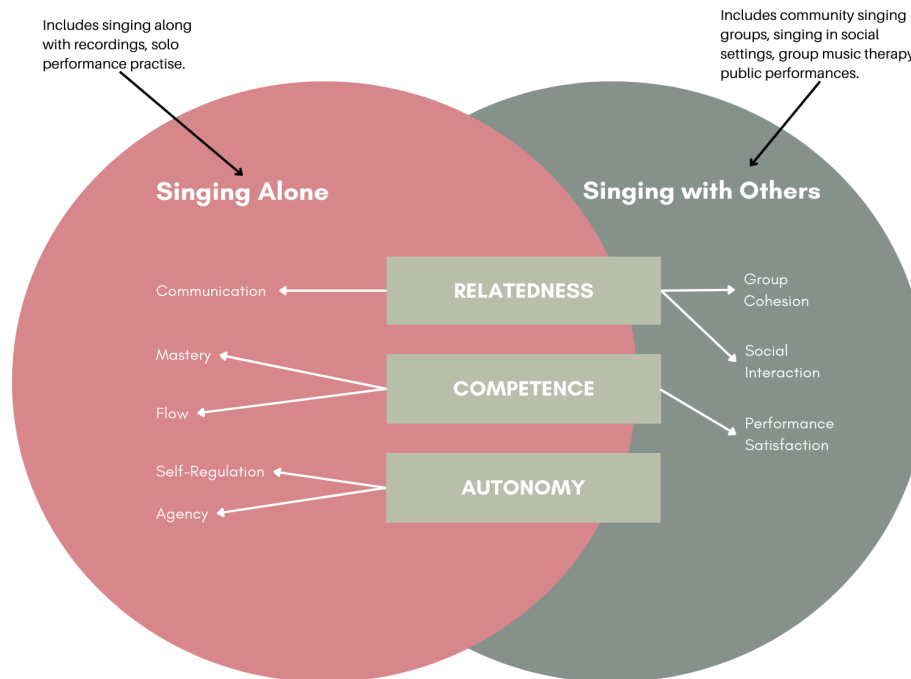
### 2.1. Know That

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 (Schäfer *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 2) (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). 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 2.** 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 alternative and complementary interventions that include breathing and movement (Kim *et al.*, 2013). Kim *et al.* (2013) argues that normalisation of cortisol-mediated negative feedback regulation within 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.

### **2.1.1. Breathing**

Research indicates that slow breathing has a balancing effect on the autonomic nervous system by enhancing parasympathetic activation and stimulating stretch-induced inhibitory signals (Kim *et al.*, 2013). This modulation contributes to a reduction in the prevalence of symptoms among individuals displaying subclinical features of PTSD (Kim *et al.*, 2013). Moreover, it enhances vagal activity, resulting in decreased psychophysiological arousal, diminished sympathetic activity, and a reduction in stress responses, all of which are associated with an attenuation in severity of PTSD symptoms (Kim *et al.*, 2013). By engaging both the parasympathetic and sympathetic nervous systems, breathing exercises can induce a state characterised by both alertness and calm (Seppälä *et al.*, 2014). Traditional mindfulness practices may prove challenging for individuals experiencing heightened physiological arousal; thus, structured breathing exercises may be more advantageous as they involve participants in a directed activity that yields immediately observable calming effects (Brown and Gerbarg, 2005). Given that variations in respiration can influence emotional states (Boiten *et al.*, 1994), the modulation of breath may provide individuals with a means to exert control over anxiety, thereby highlighting the relevance 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) indicated that this approach may serve as a viable alternative for

addressing PTSD and suicide among returning veterans. The study reported significant reductions in PTSD symptoms, anxiety, and respiration rate, with the most pronounced effects observed in hyperarousal and re-experiencing symptoms (Seppälä *et al.*, 2014). These findings are particularly noteworthy, as hyperarousal has been shown to have a substantial impact on health-related quality of life among individuals with PTSD (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 CO<sub>2</sub> tolerance has proven to provide curative benefits (Roth, 2005; Ghordadekar *et al.*, 2020). These efforts result in minimal accumulation of CO<sub>2</sub> 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) represents a form of somatic education that utilises a mind-body approach to learning, aimed at enhancing both psychological and physical well-being through interoceptive mechanisms (Wallman-Jones *et al.*, 2023 Ahmadi *et al.*, 2020). The Feldenkrais Method (FM) has various applications, including instruction for musicians, promotion of self-acceptance, stress and anxiety reduction, and strategies for managing depressive thoughts (Martin *et al.*, 2024). A fundamental principle of FM is to enhance emotional expression, potentially fostering a positive feedback loop (Feldenkrais, 2013). FM emphasises the interconnection among action patterns, bodily sensations and cognitive processes (Martin *et al.*, 2024). Research by Kolt and McConville (2000) demonstrates that FM effectively reduces anxiety in female participants by providing temporary distractions from negative thoughts and emotions. Furthermore, FM is associated with lower perceived exertion during movement, relaxation, improved mood, enhanced learning capacity and reduced 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 targeted vocalisation exercises, which are crucial for warming up the voice, correcting vocal faults - such as pitch intonation and pressed phonation issues caused by poor breath support (Ter *et al.*, 2022) - extending vocal range and acquiring vocal techniques, including interval singing, staccato, legato and dynamic control (Gish *et al.*, 2012). Commonly employed exercises include: (1) stretching, (2) breathing, (3) semi-occluded vocal tract (SOVT) exercises, and (4) resonant voice exercises (Ragan and Kapsner-Smith, 2019). Vocal warm-ups enhance blood flow and oxygenation, promote muscle flexibility and improve vocal projection and articulation (Sousa *et al.*, 2020). Singing teachers frequently utilise traditional vocal warm-ups (TVW) to optimise breath support, voice placement, and vocal timbre (Portillo *et al.*, 2018), while speech-language pathologists apply physiological vocal warm-up exercises for rehabilitation. Vocal warm-up is essential for preventing vocal fold injury and achieving optimal voice function in both untrained and professional singers (Gish *et al.*, 2012). As the intended user of this artefact is likely unfamiliar with singing, the initial design will emphasise basic SOVT

exercises to build foundational competence, with the potential to integrate traditional vocal warm-ups (TVW) in future iterations.

Semi-occluded vocal tract exercises have long supported healthy and economical production of the voice (Orhon *et al.*, 2022). SOVT exercises are used to improve the quality of the resonant voice by reducing excessive tension in the vocal tract (Nam *et al.*, 2019; Sahin, 2020; Orhon *et al.*, 2022) aimed at achieving normal voice intensity and power with less stress to the laryngeal tissue, less muscular effort and less energy loss (Orhon *et al.*, 2022). SOVT exercises are suitable for new singers as they encourage production of a wide range of pitches and volumes without excessive impact on the vocal folds. Humming and straw phonation (SP) are 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 deploy a massaging effect on vocal organs (Saldías *et al.*, 2020). According to Titze (2006), SP is the most efficient and easiest to master as compared to the other five progressive exercises (i.e., tongue trills, lip trills, bilabial fricatives, phonation into tubes and humming) (Titze, 2006). Untrained singers may consider SP as a starting point and progress to TVW as competency improves (Ter *et al.*, 2022) therefore, SOVT exercises have been incorporated into the content of this artefact.

## **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 2 and 3) 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).

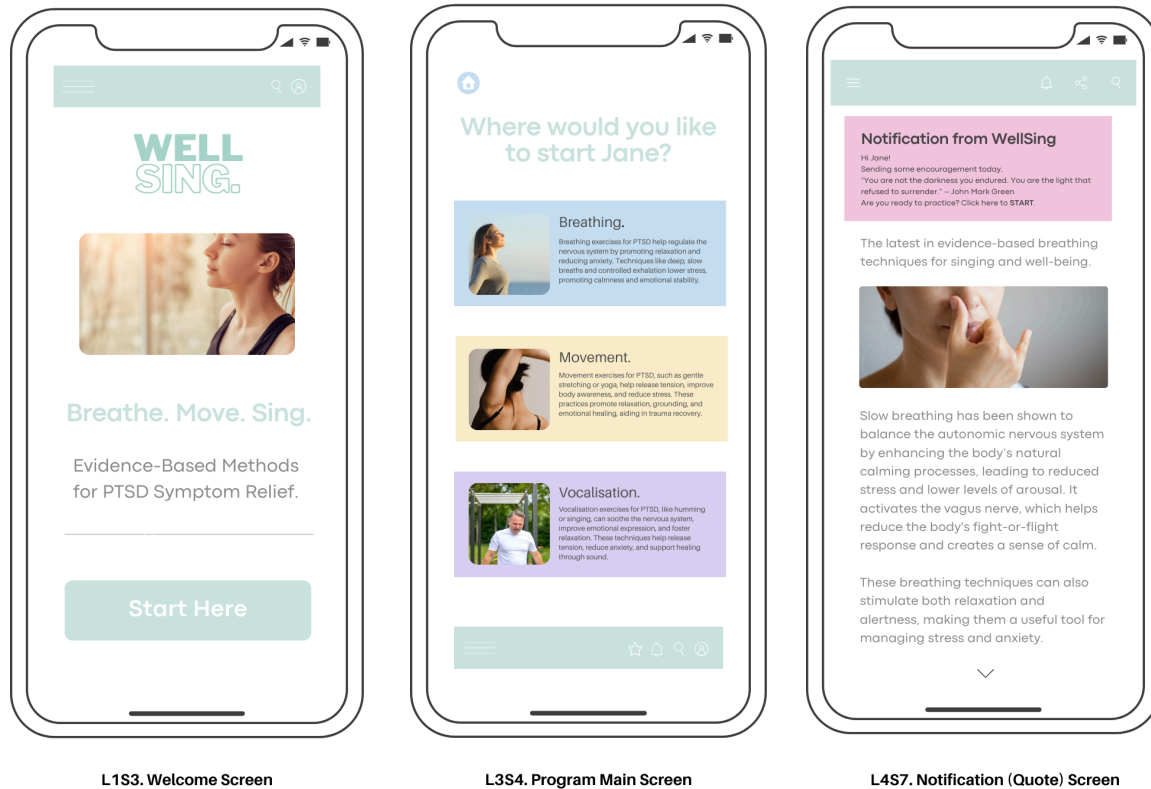
### **2.2.1. Design**

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 constrained 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.** Artefact - Design Elements. Wireframe Depiction of Colour Scheme, Application Name and Simplicity of Design.



