EFFICACY OF MOBILE MINDFULNESS-BASED INTERVENTION (M-MBI) IN REDUCING STRESS IN EMERGING ADULTS TRANSITIONING OUT OF UNIVERSITY – A MIXED-METHOD STUDY

FREDA JONG JIA XIN

DISSERTATION SUBMITTED IN FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN PSYCHOLOGY

SCHOOL OF MEDICAL AND LIFE SCIENCES
SUNWAY UNIVERSITY MALAYSIA

2024

ORIGINAL LITERARY WORK DECLARATION

Name of Candidate : **Freda Jong Jia Xin**

IC /Passport No : **960905-13-5208**

Student ID : **15010564**

Name of Degree : **Master of Science in Psychology**

Title of Project Paper/Research Report/Dissertation/Thesis ("this Work"):
Efficacy of Mobile Mindfulness-Based Intervention (M-MBI) in Reducing Stress in Emerging Adults Transitioning Out of University – A Mixed-Method Study

I do solemnly and sincerely declare that:

1. I am the sole author/writer of this Work;

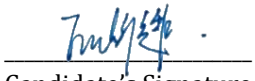
2. This Work is original;

3. Any use of any work in which copyright exists was done by way of fair dealing and for permitted purposes and any excerpt or extract from, or reference to or reproduction of any copyright work has been disclosed expressly and sufficiently and the title of the Work and its authorship have been acknowledged in this Work;

4. I do not have any actual knowledge nor do I ought reasonably to know that the making of this work constitutes an infringement of any copyright work;

5. I hereby assign all and every right in the copyright to this Work to the Sunway University (SunU), who henceforth shall be owner of the copyright in this Work and that any reproduction or use in any form or by any means whatsoever is prohibited without the written consent of Sunway University having been first had and obtained;

6. I am fully aware that if in the course of making this Work I have infringed any copyright whether intentionally or otherwise, I may be subject to legal action or any other action as may be determined by Sunway University.



Candidate's Signature Date: 30 May 2024

Subscribed and solemnly declared before,

Witness's Signature Date: 30 May 2024

Name : Prof. Alvin Ng Lai Oon
Designation : Associate Dean (International), Department of Psychology

**Witness will be the supervisor*

(This form to be attached together with the final hardbound thesis)

EFFICACY OF MOBILE MINDFULNESS-BASED INTERVENTION (M-MBI) IN REDUCING STRESS IN EMERGING ADULTS TRANSITIONING OUT OF UNIVERSITY – A MIXED-METHOD STUDY

ABSTRACT

Transitioning out of university is a multi-layered experience that can be highly stressful for emerging adults (EAs). Evidence suggests that mindfulness-based interventions (MBIs), may improve aspects of psychological well-being. This study aimed to investigate the effectiveness of mobile-MBI (m-MBI) in alleviating stress and improving mental well-being (i.e., worry, mindfulness, and self-compassion) in EAs. The study employed a mixed-method design, with a 9-week randomised controlled trial (RCT; i.e., 5-week intervention and 4-week follow-up), followed by qualitative interviews. Ninety-two final-year university students (91.5% female, mean age 22.55), majority with no prior mindfulness experience (77.2%) were randomly assigned to either a 5-week m-MBI group (n = 47) or a waitlist group (n = 45). Half of the randomized participants did not complete the study. Daily mindfulness practices were required, and adherence was tracked within the application. Intention-to-treat (ITT) and per-protocol (PP) analyses were performed. Findings from both analyses suggested that relative to waitlist control, m-MBI exerted a significant small-to-moderate positive impact on worry (d_{ITT} = .40; d_{PP} = .49), even after Bonferroni correction at post-intervention and 1-month follow-up. Perceived stress, self-compassion and mindfulness were not significantly improved across the three time points after adjusting for multiple comparisons. More participants in the m-MBI group in comparison with the waitlist group showed significant reliable improvements in worry and mindfulness scores throughout the study. Mediation analyses showed that mindfulness and self-compassion together contributed as mediators to

perceived stress and that the amount of mindfulness practices was positively associated with the outcomes assessed. Qualitative findings supplemented the benefits found in self-reported measures and further illustrated adherence issues encountered by the participants. These findings suggested the feasibility of a 5-week m-MBI in mental health enhancement, especially worry for EAs in transition. Findings also highlight the importance of including components cultivating mindfulness and self-compassion in m-MBI. Nevertheless, researchers should implement methodologically more rigorous RCTs and examine withdrawals in future m-MBI studies.

Keywords—Smartphone Application, Transition, Worry, Self-Compassion, Mediation Analysis

(312 words)

ACKNOWLEDGEMENTS

I would like to acknowledge Sunway University for funding through the Sunway University Scholarship (100% Tuition Fee Waiver) that supported my study.

This work would not have been possible without the thorough support from all my supervisors. I would like to express my sincere gratitude to my main supervisor, Prof. Alvin Ng, who has provided me with intensive professional guidance, connections, and patience in scientific research and the field of Psychology, and especially the time spent reviewing my work. I wish to also express my thanks and admiration to my co-supervisor, Dr. Phang Cheng Kar, for being the creator and kindly providing me with the contents of one of the most sought-after mindfulness programs in Malaysia. I am also grateful and particularly indebted to my co-supervisor from the digital field, Ms. Lim Woan Ning, who made App coding fun and worthwhile even for a non-computer-science student like me. It was definitely unforgettable, every moment when you cracked the code that had been stuck for hours, or days.

I thank my fellow batchmates: Brenda Sim and Cheryi Tan for the stimulating discussion and ideas exchanged in research, both online and offline. The prompt motivational support was especially warm-hearted at times that I did not even realise that I needed them.

Nobody has been more important to me in the pursuit of this project than the members of my family. I would like to thank my parents, whose love and guidance are with me in whatever I pursue. And to my sisters, who made the days a bit brighter and a lot more bearable when we were being cooped up indoors trying to get through the lockdown.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF SYMBOLS AND ABBREVIATIONS

Abbreviations / Symbols	Definition
ANOVA	Analysis of Variance
BCa CI	Bias-Corrected Confidence Interval
CONSORT	Consolidated Standards of Reporting Trials
EA	Emerging Adult
FA	Focused Attention
FFMQ	Five Facets Mindfulness Questionnaire
FIML	Full Information Maximum Likelihood
IAA	Intention, Attention, and Attitude
ITT	Intention-To-Treat
K-S test	Kolmogorov-Smirnov's test
LOCF	Last Observation Carried Forward
M-MBI	Mobile Mindfulness-Based Intervention
MARS	Mobile Application Rating Scale
MARS	Missing at Random
MBCT	Mindfulness-Based Cognitive Therapy
MBI	Mindfulness-Based Intervention
MBSR	Mindfulness-Based Stress Reduction
MI	Multiple Imputations
NHMS	National Health and Morbidity Survey
OM	Open Monitoring
PP	Per-Protocol
PSS	Perceived Stress Scale
PSWQ	Penn State Worry Questionnaire
RCI	Reliable Change Index

RCT	Randomised Controlled Trial
SCS-SF	Self-Compassion Scale-Short Form
SUREC	Sunway University Research Ethics Committee
T1	Pre-test
T2	Post-test
T3	1-Month Follow-Up
WL	Waitlist
SD	Standard Deviation
CI	Confidence Interval
$d_{between}$	Between-Group Cohen's *d* Effect size
d_{within}	Within-Group Cohen's *d* Effect Size
F	F statistics
M	Mean
MD	Mean Difference
$M_{T2} - M_{T1}$	Mean scores difference across two time points
r	Correlation Coefficient
SE	Standard Error
α	Cronbach Alpha
χ^2	Chi-Square
r_{xx}	Internal Consistency

LIST OF APPENDICES

CHAPTER 1 : INTRODUCTION

Emerging adulthood marks the characteristics where numerous significant life transitions occur (Arnett, 2000). Each of these transitions involves changes in emotional, neurodevelopmental, and social networks. During this stage, emerging adults (EAs) would then develop a new identity, likely an independent adult role from a dependent role (Wood et al., 2018). The transitional changes also contributed to the instability and uncertainty of this stage of life (Arnett, 2000). The mismatches in expectations of the coming life stage might be unbeknownst to them, for instance, having inflated beliefs about employability skills and earnings (Nasreen et al., 2022; Perrone & Vickers, 2003). To ease this transition, some universities and organisations implement internship and graduate programmes to help reduce the theory-practical gap (Divine et al., 2007) and to gain an edge in the job market competition (Abelha et al., 2020; Afonso et al., 2012). Nevertheless, evidence on emerging adulthood transitions also highlights the psychological distress and lack of preparedness experienced by EAs (Perrone & Vickers, 2003; Stoikov et al., 2022). Qualitative interviews conducted on EAs transitioning out of the university suggest the manifestation of self-doubts and worries in decision-making about their future, leading EAs to perceive the transition to be stressful. Such pressure was intensified with high expectations of the self and the other parties (i.e., university, workplace), and a majority felt that they had no support when experiencing these emotions (Keane et al., 2021; Robbins & Wilner, 2001). This transition can be more challenging as EAs are also susceptible to risky coping behaviour, including binge drinking, drug use and risky sexual behaviour (Hafner & Craig Rushing, 2019; Lewis et al., 2018). In addition, this population is more prone to mental health risks than other age groups (Institute for Public Health, 2019). It was found that EAs seeking social support showed reduced stress and increased well-being (Lane & Fink, 2015). As such, this study

would like to propose a self-help intervention for the EAs in this transitional stage, via the aid of information technology.

1.1 Emerging Adulthood – A Contextual Background

Emerging adulthood is a developmental stage as a consequence of societal shifts in industrialised nations coined by Arnett (2000). It encompasses individuals aged 18 to 25, or sometimes extended to adults up to the age of 29 (with observed delayed median age of entering marriage and parenthood in developing countries; Arnett, 2014). It served as an extension of the identity developmental model of adolescence by Erikson (1968). The normative life trajectories of this population appeared to have shifted from concrete objectives (e.g., securing employment, achieving financial independence, getting married and settling down) to more subjective endeavours, including considering existential questions like: Who am I? What do I want to achieve in life? (Lane, 2015). EAs actively explore the various life possibilities open to them and gradually arrive at more lasting decisions in love, career, and worldviews (Arnett, 2000). This shift thus distinguishes EAs from other developmental stages and prior young adult generations. Even though the experiences were likely to vary across different demographic, cultural, and socioeconomic contexts, this phenomenon was also increasingly found in developing countries (Arnett, 2010). Therefore, Arnett (2014) proposed to see it as a developmental stage with different possible trajectories, depending on the EA's experience in "education, work, beliefs, self-development, and relationships" (p.8). There were several distinct features of EAs, including identity explorations (exploring themselves for who they are), self-focused (focusing on oneself to form one's identity), feeling in-between (feeling they are neither adolescent nor adult), instability (uncertainties such as role and accommodation) and possibilities (abundant choices in potential mate, job opportunities and social cause; Reifman et al., 2007). While acknowledging the emphasis on emerging adulthood as being distinct from other development stages, Nelson (2021) also noticed

changes in the qualities of emerging adulthood. EAs now are delaying marriage even longer than two decades ago and show less commitment to others. They are also granted more autonomy on a greater variety of life options, and with little structure to guide their behaviour and life choices. This suggested that emerging adulthood can be threatening for EAs that have lower emotional tolerance for ambiguous situations (i.e., intolerance of uncertainty; Buhr & Dugas, 2009) as this stage is marked by uncertainty and novelty (Padilla-Walker et al., 2017). Therefore, effectively managing this uncertainty and instability is crucial for EAs to cope with this emotionally tense phase.

1.2 Significance of Problem – The Transition Itself

According to the transition model by Bridges and Bridges (2009) transition is characterised by three overlapping phases. First, 'ending, losing and letting go' suggested a realization of the need to change an old identity or a usual way of doing things. It was often marked with resistance and emotional upheaval. Moving to the neutral zone suggested a process of letting go of the old identity and adapting to new beliefs and attitudes. Lastly, the new beginning suggested a proactive and productive process in the assimilation of the new identity or new ways of being in concordance with the new situation. The transition could be challenging because it forces individuals to dismantle their pre-existing life structure, in the face of a future of uncertainty. With this disintegration and fragmentation of existing structure comes a high probability of crisis (Robinson et al., 2021). Being worried about the ambivalence and uncertainty of the future lying ahead is not an uncommon theme for the EAs (Keane et al., 2021; Silver & Roksa, 2017; Yazedjian et al., 2010).

If we apply the transition model to the EAs in university settings (Bridges & Bridges, 2009), within two years of their lives, they will first disengage from university life and their role as a student - the ending phase. It could be overwhelming because the university is largely focused on academic learning and represents a moratorium period of

many adult responsibilities (e.g., job searching and settling down; Raymore et al., 1999). Some EAs may seek to postpone major life decisions until after university (Grosemans et al., 2020). Therefore, impending graduation could be identified as an anticipated stressor as societal expectations denote the execution of adult roles and major life decisions (Keane et al., 2021). It could signify life changes where graduating EAs may not feel competent to march (Lane, 2013). Qualitative interviews even found that some graduating EAs attempted to prolong their education by continuing their studies into postgraduate education (Keane et al., 2021).

The neutral zone indicated the time between graduation and the beginning of a new profession. Bridges and Bridges (2009) sees this zone as a limbo – a 'psychological no-man's-land' between the old and new way of doing and being. At this stage, EAs could be stressed in making plans for the new identity, yet they may find it challenging to disengage from their student role, particularly as the curriculum remains (Keane et al., 2021). Moreover, these thoughts and plans would merely be static provided EAs had the right expectations regarding employability and potential employers. These to-be graduates often have expectations that are mismatched with the employers' (Ang, 2015; Rizwan et al., 2021), with inflated expectations in their self-management skills and mental well-being management (Dunning-Kruger effect; Kruger & Dunning, 1999).

Lastly, the beginning phase would be the first year of their respective professions. These new graduates must adapt to a new role where feedback is less structured than afforded compared to their university experience (Hettich, 2009), transitioning into an environment where achievements come before personal development (Grosemans et al., 2020). As a result, they may experience psychological stress acclimating to their new role (*role stress*; Allanach & Jennings, 1990), potentially due to the insufficient or inconsistent information and expectations of their role (*role ambiguity*, Chang & Hancock, 2003). To cope, adjustments in attitudes, expectations and even their social network were required

(Polach, 2004; Wendlandt & Rochlen, 2008). Besides, a review also observed that graduating EAs see job changing as an unavoidable process due to the economic situation, perceived misfit and/or dissatisfaction towards the job, as well as achieving career goals (Grosemans et al., 2020). All in all, the transitional model revealed EAs' susceptibility to psychological turmoil at this stage, and in such a short period.

1.3 What Could Possibly Make This Stage Harder?

1.3.1 A Pinch of Economics

The novel coronavirus COVID-19 has profoundly disturbed lives all over the globe (Ferguson et al., 2020). It has had a devastating impact on the labour markets (Lee, 2020) and is particularly disruptive for young people (OECD, 2022), including the EAs. Although the recovery in youth employment has been observed two years after the onset of the pandemic, it was still lagging behind older adults, and, compared to the pre-pandemic levels (OECD, 2022). The latest data from The World Bank (2022) revealed that global youth unemployment was 17.89% in 2021, three times the unemployment rate of adults. Malaysia has not been spared the global trends, reaching 12.0% of youth unemployment as of the third quarter of 2022. Furthermore, even before the pandemic, job opportunities in the Malaysian economy remained concentrated on semi-skilled jobs (62.3% of positions) rather than high-skilled jobs (24.7% of positions), despite the increasingly educated workforce (Department of Statistics Malaysia, 2022; Yap, 2020). This suggested that the high-skilled job markets posed greater competition for university graduates, potentially providing higher salaries and opportunities to utilise the skills obtained in tertiary education. The economic outlook could be worrying for the EAs as they were likely to graduate in a global recession, further impacting their employability. The inability to obtain employment could also lead to self-doubt in their capabilities (Lane, 2015), which could have implications for their psychological well-being (Bartelink et al., 2020; Hayes & Nutman, 1981).

1.3.2 Mental Health Concerns

The National Health and Morbidity Survey (NHMS) 2019 morbidity survey (Institute for Public Health, 2019) recorded that EAs at 20 to 24 years old have the highest rate of current depression in Malaysia. The previous NHMS survey in 2015 also showed the highest psychological morbidity (32.1%) in EAs between 20 to 24 years old (Institute of Public Health, 2015). Studies have documented a relatively high prevalence of mental health problems in the third decade of life. A telephone survey conducted in the US revealed a U-shape psychological well-being profile upon age, with declining well-being over age and only showing a gradual increase after the age of 50 (Stone et al., 2010). In a recent survey conducted in Malaysia during the COVID-19 pandemic, it was discovered that around one-third of EAs in tertiary education experienced a mild-to-moderate level of anxiety. The study further revealed that EAs aged between 21 to 24 years old were 1.67 and 2.84 times more likely to exhibit depressive and anxiety symptoms compared to other age groups (Marzo et al., 2021). Mitigation to reduce COVID-19 transmissions such as lockdowns and social distancing could risk social isolation and loneliness, amongst other psychological issues (Hoffart et al., 2020; Miller, 2020). This population is also susceptible to risky and impulsive coping behaviour, including drug use, risky sexual behaviour, and binge alcoholic drinking (Hafner & Craig Rushing, 2019; Lewis et al., 2018). The NHMS 2019 (Institute for Public Health, 2019) recorded the highest prevalence of alcoholics (54.5%) at the age of 20-24, compared to adults in other age groups. Although most EAs underwent this transition safely or even thrived during this period (Arnett, 2014), it was highly probable that they were using less effective coping skills (e.g., avoidance coping), even for just a short run (Lostutter et al., 2013). With high mental health risks and suboptimal circumstances, it could result in stress, worry and rumination that could manifest into anxiety disorder or depression. Thus, it is crucial for

EAs to cultivate awareness towards their psychological well-being and be self-compassionate during this transitional journey.

1.4 The Problem Statement

Interventions targeting the prevention of high-risk behaviour of the EAs, such as alcohol binging and engaging in sexual risk, have been assessed in previous studies (Hafner & Craig Rushing, 2019; Layland et al., 2018; Lewis et al., 2018). A web-based personalized feedback intervention that integrated alcohol and risky sexual behaviour content showed short-term reductions of alcohol-related risky sexual behaviour in EAs when compared to control group (Lewis et al., 2018). However, these studies did not evaluate the mental well-being of EAs. One study found that social support helped improve the well-being of university seniors and fresh graduates (Lane & Fink, 2015). Besides that, a group-based two-week positive psychology intervention (i.e., creating a positive mindset, cultivating gratitude, and goal setting) showed positive changes in EAs' level of hope, perception of social support and stress (Leontopoulou, 2015). Although these group-based approaches showed promising results, they required external parties (e.g., family and /or peer support). This population was also less likely to seek help from professionals (Spence et al., 2016). Stigma and concern about peers' evaluation often prompt disengagement and discontinuation of mental health services during the transition (Anderson et al., 2022). Hence, it is essential to introduce an interventional approach that can aid EAs in managing themselves holistically and, at the same time, minimise the stigma of peers' evaluation. It is suggested that digital technology would be a fitting platform for the intervention.

1.5 Mindfulness-based Intervention (MBI) As Self-Help

Mindfulness is often defined as a skill of paying attention to moment-to-moment experiences, with a non-judgemental attitude (Kabat-Zinn, 2013). It is also known to be a holistic state of mind that could be enhanced through systematic practice, such as

meditation (Kabat-Zinn, 2013), giving rise to third-wave therapies such as mindfulness-based cognitive therapy (Hayes & Hofmann, 2017; Kabat-Zinn, 1982). Although secular mindfulness-based interventions (MBIs) were originally conducted in a group-based instructor-led format, with a relatively intensive curriculum (Kabat-Zinn, 1982), its flexibility allowed the format to be tailored based on the population in need. MBIs have been shown to foster positive adaptations, including stress reduction, positive emotional adjustment (Ramler et al., 2016), well-being improvements and decreases in anxiety and depression (Dvořáková et al., 2017) among first-year university students. In recent years, MBIs have also been increasingly delivered through the Internet in a self-help format, showing adequate effectiveness in improving mental well-being in both healthy and clinical samples (Sommers-Spijkerman et al., 2021; Spijkerman et al., 2016). In addition, the surge in smartphone usage and customizable mobile application features makes it a compelling tool for clinical interventions (Hoffmann et al., 2017) and well-being management for citizens of the digital era (Wahbeh et al., 2014). Therefore, this study aimed to propose a mobile-based MBI (m-MBI) for the tech-savvy EAs undergoing out-of-university transition as a self-paced intervention. The self-help format could also help reduce the concerns about seeking help from external parties. Moreover, cultivating mindfulness through m-MBI could potentially help EAs in developing awareness of their impending transition which could be stressful, with a non-judgmental attitude. With mindful awareness, EAs might be able to adopt a caring, compassionate, loving attitude towards themselves to see their experiences as part of universal experiences, rather than over-identifying painful experiences during this transitional journey (Neff, 2003b). Therefore, this study aimed to investigate the effectiveness of a m-MBI in alleviating stress as the primary outcome. Besides that, with stress not likely the only psychological implication of the EA transitions, the present study also aimed to determine the

effectiveness of m-MBI on the improvement in worry, self-compassion, and mindfulness as the secondary outcomes.

CHAPTER 2 : LITERATURE REVIEW

"You can't stop the waves, but you can learn to surf" – Kabat-Zinn (2005).

The present study aimed to investigate the effectiveness of a mobile-based mindfulness-based intervention (m-MBI) in promoting mental health well-being of emerging adults (EAs) transitioning out of university. This section first reviews the implementation and effectiveness of online and m-MBIs in secular settings. Secondly, evidence on how MBIs improved perceived stress, worry, self-compassion and mindfulness are discussed. Consequently, the mechanisms of MBIs on the changes in outcomes assessed through the mediating effect of mindfulness and self-compassion are further elaborated. Lastly, gaps and inconsistencies in the mindfulness literature are explored. The research questions of the current study were detailed as follows.

2.1 Research Questions

The main research questions for this study were:

1. Is MBI delivered via a smartphone (m-MBI) an effective way to reduce perceived stress and worry in EAs undergoing transition?
2. Is m-MBI an effective way to increase self-compassion and cultivate mindfulness in EAs?

The current study also sought to explore the mechanism of the benefits of MBI, with mindfulness and self-compassion as potential mediators. Further research questions were:

3. Would the change in mindfulness scores mediate the relationship between m-MBI and stress, worry and self-compassion in EAs?
4. Would the change in self-compassion scores mediate the relationship between m-MBI and stress, worry and mindfulness in EAs?

In addition, this study further explored gaps and inconsistencies in the mindfulness literature on mindfulness facets (Glomb et al., 2011) and the amount of mindfulness

practices (Strohmaier, 2020; Vettese et al., 2009) on the outcome assessed. Hence, the exploratory research questions were:

5. Which of the mindfulness facets would mediate the relationship between m-MBI and stress, worry and self-compassion in EAs?
6. Is the amount of mindfulness practice (frequency and duration) associated with the changes in stress, worry, self-compassion and mindfulness in EAs?

2.2 Mindfulness-Based Interventions (MBIs)

MBIs are mindfulness training that requires individuals to focus attention on a chosen object and to return focus to the object each time the mind wanders. Once this foundation has been established, the practice further entails an open and non-reactive stance towards bodily sensations, thoughts and feelings that arise (Lutz et al., 2008). One of the earliest secular MBI was Mindfulness-Based Stress Reduction (MBSR), an 8-week program founded in 1979 for chronic pain patients, consisting of daily formal and informal practices of at least 45 minutes per day (Kabat-Zinn, 2013). Given its flexibility in design to adapt to specific populations, various MBIs flourished in response to the adaptation of the MBSR program, including mindfulness-based cognitive therapy (MBCT), targeting specifically clinically depressed patients (Segal, 2013). Other modifications involved reducing the length of the MBI and its practice as MBSR could be time demanding. However, some key essentials were required to be known as MBSR, including mindfulness teaching modules, and formal and informal practices (Schell et al., 2019). Formal practices commonly involved meditation practices, such as mindful breathing, body scan, mindful movements, and sometimes self-compassion meditations. Informal practices are usually comprised of short practices that incorporate mindfulness skills into daily lives, for instance, mindful eating or walking. These practices promoted greater awareness and acceptance towards internal and external experiences, and in turn, allowed individuals to respond thoughtfully rather than recklessly (Chiesa & Serretti,

2009). Therefore, the key components of MBSR - psychoeducation, formal and informal practice – were incorporated in the present m-MBI.

Studies and meta-analyses demonstrated the effectiveness of MBI in improving mental well-being in a wide range of samples (Chiesa & Serretti, 2009; Keng et al., 2011; Khoury et al., 2015). This further gave rise to the opportunity to deliver MBI through the Internet, given the rapid development of the internet-of-things (IoT). Indeed, online interventions yielded several advantages over in-person interventions, in that they (i) have wider accessibility; (ii) are available 24/7 at self-pace; (iii) ensure user anonymity; (iv) do not necessarily require the involvement of a therapist; and (v) are more cost-effective (Andersson & Titov, 2014). Moreover, people checked on their devices on an average of 58 times each day and spent most of their time on downloaded applications (Howarth, 2023). This made smartphones a compelling tool to deliver MBIs, at least to a handful of researchers (e.g., Bostock et al., 2019; Champion et al., 2018). Meta-analyses found that online and m-MBI achieved moderate effect size in stress reduction (g = .44 and .51), which is comparable to the effect size found in group-based in-person MBSR. However, the effect size for depression (g = .34) and anxiety (g = .26) were generally smaller compared to the traditional MBI (Sommers-Spijkerman et al., 2021; Spijkerman et al., 2016). Table 2.1 displayed a brief review of studies not included in Spijkerman et al. (2016), supporting the small-to-moderate magnitude of effect of online and m-MBIs. While different features of online or digital-based MBIs may influence intervention efficacy (e.g., guided versus unguided practices), with guided online practices showing stronger effects compared to unguided ones (Seewer et al., 2024; Spijkerman et al., 2016) , the cost-effectiveness, wider accessibility, and highly customisable feature of smartphone applications make them a feasible platform for reaching EAs during transitional periods.

Table 2.1

Summary of Efficacy Trials of Online and Mobile Application Mindfulness-Based Interventions (MBIs)

No.	Authors / Country	Populations	Intervention	Sessions	web or app	Control	Outcome measures (Scales, Between[a,b] & Within[a,c] Group Effect Size)			
							Mindfulness	Stress	Worry	Self-compassion
1	Küchler et al., 2023 / Germany	University students from Germany, Austria, and Switzerland (n=386; Mage: 29.85; SD: 4.80)	StudyCare Mindfulness a. Unguided Group (UG, n=129) Incl: Psychoeducation, meditation (e.g., body scan, breathing meditation, loving kindness meditation), yoga, mindfulness diary. b. Guidance on Demand (GoD, n=130) Incl: UG group intervention + personalized feedback /support	8 weeks (7 core modules)	Mobile Application & Website (StudiCare-M) Both w/ guidance & w/o guidance	Treatment as Usual (TAU, n=127)	Scale: FMI Between Group Effect Size: UG v. TAU = .947** GoD v. TAU = 1.059** UG v. GoD = -.128 Within Group Effect size: UG = 1.325 GoD = 1.378 TAU = .361	Scale: PSS Between Group Effect Size: UG v. TAU = -.319** GoD v. TAU = -.625** UG v. GoD = .322** Within Group Effect size: UG = -.473 GoD = -.81 TAU = -.159	N/A	N/A
2	Isham et al., 2022 / Scotland	Depressive adults recruited from online, campus and community in Scotland. (n=55, Mage: 22.36, age range: 18-65)	Palouse Mindfulness* (MBSR, n=28) *30-min daily practice Including meditation practices (i.e., body scans, sitting meditation, loving kindness meditation, visualization) and yoga	8 weeks (8 modules)	Website w/o guidance	Waitlist (WL, n=27)	Scale: FFMQ Between Group Effect Size**: MBSR v. WL = .516 Within Group Effect size: MBSR: .605 WL: .131	N/A	Scale: RRS Between Group Effect Size: MBSR v. WL = .064 Within Group Effect size: MBSR: .095 WL: .157	N/A

Table 2.1, continued.

No.	Authors / Country	Populations	Intervention	Sessions	web or app	Control	Outcome measures (Scales, Between[a,b] & Within[a,c] Group Effect Size) Mindfulness	Stress	Worry	Self-compassion
3	González-García et al., 2021 / Spain	First year psychology students from a university in Spain (n=66,Mage:19.83, SD: 1.49)	E-Mindfulness Intervention (E-MBI, n=66) * 4 weekly modules consisting of mini lectures, mindfulness (e.g., body scan) and compassion meditations, reflections	16 days (4 modules)	Online platform w/ guidance	N/A	N/A	Scale: PSS Within Group Effect Size**: E-MBI: .51	N/A	Scale: SCS Within Group Effect Size**: E-MBI: .61
4	El Morr et al., 2020 / Canada	Undergraduates from a university in Canada (n=148, Mage:22.55, SD: 6.1)	Mindfulness Virtual Community (MVC, n=68) *psychoeducation videos, guided meditation, text-based discussion, videoconferencing	8 weeks (12 modules)	Online platform w/ guidance	Waitlist (WL, n=80)	Scale: FFMQ Between Group Effect Size**: MVC v. WL = .47 Within Group Effect size: MVC = .184 WL = -.213	Scale: PSS Between Group Effect Size: MVC v. WL = –.23 Within Group Effect size: MVC = -0.1 WL = -.164	N/A	N/A
5	Huberty et al., 2019 / US	Undergraduate from university in the Southwestern United States (n=88, Mage: 21.13, SD: N/A)	Calm app* (INT, n=41) *10 mins daily for 8 weeks (at least 30 mins per week)	8 weeks	Mobile Application (Calm) w/o guidance	Waitlist (WL, n=47)	Scale: FFMQ Between Group Effect Size**: INT v. WL = 1.29 Within Group Effect size: INT: 1.108 WL: -.157	Scale: PSS Between Group Effect Size**: INT v. WL = 1.024 Within Group Effect Size: INT: 1.233 WL: .329	N/A	Scale: SCS-SF Between Group Effect Size**: INT v. WL = .872 Within Group Effect Size: INT: .842 WL: .007

Table 2.1, continued.

No.	Authors / Country	Populations	Intervention	Sessions	web or app	Control	Outcome measures (Scales, Between[a,b] & Within[a,c] Group Effect Size) Mindfulness	Stress	Worry	Self-compassion
6	Yang et al., 2018 / California, US	Medical student from Keck School of USC (n=88, Mage: 25.11, age range: 21-47)	Headspace* (HS, n=45) *10 mins for 10 days, 15 mins for next 15 days, 20 mins for subsequent session	30 days (30 sessions)	Mobile Application (Headspace) w/o guidance	Waitlist (WL, n=43)	Scale: FFMQ Between Group Effect Size**: HS v. WL = .262 Within Group Effect Size**: HS: .387 CTL: .013 **Observing subscale only	Scale: PSS Between Group Effect Size: HS v. WL = .327 Within Group Effect Size: HS: .314 CTL: .387	N/A	N/A
7	van Emmerik et al., 2018 / N/A (likely Netherland)	General adult recruited in FB through social media agency (n=377, Mage: 43.78-45.63; SD: 9.09-1.48)	VGZ Mindfulness Coach* (n=191) Including: breathing meditation, relaxation, walking meditation, visualization, body scan, sitting meditation, 3-min breathing space *no readings	5 weeks	Mobile application (VGZ mindfulness Coach) w/o guidance	Waitlist (WL, n=186)	Scale: FFMQ Between Group Effect Size: VGZ v. WL =.77 Within Group Effect Size: VGZ= .79 WL= .15	N/A	N/A	N/A

Table 2.1, continued.

No.	Authors / Country	Populations	Intervention	Sessions	web or app	Control	Outcome measures (Scales, Between[a,b] & Within[a,c] Group Effect Size) Mindfulness	Stress	Worry	Self-compassion
8	Mak et al., 2015 / Hong Kong	General adult population through newspaper and mass emails to large institution (n=2161, Mage:33, SD=12)	a. mindfulness-based program (MBP, n=703) Including: body scan , mindful breathing, mindful eating, mindful walking, 3-min breathing space, reading and graphics b. Cognitive Behavioural Program (CBP, n=753) Including: problem solving skills, emotional management, PMR, imagery c. Self-compassion Program (SCP, n=705) Including: compassionate body scan, affectionate breathing, loving-kindness meditation, compassionate walking, soften-allow-soothe, self-compassion break, and self-compassion journaling	4 weeks , 28 sessions	Mobile application (Living with Heart) w/o guidance	N/A	Scale: MAAS Between Group Effect Size: MBP v. SCP = .101 MBP v. CBP= -.091 Within Group Effect Size: MBP = .08 SCP = .19 CBP = .10	N/A	N/A	Scale: SCS Between Group Effect Size: MBP v. SCP = -.227 MBP v. CBP= -.187 Within Group Effect Size: MBP = .07 SCP = .32 CBP = .27

Table 2.1, continued.

No.	Authors / Country	Populations	Intervention	Sessions	web or app	Control	Outcome measures (Scales, Between[a,b] & Within[a,c] Group Effect Size) Mindfulness	Stress	Worry	Self-compassion
9	Gu et al., 2017 / UK	UK University students and staffs (n=120, Mage:24.66, SD:6.40 , 90% students)	Online Mindfulness Self-Help (MBSH; n=42)	2 weeks	Web-based Learning Management System (Learning Mindfulness Online) w/o guidance	1. classical music control (Music, n= 42) 2. waitlist control (WL, n= 36)	Scale: FFMQ Between Group Effect Size: MBSH v. WL = .220, MBSH v. music= .148 Within Group Effect Size: MBSH =.471 Music =.265 WL =.052	Scale: PSS Between Group Effect Size: MBSH v WL=.391 MBSH v music=.413 Within Group Effect Size: MBSH =.484 Music =.075 WL =.045	Scale: PSWQ Between Group Effect Size: MBSH v.WL= .173 MBSH v.music= .226 Within Group Effect Size: MBSH =.586 Music =.148 WL =.142	Scale: SCS-SF Between Group Effect Size: MBSH v. WL= .036 MBSH v. music =.024 Within Group Effect Size: MBSH =.456 Music =.335 WL =.031
10	Economides et al., 2018 / N/A (likely US)	General adult recruited via a 3rd-party recruitment service (n=69, >50% age range 18-29)	Headspace (HS, n=41) 10 first introductory session (Take 10)	up to 4 weeks; 10 sessions	Mobile Application (Headspace) w/o guidance	Audiobook (CTL, n=28) Psychoedu-cation of mindfulness and Puddicome' s experience as monk	N/A	Scale: SOS Between Group Effect Size: HS v. CTL = .26 (PV) and .45 (EO) Within Group Effect Size: a. PV: HS = 1.16 CTL =.82 b. EO: HS = .65 CTL =.02	N/A	N/A

Table 2.1, continued.

No.	Authors / Country	Populations	Intervention	Sessions	web or app	Control	Outcome measures (Scales, Between[a,b] & Within[a,c] Group Effect Size) Mindfulness	Stress	Worry	Self-compassion
11	Champion et al., 2018 / UK (n=72) US (n=2)	Adults from general population (n=62, Mage: 39.13, SD: 5.70)	Guided mindfulness meditation (MM, n= 38)	30 days (30 sessions)	Mobile Application (Headspace) w/o guidance	Waitlist (WL, n=36)	N/A	Scale: PSS Between Group Effect Size: MM v. WL = 1.42 Within Group Effect Size: MM= .83 WL= -.47	N/A	N/A
12	Course-Choi et al., 2017 / UK	High worriers recruited in a UK campus and online. (n=60, Mage: 27.33- 30.67, SD=3.96-9.48)	a. mindfulness (MM, n=15) Including: seated meditation (21 mins) b. N-back (n=15) Including: cognitive task training c. Combined (n=15, n-back + mindfulness)	1 week	Website w/o guidance	control (CTL, n=15)	N/A	N/A	Scale: PSWQ Between Group Effect Size: MM v. CTL= .121 MM v. N-back = .481 MM v. Combined =.133 Within Group Effect Size: MM=.902 Combined d=.526 N-back d=.796 CTL=.302	N/A

Table 2.1, continued.

No.	Authors / Country	Populations	Intervention	Sessions	web or app	Control	Outcome measures (Scales, Between[a,b] & Within[a,c] Group Effect Size) Mindfulness	Stress	Worry	Self-compassion
13	Cavanagh et al., 2018 / UK	University Staff and Students (n=155, Mage: 3.60-31.54, SD: 11.45-12)	a. MBI with meditation (MM, n=53) b. MBI without meditation (Mpsych, n=52)	2 weeks	Web-based Learning Management System w/o guidance	Waitlist (WL, n=50)	Scale: FFMQ Between Group Effect Size: MM v. Mpsych= .217 MM v. WL= .431 Within Group Effect Size: MM= .25 Mpsych: d=.35 WL: d=.09	Scale: PSS Between Group Effect Size: MM v. Mpsych= .28 MM v. WL= .43 Within Group Effect Size: MM= .27 Mpsych: d=.37 WL: d=.06	N/A	N/A
14	Bhayee et al., 2016 / Toronto, Canada	Healthy community dwelling adult (n=26, Mage:32-33 , SD:4.7-4.9)	Neurofeedback-assisted, technology-supported Mindfulness Training (N-tsMT; n=13)	6 weeks (10 mins daily)	Mobile Application (Calm) w/o guidance	Math training active control (CTL, n=13)	Scale: FMI Between Group Effect Size: N-tsMT v. CTL= .08 Within Group Effect Size: N-tsMT= .109 CTL= .023	N/A	N/A	N/A

Table 2.1, continued.

No.	Authors / Country	Populations	Intervention	Sessions	web or app	Control	Outcome measures (Scales, Between[a,b] & Within[a,c] Group Effect Size) Mindfulness	Stress	Worry	Self-compassion
15	Allexandre et al., 2016 / Ohio, US	Employees in a corporate call centre (n=161, Mage:40; SD:12.6)	a. Web based stress management (WSM, n=54) b. WSM with non-expert guide (WSMg1, n=37) c. WSM with expert guide (WSMg2, n=33)	8 weeks	Web-based Learning Management System w/ guidance	Waitlist (WL, n= 37)	Scale: MAAS Between Group Effect Size: WSM v. WL= .1 WSMg v. WL= .3 Within Group Effect Size: WSM= .2 WSMg1= .5 WSMg2= .3 WL= .1	Scale: PSS Between Group Effect Size: WSM v. WL= .40 WSMg v. WL= .80 Within Group Effect Size: WSM= .6 WSMg1= 1.1 WSMg2= 1.1 WL= .2	N/A	N/A
16	O'Leary et al., 2016 / N/A (likely Ireland)	Female participants (n=65, Mage: 28.35, SD: 6.65)	a. Gratitude intervention* (GI, n=15) b. Mindfulness intervention* (MI, n=13) * Intervention including diary and gratitude reflection/ body scan	3 weeks, record 4 times per week	Web-based Learning Management System w/o guidance	Control (CTL, n=7)	N/A	Scale: PSS Between Group Effect Size: MI v. GI= .401 MI v. CTL= 1.022 Within Group Effect Size: MI= .502 GI= .573 CTL= .034	N/A	N/A

Note. Mage = Mean age; SD = Standard Deviation; N/A = Non-applicable; FFMQ = Five Facet Mindfulness Scale; MAAS = Mindfulness Awareness and Acceptance Scale; PSS = Perceived Stress Scale; SOS = Stress Overload Scale; PV = Personality vulnerability; EO = Event overload; PSWQ = Penn State Worry Questionnaire; SCS = Self-Compassion Scale; SCS-SF = Self-Compassion Scale-Short Form; w/o guidance = without online/offline course support; w/ guidance = with online/offline course support.

[a.] Effect size in Cohen's *d*.

[b.] Between-group effect size reflect intervention condition and comparison group at post-test.

[c.] Within group effect size reflecting change from preintervention to post-test in study.

2.3 Stress, Worry, and the Impact of MBI in EA Transition

For EAs, the prospect of impending graduation, job searches, or postgraduate studies applications represents anticipated stressors with outcomes that may be ambivalent and beyond their control (Lambert, 1999; Silver & Roksa, 2017). While anticipating a stressor could be beneficial which allowed individuals to set the stage for coping strategies (Feldman & Hayes, 2005), seeing a stressor coming can be unpleasant. For instance, a 7-day ambulatory assessment revealed elevated negative affect in participants expecting and experiencing stressful events (Neubauer et al., 2018).

Furthermore, even after securing a job or enrolling in postgraduate studies, the adjustment to new roles, such as role ambiguity and potentially inconsistent demands like role conflict, remains a significant source of stress for EAs (Biddle, 1986; Kalkman, 2018; Wong et al., 2018). This was evidenced by studies conducted on newly graduated nurses (Ebrahimi et al., 2016; Parker et al., 2014;Tsang et al., 2016; Walker & Costa, 2017). In addition, worry, characterized by negatively laden and uncontrollable thoughts (Borkovec et al., 1983; p.10), is more prevalent in EAs than in older adults. This prevalence aligns with the developmental process of identity exploration and the inherent instability of emerging adulthood (Reifman et al., 2007).

Notably, a study found that the instability dimension not only heightened EAs' worry about work and finances but also contributed to overall life instability (Barlett & Barlett, 2018). Coupled with self-doubt regarding their capabilities (Lane, 2015; Peer & McAuslan, 2016), EAs may engage in constant rumination over decision-making, presenting a risk factor in identity development (Beyers & Luyckx, 2016).

Engaging in mindfulness, through practices like focused attention meditation (FA) and open monitoring meditation (OM), has the potential to significantly reduce stress and worrying thoughts. Neuroscientific studies indicated that FA, which focuses on an object like the breath, activates brain regions regulating attention, engagement, and monitoring,

while OM, involving monitoring present moment experiences such as body scans, is associated with brain regions involved in monitoring, vigilance, and directed attention (Lippelt et al., 2014; Lutz et al., 2008). These practices could potentially cultivate awareness, redirect attention, and acknowledge moment-to-moment stress without fostering overthinking.

