

**South African University Students' User Experience of
Mobile Applications for Anxiety and Depression**

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ABSTRACT

Background: Globally, university students have been shown to be disproportionately affected by common mental disorders (CMDs). The primary CMDs reported by students have been anxiety and depression. Research on South African students has proven no exception. Moreover, this predicament is worsened by low rates of help-seeking, historically entrenched systemic inequality regarding access to resources, a lack of culturally appropriate interventions, and a population that tends to be overly self-reliant.

Objective: With the prevalence of CMDs in mind, as well as the many challenges students face, it was deemed worth exploring current, available alternatives. Given some evidence for the use of mobile mental health (MMH) applications (apps) among university students in high income countries, the current study aimed to investigate South African university students' user experience of MMH apps for depression and anxiety.

Methods: South African students in the psychology department of the University of Cape Town were recruited to make use of two MMH apps, Headspace and Woebot, for two weeks total, but one week per app. They then completed online questionnaires related to their experience of using these apps, and semi-structured interviews were conducted, recorded, and transcribed by the researcher. Due to a lack of meaningful data from the online questionnaires, only the semi-structured interviews were used for analysis. Braun and Clarke's (2006) method of thematic analysis was used to analyse the data.

Results: After analysing the semi-structured individual interviews, themes were defined, described, and discussed. The participants expressed that the apps facilitated insight and self-awareness, and were found to be supportive, encouraging, and convenient. However, they valued different aspects of the two apps, with each offering something that the other did not. The importance of each design was also highlighted as a vital factor in the overall user experience, while affordability was also emphasised for the student population in particular.

Conclusion: The two apps were found to be accessible and acceptable for participants in this South African university setting. Additionally, user experience design enhanced their experiences. However, as each app offered different approaches and benefits, the integration of features could be something to work towards. There are also important ethical considerations that need to be factored before recommending them. Further research and development are required in order to address these concerns.

Keywords: user experience; university students; mobile mental health applications; depression; anxiety

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CHAPTER ONE: INTRODUCTION

In the realm of higher education, the widespread prevalence of common mental disorders (CMDs) among university students has become a growing concern with profound implications. Among CMDs, anxiety and mood disorders have particularly emerged as significant challenges, impacting students' wellbeing and academic success on a global scale (Auerbach et al., 2016). Notably, South African first-year university students are disproportionately vulnerable to CMDs, with alarmingly high rates reported (Bantjes et al., 2019). This chapter aims to delve into this issue by investigating the potential of mobile mental health (MMH) applications (apps) as a proactive strategy. Through an analysis of existing research and user experiences, this study seeks to illuminate the efficacy and adaptability of MMH apps in addressing CMDs among university students, particularly in the South African context. By understanding the role MMH apps can play and uncovering insights on their utilisation, this research could provide insight into a means of addressing the mental health needs of university students.

Globally, the prevalence of CMDs among university students has been shown to be high (20.3%), with anxiety disorders ranking as the most common (11.7-14.7%), and mood disorders following as second most common (6.0-9.9%) (Auerbach et al., 2016). One study showed that first-year university students in South Africa are particularly vulnerable (Bantjes et al., 2019), with nearly 40% of a student sample reporting at least one lifetime CMD. Among those, generalised anxiety disorder (GAD) and major depressive disorder (MDD) were reported to have the highest prevalence over a 12-month period at 20.8% and 13.6% respectively, while the lifetime prevalence of these disorders reflected inverse rankings with MDD at 24.7% and GAD at 22.6%.

The high prevalence of CMDs is compounded by low rates of help-seeking. A systematic review of twenty-two independent studies reported that young people (adolescents and young adults) typically had difficulties overcoming stigma, demonstrated poor insight into their own mental health symptoms, and tended towards relying on their own resources (Gulliver et al., 2010); all significant stumbling blocks to help-seeking. In South Africa, this problem is exacerbated by an under-resourced healthcare system. The legacy of apartheid is evident in the lack of accessible mental health services, with understaffing, unattainable services, and a lack of culturally adaptive interventions (Lund & Flisher, 2006; Lund et al., 2012; Petersen & Lund, 2011). Consequently, even students who are willing to access services may not have adequate resources to do so, while the services may not be suitable or sufficiently culturally attuned.