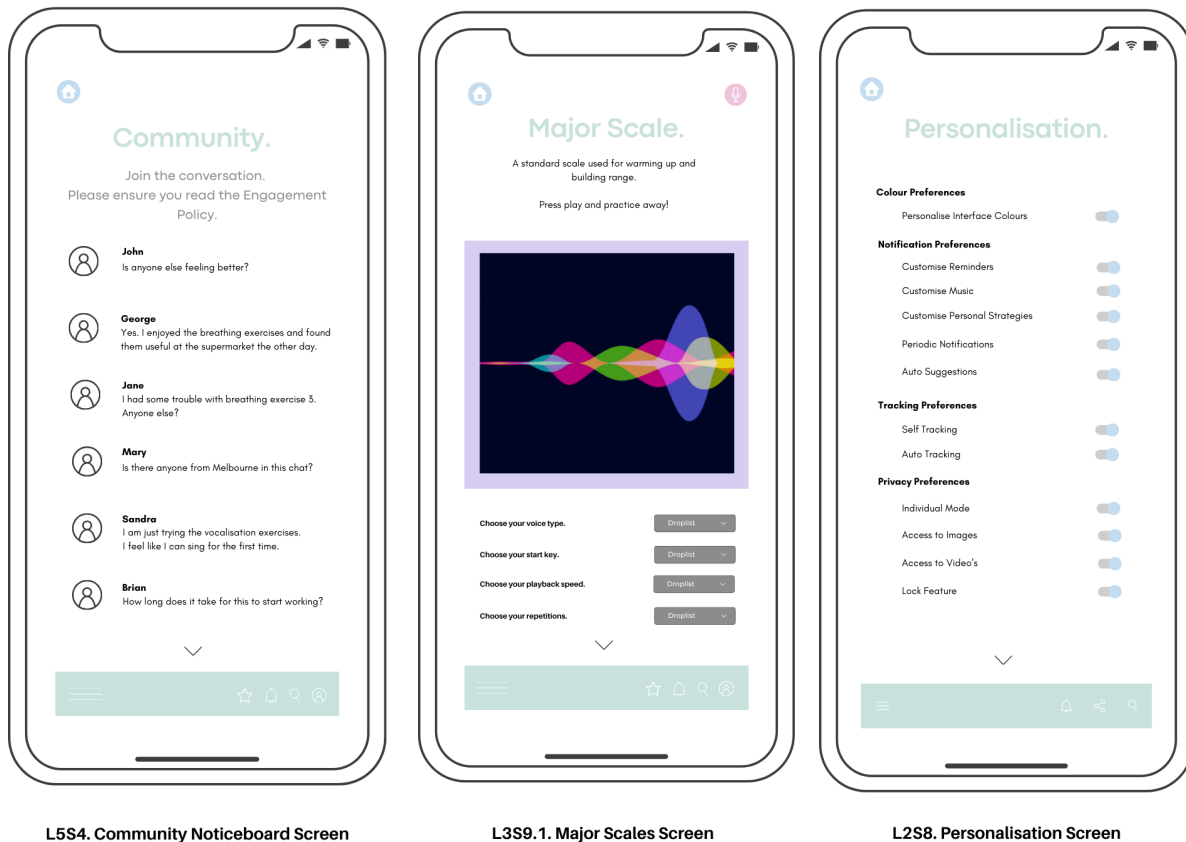
## 2.2.2. Functionality

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 8, 9, 10). 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.** Artefact - Functionality Elements. Wireframe Depiction of Functionality including Video, Audio, Pitch Adjustment; Microphone Recording; Share Connectivity and Personalisation Options.

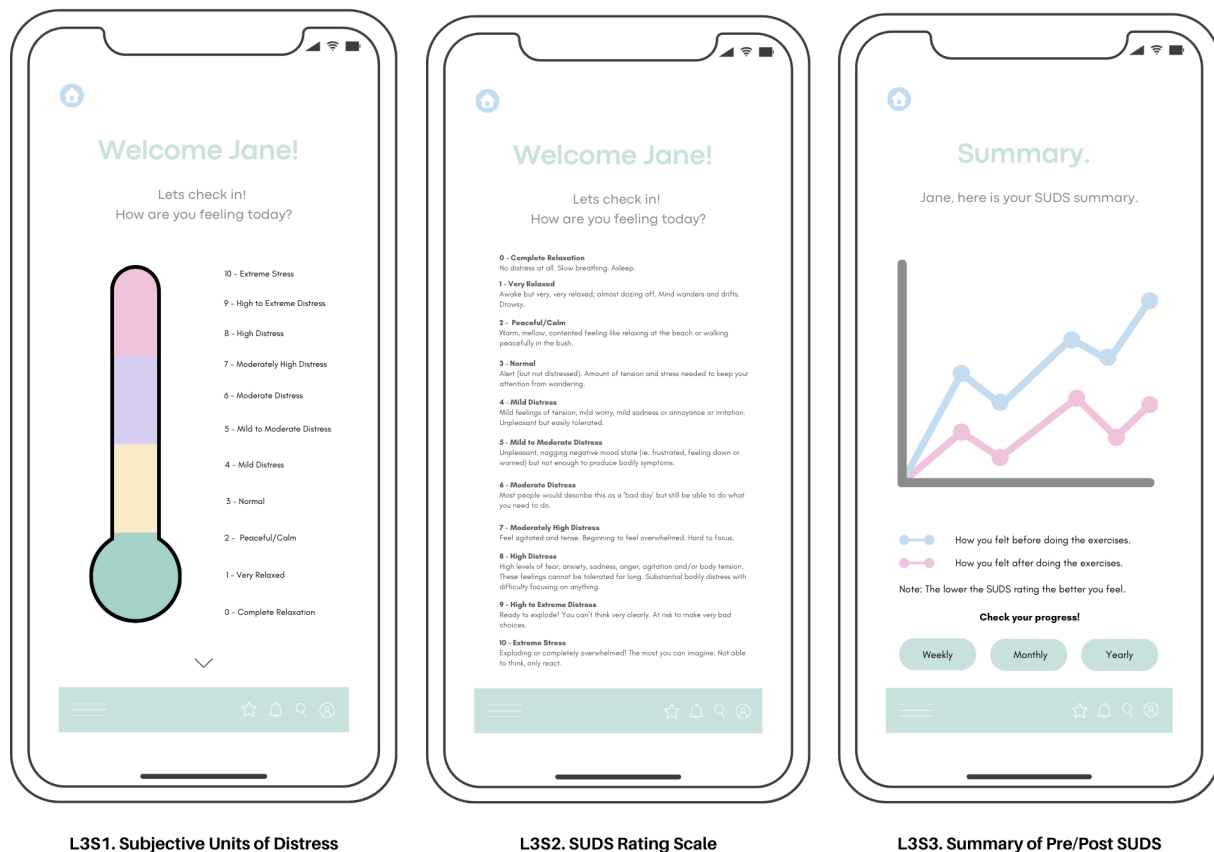


### 2.2.3. Usability

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 (Figure 5) (Appendix 7).

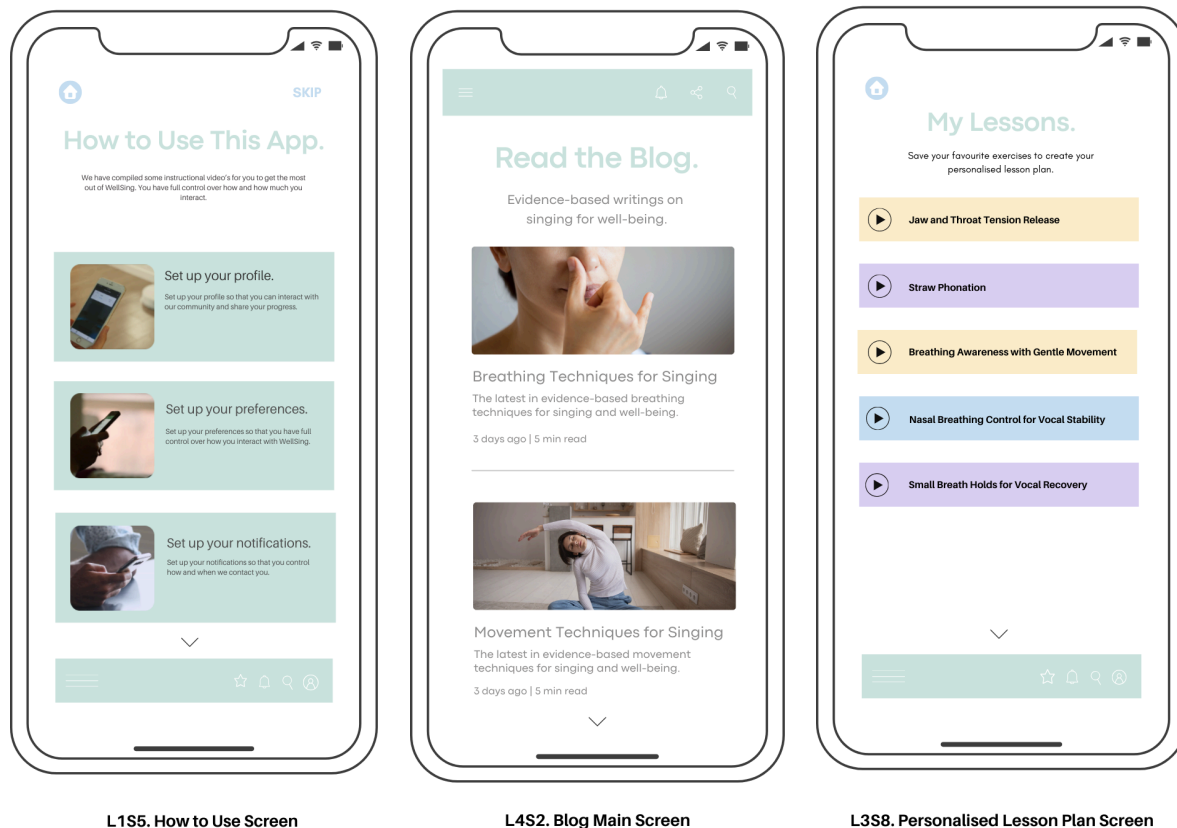
**Figure 5.** Artefact - Wireframe Depiction of Subjective Units of Distress Scale with Rating Descriptive and Rating Summary.