Additionally, mindfulness enhances the ability to monitor, inhibit, and redirect attentional focus when facing conflicting or ruminative thoughts. A study on experienced meditators found increased brain activity associated with conflict monitoring and emotional regulation during mind-wandering episodes in meditation practice (Hasenkamp et al., 2012). Intensive OM meditation enhances efficiency in engaging and disengaging from a target stimulus (Bishop et al., 2004), reducing the likelihood of becoming 'stuck' in worrying thoughts and effectively orienting EAs to current tasks.

One of the most robust results of MBI is stress reduction, with meta-analyses showing comparable moderate effect sizes in both in-person MBI (Gotink et al., 2015) and MBI delivered online (Sommers-Spijkerman et al., 2021). A 30-day m-MBI significantly reduced perceived stress in medical students assigned to the mindfulness group, compared to the waitlist control (Yang et al., 2018). Other studies focused on student EAs also showed an agreeable outcome in stress alleviation (Greeson et al., 2014; Phang et al., 2015).

Besides that, web-based MBIs, implemented for one and two weeks, significantly alleviated worry in university students (Course-Choi et al., 2017; Gu et al., 2017). Additionally, MBIs were also found to mitigate ruminative thoughts in university students, when compared to the control group (Jain et al., 2007). Despite evidence indicating a well-established link between MBI and stress in university students, it is crucial to extend its application to EAs undergoing transitions beyond tertiary education, given the distinct stressors of the latter group. Recognizing that the transition process during emerging

adulthood can be profoundly stressful and worrying, and considering that MBI has shown efficacy in reorienting and reperceiving challenges and worrying thoughts, it was proposed that:

Hypothesis 1: M-MBI group would experience greater reduction in stress compared to waitlist control across 3 time periods: pre-test (T1), post-test (T2), and 1-month follow-up (T3).

Hypothesis 2: M-MBI group will experience greater reduction in worry compared to waitlist control across 3 time periods: pre-test (T1), post-test (T2), and 1-month follow-up (T3).

2.4 Mindfulness, Self-Compassion, and the Impact of MBI in EA Transition

Mindfulness, rooted in Buddhism with the Pali term '*sati*', denoting bare attention (Gethin, 2011), has evolved in secular settings to address how the mind processes thoughts and events (White, 2014) . A widely cited definition by Kabat-Zinn (2005, p.4) denotes mindfulness as "paying attention in a particular way: on purpose, in the present moment, and non-judgmentally."

Shapiro et al. (2006) expanded this with the IAA model (Intention, Attention, and Attitude) to underscore mindfulness as a multi-faceted construct. Intention advocates practicing mindfulness with a personal vision or purpose. Attention involves being aware of present-moment experiences, both internal and external. Attitude, as proposed by Kabat-Zinn (2013), encompasses qualities such as non-judging, patience, beginner's mind (open-mindedness), trust, non-striving, acceptance, and letting go. Mindfulness has shown developmental benefits for EAs, associated with lower instability and aiding exploration of core values during transitions (Peer & McAuslan, 2016; Rogers, 2013). Therefore, developing a mindful stance could allow EAs to explore their core identity, not only through pleasant experiences but also by acknowledging difficult experiences.

Moreover, self-compassion, the inward turn of compassion that enables individuals to confront their suffering with concern, kindness, and connection, holds particular relevance for EAs undergoing transitions (Neff, 2003b). EAs commonly contended with elevated self-expectations and self-criticism during this trial-and-error phase of adulthood (Parker et al., 2014; Wong et al., 2018). They frequently experience imposter syndrome, perceive themselves as fraudulent (Clance & Imes, 1978), and demonstrate less adaptive emotional regulation towards negative events and emotions (Lane, 2015; Zimmermann & Iwanski, 2014). Cultivating self-compassion could potentially empower EAs to approach personal inadequacies and challenges during workplace transitions with greater forgiveness and acceptance.

Neff (2003) outlined three components of self-compassion: treating oneself with kindness, acknowledging common humanity, and practicing mindfulness. Treating oneself with kindness refers to treating oneself with care rather than harsh and critical self-judgment. This involves caring for oneself without harsh self-judgment, recognizing imperfection as a shared human experience, and maintaining a balanced perspective on negative experiences without over-identification (Neff, 2003a).

There is evidence showing the effectiveness of MBIs in enhancing mindfulness. A 4-week group-based MBI tailored to EAs demonstrated significant improvement in mindfulness compared to the waitlist group (Greeson et al., 2014). Ramler et al. (2016) showed that mindfulness scores increased in first-year university students after an 8-week in-person MBI, especially in the observing, describing, and nonreactivity facets. In Malaysia, a 5-week MBI developed and tested with the local communities found a small effect of improvement in mindfulness in medical students when conducted using a self-help DVD format (Phang et al., 2015).

Similarly, there was empirical support for the effectiveness MBIs in promoting self-compassion, particularly evident in the healthcare profession due to the unique

demands of their work (e.g., Boellinghaus et al., 2012; Shapiro et al., 2007). An m-MBI implemented for healthcare students showed a large effect increase in self-compassion when compared to the inactive controls (Orosa-Duarte et al., 2021). In addition, a 2-week web-based MBI showed significant enhancement in self-compassion score when compared to a waitlist control (Gu et al., 2017). In view of the empirical support and the importance of mindfulness and self-compassion for EAs during the out-of-university transition, it was proposed that:

Hypothesis 3:M-MBI group will experience a greater increase in the degree of mindfulness compared to waitlist control across 3 time periods: pre-test (T1), post-test (T2), and 1-month follow-up (T3).

Hypothesis 4: M-MBI group would experience a greater increase in self-compassion compared to waitlist control across 3 time periods: pre-test (T1), post-test (T2), and 1-month follow-up (T3).

2.5 The Relationship Between Mindfulness and Self-Compassion

Studies have found that mindfulness and self-compassion mediated each other in an MBI (Baer et al., 2012; Van Dam et al., 2010). Neff (2003b) posited that a certain degree of mindful attention to an individual's suffering was first needed to apply the intention to self-compassion. For instance, only when the negative thoughts were attended, one could then realize the self-imposed judgemental thoughts, and further allow the intention to be self-kind towards the unfulfilled experiences. Non-judgmental attitudes cultivated in MBI could also contribute to self-kindness with an increased sense of self-understanding and reduced self-criticism (Jopling, 2000). Neff (2003b) also proposed that self-compassion cultivated through mindfulness could further feedback to improve the level of mindfulness. For example, when one applies self-compassion and minimises self-judgmental thoughts upon one’s own mistakes, thoughts, and emotions would be easier to be held in mindful awareness as there would be less emotional disturbance (Fredrickson,

2001). Therefore, from a theoretical perspective, there would be considerable overlap between the constructs of mindfulness and self-compassion (Neff & Dahm, 2014). However, the authors summarised the distinct difference between the two constructs: self-compassion is especially relevant in the midst of suffering, while mindfulness can be relevant to all experiences. Besides, the focus of mindfulness is one's relationship to internal experience, while self-compassion relates to the person as a whole. Keng et al. (2012) found that mindfulness and self-compassion had different mediating effects in MBSR on psychological outcomes, denoting the distinction between both constructs. There was also evidence that, in terms of the mediating relationship between the two constructs, changes in mindfulness predicted the changes in self-compassion in community samples (Birnie et al., 2010). Using a cross-lagged model, a study found a sequential process in which meditation practice fostered mindfulness, which then led to an increase in self-compassion in a university student sample after a 14-week MBI (Bergen-Cico & Cheon, 2013). A later study also uncovered similar findings, with mindfulness as a key component in the development of self-compassion, but not vice versa (Evans et al., 2018). Nevertheless, Fulton (2018) demonstrated that self-compassion mediated mindfulness in a cross-sectional study on postgraduate counselling students. Therefore, it was hypothesised that:

Hypothesis 5: Change in mindfulness scores would mediate the relationship between MBI effects and changes in self-compassion scores in pre (T1) and post (T2) intervention.

Hypothesis 6: Change in self-compassion scores would mediate the relationship between MBI effects and changes in mindfulness scores in pre (T1) and post (T2) intervention.

2.6 Mindfulness As a Potential Mediator of MBI

Research suggests that mindfulness is a metacognitive awareness, involving the ability to re-perceive and decentre from extreme emotions or thoughts (Segal, 2013; Shapiro et al., 2006). Hence, rather than identifying with negative thoughts or emotions

as a direct depiction of reality, but merely just passing mental events, individuals underwent desensitisation after repeated exposures to perceived stressful experiences (Shapiro et al., 2006). For instance, MBI was found to reduce the symptoms of post-traumatic stress disorder via increased exposure to traumatic experiences (Boyd et al., 2018). Besides, it was also proposed that intentionally (I) attending (A) experiences with openness and non-judgmental-ness (A) could lead to a significant shift in perspective – where individuals viewed an event with greater clarity and minimized over-elaborated thoughts (Shapiro et al., 2006). Therefore, instead of 'automatically and intrusively worrying and ruminative thoughts,' individuals who cultivated mindfulness would re-perceive them as just thoughts that arise at the moment that captured attention. A review supported and showed that mindfulness strategies did not significantly reduce intrusive thoughts compared to other coping strategies, but lessened the emotional reactivity associated with the thoughts (Perestelo-Perez et al., 2017). It thus fostered greater cognitive and behavioural flexibility. A study found that participants who went through an 8-week MBI scored significantly lower rigidity scores and were less likely to be blinded by habituated experience (e.g., solving similar tasks with new, simpler formulas; Greenberg et al., 2012). A meta-analysis of mediation studies demonstrated mindfulness as a moderate and consistent mediator of the effects of MBIs on mental health outcomes, including stress (Gu et al., 2015). Also, a 3-day mindfulness meditation training in university students showed that the training-induced changes in mindfulness scores mediated the decrease in perceived stress and cortisol levels (Sousa et al., 2021). Results from a study also suggested that MBSR reduces worry through an increase in mindfulness, specifically via the increase in awareness and non-reactive observation (Hoge et al., 2015). Therefore, with mindfulness cultivation potentially allowing individuals to decentre and gain greater clarity over the potentially stressful or worrying experiences and thoughts, it was conjectured that:

Hypothesis 7: Change in mindfulness scores would mediate the relationship between m-MBI effects and change in perceived stress score in pre (T1) and post (T2) intervention, over and above the effect of self-compassion.

Hypothesis 8: Change in mindfulness scores would mediate the relationship between m-MBI effects and change in worry score in pre (T1) and post (T2) intervention, over and above the effect of self-compassion.

2.7 Self-Compassion as a Potential Mediator of MBI

Besides mindfulness, self-compassion has increasingly been identified as a possible mediator of mental health indicators (e.g., Keng et al., 2012; Neff, 2003b). A review found that self-compassion improved mental health by facilitating emotion regulation (Inwood & Ferrari, 2018). For instance, Diedrich et al. (2016) found that tolerance of negative emotion was the emotional regulation skill that mediated the relationship between self-compassion and depressive symptoms in adult samples. This was in line with the proposal from Keng et al. (2012), suggesting developing self-compassion in MBI may bring about benefits in increasing the willingness to accept and experience emotions. Research has found that self-compassion was associated with lower stress levels (Neely et al., 2009; Sirois et al., 2015). A study that conducted mediation analysis of MBI in community samples suggested that the reduction of psychological distress was serially mediated by changes in self-compassion both directly and indirectly through mindful awareness (Sevel et al., 2020). In addition, a study found a significant mediating role of emotion regulation in the relationship between self-compassion and stress, adding to the appeal of self-compassion as an emotional regulation strategy (Finlay-Jones et al., 2015). Research also found that self-compassion alone mediated the MBI effect on worry, after controlling for mindfulness (Keng et al., 2012). Van Dam et al. (2010) even demonstrated that self-compassion was a better predictor than mindfulness in reducing worry and the symptoms of anxiety and depression. With the

above evidence suggesting the mediating role of self-compassion, it was hypothesised that:

Hypothesis 9: Change in self-compassion scores would mediate the relationship between the m-MBI effects and changes in perceived stress scores in pre (T1) and post (T2) intervention, over and above the effect of mindfulness.

Hypothesis 10: Change in self-compassion scores would mediate the relationship between the m-MBI effects and changes in worry scores in pre (T1) and post (T2) intervention, over and above the effect of mindfulness.

2.8 Exploring Other Gaps and Inconsistencies in the Literature

Besides replicating the effectiveness of MBI to a new population, this study also intended to shed light on some other inconsistencies in the literature, including: (i) the effect of mindfulness facets on study outcomes, and (ii) the amount of mindfulness practice on the outcomes assessed.

2.8.1 Mindfulness Facets and Study Outcomes

There was interest in the mechanisms of change of mindfulness and one of the methods was to understand which of the mindfulness facets exerts benefits on the observed outcomes (Glomb et al., 2011), facilitated by statistical models of mediation (Querstret et al., 2018). Understanding how mindfulness facets work would help in identifying the major components of an MBI, thereby allowing the flexibility to modify interventions based on individual or population needs.

In this study, the exploration of mindfulness extends to its facets, utilizing the Five Facets Mindfulness Questionnaire (FFMQ) to analyse its impact on outcomes among EAs undergoing transition. Studies suggested that not all facets of the mindfulness scale (e.g., FFMQ) uniformly predict psychological outcomes. Recent research suggests that certain facets might play a more substantial role in mediating the effects of MBIs. For instance, non-judging **(**Haenen et al., 2016; Mayer et al., 2019; Querstret et al., 2018**)** and non-

reactivity (along with self-compassion**;** Hindman et al., 2014; van der Meulen et al., 2021**)**, have been identified in multiple studies as significant predictors or mediators of the effects of MBIs on perceived stress. These findings proposed that cultivating mindfulness may lead to non-judgmental and non-reactive acceptance of one's experiences, fostering positive psychological outcomes (Kabat-Zinn, 1982; Teasdale, 2000). Moreover, the facet of Acting with awareness has been implicated in mediating the effects of a 6-week MBI on stress and fatigue in a specific study that utilized multiple parallel and serial mediation analyses (van der Meulen et al., 2021). An earlier study by Querstret et al. (2017) also suggested the Acting with awareness facet mediated the change in rumination, sleep quality and fatigue. Building on these insights, the study posits that specific mindfulness facets, especially non-judging, non-reactivity, and/or acting with awareness, would mediate the relationship between m-MBI and study outcomes.

2.8.2 Amount of Mindfulness Practices on Study Outcomes

The literature presents a nuanced view regarding the relationship between the frequency of mindfulness practices and psychological outcomes, despite numerous studies on MBIs. For instance, recent meta-analyses found that while larger effect enhancement on mindfulness was predicted by greater use of MBI, amount of face-to-face contact, and more sessions of MBIs, such improvement was not found on stress, anxiety, and depression (Strohmaier, 2020). Another meta-analysis found that a greater amount of MBI home practices showed a small significant association with outcomes (Parsons et al., 2017). Earlier meta-analysis uncovered that only about one-third of the studies reviewed demonstrated a significant correlation between duration and frequency of home practice and study outcomes (Vettese et al., 2009). In exploring formal and informal mindfulness practices, some studies reported more frequent mindfulness formal practices, rather than informal practices significantly improved mindfulness levels and depressive symptoms (Hawley et al., 2013) and well-being (Carmody & Baer, 2007).

However, a later study found that the frequency of informal practices was significantly related to psychological flexibility and well-being (Birtwell et al., 2018). On the contrary, others found no significant association between the duration of both formal and informal practices on any psychological outcomes (Hindman et al., 2014; Jain et al., 2007; van Emmerik et al., 2018).

Mixed findings in the literature are attributed, in part, to the reliance on self-report methods for collecting home practice data, which could be subjected to memory inaccuracies and other biases. Even with the upsurge trend in smartphone usage and functionality, the tracking of mindfulness practice completion via objective methods was not fully utilised, except for some studies (Lim et al., 2015; Ly et al., 2014; Ribeiro et al., 2018). Despite this, a consensus suggests that more mindfulness instruction and practice tend to yield better outcomes (e.g., Beblo & Schulte, 2017; Galante et al., 2023), especially within the initial 500 hours of practice (Bowles et al., 2022). Kabat-Zinn (2013) likens mindfulness to a muscle that strengthens with continuous practice, facilitating the shift from the 'doing' mode to the 'being' mode (Williams, 2008).

To empirically examine this notion this study would explore the association between the amount of mindfulness practices on the outcome assessed by objectively tracking participants' practice compliance via the application platform. Participants' progress would be recorded through frequency (i.e., total days) and duration (i.e., total minutes) of formal practices, as well as the frequency (i.e., the total number of sessions) of informal practices completed. It was posited that a greater amount (i.e., frequency and duration) of practices in m-MBI would be positively associated with the improvement in the study outcomes. Figure 2.1 showed the proposed model of the study. Table 2.2 displayed a compiled list of hypotheses of the current study.

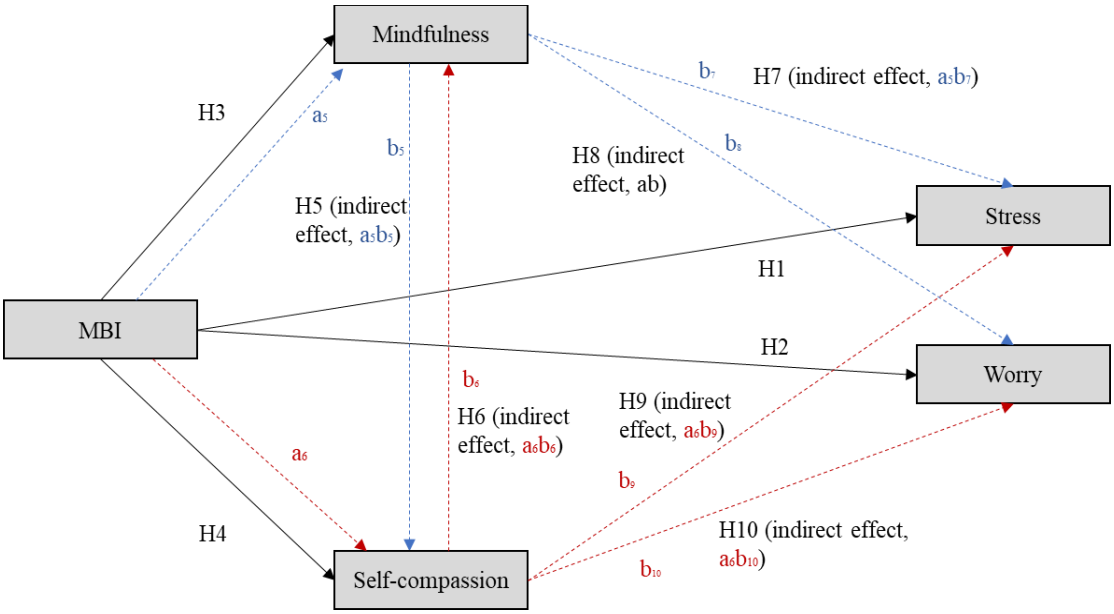


Figure 2.1 Proposed Model of the Study.

Note. The figure showed the hypothetical pathways of the present study. Dotted pathway in blue suggests mediation analyses with self-compassion as mediator. Dotted pathway in red suggests mediation analyses with mindfulness as mediator.

Table 2.2

List of Hypotheses and Exploratory Analyses of The Current Study

	Hypotheses and Exploratory Analyses
H1	M-MBI group would experience a greater reduction in stress compared to waitlist control across 3 time periods: pre-test [T1], post-test [T2] and 1-month follow-up [T3].
H2	M-MBI group would experience a greater reduction in worry compared to waitlist control across 3 time periods: pre-test [T1], post-test [T2] and 1-month follow-up [T3].
H3	M-MBI group would experience a greater reduction in mindfulness compared to waitlist control across 3 time periods: pre-test [T1], post-test [T2] and 1-month follow-up [T3].
H4	M-MBI group would experience a greater reduction in self-compassion compared to waitlist control across 3 time periods: pre-test [T1], post-test [T2] and 1-month follow-up [T3].
H5	Change in mindfulness scores would mediate the relationship between MBI effects and change in self-compassion scores in pre- [T1] and post- [T2] intervention.
H6	Change in self-compassion scores would mediate the relationship between MBI effects and change in mindfulness scores in pre- [T1] and post- [T2] intervention.
H7	Change in mindfulness scores would mediate the relationship between MBI effects and change in perceived stress scores in pre- [T1] and post- [T2] intervention, over and above the effect of self-compassion.
H8	Change in mindfulness scores would mediate the relationship between MBI effects and change in worry scores in pre- [T1] and post- [T2] intervention, over and above the effect of self-compassion.
H9	Change in self-compassion scores would mediate the relationship between MBI effects and change in perceived stress scores in pre- [T1] and post- [T2] intervention, over and above the effect of mindfulness.
H10	Change in self-compassion scores would mediate the relationship between MBI effects and change in worry scores in pre- [T1] and post- [T2] intervention, over and above the effect of mindfulness.
EA1	Certain mindfulness facets, especially non-judging, non-reactivity, and/or acting with awareness, would mediate the relationship between m-MBI and study outcomes.
EA2	A greater amount (i.e., frequency and duration) of mindfulness practice in m-MBI would be positively associated with the improvement in the study outcomes

CHAPTER 3 : METHODOLOGY

3.1 Study Design

The study was conducted from September 2020 to July 2021. A 9-week randomised controlled trial (RCT; i.e., 5 weeks intervention and 4 weeks follow-up) with a 2-level between-subject intervention design (i.e., m-MBI group and waitlist group) and 3-level within-subject design (i.e., pre-test [T1], 5th week post-test [T2] and 9thweek follow-up [T3]), as well as qualitative interviews, were implemented. The independent variables were study groups (between-subject) and the 3-time period (within-subject; T1, T2 and T3). The dependent variables were the changes in stress, worry, mindfulness and self-compassion scores across three time periods, accessed via self-report measures. Qualitative interviews were conducted on participants in the m-MBI group, semi-structured, virtual, and self-selected. Participants were Malaysian university final-year students recruited via convenient sampling and snowball sampling.

3.2 Participants

Emerging adults (EAs) who were between 21 to 25 years old and in their final year of undergraduate and postgraduate studies were recruited. The age of 25 (instead of 29) was chosen based on Arnett's (2014) suggestion that this is a more conservative range to refer to emerging adulthood when specifying age ranges. The eligibility criteria included (i) Android smartphone user; (ii) having internet access of at least 20 minutes per day; (iii) native English speaker or attending a university with an English syllabus; (iv) ability to commit to a 5-week intervention. Based on power analysis using the software G-power for mixed between-within ANOVA analysis, with expected medium effect size (Cohen's d =.5) and a power of .80, a minimum of 76 participants were required. An attrition rate of 20% was anticipated for mindfulness interventions in university student population (Greeson et.al., 2014; Querstret et al., 2018). Therefore, 91 participants were required for the study. Participants were recruited through social

network sites (e.g., Facebook, LinkedIn) and within university campuses in Malaysia. Participants who completed the 9-week intervention were each compensated with the MINDFULGym mindfulness smartphone application and a RM50 cash compensation. Qualitative interviews were conducted for participants in the m-M-MBI group who completed the intervention and opted for the interview session. Participants who took part in the qualitative interview were compensated with an additional RM10.

3.3 Procedure

The study obtained ethical approval from the Sunway University Research Ethics Committee (SUREC) in compliance with the ethical principles outlined in the Declaration of Helsinki prior to the commencement of the participants recruitment (Approval code: PGSUREC2020/023). Interested participants that matched the recruiting criteria were provided participant information sheet and were required to provide digital consent. Then, they were asked to complete the T1 questionnaires. Participants who consented were then included and randomly assigned to the m-MBI group or the waitlist control (WL) in a block size of four using a block randomization list generated via Sealed Envelope (Sealed Envelope Ltd, 2022). Participants allocated to the m-MBI group had immediate access to the application with an assigned account to reduce the likelihood of personal information identified by the researcher. They were reminded to engage in daily Home Gym practices and to complete the daily journaling through pop-out notifications (3 times/week) generated through the application. A survey link containing the questionnaires was emailed to participants who completed the intervention at T2 and T3. They were then invited to take part in an optional qualitative interview after having completed the 5-week MINDFULGym program. Participants that failed to complete the T2 and T3 questionnaires or the daily journals within the subsequent weekly module after two reminder emails were considered to have withdrawn. Participants assigned to the WL group were asked to refrain from commencing any mindfulness-related practices until the

end of the study (T3). They were instructed to complete the T2 and T3 questionnaires before being given access to the MINDFULGym application. To reduce cross-contamination across the group, participants assigned to the m-MBI group were asked to keep the accessed materials for their personal use and viewing only. However, blinding was not achieved due to budget restraint and the nature of the intervention. All the questionnaires were delivered online via Google Forms. The intervention outline was shown in Figure 3.1.

3.4 App-based MINDFULGym

The 5-week m-MBI, MINDFULGym, was delivered entirely via a smartphone application with an Android operating system. The program content was developed in Malaysia by a certified .b (dot b) mindfulness instructor Dr. Phang Cheng Kar. The effectiveness of the program has been intensively tested by empirical studies, including but not limited to a 5-week face-to-face program (Lan et al., 2014) and in a DVD format (Phang et al., 2015). MINDFULGym has a slogan “Be Present, Be Calm & Be Grateful" and emphasises the importance of experiential training as well as daily practices.

The outline and the content of the MINDFULGym program to be included in the application were first discussed with the researcher’s co-supervisor, who is also the MINDFULGym instructor. Subsequently, a prototype of the application's visual design was created using the software JustinMind (JustinMind, 2019). Throughout the process, continuous discussions were held with the researcher’s supervisors to determine the workflow and the aesthetic display of the prototype MINDFULGym application. The researcher then commenced the coding process of the application, in Android Studio version 3.4, using Java as the programming language. Discussions with the researcher’s supervisor in the computer science field were carried out to troubleshoot coding errors when necessary. A backend cloud computing service platform, Firebase, was used to host the database user sign-in authentication as well as adherence tracking of the

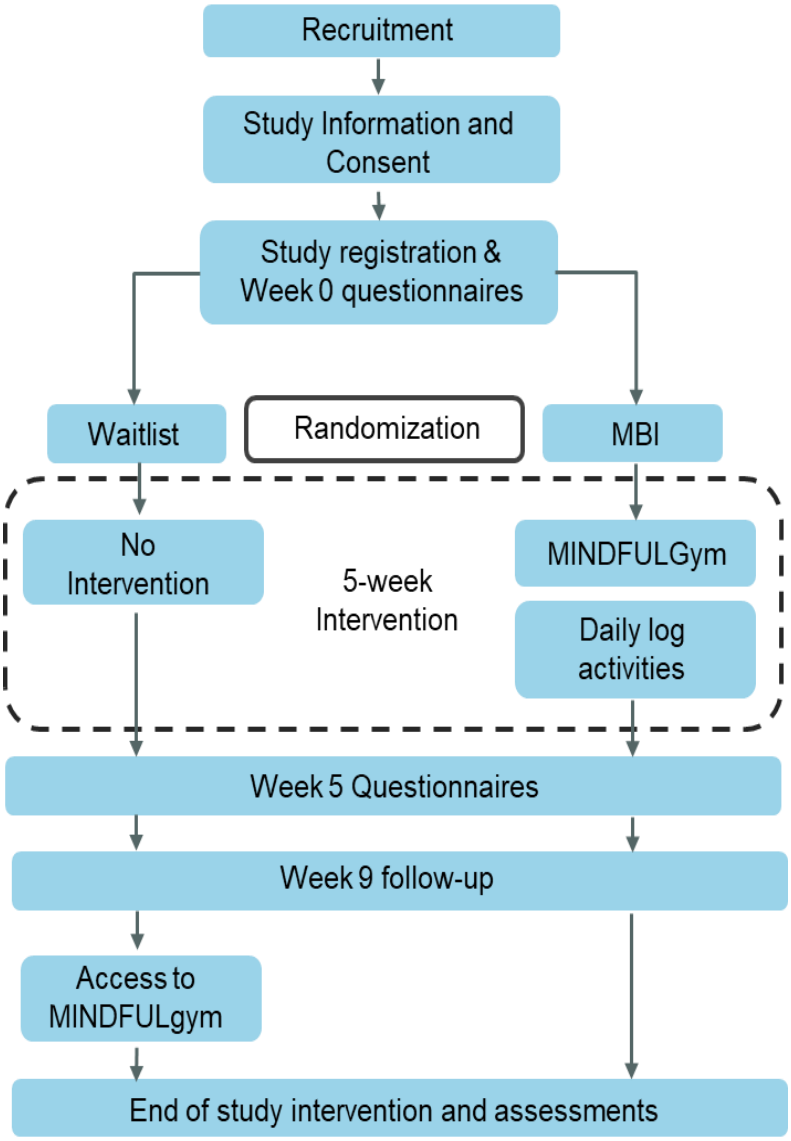


Figure 3.1 Intervention Outline of the Study.

MINDFULGym application. Finally, dummy accounts were created for testing and simulation purposes to ensure the functionality of the application prior to study commencement.

The MINDFULGym application was organised into five weekly modules. Each week, participants were required to understand the rationale of the weekly module through brief psychoeducation, which included short texts, stories, videos, and songs. The psychoeducation included the understanding of stress mechanisms, techniques to focus attention on the present moment, decrease reactivity to emotion, and increase the feelings

of gratitude and self-compassion. Subsequently, participants were required to spend at least 15 minutes daily in the Home Gym, which included a series of audio- and video-guided formal practices (i.e., Mindful Breathing) and/or informal practices (i.e., NOW-Ing) based on the module of the week. Home Gym practice frequency ranged from three sessions per day to three sessions per week. After each practice, participants were to submit after-practice reflections in the journalling section, to which they would be directed from the application to Google Forms. The outline and snapshots of the MINDFULGym application are shown in Table 3.1 and Appendix A, respectively.

3.5 Primary Outcome Measures

3.5.1 Perceived Stress Scale (PSS)

This scale uses 10 items to measure one's perception and response to daily hassles and stress (Appendix B; Kamarck et al., 1983). Participants rated the items over a 5-point Likert scale, ranging from 0 (*never*) to 4 (*very often*), resulting in a 0 (no stress) to 40 (extreme stress) total score. The PSS scale has shown robust psychometric properties, including high internal consistency and test-retest reliability (> 0.70), validated across diverse countries such as the USA, France, Japan, Thailand, China, and Brazil (Lee, 2012). Moreover, in Malaysia, the Malay-adapted PSS scale exhibited adequate psychometric properties in samples of university students (Al-Dubai et al., 2012). Cronbach alpha of the PSS scale in the present study was good at T1 ($\alpha = .87$), T2 ($\alpha = .89$), and T3 ($\alpha = .93$).

3.6 Secondary Outcome Measures

3.6.1 Penn State Worry Questionnaire (PSWQ)

This scale uses 16 items to measure the generality, uncontrollability, and excessiveness of compulsive worry (Appendix C; Meyer et al., 1990). Participants rated the items over a 5-point Likert scale ranging from 1 (*not typical of me*) to 5 (*very typical of me*), adding up to a 16 (least worry) to 80 (extreme worry) total score.

Table 3.1

Outline of the App-Based MINDFULGym program

Week 1: Introduction to Mindfulness	
• ABC of stress	• NOW-ing the Present Moment
• Introduction to mindfulness	• Home Gym (homework assignment)
• Mindful Body Stretching	
Week 2: Living in the here-and-now	
• Review of week 1 lessons and exercises	• Contacting the Present Moment with HTC
• Song: Happiness is here-and-now	• Mindful-STOP: Log on to mindfulness at any time
• Mindful Breathing: Deepening the NOW	• Home Gym (homework assignment)
Week 3: Appreciating the Present Moment	
• Review of week 2 lessons and exercises	• Mindful Eating
• Beginner's Mind	• Mindful M.I.Y.A.O.W?
• Mindful Photography	• Home Gym (homework assignment)
Week 4: Transforming Thoughts	
• Review of week 3 lessons and exercises	• Google-WWW-Yahoo
• Story: A better tomorrow chocolate	• Gratitude Cards
• Gratitude Workout	• Home Gym (homework assignment)
Week 5: Befriending Challenges	
• Review of week 4 lessons and exercises	• 5 Mindful Vitamins
• Body Scan & Kindness	• Mindfulness Personal Practice Package (MP3)
• Loving-Kindness: 'Rasa Sayang Hey'	• Home Gym (homework assignment)

PSWQ has been shown to have good internal consistency (α > .80) in anxiety disorder patients (Brown et al., 1992), community samples (Olatunji et al., 2007; Rodríguez-Biglieri & Vetere, 2011) and even university samples (Carter et al., 2005; Meyer et al., 1990). It has also demonstrated good test-retest reliability over 8 to 10 weeks in university samples (r = 0.92; Meyer et al., 1990). Cronbach alpha of the PSWQ scale in the present study was good at T1 (α = .94), T2 (α = .96), and T3 (α = .96).

3.6.2 Five Facet Mindfulness Scale (FFMQ)

This scale uses 39 items to measure the changes in mindfulness levels throughout the MBI (Appendix E; Baer et al., 2006). Participants rated over a 5-point Likert scale, ranging from 1 (*never or rarely true*) to 5 (*very often or always true*) on items consisting of the subscales of Observing, Describing, Acting with Awareness, Non-judging, and Non-reactivity. The scores were summed up in total, scoring from 39 (least mindful) to 195 (high mindfulness) or in subscales (ranging from 7 to 40). The FFMQ total scale and subscales showed good internal consistencies (α > .80) and construct validity in community samples (Christopher et al., 2012; Shallcross et al., 2020), and patients with depression (Sweeney et al., 2021). The total scale and subscales demonstrated comparable internal consistency at T1 (α = .81 to .92), T2 (α = .86 to .94), and T3 (α = .91 to .95) in the present study.

3.6.3 Self-Compassion Scale-Short Form (SCS-SF)

This scale uses 12 items to measure six aspects of compassion, namely Self-kindness, Self-judgement, Common humanity, Isolation, Mindfulness, and Over-identification (Appendix D; Neff, 2003a). The authors suggested utilizing the scale with a total mean score instead of separating it with subscales. Participants rated the items over a 5-point Likert scale, ranging from 1 (*almost never*) to 5 (*almost always*), and averaged into a total mean score. A higher score indicated a higher level of self-compassion. The SCS-SF has demonstrated strong internal consistency in both Dutch and English samples

($\alpha = 0.86$) and exhibits a nearly perfect correlation with the full version of the SCS ($r \geqslant 0.97$; Raes et al., 2011). Cronbach alpha of the SCS-SF scale in the present study was good at T1 ($\alpha = .86$), T2 ($\alpha = .89$), and T3 ($\alpha = .90$).

3.6.4 Mobile Application Rating Scale (MARS)

This scale uses 23 items to measure the quality and feasibility of health-related applications (Appendix F; Stoyanov et al., 2015). Participants rated over a 5-point scale, ranging from 1 (*inadequate*) to 5 (*excellent*) in four sections of the objective app quality, including Engagement, Functionality, Aesthetic, and Information Quality. It also includes a subject quality rating section. Mean scores of Objective app quality and Subjective quality were calculated respectively, ranging from 1 (*poor application*) to 5 (*excellent application).* Previous research has indicated that the MARS scale exhibits satisfactory construct validity and internal consistencies within the range of $\omega = 0.79$ to 0.93 (Terhorst et al., 2020) and adaptations of the MARS scale into various languages, including Spanish, German, and French, have been reported (Martin Payo et al., 2019; Messner et al., 2020; Saliasi et al., 2021). Cronbach alpha values for the scales and sections were assessed only at T2 for participants in the m-MBI group after completing the intervention, ranging from .73 to .87.

3.7 Qualitative Interviews of MINDFULGym Feasibility

Semi-structured individual interviews were conducted to gain insights into participants' experiences and barriers encountered in the 5-week mobile-based MBI that were not captured using self-report measures. Virtual individual interviews were scheduled and conducted with the first 20 participants who completed the T2 questionnaires and opted for the session, via Zoom (Zoom Video Communications Inc., 2020). The interviews were conducted in English by the researcher and audio-recorded for transcribing. Participants were first asked to reflect on the overall experience of the entire program. Experiences and potential improvements on the three aspects of

MINDFULGym modules, namely, the reading content, daily Home Gym practices, and daily journaling were explored. Consequently, participants were encouraged to share their experiences in encountering and addressing adherence issues. The interview ended by prompting MINDFULGym app recommendations. The interview outline is presented in Appendix G.

3.8 Data Analyses

3.8.1 Participants' Characteristics and Dropouts

Chi-squares independent tests (for categorical variables) and independent-samples t-tests (for continuous variables) were used to evaluate the demographic characteristics and baseline difference between 1) the m-MBI group and WL group, 2) completers (i.e., participants who completed the T3 questionnaires) and dropouts. Data were analysed using IBM SPSS Statistics for Windows, version 25 (IBM Corp., Armonk, N.Y., USA).

3.8.2 Self-reported Measures

Statistical Analysis. To assess hypotheses 1 to 4, both intention-to-treat (ITT) and per-protocol (PP, also known as complete-case) analyses were performed. In an ITT analysis, all randomized participants are included in the analysis in their assigned group regardless of treatment adherence or completion and aim to preserve the internal validity of the study (Altman, 2009). In the current study, missing data were replaced using the 'last observation carried forward' (LOCF) method (e.g., Cavanagh et al., 2013; Isham et al., 2022). LOCF follows the assumption that intervention participants who did not complete the subsequent measures did not benefit from the intervention and is therefore a conservative method for dealing with missing data. PP analysis refers to the inclusion in the analysis of only participants who strictly adhered to the intervention protocol to identify a treatment effect which would occur under an optimal condition (Ranganathan et al., 2016). It was done by the inclusion of data on only participants who completed the

questionnaires at all three assessment points in the current study (i.e., T1, T2, and T3; Field, 2018). The Consolidated Standards of Reporting Trials (CONSORT) guidelines for reporting 'parallel-group RCTs' recommend that both ITT and PP analyses should be reported for all planned outcomes (Schulz et al., 2010). Thus, ITT was the main approach to analyses and interpretations, while the PP approach was used as a supporting analysis in the present study (Altman, 2009; Querstret et al., 2018). Using both ITT and PP analyses, a series of mixed between-within ANOVAs were fitted to assess if the m-MBI group scored significantly different in perceived stress, worry, self-compassion and mindfulness compared to the WL group across the three assessment points. Post-hoc tests were conducted upon significant Time x Group interaction on the outcomes assessed. Bonferroni correction adjusted significance levels were also adopted (i.e., p = .05 divided by the number of comparisons, i.e., $\alpha = .05/9 = .006$). Influential outliers and assumptions inspection (i.e., normality, homogeneity of variance and sphericity) were conducted prior to statistical analysis to ensure there were no violations. Boxplots were first inspected to identify potential influential outliers (i.e., points extending more than 1.5 box lengths) and were further investigated using Cook's Distance (i.e., > 1 were influential outliers). Normality was assessed using Q-Q plots, histograms, and Kolmogorov-Smirnov's (K-S) tests (Dodge, 2008) for outcome variables at each time point. The Levene's Test (Levene, 1960) was used to test for homogeneity of variance. Sphericity was inspected using Mauchly's Test of Sphericity (Mauchly, 1940).

Effect Size Calculation. Within-group effect sizes (Cohen's *d*) were calculated by dividing the differences in mean scores from T1 to T2 and from T1 to T3, by pooled standard deviations (SDs) at T1, $d_{within} = [M_{T2} - M_{T1}]/SD_{pooled.}$ Standard deviation was corrected by taking the correlation of the scores into account, $SD_{corrected} = SD_{pooled}$ $[2(1-r)]^{1/2}$ (Morris, 2008). Between-group effect sizes were derived from the change scores between study groups divided by pooled standard deviation at T1, $d_{between} = [(M_{T2,MBI}$

$-M_{T1,MBI}) - (M_{T2,WL} - M_{T1,WL})]/SD_{pooled,T1}$ (Morris, 2008). Cohen's *d* of .2, .5 and .8 were considered as small, moderate, and large effect sizes, respectively (Cohen, 2013).

Reliable Change Index (RCI). To assess the reliability of changes in the outcomes between the m-MBI group, relative to the WL group, RCIs (Jacobson & Truax, 1991) were calculated in statistically significant outcomes. This assessment has been used in interventional studies involving self-reported outcomes, including mindfulness interventions (Biegel et al., 2009; Siebelink et al., 2022; Wolpert et al., 2020). It is a psychometric criterion used to evaluate whether a change in an individual's score over time, specifically the difference between two measurement points, is statistically significant and not merely a result of measurement error. RCI represents a ratio that compares two key components. The numerator represents the observed difference score between two measurements taken at different time points (e.g., T1 and T2). The denominator, on the other hand, represents the standard error of measurement difference, primarily a function of the initial standard deviation of the measurement and its internal consistency. Individual RCI scores exceeding 1.96 (improvement) or -1.96 (worsening) were considered to reflect reliable change, with a 95% confidence interval. The formula used was as follows:

$$\text{RCI} = (x_{T2} - x_{T1}) / \sqrt{2(SD_{T1}\sqrt{1 - r_{xx}})^2}$$

3.8.3 Mediation Analyses

To examine if the changes in mindfulness and self-compassion scores were potential mediators between MBI effect to one another at T1 and T2 (H5 and H6), two simple mediation analyses were conducted. On the other hand, two multiple mediator models were utilised to interrogate the individual mediation effect of the T1-T2 change scores of mindfulness and self-compassion on the change scores of perceived stress and worry, while controlling for mindfulness and self-compassion, respectively (H7 to H10).