Increasingly, technology is being sought out as a means of overcoming some of these barriers, with MMH apps offering the potential to address these challenges (Firth et al., 2017; Ng et al., 2019; Torous et al., 2018). Stigma, widely regarded as a primary barrier to accessing help (Michel et al., 2019), is countered especially well by using MMH apps as there is no need for another person to be involved (Fitzpatrick et al., 2017). Prentice and Dobson (2014) suggest that these apps are also useful in dealing with time conflicts and lengthy waiting lists, while the barriers mentioned by Gulliver et al. (2010) such as negative views towards seeking support, the cost of conventional services, transportation logistics, worries about mistreatment and not being able to find the location can all potentially be mitigated by mobile applications. This represents promising alternatives for students who are willing to seek help but who may typically be prevented from accessing appropriate services.

There is a plethora of MMH apps available on both Apple and Google Play app stores (Nicholas et al., 2016), though most studies related to these apps focus on depression and anxiety disorders (Mehotra & Tripathi, 2018). With regards to the types of therapy that these

apps offer, several make use of cognitive behavioural therapy (CBT) techniques and mindfulness practices (Mani et al., 2015; Martinengo et al., 2021), which are both utilised as effective therapies for depression and anxiety (Fitzpatrick et al., 2017; Hofmann & Gómez, 2017).

In terms of the evidence for MMH apps that make use of these modalities, both Woebot (Abd-alrazaq et al., 2019; Bibault et al., 2019; Fitzpatrick et al., 2017; Kocaballi et al., 2019; Kretzschmar et al., 2019; Ly et al., 2017; Singh, 2020; Vaidyam et al., 2019) and Headspace (Fish & Saul, 2019; Flett et al., 2019; Kubo et al., 2018; Laurie & Blandford, 2016; Zollars et al., 2019) have been the subject of multiple studies; an indication of the rapidly growing academic interest in their potential real-world application.

Not all studies that included Woebot focused exclusively on it though, as most sought to review chatbots comparatively. For example, in a scoping review by Abd-alrazaq et al. (2019), 41 apps were examined, of which Woebot was one. A systematic review by Bibault et al. (2019) looked at six different apps, including Woebot and reported on findings already established by Fitzpatrick et al. (2017). In that study, which made use of a randomised control trial (RCT), depression symptoms (PHQ-9) and anxiety symptoms (GAD-7) were measured before and after the treatment; it was found that the participants who used Woebot compared favourably to the control group (Fitzpatrick et al., 2017). Another systematic review conducted by Kocaballi et al. (2019) concluded that “user satisfaction, user engagement and dialogue quality” (p. 1) were all improved as a result of personalisation, and favourable evaluations were given of Woebot in terms of “empathic responses tailored to reported mood, tailoring of support content depending on the reported mood, daily prompting messages to initiate a conversation, weekly charts depicting the reported mood and textual summary” (p. 6). In fact, only Fitzpatrick et al. (2017) have completed an RCT, which is the primary evidence base for Woebot. Clearly, more research is needed to explore the efficacy of

Woebot. This could also explain why the reviews mentioned above are unanimous in recommending further research into chatbots in general.

With regards to Headspace, Fish and Saul (2019) conducted a randomised-controlled study and found that participants experienced significantly decreased symptoms of depression in comparison to the control group. In another RCT, Flett et al. (2018) found that participants who used Headspace showed improvements regarding symptoms of depression, resilience and mindfulness when compared to the control group, at both 10- and 30-day intervals. Data from a study by Kubo et al. (2018) that included cancer patients and their caregivers found that the app improved quality of life and reduced stress among this population. The study also found that the use of a mindfulness app is both feasible and acceptable in an integrated healthcare system. In a study on user experience, Laurie and Blandford (2016) found that users were principally concerned about making time for use of the app while leading demanding lives. Furthermore, participants offered valuable recommendations for future app design, stressing the importance of managing user expectations related to app usage. They suggested creating designs that are accommodating to users with busy schedules and ensuring that the content remains relevant to a diverse range of users.