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 (Figure 6).

**Figure 6.** 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?

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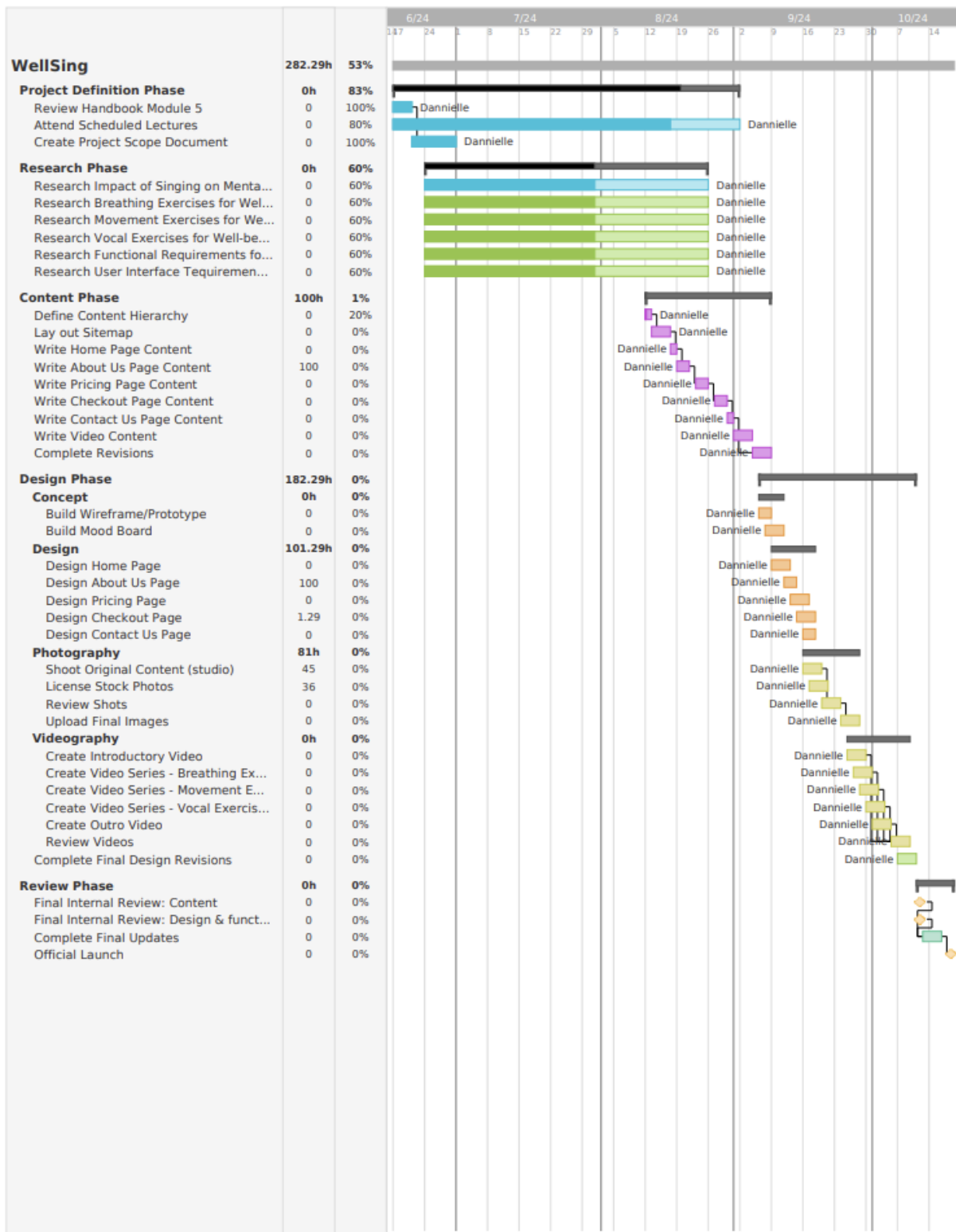
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## APPENDIX 1. GANTT Chart



## **APPENDIX 2.** Public View Link to Online Artefact - WireFrame.

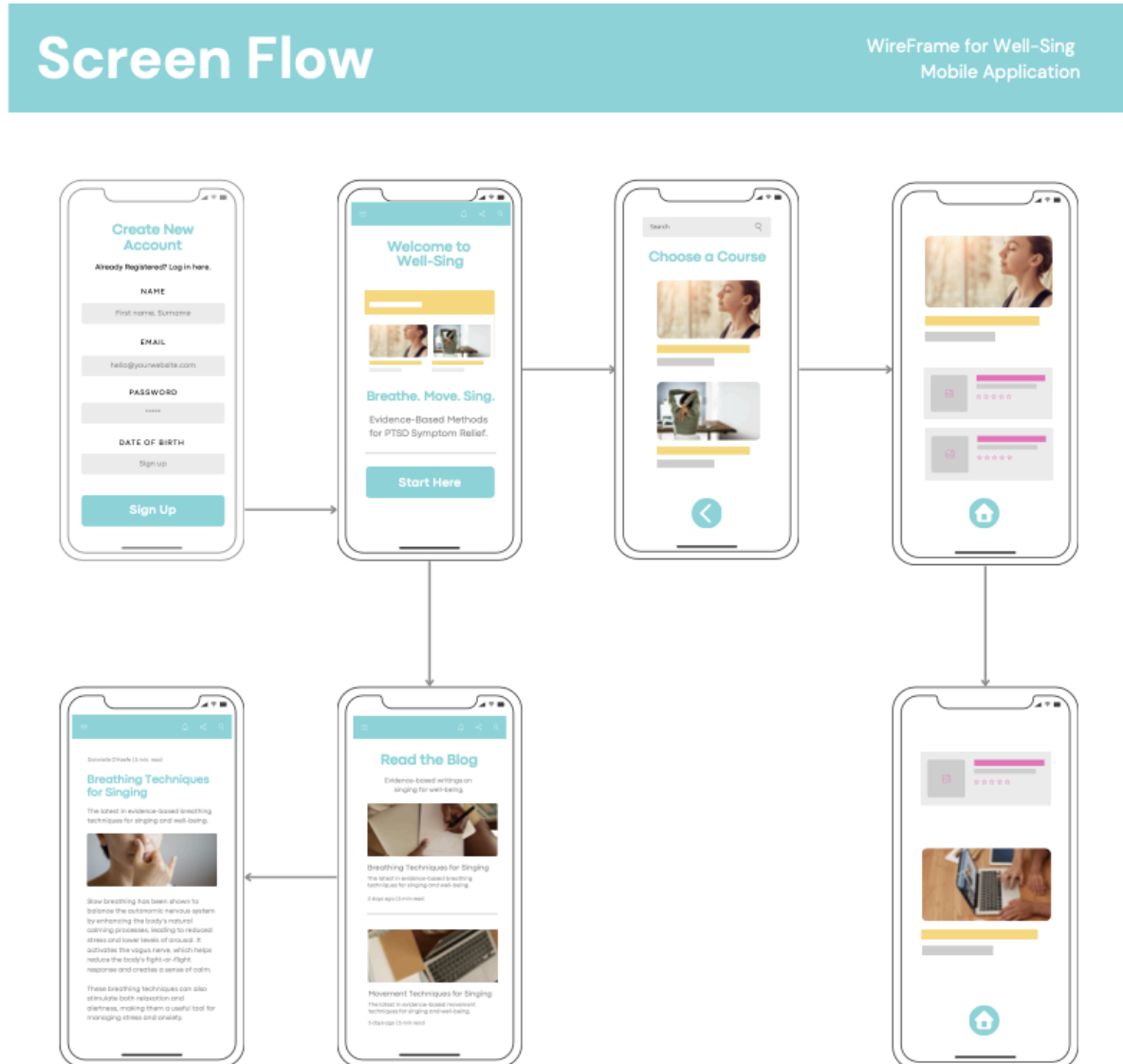
To view the artefact, copy the link below and paste into a web browser and click enter.

There is no requirement for a password.