Mediation analyses were conducted using PROCESS macro model 4, in SPSS (Hayes, 2018). In this study, bootstrap resampling was accomplished by taking 5,000 bootstrap samples from the dataset and computing the indirect effect (*ab* product), with 95% bias-corrected confidence intervals (BCa CIs). As recommended by Kazdin (2007), only complete data sets were used for the mediation analysis. Thus, the main analysis was conducted on participants who completed the T1 and T2 measures to determine the mechanism of m-MBI effect in the current study (e.g., Cavanagh et al., 2018) , while analysis using ITT sample was included as supplementary information. The mediation effect was established when the upper and lower limits of BCa CIs of the indirect effect do not contain zero. This bootstrapping method was recommended over the traditional causal steps approach (Baron & Kenny, 1986) or the Sobel test (Sobel, 1982), given that the former approach has been shown to have higher power and relatively controlled Type I error rate (Hayes, 2018; Keng et al., 2012). Thus, the statistical significance of independent variables on dependent variables (i.e., total effect) was not a prerequisite to bootstrapping mediation (Hayes, 2018).

3.8.4 Exploratory Analyses

To explore the mechanism of mindfulness with mindfulness facets on the outcome assessed (exploratory analysis 1), bootstrap resampling procedures for multiple mediator models using PROCESS macros were conducted on participants who completed the T1 and T2 measures. In the bootstrap analysis, 5,000 bootstrap resamples and 95% CIs were specified. The respective indirect effect for each mediator will be considered significant if the upper and lower limits of CI do not contain zero (Hayes, 2018). In the current analyses, T1-T2 mindfulness facets change scores were entered as mediators in the relationship between MBI's effect and the change scores in perceived stress, worry, and self-compassion.

To investigate if mindfulness formal and informal practice frequency (i.e., total practice sessions) and formal practice duration (i.e., total minutes meditated) were associated with the study outcomes (exploratory analysis 2), a series of Pearson's product-moment correlations were conducted. The correlation coefficient, *r*, of .10, .30, and .50 were interpreted as small, moderate, and large correlation strength, respectively (Cohen, 2013).

3.8.5 Qualitative Interviews

The present study utilised the dualistic technique of inductive and deductive thematic analysis informed by the work of Fereday and Muir-Cochrane (2006) and Roberts et al. (2019). This approach allowed for the tenets in the literature to integrate during the process of the deductive approach while letting themes emerge directly from the data using inductive thematic analysis. The deductive component consisted of the development and description of an analytical codebook, which was based on the exploration of the literature and a preliminary scan of the transcribed data. Conversely, the inductive approach was to explore patterns from the interview data and to allow potential themes to develop during the coding process. The present study thus followed the steps to inductive thematic analysis laid out in Braun and Clarke (2006), complemented by the development of the codebook. Informed by the work of Fereday and Muir-Cochrane (2006), a single coder (i.e., the PhD candidate) conducted the analysis. This individual was required to be familiar with the data, create initial codes, generate initial themes, review, and refine themes, define and naming themes, and produce the report.

To familiarise with the data, the audio recordings of the interview sessions were transcribed into verbatim by the researcher. To generate initial themes and codes in the codebook, a preliminary read of the transcribed data and a priori research on qualitative (sub)themes generated on participants' perspectives and feasibility of the MBI program

(Schoultz et al., 2016; Taylor et al., 2021) were conducted. The codes in the codebook manual were drafted following the guideline of Boyatzis (1998) with the following: label, definition, description, and examples from the raw data. Two transcripts were selected as test pieces to determine the applicability of the preliminary codebook to the raw information. The preliminary codebook was then submitted and presented to the researcher's supervisor for further review and discussion.

To generate additional themes and codes, transcripts were then transferred into computer software QSR NVivo (released 2020) to highlight 'codable' units. Each transcript was systematically coded using an inductive approach to identify interesting aspects or repeated patterns across the dataset. Analysis at this stage was guided, but not confined by the codebook. Preidentified codes were assigned to the respective themes in the codebook. Additional codes were also identified, that were either separated from the predetermined codes or they were expanded as a code from the manual.

The themes and subthemes identified and updated in the codebook were then reviewed and corroborated in several iterations to ensure that it was representative. At this stage, codes were reviewed and refined to ensure coherence with the theme. Data were also reread to ascertain if they work in relation to the themes. The codebook with summarised themes and subthemes was submitted and reviewed by the researcher's supervisor. Lastly, themes and subthemes with the consensus of the researcher's supervisor were finalised and proceeded to an interpretative phase. The flow of qualitative analysis is presented in Figure 3.2.

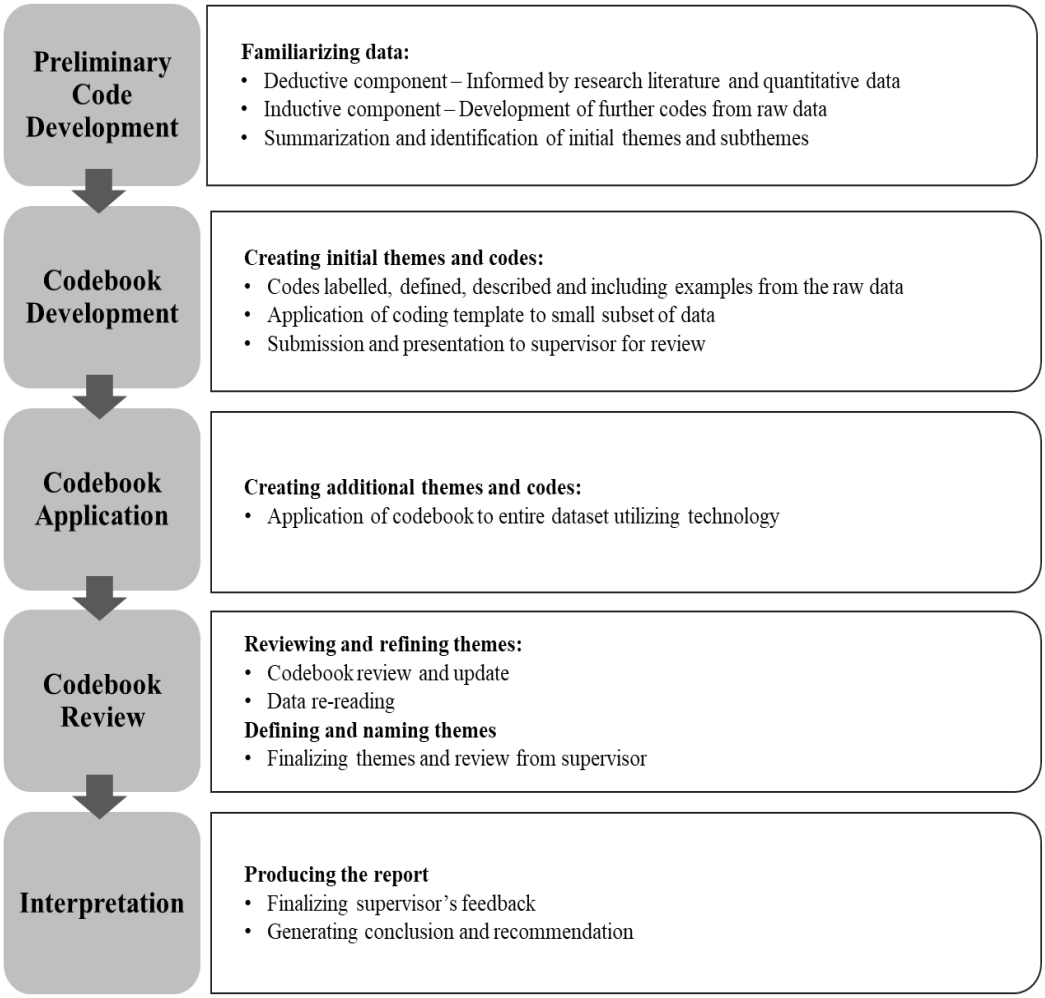


Figure 3.2 Process Flow of Qualitative Analysis

Note. The figure showed the process of code creation and testing (left) in accordance with the steps to thematic analysis proposed in Braun and Clark (2006) (right)

CHAPTER 4 : RESULTS

4.1 Participant Characteristics and Baseline Equivalence

Ninety-two interested final-year university students who met the eligible criteria, consented, and completed the pre-intervention questionnaires were included and randomized. Figure 4.1 displays the CONSORT flow of participants throughout the study. Forty-seven (51.1%) were allocated to the m-MBI group and 45 (48.9%) were allocated to the waitlist (WL) group. The mean age of 92 participants was 22.55 (*SD* = 1.26). The majority of the participants recruited were female (*n* = 83; 90.2%), who were currently in the final year of their undergraduate studies (*n* = 85; 92.4%) in Malaysian private universities (*n* = 55; 59.8%). Participants were mainly Malaysian (*n* = 90; 97.8%), single (*n* = 90; 97.8%), Chinese in ethnicity (*n* = 64; 69.6%), and with no prior mindfulness experience (*n* = 71; 77.2%). Pre-test (T1) scores suggested that participants in both groups had moderate levels of stress (cf. Kamarck et al., 1983) and worry (cf. Meyer et al., 1990). Participants also had a level of self-compassion comparable to other university samples (cf. Neff & Tóth-Király, 2022). Results showed a significant age difference in the m-MBI group (*M* = 22.28, *SD* = 1.17) and the waitlist (*M* = 22.84, *SD* = 1.30) although participants from both groups had a mean age of 22. Follow-up analyses using regression suggested that age did not predict changes in any of the outcome variables (i.e., perceived stress, worry, self-compassion, and mindfulness) and therefore was unlikely to be a covariate (Appendix H). There were no significant differences found between study groups on any other measures (Table 4.1).

4.2 Dropouts

A total of 46 participants (47.4%) completed the study, of which 23 (50.0%) participants were from the m-MBI group and WL group, respectively. Reasons for withdrawal recorded from two participants in the m-MBI group suggested time

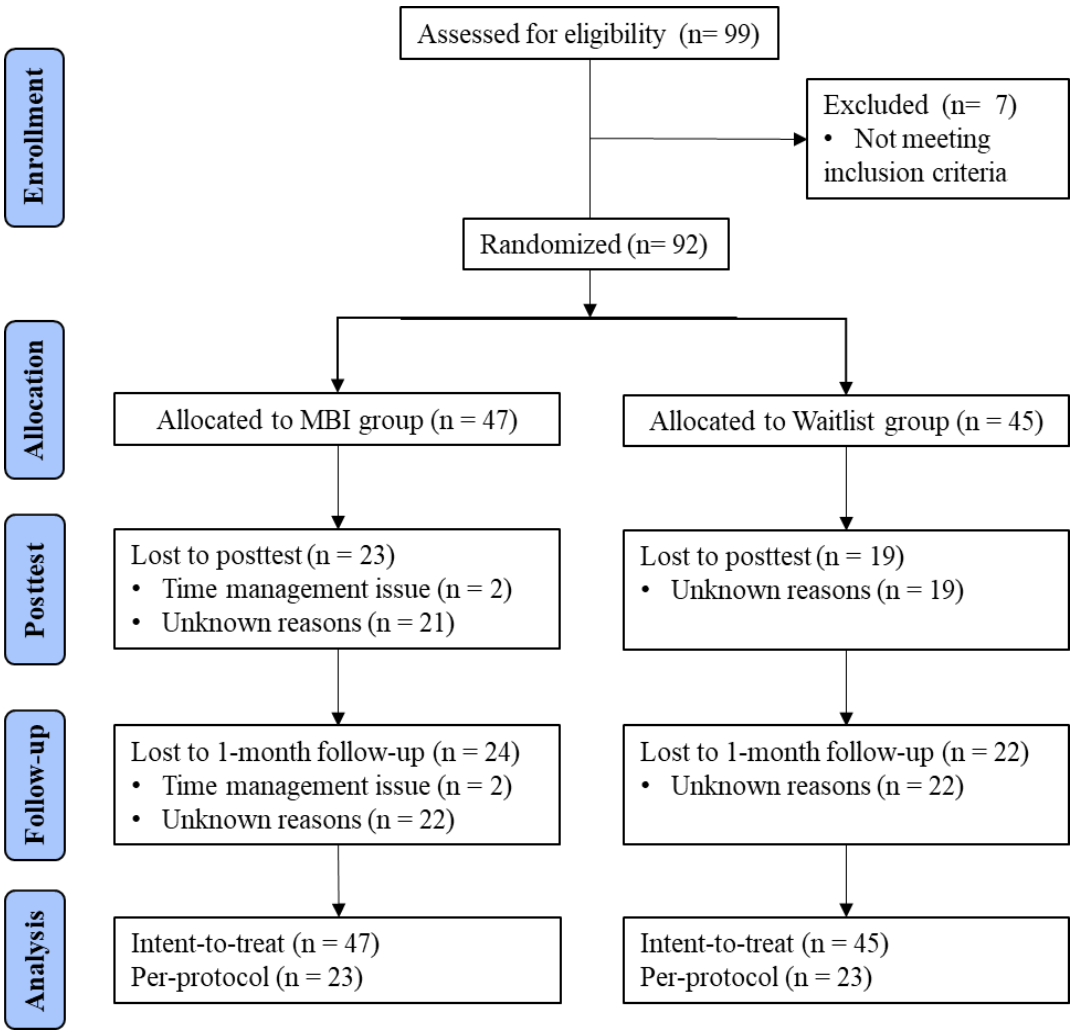


Figure 4.1 Study CONSORT Diagram of Participant Flow

Table 4.1

Demographic Characteristics and Baseline Results Between MBI and Waitlist Group

Variables	m-MBI (n = 47)	WL (n = 45)	Test Statistics
Age (Mean (SD))	22.28 (1.17)	22.84 (1.30)	$t(90) = -2.204$, **$p = .030$**
Gender (n (%))			
Male	4 (8.5%)	5 (11.1%)	$\chi^2(1) = .005$, $p = .737$
Female	43 (91.5%)	40 (88.9%)	
Marital Status			
Single	46 (97.9%)	44 (97.8%)	$\chi^2(1) = .000$, $p = 1.000$
Married	1 (2.1%)	1 (2.2%)	
Nationality			
Malaysian	47 (100%)	43 (95.6%)	$\chi^2(2) = 2.907$, $p = .234$
Singaporean	0 (.0%)	1 (2.2%)	
Bangladeshi	0 (.0%)	1 (2.2%)	
Ethnicity			
Chinese	31 (66.0%)	33 (73.7%)	$\chi^2(4) = 3.198$, $p = .525$
Malay	8 (17.0%)	7 (15.6%)	
Indian	5 (1.6%)	1 (2.2%)	
Malaysia Indigenous	2 (4.3%)	3 (6.7%)	
Others	1 (2.1%)	1 (2.2%)	
Current Level of Education			
Undergraduate	45 (95.7%)	40 (88.9%)	$\chi^2(1) = .717$, $p = .262$
Postgraduate	2 (4.3%)	5 (11.1%)	
Malaysia University			
Private	31 (66.0%)	24 (53.3%)	$\chi^2(1) = 1.044$, $p = .307$
Public	16 (34.0%)	21 (46.7%)	
Previous Mindfulness Experience			
None	35 (74.5%)	36 (8.0%)	$\chi^2(1) = .147$, $p = .701$
Yes	12 (25.5%)	9 (2.0%)	
T1 PSS	21.64 (6.64)	21.67 (6.18)	$t(90) = .021$, $p = .983$
T1 PSWQ	56.32 (11.72)	54.33 (14.41)	$t(90) = -.727$, $p = .469$
T1 SCS-SF	2.97 (.66)	3.01 (.64)	$t(90) = .291$, $p = .772$
T1 FFMQ - Total	114.45 (17.88)	11.64 (2.17)	$t(90) = -.958$, $p = .341$
T1 FFMQ - Observing	26.55 (6.11)	26.49 (5.88)	$t(90) = -.051$, $p = .959$
T1 FFMQ - Describing	23.57 (6.44)	23.42 (7.30)	$t(90) = -.106$, $p = .916$
T1 FFMQ - Act with Awareness	23.55 (6.05)	21.69 (7.03)	$t(90) = -1.365$, $p = .176$
T1 FFMQ - Non-judging	2.45 (6.62)	19.29 (6.40)	$t(90) = -.853$ $p = .396$
T1 FFMQ - Non-reactivity	2.32 (3.94)	19.76 (4.83)	$t(90) = -.614$, $p = .540$

Note. MBI = Mindfulness-Based Intervention; WL = Waitlist; PSS = Perceived Stress Scale; PSWQ = Penn State Worry Questionnaire; SCS-SF = Self- Compassion Scale - Short Form; FFMQ = Five Facet Mindfulness Questionnaire; T1 = Baseline.

management concerns (i.e., “I cannot find time to incorporate the daily practices”). The reasons for early termination from the majority who withdrew remained unknown.

When comparing the demographic characteristics between completers and dropouts, analyses found a significantly greater proportion of completers (n = 37, 80.4%) than dropouts (n = 27, 58.7%) were Chinese in ethnicity, $\chi^2(4)= 1.879$, p = .028. A comparison of T1 results showed a significantly higher T1 perceived stress (PSS) score in dropout participants compared to completers, $t(90) = -2.130$, p = .036, MD = 2.78. This significant difference in PSS score was found in the m-MBI group, $t(45) = -3.46$, p = .001, MD = 6.02. A lower T1 mindfulness (FFMQ) Non-judging score was also observed in dropouts in comparison to completers, $t(90) = 3.178$, p = .002, MD = -4.10. An independent t-test within the study group found that there was a significant difference in the m-MBI group, $t(45) = 3.60$, p = .001, MD = 6.19. There were no significant differences between completers and dropouts on other T1 variables (Table 4.2).

4.3 Self-reported Measures

4.3.1 Assumptions

Although both intention-to-treat (ITT) and per-protocol (PP) samples did not suggest influential outliers (Appendix I), sphericity was violated in majority of the outcomes measured (ps < .05; Appendix J), except for FFMQ Non-reactivity and Non-judging scores in ITT sample, and self-compassion in PP sample. In the ITT sample, there was a departure from normality with FFMQ Observing scores at T1 and T3, FFMQ Non-judging scores at T2 (and in PP sample) and T3, and FFMQ Non-reactivity score at T2 (ps < .05 in K-S test, Appendix K). However, the violation of normality should not cause a major problem in proceeding with the planned analysis because the sample size was considered ‘large enough’ (> 30 or 40) (Ghasemi & Zahediasl, 2012; Pallant, 2016). In the PP sample, the homogeneity of variance was violated, with ‘worry’ (PSWQ) score at T2 and T3 (ps < .05, Appendix L). There was no violation of other test assumptions.

Table 4.2

Demographic Characteristics and Baseline Results Between Completers and Dropouts

Variables	Completers (n = 46)	Dropouts (n = 46)	Test Statistics
Age (Mean (SD))	22.52 (1.31)	22.59 (1.22)	$t(90) = -.247$, $p = .806$
Gender (n (%))			
Male	4 (8.7%)	5 (1.9%)	$\chi^2(1) = .000$, $p = .500$
Female	42 (91.3%)	41 (89.1%)	
Marital Status			
Single	45 (97.8%)	45 (97.8%)	$\chi^2(1) = .000$, $p = .750$
Married	1 (2.2%)	1 (2.2%)	
Nationality			
Malaysian	45 (97.8%)	45 (97.8%)	$\chi^2(2) = 2.773$, $p = .250$
Singaporean	0 (.0%)	1 (2.2%)	
Bangladeshi	1 (2.2%)	0 (.0%)	
Ethnicity			
Chinese	37 (80.4%)	27 (58.7%)	$\chi^2(4) = 1.879$*, $p = .028$
Malay	5 (10.9%)	10 (21.7%)	
Indian	1 (2.2%)	5 (10.9%)	
Malaysia Indigenous	1 (2.2%)	4 (8.7%)	
Others	2 (4.3%)	0 (.0%)	
Current Level of Education			
Undergraduate	40 (87.0%)	45 (97.8%)	$\chi^2(1) = 2.474$, $p = .111$
Postgraduate	6 (13.0%)	1 (2.2%)	
Malaysia University			
Private	27 (58.7%)	28 (6.9%)	$\chi^2(1) = .000$, $p = 1.000$
Public	19 (41.3%)	18 (39.1%)	
Previous Mindfulness Experience			
None	32 (69.6%)	39 (84.8%)	$\chi^2(1) = 2.221$, $p = .136$
Yes	14 (3.4%)	7 (15.2%)	
Attrition rate across groups			
MBI	23 (5.0%)	24 (52.2%)	$\chi^2(1) = .000$, $p = 1.000$
Waitlist	23 (5.0%)	22 (47.8%)	
T1 PSS	2.26 (5.76)	23.04 (6.73)	$t(90) = -2.130$*, $p = .036$
T1 PSWQ	54.20 (12.10)	56.50 (14.01)	$t(90) = -.844$, $p = .401$
T1 SCS-SF	3.07 (.59)	2.91 (.70)	$t(90) = 1.159$, $p = .250$
T1 FFMQ - Total Score	115.13 (19.42)	11.04 (18.487)	$t(90) = 1.287$, $p = .202$
T1 FFMQ - Observing	26.09 (6.55)	26.96 (5.36)	$t(90) = -.697$, $p = .488$
T1 FFMQ - Describing	23.13 (7.05)	23.87 (6.68)	$t(90) = -.516$, $p = .607$
T1 FFMQ - Act with Awareness	23.96 (6.23)	21.33 (6.72)	$t(90) = 1.946$, $p = .055$
T1 FFMQ - Non-judging	21.93 (6.86)	17.83 (5.46)	$t(90) = 3.178$*, $p = .002$
T1 FFMQ - Non-reactive	2.02 (4.20)	2.07 (4.60)	$t(90) = -.047$, $p = .962$

Note. PSS = Perceived Stress Scale; PSWQ = Penn State Worry Questionnaire; SCS-SF = Self- Compassion Scale - Short Form; FFMQ = Five Facet Mindfulness Questionnaire; T1 = Baseline.

*$p < .05$

To ensure conservativity to the violation in sphericity and homogeneity of variance, Greenhouse-Geisser correction was used in the test analysis (Field, 2018).

4.3.2 Perceived Stress (PSS)

A 2 x 3 ANOVA conducted using both ITT and PP approaches showed no significant Group x Time interaction, $F(1.59, 143.23) = 3.22$, $p = .054$ (ITT); $F(1.64, 73.34) = 2.33$, $p = .114$ (PP), indicating no difference between both study groups across the assessment points on perceived stress. The between-group effect size from T1 to T3 was small in ITT analysis ($d_{between} = .32$; Table 4.3). There was no significant main effect for time (ps > .05). However, PP analysis found a significant main effect for the study groups, $F(1, 44) = 13.45$, $p = .001$, with lower PSS score in the m-MBI group compared to the WL group (Mean difference; $MD = -5.71$). Therefore, hypothesis 1 was not supported.

4.3.3 Worry (PSWQ)

A 2 x 3 ANOVA revealed a significant Group x Time interaction in PSWQ score, $F(1.50, 134.84) = 15.02$, $p < .001$ (ITT); $F(1.59, 69.88) = 14.76$, $p < .001$ (PP). Pairwise comparisons showed that the PSWQ scores were reduced in the m-MBI group in T3 compared to T2 ($MD = -1.49$, $p = .034$ [ITT]; $MD = -3.04$, $p = .030$ [PP]), and compared to T1 ($MD = -4.53$, $p < .001$ [ITT]; $MD = -8.52$, $p < .001$ [PP]), as well as T2 compared to T1 ($MD = -3.04$, $p = .008$ [ITT]; $MD = -5.48$, $p = .013$ [PP]). This reduction was not found in the WL group across any of the assessment points (ps > .05).

Table 4.3

Mean Scores, Treatment Effects, and Cohen's d Effect Sizes of Study Outcomes

Outcome Variables; Measures	ITT/ PP	Study Group	*n*	*M* (*SD*)			Group X Time Int.		Effect sizes (Cohen's *d*)			
				Pre-test (T1)	Post-test (T2)	1-month FU (T3)	F (df)	*p*	Within-group		Between-group	
									T1 - T2	T1 - T3	T1 - T2	T1 - T3
Perceived Stress; PSS	ITT	m-MBI	47	21.64 (6.64)	19.96 (7.15)	19.38 (8.08)	3.22 (1.59, 143.23)	0.054	.31	.39	.34	.32
		Waitlist	45	21.67 (6.18)	22.18 (7.09)	21.49 (7.35)			.14	.05		
	PP	m-MBI	23	18.57 (5.77)	15.70 (5.07)	14.52 (6.63)	2.33 (1.64, 73.34)	0.114	.35	.50	.63	.60
		Waitlist	23	21.96 (5.35)	22.65 (7.33)	21.30 (7.86)			.16	.16		
Worry; PSWQ	ITT	m-MBI	47	56.32 (11.72)	53.28 (12.45)	51.79 (13.17)	15.02 (1.50, 134.84)	**< .001**	.42	.56	.40	.49
		Waitlist	45	54.33 (14.41)	56.56 (15.29)	56.33 (14.82)			.39	.44		
	PP	m-MBI	23	53.87 (9.94)	48.39 (9.23)	45.35 (9.38)	14.76 (1.59, 69.88)	**< .001**	.55	.78	.74	.95
		Waitlist	23	54.52 (14.16)	58.22 (16.64)	27.78 (15.81)			.54	.61		
Self-compassion; SCS-SF[a]	ITT	m-MBI	47	2.97 (.66)	3.08 (.70)	3.20 (.72)	4.25 (1.83, 164.84)	**0.019**	.27	.58	.21	.28
		Waitlist	45	3.01 (.64)	2.98 (.67)	3.06 (.69)			.16	.19		
	PP	m-MBI	23	3.09 (.62)	3.28 (.63)	3.53 (.57)	4.30 (1.86, 81.94)	**0.019**	.34	.85	.41	.58
		Waitlist	23	3.05 (.56)	2.99 (.67)	3.14 (.70)			.24	.33		
Mindfulness; FFMQ[a]	ITT	m-MBI	47	114.45 (17.88)	12.45 (2.13)	123.02 (22.06)	4.44 (1.53, 137.66)	**0.022**	.46	.60	.25	.35
		Waitlist	45	11.64 (2.17)	111.93 (2.20)	112.49 (2.48)			.14	.23		
	PP	m-MBI	23	118.96 (16.38)	13.04 (18.02)	135.30 (19.36)	4.65 (1.62, 71.46)	**0.018**	.64	.90	.44	.65
		Waitlist	23	111.30 (21.75)	113.87 (21.75)	114.96 (22.16)			.20	.33		
Mindfulness Observing; FFMQ	ITT	m-MBI	47	26.55 (6.11)	28.30 (6.35)	28.02 (6.43)	1.35 (1.61, 144.97)	0.259	.41	.35	.19	.18
		Waitlist	45	26.49 (5.88)	27.07 (5.65)	26.89 (5.93)			.13	.11		
	PP	m-MBI	23	26.00 (7.01)	29.57 (7.25)	29.00 (7.49)	1.25 (1.68, 73.74)	0.288	.64	.54	.32	.29
		Waitlist	23	26.17 (6.22)	27.57 (5.88)	27.22 (6.44)			.22	.22		

Table 4.3, continued.

Outcome Variables; Measures	ITT/ PP	Study Group	*n*	*M* (*SD*)			Group X Time Int.		Effect sizes (Cohen's *d*)			
				Pre-test (T1)	Post-test (T2)	1-month FU (T3)	F (df)	*p*	Within-group		Between-group	
									T1 - T2	T1 - T3	T1 - T2	T1 - T3
Mindfulness Describing; FFMQ	ITT	m-MBI	47	23.57 (6.44)	25.64 (6.95)	25.51 (6.89)	2.23 (1.66, 148.96)	0.121	.49	.42	.23	.21
		Waitlist	45	23.42 (7.30)	23.93 (6.79)	23.96 (7.21)			.13	.13		
	PP	m-MBI	23	24.26 (6.68)	28.22 (6.79)	27.96 (6.78)	2.07 (1.73, 76.04)	0.140	.71	.59	.40	.36
		Waitlist	23	22.00 (7.36)	23.09 (6.54)	23.13 (7.40)			.20	.20		
Mindfulness Act with Awareness[a]; FFMQ	ITT	m-MBI	47	23.55 (6.05)	25.36 (5.73)	25.85 (6.02)	4.24 (1.52, 136.57)	**0.025**	.38	.45	.28	.31
		Waitlist	45	21.69 (7.03)	21.64 (7.46)	21.91 (7.86)			.01	.07		
	PP	m-MBI	23	24.48 (5.87)	27.70 (4.85)	28.70 (5.01)	5.06 (1.62, 71.43)	**0.013**	.50	.60	.58	.65
		Waitlist	23	23.43 (6.66)	22.96 (7.28)	23.48 (7.97)			.11	.01		
Mindfulness Non-judging; FFMQ	ITT	m-MBI	47	2.45 (6.62)	2.06 (6.46)	22.09 (7.31)	3.04 (1.89, 170.07)	0.053	.09	.32	.08	.22
		Waitlist	45	19.29 (6.40)	19.40 (7.34)	19.49 (7.25)			.04	.08		
	PP	m-MBI	23	23.61 (6.73)	22.48 (6.96)	26.61 (6.54)	3.34 (1.86, 81.73)	0.044	.20	.40	.22	.36
		Waitlist	23	2.26 (6.71)	2.65 (8.57)	2.83 (8.39)			.11	.19		
Mindfulness Non-reactivity; FFMQ	ITT	m-MBI	47	2.32 (3.94)	21.09 (4.52)	21.55 (4.90)	1.01 (1.88, 169.51)	0.333	.33	.49	.12	.14
		Waitlist	45	19.79 (4.83)	19.89 (4.98)	2.24 (5.08)			.05	.18		
	PP	m-MBI	23	2.61 (3.75)	22.09 (4.73)	23.04 (5.23)	1.33 (1.95, 85.65)	0.270	.49	.79	.31	.37
		Waitlist	23	19.43 (4.62)	19.61 (5.10)	2.30 (5.31)			.06	.27		

Note. Int. = Interaction; FU = Follow-up; PSS = Perceived Stress Scale; PSWQ = Penn State Worry Questionnaire; SCS-SF = Self- Compassion Scale - Short Form; FFMQ = Five Facet Mindfulness Questionnaire; ITT = Intention-to-Treat Analysis; PP = Per-Protocol Analysis.

[a] Interaction effects not significant after Bonferroni Correction

Between-group effect sizes from T1 to T3 were moderate in ITT ($d_{between}$ = .49; Table 4.3). No main effect for time was observed (*p*s > .05). However, PP analysis found a significant main effect for the study groups, *F* (1, 44) = 4.57, *p* =.038, with an overall lower worry score in the m-MBI group compared to the WL group (*MD* = -7.64). Therefore, hypothesis 2 was supported.

4.3.4 Mindfulness (FFMQ)

A 2 x 3 ANOVA revealed a significant Group x Time interaction, *F* (1.53, 137.66) = 4.44, *p* = .022 (ITT); *F*(1.62, 71.46) = 4.65, *p* = .018 (PP). Post hoc tests demonstrated that FFMQ scores in the m-MBI group increased from T1 to T2 (*MD* = 6.00, *p* = .003 [ITT]; *MD* = 11.09, *p* = .005 (PP)) and T1 to T3 (*MD* = 8.57, *p* < .001 [ITT]; *MD* = 16.35, *p* < .001 [PP]). FFMQ scores did not differ between any assessment points in the WL group (*p*s > .05). Between-group effect size between T1 and T3 was small in ITT ($d_{between}$ = .35; Table 4.3). There was also a main effect for time, F (1.23, 137.66) = 1.65, *p* < .001 (ITT); *F*(1.62, 71.46) = 11.60, *p* < .001 (PP), that showed overall an improved mindfulness score from T1 to and T2 (*MD* = 3.64, *p* = .014 [ITT]; *MD* = 6.83, *p* = .016 (PP)), as well as T1 to T3 (*MD* = 5.21, *p* = .001 [ITT]; *MD* = 1.00, *p* < .001 [PP]). Finally, PP analysis found a significant main effect for the study groups, *F*(1, 44) = 7.52, *p* =.009, with an overall higher mindfulness score in the m-MBI group compared to the WL group (*MD* = 14.73). Therefore, hypothesis 3 was supported.

Analyses on FFMQ facets scores revealed a significant Group x Time interaction in the Act with Awareness score, *F*(1.52, 136.57) = 4.24, *p* = .025 (ITT); *F*(1.62, 71.43) = 5.06, *p* = .013 (PP), demonstrating substantial enhancement in the m-MBI group at T2 compared to T1 (*MD* = 1.81, *p* = .009 [ITT]; *MD* = 3.22, *p* = .015 [PP]) and T3 compared to T1 (*MD* = 2.30, *p* = .002 [ITT]; *MD* = 4.22, *p* = .002 [PP]). The main effect of time was found in all five of the FFMQ facets (*p*s < .05). Overall improvements in the facets were demonstrated in the Observing score from T1 to T2 (*MD* = 1.16, *p* = .039 [ITT];

MD = 2.48, *p* = .020 [PP]), Describing score from T1 to T2 (*MD* = 1.29, *p* = .012 [ITT]; *MD* = 2.52, *p* = .010 [PP]) and T1 to T3 (*MD* = 1.24, *p* = .027 [ITT]; *MD* = 2.41, *p* = .026 [PP]), Act with Awareness score from T1 to T3 (*MD* = 1.26, *p* = .022 [ITT]; *MD* = 2.12, *p* = .040 [PP]), Non-judging score from T2 to T3 (*MD* = 1.06, *p* = .017 [ITT]; *MD* = 2.15, *p* = .009 [PP]), and Non-reactivity score from T1 to T3 (*MD* = .86, *p* = .015 [ITT]; *MD* = 1.65, *p* = .014 [PP]). All the facets had non-significant main effect for the study groups, except Act with Awareness score, *F*(1, 90) = 5.72, *p* = .019 (ITT); *F*(1, 44) = 4.72, *p* = .035 (PP), with a higher score in the m-MBI group compared to the WL group (*MD* = 3.17 [ITT]; *MD* = 3.67 [PP]).

In addition, the PP analysis also uncovered a significant Group x Time interaction in the Non-judging facet, F (1.86, 81.73) = 3.34, *p* = .044, demonstrating an increased score in the m-MBI group at T3 compared to T2 (*MD* = 4.13, *p* < .001). A significant main effect for the study groups was also found in PP analysis in the Describing facet, *F*(1, 44) = 4.91, *p* = .032, with an overall higher FFMQ facet score in the m-MBI group compared to the WL group (Table 4.3).

4.3.5 Self-compassion (SCS-SF)

A 2 X 3 ANOVA found a significant Group x Time interaction, *F*(1.83, 164.84) = 4.25, *p* = .019 (ITT); *F*(1.86, 81.94) = 4.30, *p* = .019 (PP). Pairwise comparisons showed that self-compassion significantly increased in the m-MBI group in T3 compared to T2 (*MD* = .13, *p* = .006 [ITT]; *MD* = .26, *p* = .003 [PP]) and compared to T1 (*MD* = .23, *p* < .001 [ITT]; *MD* = .45, *p* < .001 [PP]). There were no changes in SCS-SF score in the WL group across all the assessment points (*p*s > .05). Between-group effect size from T1 to T3 was small in ITT ($d_{between}$ = .28; Table 4.3). There was also a main effect for time, *F*(1.83, 164.84) = 9.46, *p* < .001 (ITT); F(1.86, 81.94) = 1.81, *p* < .001 (PP) that showed overall enhanced self-compassion score from T2 to and T3 (*MD* = .10, *p* = .001 [ITT]; MD = .21, *p* = .001 [PP]), as well as T1 to T3 (*MD* = .14, *p* = .001 [ITT]; *MD* = .27, *p*

< .001 [PP]). No main effect for study groups was found (*p*s > .05). Therefore, hypothesis 4 was supported.

4.3.6 Bonferroni Correction

The results were relatively robust across ITT and PP analyses. However, when correcting for multiple comparisons using the Bonferroni correction (i.e., $p_{corrected}$ = .05/9 = .006), Group x Time interaction only remained significant for worry score (*p*s < .001). Main effect for time remained significant for mindfulness, self-compassion and mindfulness describing scores. Other comparisons were no longer significant after the Bonferroni correction. While hypothesis 2 remained supported, hypotheses 3 and 4 were no longer validated based on the adjusted findings.

4.3.7 Reliability of Significant Effect on Self-Reported Outcomes

In order to assess the reliable change of the significant treatment effect observed between the m-MBI group and the WL group (i.e., PSWQ, SCS-SF, and FFMQ scores), participants were categorized based on whether they exhibited reliable improvements, declines, or no changes in the respective outcome measures (Table 4.4). Significant reliable improvements were observed in worry scores within the m-MBI group when compared to the WL group across the two-time intervals, from T1 to T2, $\chi^2(2)= 15.19$, $p = .001$, and from T1 to T3, $\chi^2(2)= 15.19$, $p = .001$. Specifically, a larger proportion of participants in the m-MBI group demonstrated reliable improvement in worry scores, compared to the WL group, both at the T1 to T2 (47.8% vs. 8.7%) and T1 to T3 (56.5% vs 4.3%) time-points. Similarly, there were reliable improvements in mindfulness scores within the m-MBI group compared to WL group from T1 to T2, $\chi^2(2)= 15.19$, $p = .001$, and from T1 to T3, $\chi^2(2)= 15.19$, $p = .001$.

Table 4.4

Summary of Results of Reliable Change Index (RCI) with Numbers and Percentages (%) of Participants in MBI and WL Groups

Outcome variables; Measures	Time-points	MBSR (n, %)			WL (n, %)			χ^2	*p*
		Improved	No Change	Worsened	Improved	No Change	Worsened		
Worry; PSWQ	T1 to T2	11 (47.8)	10 (43.5)	2 (8.7)	2 (8.7)	14 (60.9)	7 (30.4)	9.68	**0.008**
	T1 to T3	13 (56.5)	8 (34.8)	2 (8.7)	1 (4.3)	15 (65.2)	7 (30.4)	15.19	**0.001**
	T2 to T3	6 (26.1)	17 (73.9)	0 (0.0)	2 (8.7)	20 (87.0)	1 (4.3)	3.24	0.198
Self-compassion; SCS-SF	T1 to T2	5 (21.7)	16 (19.6)	2 (8.7)	1 (4.3)	20 (87.0)	2 (8.7)	3.11	0.211
	T1 to T3	7 (30.4)	16 (69.6)	0 (0.0)	3 (13.0)	20 (87.0)	0 (0.0)	2.04	0.284
	T2 to T3	7 (30.4)	16 (69.6)	0 (0.0)	3 (13.0)	20 (87.0)	0 (0.0)	2.04	0.153
Mindfulness; FFMQ	T1 to T2	11 (47.8)	11 (47.8)	1 (4.3)	3 (13.0)	19 (82.6)	1 (4.3)	6.71	**0.035**
	T1 to T3	13 (56.5)	7 (30.4)	3 (13.0)	5 (21.7)	15 (65.2)	3 (13.0)	6.47	**0.039**
	T2 to T3	9 (39.1)	12 (52.2)	2 (8.7)	3 (13.0)	19 (82.6)	1 (4.3)	4.91	0.086
Mindfulness Act with Awareness; FFMQ	T1 to T2	9 (39.1)	12 (52.2)	2 (8.7)	2 (8.7)	17 (73.9)	4 (17.4)	5.98	0.050
	T1 to T3	12 (52.2)	8 (34.8)	3 (13.0)	5 (21.7)	15 (65.2)	3 (13.0)	5.01	0.082
	T2 to T3	0 (0.0)	22 (95.7)	1 (4.3)	4 (17.4)	15 (65.2)	4 (17.4)	7.12	**0.028**

Note. PSWQ = Penn State Worry Questionnaire; SCS-SF = Self- Compassion Scale - Short Form; FFMQ = Five Facet Mindfulness Questionnaire; T1 = Pre-test; T2 = Post-test; T3 = 1-month Follow-up

A higher percentage of participants within the m-MBI group exhibited reliable improvement in mindfulness scores, contrasting with the WL group, both at the T1 to T2 (47.8% vs. 8.7%) and T1 to T3 (56.5% vs. 4.3%) time intervals. Differences in reliable change between study groups for self-compassion and Act with Awareness scores did not reach statistical significance (*p*s > .05), but all were in the expected direction.

4.4 Mediation Analyses

4.4.1 Did Mindfulness Mediate the MBI Effects on Self-Compassion?

A single mediation analysis was conducted with self-compassion T1-T2 change score entered as a dependent variable; mindfulness change score entered as the mediator and study groups (i.e., MBI = 1, WL = 0) entered as an independent variable. The bootstrap confidence interval (CI) for the indirect effect of the MBI effects on self-compassion through mindfulness contained zero, *b* = .08, 95% BCa CI [-.01,.24], indicating a non-significant mediation effect (Table 4.5; analysis using ITT samples was displayed in Appendix M). Therefore, hypothesis 5 was not supported.

4.4.2 Did Self-Compassion Mediate the MBI Effects on Mindfulness?

A single mediator analysis was performed with mindfulness T1-T2 change score entered as the dependent variable; self-compassion change score entered mediator and study groups remained as the independent variable. A non-significant indirect effect of MBI effect on mindfulness through self-compassion was found, *b* = 2.83, 95% BCa CI [-.25, 8.24], suggesting no mediation effect (Table 4.5, analysis using ITT samples was displayed in Appendix M). Therefore, hypothesis 6 was not supported.

Table 4.5

Bootstrap Resampling Point Estimates and 95% Confidence Intervals (CI) for Single Mediator and Multiple Mediator Analyses (*N* = 50)

				Bootstrapping Bca 95% CI	
Outcomes	Mediators	Point Estimate	SE	Lower	Upper
Self-compassion	M	.08	.06	-.01	.24
	Total Effect	.27*	.12	.02	.51
Mindfulness	SC	2.83	2.2	-.25	8.24
	Total Effect	9.52*	4.36	.76	18.28
Stress	M	-1.04	.68	-2.52	.12
	SC	-1.13	1	-3.73	.02
	Total Indirect	-2.17*	1.21	-5.03	-.33
	M vs. SC	.10	1.2	-1.85	3.01
Worry	M	-.95	1.08	-3.18	1.2
	SC	-.63	1.06	-3.55	.65
	Total Indirect	-1.57	1.35	-4.79	.57
	M vs. SC	-.32	1.66	-3.11	3.66

Notes. Confidence intervals that do not contain zero indicate that the point estimate is statistically significant. M= mindfulness; SC = self-compassion; Bca 95% CI = bias-corrected and accelerated 95% confidence intervals; SE = standard error.