With diversity of users in mind, a review conducted by Mehotra and Tripathi (2018), that analysed results from studies on 18 different MMH apps in a variety of different countries, showed positive outcomes in nearly all findings. That study was carried out in mostly Western, high-income countries (HICs), however, with only India, China and Peru being exceptions. In contrast, a review of mobile health (mhealth) studies conducted in LMICs showed that while there is a growing body of research of mhealth in general, there is a scarcity of studies that provide information specifically on the adoption (user uptake and engagement) of mobile health technology (Chib et al., 2015). This may raise the question: what is the acceptability of MMH apps in LMIC settings such as South Africa?

In a study conducted in Indonesia (Ardi et al., 2018), demographically diverse respondents were generally accepting of using MMH app services and more than half of them believed that using these services could help them overcome a number of obstacles including distance to support services and time limitations. The majority of respondents also expressed their optimism in the potential efficacy of utilising such services.

South African students who were interviewed about their willingness to adopt mobile phone technology to access health information shared similar sentiments, leading researchers to conclude that use of this technology is a “useful, convenient and cost-effective health-promotion strategy” (Cilliers et al., 2018, pp. 59). However, this study only considered health information in general, and did not specifically assess attitudes towards accessing mental health information. To date, there is a dearth of studies examining the willingness to engage with MMH apps among university students in South Africa. To the best of the researcher’s knowledge, there is no literature on South African university students’ user experience of MMH apps either. Understanding more about this could enable future research and development of relevant and acceptable apps for South Africa’s university student population.

Thesis Outline

Chapter Two of the thesis reviews the existing literature on university students and their prevalence of mental health difficulties, the consequences of those mental health difficulties being left untreated, their treatment-seeking patterns, and lastly, mobile health as an intervention for this specific population. Chapter Three describes the methods applied to execute this study, while Chapter Four presents and discusses the findings of the study, with reference to the relevant, existing literature. The concluding chapter offers a summary of the major findings, a consideration of the study’s limitations, and recommendations regarding

student mental health, MMH apps as an intervention or supplement to traditional forms of therapy or counselling, and the role of technology in mental health and wellbeing going forward.

CHAPTER TWO: LITERATURE REVIEW

This literature review aims to offer a comprehensive overview of several key aspects pertaining to the role of MMH apps in addressing the mental health of university students. Specifically, it establishes the prevalence of mental health difficulties among this population, examines the potential consequences of untreated mental health issues, investigates treatment-seeking behaviours among university students, and evaluates the potential of MMH apps as a means of addressing treatment barriers and supporting student mental wellbeing. It also seeks to provide a theoretical framework for the psychology involved in user experience (UX) design.

Prevalence of Mental Health Difficulties Among University Students

In a review of literature extending over three decades and covering several diverse countries around the world, university students were shown to be more likely to experience psychological distress than the non-student adult population (Sharp & Theiler, 2018). Moreover, the review demonstrated that this psychological distress, though problematic within itself, was also associated with reduced academic performance, higher dropout rates, physical health problems, and various harmful behaviours such as substance abuse, self-injury and increased physical aggression.

Moreover, the World Health Organisation's report "Preventing suicide: a global imperative" (WHO, 2014) highlights that suicide ranks as the second leading cause of death among young adults. Disturbingly, research conducted by Mortier et al. (2018) reveals that university students face an even higher risk of suicide compared to their non-student counterparts. These findings underscore the urgent need to take proactive measures to address mental health challenges and enhance suicide prevention efforts within university settings.

Mental health difficulties are also prevalent among university students in the African context. For instance, a study conducted in Ghana found that 57% of respondents indicated experiencing mild to extremely severe depression, 84% reported mild to extremely severe anxiety, and 49% reported mild to extremely severe stress (Kugbey et al., 2015). Similarly, a study by Peltzer et al. (2013) revealed that 7% of Nigerian university students showed symptoms of severe depression, while 25.2% exhibited moderate to severe depression symptoms. In an Ethiopian student sample, at least 60% met the diagnostic criteria for a CMD (Haile et al., 2017). In a Kenyan survey of university students, the overall prevalence of moderate depressive symptoms was 35.7%, with 33.5% among males and 39.0% among females, while the prevalence of severe depression was 5.6%, with similar rates for males and females (Othieno et al., 2014). Furthermore, a study conducted in an undergraduate Somaliland university found that nearly one in five participants was experiencing mental distress (Hersi et al., 2017). These findings highlight the significant mental health challenges faced by university students in the African context.