[https://www.canva.com/design/DAGTWkQo0xQ/2AjqQs8sE7vO0\\_zc4Rz5Fw/view?utm\\_content=DAGTWkQo0xQ&utm\\_campaign=designshare&utm\\_medium=link&utm\\_source=editor](https://www.canva.com/design/DAGTWkQo0xQ/2AjqQs8sE7vO0_zc4Rz5Fw/view?utm_content=DAGTWkQo0xQ&utm_campaign=designshare&utm_medium=link&utm_source=editor)

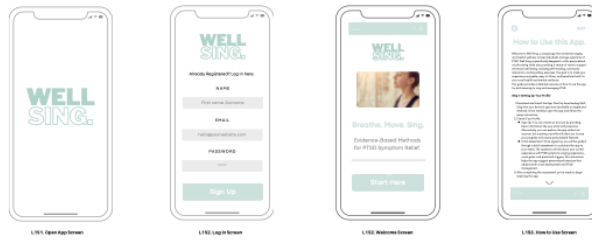
## APPENDIX 3. Iterations of Artefact Wireframe.

### Iteration 1.

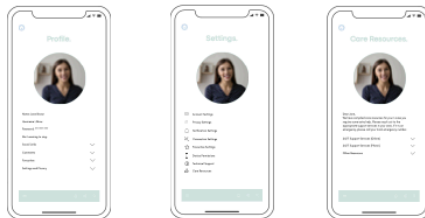


## Iteration 2.

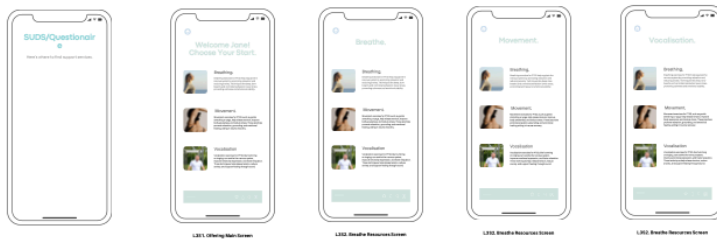
### Level 1 - Introduction



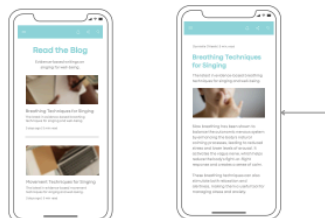
### Level 2 - Settings



### Level 3 - Program



### Level 4 - Motivation Resources

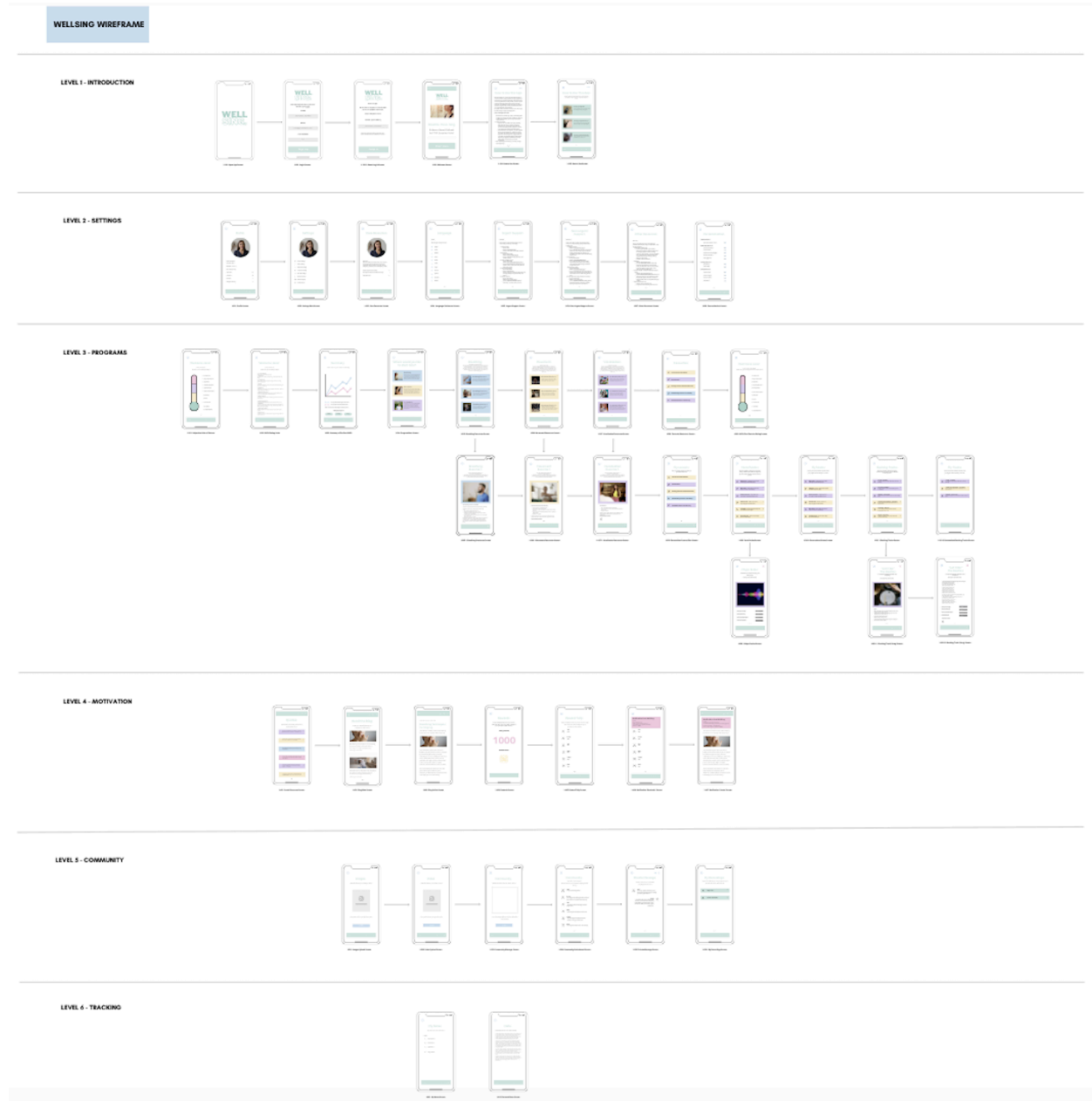


### Level 5 - Community



### Level 6 - Tracking

### Iteration 3.



## APPENDIX 4. WellSing Build Review Checklist.

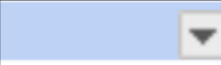
### WellSing Build Review Checklist

| Domain                                                                                                   | Preference                                                                                                              | Embedded<br>(Wireframe<br>Reference)                                                                                | Not-Embedded<br>(Justification)                                    |
|----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------|
| <b>Mental Health</b>  |                                                                                                                         |                                                                                                                     |                                                                    |
| <b>Design</b>                                                                                            |                                                                                                                         |                                                                                                                     |                                                                    |
| <b>Application Name</b>                                                                                  | The name should be simple and not include or mention or be related to any mental health issue (Alqahtani et al., 2021). | L1S1.<br>Open App<br>Screen                                                                                         |                                                                    |
| <b>Purpose</b>                                                                                           | The application should have a clear purpose that is easy for users to understand (Alqahtani et al., 2021).              | L1S3.<br>Welcome Screen                                                                                             |                                                                    |
| <b>Colour Scheme</b>                                                                                     | Bright, happy, calm (Alqahtani et al., 2021).                                                                           | L3S4.<br>Program Main<br>Screen                                                                                     |                                                                    |
| <b>Language</b>                                                                                          | Supports different languages (Alqahtani et al., 2021).                                                                  | L2S4.<br>Language<br>Preference<br>Screen                                                                           |                                                                    |
| <b>Functionality</b>                                                                                     |                                                                                                                         |                                                                                                                     |                                                                    |
| <b>Self-Tracking</b>                                                                                     | Able to make their own notes and track their successful personal solutions (Alqahtani et al., 2021).                    | L6S1.<br>My Notes Screen<br><br>L6S2.<br>Personal Note<br>Screen                                                    |                                                                    |
|                                                                                                          | Anxiety tracker or SUDS rating scale to keep track of progress (Alqahtani et al., 2021).                                | L3S1. Subjective<br>Units of Distress<br><br>L3S2. SUDS<br>Rating Scale<br><br>L3S3. Summary<br>of Pre/Post<br>SUDS |                                                                    |
| <b>Biometrics</b>                                                                                        | Auto-track biometrics including sleep, heart rate and phone use (Alqahtani et al., 2021).                               |                                                                                                                     | Not embedded due to these metrics being outside scope of practice. |
| <b>Community</b>                                                                                         | Application should have social community so users may interact with                                                     | L5S3.<br>Community                                                                                                  |                                                                    |

|                        |                                                                                                                                                                                                             |                                                                                                 |                                                     |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-----------------------------------------------------|
|                        | others to share issues, give advise and relate to people's experiences (Alqahtani <i>et al.</i> , 2021).                                                                                                    | Message Screen<br><br>L5S4. Community Noticeboard Screen<br><br>L5S5. Private Message Screen    |                                                     |
| <b>Video Calling</b>   | Ability to set up video calls with other users within the application (Alqahtani <i>et al.</i> , 2021).                                                                                                     | L5S5. Private Message Screen                                                                    |                                                     |
| <b>Image Sharing</b>   | Ability to share images with other users (Alqahtani <i>et al.</i> , 2021).                                                                                                                                  | L5S1. Images Upload Screen                                                                      |                                                     |
| <b>Reward Program</b>  | Application should allow users to gain rewards after each task they have completed and compare their points with other users on the app to motivate them to keep using it (Alqahtani <i>et al.</i> , 2021). | L4S4. Rewards Screen<br><br>L4S5. Reward Tally Screen                                           |                                                     |
| <b>Personalisation</b> | The ability to personalise the interface by customising reminders, background colour and music (Alqahtani <i>et al.</i> , 2021).                                                                            | L2S8. Personalisation Screen                                                                    |                                                     |
|                        | Ability to add personal strategies to their profile so the app could make personalised suggestions then they experience a crisis (Alqahtani <i>et al.</i> , 2021)                                           | L3S8. Favourite Resources Screen<br><br>L6S1. My Notes Screen<br><br>L6S2. Personal Note Screen |                                                     |
|                        | Ability for app to administer an assessment before using app to personalise the content based on users answers (Alqahtani <i>et al.</i> , 2021). Must be short.                                             | L3S1. Subjective Units of Distress<br><br>Subjective self-assessment embedded.                  | Psychological Assessment outside scope of practice. |
|                        | Ability for the app to greet them by name and asking questions like, 'How are you today?' (Alqahtani <i>et al.</i> , 2021).                                                                                 | L2S3. Care Resources Screen<br><br>L3S1. Subjective Units of Distress                           |                                                     |
| <b>Notifications</b>   | Ability for app to send periodic notifications to check on user either at random or user-defined times (Alqahtani <i>et al.</i> , 2021)                                                                     | L4S6. Notification (Reminder) Screen                                                            |                                                     |