* Indicates a significant indirect effect

4.4.3 Did Self-compassion and/or Mindfulness Mediate the MBI Effects on Stress?

A multiple mediator analysis was conducted with both mindfulness and self-compassion T1-T2 change scores were entered simultaneously as mediators, perceived stress change score was entered as dependent variable and study groups remained as the independent variable. The correlations between mediators were also assessed and suggested no collinearity (*r*s < .7) (Hayes, 2018).

After accounting for self-compassion, mindfulness was not found to significantly mediate between m-MBI effects and perceived stress, *b* = -1.04, 95% BCa CI [-2.52, .12]. Self-compassion did not mediate perceived stress after controlling for mindfulness, *b* = -1.13, 95% BCa CI [-3.73, .02]. Therefore, hypotheses 7 and 9 were not supported.

However, analysis indicated that both mindfulness and self-compassion were significant mediators of MBI effect on stress even after controlling for each other, *b* = -2.17, 95% BCa CI [-5.03, -.33] (Table 4.5, analysis using ITT samples was displayed in Appendix M).

4.4.4 Did Self-compassion and/or Mindfulness Mediate the MBI Effects on Worry?

A multiple mediator analysis was conducted with worry T1-T2 change score inserted as a dependent variable and both mindfulness and self-compassion change scores remained as mediators.

Neither mindfulness, *b* = -.95, 95% BCa CI [-3.18, 1.20] nor self-compassion, *b* = -.63, 95% BCa CI [-3.55, .65] alone mediated the effects of MBI on worry after accounting for one another. Therefore, hypotheses 8 and 10 were not supported (Table 4.5, analysis using ITT samples was displayed in Appendix M).

4.5 Exploratory Analyses

4.5.1 Which Mindfulness Facet(s) Mediated the MBI Effects on the Study Outcomes?

Three multiple mediator analyses were conducted to assess whether mindfulness facets mediated the effect of the intervention on perceived stress, worry and self-compassion, respectively. For each outcome, respective T1-T2 change scores were entered as dependent variables and study groups as independent variables. Mindfulness Observing, Describing, Acting with Awareness, Non-judging, and Non-reactivity T1-T2 change scores were entered simultaneously as mediators. The correlations between mediators were also assessed and suggested no collinearity (*r*s < .7) (Hayes, 2018).

After controlling for each of the facets, it was found that the bootstrap CI for the indirect effect of all the mindfulness facets included zero on perceived stress, worry, and self-compassion (Table 4.6). Therefore, none of the mindfulness facets mediated the MBI effects and study outcomes.

Table 4.6

Bootstrap Resampling Point Estimates and 95 % Confidence Intervals (CI) for the Total Indirect Effect and Total Effect of MBI on Outcome Variables and the Individual Indirect Effects of Each Mindfulness Facet (N = 50)

				Bootstrapping Bca 95% CI	
Outcomes	Mediators	Point Estimate	*SE*	Lower	Upper
Perceived stress	Observing	0.41	0.50	-0.46	1.56
	Describing	-0.19	0.56	.-1.49	0.81
	Act with Awareness	-0.77	0.72	-2.54	0.29
	Non-judging	0.59	0.98	-1.15	2.82
	Non-reactivity	-0.12	0.51	-1.29	0.85
	Total indirect	-0.09	1.42	-3.16	2.61
	Total effect	-4.18*	1.85	-7.89	-0.46
Worry	Observing	1.42	1.33	-0.37	4.87
	Describing	-0.85	1.08	-3.64	0.62
	Act with Awareness	-1.11	1.19	-3.83	0.88
	Non-judging	0.37	0.76	-0.88	2.28
	Non-reactivity	-0.56	0.78	-2.65	0.36
	Total indirect	-0.74	1.90	-4.66	2.77
	Total effect	-9.80*	2.42	-14.68	-4.93
Self-compassion	Observing	-0.04	0.05	-0.18	0.01
	Describing	0.04	0.05	-0.04	0.13
	Act with Awareness	0.02	0.05	-0.07	0.14
	Non-judging	-0.02	0.04	-0.10	0.05
	Non-reactivity	0.04	0.05	-0.02	0.16
	Total indirect	0.04	0.09	-0.12	0.24
	Total effect	0.27*	0.12	0.02	0.51

Note. Confidence intervals that do not contain zero indicate that the point estimate is statistically significant. Bca 95% CI = bias-corrected and accelerated 95% confidence intervals; SE = standard error.

* Indicates a significant effect.

4.5.2 Was Mindfulness Practice Related to Changes in the Study Outcomes?

M-MBI participants were anticipated to finish 63 sessions of the informal practices, 33 sessions of formal practices, and 159 minutes of formal practices (assuming the shortest guided audios were selected). Among the 47 participants in the m-MBI group, 20 (42.55%) completed the total informal practice, while nine (19.15%) completed the required sessions and duration formal practice. On average, MBI participants (n = 47) completed 43.26 (SD = 29.94, out of 63 total sessions) informal practice sessions, 13.70 (SD = 15.62, out of 33 total sessions) formal practice sessions, and 74.19 minutes (SD = 92.35, out of 159 minutes) of formal practice throughout the 5-week intervention. Pearson correlation coefficients suggested a medium-to-large negative correlation of all three mindfulness practice indicators on the T1-T2 changes of perceived stress, with greater practice associated with reduced perceived stress scores. All three of the mindfulness practice indicators also positively and moderately predicted the changes in mindfulness scores, with greater practice associated with enhanced mindfulness levels. Moreover, formal meditation sessions and duration had moderate, positive significant correlations with self-compassion change scores. Informal practice sessions achieved a significant moderate, negative correlation with worry change scores (Table 4.7).

4.6 MINDFULGym App Quality

Participants in the m-MBI group who completed the post-test (n = 24) subjectively perceived the MINDFULGym app as having average quality (M = 2.67, SD = .80) (Table 4.8). However, the mean objective quality score obtained was 3.70 out of 5 (SD = .55). Among the four domains rated for objective app quality (i.e., functionality, engagement, aesthetic, information), MINDFULGym scored highest in the functionality domain (4.20 out of 5; SD = .71), indicating the app being fairly easy to use and had satisfactory flow logic (i.e., app navigations). MINDFULGym app scored the lowest (but average) in the

engagement domain (3.18 out of 5; *SD* = .67), suggesting room for improvements in enhancing engagement with the users.

Table 4.7

Pearson Correlation Coefficient of Mindfulness Formal and Informal Practice on Pre-Post Outcome Changes

	Variables	1	2	3	4	5	6	7
1	PSS	-	-	-	-	-	-	-
2	PSWQ	.242	-	-	-	-	-	-
3	SCS-SF	.444**	-.223	-	-	-	-	-
4	FFMQ	.434**	.536**	.340*	-	-	-	-
5	Frequency of formal mindfulness practice	-.510**	-.266	.369*	.445**	-	-	-
6	Duration of formal mindfulness practice (minutes)	-.474**	-.268	.382**	.368*	.948**	-	-
7	Frequency of informal mindfulness practice	-.292*	-.340*	.254	.433**	.781**	.795**	-

Note. PSS = Perceived Stress Scale; PSWQ = Penn State Worry Questionnaire; SCS-SF = Self-Compassion Scale - Short Form; FFMQ = Five Facet Mindfulness Questionnaire.

**p<.05, **p<.01*

Table 4.8

Assessment of MINDFULGym App Quality using Mobile Application Rating Scale (MARS) in m-MBI group

Rating Sections (n = 24)	*M*	*SD*
Objective App Quality	3.70	.55
A. Engagement	3.18	.67
B. Functionality	4.20	.71
C. Aesthetic	3.51	.76
D. Information	3.89	.54
Subjective App Quality	2.67	.80

Note. Objective App Quality was the average mean score of Engagement, Functionality, Aesthetic, and Information

4.7 Qualitative Analyses MINDFULGym Feasibility

Sixteen out of the 23 participants who completed the 5-week intervention in the m-MBI group agreed and took part in the interview. All interviewed participants were females, except for one. The duration of the interviews ranged from 28 minutes to 99 minutes (M = 49.36, SD = 17.01). The key themes derived from the interviews were: Benefits experienced, likes/dislikes, encountering and addressing adherence issues, MINDFULGym content improvement, app feedback and suggestions, recommendations, low app sustainability, and post-intervention understanding of mindfulness. Themes, subthemes, codes, and illustrative quotes are displayed in Table 4.9.

4.7.1 Benefits Experienced

The perceived main benefit of MINDFULGym was the convenience of access to cultivating mindfulness in daily life. MINDFULGym was considered as a tool, or an internal resource accumulated through the 5-week program that became applicable in daily life (Quote 1, 2). More than half of the participants expressed that the daily practices (i.e., Home Gym) exerted a calming and stress-relieving effect that helped with study

Table 4.9

Themes and Illustrative Quotations of the Qualitative Interviews.

Themes	Subthemes /Codes		Illustrative Quotes
Benefits	Convenience of access	1	I think the central point is, I tried to be grateful maybe once in a while. Like, when I am going to sleep, then I'll think like, okay, I'm grateful that maybe my friends helped me with my assignments or that. So, it kind of like stick to me, but it will pop out once in a while...(P15)
		2	I would stick to the stretching in my day-to-day routine. (P09)
	Calming and stress relieving	3	Overall, I think it does help me to relief some stresses with my work. Because I'm a final year student and I'm doing my final year project. Yeah, sometimes it was very stressful with all those works. (P02)
	Awareness of the self and surroundings	4	...through the practices, it kind of forces me to be very conscious about my surroundings and how I feel and on the actions that I take and the things I'm doing. (P14)
		5	I think what is more obvious to me is that it brought up the issues, like, when you're doing stuff and then you are not aware of what you're currently doing. This helped me realise that: 'Hey, I actually spent a lot of time in this [unaware] state'. (P09)
	Reperceiving negative experience	6	(Acceptance and let go) And a lot of times, I know what I'm feeling and I'm aware of it. And I try to just feel it and I just let it go (P01)
		7	(Common Humanity) It reminds me to change thoughts at the moment when I'm facing with difficulties. And so that I know that, like: 'Yeah, it's hard time for me, but somebody is also have the same issue.' Oh, yeah. So, it is helping me to become less stressful and become calmer in facing the issue next time. (P04)
		8	(It was just temporary) Yeah. It's like when things go wrong, I would remember to remind myself that these are just temporary, these will past. (P11)

Table 4.9, continued.

Themes	Subthemes /Codes		Illustrative Quotes
	Sustained attention	9	But (when) I practise the mindful NOW-ing, it helps me to study for a longer time because I will not think of any other things and just reading out my mind. (P08)
	Sense of gratitude	10	I think that also cultivated a sense of gratitude... That you are appreciating all the good things that happen in your life. (P15)
	Improved sleep	11	...sometimes I did it before my sleep, and it helps. It helps me to sleep better, in a way. (P11)
Likes/ Dislikes	Subtheme: Preferred/ Less preferred MINDFULGym content		
	Reading content	12	I did get a beginner's idea of what mindfulness is. So, I go through the weeks. Okay, it gives a concise description of what was going to be learned that particular week. Yes. So, I think like when it comes to the teaching moment it's like a good insight for beginners. (P03)
		13	I think the reading content is like, um, they split into a lot of pages where I have to like flip and go through a lot (of pages). So maybe it would be nice to have a synopsis or maybe less pages…(P12)
	Heartful Stories	14	I really like the stories that were featured in each of the lesson, I think that was very cute, and very inspiring and motivating. (P15)
	Daily Journaling	15	But in terms of the content of writing, I felt like it was a bit repetitive. Um, I was writing the same things a lot because I felt the same every time I did the practice. (P14)

Table 4.9, continued.

Themes	Subthemes /Codes		Illustrative Quotes
		16	…further to the last question to the daily journal, 'What did you further modify the practice?' Most of the times, I had no thoughts, ideas or even the desire to modify the practice. I tend to just keep doing the practice until it was alright. (P03)
		17	Just when I want to log in to the daily journal, sometimes it will take a bit, like, just a few seconds longer to load. (P07)
		18	I didn't like practice with this journaling kind of stuff... I'm that kind of person like more to report to myself rather than to others... thinking that: "Oh, I should show my feelings to you..." I feel a bit of overwhelmed. (P06)
		19	...sometimes I find it troublesome if I want to be quick. But, um, I understand the importance of journaling. When you're writing, you are actually stopping your mind, which is really a good time for you to reflect on what you just do. So, I would say the benefit outweighs the cons...(P10)
	MINDFULGym Songs	20	I'm not entirely sure if it was like a relaxing exercise because it's more like singing about being happy and being relaxed and it feels more performative than healing. (P03)
		21	Yeah, the theme song is actually quite fun. And when I'm listening to it, I'm like, "Oh, it's interesting."
	Subtheme: Preferred /less preferred Home Gym practices		
	Mindfulness Meditation	22	That was hard for me. I think I wrote that a few times (in the journal) while doing the body scan, I would fall asleep. (P13)
		23	...I'm not really a meditation sort of person. For me, sitting still, for so long just makes me more fidgety than it actually makes me calm. (P15)

Table 4.9, continued.

Themes	Subthemes /Codes		Illustrative Quotes
		24	...if it's guided meditation, if it's too long, I would say I wouldn't [enjoy them much] because firstly, I don't know what it is talking about. Secondly, my screen keep turn off and I have to keep pressing. So, I normally go for shorter ones. (P01)
		25	I definitely get judgmental at times, like, "Aiyo, what are you thinking?! You are missing out what he is saying!" Something like that. So, it makes me harder to focus. (P10)
	Mindful Body Stretching	26	Because I would just do it together with my workouts...I would just combine them, so the stretching was alright…(P02)
	Gratitude Based practices	27	The two others that I really liked were the, the mindful vitamins and the gratitude cards... Yeah. So, the mindful vitamins were, I think, very relevant, because we are in this pandemic, and it's just been a roller coaster of like, ups and downs…There's just so much going on in your head. Sometimes, you just have to calm yourself down and say that: 'this too shall pass.' (P15)
		28	...before this I only came across like, 'mindfulness is equated to meditation'... I didn't know like, gratitude was also a big aspect of mindfulness…(P15)
	Mindful Eating	29	...mindful eating is very good. I noticed that I haven't been really enjoying my food, so I take the time to smell it and [realised] "Oh, so I remember this is what guava smells like..." Then I would just chew slowly. (P03)
		30	I think it's just not for me because I really am not used to the feeling of keep chewing the food, until it gets paste-ty? Yeah, I don't like the feeling. (P16)

Table 4.9, continued.

Themes	Subthemes /Codes		Illustrative Quotes
Encountering and Addressing Adherence Issues	Subtheme: Challenges for completion		
	Busy Schedules	31	I was preparing for examination, and I also have some part-time job. So suddenly, I was like caught up in my daily activities. I stop doing it, but then I come back to finish them. (P12)
		32	...sometimes I feel that the meditation and the stretching wasn't that useful, probably because that day, I have a lot of things to do. Then (I still) have to commit myself to do this thing... (trying to) push through the program but you're not feeling the impact. (P13)
	Establishing habits at the beginning	33	I would say because it's a five-week program, that you have to have a lot of discipline and make it a daily part of your routine. (P15)
	Sustaining motivation throughout the program	34	Uh, it was quite okay at the beginning, but then, um, I find it hard to continue. Maybe it's my own problem. Like, some days I'm just feeling lazy… (P10)
		35	But I guess the biggest issue is that …[when] I did it the first few times, it was good. And then after that, it just became a little bit repetitive. Like I didn't feel the need to do it, but I had to do it every day. (P14)
	Forgotten	36	Sometimes I just dismiss my timer and then I go do other things and then I forgot. (P06)
	Minimal adherence issue	37	The practising time is actually flexible... There's somewhat a routine too for the practice, like, before I sleep. Or, when I'm taking my lunch, or breaks in between my study. (P08)

Table 4.9, continued.

Themes	Subthemes /Codes		Illustrative Quotes
	Subtheme: Addressing barriers		
	Practices are beneficial	38	I do feel like completing the practices because it really calms my mind sometimes. Like, more ideas tend to pop up...Even though it takes a long time. I realised that the longer you practise it, the better the effect. (P08)
	Reminders	39	I put, need to do mindful practice in my to-do lists... So, I will perform the exercise. Yeah. Another thing is like, you did, like email me that, which one that I missed out, so I will continue with that practice. (P06)
	Self-modified practice	40	I also separate the practice during my day. Like, once during the morning, once in the afternoon and once during the night. Then, it wouldn't take long per practice.(P16)
	Responsibility as a research participant	41	I think that's what motivated me because I've been on the other end of it, I take my roles and responsibilities very seriously. So, as a participant, I felt like it's unfair, if you agree to be a part of something, and then you just don't keep up to your end of it... (P15)
	Incentive as motivation	42	To be honest, like if let's say I'm feeling really unmotivated, knowing that I will get the reward will motivate me. (P07)
Improvements and Feedback of app based MINDFULGym	Subtheme: MINDFULGym Format Feedback		
	Daily practice format	43	…for me, the cheat days mattered, like: "Finally I can have a rest and no need to do the report and the exercises." Something like that. (P04)
		44	I think for the gratitude card and the Google-WWW-Yahoo, I think maybe like, can slowly increase the intensity. Like for newbies, you can start with one thing to be grateful for, and then maybe slowly increase it…(P12)

Table 4.9, continued.

Themes	Subthemes /Codes		Illustrative Quotes
		45	Um, instead of every exercise you'll want it six times a week, maybe you just require two types of activities that need six times a week. And then it's really up to them to choose which one they like. (P09)
	Daily journaling format	46	So, I think the questions 'what is helpful and what is not? ' and 'How do you modify?' you can combine together? Because it's quite repetitive. (P01)
		47	...if it's something I had to do every day, um, I can record it the first time I do it. And then like the last day of the week, and maybe even like a midpoint check. So, like two to three times (per week) instead of everyday. (P14)
		48	Or, not necessarily have to write it down. We can just read it out in our minds, like, 'practice quality four of five stars today.' Or we can collect the record every day, so we can see our progress... Something like, 'How's your rating, for the past week?'
	Subtheme: App feedback and suggestions		
	Errors and crashes	49	One thing I find out was...(that) when I wanted to do the meditation using the audio. I'm not sure (if) is it my phone setting, because when the audio was too long, like 10 minutes, it stopped, and my phone was dimmed. It will stop halfway. So, I had to unlock my phone again and restart. So, my meditation was halfway... it wasn't a smooth audio for meditation. (P05)
		50	Sometimes, I don't know if it's the internet connection issue or the app issue. It actually takes a while to load the form…(so) sometimes I feel draggy to complete the form (P11)

Table 4.9, continued.

Themes	Subthemes /Codes		Illustrative Quotes
		51	I think ideally, it would be good if we can record our responses in the app. Because, let's say, I want to check in and see how I felt two days ago, right? Right now, I have to go through my Google Form…
	Looks and feels	52	...the app design (is) colourful, so, no issue with that…(P08)
		53	...the design is...maybe it's a bit too colourful for me. It has that strange background...just personally, I prefer a very minimalistic design… (P07)
		54	...maybe some visuals will help...If you want to make it more appealing...then maybe you could add, like some animations or some transitions...And some people have different learning preferences...So maybe a simple video, or infographic, or posters or something like that, perhaps. (P15)
	Functionality	55	...in the practice session, you can provide a link for me to click back to the instruction. Yeah, because sometimes I just read it and then I do my other things and I come back and then I...forget, like how to do that. I have to refer back to the instruction to see what it's required. (P06)
		56	Maybe like a reminder setting? So maybe participants can choose the reminder settings like what time, or the frequency of the reminder appearing in the phone. (P16)
		57	I remember that there was something like 'day 1 attempt 1'. Yeah. Right. Yeah. I think maybe there's a need to put up a tick beside [the completed journals], right after you are done recording it because sometimes, I get quite confused... I tend to forget which attempt I am recording during the next day. (P04)

Table 4.9, continued.

Themes	Subthemes /Codes		Illustrative Quotes
	Engagement and Gamification	58	...like, they can maybe check-in to the apps or something and then they can get their daily rewards...One suggestion to encourage people doing the practice daily. (P16)
		59	I'm not so sure about this MINDFULGym, if participant had to do it alone. But maybe you can encourage that they can do together with their friends. (P02)
Recommendation to Others	To individuals experiencing difficult emotions	60	Yes. Because I think due to this MCO, I found it many friends are expressing depressing symptoms because of stress This mindful gym activities might help them to release some stress. (P02)
	Would not recommend	61	I think I would be more comfortable to recommend the app to others when it's improved. It's because, as I mentioned, I'm not sure where the journal had gone to after I've submitted it, and that I can't see what I've done, so it did not bring up the motivation to continue the practice. (P04)
Low App Sustainability	Not using the app anymore	62	Um, I'm not using the app anymore (P06)
	For instructions only	63	I just sometimes log in to see the instructions, but I rarely used it.
Post-Intervention Understanding of Mindfulness	Grounded at the present moment	64	For me, it's more about living in the present and acknowledging you are in the present. (P11)
	Awareness of the self and surroundings	65	I think mindfulness is being aware of what is going on, not just with myself, but also what's going on around me. (P14)
	Sense of gratitude	66	So, when you're more present in the moment, you begin to notice even the smallest of things in life that you can be grateful about. (P15)

Table 4.9, continued.

Themes	Subthemes /Codes		Illustrative Quotes
	Self-compassion	67	...being less judgment on ourselves, and then maybe be more positive and not too negative on ourselves, on our strength, our ability, because every people have a limited ability to do the things, but we need to believe in ourselves. (P04)
	Free from negative thoughts	68	To me, mindful is more like relaxing. Don't think of negative thing. Just calm, relax. Like something like those monks in the ‘tokong’ (temple). (P13)

pressures (Quote 3). The program also helped create awareness towards the self (i.e., behaviour, thoughts, emotions) and towards the surroundings (Quote 4).Notably, one participant expressed the issue of the non-present-minded tendency while completing his daily tasks and feeling more attuned to the present-moment experiences after the intervention (Quote 5). Several participants noticed changes when dealing with negative experiences. Some observed using mindfulness approach in reframing negative experiences, including acceptance, and letting go (Attitudes; Kabat-Zinn, 2013; Quote 6), seeing experience as part of larger human experience (Common humanity, Neff, 2003b; Quote 7), and seeing negative thoughts as just temporary (Attitudes; Kabat-Zinn, 2013; Quote 8). Lastly, a few participants claimed that the program was effective in helping them sustain attention in studies, cultivating gratitude, and improving sleep (Quote 9 - 11).

4.7.2 Likes/ Dislikes

Two subthemes emerged from the main themes: preferred/less preferred MINDFULGym content (i.e., readings, songs, daily journaling) and preferred/less preferred Home Gym practices.

Preferred / Less Preferred MINDFULGym Content. Most participants found the reading materials to be informative and easy to understand, even for mindfulness beginners (Quote 12). Yet, a few participants found some contents too wordy even though the materials were displayed in bullet-point format (Quote 13). Participants especially enjoyed and expressed the warm and reflective nature of the heartful stories (Quote 14). However, more than half of the interviewed participants deemed daily journaling less favourable, due to the intensive journaling frequency and repetitive questions and responses (Quote 15). Most of the time participants followed the exact instructions of Home Gym practices and thus felt stumped at the journal question: “What have you modified during the practice?” (Quote 16). Some considered the journaling to be

inconvenient due to the input format (i.e., participants were required to quit the app to access the Google Form for the journaling; Quote 17). One participant in particular reported feeling uneasy submitting the journals to the researcher as it contained personal emotions and feelings (Quote 18). Nevertheless, a few participants figured that daily journaling served as reflective sessions on their thoughts and emotions albeit troublesome at times (Quote 19). Lastly, mixed feelings were observed on the songs in MINDFULGym. Some participants felt that the songs were performative and were less useful while some thought the songs helped lighten their mood (Quote 20, 21).

Preferred / Less preferred Home Gym practices. In general, participants preferred shorter and/or movement-based (i.e., stretching) informal Home Gym practices compared to the longer, seated formal practices (i.e., mindfulness meditation). Participants deemed meditation less favourable as they found themselves losing patience or feeling sleepy during the sessions, and sometimes encountered technical errors in the guided audios. (Quote 22 - 24). One participant further reported feeling judgemental towards herself about being easily distracted when her attention went astray during the meditation practices (Quote 25). Participants preferred the stretching exercises as they could be easily merged into their workout routine (Quote 26). Half of the interviewed participants preferred informal practices that cultivated a sense of gratitude and self-compassion and found it relevant during the pandemic (Quote 27). One participant expressed that the gratitude practices debunked the mindfulness-as-meditation misconception (Quote 28). Other practices gathered mixed preferences. For instance, a few of the participants enjoyed mindful eating while some found it less useful and odd (Quote 29, 30).

4.7.3 Encountering and Addressing Adherence Issue

This theme was classified into two subthemes: challenges for completion and addressing barriers.

Challenges for Completion. Almost all of the interviewed participants encountered barriers while committing to the intervention. The most commonly encountered obstacle was busy schedules, i.e., classes, assignments, and examinations (Quote 31). For instance, one participant expressed feeling forced and not feeling the impact of Home Gym practices when being swamped with work (Quote 32). Participants also faced challenges in commencing and sustaining motivation for the program. While some participants encountered difficulties incorporating daily practices into their routine in the beginning (Quote 33), others struggled to gather motivation for daily practices throughout the program and commented that certain practices were repetitive and intense (Quote 34, 35). Several participants admitted forgetting about the Home Gym practices, even though notifications were sent (Quote 36). Nevertheless, some participants integrated the Home Gym practices within study breaks and reported no problem adhering to the program (Quote 37).

Addressing Barriers. Despite the barriers, most of the participants observed the after-practice benefits (i.e., calming effect), which led them back to the daily practices and thus, completing the program (Quote 38). Many participants relied on reminders, such as notifications, to-do lists, alarms, and mental notes to get into daily practices (Quote 39). Others modified certain practices to better yoke into their daily routine. For instance, one participant had split the movement-based guided practices in between study breaks (Quote 40). Nonetheless, some participants asserted the sense of responsibility as a research participant as motivation to complete the program (Quote 41); and some were driven by the research incentive upon program completion (Quote 42).

4.7.4 Improvements and Feedback of the App-Based MINDFULGym

The majority of the participants were satisfied with the length of the 5-week MINDFULGym intervention, except for four participants. Three would prefer interventions of shorter duration (i.e., 2 to 4 weeks) while one participant thought that the

program would be more effective with a longer duration. When they were asked about the feedback to the app-based MINDFULGym, responses could be further categorised into two subthemes: MINDFULGym format feedback and app feedback and suggestions.

MINDFULGym Format Feedback. More than half of the participants commented on the format of Home Gym practices. Most would like to reduce daily practice frequency, or gradually increase the intensity to ease the transition of incorporating mindfulness practices into daily lives. For instance, some suggested having 'cheat days' or reducing the activities of the daily Home Gym practices (Quote 43, 44). A few participants suggested implementing a less structured Home Gym, allowing them to choose their preferred 'practice-of-the-day'(Quote 45). However, one participant felt that her practice routine was changed abruptly each week and would prefer a longer practice routine for each weekly module, i.e., 10 days/module. Participants also gave feedback on the questions and format of implementation of the daily journaling, with most of them proposing the merging of questions in the journal (Quote 46). Others voiced out the repetitiveness of the daily journaling and suggested reducing journal submissions, i.e., two to three submissions per week instead of daily journaling (Quote 47). When being told the purpose of the journals was to ensure daily practice compliance, participants recommended a daily 'check-in' system to replace the journaling exercises (Quote 48).

App Feedback and Suggestions. Although participants claimed that the MINDFULGym app is simple and easy to use, limitations and complaints were acknowledged regarding the errors, aesthetics, functionality, and overall quality of the application. A little more than half of the participants had reported errors or crashes while using the app (Quote 49). The use of Google Forms for the journals had also been found to encounter submission and loading errors (Quote 50). To ease the process of submitting and reviewing the daily journals, participants would prefer the daily journaling to be implemented within the app (Quote 51). Participants also commented on the visual appeal

and colour schemes of the app. While a few participants enjoyed the visual palette (Quote 52), others deemed the design to be unattractive or 'too colourful' and would prefer a 'minimalist' design (Quote 53). Several participants suggested incorporating other visual formats (i.e., videos and animated fonts) to cater to different learning styles and to increase user engagement (Quote 54).

In terms of functionality, some participants expressed incorporating additional features to improve the ease of navigation throughout the app. For instance, integrating buttons navigating from Home Gym to reading contents to easily review the practice instructions (Quote 55). Another functional feature proposed was a built-in reminder or alarm to remind participants to get into daily practice (Quote 56). Besides, participants encountered an inconvenience with the practice tracking features and suggested adding an indicator (i.e., tick boxes) for completed journaling attempts and providing a weekly Home Gym practice progress (Quote 57). These features would thus provide direct visual feedback of the individual's progress performance and create a sense of achievement (i.e., "I'm levelling up!"). This technique could increase app interactivity and is known to effectively 'gamify' smartphone applications to increase user engagement (Hoffmann et al., 2017; Wang et al., 2021). Other gamification techniques mentioned by participants include games (e.g., daily check-in; Quote 58) and setting a buddy system to support and keep them accountable for the daily Home Gym practices (Quote 59).

4.7.5 Recommendations to Others

Almost all participants would recommend the mobile MINDFULGym to their friends and family, especially to individuals experiencing difficult emotions, i.e., stress, anxiety, or depressive symptoms (Quote 60). However, one participant expressed that she would only recommend the mobile MINDFULGym to others if the app functionality was improved (Quote 61).

4.7.6 Low App Sustainability

Despite the willingness to recommend the mobile MINDFULGym to others, most of the participants no longer use the app upon the completion of the 5-week MBI (Quote 62), while a few would occasionally log in for Home Gym instructions (Quote 63). When asked to estimate the number of Home Gym practices after the 5-week program, weekly practice frequency was reduced to two to four times.

4.7.7 Post-Intervention Understanding of Mindfulness

Participant also expressed their understanding of mindfulness after the program, more than half of the participants alluded to mindfulness as staying in the present moment and being aware of oneself as well as the surroundings (Quote 64, 65). Some perceived mindfulness as being appreciative towards positive events, even small ones (Quote 66). One participant particularly expressed mindfulness as self-compassion (Quote 67). However, one participant reported that mindfulness meant achieving a state with no negative thoughts, like ‘monks in the temple’ (Quote 68).

CHAPTER 5 : DISCUSSION

This study investigated the efficacy of using a mobile mindfulness-based intervention (m-MBI; i.e., MINDFULGym) in improving the mental well-being in EAs experiencing out-of-university transition over a 5-week intervention and 1-month follow-up. Relative to the waitlist control, 5-week m-MBI positively impacted self-reported worry, self-compassion, and mindfulness, but not perceived stress at post-intervention and 1-month follow-up. However, only the worry scores remained significant after applying strict adjustment to multiple comparisons (i.e., Bonferroni correction). Evaluation of the mechanisms revealed that m-MBI primarily reduced stress levels by increasing both mindfulness and self-compassion. Exploratory findings suggested that the amount of mindfulness practices was positively related to the outcomes assessed. Qualitative findings illustrated that MINDFULGym m-MBI revealed benefits that supplemented the quantitative findings, including stress relief, heightened awareness, reframing negative experiences, and cultivated sense of gratitude. In addition, participants expressed encountering adherence issues and provided further suggestions to improve the MINDFULGym m-MBI.

5.1 Effect of M-MBI on Perceived Stress

Although evidence suggested stress reduction as one of the most robust outcomes of the online MBIs (Gu et al., 2015; Sommers-Spijkerman et al., 2021; Yang et al., 2018) and further recorded in the qualitative findings of the present study, the gain was not significantly reflected on the self-reported measures. Statistical power was likely a factor in the present study where comparable effect size did not reach significance, rather than the absence of effects.

Another speculation was that the focus on present moment awareness cultivated in an MBI may have led to increased engagement with active stressors, resulting in little or no reduction in perceived stress. A cross-sectional study found that higher overall

mindfulness, particularly in the Act with Awareness facet predicted cardiovascular responses consistent with greater task engagement and stress reactivity (i.e., increased heart rate and ventricular contractility; Saltsman et al., 2021).

Additionally, differences in results compared to previous studies may be attributed to the heterogeneity of content across different m-MBIs, each focusing on different aspects of mindfulness cultivation. For instance, the intervention used by Yang et al. (2018) (i.e., Headspace) emphasized mindfulness meditation, instructing participants to acknowledge unpleasant thoughts arise non-judgmentally during meditation sessions. In contrast, the MINDFULGym intervention focused more on informal practices, where participants were encouraged to "transform" their thoughts by focusing on the positive aspects and expressing gratitude for positive experiences encountered.

This deviation in intervention content, with the MBI in the former study directly focusing on the deficit-focused field of mental health, and the emphasis on increasing positive states of mind in the current study, may contribute to the lack of significance in perceived stress scores in the current study. Nevertheless, the effectiveness of MBI on stress in the current study warranted careful interpretation because participants with higher stress scores tended to withdraw from the current intervention. It was possible that the stress-relieving benefit failed to extend to, or even resulted in elevated stress in higher-stress participants. Therefore, the study should be replicated with larger EA samples to ensure adequate power and could further explore the effects of m-MBI with comparably similar content on stress reduction between high-stress and low-stress participants.

5.2 Effects of M-MBI on Worry

Consistent with what was hypothesised, worry was significantly reduced post-intervention at close-to-moderate effect size and with the magnitude of impact further increased at 1-month follow-up. The results were consistent with and demonstrated a

slightly larger effect compared to other randomized controlled trials (RCTs) of MBIs with shorter durations (i.e., 1 and 2 weeks) conducted on university students (Course-Choi et al., 2017; Gu et al., 2017). Reliable improvements were found in 57% of participants in the m-MBI group, compared to 4% of the waitlist group in the worry measure, suggesting that the self-reported changes were not attributable to measurement error variance. Moreover, qualitative findings revealed that participants reported identifying difficult episodes and described methods of reframing those experiences. This finding was agreeable to the known clinical benefits of MBIs (Feldman et al., 2010; Kumar et al., 2008), such that reduced rumination was found coupled with the improvement in the attentional control and inhibition of unnecessary elaborative processing (Bishop et al., 2004).

It was also noticed that participants utilising approaches theorised in the IAA model of mindfulness (i.e., the attitude of Acceptance and Letting go; Kabat-Zinn, 2013) as well as self-compassion (i.e., Common Humanity; Neff, 2003b) in reframing potentially ruminative events, thus, providing support to the proposed theoretical models. This further highlighted the role of both mindfulness and self-compassion in alleviating worry after the 5-week m-MBI. In summary, these findings suggested that the 5-week self-help m-MBI could bring about direct benefits for EAs in lessening their worry, potentially when encountering unpleasant circumstances during their out-of-university transition.

5.3 Effects of M-MBI on Mindfulness and Self-Compassion

Although quantitative findings showed initial evidence of the effectiveness of the 5-week MINDFULGym in mindfulness and self-compassion enhancement, the results no longer rendered support to the hypotheses after being subjected to Bonferroni correction. Whilst the correction was conducted to reduce Type I error (i.e., concluding that a significant difference is present when it is not), it was found to be stringent and at the

expense of Type II error (i.e., not rejecting the null hypothesis when it is false) (Armstrong, 2014). Some researchers have suggested reporting the exact p-values of important individual tests without employing Bonferroni correction or applying a less stringent correction method (i.e., Bonferroni-Holms) (Perneger, 1998; Streiner & Norman, 2011). Yet, a small effect size improvement was obtained in the m-MBI group on mindfulness (d = .25) and self-compassion (d = .21), compared to the waitlist group (Gu et al., 2017; Huberty et al., 2019). The uncovered effect sizes were smaller when compared to other online MBI studies conducted on university students. For instance, a 2-week online MBI achieved a small-to-moderate effect size on mindfulness (d = .41) and self-compassion (d = .39) (Gu et al., 2017).

One potential reason for the difference in effect sizes was due to the statistical analysis, where both mentioned studies only conducted completers' analysis (i.e., PP analysis), instead of intention-to-treat (ITT) analysis. The effect sizes from PP analysis in the current study (d = .41 and .43) were found comparable to the mentioned studies (Gu et al., 2017; Huberty et al., 2019). A meta-analysis found that PP analysis tended to inflate the treatment effect and produced larger effect sizes compared to ITT analysis (Mostazir et al., 2021). Moreover, 57% of participants in the m-MBI group demonstrated reliable improvement in mindfulness measures, compared to 22% of participants in the waitlist group. The qualitative results found reports of increased awareness of the self and surroundings, as well as a cultivated sense of gratitude, suggesting perceived gains in mindfulness and compassion after the intervention. Therefore, the 5-week self-paced m-MBI could potentially aid the in-transition EAs in cultivating mindful and compassionate awareness of the self during their journey of self-exploration.

5.4 Mindfulness and Self-Compassion as Mediators

Findings from the present study suggested that both mindfulness and self-compassion together played a mediating role in alleviating stress. While previous studies

had established the mechanism of mindfulness in MBI in improving psychological well-being (Baer et al., 2012; Baer et al., 2012; Shapiro et al., 2008), recent studies also uncovered findings that suggested the importance of cultivating self-compassion in mental health enhancement (Duarte & Pinto-Gouveia, 2017; Fong & Loi, 2016). Keng et al. (2012) posited that both constructs work in a way in which mindfulness brings clarity in developing self-compassion, and self-compassion provides pathways for mindfulness by reducing negative and attention-impeding cognition. This could suggest emphasizing cultivating self-compassion in addition to mindfulness in m-MBI might eventually lead to a greater reduction in stress in the EA population.

Nevertheless, when investigating the mediating effect of mindfulness and self-compassion on each other, the results were unexpected. Contrary to the consensus in the evidence that mindfulness mediated self-compassion (Bergen-Cico & Cheon, 2013; Neff, 2003b) and that mindful awareness was first needed before self-kindness could be applied, this study found no mediating effect between these two factors. Similarly, results suggested that neither mindfulness nor self-compassion acted as mediators for worry, despite the significant impact of m-MBI on reducing worry as identified through both quantitative and qualitative findings. One speculation was that the relationship between MBI and changes in worry may be mediated by other factors, such as changes in affective states (Gaynor, 2014). Having said that, the findings of mindfulness and self-compassion as potential mediators warrant prudent consideration because it was plausible that the bootstrapping mediation analysis in the current study yielded insufficient statistical power to discern the effect of mediators with the small sample size (ranging from 20 to 100 participants). Whilst the bootstrapping mediation method was more powerful than Sobel's method with a relatively smaller effect size required for the analysis, prior research found that a moderate effect size necessitated a sample size of 100 for the analysis (Koopman et al., 2015). Pan et al. (2018) proposed a minimal sample size of 69

(and more with larger within-subject correlation value) for detecting a medium-sized effect using the bootstrapping mediation method. Therefore, mediation analysis with a sample size of 50 in the present study may lack adequate power to detect a mediation effect of mindfulness and self-compassion, even if they existed.

An additional speculation was that the Observing facet in the FFMQ may have operated differently in the experienced and naïve meditators, such that the facet failed to load on as a higher-order construct among the latter population (Baer et al., 2008; Gu et al., 2016; Pang & Ruch, 2019). The Observing facet involves noticing or attending to internal and external experiences and is a central tenet of mindfulness and intentional awareness. However, relying solely on observing may also lead to excessive emotional rumination. Previous research has indeed found that a greater tendency to observe oneself was associated with less psychological symptom adjustment in non-meditating individuals (Baer et al., 2006; Baer et al., 2008). This might suggest the intricate interplay between mindfulness facets and meditation experience levels. Nonetheless, since the mediation analyses were conducted using the pre-post intervention changes in mindfulness and self-compassion scores, it could be possible that the effects of mindfulness were not registered within the 5-week interval. Therefore, future research could further examine the relationship between mindfulness and self-compassion at multiple and longer time points using a path model. However, it should be noted that both constructs are not unrelated. Although both constructs did not suggest multicollinearity, mindfulness and self-compassion were correlated across the three time points, thus suggesting that both constructs were not operating fully independently of each other. Although the previous study found that both scales were distinguishable from one another (Keng et al., 2012), future studies should consider using mindfulness and self-compassion scales of different subdomains to better detangle the specific contribution of the constructs.

5.5 M-MBI on Mindfulness Facets

Further exploration of improvement in mindfulness facets suggested that only Act with Awareness was potentially improved after the intervention. This implies that participants in the m-MBI group may have developed greater attentiveness by focusing on their activities and experiencing fewer 'auto-pilot' moments. Qualitative insights from the participants supported this notion, as they reported improved recognition of their tendency towards non-present-mindedness post-intervention.

While the intervention worked to increase levels of Act with Awareness, the changes in facet scores did not mediate the shift in outcome variables. In fact, none of the mindfulness facets seemed to be mediators of the outcomes in the current intervention. Previous studies have managed to uncover certain mindfulness facets, such as Acting with Awareness and Non-judging (Mayer et al., 2019; Querstret et al., 2018), Non-reactivity (Hindman et al., 2014) mediating the change in perceived stress, albeit not all improved facets mediate the change in the outcomes. However, a cross-sectional study revealed that while FFMQ facets align with underlying common factors related to mechanisms of mindfulness (i.e., attentional control, body awareness, decentring, emotional regulation, and the ability to identify/describe feelings), other measures may capture these factors with higher accounted variance (Bednar et al., 2020). The authors suggested that the complex item formulations of the FFMQ and individual differences in meditative experience may influence comprehension of its items. Therefore, they encouraged the use of alternative measures to assess the mechanisms of mindfulness, rather than relying solely on dedicated scales like the FFMQ. Indeed, alternative measures that align more closely with the proposed mechanism (e.g., attentional control with regards to the Act with Awareness facets) may offer a more comprehensive understanding of the relationship between mindfulness and outcomes. Although it would be interesting to

explore the varying importance of different mindfulness facets in relation to various health outcomes, our findings did not conclusively support this proposition.