While research on this topic in South Africa is limited at present, some existing literature has raised concerns about the prevalence and sociodemographic factors associated with CMDs among first-year students in post-apartheid South Africa. Bantjes et al. (2019) reported a high incidence of mental health issues among first-year students at two South African universities. The 12-month prevalence of any CMD was 31.5% (95% CI = 29.1-34.0), with GAD being the most common at 20.8% (18.7–23.0), followed by MDD at 13.6% (11.9–15.5). The prevalence of the other disorders assessed were comparatively low, with 12-month rates ranging from a high of 5.6% for Alcohol Use Disorder (AUD) to a low of 1.0% for bipolar spectrum disorder. Furthermore, sociodemographic factors such as being female, having atypical sexual orientation, and living with a disability, were identified as potential

factors associated with mental disorders among first-year university students (Bantjes et al., 2019).

Another noteworthy finding from the study was that the median age of onset for any of the CMDs was 15 years (Bantjes et al., 2019), indicating that the majority of first-year university students had already experienced mental health difficulties before starting their undergraduate studies. This highlights the importance of implementing mental health support initiatives at earlier levels of education to prevent or mitigate CMDs for future students.

Overall, the findings of Bantjes et al. (2019) suggest a higher occurrence of CMDs, such as anxiety and depression, among first-year university students in post-apartheid South Africa compared to the general population, as documented in a national prevalence study of South African adults not at university, where it was shown that the 12-month prevalence rate of anxiety and mood disorders was at 8.1% and 4.9%, respectively (Williams et al., 2008).

Another South African study by Pillay et al. (2020) focused on depressive symptoms among first-year students at a rural university in KwaZulu Natal. Approximately one-fifth of the participants reported feelings of hopelessness, loss of interest, low self-esteem, and low mood, while 20.3% questioned if life was worth living. Seven percent of the participants admitted having thoughts of suicide. The transition from high school to university life, coupled with academic stressors, financial constraints, and limited support networks, were considered potential influences that exacerbated the depressive symptoms among this vulnerable population. The unique sociocultural and environmental characteristics of rural areas, such as limited access to mental health resources, economic inequality, and social isolation, were identified as further contributing factors to the development and persistence of depression (Pillay et al., 2020).

Collectively, these studies emphasise a notable increase in CMDs like anxiety and depression among first-year university students in post-apartheid South Africa when compared to the wider population. These results underline the pressing requirement for extensive mental health education, psychological assistance, and interventions in university environments, especially in regions with limited resources, to tackle the escalating mental health challenges faced by students.

Treatment-Seeking Among University Students

Although mental health issues are so prevalent among university students, a significant number do not seek treatment for these difficulties. Research by Marsh and Wilcoxon (2015) found that despite the documented benefits of counselling and mental health services on academic performance and degree attainment, only about 10% of psychologically distressed college students ever seek professional help. Bantjes et al. (2020) found that only 28% of South African students with CMDs had accessed treatment, with historically marginalised students being least likely to have done so.

Several factors, including structural and attitudinal barriers, influence students' treatment-seeking behaviour. Structural barriers, such as financial constraints, time limitations, and waiting lists, can impede access to mental health care. For example, a study conducted by Dunley and Papadopoulos (2019) found that finances posed a significant obstacle for students seeking mental health treatment. Insufficient financial resources and high treatment costs often hinder students from obtaining the necessary help they require. Additionally, some students lack health insurance coverage or have inadequate coverage, and even those with insurance may face high co-payments or out-of-pocket expenses for mental health services (Eisenberg et al., 2013). These financial barriers to treatment access for university students are likely to be even more acute in lower resource countries. Another

notable barrier is the availability and accessibility of mental health services. Some university counselling centres have limited staff and resources, resulting in long wait times for appointments and limited availability during crisis situations (Eisenberg et al., 2013). Additionally, students may be unaware of the mental health resources available to them, or they may face logistical barriers such as transportation or scheduling conflicts that prevent them from accessing services (Marsh & Wilcoxon, 2015). Moreover, in the South African context, people who are not fluent in English may encounter challenges in accessing mental health services due to language barriers (Hagan et al., 2020).