|                                         |                                                                                                                                                                                                                                |                                                                                                            |                                                                                             |
|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
|                                         |                                                                                                                                                                                                                                | L4S7. Notification (Quote) Screen                                                                          |                                                                                             |
|                                         | Ability for app to notify user about their feelings based upon their personal tracked data and check on how they are feeling (Alqahtani <i>et al.</i> , 2021).                                                                 | L3S3. Summary of Pre/Post SUDS                                                                             |                                                                                             |
| <b>Auto Suggestions</b>                 | Ability for app to make helpful suggestions on content based upon auto-sensed data and their current circumstances (Alqahtani <i>et al.</i> , 2021). Could be positive articles, strategies, advice to make users feel better. | L4S7. Notification (Quote) Screen                                                                          | Difficult to embed in concept WireFrame based upon psychological assessment or SUDS rating. |
| <b>Usability</b>                        |                                                                                                                                                                                                                                |                                                                                                            |                                                                                             |
| <b>Ease of Use</b>                      | Simplicity and ease of use are characteristic of mental health apps that they use regularly (Alqahtani <i>et al.</i> , 2021).                                                                                                  | L2S1. Profile Screen<br>L2S2. Settings Main Screen                                                         |                                                                                             |
| <b>Ease of Navigation</b>               | Able to find relevant or required information or app components directly and quickly (Alqahtani <i>et al.</i> , 2021) Not too many steps to get where one needs to go.                                                         | L3S4. Program Main Screen<br>L2S2. Settings Main Screen                                                    |                                                                                             |
| <b>Organised and Simple Home Screen</b> | Applications that are organised with fewer details on the home screen with information presented in a non-overwhelming way (Alqahtani <i>et al.</i> , 2021).                                                                   | L1S3. Welcome Screen<br>L1S5. How to Use Screen<br>L2S2. Settings Main Screen<br>L3S4. Program Main Screen |                                                                                             |
| <b>Tutorials</b>                        | Applications with simple instructions on how to use the app perhaps including a tiny pop-up for each activity as a brief overview (Alqahtani <i>et al.</i> , 2021).                                                            | L1S5. How to Use Screen                                                                                    |                                                                                             |
| <b>Content</b>                          |                                                                                                                                                                                                                                |                                                                                                            |                                                                                             |
| <b>Activities</b>                       | A variety of activities in the app that activates curiosity (Alqahtani <i>et al.</i> , 2021).                                                                                                                                  | L3S4. Program Main Screen                                                                                  |                                                                                             |

|                        |                                                                                                                                                                                                                                                |                                                                                                                                                        |  |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <b>Content Updates</b> | Regular content updates from trusted sources (Alqahtani <i>et al.</i> , 2021).                                                                                                                                                                 | L3S5.1. Breathing Resources Screen<br><br>L3S6.1. Movement Resources Screen<br><br>L3S7.1. Vocalisation Resources Screen<br><br>L4S2. Blog Main Screen |  |
| <b>Content Focus</b>   | Content that shifts attention away from their current issues (Alqahtani <i>et al.</i> , 2021).                                                                                                                                                 | L4S2. Blog Main Screen                                                                                                                                 |  |
|                        | Content that does not show stress or depression as an illness (Alqahtani <i>et al.</i> , 2021).                                                                                                                                                | L3S4. Program Main Screen<br><br>L4S3. Blog Article Screen<br><br>L3S10. Backing Track (Song) Screen<br><br>L3S9. Vocal Scales Screen                  |  |
|                        | Motivational content to encourage users to be positive (Alqahtani <i>et al.</i> , 2021).                                                                                                                                                       | L4S1. Quote Resources Screen                                                                                                                           |  |
|                        | Motivation to encourage participants to use the application including inspiring stories, positive news and quotes, pictures and articles that improve their well-being and motivate them to be more positive (Alqahtani <i>et al.</i> , 2021). | L4S6. Notification (Reminder) Screen<br><br>L4S5. Reward Tally Screen                                                                                  |  |
|                        | Relaxation approaches: self talk and breathing exercises (Alqahtani <i>et al.</i> , 2021).                                                                                                                                                     | L3S5.1. Breathing Resources Screen                                                                                                                     |  |
|                        | Provides credible information that is not overwhelming (Alqahtani <i>et al.</i> , 2021).                                                                                                                                                       | L4S3. Blog Article Screen                                                                                                                              |  |

|                                  |                                                                                                                                                                                                                                    |                                                                                                          |                                                                                     |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|                                  |                                                                                                                                                                                                                                    |                                                                                                          |                                                                                     |
| <b>Professional Support</b>      | App should provide access to professional support through offering contact details of medical practitioners and hotlines or providing live therapists who can be accessed to respond to concerns (Alqahtani <i>et al.</i> , 2021). | L2S5. Urgent Support Screen<br><br>L2S6. Non-Urgent Support Screen                                       |                                                                                     |
| <b>Security</b>                  |                                                                                                                                                                                                                                    |                                                                                                          |                                                                                     |
| <b>Tracking of Personal Data</b> | Self-tracking and auto-tracking.                                                                                                                                                                                                   | L3S3. Summary of Pre/Post SUDS                                                                           |                                                                                     |
| <b>Privacy</b>                   | Option for an individual mode as opposed to a web-based community mode in which a user can make personal notes and express their feelings within the app privately (Alqahtani <i>et al.</i> , 2021).                               | L6S1. My Notes Screen<br><br>L6S2. Personal Note Screen                                                  |  |
|                                  | Permissions required to access images of users (Alqahtani <i>et al.</i> , 2021).                                                                                                                                                   | L2S8. Personalisation Screen                                                                             |                                                                                     |
|                                  | Ability to use the app without creating an account (Alqahtani <i>et al.</i> , 2021).                                                                                                                                               |                                                                                                          | Not embedded due to privacy and engagement considerations.                          |
|                                  | Lock feature to protect user data (Alqahtani <i>et al.</i> , 2021).                                                                                                                                                                | L2S8. Personalisation Screen                                                                             |                                                                                     |
| <b>Vocal Pedagogy</b>            |                                                                                                                                                                                                                                    |                                                                                                          |                                                                                     |
| <b>Design</b>                    |                                                                                                                                                                                                                                    |                                                                                                          |                                                                                     |
|                                  | No name/colour/design preferences identified in literature.                                                                                                                                                                        | -                                                                                                        |                                                                                     |
| <b>Functionality</b>             |                                                                                                                                                                                                                                    |                                                                                                          |                                                                                     |
| <b>Tracks</b>                    | Creation of a playlist for training sessions containing selected video's, audio, tracks (Shi, 2021)                                                                                                                                | L3S8. Favourite Resources Screen<br><br>L3S8. Personalised Lesson Plan Screen<br><br>L3S10. Personalised |                                                                                     |

|                   |                                                                                                            |                                                                         |  |
|-------------------|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|--|
|                   |                                                                                                            | Scales Screen<br><br>L3S12. Personalised Backing Tracks Screen          |  |
|                   | Ability to determine the length of exercise by adjusting the number of repetitions for a track (Shi, 2021) | L3S9.1. Major Scales Screen<br><br>L3S11.2. Backing Track (Song) Screen |  |
|                   | Adjustment of playback speed (Shi, 2021).                                                                  | L3S9.1. Major Scales Screen<br><br>L3S11.2. Backing Track (Song) Screen |  |
| <b>Pitch</b>      | Ability to fine tune starting pitch of the track (Shi, 2021).                                              | L3S10. Backing Track (Song) Screen<br><br>L3S9. Vocal Scales Screen     |  |
|                   | Ability to choose voice type (Shi, 2021).                                                                  | L3S9.1. Major Scales Screen<br><br>L3S11.2. Backing Track (Song) Screen |  |
|                   | Pitch detection technology (Shi, 2021)                                                                     | L3S9.1. Major Scales Screen<br><br>L3S11.2. Backing Track (Song) Screen |  |
| <b>Microphone</b> | Analysis of singing through device microphone (Shi, 2021)                                                  | L3S9.1. Major Scales Screen<br><br>L3S11.2. Backing Track (Song) Screen |  |
|                   | Record and save singing to playback and assess progress (Shi, 2021).                                       | L3S9.1. Major Scales Screen<br><br>L3S11.2. Backing Track (Song) Screen |  |