It was also of interest why the m-MBI did not affect all of the mindfulness facets. Querstret et al. (2016) posited that facets such as Observing, Describing, and Acting with Awareness may develop earlier in the mindfulness training, while the remaining facets (i.e., Non-judging and Non-reacting) emerge when participants are more skilled in the training. One speculation was the types of mindfulness practices focused on the MBI. Studies implemented m-MBI on university students that found improvement in the Observing and Describing facets mainly focused on meditative practices (i.e., formal practices) (Huberty et al., 2019; Yang et al., 2018), while the current study implemented more informal practices. A cross-sectional study found that meditative practices were the main predictors of all the mindfulness facets, while informal practices only predicted the Observing facet (Cebolla et al., 2017), potentially hinting at the importance of meditative practices in cultivating a mindful stance. However, participants in the present study also denoted their preference for informal practices over meditative practices, with the loss of patience and falling asleep as the main hindrance to the practice sessions. If that were the case, future mindfulness researchers would be encouraged to implement meditative practices, albeit with modifications such as gradually increased duration and providing helpful instruction to meditation to help build up patience in meditative practices.

5.6 Mindfulness Practices on Study Outcomes

While a meta-analytic review conjured mixed results regarding the amount of mindfulness practices on psychological outcomes (Strohmaier, 2020), the present study found that both formal and informal practice sessions and duration were positively associated with the outcomes assessed. The mixed results could be due to the self-report method of collecting adherence data, which is subject to memory retrieval inaccuracies and biases (e.g., social desirability; Strohmaier, 2020). However, the current findings did

not correspond with an m-MBI study that found a non-significant relationship between the amount of meditation (duration and frequency) in psychological outcomes, although adherence was digitally measured (Ribeiro et al., 2018). One potential reason might pertain to the length of the meditation per session, as Ribeiro et al. (2018) had longer sessions (i.e., 20-30 minutes) compared to the current m-MBI sessions (i.e., 4-12 minutes). A recent study also found that shorter sessions (i.e., 5 minutes per session) yielded a larger effect than longer meditation sessions (20 minutes per session; Strohmaier et al., 2021). Although meditation is a major component in mindfulness training, novice practitioners tend to find longer practices challenging and can experience mind-wandering episodes (Frewen et al., 2016). If this account is true, an important implication was that the effectiveness of mindfulness meditation may depend on session duration, with novice practitioners likely benefitting from shorter practices, divided into more sessions.

In addition, the present findings hinted at the importance of understanding the number of informal practice sessions on stress, worry, and mindfulness levels. Studies have also shown a positive impact on stress, anxiety, and depression from an 8-week informal practice-based MBI (Birtwell et al., 2018; Shankland et al., 2021). Although the present study sheds light on the importance of both formal and informal practices for the EAs, more studies are needed to elucidate the number of informal practices that could positively affect psychological outcomes.

5.7 Strengths

The strength of this study was the experimental design, which involved the randomised assignment of participants to treatment and waitlist groups. The act of randomisation balanced participant characteristics between the groups, allowing any differences in the outcomes to the study intervention (Hariton & Locascio, 2018). The present study also supplemented the quantitative findings with qualitative methods, which allowed for a more in-depth understanding of the feasibility of an m-MBI. A study

observed that only 3% of the mindfulness research utilised qualitative research methods and advocated for their implementation, given the introspective nature of mindfulness (Lee et al., 2021). Additionally, common therapeutic factors found in group-based MBIs (i.e., social common factor) were minimised by employing a self-learning m-MBI. A mixed-method study suggested that social factors such as instructor and group ratings were stronger predictors of changes in stress, depression, and mindfulness than specific mindfulness practice-related factors (i.e., formal, and informal mindfulness practices; Canby et al., 2021). Finally, the present study ensured greater accuracy in tracking participants' engagement with the intervention by utilising app-based tracking for practice sessions and duration. An MBI study utilising both self-report and objective adherence tracking (i.e., app tracking of completed meditation sessions) observed inflated daily self-report adherence. This remained true even though participants were aware that objective adherence data were collected and were told that remuneration was not affected by adherence (Flett et al., 2019).

5.8 Limitations and Future Directions

Nevertheless, a few limitations warrant a prudent interpretation of the results. Notably, a relatively high dropout rate impacted the overall sample size, limiting the generalizability of the findings. While high withdrawal rates are not uncommon in e-health research (cf., Mrazek et al., 2019; van Emmerik et al., 2018) and have been described as "a natural and typical feature" (Eysenbach, 2005), they pose questions about the validity of the findings. Although the present study utilized a conservative approach to handling missing data (i.e., ITT analyses), such an approach might still exaggerate or underestimate treatment effects (McCoy, 2017), especially when the attrition rate is greater than 20% (Unnebrink & Windeler, 2001). In fact, some findings were inconsistent between ITT and PP analyses, suggesting that withdrawals might have affected the present findings. Evidence also increasingly questioned the use of LOCF as an approach

in handling missing data as it tends to lead to a liberal bias that exaggerates treatment effects and inflates Type I and Type II error rates (e.g., Lachin, 2016; Saha & Jones, 2009). As such, Rioux and Little (2021) recommended using full information maximum likelihood (FIML; an approach that deals with missing data by estimating parameters and standard errors) and multiple imputation (MI; a method that substitutes missing values with a predicted value that was conducted multiple times) which could provide unbiased results when handling data missing at random (MAR; where missing data points are predicted from other variable in the observed data). Therefore, besides replicating the study with a larger sample size, future studies should also explore the reasons for withdrawals and methods for reducing them. However, when dropouts were inevitable, future research are recommended to utilize less biased ITT analyses approach when dealing with missing data.

The study attempted to investigate the dropouts via questionnaires, however, the majority of the participants did not provide their reasons for termination. Reasons collected from the relatively few participants who responded suggested busy schedules and perceived heavy demand from the m-MBI. Other potential reasons denoted by the qualitative findings included loss of motivation and forgetting to perform daily mindfulness practices. Some participants even expressed having research compensation and upholding the responsibilities of a research participant as motivating factors to complete the study. Moreover, less than half of the m-MBI group participants fulfilled the expected formal and informal practice sessions, with many failing to meet the daily session requirements (some practices were to be conducted three times daily). One conjecture was that the current m-MBI lacked features to sustain user engagement. Indeed, the MINDFULGym application scored the lowest in the engagement features that cover entertainment, interest, customization, and interactivity in the MARS scale. Gamification, the use of game elements in a non-game context, intended to make interventions more

engrossing (Deterding et al., 2011), has been shown to provide motivational support (Blohm & Leimeister, 2013) that increased the user's interest (Oinas-Kukkonen & Harjumaa, 2009) and exposure to evidence-based content (Davies et al., 2012). One of the most used gamification techniques in stress management applications was a form of feedback (e.g., visual) that evaluates the user's performance to a standard or another's performance (Hoffmann et al., 2017; Wang et al., 2021), which was also expressed by interviewed participants. Some other techniques commonly used were offering digital rewards (e.g., points, powers, or abilities) through intervention progression or secondary games (i.e., secondary goals of play that reward the players upon completion; Hoffmann et al., 2017). A few of the interviewed participants requested 'cheat days' to the daily practices and also features such as daily app check-ins. One way that the digital rewards and secondary games might apply to the participants was by allowing them to earn rewards through daily check-ins and thereby obtaining power-ups for the cheat days (e.g., mindfulness streak freeze). Besides, implementing a communication system with other app users might be applicable in the m-MBI context (Hoffmann et al., 2017) as a few participants preferred to interact with 'buddies' as a motivating factor to complete daily mindfulness practices. Understanding dropouts and app sustainability were essential to self-help interventions like mindfulness, which regular practice is highly encouraged to prove efficacy. Therefore, in addition to monitoring reasons behind intervention withdrawals, m-MBI researchers are encouraged to develop mindfulness apps that could increase user engagement.

Third, while block randomisation allocation would suggest an advantage to the study design, it still resulted in a slight difference in age between the study groups. This likely reflects a limitation of simple block randomisation and with a small sample size. Although such a minor age difference (the mean age of both groups was 22) did not show group differences in the outcomes, and there were no other differences found, future

studies could attempt to avoid this limitation by using other randomisation methods (e.g., stratified; Kim & Shin, 2014). In addition, the researcher was not formally blinded to group allocation. Participants were also not masked in the allocation to the intervention groups due to the implementation of waitlist control. According to CONSORT guidelines, blinding outcome assessors are important when outcome measures involve some subjectivity, such as the use of self-report measures (Schulz et al., 2010). It was found that the treatment effect size tends to be inflated in trials with a lack of blinding of patients and assessors (Moustgaard et al., 2020). Unblinded data collectors and analysts may introduce bias through the choice of analytical strategies, such as the selection of favourable time points or outcomes (Schulz et al., 2010 In addition to the limitation addressed, it is important to acknowledge the potential response biases associated with relying on self-report data (i.e., acquiescence, negativism, extreme responders, impression management; Jordan & Troth, 2020; McGrath et al., 2010). To mitigate this, future research could incorporate diverse measurement modes, such as physiological (e.g., hair cortisol test for stress level) or performance-based data, to provide a more comprehensive assessment of the impact of m-MBIs on psychological health. Therefore, future studies should formally blind the group allocation from the investigator by including multiple researchers or third-party organisations. In addition to that, it was also encouraged to implement a time- and intensity-matched active control group (e.g., progressive relaxation) to minimise expectation bias of intervention allocation of both the participants and investigators.

Fourth, due to the nature of the study, data and themes identified from the qualitative study were coded and analysed by only one researcher. Nevertheless, a codebook was developed as a guide to data coding and theme development. Discussions with supervisors were also conducted at different stages of qualitative analysis (i.e., codebook development, theme refinement, and theme finalisation) to ensure themes and

code quality. While this process allowed for consistency in the method, it did not provide theme identification and data coding from multiple perspectives with individuals with differing expertise (i.e., investigator triangulation; Denzin, 2017). Future studies should involve several researchers in theme development and qualitative coding, or even discuss the coded transcript with participants themselves, to allow for more comprehensive qualitative findings (Denzin, 2017). As the qualitative interviews were conducted to supplement the interpretation of quantitative results and not the main focus of the study, the number of interviews required to reach data and/or theme saturation was not statistically estimated. Data saturation is said to be the conceptual yardstick for estimating and assessing qualitative sample sizes (Guest et al., 2020). Previous studies using inductive thematic analysis discovered that most of the themes were identifiable in the first five to six interviews and that 92% were identified within the first twelve interviews (Guest et al., 2006; Guest et al., 2020). Although it was confident that the sixteen interviews conducted had captured the majority of the themes intended, future studies are encouraged to utilise a statistically sound method for calculating and reporting data saturation in a qualitative approach.

Lastly, the present study mainly focused on EAs in their final year of university studies, thus, limiting the generalizability of the present findings to EAs at other stages of transition (i.e., fresh graduates). Given that instability and possibilities are the hallmark features of EAs (Reifman et al., 2007), it is reasonable to believe that stressors varied among EAs in different stages of transition, thus eliciting different impacts on their overall stress levels. For instance, freshly graduated EAs who have just entered the workforce might be stressed about understanding and meeting expectations of their roles as young professionals, adding to other stressors, e.g., heavy workload. Other than that, to ensure comprehension of the m-MBI instructions, the present study only recruited EAs who were relatively highly educated, hence limited generalizability to in-transition EAs

with lower educational levels (i.e., non-graduates). In particular, non-graduates might face greater uncertainty and declines in their employment due to the COVID-19 crisis compared to their tertiary-educated counterparts. For instance, Malaysia faced great contractions in lower-skilled jobs (Zhang & Zhang, 2021) and workers without tertiary education recorded a 15.5% decline in employment compared to 2019 (Cheng, 2020). Furthermore, it is important to note that our study was conducted solely in one country, utilizing a locally adapted MBI course, which may restrict the broader applicability of the findings to other countries or cultural contexts. Future research could enrich the study by conducting subgroup analyses based on demographic and socioeconomic backgrounds to explore whether the m-MBI is equally effective across diverse populations of EAs. For example, a study among university students found that women exhibited greater increases in positive affect, mindfulness, and self-compassion scores following participation in a 12-week MBI. The authors posited that the divergent effects observed may be due to the difference in emotional regulation techniques utilized by men and women (i.e., internalizing and externalizing; Rojiani et al., 2017). Therefore, future research is encouraged to replicate the study employing other populations of in-transition EAs, such as fresh graduates and non-graduates, potentially using a matched-pairs study design, or conducting subgroup analyses to ensure the findings were representative of the population of EAs undergoing study-to-work transition. Consequently, pilot studies could be implemented for in-transition EAs with lower levels of education to ensure the feasibility of the m-MBI extending to this population, especially considering that this population might be faring worse amid the pandemic.

5.9 Other Aspects of Future Directions

5.9.1 The Role of MBIs in EA Developmental Dimensions

Although the present study examined m-MBI and the impact on various aspects of the mental well-being of the EAs, it would be interesting to understand how MBIs play

a role in the various EA developmental dimensions (Reifman et al., 2007). Studies have found that different developmental dimensions were associated with EAs' mental well-being using scales specifically assessing the developmental dimensions of EAs, such as the Inventory of Dimensions of Emerging Adulthood (IDEA scale; Reifman et al., 2007) For instance, data collected from 4,991 Swiss EAs revealed that those with high Negativity dimension and a low Identity Exploration dimension had a lower level of psychosocial well-being (including satisfaction with life, quality of life, and perceived social support; Baggio et al., 2017). On the contrary, EAs exploring possibilities with a positive outlook (Possibility dimension) showed higher levels of psychosocial well-being. Another study found that high levels of Instability and Feeling in-between, combined with low levels of the Self-focus dimension, were related to higher levels of self-doubt about one's abilities and competence (Peer & McAuslan, 2016). The same study concurrently found that a higher level of dispositional mindfulness was related to the same developmental dimensions but in an opposite and positive direction. However, no study so far has investigated the proactive involvement in mindfulness activities on the normative developmental features of the EAs. Nevertheless, a meta-analysis showed promise in applying MBI to enhance meaning in life (Chu & Mak, 2020), a feature that is crucial in the identity exploration dimension in emerging adulthood (Arnett, 2000). This might imply that engaging in MBIs could potentially and positively influence certain developmental features in EAs, and thereby, positively influence their psychosocial well-being. Furthermore, future research in the field of emerging adulthood could benefit from incorporating measures specifically designed to assess stress or stressors experienced by EAs, such as the newly developed Emerging Adult Stress Inventory (EASI; Murray et al., 2020), to obtain insights unique to this population. Therefore, moving MBI research into this novel area, utilizing measures tailored for this population, seems necessary to better

understand the effectiveness of MBI in EAs' adjustment specifically during this critical developmental stage.

5.9.2 Experience Sampling Methods (ESM) for MBI Research

Given the widespread availability of smartphone features and the emphasis on moment-to-moment attention to the 'now' in mindfulness practices, another direction that MBI research could venture into is the use of experience sampling methods (ESM) in data collection. ESM is the repeated monitoring of momentary experiences and behaviours in a participant's normal environment, which can assess moment-to-moment experiences and situational contexts (Larson & Csikszentmihalyi, 2014; Trull & Ebner-Priemer, 2014). This method allowed for investigation of the level of integration of skills learned in MBI into daily lives. Participants in ESM respond to randomly timed triggers and then complete short, repeated assessments (8 to 10 times per day) over a course of time (usually 10 days) (Larson & Csikszentmihalyi, 2014; Trull & Ebner-Priemer, 2014). This is pertinent in MBI studies as it improved ecological validity by measuring the moment-centred process of mindfulness cultivation and is less susceptible to retrospective bias, which tends to be overlooked in the standard questionnaire methods (Shiffman et al., 2008). With repeated daily notifications, it also serves as just-in-time information (i.e., reminders) that increases participants' adherence (Winter et al., 2022). It can also provide immediate feedback that fosters active involvement in self-monitoring of one's mental health (Wichers et al., 2011). This method of data collection has been slowly gaining recognition in MBI research in recent years (Shoham et al., 2017; Van der Gucht et al., 2019; Walsh et al., 2019), and pointed to the "upward spiral" between mindfulness and mood (Gotink et al., 2015). It has also been implemented as a more rigorous approach in documenting the unintended momentary and sustained adverse effects of mindfulness practices, which are seldom evaluated in MBI studies (Aizik-Reebs et al., 2021).

Therefore, furthering MBI research using this ecologically valid and less biased approach would seem preferable and feasible, given the prevalent usage of customizable apps.

5.9.3 Long-Term Effects and Trajectories of MBIs

While our study focused on the efficacy of MBI intervention over a 9-week period, investigating the longer-term effects of m-MBIs could yield valuable insights, as evidence supporting long-term benefits remains limited primarily to cross-sectional comparisons between novice mindfulness meditators and long-term practitioners (Baer et al., 2012; Gamaiunova et al., 2019).

Nonetheless, observation across available evidence suggest a decline in intervention effects and a decrease in effect sizes for study outcomes over time. For instance, a longitudinal RCT tracking university students for four years post-MBI found a reduction in effect size (from moderate to small) for mental distress and subjective well-being at various follow-up points (Solhaug et al., 2019). Similarly, a systematic review and meta-analysis of trials indicated that, compared to no intervention, MBIs generally improve average anxiety, depression, psychological distress, and well-being between one- and six-months post-program completion; however, these benefits tend to diminish beyond this timeframe (Galante et al., 2021).

Although most evidence suggests a linear trajectory, there are indications that various emotion-cognitive domains targeted by MBIs may lead to positive health outcomes when moderately activated but could yield negative outcomes when intensely activated. For instance, decentring, the ability to establish psychological distance from one's thoughts and emotions, may follow an inverted U-shaped trajectory over time (Britton, 2019). An earlier meta-analysis also refuted the notion that continuous mindfulness meditation practice leads to cumulative changes in emotion-cognitive domains (Sedlmeier et al., 2012).

Nevertheless, longitudinal studies remain paramount for examining individual variation patterns over the long term, employing rigorous methodological procedures to minimize attrition rates and monitor regular mindfulness practices. Additionally, employing complex statistical techniques such as intensive longitudinal data approaches or latent trajectory modelling can further capture the spectrum of experiences arising from MBI participation.

5.10 Implications

Several implications could be derived from the present study. First, EAs in transition should consider engaging in the self-paced m-MBI program, especially when encountering circumstances with uncertain and potentially negative nature (e.g., job interviews, graduation examination). The university's student services department could promote awareness of these on-the-go mindfulness mobile interventions, particularly among final-year students. If in-person group-based mindfulness courses were implemented for the final year EAs, the m-MBI can also be utilized as at-home and easily accessible mindfulness practices. Considering the more frequent and longer duration of formal and informal practices and the positive association with psychological outcomes, EAs who aim to gain long-term benefits from m-MBI should engage in regular mindfulness practices. Finally, EAs in the current study were prone to feel restlessness during the meditation practices, thus, showing less preference for such practice compared to the informal practices. Future mindfulness researchers could consider exploring ways to increase engagement or reduce hindrance to meditations in EAs. It was also worth deliberating whether an MBI comprised only of short practices that could be easily incorporated into daily lives (i.e., informal practices) could show effectiveness in cultivating mindfulness skills and improving psychological well-being in EAs in transition.

CHAPTER 6 : CONCLUSION

In general, the findings elucidated that a 5-week self-help m-MBI can help alleviate worry and potentially cultivate mindfulness and self-compassion among EAs during their transition out of university. The results also illustrated the effect of both mindfulness and self-compassion as mechanisms of stress change. Overall, the present m-MBI showed promising results and feasibility for EAs with little or no prior experience in mindfulness interventions, with comparatively less emphasis on and shorter meditation sessions that could be challenging for naïve practitioners. However, future trials should closely monitor withdrawals and be informed of the reasons behind study termination to further improve user engagement with the m-MBI. Besides, methodologically more rigorous m-MBI RCTs should be conducted by involving an active control group, blinding, appropriately handling missing cases, and including larger and wider EA cohorts. Lastly, it might be worth exploring if m-MBI could further impact the study outcomes or developmental characteristics of the EAs, possibly using an ambulatory assessment or a longitudinal study approach.

REFERENCES

Abelha, M., Fernandes, S., Mesquita, D., Seabra, F., & Ferreira-Oliveira, A. T. (2020). Graduate employability and competence development in higher education—A systematic literature review using PRISMA. *Sustainability, 12*(15), 5900. https://www.mdpi.com/2071-1050/12/15/5900

Afonso, A., Ramírez, J. J., & Díaz-Puente, J. M. (2012). University-industry cooperation in the education domain to foster competitiveness and employment. *Procedia-Social and Behavioral Sciences, 46*, 3947-3953. https://doi.org/10.1016/j.sbspro.2012.06.177

Aizik-Reebs, A., Shoham, A., & Bernstein, A. (2021). First, do no harm: An intensive experience sampling study of adverse effects to mindfulness training. *Behaviour Research and Therapy, 145*, Article 103941. https://doi.org/10.1016/j.brat.2021.103941

Al-Dubai, S. A., Alshagga, M. A., Rampal, K. G., & Sulaiman, N. A. (2012). Factor structure and reliability of the Malay version of the Perceived Stress Scale among Malaysian medical students. *Malaysian Journal of Medical Sciences, 19*(3), 43-49.

Allanach, B. C., & Jennings, B. M. (1990). Evaluating the effects of a nurse preceptorship programme. *Journal of Advance Nursing, 15*(1), 22-28. https://doi.org/10.1111/j.1365-2648.1990.tb01668.x

Allexandre, D., Bernstein, A. M., Walker, E., Hunter, J., Roizen, M. F., & Morledge, T. J. (2016). A web-based mindfulness stress management program in a corporate call center: A randomized clinical trial to evaluate the added benefit of onsite group support. *Journal of Occupational and Environmental Medicine, 58*(3), 254-264. https://doi.org/10.1097/jom.0000000000000680

Altman, D. G. (2009). Missing outcomes in randomized trials: addressing the dilemma. *Open Medicine : A Peer-Reviewed, Independent, Open-Access Journal, 3*(2), Article e51-53.

Anderson, J. K., Newlove‐Delgado, T., & Ford, T. J. (2022). Annual research review: A systematic review of mental health services for emerging adults‐moulding a precipice into a smooth passage. *Journal of Child Psychology and Psychiatry, 63*(4), 447-462. https://doi.org/10.1111/jcpp.13561

Andersson, G., & Titov, N. (2014). Advantages and limitations of Internet‐based interventions for common mental disorders. *World Psychiatry, 13*(1), 4-11. https://doi.org/10.1002/wps.20083

Ang, M. C. H. (2015). Graduate employability awareness: A gendered perspective. *Procedia-Social and Behavioral Sciences, 211*, 192-198. https://doi.org/10.1016/j.sbspro.2015.11.083

Armstrong, R. A. (2014). When to use the Bonferroni correction. *Ophthalmic and Physiological Optics, 34*(5), 502-508. https://doi.org/10.1111/opo.12131

Arnett, J. J. (2000). Emerging adulthood: A theory of development from the late teens through the twenties. *American Psychologist, 55*(5), 469.

Arnett, J. J. (2010). Emerging adulthood(s). In L. A. Jensen (Ed.), *Bridging cultural and developmental approaches to psychology: New syntheses in theory, research, and policy.* (pp. 255-275). Oxford University Press. https://doi.org/10.1093/acprof:oso/9780195383430.003.0012

Arnett, J. J. (2014). A longer road to adulthood. In *Emerging adulthood: The winding road from the late teens through the twenties* (pp. 1-29). Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199929382.001.0001

Baer, R. A., Lykins, E. L. B., & Peters, J. R. (2012). Mindfulness and self-compassion as predictors of psychological wellbeing in long-term meditators and matched nonmeditators. *The Journal of Positive Psychology, 7*(3), 230-238. https://doi.org/10.1080/17439760.2012.674548

Baer, R. A., Smith, G. T., Hopkins, J., Krietemeyer, J., & Toney, L. (2006). Using self-report assessment methods to explore facets of mindfulness. *Assessment, 13*(1), 27-45. https://doi.org/10.1177/1073191105283504

Baer, R. A., Smith, G. T., Lykins, E., Button, D., Krietemeyer, J., Sauer, S., Walsh, E., Duggan, D., & Williams, J. M. G. (2008). Construct validity of the five facet mindfulness questionnaire in meditating and nonmeditating samples. *Assessment, 15*(3), 329-342. https://doi.org/10.1177/1073191107313003

Baggio, S., Studer, J., Iglesias, K., Daeppen, J.-B., & Gmel, G. (2017). Emerging adulthood: A time of changes in psychosocial well-being. *Evaluation & the Health Professions, 40*(4), 383-400. https://doi.org/10.1177/0163278716663602

Barlett, N. D., & Barlett, C. P. (2018). Money and job worries as a function of emerging adulthood markers: An analysis of college-aged and adult populations using correlational and longitudinal designs. *Journal of Adult Development, 26*(2), 116-128. https://doi.org/10.1007/s10804-018-9302-4

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical

considerations. *Journal of Personality and Social Psychology, 51*(6), 1173-1182. https://doi.org/10.1037//0022-3514.51.6.1173

Bartelink, V. H., Zay Ya, K., Guldbrandsson, K., & Bremberg, S. (2020). Unemployment among young people and mental health: A systematic review. *Scandinavian Journal of Public Health, 48*(5), 544-558. https://doi.org/10.1177/1403494819852847

Beblo, T., & Schulte, J. (2017). Mindfulness: More practice-better results? *Neurologie und Rehabilitation, 23*, 19-26.

Bednar, K., Voracek, M., & Tran, U. S. (2020). Common Factors Underlying the Five Facets of Mindfulness and Proposed Mechanisms: a Psychometric Study Among Meditators and Non-meditators. *Mindfulness, 11*(12), 2804-2817. https://doi.org/10.1007/s12671-020-01492-6

Beyers, W., & Luyckx, K. (2016). Ruminative exploration and reconsideration of commitment as risk factors for suboptimal identity development in adolescence and emerging adulthood. *Journal of Adolescence*, *47*(1), 169-178. https://doi.org/10.1016/j.adolescence.2015.10.018

Bhayee, S., Tomaszewski, P., Lee, D. H., Moffat, G., Pino, L., Moreno, S., & Farb, N. A. S. (2016). Attentional and affective consequences of technology supported mindfulness training: A randomised, active control, efficacy trial. *BMC Psychology*, *4*(1), 60. https://doi.org/10.1186/s40359-016-0168-6

Biddle, B. J. (1986). Recent developments in role theory. *Annual Review of Sociology, 12*(1), 67-92. https://doi.org/10.1146/annurev.so.12.080186.000435

Biegel, G. M., Brown, K. W., Shapiro, S. L., & Schubert, C. M. (2009). Mindfulness-based stress reduction for the treatment of adolescent psychiatric outpatients: A randomized clinical trial. *Journal of Consulting and Clinical Psychology*, *77*(5), 855-866. https://doi.org/10.1037/a0016241

Birnie, K., Speca, M., & Carlson, L. E. (2010). Exploring self-compassion and empathy in the context of mindfulness-based stress reduction (MBSR). *Stress and Health*, *26*(5), 359-371. https://doi.org/10.1002/smi.1305

Birtwell, K., Williams, K., van Marwijk, H., Armitage, C. J., & Sheffield, D. (2018). An exploration of formal and informal mindfulness practice and associations with wellbeing. *Mindfulness*, *10*(1), 89-99. https://doi.org/10.1007/s12671-018-0951-y

Bishop, S. R., Lau, M., Shapiro, S., Carlson, L., Anderson, N. D., Carmody, J., Segal, Z. V., Abbey, S., Speca, M., & Velting, D. (2004). Mindfulness: A proposed operational definition. *Clinical Psychology: Science and Practice, 11*(3), 230. https://doi.org/10.1093/clipsy.bph077

Blohm, I., & Leimeister, J. M. (2013). Gamification. *Business & Information Systems Engineering*, *5*(4), 275-278. https://doi.org/10.1007/s12599-013-0273-5

Boellinghaus, I., Jones, F. W., & Hutton, J. (2012). The role of mindfulness and loving-kindness meditation in cultivating self-compassion and other-focused concern in health care professionals. *Mindfulness*, *5*(2), 129-138. https://doi.org/10.1007/s12671-012-0158-6

Borkovec, T. D., Robinson, E., Pruzinsky, T., & DePree, J. A. (1983). Preliminary exploration of worry: Some characteristics and processes. *Behaviour Research and Therapy*, *21*(1), 9-16. https://doi.org/10.1016/0005-7967(83)90121-3

Bostock, S., Crosswell, A. D., Prather, A. A., & Steptoe, A. (2019). Mindfulness on-the-go: Effects of a mindfulness meditation app on work stress and well-being. *Journal of Occupational Health Psychology*, *24*(1), 127-138. https://doi.org/10.1037/ocp0000118

Bowles, N. I., Davies, J. N., & Van Dam, N. T. (2022). Dose–response relationship of reported lifetime meditation practice with mental health and wellbeing: A cross-sectional study. *Mindfulness, 13*(10), 2529-2546. https://doi.org/10.1007/s12671-022-01977-6

Boyatzis, R. (1998). *Transforming qualitative information: Thematic analysis and code development*. Sage Publications, Inc.

Boyd, J. E., Lanius, R. A., & McKinnon, M. C. (2018). Mindfulness-based treatments for posttraumatic stress disorder: A review of the treatment literature and neurobiological evidence. *Journal of Psychiatry & Neuroscience*, *43*(1), 7-25. https://doi.org/10.1503/jpn.170021

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77-101. https://doi.org/10.1191/1478088706qp063oa

Bridges, W., & Bridges, S. (2009). *Managing Transitions : Making the Most of Change* (3rd ed.). Da Capo Lifelong Books.

Britton, W. B. (2019). Can mindfulness be too much of a good thing? The value of a middle way. *Current Opinion in Psychology, 28*, 159-165. https://doi.org/https://doi.org/10.1016/j.copsyc.2018.12.011

Brown, T. A., Antony, M. M., & Barlow, D. H. (1992). Psychometric properties of the Penn state worry questionnaire in a clinical anxiety disorders sample. *Behaviour Research and Therapy, 30*(1), 33-37. https://doi.org/https://doi.org/10.1016/0005-7967(92)90093-V

Buhr, K., & Dugas, M. J. (2009). The role of fear of anxiety and intolerance of uncertainty in worry: An experimental manipulation. *Behaviour Research and Therapy, 47*(3), 215-223. https://doi.org/10.1016/j.brat.2008.12.004

Canby, N. K., Eichel, K., Lindahl, J., Chau, S., Cordova, J., & Britton, W. B. (2021). The contribution of common and specific therapeutic factors to mindfulness-based intervention outcomes. *Frontiers in Psychology, 11*. https://doi.org/10.3389/fpsyg.2020.603394

Carmody, J., & Baer, R. A. (2007). Relationships between mindfulness practice and levels of mindfulness, medical and psychological symptoms and well-being in a mindfulness-based stress reduction program. *Journal of Behavioral Medicine, 31*(1), 23-33. https://doi.org/10.1007/s10865-007-9130-7

Carter, M. M., Sbrocco, T., Miller, O., Jr., Suchday, S., Lewis, E. L., & Freedman, R. E. (2005). Factor structure, reliability, and validity of the Penn State Worry Questionnaire: Differences between African-American and White-American college students. *Journal of Anxiety Disorders, 19*(8), 827-843. https://doi.org/10.1016/j.janxdis.2004.11.001

Cavanagh, K., Churchard, A., O'Hanlon, P., Mundy, T., Votolato, P., Jones, F., Gu, J., & Strauss, C. (2018). A randomised controlled trial of a brief online mindfulness-based intervention in a non-clinical population: Replication and extension. *Mindfulness, 9*(4), 1191-1205. https://doi.org/10.1007/s12671-017-0856-1

Cavanagh, K., Strauss, C., Cicconi, F., Griffiths, N., Wyper, A., & Jones, F. (2013). A randomised controlled trial of a brief online mindfulness-based intervention. *Behaviour Research and Therapy, 51*(9), 573-578. https://doi.org/10.1016/j.brat.2013.06.003

Cebolla, A., Campos, D., Galiana, L., Oliver, A., Tomás, J. M., Feliu-Soler, A., Soler, J., García-Campayo, J., Demarzo, M., & Baños, R. M. (2017). Exploring relations among mindfulness facets and various meditation practices: Do they work in different ways? *Consciousness and Cognition, 49*, 172-180. https://doi.org/10.1016/j.concog.2017.01.012

Champion, L., Economides, M., & Chandler, C. (2018). The efficacy of a brief app-based mindfulness intervention on psychosocial outcomes in healthy adults: A pilot randomised controlled trial. *PLoS One*, *13*(12), Article e0209482. https://doi.org/10.1371/journal.pone.0209482

Chang, E., & Hancock, K. (2003). Role stress and role ambiguity in new nursing graduates in Australia. *Nursing & Health Sciences*, *5*(2), 155-163. https://doi.org/10.1046/j.1442-2018.2003.00147.x

Cheng, C. (2020). *COVID-19 in Malaysia: Economic Impacts & Fiscal Responses*. Institute of Strategic & International Studies (ISIS) Malaysia. https://www.isis.org.my/2020/03/26/covid-19-in-malaysia-economic-impacts-fiscal-responses/

Chiesa, A., & Serretti, A. (2009). Mindfulness-based stress reduction for stress management in healthy people: A review and meta-analysis. *The Journal of Alternative and Complementary Medicine*, *15*(5), 593-600. https://doi.org/10.1089/acm.2008.0495

Christopher, M. S., Neuser, N. J., Michael, P. G., & Baitmangalkar, A. (2012). Exploring the psychometric properties of the Five Facet Mindfulness Questionnaire. *Mindfulness*, *3*(2), 124-131. https://doi.org/10.1007/s12671-011-0086-x

Chu, S. T.-W., & Mak, W. W. S. (2020). How mindfulness enhances meaning in life: A meta-analysis of correlational studies and randomized controlled trials. *Mindfulness*, *11*(1), 177-193. https://doi.org/10.1007/s12671-019-01258-9

Clance, P. R., & Imes, S. A. (1978). The imposter phenomenon in high achieving women: Dynamics and therapeutic intervention. *Psychotherapy: Theory, Research & Practice, 15*(3), 241-247. https://doi.org/10.1037/h0086006

Cohen, J. (2013). *Statistical power analysis for the behavioral sciences*. Routledge.

Course-Choi, J., Saville, H., & Derakshan, N. (2017). The effects of adaptive working memory training and mindfulness meditation training on processing efficiency and worry in high worriers. *Behaviour Research and Therapy*, *89*, 1-13. https://doi.org/https://doi.org/10.1016/j.brat.2016.11.002

Davies, C. A., Spence, J. C., Vandelanotte, C., Caperchione, C. M., & Mummery, W. K. (2012). Meta-analysis of internet-delivered interventions to increase physical activity levels. *International Journal of Behavioral Nutrition and Physical Activity*, *9*(1), 1-13. https://doi.org/10.1186/1479-5868-9-52

Denzin, N. K. (2017). *The research act: A theoretical introduction to sociological methods*. Routledge.

Department of Statistics Malaysia. (2022). *Press Release: Employment statistics first quarter 2022.* https://www.dosm.gov.my/v1/index.php?r=column/pdfPrev&id=SkVDa05vRE04eUdHS0laZ0JIOW5ndz09

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. E. (2011). From game design elements to gamefulness: Defining "Gamification". Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments, Finland.

Diedrich, A., Hofmann, S. G., Cuijpers, P., & Berking, M. (2016). Self-compassion enhances the efficacy of explicit cognitive reappraisal as an emotion regulation strategy in individuals with major depressive disorder. *Behaviour Research and Therapy, 82*, 1-10. https://doi.org/10.1016/j.brat.2016.04.003

Divine, R. L., Linrud, J. K., Miller, R. H., & Wilson, J. H. (2007). Required internship programs in marketing: Benefits, challenges and determinants of fit. *Marketing Education Review*, *17*(2), 45-52. https://doi.org/10.1080/10528008.2007.11489003

Dodge, Y. (2008). Kolmogorov–Smirnov test. In *The concise encyclopedia of statistics* (pp. 283-287). Springer. https://doi.org/10.1007/978-0-387-32833-1_214

Duarte, J., & Pinto-Gouveia, J. (2017). Mindfulness, self-compassion and psychological inflexibility mediate the effects of a mindfulness-based intervention in a sample of oncology nurses. *Journal of Contextual Behavioral Science*, *6*(2), 125-133. https://doi.org/https://doi.org/10.1016/j.jcbs.2017.03.002

Dvořáková, K., Kishida, M., Li, J., Elavsky, S., Broderick, P. C., Agrusti, M. R., & Greenberg, M. T. (2017). Promoting healthy transition to college through mindfulness training with first-year college students: Pilot randomized controlled trial. *Journal of American College Health, 65*(4), 259-267. https://doi.org/10.1080/07448481.2017.1278605

Ebrahimi, H., Hassankhani, H., Negarandeh, R., Azizi, A., & Gillespie, M. (2016). Barriers to support for new graduated nurses in clinical settings: A qualitative study. *Nurse Education Today, 37*, 184-188. https://doi.org/10.1016/j.nedt.2015.11.008

Economides, M., Martman, J., Bell, M. J., & Sanderson, B. (2018). Improvements in stress, affect, and irritability following brief use of a mindfulness-based

smartphone app: A randomized controlled trial. *Mindfulness, 9*(5), 1584-1593. https://doi.org/10.1007/s12671-018-0905-4

El Morr, C., Ritvo, P., Ahmad, F., & Moineddin, R. (2020). Effectiveness of an 8-week web-based mindfulness virtual community intervention for university students on symptoms of stress, anxiety, and depression: Randomized controlled trial. *JMIR Mental Health, 7*(7), Article e18595. https://doi.org/10.2196/18595

Erikson, E. H. (1968). *Identity: Youth and crisis*. WW Norton & company.

Evans, S., Wyka, K., Blaha, K. T., & Allen, E. S. (2018). Self-compassion mediates improvement in well-being in a mindfulness-based stress reduction program in a community-based sample. *Mindfulness*, *9*(4), 1280-1287. https://doi.org/10.1007/s12671-017-0872-1

Eysenbach, G. (2005). The law of attrition. *Journal of Medical Internet Research*, *7*(1), Article e11. https://doi.org/10.2196/jmir.7.1.e11

Feldman, G., Greeson, J., & Senville, J. (2010). Differential effects of mindful breathing, progressive muscle relaxation, and loving-kindness meditation on decentering and negative reactions to repetitive thoughts. *Behaviour Research and Therapy, 48*(10), 1002-1011. https://doi.org/10.1016/j.brat.2010.06.006

Feldman, G., & Hayes, A. (2005). Preparing for problems: A measure of mental anticipatory processes. *Journal of Research in Personality, 39*(5), 487-516. https://doi.org/10.1016/j.jrp.2004.05.005

Fereday, J., & Muir-Cochrane, E. (2006). Demonstrating rigor using thematic analysis: A hybrid approach of inductive and deductive coding and theme development. *International Journal of Qualitative Methods*, *5*(1), 80-92. https://doi.org/10.1177/160940690600500107

Ferguson, N. M., Laydon, D., Nedjati-Gilani, G., Imai, N., Ainslie, K., Baguelin, M., Bhatia, S., Boonyasiri, A., Cucunubá, Z., & Cuomo-Dannenburg, G. (2020). Impact of non-pharmaceutical interventions (NPIs) to reduce COVID-19 mortality and healthcare demand. (Imperial College London), 1-20. https://doi.org/https://doi.org/10.25561/77482

Field, A. (2018). *Discovering Statistics Using IBM SPSS Statistics* (5th ed.). Sage Publishing.

Finlay-Jones, A. L., Rees, C. S., & Kane, R. T. (2015). Self-compassion, emotion regulation and stress among Australian psychologists: Testing an emotion

regulation model of self-compassion using structural equation modeling. *PLoS One*, *10*(7), Article e0133481. https://doi.org/10.1371/journal.pone.0133481

Flett, J. A. M., Fletcher, B. D., Riordan, B. C., Patterson, T., Hayne, H., & Conner, T. S. (2019). The peril of self-reported adherence in digital interventions: A brief example. *Internet Interventions, 18,* Article 100267. https://doi.org/10.1016/j.invent.2019.100267

Fong, M., & Loi, N. M. (2016). The mediating role of self‐compassion in student psychological health. *Australian Psychologist, 51*(6), 431-441. https://doi.org/10.1111/ap.12185

Fredrickson, B. L. (2001). The role of positive emotions in positive psychology: The broaden-and-build theory of positive emotions. *The American Psychologist, 56*(3), 218-226. https://doi.org/10.1037/0003-066X.56.3.218

Frewen, P., Hargraves, H., DePierro, J., D'Andrea, W., & Flodrowski, L. (2016). Meditation Breath Attention Scores (MBAS): Development and investigation of an internet-based assessment of focused attention during meditation practice. *Psychological Assessment, 28*(7), 830-840. https://doi.org/10.1037/pas0000283

Fulton, C. L. (2018). Self‐compassion as a mediator of mindfulness and compassion for others. *Counseling and Values, 63*(1), 45-56. https://doi.org/10.1002/cvj.12072

Galante, J., Friedrich, C., Dawson, A. F., Modrego-Alarcón, M., Gebbing, P., Delgado-Suárez, I., Gupta, R., Dean, L., Dalgleish, T., White, I. R., & Jones, P. B. (2021). Mindfulness-based programmes for mental health promotion in adults in nonclinical settings: A systematic review and meta-analysis of randomised controlled trials. *PLOS Medicine, 18*(1), e1003481. https://doi.org/10.1371/journal.pmed.1003481

Galante, J., Grabovac, A., Wright, M., Ingram, D. M., Van Dam, N. T., Sanguinetti, J. L., Sparby, T., van Lutterveld, R., & Sacchet, M. D. (2023). A framework for the empirical investigation of mindfulness meditative development. *Mindfulness, 14*(5), 1054-1067. https://doi.org/10.1007/s12671-023-02113-8

Gamaiunova, L., Brandt, P.-Y., Bondolfi, G., & Kliegel, M. (2019). Exploration of psychological mechanisms of the reduced stress response in long-term meditation practitioners. *Psychoneuroendocrinology, 104,* 143-151. https://doi.org/https://doi.org/10.1016/j.psyneuen.2019.02.026

Gaynor, K. (2014). A critical review of mindfulness-based psychological treatments for worry and rumination. *OA Behavioural Medicine, 2*(1), 2.