Attitudinal barriers can also impede treatment-seeking behaviour. Research indicates that the stigma surrounding mental health is a significant barrier to seeking help (Eisenberg et al., 2013). Students may fear being perceived as weak or incompetent if they seek help for their mental health difficulties, which can lead to feelings of shame and embarrassment. Additionally, students may perceive a lack of support from their peers and families, further reinforcing the stigma and discouraging help-seeking (Eisenberg et al., 2013). Some students come from cultures or communities where mental health is stigmatised or misunderstood, leading them to avoid seeking help out of fear of ostracism or discrimination (Roessler, 2016). A study by Xiao et al. (2017) also revealed that many students perceive mental health treatment as ineffective, which diminishes their motivation to seek care. However, research has shown that students with positive attitudes towards mental health treatment are more likely to seek help, even if many do not follow through (Dunbar et al., 2018). These positive attitudes may include beliefs that treatment is effective, seeking help is a sign of strength, and mental health is a legitimate concern.

Numerous studies have demonstrated the detrimental consequences of untreated mental health difficulties among university students. These consequences range from impaired academic performance (Auerbach et al., 2016; 2018; Bruffaerts et al., 2018) to

suicidal ideation and/or suicidality (Eskin et al., 2016; Mortier et al., 2018; Owusu-Ansah et al., 2020), as well as links between sleep difficulties and self-harm and suicide (Russell et al., 2019). Additionally, research has shown associations between mental health issues and educational attrition (Markoulakis & Kirsh, 2013) and challenges with employment opportunities in the long-term (Kovess-Masfety et al., 2016), which can have profound consequences for young adults. Further, in a global survey 20% of students with mental health difficulties experienced severe role impairment, including in areas such as home management/chores, meaningful relationships, and social life (Alonso et al., 2018). In South Africa, 41.3% of the students who reported a mental disorder experienced severe role impairment (Alonso et al., 2018).

In conclusion, university students face various barriers when seeking treatment for mental health issues, including structural barriers (such as financial constraints, time limitations, and limited resources) and attitudinal barriers (such as stigma and perceptions of treatment effectiveness). These barriers can prevent students from accessing the necessary care required, leading to adverse consequences such as impaired academic performance and compromised wellbeing. It is crucial for universities to address these barriers by providing more accessible mental health services and resources, with MMH apps offering a potential means of doing so.

MMH applications

Kern et al. (2018) define an MMH app as a software application designed to provide mental health support and resources to individuals through their smartphones or other mobile devices such as tablets. These apps aim to improve mental wellbeing, enhance self-care practices, and offer tools for managing and monitoring mental health conditions such as depression (Firth et al., 2017a), anxiety (Firth et al., 2017b), bipolar disorder (Ben-Zeev et al.,

2018), psychosis (Kumar et al., 2018), insomnia (Kuhn et al., 2022), and others (Neary & Schueller, 2018).

The National Institute of Mental Health (NIMH) categorises mental health apps into six functional categories, which include self-management, cognition improvement, skills training, social support, symptom tracking, and passive data collection (NIMH, 2017).

Self-management (NIMH, 2017) refers to the user inputting information into the app, enabling it to offer feedback. This can involve setting medication reminders or using the app to create strategies for dealing with stress, anxiety, or sleep issues. Certain software can also utilise external devices to monitor heart rate, breathing patterns, blood pressure, and other metrics, assisting the user in monitoring progress and receiving guidance.

Cognition improvement apps (NIMH, 2017) are focused on cognitive remediation, which aim to enhance thinking skills. These applications typically cater to individuals facing significant mental illnesses.

Skill-training apps (NIMH, 2017) often have a gamified feel compared to other mental health apps, as they assist users in acquiring new coping mechanisms or thinking skills. For instance, a user might engage with an educational video regarding anxiety management or the significance of social support. Following that, they can select and implement new strategies, using the app to monitor the frequency of practicing those newly acquired skills.