|                      |                                                                                       |                                                                                                       |  |
|----------------------|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|--|
| <b>Community</b>     | Connectivity to share achievements with friends on social media platforms (Shi, 2021) | L5S6. My Recordings Screen                                                                            |  |
| <b>Usability</b>     |                                                                                       |                                                                                                       |  |
| <b>Ease of Use</b>   | Innovative user interface (Shi, 2021).                                                | L3S4. Program Main Screen                                                                             |  |
|                      | Supports any sized mobile device (Shi, 2021)                                          | Embedded - not demonstrated.                                                                          |  |
| <b>Content</b>       |                                                                                       |                                                                                                       |  |
| <b>Content Focus</b> | Games: continuous play with increasing difficulty (Shi, 2021)                         | L4S4. Rewards Screen                                                                                  |  |
|                      | Lessons: categorised by the complexity principle (Shi, 2021)                          | L3S8. Personalised Lesson Plan Screen                                                                 |  |
|                      | Songs: singing real songs (Shi, 2021).                                                | L3S11.1. Backing Track (Song) Screen                                                                  |  |
|                      | Hints: Various tips for vocal skills (Shi, 2021)                                      | L3S7. Vocalisation Resources Screen                                                                   |  |
|                      | Unlimited number of training variations (Shi, 2021).                                  | L3S8. Personalised Lesson Plan Screen<br><br>L3S10. Personalised Scales Screen                        |  |
|                      | Ability to create personalised scale patterns (Shi, 2021)                             | L3S9. Vocal Scales Screen<br><br>L3S9.1. Major Scales Screen<br><br>L3S10. Personalised Scales Screen |  |
|                      | Professionally recorded audio samples (Shi, 2021)                                     | L3S5.1. Breathing Resources Screen                                                                    |  |

|  |                                                       |                         |  |
|--|-------------------------------------------------------|-------------------------|--|
|  | Video tutorials for using the app (Shi, 2021).        | L1S5. How to Use Screen |  |
|  | Contextual help on every page of the app (Shi, 2021). |                         |  |

## **APPENDIX 5. Mobile Application Content Examples (Video Scripts/Blog Content)**

### **Buteyko Method.**

The Buteyko Breathing Method is a technique developed by Ukrainian Doctor Konstantin Buteyko in the 1950s. It is based on the principle that many modern breathing patterns—such as chronic over-breathing or hyperventilation—are unhealthy and contribute to a range of health issues, including anxiety and respiratory problems. The method aims to retrain the body to breathe in a way that optimises carbon dioxide (CO<sub>2</sub>) levels in the blood, which is crucial for oxygen transport and overall health.

The technique involves nasal breathing, reduced breathing volume, and breath-holding exercises. By practising these, individuals can improve their breathing efficiency and reduce excessive air intake, which stabilises CO<sub>2</sub> levels and helps prevent hyperventilation. When someone over-breathes, they exhale too much CO<sub>2</sub>, which causes blood vessels to constrict and reduces the oxygen supply to vital organs and tissues, including the brain. This state of reduced oxygen flow can exacerbate feelings of anxiety and stress, creating a vicious cycle of shallow, rapid breathing and heightened anxiety.

For anxiety management, the Buteyko method encourages slow, controlled breathing, which activates the parasympathetic nervous system—the part of the nervous system that promotes relaxation and stress relief. As a result, practising Buteyko can reduce the physical symptoms of anxiety, such as rapid heartbeat, dizziness, and chest tightness, by promoting a calm and steady breathing rhythm.

In terms of vocal health, Buteyko breathing can be highly beneficial. Singers, actors, and public speakers rely on efficient breath control for vocal performance. By practising Buteyko, individuals can develop better breath awareness and control, which enhances vocal projection, stamina, and tone quality. Moreover, nasal breathing helps to humidify and warm the air, reducing strain on the vocal cords, which can prevent vocal fatigue and support long-term vocal health.

Here are three Buteyko-inspired exercises for improving vocal health and managing anxiety:

### **1. Nasal Breathing Control for Vocal Stability**

This exercise helps optimise breath control, promoting vocal stability and reducing anxiety by encouraging calm, nasal breathing.

#### **Steps:**

- Sit or stand in a relaxed, upright posture.
- Inhale gently through your nose for 3 seconds.
- Exhale slowly and silently through your nose for 4-6 seconds, focusing on a soft, steady breath.
- At the end of the exhale, hold your breath for 3-5 seconds (called the "control pause").
- Repeat this cycle for 5-10 minutes.

#### **Benefits:**

Nasal breathing encourages proper airflow, reducing dryness and irritation of the vocal cords while helping manage anxiety by promoting slower, controlled breathing. The breath-holding phase helps increase CO2 tolerance, which stabilises oxygen levels in the body.

### **2. Extended Exhale for Anxiety Reduction and Vocal Endurance**

This exercise aims to relax the body and mind while strengthening the diaphragm for enhanced vocal endurance.

#### **Steps:**

- Inhale gently through your nose for 2-3 seconds.
- Slowly exhale through pursed lips (as if gently blowing out a candle) for as long as possible, focusing on extending the exhale to 6-8 seconds.
- After exhaling fully, hold your breath for 5 seconds (control pause), and then breathe normally for a few cycles.
- Gradually repeat the process for 5-10 minutes.

#### **Benefits:**

Long, slow exhalations trigger the parasympathetic nervous system, reducing stress and anxiety. The controlled release of air also strengthens the diaphragm, improving breath support for singing or speaking.

### **3. Small Breath Holds for Vocal Recovery and Anxiety Relief**

This exercise helps improve CO2 tolerance, promoting relaxation while reducing breathlessness and vocal strain.

#### **Steps:**

- Take a small, soft breath in through your nose for 2-3 seconds.
- Gently exhale through your nose, and at the end of the exhale, hold your breath (control pause) for 3-5 seconds.
- Resume gentle nasal breathing for 5-10 breaths, and then repeat the breath hold for 3-5 seconds.
- Repeat the cycle for 5 minutes, gradually increasing the hold time as you feel comfortable.

#### **Benefits:**

Short breath holds help restore CO2 balance, reducing the urge to over-breathe. This process calms the nervous system, reduces anxiety symptoms, and prevents vocal fatigue, which is especially useful for performers or public speakers.

These exercises, when practised consistently, can help you manage anxiety while improving breath control and overall vocal health.

## **Feldenkrais Method**

The Feldenkrais Method is a movement-based practice developed by Moshe Feldenkrais, designed to improve physical and mental well-being through heightened awareness of body movements. It emphasises gentle, mindful movements that help retrain the nervous system, releasing chronic tension and improving posture, flexibility, and coordination. By focusing on awareness, Feldenkrais practitioners can reprogram habitual, inefficient movement patterns that may contribute to physical discomfort, anxiety, or emotional stress.

For individuals with PTSD, the Feldenkrais Method can be particularly beneficial. PTSD often results in heightened stress responses, chronic tension, and dissociation from the body. Through slow, mindful movements, this method helps individuals reconnect with their physical sensations, promoting body awareness and calming the nervous system. The non-invasive and gentle nature of the movements helps regulate the body's stress response, which can reduce symptoms of hypervigilance and anxiety. This method fosters a sense of control and safety within the body, making it a valuable tool in PTSD recovery.

Regarding vocal health, Feldenkrais can enhance voice quality by improving breath coordination, posture, and muscular tension around the neck and throat. Many vocal issues stem from unnecessary tension in the chest, throat, and diaphragm, and Feldenkrais helps practitioners explore efficient ways of using these muscles. By promoting body awareness and relaxation, the method can improve vocal projection, tone, and stamina while reducing strain on the vocal cords.

### **Three Feldenkrais Exercises for PTSD Symptom Management and Vocal Health:**

#### **1. Breathing Awareness with Gentle Movement:**

- Lie on your back in a comfortable position.
- Begin with slow, deep nasal breathing.
- Slowly raise one arm overhead with each inhale and lower it with the exhale.
- Focus on how your breathing and movement connect, creating a calming rhythm.
- Repeat for 5-10 minutes.

#### **Benefits:**

Calms the nervous system, increases lung capacity, and releases tension in the chest and shoulders, supporting vocal ease.

## **2. Jaw and Throat Tension Release:**

- Sit comfortably, keeping your spine elongated.
- Slowly open and close your mouth as you gently tilt your head side to side.
- Focus on releasing any tension in your jaw, neck, and throat with each movement.
- Repeat this for 5 minutes.

### **Benefits:**

Reduces tension in the throat and jaw, common in both PTSD and vocal strain, improving vocal resonance and clarity.

## **3. Pelvic Clock for Grounding and Posture:**

- Lie on your back with your knees bent.
- Imagine a clock on your pelvis, and gently rock your pelvis toward the 12 o'clock (toward your head) and 6 o'clock (toward your feet) positions.
- Then rock between 3 and 9 o'clock positions (side to side).
- Continue for 5-7 minutes, focusing on relaxation and fluidity.

### **Benefits:**

Enhances body awareness, promotes grounded posture for vocal support, and fosters a sense of physical presence, reducing anxiety and dissociation common in PTSD.

These exercises, done regularly, can support both trauma recovery and vocal performance by fostering physical awareness, relaxation, and improved breath control.

## **Semi-Occluded Vocal Tract Exercises.**

Semi-occluded vocal tract (SOVT) exercises involve partially closing the vocal tract while phonating, which creates back pressure that helps regulate airflow and vocal fold vibration. This technique, used widely in voice therapy and vocal training, can improve vocal quality, reduce strain, and promote efficient voice production. By partially closing the lips, using straws, or humming, SOVT exercises encourage the vocal folds to vibrate more freely and with less effort, leading to healthier vocal function and increased resonance.

SOVT exercises are particularly useful for vocal health because they allow for smooth and controlled airflow, minimising strain on the vocal cords. The exercises improve coordination between the breath and the vocal folds, enhancing vocal endurance and tone. For singers, actors, and speakers, these exercises are invaluable for improving projection and reducing vocal fatigue. They also support vocal recovery, as the controlled back pressure reduces tension and promotes healing in the vocal folds.