Gethin, R. (2011). On some definitions of mindfulness. *Contemporary Buddhism*, *12*(1), 263-279. https://doi.org/10.1080/14639947.2011.564843

Glomb, T. M., Duffy, M. K., Bono, J. E., & Yang, T. (2011). Mindfulness at work. In H. L. A. Joshi, & J.J. Martocchio (Ed.), *Research in personnel and human resources management* (pp. 115-157). Emerald Group Publishing Limited.

González-García, M., Álvarez, J. C., Pérez, E. Z., Fernandez-Carriba, S., & López, J. G. (2021). Feasibility of a brief online mindfulness and compassion-based intervention to promote mental health among university students during the COVID-19 pandemic. *Mindfulness*, *12*(7), 1685-1695. https://doi.org/10.1007/s12671-021-01632-6

Gotink, R., Chu, P., van Busschbach, J., Benson, H., Fricchione, G. L., & Hunink, M. (2015). Standardised mindfulness-based interventions in healthcare: An overview of systematic reviews and meta-analyses of RCTs. *PLoS One*, *10*(4), Article e0124344. https://doi.org/10.1371/journal.pone.0124344

Greenberg, J., Reiner, K., & Meiran, N. (2012). "Mind the trap": Mindfulness practice reduces cognitive rigidity. *PLoS One*, *7*(5), Article e36206. https://doi.org/10.1371/journal.pone.0036206

Greeson, J. M., Juberg, M. K., Maytan, M., James, K., & Rogers, H. (2014). A randomized controlled trial of koru: A mindfulness program for college students and other emerging adults. *Journal of American College Health*, *62*(4), 222-233. https://doi.org/10.1080/07448481.2014.887571

Grosemans, I., Hannes, K., Neyens, J., & Kyndt, E. (2020). Emerging adults embarking on their careers: Job and identity explorations in the transition to work. *Youth and Society*, *52*(5), 795-819. https://doi.org/10.1177/0044118x18772695

Gu, J., Cavanagh, K., & Strauss, C. (2017). Investigating the specific effects of an online mindfulness-based self-help intervention on stress and underlying mechanisms. *Mindfulness*, *9*(4), 1245-1257. https://doi.org/10.1007/s12671-017-0867-y

Gu, J., Strauss, C., Bond, R., & Cavanagh, K. (2015). How do mindfulness-based cognitive therapy and mindfulness-based stress reduction improve mental health and wellbeing? A systematic review and meta-analysis of mediation studies. *Clinical Psychology Review*, *37*, 1-12. https://doi.org/10.1016/j.cpr.2015.01.006

Gu, J., Strauss, C., Crane, C., Barnhofer, T., Karl, A., Cavanagh, K., & Kuyken, W. (2016). Examining the factor structure of the 39-item and 15-item versions of the five facet mindfulness questionnaire before and after mindfulness-based

cognitive therapy for people with recurrent depression. *Psychological Assessment*, *28*(7), 791-802. https://doi.org/10.1037/pas0000263

Guest, G., Bunce, A., & Johnson, L. (2006). How many interviews are enough?: An experiment with data saturation and variability. *Field Methods, 18*(1), 59-82. https://doi.org/10.1177/1525822X05279903

Guest, G., Namey, E., & Chen, M. (2020). A simple method to assess and report thematic saturation in qualitative research. *PLoS One, 15*(5), Article e0232076. https://doi.org/10.1371/journal.pone.0232076

Haenen, S., Nyklíček, I., van Son, J., Pop, V., & Pouwer, F. (2016). Mindfulness facets as differential mediators of short and long-term effects of Mindfulness-Based Cognitive Therapy in diabetes outpatients: Findings from the DiaMind randomized trial. *Journal of Psychosomatic Research, 85*, 44-50. https://doi.org/10.1016/j.jpsychores.2016.04.006

Hafner, S. P., & Craig Rushing, S. (2019). Sexual health, STI and HIV risk, and risk perceptions among American Indian and Alaska native emerging adults. *Prevention Science*, *20*(3), 331-341. https://doi.org/10.1007/s11121-018-0920-7

Hariton, E., & Locascio, J. J. (2018). Randomised controlled trials - the gold standard for effectiveness research. *BJOG: an International Journal of Obstetrics & Gynaecology*, *125*(13), 1716-1716. https://doi.org/10.1111/1471-0528.15199

Hasenkamp, W., Wilson-Mendenhall, C. D., Duncan, E., & Barsalou, L. W. (2012). Mind wandering and attention during focused meditation: A fine-grained temporal analysis of fluctuating cognitive states. *Neuroimage*, *59*(1), 750-760. https://doi.org/10.1016/j.neuroimage.2011.07.008

Hawley, L. L., Schwartz, D., Bieling, P. J., Irving, J., Corcoran, K., Farb, N. A. S., Anderson, A. K., & Segal, Z. V. (2013). Mindfulness practice, rumination and clinical outcome in mindfulness-based treatment. *Cognitive Therapy and Research*, *38*(1), 1-9. https://doi.org/10.1007/s10608-013-9586-4

Hayes, A. F. (2018). *Introduction to mediation, moderation, and conditional process analysis : A regression-based approach* (2nd ed.). The Guilford Press.

Hayes, J., & Nutman, P. (1981). *Understanding the unemployed: The psychological effects of unemployment.* Tavistock Publications.

Hayes, S. C., & Hofmann, S. G. (2017). The third wave of cognitive behavioral therapy and the rise of process‐based care. *World Psychiatry, 16*(3), 245-246. https://doi.org/10.1002/wps.20442

Hettich, P. I. (2009). College-to-workplace transitions: Becoming a freshman again. In T. W. Miller (Ed.), *Handbook of stressful transitions across the lifespan* (pp. 87-109). Springer Science + Business Media. https://doi.org/10.1007/978-1-4419-0748-6_5

Hindman, R. K., Glass, C. R., Arnkoff, D. B., & Maron, D. D. (2014). A comparison of formal and informal mindfulness programs for stress reduction in university students. *Mindfulness*, *6*(4), 873-884. https://doi.org/10.1007/s12671-014-0331-1

Hoffart, A., Johnson, S. U., & Ebrahimi, O. V. (2020). Loneliness and social distancing during the COVID-19 pandemic: Risk factors and associations with psychopathology. *Frontiers in Psychiatry*, *11*, Article 589127. https://doi.org/10.3389/fpsyt.2020.589127

Hoffmann, A., Christmann, C. A., & Bleser, G. (2017). Gamification in stress management apps: A critical app review. *JMIR Serious Games*, *5*(2), Article e13. https://doi.org/10.2196/games.7216

Hoge, E. A., Bui, E., Goetter, E., Robinaugh, D. J., Ojserkis, R. A., Fresco, D. M., & Simon, N. M. (2015). Change in decentering mediates improvement in anxiety in mindfulness-based stress reduction for generalized anxiety disorder. *Cognitive Therapy and Research*, *39*(2), 228-235. https://doi.org/10.1007/s10608-014-9646-4

Howarth, J. (2023). *Time spent using smartphones (2023 statistics)*. Exploding Topics. https://explodingtopics.com/blog/smartphone-usage-stats#smartphone-use-by-nation

Huberty, J., Green, J., Glissmann, C., Larkey, L., Puzia, M., & Lee, C. (2019). Efficacy of the mindfulness meditation mobile app "calm" to reduce stress among college students: Randomized controlled trial. *JMIR mHealth and uHealth*, *7*(6), Article e14273. https://doi.org/10.2196/14273

Institute for Public Health. (2019). National Health and Morbidity Survey 2019 (NHMS 2019). *Vol. I: NCDs – Non-Communicable Diseases: Risk Factors and other Health Problems.* http://www.iku.gov.my/images/IKU/Document/REPORT/NHMS2019/Report_NHMS2019-NCD_v2.pdf

Institute of Public Health. (2015). National Health and Morbidity Survey 2015 (NHMS 2015). *Vol. II: Non-Communicable Diseases, Risk Factors & Other Health Problems.* http://iku.moh.gov.my/images/IKU/Document/REPORT/nhmsreport2015vol2.pdf

Inwood, E., & Ferrari, M. (2018). Mechanisms of change in the relationship between self‐compassion, emotion regulation, and mental health: A systematic review. *Applied Psychology: Health and Well‐Being*, *10*(2), 215-235. https://doi.org/10.1111/aphw.12127

Isham, A. E., del Palacio-Gonzalez, A., & Dritschel, B. (2022). The effects of an online mindfulness intervention on emotion regulation upon autobiographical memory retrieval in depression remission: A pilot randomized controlled trial. *Mindfulness*, *13*(10), 2613-2627. https://doi.org/10.1007/s12671-022-01983-8

Jacobson, N. S., & Truax, P. (1991). Clinical significance: A statistical approach to defining meaningful change in psychotherapy research. *Journal of Consulting and Clinical Psychology*, *59*(1), 12-19. https://doi.org/10.1037/0022-006X.59.1.12

Jain, S., Shapiro, S. L., Swanick, S., Roesch, S. C., Mills, P. J., Bell, I., & Schwartz, G. E. (2007). A randomized controlled trial of mindfulness meditation versus relaxation training: Effects on distress, positive states of mind, rumination, and distraction. *Annals of Behavioral Medicine*, *33*(1), 11-21. https://doi.org/10.1207/s15324796abm3301_2

Jopling, D. A. (2000). *Self-Knowledge and the Self* (1st ed.). Taylor & Francis Group.

Jordan, P. J., & Troth, A. C. (2020). Common method bias in applied settings: The dilemma of researching in organizations. *Australian Journal of Management*, *45*(1), 3-14. https://doi.org/10.1177/0312896219871976

Justinmind. (2019). *Tools to design UX and interactions you can test early*. In (Version 8.7.2) Justinmind. https://www.justinmind.com/ux-design-tool

Kabat-Zinn, J. (1982). An outpatient program in behavioral medicine for chronic pain patients based on the practice of mindfulness meditation: Theoretical considerations and preliminary results. *General Hospital Psychiatry*, *4*(1), 33-47.

Kabat-Zinn, J. (2005). *Wherever you go, there you are: Mindfulness meditation in everyday life* (10th ed.). Hachette Book.

Kabat-Zinn, J. (2013). *Full catastrophe living : Using the wisdom of your body and mind to face stress, pain, and illness*. Bantam Books.

Kalkman, B. (2018). Concept analysis: Role ambiguity in senior nursing students. *Nursing Forum*, *53*(2), 232-240. https://doi.org/https://doi.org/10.1111/nuf.12231

Kamarck, T., Mermelstein, R., & Cohen, S. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior*, *24*(4), 385-396. https://doi.org/10.2307/2136404

Kazdin, A. E. (2007). Mediators and mechanisms of change in psychotherapy research. *Annual Review of Clinical Psychology*, *3*, 1-27. https://doi.org/10.1146/annurev.clinpsy.3.022806.091432

Keane, C., Waldeck, D., Holliman, A., Goodman, S., & Choudhry, K. (2021). Exploring the experience of anxiety among final year students at university: A thematic analysis. *The Qualitative Report*, *26*(8), 2621-2630. https://doi.org/10.46743/2160-3715/2021.4874

Keng, S.-L., Smoski, M. J., & Robins, C. J. (2011). Effects of mindfulness on psychological health: A review of empirical studies. *Clinical Psychology Review*, *31*(6), 1041-1056. https://doi.org/10.1016/j.cpr.2011.04.006

Keng, S.-L., Smoski, M. J., Robins, C. J., Ekblad, A. G., & Brantley, J. G. (2012). Mechanisms of change in mindfulness-based stress reduction: Self-compassion and mindfulness as mediators of intervention outcomes. *Journal of Cognitive Psychotherapy*, *26*(3), 270-280. https://doi.org/10.1891/0889-8391.26.3.270

Khoury, B., Sharma, M., Rush, S. E., & Fournier, C. (2015). Mindfulness-based stress reduction for healthy individuals: A meta-analysis. *Journal of Psychosomatic Research, 78*(6), 519-528. https://doi.org/10.1016/j.jpsychores.2015.03.009

Kim, J., & Shin, W. (2014). How to do random allocation (randomization). *Clinics in Orthopedic Surgery*, *6*(1), 103-109. https://doi.org/10.4055/cios.2014.6.1.103

Koopman, J., Howe, M., Hollenbeck, J. R., & Sin, H.-P. (2015). Small sample mediation testing: Misplaced confidence in bootstrapped confidence intervals. *Journal of Applied Psychology*, *100*(1), 194-202. https://doi.org/10.1037/a0036635

Kruger, J., & Dunning, D. (1999). Unskilled and unaware of it: How difficulties in recognizing one's own incompetence lead to inflated self-assessments. *Journal of Personality and Social Psychology, 77*(6), 1121-1134. https://doi.org/10.1037/0022-3514.77.6.1121

Küchler, A. M., Schultchen, D., Dretzler, T., Moshagen, M., Ebert, D. D., & Baumeister, H. (2023). A three-armed randomized controlled trial to evaluate the effectiveness, acceptance, and negative effects of Studicare Mindfulness, an internet- and mobile-based intervention for college students with no and "on demand" guidance. *International Journal of Environmental Research and Public Health*, *20*(4), Article 3208. https://doi.org/10.3390/ijerph20043208

Kumar, S., Feldman, G., & Hayes, A. (2008). Changes in mindfulness and emotion regulation in an exposure-based cognitive therapy for depression. *Cognitive Therapy and Research, 32*(6), 734-744. https://doi.org/10.1007/s10608-008-9190-1

Lachin, J. M. (2016). Fallacies of last observation carried forward analyses. *Clinical Trials, 13*(2), 161-168. https://doi.org/10.1177/1740774515602688

Lambert, S. E. (1999). *An examination of the socioemotional impact of the resume on graduating seniors* [PhD Dissertation, University of Sarasota]. https://www.proquest.com/docview/304548178?pq-origsite=gscholar&fromopenview=true

Lan, H. K., Subramanian, P., Rahmat, N., & Kar, P. C. (2014). The effects of mindfulness training program on reducing stress and promoting well-being among nurses in critical care units. *Australian Journal of Advanced Nursing, 31*(3), 22-31. https://doi.org/10.3316/ielapa.285671898965330

Lane, J. A. (2013). Group counseling for students transitioning out of postsecondary education. *Groupwork, 23*(1), 34-55. https://doi.org/10.1921/gpwk.v23i1.759

Lane, J. A. (2015). The imposter phenomenon among emerging adults transitioning into professional life: Developing a grounded theory. *Adultspan Journal, 14*(2), 114-128. https://doi.org/10.1002/adsp.12009

Lane, J. A., & Fink, R. S. (2015). Attachment, social support satisfaction, and well-being during life transition in emerging adulthood. *The Counseling Psychologist, 43*(7), 1034-1058. https://doi.org/10.1177/0011000015592184

Larson, R., & Csikszentmihalyi, M. (2014). The experience sampling method. In *Flow and the foundations of positive psychology* (pp. 21-34). Springer.

Layland, E. K., Calhoun, B. H., Russell, M. A., & Maggs, J. L. (2018). Is alcohol and other substance use reduced when college students attend alcohol-free programs? Evidence from a measurement burst design before and after legal drinking age. *Prevention Science, 20*(3), 342-352. https://doi.org/10.1007/s11121-018-0877-6

Lee, E.-H. (2012). Review of the Psychometric Evidence of the Perceived Stress Scale. *Asian Nursing Research, 6*(4), 121-127. https://doi.org/https://doi.org/10.1016/j.anr.2012.08.004

Lee, J. (2020). Mental health effects of school closures during COVID-19. *The Lancet Child & Adolescent Health*, *4*(6), 421. https://doi.org/10.1016/S2352-4642(20)30109-7

Lee, J., Kim, K. H., Webster, C. S., & Henning, M. A. (2021). The evolution of mindfulness from 1916 to 2019. *Mindfulness*, *12*(8), 1849-1859. https://doi.org/10.1007/s12671-021-01603-x

Leontopoulou, S. (2015). A positive psychology intervention with emerging adults. *The European Journal of Counselling Psychology*, *3*(2), 113-136. https://doi.org/10.5964/ejcop.v3i2.33

Levene, H. (1960). Robust tests for equality of variances. In W. H. I. Olkin, W. G. Madow, & H. B. Mann (Ed.), *Contributions to Probability and Statistics: Essays in Honor of Harold Hotelling* (pp. 278–292). Stanford University Press.

Lewis, M. A., Rhew, I. C., Fairlie, A. M., Swanson, A., Anderson, J., & Kaysen, D. (2018). Evaluating personalized feedback intervention framing with a randomized controlled trial to reduce young adult alcohol-related sexual risk taking. *Prevention Science*, *20*(3), 310-320. https://doi.org/10.1007/s11121-018-0879-4

Lim, D., Condon, P., & DeSteno, D. (2015). Mindfulness and compassion: An examination of mechanism and scalability. *PLoS One*, *10*(2), Article e0118221. https://doi.org/10.1371/journal.pone.0118221

Lippelt, D. P., Hommel, B., & Colzato, L. S. (2014). Focused attention, open monitoring and loving kindness meditation: Effects on attention, conflict monitoring, and creativity - A review. *Frontiers in Psychology*, *5*, Article 1083. https://doi.org/10.3389/fpsyg.2014.01083

Lostutter, T. W., Larimer, M. E., Neighbors, C., & Kaljee, L. M. (2013). Perceived stress and avoidant coping moderate disordered gambling among emerging adults in Vietnam. *Youth & Society*, *45*(1), 117-139. https://doi.org/10.1177/0044118X11409255

Lutz, A., Slagter, H. A., Dunne, J. D., & Davidson, R. J. (2008). Attention regulation and monitoring in meditation. *Trends in Cognitive Sciences*, *12*(4), 163-169. https://doi.org/10.1016/j.tics.2008.01.005

Ly, K. H., Trüschel, A., Jarl, L., Magnusson, S., Windahl, T., Johansson, R., Carlbring, P., & Andersson, G. (2014). Behavioural activation versus mindfulness-based guided self-help treatment administered through a smartphone application: A randomised controlled trial. *BMJ Open*, *4*(1), Article e003440. https://doi.org/10.1136/bmjopen-2013-003440

Mak, W. W. S., Chan, A. T. Y., Cheung, E. Y. L., Lin, C. L. Y., & Ngai, K. C. S. (2015). Enhancing Web-based mindfulness training for mental health promotion with the health action process approach: Randomized controlled trial. *Journal of Medical Internet Research*, *17*(1), Article e8. https://doi.org/10.2196/jmir.3746

Martin Payo, R., Fernandez Álvarez, M. M., Blanco Díaz, M., Cuesta Izquierdo, M., Stoyanov, S. R., & Llaneza Suárez, E. (2019). Spanish adaptation and validation of the Mobile Application Rating Scale questionnaire. *International Journal of Medical Informatics*, *129*, 95-99. https://doi.org/https://doi.org/10.1016/j.ijmedinf.2019.06.005

Marzo, R. R., Vinay, V., Bahari, R., Chauhan, S., Ming, D. A. F., Nelson Fernandez, S. F. A. P., Johnson, C. C. P., Thivakaran, A. Q. A. L., Rahman, M. M., & Goel, S. (2021). Depression and anxiety in Malaysian population during third wave of the COVID-19 pandemic. *Clinical Epidemiology and Global Health*, *12*, 100868. https://doi.org/10.1016/j.cegh.2021.100868

Mauchly, J. W. (1940). Significance test for sphericity of a normal n-variate distribution. *The Annals of Mathematical Statistics*, *11*(2), 204-209. http://www.jstor.org/stable/2235878

Mayer, C., Im, S., Stavas, J., & Hazlett-Stevens, H. (2019). Mindfulness facets associated with perceived stress: The role of nonreactivity. *Journal of Depression and Anxiety Forecast*, *2*(1), Article 1009.

McCoy, C. E. (2017). Understanding the intention-to-treat principle in randomized controlled trials. *The Western Journal Of Emergency Medicine*, *18*(6), 1075-1078. https://doi.org/10.5811/westjem.2017.8.35985

McGrath, R. E., Mitchell, M., Kim, B. H., & Hough, L. (2010). Evidence for response bias as a source of error variance in applied assessment. *Psychological Bulletin*, *136*(3), 450-470. https://doi.org/10.1037/a0019216

Messner, E.-M., Terhorst, Y., Barke, A., Baumeister, H., Stoyanov, S., Hides, L., Kavanagh, D., Pryss, R., Sander, L., & Probst, T. (2020). The German version of the Mobile App Rating Scale (MARS-G): Development and validation study. *JMIR Mhealth Uhealth*, *8*(3), Article e14479. https://doi.org/10.2196/14479

Meyer, T. J., Miller, M. L., Metzger, R. L., & Borkovec, T. D. (1990). Development and validation of the penn state worry questionnaire. *Behaviour Research and Therapy*, *28*(6), 487-495. https://doi.org/10.1016/0005-7967(90)90135-6

Miller, E. D. (2020). Loneliness in the era of COVID-19. *Frontiers in Psychology*, *11*, Article 2219. https://doi.org/10.3389/fpsyg.2020.02219

Morris, S. B. (2008). Estimating effect sizes from pretest-posttest-control group designs. *Organizational Research Methods, 11*(2), 364-386. https://doi.org/10.1177/1094428106291059

Mostazir, M., Taylor, G., Henley, W. E., Watkins, E. R., & Taylor, R. S. (2021). Per-protocol analyses produced larger treatment effect sizes than intention to treat: A meta-epidemiological study. *Journal of Clinical Epidemiology*, *138*, 12-21. https://doi.org/10.1016/j.jclinepi.2021.06.010

Moustgaard, H., Clayton, G. L., Jones, H. E., Boutron, I., Jorgensen, L., Laursen, D. L. T., Olsen, M. F., Paludan-Mueller, A., Ravaud, P., Savovic, J., Sterne, J. A. C., Higgins, J. P. T., & Hrobjartsson, A. (2020). Impact of blinding on estimated treatment effects in randomised clinical trials: Meta-epidemiological study. *The BMJ, 368*, Article l6802. https://doi.org/10.1136/bmj.l6802

Mrazek, A. J., Mrazek, M. D., Cherolini, C. M., Cloughesy, J. N., Cynman, D. J., Gougis, L. J., Landry, A. P., Reese, J. V., & Schooler, J. W. (2019). The future of mindfulness training is digital, and the future is now. *Current Opinion in Psychology, 28*, 81-86. https://doi.org/10.1016/j.copsyc.2018.11.012

Murray, K., Crisp, D. A., Burns, R. A., & Byrne, D. (2020). Psychometric validation of the Emerging Adult Stress Inventory (EASI). *Psychological Assessment, 32*(12), 1133-1144. https://doi.org/10.1037/pas0000952

Nasreen, F., Halili, S. H., & Razak, R. A. (2022). Employability skills of Malaysian university students for IR4.0: A systematic literature review. *Malaysian Online Journal of Educational Management*, 15-28.

Neely, M. E., Schallert, D. L., Mohammed, S. S., Roberts, R. M., & Chen, Y.-J. (2009). Self-kindness when facing stress: The role of self-compassion, goal regulation, and support in college students' well-being. *Motivation and Emotion, 33*(1), 88-97. https://doi.org/10.1007/s11031-008-9119-8

Neff, K. (2003a). The Development and Validation of a Scale to Measure Self-Compassion. *Self and Identity, 2*(3), 223-250. https://doi.org/10.1080/15298860309027

Neff, K. (2003b). Self-compassion: An alternative conceptualization of a healthy attitude toward oneself. *Self and Identity, 2*(2), 85-101. https://doi.org/10.1080/15298860390129863

Neff, K., & Dahm, K. (2014). Self-compassion: What it is, what it does, and how it relates to mindfulness. In B. Ostafin, Robinson, M., Meier, B. (Ed.), *Handbook of mindfulness and self-regulation* (pp. 121-137). Springer. https://doi.org/10.1007/978-1-4939-2263-5_10

Neff, K. D., & Tóth-Király, I. (2022). Self-Compassion Scale (SCS). In *Handbook of Assessment in Mindfulness Research* (pp. 1-22). Springer.

Nelson, L. J. (2021). The theory of emerging adulthood 20 years later: A look at where it has taken us, what we know now, and where we need to go. *Emerging Adulthood*, *9*(3), 179-188. https://doi.org/10.1177/2167696820950884

Neubauer, A. B., Smyth, J. M., & Sliwinski, M. J. (2018). When you see it coming: Stressor anticipation modulates stress effects on negative affect. *Emotion*, *18*(3), 342-354. https://doi.org/10.1037/emo0000381

O'Leary, K., O'Neill, S., & Dockray, S. (2016). A systematic review of the effects of mindfulness interventions on cortisol. *Journal of Health Psychology*, *21*(9), 2108-2121. https://doi.org/10.1177/1359105315569095

OECD. (2022). *OECD Employment Outlook 2022: Building Back More Inclusive Labour Markets*. O. Publishing. https://www.oecd-ilibrary.org/content/publication/1bb305a6-en

Oinas-Kukkonen, H., & Harjumaa, M. (2009). Persuasive systems design: Key issues, process model, and system features. *Communications of the association for Information Systems*, *24*(1), Article 28. https://doi.org/10.17705/1CAIS.02428

Olatunji, B. O., Schottenbauer, M. A., Rodriguez, B. F., Glass, C. R., & Arnkoff, D. B. (2007). The structure of worry: relations between positive/negative personality characteristics and the Penn State Worry Questionnaire. *Journal of Anxiety Disorders*, *21*(4), 540-553. https://doi.org/10.1016/j.janxdis.2006.08.005

Orosa-Duarte, Á., Mediavilla, R., Muñoz-Sanjose, A., Palao, Á., Garde, J., López-Herrero, V., Bravo-Ortiz, M.-F., Bayón, C., & Rodríguez-Vega, B. (2021). Mindfulness-based mobile app reduces anxiety and increases self-compassion in healthcare students: A randomised controlled trial. *Medical Teacher*, *43*(6), 686-693. https://doi.org/10.1080/0142159X.2021.1887835

Padilla-Walker, L. M., Memmott-Elison, M. K., & Nelson, L. J. (2017). Positive relationships as an indicator of flourishing during emerging adulthood. In *Flourishing in emerging adulthood: Positive development during the third decade of life*. (pp. 212-236). Oxford University Press.

Pan, H., Liu, S., Miao, D., & Yuan, Y. (2018). Sample size determination for mediation analysis of longitudinal data. *BMC Medical Research Methodology*, *18*(1), 32. https://doi.org/10.1186/s12874-018-0473-2

Pang, D., & Ruch, W. (2019). Scrutinizing the Components of Mindfulness: Insights from Current, Past, and Non-meditators. *Mindfulness*, *10*(3), 492-505. https://doi.org/10.1007/s12671-018-0990-4

Parker, V., Giles, M., Lantry, G., & McMillan, M. (2014). New graduate nurses' experiences in their first year of practice. *Nurse Education Today*, *34*(1), 150-156. https://doi.org/10.1016/j.nedt.2012.07.003

Parsons, C. E., Crane, C., Parsons, L. J., Fjorback, L. O., & Kuyken, W. (2017). Home practice in mindfulness-based cognitive therapy and mindfulness-based stress reduction: A systematic review and meta-analysis of participants' mindfulness practice and its association with outcomes. *Behaviour Research and Therapy*, *95*, 29-41. https://doi.org/10.1016/j.brat.2017.05.004

Peer, J. W., & McAuslan, P. (2016). Self-doubt during emerging adulthood: The conditional mediating influence of mindfulness. *Emerging Adulthood*, *4*(3), 176-185. https://doi.org/10.1177/2167696815579828

Perestelo-Perez, L., Barraca, J., Peñate, W., Rivero-Santana, A., & Alvarez-Perez, Y. (2017). Mindfulness-based interventions for the treatment of depressive rumination: Systematic review and meta-analysis. *International Journal of Clinical and Health Psychology*, *17*(3), 282-295. https://doi.org/10.1016/j.ijchp.2017.07.004

Perneger, T. V. (1998). What's wrong with Bonferroni adjustments. *The BMJ*, *316*, 1236-1238. https://doi.org/10.1136/bmj.316.7139.1236

Perrone, L., & Vickers, M. H. (2003). Life after graduation as a “very uncomfortable world”: An Australian case study. *Education & Training*, *45*(2). https://doi.org/10.1108/00400910310464044

Phang, K. C., Firdaus, M., Normala, I., Keng, L. S., & Sherina, M. S. (2015). Effects of a DVD-delivered mindfulness-based intervention for stress reduction in medical students: A randomized controlled study. *Education in Medicine Journal*, *7*(3). https://doi.org/10.5959/eimj.v7i3.369

Polach, J. L. (2004). Understanding the experience of college graduates during their first year of employment. *Human Resource Development Quarterly*, *15*(1), 5-23. https://doi.org/10.1002/hrdq.1084

Querstret, D., Cropley, M., & Fife-Schaw, C. (2017). Internet-based instructor-led mindfulness for work-related rumination, fatigue, and sleep: Assessing facets of mindfulness as mechanisms of change. A randomized waitlist control trial. *Journal of Occupational Health Psychology*, *22*(2), 153-169. https://doi.org/10.1037/ocp0000028

Querstret, D., Cropley, M., & Fife-Schaw, C. (2018). The effects of an online mindfulness intervention on perceived stress, depression and anxiety in a non-clinical sample: A randomised waitlist control trial. *Mindfulness*, *9*(6), 1825-1836. https://doi.org/10.1007/s12671-018-0925-0

Querstret, D., Cropley, M., Kruger, P., & Heron, R. (2016). Assessing the effect of a Cognitive Behaviour Therapy (CBT)-based workshop on work-related rumination, fatigue, and sleep. *European Journal of Work and Organizational Psychology*, *25*(1), 50-67. https://doi.org/10.1080/1359432X.2015.1015516

Raes, F., Pommier, E., Neff, K. D., & Van Gucht, D. (2011). Construction and factorial validation of a short form of the Self-Compassion Scale. *Clinical Psychology & Psychotherapy*, *18*(3), 250-255. https://doi.org/10.1002/cpp.702

Ramler, T. R., Tennison, L. R., Lynch, J., & Murphy, P. (2016). Mindfulness and the college transition: the efficacy of an adapted mindfulness-based stress reduction intervention in fostering adjustment among first-year students. *Mindfulness, 7*(1), 179-188. https://doi.org/10.1007/s12671-015-0398-3

Ranganathan, P., Pramesh, C. S., & Aggarwal, R. (2016). Common pitfalls in statistical analysis: Intention-to-treat versus per-protocol analysis. *Perspectives in Clinical Research*, *7*(3), 144-146. https://doi.org/10.4103/2229-3485.184823

Raymore, L. A., Barber, B. L., Eccles, J. S., & Godbey, G. C. (1999). Leisure behavior pattern stability during the transition from adolescence to young adulthood. *Journal of Youth and Adolescence*, *28*(1), 79-103. https://doi.org/10.1023/A:1021624609006

Reifman, A., Arnett, J. J., & Colwell, M. J. (2007). Emerging adulthood: Theory, assessment and application. *Journal of Youth Development, 2*(1), 37-48. https://doi.org/10.5195/jyd.2007.359

Ribeiro, L., Atchley, R. M., & Oken, B. S. (2018). Adherence to practice of mindfulness in novice meditators: Practices chosen, amount of time practiced, and long-term effects following a mindfulness-based intervention. *Mindfulness*, *9*(2), 401-411. https://doi.org/10.1007/s12671-017-0781-3

Rioux, C., & Little, T. D. (2021). Missing data treatments in intervention studies: What was, what is, and what should be. *International Journal of Behavioral Development, 45*(1), 51-58. https://doi.org/10.1177/0165025419880609

Rizwan, A., Alsulami, H., Shahzad, A., Elnahas, N., Almalki, S., Alshehri, R., Alamoudi, M., & Alshoaibi, H. (2021). Perception gap of employability skills between employers and female Engineering graduates in Saudi Arabia.

International Journal of Engineering Education, *37*(2), 341-350. https://doi.org/10.3390/su132011327

Robbins, A., & Wilner, A. (2001). *Quarterlife crisis: The unique challenges of life in your twenties*. Penguin.

Roberts, K., Dowell, A., & Nie, J.-B. (2019). Attempting rigour and replicability in thematic analysis of qualitative research data: A case study of codebook development. *BMC Medical Research Methodology, 19*(1), Article 66. https://doi.org/10.1186/s12874-019-0707-y

Robinson, O. C., Cimporescu, M., & Thompson, T. (2021). Wellbeing, developmental crisis and residential status in the year after graduating from higher education: A 12-month longitudinal study. *Journal of Adult Development, 28*(2), 138-148. https://doi.org/10.1007/s10804-020-09361-1

Rodríguez-Biglieri, R., & Vetere, G. L. (2011). Psychometric characteristics of the Penn State Worry Questionnaire in an Argentinean sample: a cross-cultural contribution. *The Spanish Journal of Psychology*, *14*(1), 452-463. https://doi.org/10.5209/rev_sjop.2011.v14.n1.41

Rogers, H. B. (2013). Koru: Teaching mindfulness to emerging adults. *New Directions for Teaching and Learning*, *2013*(134), 73-81. https://doi.org/10.1002/tl.20056

Rojiani, R., Santoyo, J. F., Rahrig, H., Roth, H. D., & Britton, W. B. (2017). Women benefit more than men in response to college-based meditation training. *Frontiers in Psychology, 8*. https://doi.org/10.3389/fpsyg.2017.00551

Saha, C., & Jones, M. P. (2009). Bias in the last observation carried forward method under informative dropout. *Journal of Statistical Planning and Inference, 139*(2), 246-255. https://doi.org/10.1016/j.jspi.2008.04.017

Saliasi, I., Martinon, P., Darlington, E., Smentek, C., Tardivo, D., Bourgeois, D., Dussart, C., Carrouel, F., & Fraticelli, L. (2021). Promoting health via mHealth applications using a French version of the Mobile App Rating Scale: Adaptation and validation study. *JMIR Mhealth Uhealth, 9*(8), Article e30480. https://doi.org/10.2196/30480

Saltsman, T. L., Seery, M. D., Ward, D. E., Radsvick, T. M., Panlilio, Z. A., Lamarche, V. M., & Kondrak, C. L. (2021). Facing the facets: No association between dispositional mindfulness facets and positive momentary stress responses during active stressors. *Personality and Social Psychology Bulletin*, *47*(7), 1057-1070. https://doi.org/10.1177/0146167220956898

Schell, L. K., Monsef, I., Wöckel, A., & Skoetz, N. (2019). Mindfulness‐based stress reduction for women diagnosed with breast cancer. *Cochrane Database of Systematic Reviews*, *3*(3), Article CD011518. https://doi.org/10.1002/14651858.CD011518.pub2

Schoultz, M., Macaden, L., & Hubbard, G. (2016). Participants' perspectives on mindfulness-based cognitive therapy for inflammatory bowel disease: A qualitative study nested within a pilot randomised controlled trial. *Pilot Feasibility Study*, *2*(1), Article 3. https://doi.org/10.1186/s40814-015-0041-z

Schulz, K. F., Altman, D. G., & Moher, D. (2010). CONSORT 2010 statement: Updated guidelines for reporting parallel group randomized trials. *BMC Medicine*, *8*(18). https://doi.org/10.1186/1741-7015-8-18

Sealed Envelope Ltd. (2022). *Create a blocked randomisation list*. Retrieved February, 1 from https://www.sealedenvelope.com/simple-randomiser/v1/lists

Sedlmeier, P., Eberth, J., Schwarz, M., Zimmermann, D., Haarig, F., Jaeger, S., & Kunze, S. (2012). The psychological effects of meditation: a meta-analysis. *Psychological Bulletin*, *138*(6), 1139-1171. https://doi.org/10.1037/a0028168

Seewer, N., Skoko, A., Käll, A., Andersson, G., Luhmann, M., Berger, T., & Krieger, T. (2024). Efficacy of an Internet-based self-help intervention with human guidance or automated messages to alleviate loneliness: a three-armed randomized controlled trial. *Scientific Reports*, *14*(1), 6569. https://doi.org/10.1038/s41598-024-57254-0

Segal, Z. V. (2013). *Mindfulness-based cognitive therapy for depression* (2nd ed.). Guilford Press.