Social support apps (NIMH, 2017) enable user interaction with another individual. This particular type of app technology provides supplementary support. The app facilitates connections with peer support networks or shares relevant information with trained healthcare providers who can offer guidance and therapy choices. Researchers are actively

studying the optimal level of human interaction required for app-based treatments to be efficacious.

Symptom tracking apps (NIMH, 2017) gather data using the inherent sensors in smartphones and wearable devices. These sensors have the capability to capture movement patterns, social interactions (such as call and text frequencies), temporal behaviour variations, vocal tone, speed, and more. In the future, these data could potentially be analysed by apps to ascertain the user's current mental state in real-time. Such apps might even identify behavioural changes that indicate an impending mood episode, such as mania, depression, or psychosis. While an app may not replace the expertise of a mental health professional, it could potentially notify caregivers when a client requires additional attention. The objective is to create apps that cater to diverse users, including those with severe mental illnesses.

Finally, data collection apps (NIMH, 2017) can gather data without any help from the user. Receiving information from a large number of individuals at the same time can increase researchers' understanding of mental health and help them develop better interventions.

Smartphone-based mental health apps offer a promising avenue for expanding access to quality mental health treatment. The growing number of mobile health (mHealth) apps specifically designed for mental health reflects their potential impact. Studies show that approximately 29% of mHealth apps focus on mental health diagnosis, treatment, or support, indicating a significant presence in the digital health landscape (Chandrashekar, 2018). According to research conducted in 2017, it is estimated that there are around 325,000 mHealth apps available, with mental health apps accounting for approximately one-third of disease-specific apps (Research2guidance, 2017).

Apps such as these are becoming increasingly popular as a way to address the growing mental health needs of populations worldwide (Luxton et al., 2011). These

interventions use mobile devices to deliver mental health services and support to individuals in need and are designed to provide users with support and resources for managing mental health difficulties (Fleming et al., 2018). These apps may include features such as mindfulness exercises, symptom tracking, and CBT tools (Kumar et al., 2018), among others.

Effectiveness of MMH apps

Research has shown that MMH apps can be effective in improving mental health outcomes. A meta-analysis of 66 RCTs aimed to explore the effectiveness of these interventions in improving various mental health outcomes and determine their clinical utility (Linardon et al., 2019). The findings suggest that app-supported smartphone interventions have demonstrated significant benefits compared to control conditions in improving depressive symptoms (other than negative affect), generalised anxiety symptoms, stress levels, quality of life, general psychiatric distress, social anxiety symptoms, and positive affect. These effects remained robust even after considering potential biasing factors. However, the interventions did not show significant benefits for symptoms of panic, post-traumatic stress, and negative affect.

Notably, interventions that included a CBT-based app and professional guidance along with reminders yielded larger effects across multiple outcomes. The study also found no significant difference between smartphone interventions and other active interventions such as face-to-face therapy or computerised treatment, although the number of studies in this comparison was limited (Linardon et al., 2019).

The study concluded that while MMH apps should not replace professional clinical services, they have the potential to be cost-effective, easily accessible, and low-intensity interventions for individuals who cannot access standard psychological treatment (Linardon et al., 2019). These findings bring to the fore the importance of up-to-date guidance on the

evidence base and clinical usefulness of app-supported smartphone interventions to bridge the treatment gap for people with mental health problems.

Luxton et al. (2011) found that the effectiveness of MMH interventions is thought to be due to their ability to provide support and resources in a convenient and accessible format. Mobile device-based interventions are available 24/7, allowing individuals to access support when they need it most (Fleming et al., 2018). Additionally, these interventions can be tailored to the individual's specific needs, providing personalised support and resources (Linardon et al., 2019). This convenience eliminates many barriers that often prevent individuals from seeking traditional mental health support, such as limited availability, stigma, or geographical constraints.

MMH apps also empower individuals to take an active role in managing their mental wellbeing. These applications often offer personalised features, allowing users to set goals and track their progress (Magwood et al., 2022). By providing self-help strategies and educational content, these apps can enhance self-awareness and equip individuals with the necessary tools to navigate their mental health journey.

MMH apps also contribute to raising awareness about various mental health conditions by providing information, symptom checkers, and screening tools (Linardon et al., 2019). They enable individuals to recognise early signs of distress and seek appropriate support promptly (Kumar et al., 2018). Early intervention facilitated by these apps can help prevent the escalation of mental health issues and promote timely professional intervention if required.