In the context of PTSD, SOVT exercises can have a calming effect. Phonation (producing sound) through these exercises can help regulate breathing patterns and create a soothing vibrational sensation that promotes relaxation. The controlled breathwork involved in SOVT exercises can reduce anxiety, slow the heart rate, and encourage parasympathetic nervous system activation, which fosters a sense of calm and control—key in managing PTSD symptoms.

## **Three SOVT Exercises for PTSD Symptom Management and Vocal Health:**

### **1. Straw Phonation:**

- Take a small straw and hum through it gently.
- Focus on producing a steady, relaxed hum while keeping the airflow smooth.
- Repeat for 5 minutes.

#### **Benefits:**

Promotes relaxation, improves vocal fold efficiency, and regulates breathing, helping both vocal health and anxiety management.

### **2. Lip Trills:**

- Gently press your lips together and blow air through them, creating a "brrrr" sound as your lips vibrate.
- Maintain a steady airflow and sound for 3-5 seconds, then pause and repeat for 5 minutes.

**Benefits:**

Eases vocal tension, improves breath control, and creates calming vibrational sensations that reduce anxiety.

**3. Humming with Hand Over Mouth:**

- Place your hand over your mouth, partially covering it, and hum softly.
- Focus on feeling the vibration in your face and throat, and continue humming for several seconds.
- Repeat for 5-7 minutes, focusing on smooth, consistent sound production.

**Benefits:**

Relaxes the throat and vocal folds, enhances resonance, and promotes mindfulness through focused breath and sound, easing PTSD symptoms.

These exercises can significantly improve vocal quality while providing calming, therapeutic benefits for individuals managing PTSD.

## APPENDIX 6. Artefact Design Elements.

# WELL SING.

### COLOR PALETTE



#C6DEF1



#C9E4DE



#6E6353



#F2C6DE



#FAEDCB

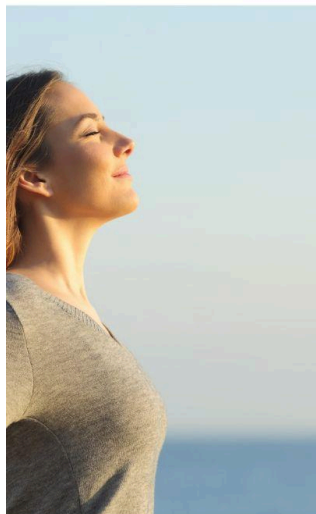
### FONT IN USE

Aa

Manjari

ABCDEFGHIJKLMNOPQRSTUVWXYZabc  
defghijklmnopqrstuvwxyz1234567890!@#  
\$%^&\*()

### INSPIRATION



Breathe.



Move.



Sing.

## APPENDIX 7. Subjective Units of Distress Scale (SUDS).

### "SUDS" Distress Ratings

| The <u>Subjective Units of Distress Scale</u> --- or SUDS --- is an easy way to track and let others know how much distress you are having at any given time. The scale ranges from zero to 100. |                           |                                                                                                                                                                                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SUDS Rating                                                                                                                                                                                      | Level                     | Description                                                                                                                                                                                      |
|  <b>100</b>                                                                                                     | Extreme Distress          | Exploding or Completely Overwhelmed! The most you can imagine. Not able to think, only react.                                                                                                    |
| <b>90's</b>                                                                                                                                                                                      | High to Extreme Distress  | Ready to explode! You can't think very clearly. At risk to make very bad choices.                                                                                                                |
| <b>80's</b>                                                                                                                                                                                      | High Distress             | High levels of fear, anxiety, sadness, anger, agitation, and/or body tension. These feelings cannot be tolerated for long. Bodily distress is substantial. It is difficult to focus on anything. |
| <b>70's</b>                                                                                                                                                                                      | Moderately High Distress  | Feel agitated and tense. Beginning to feel overwhelmed. It's hard to focus.                                                                                                                      |
| <b>60's</b>                                                                                                                                                                                      | Moderate Distress         | Most people would describe as a "bad day" but still able to do what you need to do.                                                                                                              |
| <b>50's</b>                                                                                                                                                                                      | Mild to Moderate Distress | Unpleasant, nagging negative mood state (i.e. frustrated, feeling down, or worried) but is not enough to produce many bodily symptoms.                                                           |
| <b>40's</b>                                                                                                                                                                                      | Mild Distress             | Mild feelings of tension, mild worry, mild sadness, or annoyance or irritation. Unpleasant but easily tolerated.                                                                                 |
| <b>30's</b>                                                                                                                                                                                      | "Normal"                  | Alert (but not distressed). Amount of tension and stress needed to keep your attention from wandering.                                                                                           |
| <b>20's</b>                                                                                                                                                                                      | Peaceful/Calm             | Warm, mellow, contented feeling. Like when relaxing at the beach, or at home in front of a warm fire on a cold, wintery day, or walking peacefully in the woods                                  |
| <b>10's</b>                                                                                                                                                                                      | Very Relaxed              | Awake but very, very relaxed; almost dosing off. Mind wanders and drifts. Drowsy.                                                                                                                |
|  <b>Zero</b>                                                                                                  | Complete Relaxation       | No distress at all. Slow, deep breathing. Asleep.                                                                                                                                                |

## **APPENDIX 8. Engagement and Privacy Policy.**

### **Well-Sing Mobile Application Engagement and Privacy Policy (Example Only).**

#### **Introduction**

At Well-Sing, we are committed to providing a safe, secure, and supportive environment for all users engaging with our mobile application. We recognise the importance of maintaining user privacy and ensuring the protection of personal data, while also fostering an inclusive, respectful community. This policy outlines our practices regarding user engagement, data collection, and privacy to protect the interests of all parties involved.

#### **Engagement Policy**

##### **1. User Respect and Inclusivity**

Well-Sing promotes an inclusive, respectful, and non-judgmental community for individuals using the app. Users are encouraged to engage in healthy, positive interactions with others, especially when utilising social features such as forums, group sessions, or community-based activities. Harassment, bullying, or any form of discrimination is strictly prohibited. Well-Sing reserves the right to remove users from the platform who do not adhere to these guidelines.

##### **2. Responsible Content Sharing**

Users are encouraged to share relevant content such as singing experiences, vocal progress, and motivational stories within the community features of the app. However, content that includes inappropriate language, offensive imagery, or harmful misinformation is not permitted. Well-Sing uses automated filters and manual moderation to ensure the app remains a safe space for everyone. All content shared should comply with the guidelines provided during app registration.

##### **3. Safe Social Engagement**

While Well-Sing facilitates community building through messaging, video calls, and forums, users are advised to engage cautiously when sharing personal information with others. Well-Sing encourages interactions based on mutual respect and shared goals of well-being and vocal health. Users may report any inappropriate behaviour directly through the app.

## Privacy Policy

### 1. Data Collection and Usage

Well-Sing collects limited personal information to enhance the user experience, including user names, email addresses, app usage patterns, and biometric data such as sleep and heart rate, where users consent. This data helps personalise content and provide features tailored to each individual's progress. User data is never sold to third parties or used for purposes beyond the scope of app improvement and user support.

### 2. Biometric and Self-Tracking Data

The Well-Sing app offers self-tracking and biometric features for monitoring progress in vocal exercises and wellness metrics such as anxiety levels or sleep patterns. This data remains encrypted and secure, and is accessible only by the user unless explicit consent is given to share it with healthcare professionals or within community forums. Users may opt in or out of this feature at any time.

### 3. Data Security and Encryption

Well-Sing implements industry-standard security measures, including encryption and two-factor authentication, to ensure that user data remains confidential and protected from unauthorised access. Regular security updates are applied to safeguard the app from potential vulnerabilities. Users can also enable a lock feature to further protect their personal data.

### 4. User Anonymity and Privacy

Users have the option to engage with the app anonymously, meaning they are not required to provide personally identifiable information to use the app's core features. The individual mode allows users to express themselves privately through personal notes and self-reflection tools, without having to share data with the community.

### 5. Third-Party Access

Well-Sing may collaborate with third-party service providers for specific functions such as biometric tracking or cloud storage. These partners are contractually obligated to adhere to our data protection standards. At no point will Well-Sing share user data with third-party advertisers.

### 6. Consent and Control

Users have full control over the information they share within the Well-Sing app. Upon registration, users are asked to consent to the app's data collection practices, and can revoke this consent at any time. Users also retain the right to delete their data and

account entirely, with the assurance that all personal information will be permanently erased from our servers upon request.

**Conclusion**

Well-Sing is dedicated to creating a supportive, respectful, and private space for users focused on improving their mental and vocal health. Our engagement and privacy policies are designed to protect users' data, promote healthy interactions, and ensure a safe environment for all participants. If you have any questions or concerns about our policies, please contact our support team directly through the app.

## **Appendix 9. Support Services Offered in Mobile Application.**

### **Instructions for Using the "Well-Sing" App for Singing and PTSD Management**

Welcome to Well-Sing, an app designed to support your emotional well-being through the power of singing. Well-Sing offers personalised vocal exercises, self-tracking tools, and a supportive community, all aimed at helping you manage PTSD symptoms while improving your vocal health. Here's a step-by-step guide on how to get the most out of the app.

#### **Step 1: Getting Started**

1. **Download and Install:** Start by downloading the Well-Sing app from the Apple App Store or Google Play Store.
2. **Sign-Up/Log-In:** You can create an account using your email, or log in as a guest. You don't need to sign up if you prefer to explore privately. However, signing up enables you to save progress and connect with the community.
3. **Personalization Setup:** Upon first login, you'll be guided through a short assessment to tailor the app to your needs. This will ask about your current emotional state, PTSD triggers, and vocal experience. Based on your answers, Well-Sing will suggest personalised vocal exercises and emotional support strategies.