Sevel, L. S., Finn, M. T. M., Smith, R. M., Ryden, A. M., & McKernan, L. C. (2020). Self‐compassion in mindfulness‐based stress reduction: An examination of prediction and mediation of intervention effects. *Stress Health*, *36*(1), 88-96. https://doi.org/10.1002/smi.2917

Shallcross, A., Lu, N. Y., & Hays, R. D. (2020). Evaluation of the Psychometric Properties of the Five Facet of Mindfulness Questionnaire. *Journal of Psychopathology and Behavioral Assessment*, *42*(2), 271-280. https://doi.org/10.1007/s10862-019-09776-5

Shankland, R., Tessier, D., Strub, L., Gauchet, A., & Baeyens, C. (2021). Improving mental health and well‐being through informal mindfulness practices: An intervention study. *Applied Psychology: Health and Well‐Being*, *13*(1), 63-83. https://doi.org/10.1111/aphw.12216

Shapiro, S. L., Brown, K. W., & Biegel, G. M. (2007). Teaching self-care to caregivers: Effects of mindfulness-based stress reduction on the mental health of therapists in training. *Training and Education in Professional Psychology, 1*(2), 105-115. https://doi.org/10.1037/1931-3918.1.2.105

Shapiro, S. L., Carlson, L. E., Astin, J. A., & Freedman, B. (2006). Mechanisms of mindfulness. *Journal of Clinical Psychology, 4*(4), 373-386. https://doi.org/10.1002/jclp.20237

Shapiro, S. L., Oman, D., Thoresen, C. E., Plante, T. G., & Flinders, T. (2008). Cultivating mindfulness: Effects on well-being. *Journal of Clinical Psychology, 4*(4), 840-862. https://doi.org/10.1002/jclp.20491

Shiffman, S., Stone, A. A., & Hufford, M. R. (2008). Ecological momentary assessment. *Annual Review of Clinical Psychology, 4*, 1-32. https://doi.org/10.1146/annurev.clinpsy.3.022806.091415

Shoham, A., Goldstein, P., Oren, R., Spivak, D., & Bernstein, A. (2017). Decentering in the process of cultivating mindfulness: An experience-sampling study in time and context. *Journal of Consulting and Clinical Psychology, 85*(2), 123. https://doi.org/10.1037/ccp0000154

Siebelink, N. M., Bögels, S. M., Speckens, A. E. M., Dammers, J. T., Wolfers, T., Buitelaar, J. K., & Greven, C. U. (2022). A randomised controlled trial (MindChamp) of a mindfulness-based intervention for children with ADHD and their parents. *Journal of Child Psychology and Psychiatry, 63*(2), 165-177. https://doi.org/10.1111/jcpp.13430

Silver, B. R., & Roksa, J. (2017). Navigating uncertainty and responsibility: Understanding inequality in the senior-year transition. *Journal of Student Affairs Research and Practice, 54*(3), 248-260. https://doi.org/10.1080/19496591.2017.1331851

Sirois, F. M., Molnar, D. S., & Hirsch, J. K. (2015). Self-compassion, stress, and coping in the context of chronic illness. *Self and Identity, 14*(3), 334-347. https://doi.org/10.1080/15298868.2014.996249

Sobel, M. E. (1982). Asymptotic confidence intervals for indirect effects in structural equation models. *Sociological Methodology, 13*, 290-312. https://doi.org/10.2307/270723

Solhaug, I., de Vibe, M., Friborg, O., Sørlie, T., Tyssen, R., Bjørndal, A., & Rosenvinge, J. H. (2019). Long-term mental health effects of mindfulness training: A 4-year follow-up study. *Mindfulness, 10*(8), 1661-1672. https://doi.org/10.1007/s12671-019-01100-2

Sommers-Spijkerman, M., Austin, J., Bohlmeijer, E., & Pots, W. (2021). New evidence in the booming field of online mindfulness: An updated meta-analysis of randomized controlled trials. *JMIR Mental Health, 8*(7), Àrticle e28168. https://doi.org/10.2196/28168

Sousa, G. M., Lima-Araújo, G. L., Araújo, D. B., & Sousa, M. B. C. (2021). Brief mindfulness-based training and mindfulness trait attenuate psychological stress in university students: A randomized controlled trial. *BMC Psychology, 9*(1), 21. https://doi.org/10.1186/s40359-021-00520-x

Spence, R., Owens-Solari, M., & Goodyer, I. (2016). Help-seeking in emerging adults with and without a history of mental health referral: A qualitative study. *BMC Research Notes, 9*(1), 1-8. https://doi.org/10.1186/s13104-016-2227-8

Spijkerman, M., Pots, W. T. M., & Bohlmeijer, E. T. (2016). Effectiveness of online mindfulness-based interventions in improving mental health: A review and meta-analysis of randomised controlled trials. *Clinical Psychology Review, 45*, 102-114. https://doi.org/10.1016/j.cpr.2016.03.009

Stoikov, S., Maxwell, L., Butler, J., Shardlow, K., Gooding, M., & Kuys, S. (2022). The transition from physiotherapy student to new graduate: are they prepared? *Physiotherapy Theory and Practice, 38*(1), 101-111. https://doi.org/10.1080/09593985.2020.1744206

Stone, A. A., Schwartz, J. E., Broderick, J. E., & Deaton, A. (2010). A snapshot of the age distribution of psychological well-being in the United States. *Proceedings of the National Academy of Sciences, 107*(22), 9985-9990. https://doi.org/https://doi.org/10.1073/pnas.100374410

Stoyanov, S. R., Hides, L., Kavanagh, D. J., Zelenko, O., Tjondronegoro, D., & Mani, M. (2015). Mobile app rating scale: A new tool for assessing the quality of health mobile apps. *JMIR mHealth and uHealth, 3*(1), Article e27. https://doi.org/10.2196/mhealth.3422

Streiner, D. L., & Norman, G. R. (2011). Correction for multiple testing: Is there a resolution? *Chest, 140*(1), 16-18. https://doi.org/10.1378/chest.11-0523

Strohmaier, S. (2020). The relationship between doses of mindfulness-based programs and depression, anxiety, stress, and mindfulness: A dose-response meta-regression of randomized controlled trials. *Mindfulness, 11*(6), 1315-1335. https://doi.org/https://doi.org/10.1007/s12671-020-01319-4

Strohmaier, S., Jones, F. W., & Cane, J. E. (2021). Effects of length of mindfulness practice on mindfulness, depression, anxiety, and stress: A randomized

controlled experiment. *Mindfulness*, *12*(1), 198-214. https://doi.org/10.1007/s12671-020-01512-5

Sweeney, T., Morriss, R., Nixon, E., Guo, B., & Callaghan, P. (2021). Psychometric properties of the Five Facets Mindfulness Questionnaire in moderate-to-severe, persistent depression. *Mindfulness*, *12*(4), 1009-1021. https://doi.org/10.1007/s12671-020-01573-6

Taylor, S., Qiao, S., Weissman, S., & Li, X. (2021). Attitudes toward a mindfulness-based intervention from African American women living with HIV: A qualitative study. *SAGE Open Medicine*, *9*. https://doi.org/10.1177/20503121211025144

Terhorst, Y., Philippi, P., Sander, L. B., Schultchen, D., Paganini, S., Bardus, M., Santo, K., Knitza, J., Machado, G. C., Schoeppe, S., Bauereiß, N., Portenhauser, A., Domhardt, M., Walter, B., Krusche, M., Baumeister, H., & Messner, E.-M. (2020). Validation of the Mobile Application Rating Scale (MARS). *PLoS One*, *15*(11), e0241480. https://doi.org/10.1371/journal.pone.0241480

The World Bank. (2022). *Unemployment, youth total (% of total labor force ages 15-24) (modeled ILO estimate)*. https://data.worldbank.org/indicator/SL.UEM.1524.ZS

Trull, T. J., & Ebner-Priemer, U. (2014). The role of ambulatory assessment in psychological science. *Current Directions In Psychological Science*, *23*(6), 466-470. https://doi.org/10.1177/0963721414550706

Tsang, L. F., Sham, A., Law, S. L. W., Chan, Y. M., & Sze, C. Y. (2016). ToUCH Program on competence, occupational stress and self-efficacy of newly graduated registered nurses in United Christian Hospital: a mixed method research study. *Journal of Nursing Education and Practice*, *6*(8), 129-137. https://doi.org/ 10.5430/jnep.v6n8p129

Van Dam, N. T., Sheppard, S. C., Forsyth, J. P., & Earleywine, M. (2010). Self-compassion is a better predictor than mindfulness of symptom severity and quality of life in mixed anxiety and depression. *Journal of Anxiety Disorders*, *25*(1), 123-130. https://doi.org/10.1016/j.janxdis.2010.08.011

Van der Gucht, K., Dejonckheere, E., Erbas, Y., Takano, K., Vandemoortele, M., Maex, E., Raes, F., & Kuppens, P. (2019). An experience sampling study examining the potential impact of a mindfulness-based intervention on emotion differentiation. *Emotion*, *19*(1), 123-131. https://doi.org/10.1037/emo0000406

van der Meulen, R. T., Valentin, S., Bögels, S. M., & de Bruin, E. I. (2021). Mindfulness and self-compassion as mediators of the Mindful2Work Training

on perceived stress and chronic fatigue. *Mindfulness, 12*(4), 936-946. https://doi.org/10.1007/s12671-020-01557-6

van Emmerik, A. A., Berings, F., & Lancee, J. (2018). Efficacy of a mindfulness-based mobile application: A randomized waiting-list controlled trial. *Mindfulness, 9*(1), 187-198. https://doi.org/10.1007/s12671-017-0761-7

Vettese, L. C., Toneatto, T., Stea, J. N., Nguyen, L., & Wang, J. J. (2009). Do mindfulness meditation participants do their homework? And does it make a difference? A review of the empirical evidence. *Journal of Cognitive Psychotherapy, 23*(3), 198-225. https://doi.org/10.1891/0889-8391.23.3.198

Wahbeh, H., Svalina, M. N., & Oken, B. S. (2014). Group, one-on-one, or internet? Preferences for mindfulness meditation delivery format and their predictors. *Open Medicine Journal 1*, 66-74. https://doi.org/10.2174/1874220301401010066

Walker, A., & Costa, B. M. (2017). Transition into the workplace: Comparing health graduates' and organisational perspectives. *Contemporary Nurse, 53*(1), 1-12. https://doi.org/10.1080/10376178.2016.1254050

Walsh, K. M., Saab, B. J., & Farb, N. A. (2019). Effects of a mindfulness meditation app on subjective well-being: Active randomized controlled trial and experience sampling study. *JMIR Mental Health, 6*(1), Article e10844. https://doi.org/10.2196/10844

Wang, T., Fan, L., Zheng, X., Wang, W., Liang, J., An, K., Ju, M., & Lei, J. (2021). The impact of gamification-induced users' feelings on the continued use of mhealth apps: A structural equation model with the self-determination theory approach. *Journal of Medical Internet Research, 23*(8), Article e24546. https://doi.org/10.2196/24546

Wendlandt, N. M., & Rochlen, A. B. (2008). Addressing the college-to-work transition: Implications for university career counselors. *Journal of Career Development, 35*(2), 151-165. https://doi.org/10.1177/0894845308325646

White, L. (2014). Mindfulness in nursing: An evolutionary concept analysis. *Journal of Advanced Nursing, 70*(2), 282-294. https://doi.org/10.1111/jan.12182

Wichers, M., Simons, C., Kramer, I., Hartmann, J. A., Lothmann, C., Myin‐Germeys, I., Van Bemmel, A., Peeters, F., Delespaul, P., & Van Os, J. (2011). Momentary assessment technology as a tool to help patients with depression help themselves. *Acta Psychiatrica Scandinavica, 124*(4), 262-272. https://doi.org/10.1111/j.1600-0447.2011.01749.x

Williams, J. M. G. (2008). Mindfulness, Depression and Modes of Mind. *Cognitive Therapy and Research*, *32*(6), 721-733. https://doi.org/10.1007/s10608-008-9204-z

Winter, N., Russell, L., Ugalde, A., White, V., & Livingston, P. (2022). Engagement strategies to improve adherence and retention in web-based mindfulness programs: Systematic review. *Journal of Medical Internet Research*, *24*(1), Article e30026. https://doi.org/10.2196/30026

Wolpert, M., Zamperoni, V., Napoleone, E., Patalay, P., Jacob, J., Fokkema, M., Promberger, M., Costa da Silva, L., Patel, M., & Edbrooke-Childs, J. (2020). Predicting mental health improvement and deterioration in a large community sample of 11- to 13-year-olds. *European Child & Adolescent Psychiatry*, *29*(2), 167-178. https://doi.org/10.1007/s00787-019-01334-4

Wong, S. W. J., Che, W. S. W., Cheng, M. T. C., Cheung, C. K., Cheung, T. Y. J., Lee, K. Y., So, K. C., & Yip, S. L. (2018). Challenges of fresh nursing graduates during their transition period. *Journal of Nursing Education and Practice*, *8*(6), 30-37. https://doi.org/10.1016/j.cpr.2016.03.009

Wood, D., Crapnell, T., Lau, L., Bennett, A., Lotstein, D., Ferris, M., & Kuo, A. (2018). Emerging Adulthood as a Critical Stage in the Life Course. In N. Halfon, C. B. Forrest, R. M. Lerner, & E. M. Faustman (Eds.), *Handbook of Life Course Health Development* (pp. 123-143). Springer. https://doi.org/10.1007/978-3-319-47143-3_7

Yang, E., Schamber, E., Meyer, R. M., & Gold, J. I. (2018). Happier healers: Randomized controlled trial of mobile mindfulness for stress management. *The Journal of Alternative and Complementary Medicine*, *24*(5), 505-513. https://doi.org/10.1089/acm.2015.0301

Yap, J. Y. (2020). *Covid-19 set to aggravate Malaysia's skills mismatch*. Penang Institute. https://penanginstitute.org/publications/covid-19-crisis-assessments/covid-19-set-to-aggravate-malaysias-skills-mismatch/#:~:text=The%20Covid%2D19%20pandemic%20is,semi%2Dskilled%20and%20unskilled%20jobs.

Yazedjian, A., Kielaszek, B., & Toews, M. (2010). Students' perceptions regarding their impending transition out of college. *Journal of the First-Year Experience & Students in Transition*, *22*(2), 33-48.

Zhang, H. A., & Zhang, K. (2021). *The COVID-19 recession: Rough times for young Malaysians*. I. Y. I. Institute. http://hdl.handle.net/11540/14018

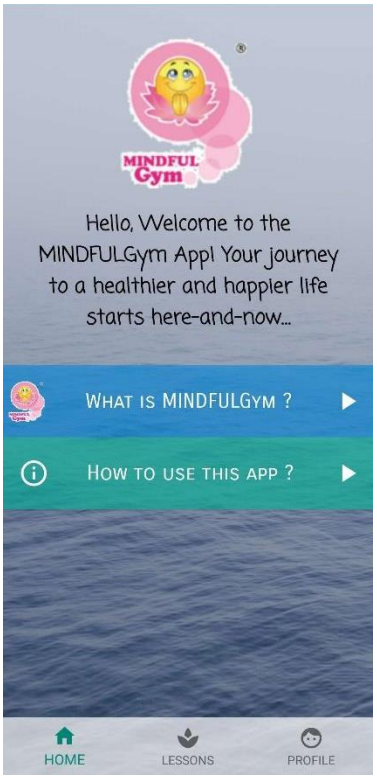
Zimmermann, P., & Iwanski, A. (2014). Emotion regulation from early adolescence to emerging adulthood and middle adulthood: Age differences, gender differences, and emotion-specific developmental variations. *International Journal of Behavioral Development, 38*(2), 182-194. https://doi.org/10.1177/0165025413515405

APPENDIX A

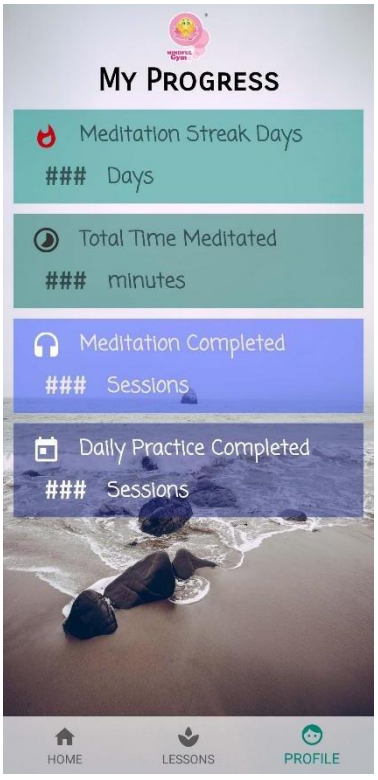
MINDFULGym Mobile Application

Login Page

Welcome Page



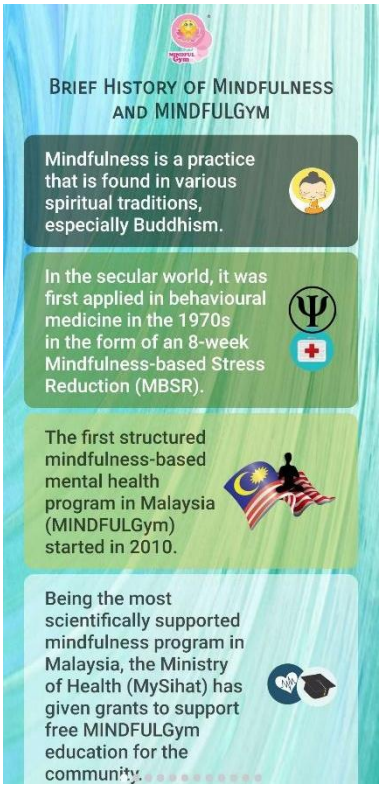
Profile Page



Weekly Lesson

Week 1 Lesson

Preview of Lesson Content 1



APPENDIX B

Perceived Stress Scale (PSS)

The questions in this scale ask about your feelings and thoughts during the last month. In each case, you will be asked to indicate how often you felt or thought a certain way. Although some of the questions are similar, there are differences between them, and you should treat each one as a separate question. The best approach is to answer fairly quickly. That is, don't try to count up the number of times you felt a particular way; rather indicate the alternative that seems like a reasonable estimate.

		Never	Almost never	Some-times	Fairly often	Very Often
1	In the last month, how often have you been upset because of something that happened unexpectedly?	0	1	2	3	4
2	In the last month, how often have you felt that you were unable to control the important things in your life?	0	1	2	3	4
3	In the last month, how often have you felt nervous and stressed?	0	1	2	3	4
4	In the last month, how often have you felt confident about your ability to handle your personal problems?	0	1	2	3	4
5	In the last month, how often have you felt that things were going your way?	0	1	2	3	4
6	In the last month, how often have you found that you could not cope with all the things that you had to do?	0	1	2	3	4
7	In the last month, how often have you been able to control irritations in your life?	0	1	2	3	4

8	In the last month, how often have you felt that you were on top of things?	0	1	2	3	4
9	In the last month, how often have you been angered because of things that happened that were outside of your control?	0	1	2	3	4
10	In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	0	1	2	3	4

APPENDIX C

Penn State Worry Scale (PWSQ)

Rate each of the following statements on a scale of 1 ("not at all typical of me") to 5 ("very typical of me"). Please do not leave any items blank.

		Not at all Typical of me				Very Typical of me
1.	If I do not have enough time to do everything, I do not worry about it.	1	2	3	4	5
2	My worries overwhelm me.	1	2	3	4	5
3	I do not tend to worry about things.	1	2	3	4	5
4	Many situations make me worry.	1	2	3	4	5
5	I know I should not worry about things, but I just cannot help it.	1	2	3	4	5
6	When I am under pressure, I worry a lot.	1	2	3	4	5
7	I am always worrying about something.	1	2	3	4	5
8	I find it easy to dismiss worrisome thoughts.	1	2	3	4	5
9	As soon as I finish one task, I start to worry about everything else I have to do.	1	2	3	4	5
10	I never worry about anything.	1	2	3	4	5

11	When there is nothing more I can do about a concern, I do not worry about it anymore.	1	2	3	4	5
12	I have been a worrier all my life.	1	2	3	4	5
13	I notice that I have been worrying about things.	1	2	3	4	5
14	Once I start worrying, I cannot stop.	1	2	3	4	5
15	I worry all the time.	1	2	3	4	5
16	I worry about projects until they are all done.	1	2	3	4	5

APPENDIX D

Self-Compassion Scale – Short-Form (SCS-SF)

Please read each statement carefully before answering. Indicate how often you behave in the stated manner, using the following scale:

		Almost never				Almost Always
1.	When I fail at something important to me, I become consumed by feelings of inadequacy.	1	2	3	4	5
2	I try to be understanding and patient towards those aspects of my personality I don't like.	1	2	3	4	5
3	When something painful happens, I try to take a balanced view of the situation.	1	2	3	4	5
4	When I'm feeling down, I tend to feel like most other people are probably happier than I am.	1	2	3	4	5
5	I try to see my failings as part of the human condition.	1	2	3	4	5
6	When I'm going through a very hard time, I give myself the caring and tenderness I need.	1	2	3	4	5
7	When something upsets me, I try to keep my emotions in balance.	1	2	3	4	5
8	When I fail at something that's important to me, I tend to feel alone in my failure.	1	2	3	4	5
9	When I'm feeling down, I tend to obsess and fixate on everything that's wrong.	1	2	3	4	5
10	When I feel inadequate in some way, I try to remind myself that	1	2	3	4	5

	feelings of inadequacy are shared by most people.					
11	I'm disapproving and judgmental about my own flaws and inadequacies.	1	2	3	4	5
12	I'm intolerant and impatient towards those aspects of my personality I don't like.	1	2	3	4	5

APPENDIX E

Five Facet Mindfulness Scale (FFMQ)

Please rate each of the following statements using the scale provided. Select the number in the blank that best describes your own opinion of what is generally true for you.

		Never or very rarely true	Rarely true	Some-times true	Often true	Very often or always true
1	When I'm walking, I deliberately notice the sensations of my body moving.	1	2	3	4	5
2	I'm good at finding words to describe my feelings.	1	2	3	4	5
3	I criticize myself for having irrational or inappropriate emotions.	1	2	3	4	5
4	I perceive my feelings and emotions without having to react to them.	1	2	3	4	5
5	When I do things, my mind wanders off and I'm easily distracted.	1	2	3	4	5
6	When I take a shower or bath, I stay alert to the sensations of water on my body.	1	2	3	4	5
7	I can easily put my beliefs, opinions, and expectations into words.	1	2	3	4	5
8	I don't pay attention to what I'm doing because I'm daydreaming, worrying, or otherwise distracted.	1	2	3	4	5

9	I watch my feelings without getting lost in them.	1	2	3	4	5
10	I tell myself I shouldn't be feeling the way I'm feeling.	1	2	3	4	5
11	I notice how foods and drinks affect my thoughts, bodily sensations, and emotions.	1	2	3	4	5
12	It's hard for me to find the words to describe what I'm thinking.	1	2	3	4	5
13	I am easily distracted.	1	2	3	4	5
14	I believe some of my thoughts are abnormal or bad and I shouldn't think that way.	1	2	3	4	5
15	I pay attention to sensations, such as the wind in my hair or sun on my face.	1	2	3	4	5
16	I have trouble thinking of the right words to express how I feel about things.	1	2	3	4	5
17	I make judgments about whether my thoughts are good or bad.	1	2	3	4	5
18	I find it difficult to stay focused on what's happening in the present.	1	2	3	4	5
19	When I have distressing thoughts or images, I "step back" and am aware of the thought or image without getting taken over by it.	1	2	3	4	5

20	I pay attention to sounds, such as clocks ticking, birds chirping, or cars passing.	1	2	3	4	5
21	In difficult situations, I can pause without immediately reacting.	1	2	3	4	5
22	When I have a sensation in my body, it's difficult for me to describe it because I can't find the right words.	1	2	3	4	5
23	It seems I am "running on automatic" without much awareness of what I'm doing.	1	2	3	4	5
24	When I have distressing thoughts or images, I feel calm soon after.	1	2	3	4	5
25	I tell myself that I shouldn't be thinking the way I'm thinking.	1	2	3	4	5
26	I notice the smells and aromas of things.	1	2	3	4	5
27	Even when I'm feeling terribly upset, I can find a way to put it into words.	1	2	3	4	5
28	I rush through activities without being really attentive to them.	1	2	3	4	5
29	When I have distressing thoughts or images, I am able just to notice them without reacting.	1	2	3	4	5
30	I think some of my emotions are bad or inappropriate and I shouldn't feel them.	1	2	3	4	5

31	I notice visual elements in art or nature, such as colours, shapes, textures, or patterns of light and shadow.	1	2	3	4	5
32	My natural tendency is to put my experiences into words.	1	2	3	4	5
33	When I have distressing thoughts or images, I just notice them and let them go.	1	2	3	4	5
34	I do jobs or tasks automatically without being aware of what I'm doing.	1	2	3	4	5
35	When I have distressing thoughts or images, I judge myself as good or bad, depending on what the thought / image is about.	1	2	3	4	5
36	I pay attention to how my emotions affect my thoughts and behaviour.	1	2	3	4	5
37	I can usually describe how I feel at the moment in considerable detail.	1	2	3	4	5
38	I find myself doing things without paying attention.	1	2	3	4	5
39	I disapprove of myself when I have irrational ideas.	1	2	3	4	5

APPENDIX F

Mobile Application Rating Scale (MARS)

App Quality Ratings

The Rating scale assesses app quality on four dimensions. All items are rated on a 5-point scale from "1. Inadequate" to "5.Excellent". Circle the number that most accurately represents the quality of the app component you are rating. Please use the descriptors provided for each response category.

1.	Entertainment: Is the app fun/entertaining to use? Does it use any strategies to increase engagement through entertainment (e.g., through gamification)? 1. Dull, not fun or entertaining at all. 2. Mostly boring 3. OK, fun enough to entertain user for a brief time (< 5 minutes) 4. Moderately fun and entertaining, would entertain user for some time (5-10 minutes total) 5. Highly entertaining and fun, would stimulate repeat use.
2.	Interest: Is the app interesting to use? Does it use any strategies to increase engagement by presenting its content in an interesting way? 1. Not interesting at all 2. Mostly uninteresting 3. OK, neither interesting nor uninteresting; would engage user for a brief time (< 5 minutes) 4. Moderately interesting; would engage user for some time (5-10 minutes total) 5. Very interesting, would engage user in repeat use
3.	Customization: Does it provide/retain all necessary settings/preferences for apps features (e.g., sound, content, notifications, etc.)? 1. Does not allow any customization or requires setting to be input every time. 2. Allows insufficient customization limiting functions. 3. Allows basic customisation to function adequately. 4. Allows numerous options for customization.

	5. Allows complete tailoring to the individual's characteristics/preferences, retains all settings
4	Interactivity: Does it allow user input, provide feedback, contain prompts (reminders, sharing options, notifications, etc.)? Note: these functions need to be customizable and not overwhelming in order to be perfect. 1. No interactive features and/or no response to user interaction 2. Insufficient interactivity, or feedback, or user input options, limiting functions. 3. Basic interactive features to function adequately. 4. Offers a variety of interactive features/feedback/user input options. 5. Very high level of responsiveness through interactive features/feedback/user input options
5	Target group: Is the app content (visual information, language, design) appropriate for your target audience? 1 Completely inappropriate/unclear/confusing 2 Mostly inappropriate/unclear/confusing 3 Acceptable but not targeted. May be inappropriate/unclear/confusing. 4 Well-targeted, with negligible issues 5 Perfectly targeted, no issues found
6	Performance: How accurately/fast do the app features (functions) and components (buttons/menus) work? 1. App is broken: no/insufficient/inaccurate response (e.g., crashes/bugs/broken features, etc.) 2. Some functions work but lagging or contains major technical problems. 3. App works overall. Some technical problems need fixing/Slow at times. 4. Mostly functional with minor/negligible problems. 5. Perfect/timely response; no technical bugs found/contains a 'loading time left' indicator
7	Ease of use: How easy is it to learn how to use the app; how clear are the menu labels/icons and instructions? 1. No/limited instruction; menu labels/icons are confusing; complicated. 2. Useable after a lot of time/effort 3. Useable after some time/effort

	4. Easy to learn how to use the app (or has clear instructions) 5. Able to use app immediately; intuitive; simple
8	Navigation: Is moving between screens logical/accurate/appropriate/ uninterrupted; are all necessary screen links present? 1. Different sections within the app seem logically disconnected and random/confusing/navigation is difficult. 2. Usable after a lot of time/effort 3. Usable after some time/effort 4. Easy to use or missing a negligible link. 5. Perfectly logical, easy, clear, and intuitive screen flow throughout, or offers shortcuts
9	Gestural design: Are interactions (taps/swipes/pinches/scrolls) consistent and intuitive across all components/screens? 1. Completely inconsistent/confusing 2. Often inconsistent/confusing 3. OK with some inconsistencies/confusing elements. 4. Mostly consistent/intuitive with negligible problems 5. Perfectly consistent and intuitive
10	Layout: Is arrangement and size of buttons/icons/menus/content on the screen appropriate or zoomable if needed? 1. Very bad design, cluttered, some options impossible to select / locate / see / read device display not optimized. 2. Bad design, random, unclear, some options difficult to select / locate / see / read. 3. Satisfactory, few problems with selecting / locating / seeing / reading items or with minor screen- size problems. 4. Mostly clear, able to select / locate / see / read items. 5. Professional, simple, clear, orderly, logically organized, device display optimized. Every design component has a purpose

11	Graphics: How high is the quality/resolution of graphics used for buttons/icons/menus/content? 1. Graphics appear amateur, very poor visual design - disproportionate, completely stylistically inconsistent. 2. Low quality/low resolution graphics; low quality visual design – disproportionate, stylistically inconsistent 3. Moderate quality graphics and visual design (generally consistent in style) 4. High quality/resolution graphics and visual design – mostly proportionate, stylistically consistent 5. Very high quality/resolution graphics and visual design - proportionate, stylistically consistent throughout
12	Visual appeal: How good does the app look? 1. No visual appeal, unpleasant to look at, poorly designed, clashing/mismatched colours. 2. Little visual appeal – poorly designed, bad use of colour, visually boring 3. Some visual appeal – average, neither pleasant, nor unpleasant 4. High level of visual appeal – seamless graphics – consistent and professionally designed. 5. As above + very attractive, memorable, stands out; use of colour enhances app features/menus
13	Goals: Does app have specific, measurable, and achievable goals (specified in app store description or within the app itself)? 1. Misleading. App does not contain the described components/functions. Or has no description. 2. Inaccurate. App contains very few of the described components/functions. 3. OK. App contains some of the described components/functions. 4. Accurate. App contains most of the described components/functions. 5. Highly accurate description of the app components/functions
14	Quality of information: Is app content correct, well written, and relevant to the goal/topic of the app? N/A There is no information within the app. 1. Irrelevant/inappropriate/incoherent/incorrect

	2. Poor. Barely relevant/appropriate/coherent/may be incorrect. 3. Moderately relevant/appropriate/coherent/and appears correct. 4. Relevant/appropriate/coherent/correct 5. Highly relevant, appropriate, coherent, and correct
15	Quantity of information: Is the extent coverage within the scope of the app; and comprehensive but concise? N/A There is no information within the app. 1. Minimal or overwhelming 2. Insufficient or possibly overwhelming 3. OK but not comprehensive or concise. 4. Offers a broad range of information, has some gaps or unnecessary detail; or has no links to more information and resources. 5. Comprehensive and concise; contains links to more information and resources.
16	Visual information: Is visual explanation of concepts – through charts / graphs / images / videos, etc.– clear, logical, correct? N/A There is no visual information within the app (e.g., it only contains audio, or text) 1. Completely unclear/confusing/wrong or necessary but missing. 2. Mostly unclear/confusing/wrong 3. OK but often unclear/confusing/wrong. 4. Mostly clear/logical/correct with negligible issues. 5. Perfectly clear/logical/correct
17	Credibility: Does the app come from a legitimate source (specified in app store description or within the app itself)? 1. Source identified but legitimacy/trustworthiness of source is questionable (e.g., commercial business with vested interest) 2. Appears to come from a legitimate source, but it cannot be verified (e.g., has no webpage) 3. Developed by small NGO/institution (hospital/centre, etc.) /specialised commercial business, funding body.

	4. Developed by government, university or as above but larger in scale. 5. Developed using nationally competitive government or research funding (e.g., Australian Research Council, NHMRC)
18	Evidence base: Has the app been trialed/tested; must be verified by evidence (in published scientific literature)? N/A The app has not been trialled/tested 1. The evidence suggests the app does not work. 2. App has been trialled (e.g., acceptability, usability, satisfaction ratings) and has partially positive outcomes in studies that are not randomised controlled trials (RCTs), or there is little or no contradictory evidence. 3. App has been trialled (e.g., acceptability, usability, satisfaction ratings) and has positive outcomes in studies that are not RCTs, and there is no contradictory evidence. 4. App has been trialled and outcome tested in 1-2 RCTs indicating positive results. 5. App has been trialled and outcome tested in > 3 high quality RCTs indicating positive results

App subjective quality

1	Would you recommend this app to people who might benefit from it? 1. Not at all I would not recommend this app to anyone. 2. There are very few people I would recommend this app 3. Maybe There are several people whom I would recommend it 4. There are many people I would recommend this app to 5. Definitely I would recommend this app to everyone
2	How many times do you think you would use this app in the next 12 months if it was relevant to you? 1. None 2. 1-2 3. 3-10 4. 10-50

	5. >50
3	Would you pay for this app? 1. No 3. Maybe 5. Yes
4	What is your overall star rating of the app? 1. ★ One of the worst apps I've used 2. ★★ 3. ★★★ Average 4. ★★★★ 5. ★★★★★ One of the best apps I've used

APPENDIX G

Intervention Feedback Interview Script

Call platform: Microsoft Teams Audio Call

Interview Duration: 30 minutes

Interview purpose: To gain feedback on participant experience

Compensation: RM10

Interview Content and Questions

[Greetings and self- introduction]. This interview is for your feedback for the program for future improvement. As you have consented to the interview, this session will be recorded. However, only de-identified transcribed data will be used for data analysis for this project only. If you are agreeable to the statement, I will start the recording now.

[wait for participant to say 'yes' or nod]

1. How was the whole program to you?
    a. (Elaborate if needed)* – Comments and feelings for reading content, daily practice, daily journaling, obstacles to sticking through the program.

[Participants will give comments on 4 aspect – reading content, daily practice, daily journaling, adherence issue – feedback given by participant on the aspects will not be repeated on later interview]

2. The 5-weekly reading content
    a. What was it like for you having to read the contents weekly?
        i. (Elaborate if needed)* – which part was okay for you? Which part is not okay for your practice?
    b. What do you think can be improved in terms of the reading content?
2. The 5-week daily practice
    a. How was 'Home Gym' for you?
        i. (Elaborate if needed)* – which part was okay for you? Which part is not okay for your practice?
    b. What do you think can be improved in terms of the daily practice?
        i. If asked to elaborate the question, researcher to direct participants to practice frequencies, duration, video and audio quality and content.
3. The daily journaling after practice
    a. How was the daily journaling for you?
        i. (Elaborate if needed)* – which part was okay for you? Which part is not okay for your practice?
    b. What do you think can be improved in terms of the daily journaling?

4. Adherence
    a. How was your experience sticking through/adhere to the program?
        i. (Elaborate if needed): What adherence issues that you have encountered during the program?
    b. How do you address the practice obstacle?
    c. What do you could be improved in terms of adherence?
        i. (Elaborate if needed)*: What are the improvements to us /future participants/yourself to improve adherence to practicing or to stick through the intervention after a person choose to participate?
5. Would you recommend to others?
    a. (Elaborate if needed)*- Would you be able to teach others? If asked about what is mindfulness and ways to cultivate mindfulness?

That wraps up for today's interview! Thank you for your time and all the feedback you have provided for the program, and, for future attempts too! I will not hold you for any much longer, goodbye and do take care!

*Elaboration/explanation were for the purpose of:

a. Participants' request.
b. Or, to prompt for feedback if participants could not think of any.
c. Or, to direct participants to the main interview purposes

APPENDIX H

Inspecting Age as Potential Confounding Variable

	ITT								PP							
	PSS T2				PSS T3				PSS T2				PSS T3			
Variable	R^2	ΔR^2	β	*p*	R^2	ΔR^2	β	*p*	R^2	ΔR^2	β	*p*	R^2	ΔR^2	β	*p*
Perceived Stress																
Step 1	.54			**<.001**	.51			**<.001**	.54			**<.001**	.51			**<.001**
PSS T1			.73				.71				.73				.71	
Step 2	.56	.03		.091	.53	.03		.076	.56	.03		.09	.53	.03		.08
Age			-.03	.667			-.11	.173			-.03	.67			-.11	.17
Study group			-.16	**.029**			-.16	**.037**			-.16	**.03**			-.16	**.04**
Worry																
Step 1	.74			**<.001**	.71			**<.001**	.54			**<.001**	.50			**<.001**
PSWQ T1			.86				.84				.73				.70	
Step 2	.77	.04		**.002**	.76	.05		**<.001**	.65	.11		**.003**	.67	.18		**<.001**
Age			-.03	.619			-.01	.819			-.04	.665			-.03	.765
Study group			-.19	**<.001**			-.23	**<.001**			-.34	**.001**			-.43	**<.001**

Note. PSS = Perceived Stress Scale ; PSWQ = Penn State Worry Scale; ITT = Intention-to-Treat; PP = Per-Protocol; T1 = Pre-test; T2 = Post-test; T3 = 1-month Follow-up

	ITT								PP							
	SCS-SF T2				SCS-SF T3				SCS-SF T2				SCS-SF T3			
Variable	R^2	ΔR^2	β	*p*	R^2	ΔR^2	β	*p*	R^2	ΔR^2	β	*p*	R^2	ΔR^2	β	*p*
Self-Compassion																
Step 1	.77			**<.001**	.74			**<.001**	.55			**<.001**	.52			**<.001**
SCS-SF T1			.88				.86				.74				.72	
Step 2	.78	.01		.060	.76	.02		**.015**	.60	.05		.071	.60	.11		**.005**
Age			.07	.195			.09	.113			.13	.201			.19	.057
Study group			.12	**.026**			.15	**.006**			.23	**.031**			.32	**.002**
Mindfulness																
Step 1	.66			**<.001**	.63			**<.001**	.47			**<.001**	.46			**<.001**
FFMQ T1			.81				.80				.69				.68	
Step 2	.68	.02		.092	.66	.03		**.026**	.54	.07		**.049**	.58	.12		**.006**
Age			.04	.507			.05	.410			.09	.401			.13	.237
Study group			.14	**.030**			.18	**.007**			.28	**.015**			.36	**.002**

Note. SCS-SF = Self-Compassion Scale Short-Form; FFMQ = Five Facet Mindfulness Questionnaire; ITT = Intention-to-Treat; PP = Per-Protocol; T1 = Pre-test; T2 = Post-test; T3 = 1-month Follow-up

	ITT								PP							
	Observing T2				Observing T3				Observing T2				Observing T3			
Variable	R^2	ΔR^2	β	*p*	R^2	ΔR^2	β	*p*	R^2	ΔR^2	β	*p*	R^2	ΔR^2	β	*p*
Observing Facet - FFMQ																
Step 1	.53			**<.001**	.62			**<.001**	.35			**<.001**	.47			**<.001**
Observing T1			.73				.79				.59				.68	
Step 2	.54	.01		.385	.63	.01		.267	.38	.03		.400	.50	.03		.313
Age			-.02	.816			.06	.358			-.04	.728			.10	.380
Study group			.10	.204			.10	.130			.15	.236			.16	.158
Describing Facet - FFMQ																
Step 1	.66			**<.001**	.63			**<.001**	.47			**<.001**	.43			**<.001**
Describing T1			.81				.79				.86				.65	
Step 2	.67	.01		.169	.64	.01		.270	.54	.07		**.048**	.48	.06		.108
Age			.02	.816			.02	.726			.08	.502			.09	.463
Study group			.12	.062			.11	.107			.28	.014			.25	**.036**

Note. FFMQ = Five Facet Mindfulness Questionnaire; ITT = Intention-to-Treat; PP = Per-Protocol; T1 = Pre-test; T2 = Post-test; T3 = 1-month Follow-up

	ITT								PP							
	ActAware T2				ActAware T3				ActAware T2				ActAware T3			
Variable	R^2	ΔR^2	β	*p*	R^2	ΔR^2	β	*p*	R^2	ΔR^2	β	*p*	R^2	ΔR^2	β	*p*
Act with Awareness Facet - FFMQ																
Step 1	.66			**<.001**	.63			**<.001**	.40			**<.001**	.37			**<.001**
ActAware T1			.81				.79				.63				.61	
Step 2	.68	.03		**.029**	.64	.03		**.038**	.51	.11		**.014**	.48	.11		**.020**
Age			.04	.517			.01	.914			.12	.300			.06	.638
Study group			.17	**.008**			.17	**.013**			.34	**.004**			.34	**.006**
Non-Judging Facet - FFMQ																
Step 1	.71			**<.001**	.65			**<.001**	.58			**<.001**	.48			**<.001**
Nonjudge T1			.84				.81				.76				.69	
Step 2	.72	.00		.673	.66	.01		.205	.59	.01		.683	.52	.05		.155
Age			.05	.452			.04	.580			.05	.615			.06	.567
Study group			-.02	.783			.12	.076			-.06	.571			.22	.055

Note. FFMQ = Five Facet Mindfulness Questionnaire; ITT = Intention-to-Treat; PP = Per-Protocol; ActAware = Act with Awareness; Nonjudge = Non-Judging; T1 = Pre-test; T2 = Post-test; T3 = 1-month Follow-up

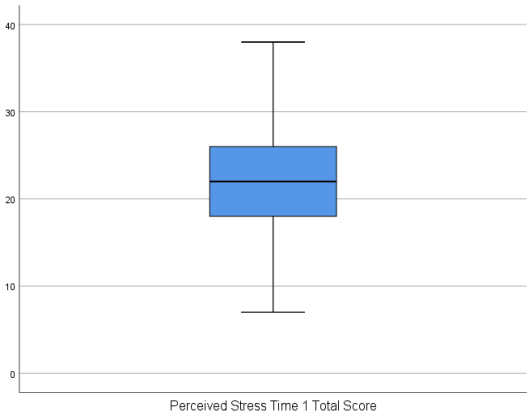
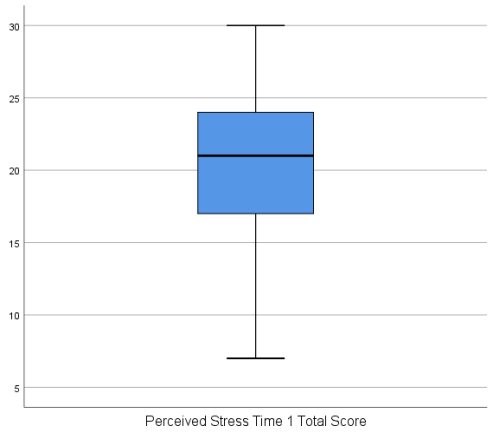
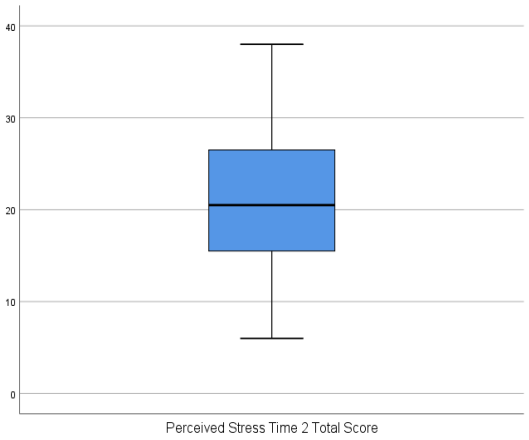
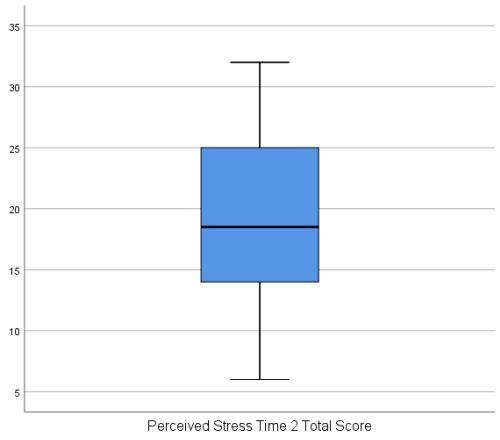
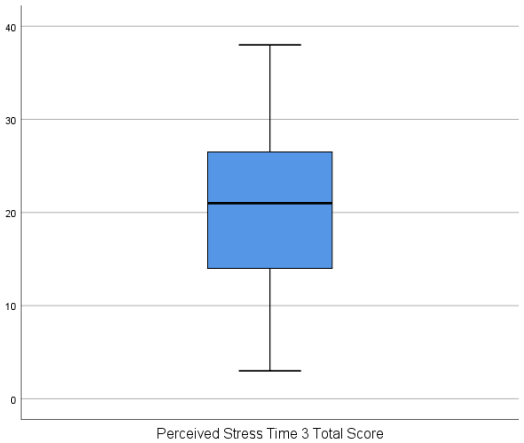
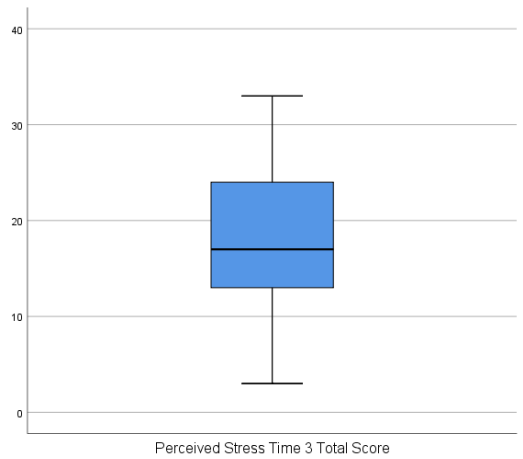
	ITT								PP							
	Nonreact T2				Nonreact T3				Nonreact T2				Nonreact T3			
Variable	R^2	ΔR^2	β	*p*	R^2	ΔR^2	β	*p*	R^2	ΔR^2	β	*p*	R^2	ΔR^2	β	*p*
Non-Reactivity Facet - FFMQ																
Step 1	.71			**<.001**	.67			**<.001**	.53			**<.001**	.51			**<.001**
Nonreact T1			.84				.82				.73				.72	
Step 2	.72	.01		.164	.69	.02		.128	.57	.04		.175	.56	.05		.117
Age			.08	.155			.10	.120			.13	.228			.16	.149
Study group			.09	.120			.10	.105			.18	.095			.20	.073

Note. FFMQ = Five Facet Mindfulness Questionnaire; ITT = Intention-to-Treat; PP = Per-Protocol; Nonreact = Non-Reactivity; T1 = Pre-test; T2 = Post-test; T3 = 1-month Follow-up

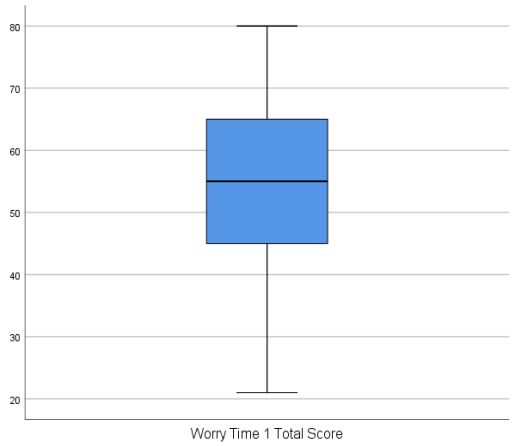
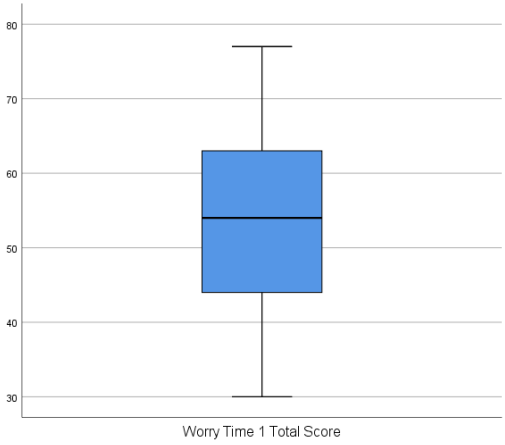
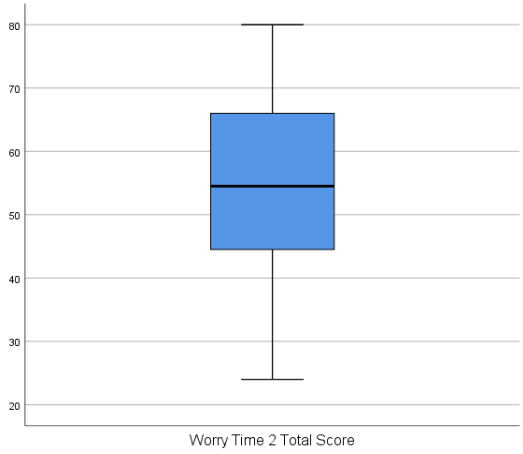
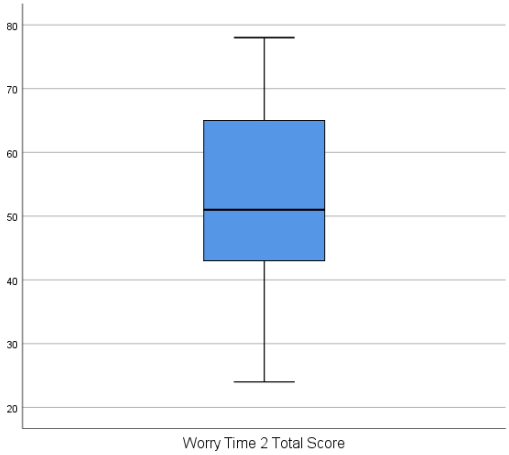
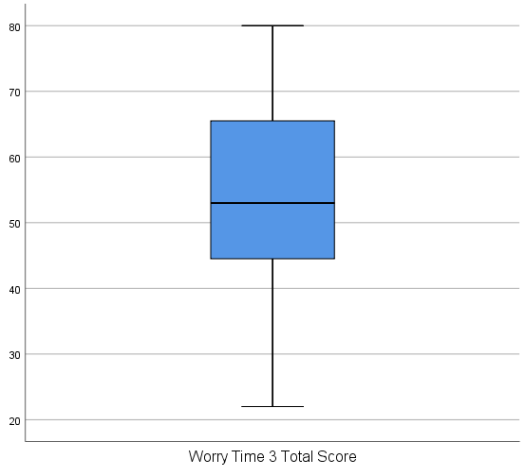
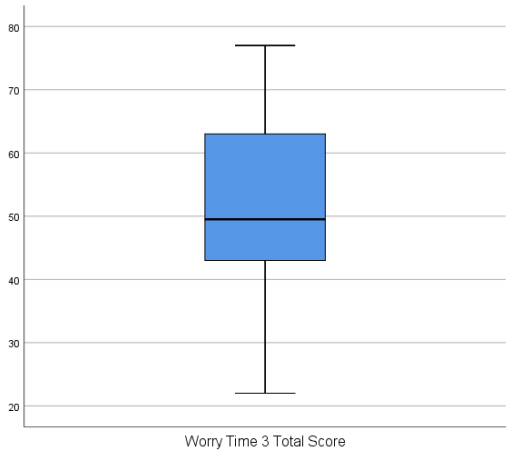
APPENDIX I

Assumption: Inspecting Outliers

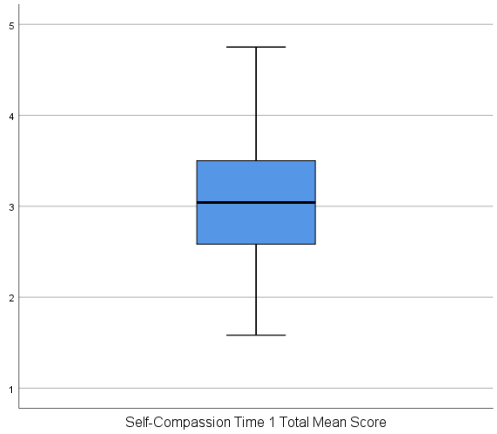
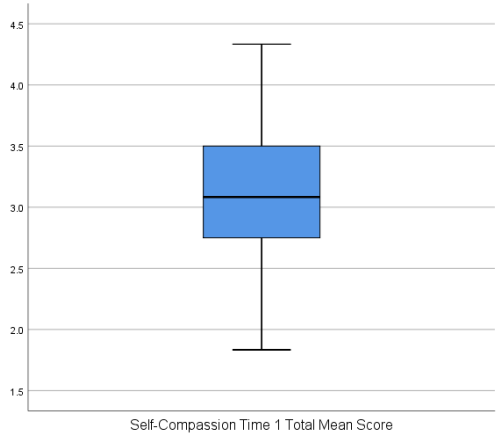
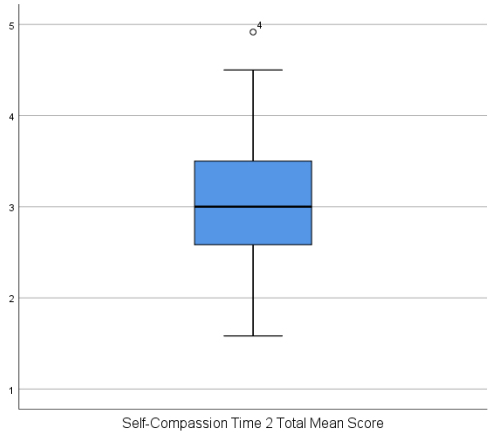
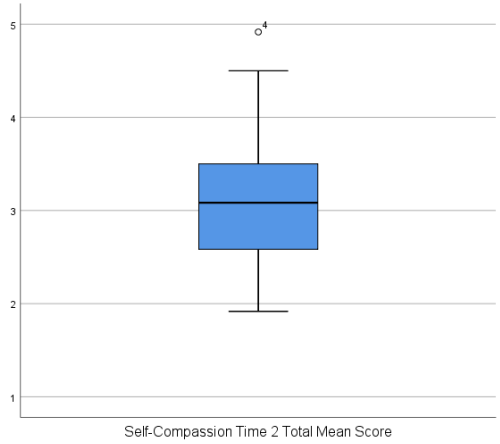
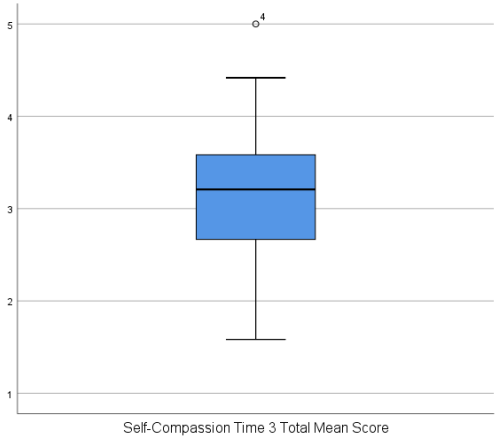
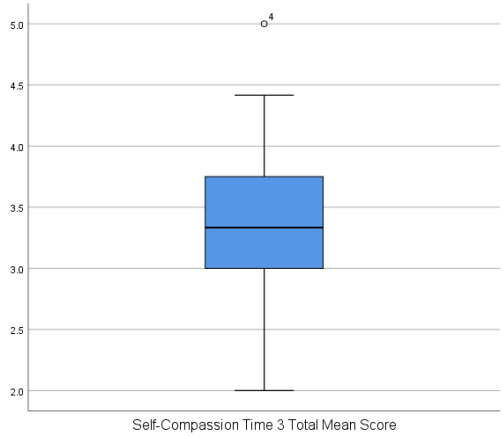
Perceived Stress

ITT	PP
T1	T1
	
T2	T2
	
T3	T3
	

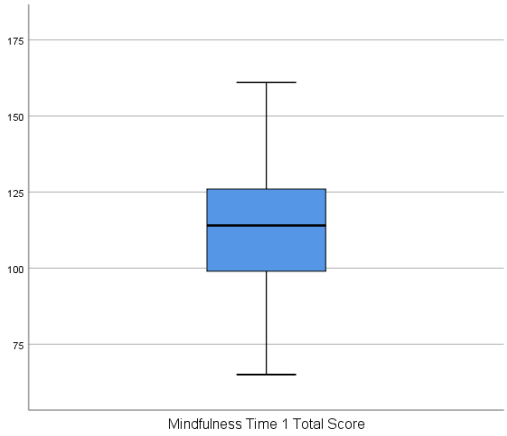
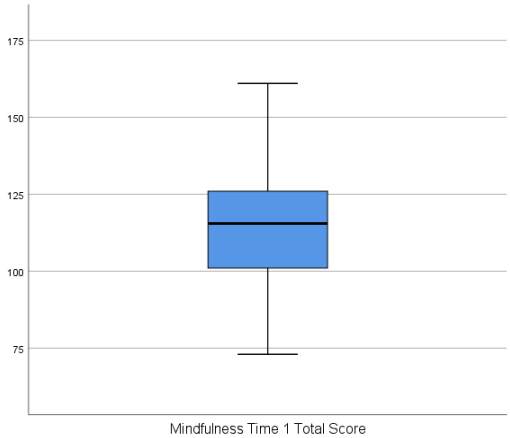
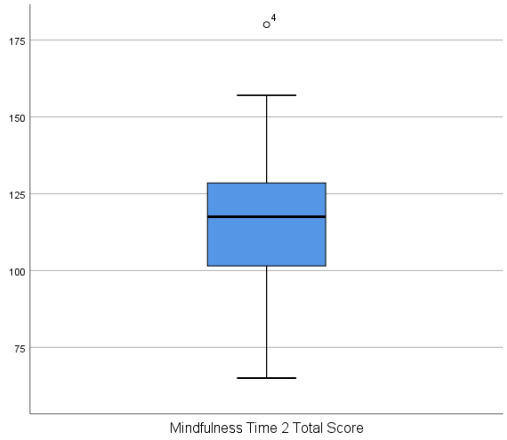
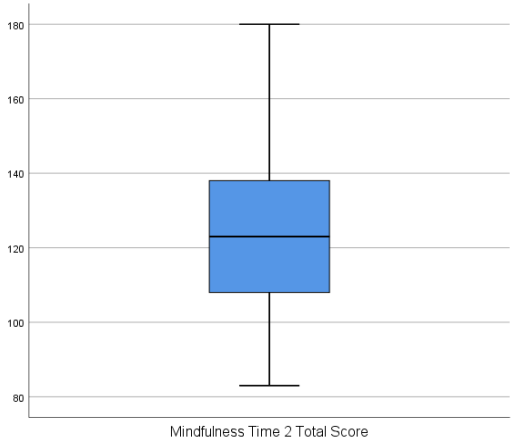
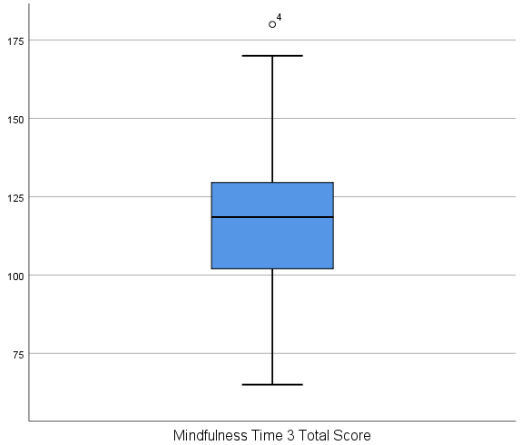
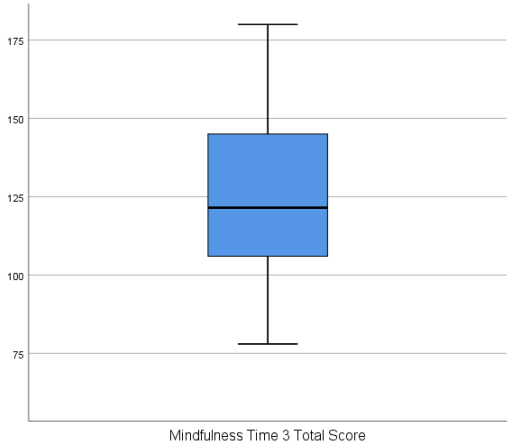
Worry

ITT	PP
T1	T1
	
T2	T2
	
T3	T3
	

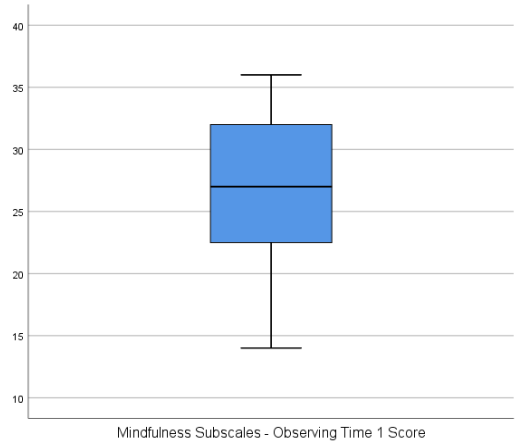
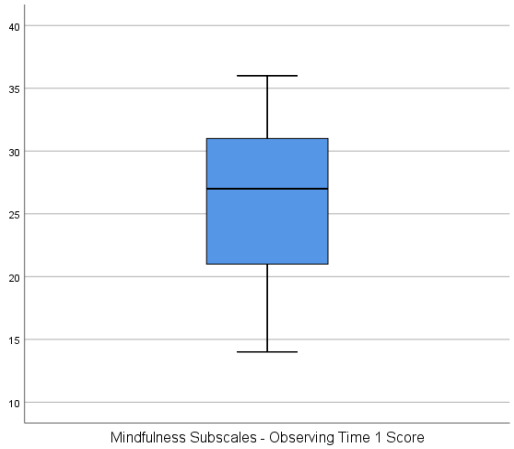
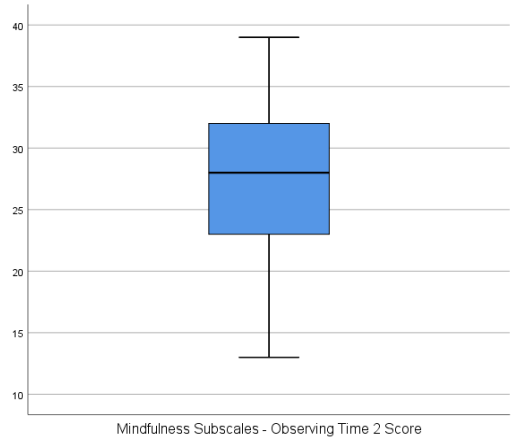
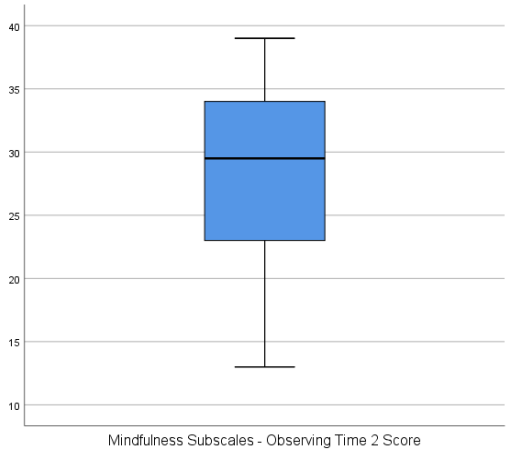
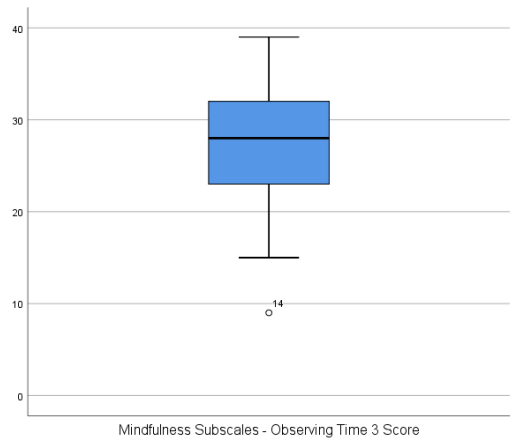
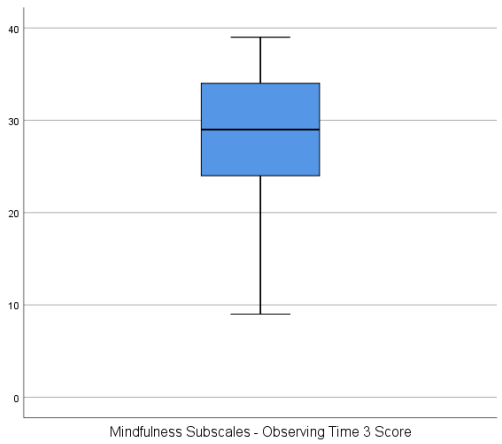
Self-compassion

ITT	PP
T1 	T1 
T2 – Outlier ID: 4 	T2 – Outlier ID: 4 
T3 – Outlier ID: 4 	T3 – Outlier ID: 4 

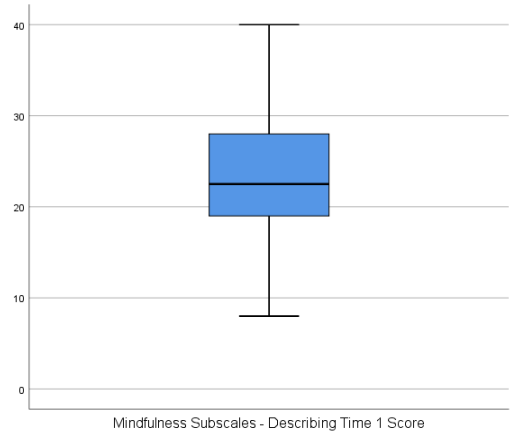
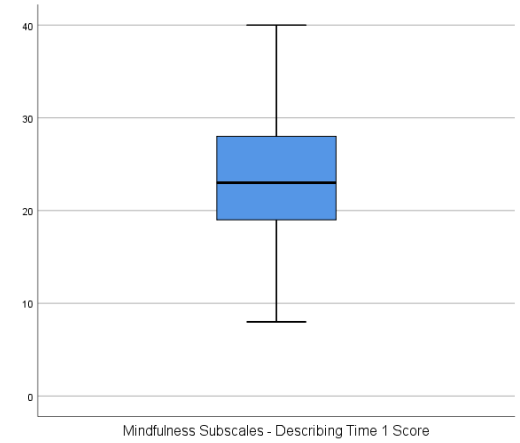
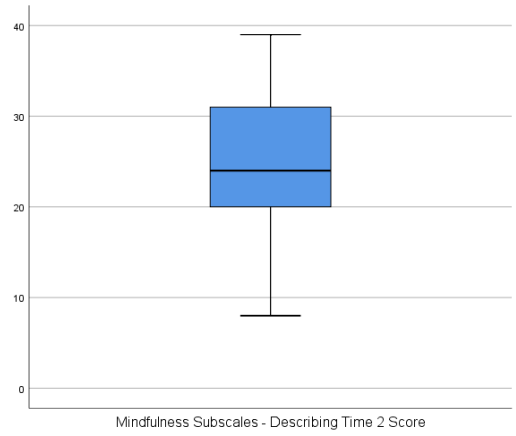
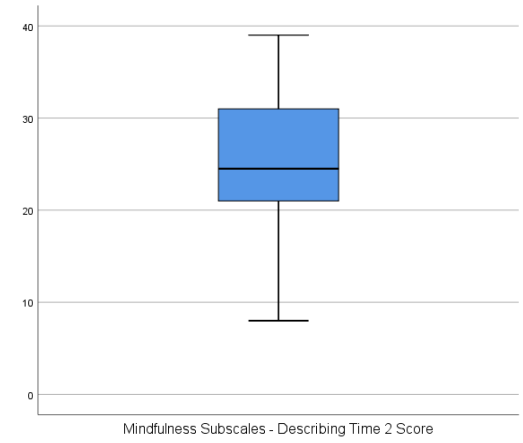
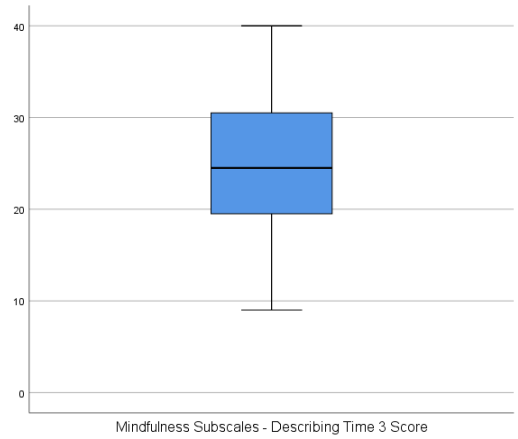
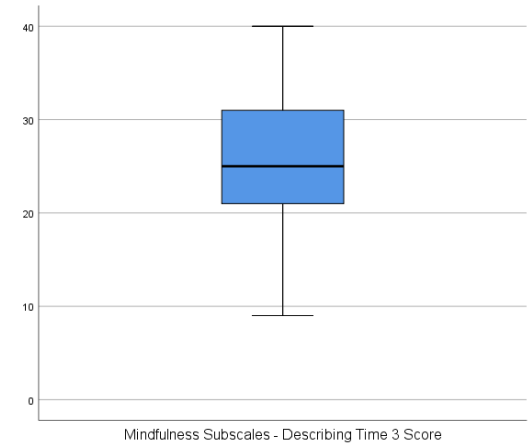
Mindfulness

ITT	PP
T1 	T1 
T2 – Outlier ID: 4 	T2 
T3 – Outlier ID: 4 	T3 

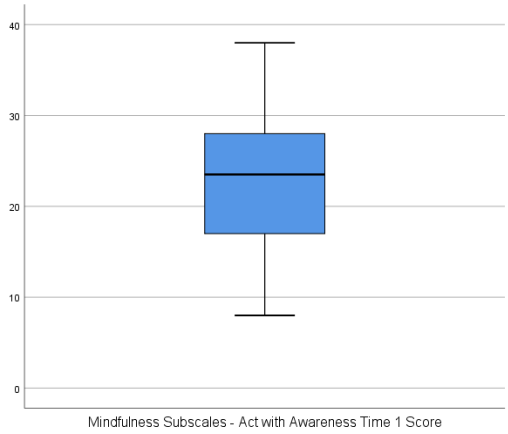
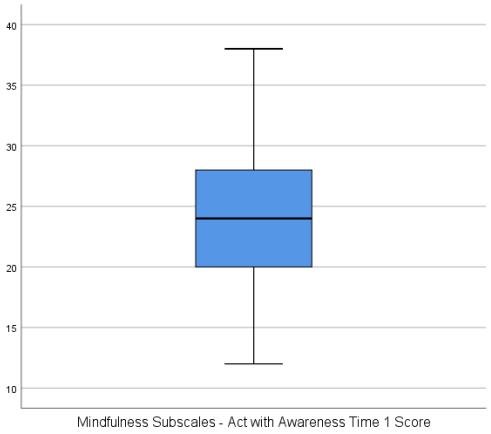
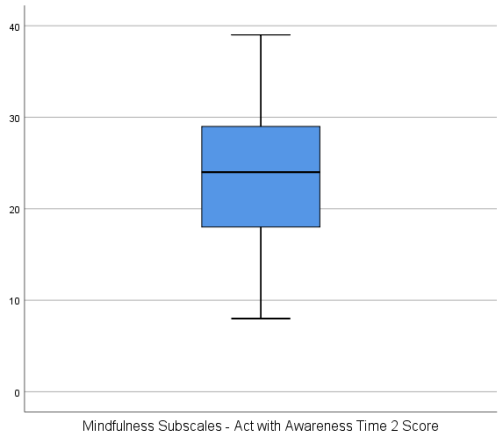
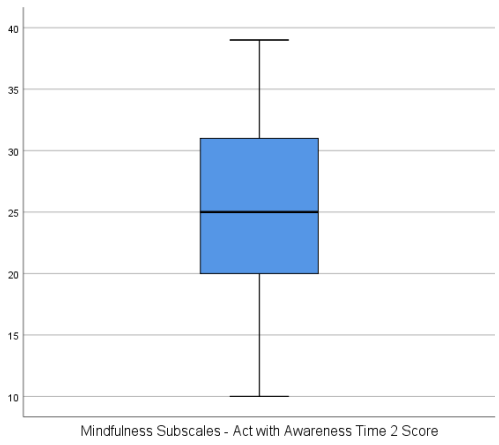
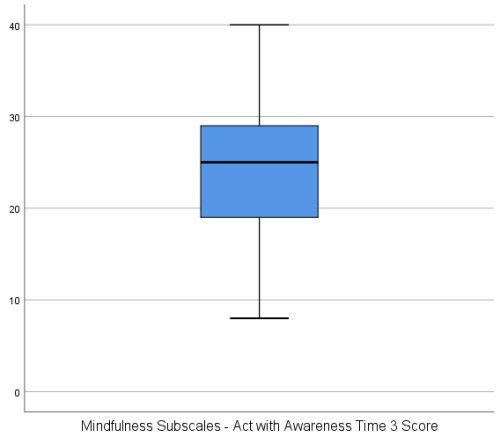
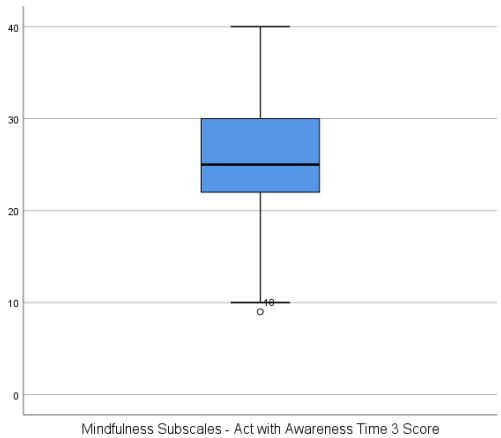
Mindfulness – Observing Facet

ITT	PP
T1 	T1 
T2 	T2 
T3 - Outlier ID: 14 	T3 

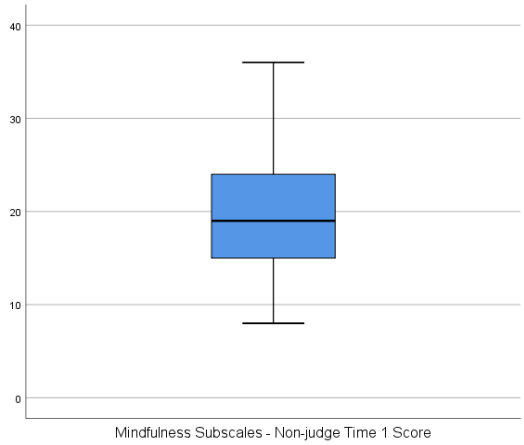
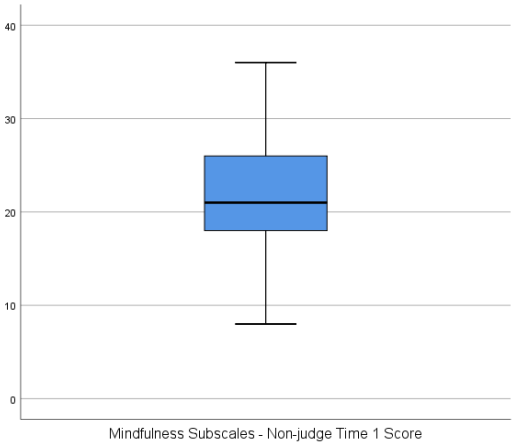
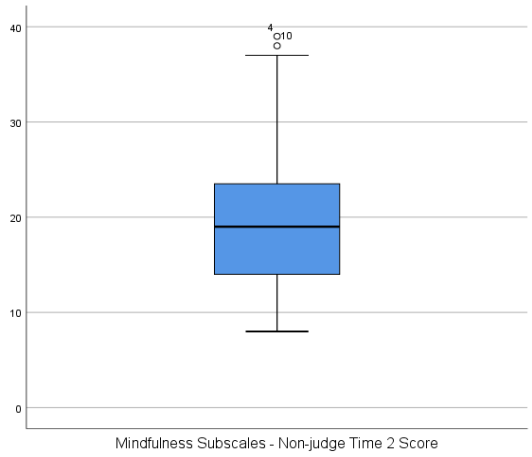
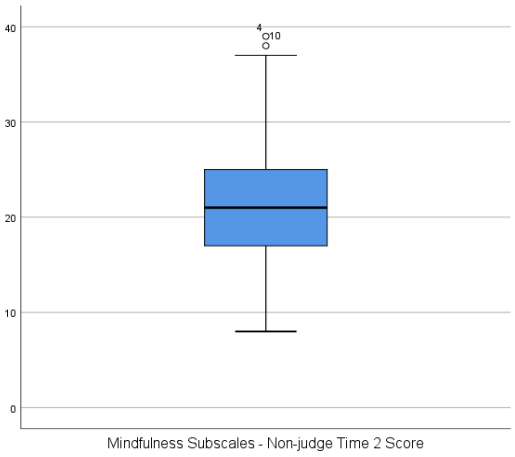
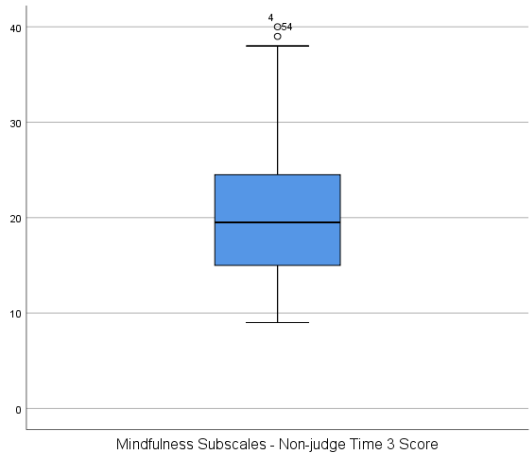
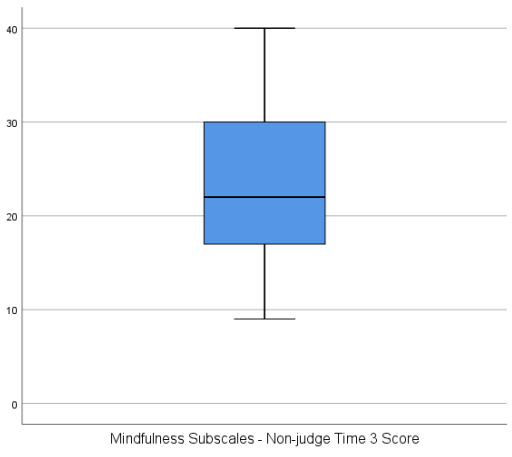
Mindfulness – Describing Facet

ITT	PP
T1 	T1 
T2 	T2 
T3 	T3 

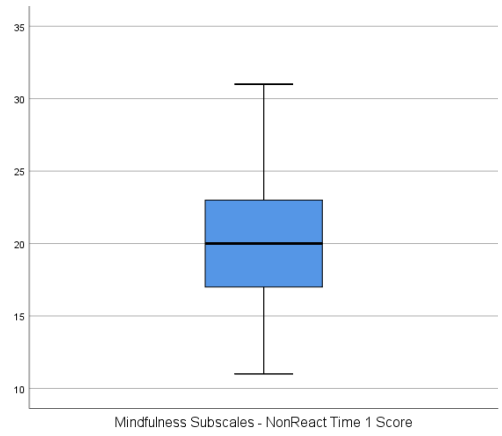
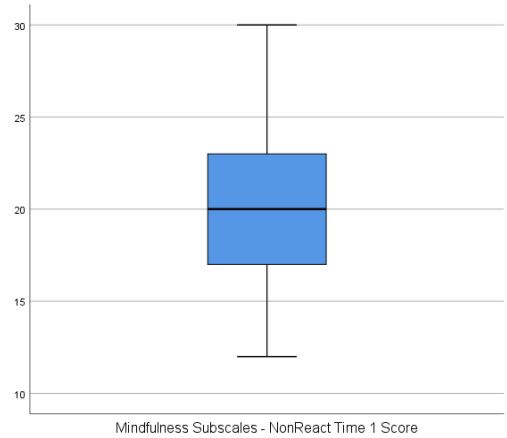
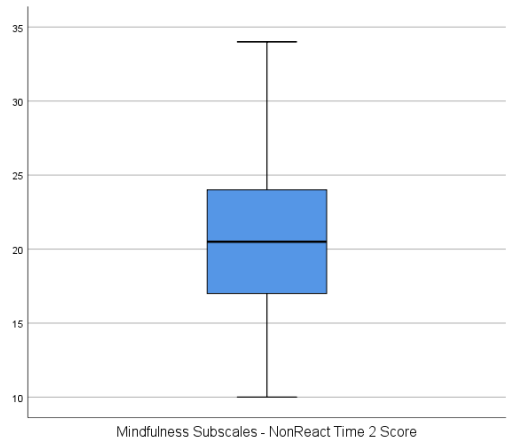
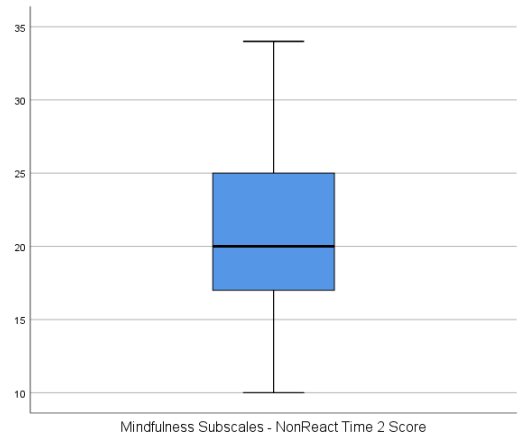
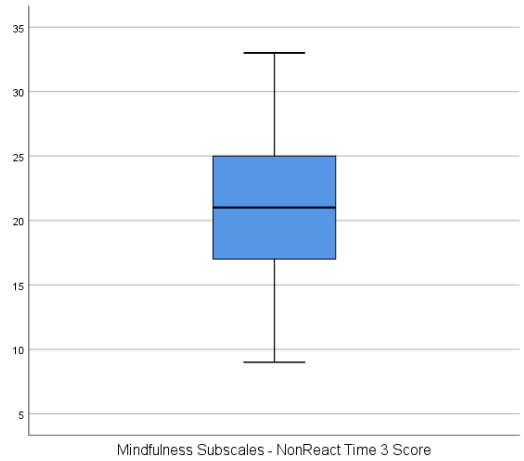
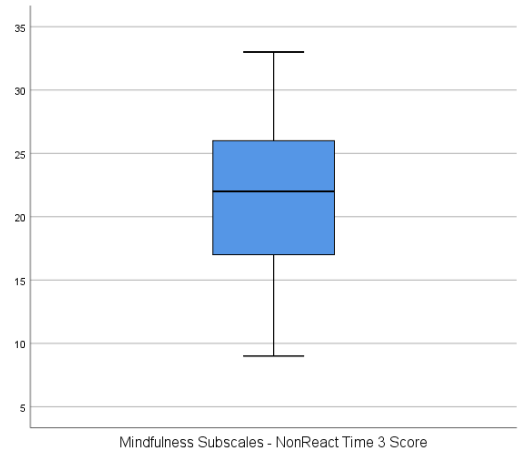
Mindfulness – Act with Awareness Facet

ITT	PP
T1	T1
	
T2	T2
	
T3	T3 – Outlier ID: 18
	

Mindfulness – Non-judging Facet

ITT	PP
T1	T1
	
T2 – Outlier ID: 4, 10	T2 – Outlier ID: 4, 10
	
T3 - Outlier ID: 4, 54	T3
	

Mindfulness – Non-Reactivity Facet

ITT	PP
T1 	T1 
T2 	T2 
T3 	T3 

Test for Influential Outliers

	Maximum Cook's Distance	
Variable	ITT	PP
Self-Compassion T2	.15	.27
Self-Compassion T3	.12	.22
Mindfulness T2	.19	.27
Mindfulness T3	.16	.21
Observing Facet T3	.08	.13
Act with Awareness Facet T3	.10	.15
Non-judging Facet T2	.14	.15
Non-judging Facet T3	.13	.14

Note. T2 = Post-test; T3 = 1-month Follow-up; ITT = Intent-to-Treat; PP = Per-Protocol

APPENDIX J

Assumption: Inspecting Sphericity

Mauchly's Test of Sphericity

	ITT		PP	
Variables	Statistic	Sig.	Statistic	Sig.
Perceived Stress	.74*	<.001	.78*	.005
Worry	.67*	<.001	.74*	.002
Self-compassion	.91*	.014	.93	.192
Mindfulness	.69*	<.001	.77*	.003
Observing Facet	.76*	<.001	.81*	.010
Describing Facet	.79*	<.001	.84*	.025
Act with Awareness Facet	.68*	<.001	.77*	.003
Non-Judging Facet	.94	.070	.92	.180
Non-Reactivity Facet	.94	.060	.97	.550

Note. ITT = Intent-to-Treat; PP = Per-Protocol

*Statistically significant result

APPENDIX K

Assumption: Inspecting Normality

Kolmogorov-Smirnov Normality Test

	ITT		PP	
Variables	Statistic	Sig.	Statistic	Sig.
Perceived Stress T1	.08	.20	.09	.20
Perceived Stress T2	.08	.20	.08	.20
Perceived Stress T3	.07	.20	.12	.09
Worry T1	.06	.20	.07	.20
Worry T2	.08	.17	.09	.20
Worry T3	.09	.09	.09	.20
Self-compassion T1	.07	.20	.09	.20
Self-compassion T2	.06	.20	.07	.20
Self-compassion T3	.07	.20	.10	.20
Mindfulness T1	.06	.20	.09	.20
Mindfulness T2	.05	.20	.09	.20
Mindfulness T3	.07	.20	.09	.20
Observing Facet T1	.12*	<.01	.13	.06
Observing Facet T2	.09	.10	.10	.20
Observing Facet T3	.10*	.02	.10	.20
Describing Facet T1	.09	.08	.10	.20
Describing Facet T2	.08	.20	.10	.20
Describing Facet T3	.06	.20	.08	.20
Act with Awareness Facet T1	.09	.08	.09	.20
Act with Awareness Facet T2	.08	.19	.13	.07
Act with Awareness Facet T3	.08	.13	.09	.20
Non-Judging Facet T1	.09	.07	.11	.20
Non-Judging Facet T2	.10*	.02	.14*	.03
Non-Judging Facet T3	.10*	.02	.12	.08
Non-Reactivity T1	.08	.14	.09	.20
Non-Reactivity T2	.10*	.04	.13	.06
Non-Reactivity T3	.09	.08	.10	.20

Note. T1 = Pre-test; T2 = Post-test; T3 = 1-month Follow-up; ITT = Intent-to-Treat; PP = Per-Protocol
*Statistically significant result

APPENDIX L

Assumption: Inspecting Homogeneity of Variance

Levene's Test of Equality of Error Variances

	ITT		PP	
Variables	Statistic	Sig.	Statistic	Sig.
Perceived Stress T1	.63	.43	.90	.35
Perceived Stress T2	.01	.91	3.42	.07
Perceived Stress T3	.77	.38	.77	.39
Worry T1	1.86	.18	2.84	.10
Worry T2	1.53	.22	6.69*	.01
Worry T3	.84	.36	6.59*	.01
Self-compassion T1	.89	.35	.55	.46
Self-compassion T2	.69	.41	.12	.73
Self-compassion T3	.39	.53	.26	.62
Mindfulness T1	.55	.46	1.93	.17
Mindfulness T2	.37	.54	.16	.69
Mindfulness T3	1.11	.30	.01	.95
Observing Facet T1	.19	.66	.95	.34
Observing Facet T2	.44	.51	1.21	.28
Observing Facet T3	.51	.48	1.14	.29
Describing Facet T1	.40	.53	.05	.83
Describing Facet T2	.35	.55	.28	.60
Describing Facet T3	.01	.92	.01	.95
Act with Awareness Facet T1	.83	.36	.37	.55
Act with Awareness Facet T2	2.67	.11	2.21	.14
Act with Awareness Facet T3	1.89	.17	2.53	.12
Non-Judging Facet T1	.22	.64	.28	.60
Non-Judging Facet T2	.26	.61	.23	.63
Non-Judging Facet T3	.51	.48	.13	.72
Non-Reactivity T1	2.35	.13	1.26	.27
Non-Reactivity T2	.12	.74	.19	.66
Non-Reactivity T3	.22	.64	.01	.93

Note. T1 = Pre-test; T2 = Post-test; T3 = 1-month Follow-up; ITT = Intention-to-Treat; PP = Per-Protocol
*Statistically significant result

APPENDIX M

Bootstrap Resampling for The Single Mediator and Multiple Mediator Analyses in ITT Analyses

		ITT (n = 92)			
				Bootstrapping Bca 95% CI	
Outcomes	Mediators	Point Estimate	SE	Lower	Upper
Self-compassion	M	.05	.03	-.003	.13
	Total Effect	**.14***	.07	.005	.27
Mindfulness	SC	**1.80***	1.27	.02	4.79
	Total Effect	4.71	2.51	-.28	9.70
Stress	M	-.55	.38	-1.39	.07
	SC	**-.63***	.52	-1.98	-.004
	Total Indirect	**-1.18***	.65	-2.69	-.20
	M vs. SC	-.08	.64	-1.61	.97
Worry	M	-.60	.61	-2.13	.22
	SC	-.47	.60	-2.08	.16
	Total Indirect	**-1.07***	.78	-.03	-2.99
	M vs. SC	.14	.93	-1.91	1.88

Notes. Confidence intervals that do not contain zero indicate that the point estimate is statistically significant. ITT = Intent-to-Treat; PP = Per-Protocol; M= mindfulness; SC = self-compassion; Bca 95% CI = bias-corrected and accelerated 95% confidence intervals; SE = standard error.

* Indicates a significant indirect effect