#### **Step 2: Exploring the Home Screen**

The home screen is simple and intuitive, with minimal text to avoid overwhelming you. The main sections are:

- **Self-Tracking:** Here, you can track your mood and symptoms. Record notes about your feelings, and track your anxiety levels using the SUDS (Subjective Units of Distress Scale) tracker. Over time, you'll see how singing exercises correlate with your progress.
- **Community:** Connect with others who are on the same journey. You can share experiences, provide and receive advice, and even join in video calls or chat forums.

#### **Step 3: Using Vocal Exercises**

1. **Personalized Vocal Workouts:** Well-Sing offers various vocal exercises aimed at improving vocal health and helping manage PTSD symptoms through breath control and vocalisation. You'll be provided with exercises based on your assessment, but you can

also explore others through the “Vocal Health” section.

Exercises are categorised as:

- **Relaxation-focused:** Helps calm the mind and reduce stress through slow, deep vocalisations.
  - **Breath control exercises:** These exercises improve your singing technique while reducing anxiety.
  - **Pitch and resonance:** Work on your pitch and resonance to improve vocal quality and emotional expression.
2. **Customising Your Practice:** Each exercise allows you to adjust the starting pitch, duration, and speed, so it’s fully customised to your voice and comfort level. A “pitch detection” feature helps you stay on track while practising.
  3. **Tracking Progress:** You can record your voice through the app’s microphone and play it back to assess progress. The app also provides real-time feedback on your pitch and tone to help you improve.

#### Step 4: Using Wellness Tools

1. **Breathing Exercises:** In addition to vocal exercises, Well-Sing includes guided breathing exercises designed to relax the body and mind, helping you manage PTSD symptoms such as anxiety, hypervigilance, or panic attacks. Access these under the “Relaxation” section.
2. **Notifications and Reminders:** Set up personalised reminders to practise your vocal exercises or check in with yourself. You can also customise how often the app sends motivational notifications like, “How are you feeling today?” or “Don’t forget to take a deep breath.”
3. **Professional Support:** Well-Sing provides resources for professional help, including links to therapists, hotlines, and medical practitioners. If you're feeling overwhelmed, the app can connect you with the help you need.

#### Step 5: Engaging with the Community

1. **Social Features:** Well-Sing is not just about individual progress—it’s about connecting with others. Join discussion groups where users share their experiences with PTSD and singing. You can also participate in video calls or share your vocal achievements with others.

2. **Share and Compare:** Share your progress with friends, or simply track your scores privately. The app features a reward system that encourages you to stay motivated by earning points for completed exercises, which you can compare with others in the community.

#### **Step 6: Security and Privacy**

1. **Lock Your Data:** For users concerned with privacy, Well-Sing offers the option to lock your data with a passcode. You can also opt to use the app without creating an account or engaging with the community, ensuring your personal information remains secure.
2. **Data Tracking:** Your self-tracked notes, biometrics, and progress can be accessed anytime, allowing you to see your overall journey and improvement over time.

Well-Sing is designed to offer a seamless and supportive experience for managing PTSD symptoms while improving vocal health. Whether you're looking for vocal exercises, relaxation techniques, or a community to lean on, Well-Sing is here to guide you toward better emotional well-being. Enjoy your journey with Well-Sing!

## **Appendix 10. Urgent and Non-Urgent Support Services Included in Mobile Application.**

### **Urgent Support Services.**

Here is a list of 10 mental health support services in Australia that provide 24/7 accessibility:

#### **1. Lifeline Australia**

- Phone: 13 11 14
- Website: [www.lifeline.org.au](http://www.lifeline.org.au)
- Service: Crisis support and suicide prevention.

#### **2. Beyond Blue**

- Phone: 1300 22 4636
- Website: [www.beyondblue.org.au](http://www.beyondblue.org.au)
- Service: Support for anxiety, depression, and suicide prevention.

#### **3. Kids Helpline**

- Phone: 1800 55 1800
- Website: [www.kidshelpline.com.au](http://www.kidshelpline.com.au)
- Service: Free, confidential online and phone counselling for young people aged 5 to 25.

#### **4. Suicide Call Back Service**

- Phone: 1300 659 467
- Website: [www.suicidecallbackservice.org.au](http://www.suicidecallbackservice.org.au)
- Service: Nationwide service offering support for people at risk of suicide, their carers, and those bereaved by suicide.

#### **5. SANE Australia Helpline**

- Phone: 1800 18 7263
- Website: [www.sane.org](http://www.sane.org)
- Service: Support for complex mental health issues, including schizophrenia, bipolar disorder, and trauma.

#### **6. MensLine Australia**

- Phone: 1300 78 99 78
- Website: [www.mensline.org.au](http://www.mensline.org.au)
- Service: Support for men with emotional, relationship, and mental health concerns.

#### **7. 1800RESPECT**

- Phone: 1800 737 732
- Website: [www.1800respect.org.au](http://www.1800respect.org.au)
- Service: Support for individuals experiencing domestic, family, or sexual violence.

#### **8. Open Arms – Veterans & Families Counselling**

- Phone: 1800 011 046
- Website: [www.openarms.gov.au](http://www.openarms.gov.au)
- Service: Counselling and support for Australian veterans and their families.

#### **9. eheadspace**

- Phone: 1800 650 890
- Website: [www.headspace.org.au/eheadspace](http://www.headspace.org.au/eheadspace)
- Service: Online and phone support for young people aged 12 to 25 dealing with mental health, drug, alcohol, or work/study-related issues.

#### **10. QLife**

- Phone: 1800 184 527
- Website: [www qlife.org.au](http://www qlife.org.au)
- Service: Support for LGBTQIA+ individuals, offering mental health and well-being advice.

### **Non-Urgent Support Services.**

Here is a list of 8 non-urgent mental health support services in Australia that are typically available within business hours:

#### **1. Headspace Centres**

- Website: [www.headspace.org.au](http://www.headspace.org.au)
- Service: Mental health support for young people aged 12–25. Centres offer support for mental health, physical health, and substance use. Available at local centres across Australia during business hours.

#### **2. Mind Australia**

- Phone: 1300 286 463
- Website: [www.mindaustralia.org.au](http://www.mindaustralia.org.au)
- Service: Mental health services for people experiencing mental health issues, including community and residential support, available during business hours.

### **3. Relationships Australia**

- Phone: 1300 364 277
- Website: [www.relationships.org.au](http://www.relationships.org.au)
- Service: Counselling and support for individuals, families, and communities around relationship and mental health issues. Available during business hours.

### **4. PANDA (Perinatal Anxiety & Depression Australia)**

- Phone: 1300 726 306
- Website: [www.panda.org.au](http://www.panda.org.au)
- Service: Support for new and expecting parents dealing with anxiety or depression, available Monday to Friday, 9 AM – 7:30 PM AEST.

### **5. Carers Australia**

- Phone: 1800 242 636
- Website: [www.carersaustralia.com.au](http://www.carersaustralia.com.au)
- Service: Support for carers of people with mental health issues, including counselling and referral services. Available during standard business hours.

### **6. ReachOut Australia**

- Website: [www.au.reachout.com](http://www.au.reachout.com)
- Service: Online mental health resources, forums, and self-help tools for young people, accessible anytime. While not phone-based, they provide online help during standard working hours for inquiries.

### **7. Blue Knot Foundation**

- Phone: 1300 657 380
- Website: [www.blueknot.org.au](http://www.blueknot.org.au)
- Service: Specialised support for adults who have experienced childhood trauma, available Monday to Friday, 9 AM – 5 PM AEST.

### **8. Gidget Foundation**

- Phone: 1300 851 758
- Website: [www.gidgetfoundation.org.au](http://www.gidgetfoundation.org.au)
- Service: Support for new and expectant parents dealing with perinatal anxiety and depression, available during business hours at Gidget House locations or via telehealth.

These services focus on providing non-urgent mental health support and are typically accessible during business hours for individuals seeking help.

## **Other Helpful Resources.**

Here are five additional resources that might help individuals with PTSD when using a mental health or vocal therapy application:

### **1. PTSD Coach Australia (App)**

- A mobile app developed by the Australian Department of Veterans' Affairs that offers tools for managing symptoms of PTSD, including education, self-assessment, and coping strategies such as relaxation and mindfulness exercises. It complements therapeutic apps by providing evidence-based support.
- Available on iOS and Android.

### **2. MindSpot**

- Website: [www.mindspot.org.au](http://www.mindspot.org.au)
- An online mental health clinic that offers free assessments and treatment courses for PTSD, anxiety, and depression. Users can access online courses and therapist support, which can be useful alongside self-guided apps.

### **3. Phoenix Australia – Centre for Posttraumatic Mental Health**

- Website: [www.phoenixaustralia.org](http://www.phoenixaustralia.org)
- Provides evidence-based research, resources, and training on trauma recovery and PTSD. They offer downloadable guides, fact sheets, and tips on managing PTSD, which can complement the app's content.

### **4. Beyond Blue Online Forum**

- Website: [www.beyondblue.org.au](http://www.beyondblue.org.au)
- A supportive online community where users can share their experiences and strategies for managing mental health, including PTSD. It's a good resource for peer support in conjunction with app usage, especially for real-time discussions.

### **5. Smiling Mind (App)**

- A mindfulness meditation app designed to help individuals manage stress, anxiety, and improve mental well-being. Guided meditation programs for different needs, including stress relief and relaxation, can support users in managing PTSD symptoms alongside other interventions.
- Available on iOS and Android.