Limitations of MMH apps

Despite the potential benefits of mobile mental health interventions, there are several challenges and limitations to their use. One of the most significant challenges is the lack of regulation and oversight of mental health apps (Marshall et al., 2020). Many mental health apps are not developed by mental health professionals and may not be evidence-based, making it difficult for individuals to determine the effectiveness and safety of these interventions (Neary & Schueller, 2018). Additionally, some apps may collect sensitive data without adequate security measures, raising concerns about privacy and confidentiality (Zhou et al., 2019). Although this data could be essential for improving app functionality and tailoring interventions, it also raises concerns about privacy and data security. Users are encouraged to carefully review the privacy policies of these apps and ensure that their personal information remains protected.

While there is a plethora of MMH apps available, not all are created equal. The study conducted by Marshall et al. (2020) showed the quality and efficacy of these applications can vary significantly. Some apps were shown to lack scientific validation, evidence-based approaches, or expert involvement. The authors concluded that it was crucial for users to conduct thorough research, consult reviews, and choose apps that have been developed in collaboration with mental health professionals or organisations.

Furthermore, Schueller et al. (2018) indicated that MMH applications should be viewed as supplements to traditional mental health care, rather than substitutes. While these apps may offer valuable resources and support, they are not often viewed as a replacement for face-to-face therapy or professional medical advice.

Another limitation of MMH interventions is the potential for low engagement and adherence. Research has found that individuals may download mental health apps but not use

them regularly or sufficiently engage with the content to gain the benefits of usage (Fleming et al., 2018). Additionally, some individuals may prefer face-to-face therapy over MMH apps (Luxton et al., 2011) or may not feel comfortable sharing personal information via text messaging (Fleming et al., 2018).

Overall, MMH interventions are a promising approach to addressing the growing mental health needs of populations worldwide. These interventions have been shown to be effective in improving mental health outcomes and providing accessible support and resources (Fleming et al., 2018). However, the lack of regulation and oversight of mental health apps (Kumar et al., 2018), potential for low engagement and adherence (Linardon et al., 2019), and limitations in the suitability of these interventions for individuals with severe mental health difficulties (Luxton et al., 2011) must be addressed. Further research is needed to identify best practices for the development and delivery of MMH apps.

Use of MMH Apps in University Populations

There is a growing body of literature on university students' use of MMH apps. Researchers have examined various aspects, including effectiveness and outcomes, factors influencing adoption and engagement, preferences and features, challenges and barriers, and integration with existing mental health services.

In an RCT conducted by Huberty et al. (2019), the 'Calm' app demonstrated significant efficacy in reducing stress, improving mindfulness, and enhancing self-compassion among students at a United States (US) university. The study reported moderate to large effect sizes, indicating the app's beneficial impact on student well-being. Lee and Jung (2018) conducted a pilot trial on the efficacy of the 'DeStressify' app among Canadian university students and found that its use reduced trait anxiety and improved general health, energy, and emotional well-being.

Other studies have explored university students' adoption and engagement with MMH apps. Lattie et al. (2022) studied the 'Intellicare' app and found low uptake among students at a US university, who reported wanting to spend less time on digital devices during remote learning. Flett et al. (2019) examined the 'Headspace' and 'Smiling Mind' apps with students at a New Zealand university and observed a significant drop-off in usage after 10 days, but users nevertheless showed improvements in depressive symptoms, adjustment to university, resilience (Smiling Mind only), and mindfulness (Headspace only). Cliffe et al. (2023) investigated the 'BlueIce' app for addressing self-harm and found that students at a United Kingdom (UK) university who self-harm considered the app an acceptable and appealing source of support for self-harm and other mental health difficulties.

Borghouts et al. (2021) conducted a web-based survey and reported that only 21.2% of students at a US university reported using mental health apps. The study found that perceived stress, perceived need to seek help, past use of professional services, and social influence were positively associated with MMH app use, while privacy concerns were negatively associated. Stigma, age, and gender did not have a statistically significant effect. Mitchell et al. (2022) explored challenges and barriers related to college students' intentions to use the 'MySSP' app at a US university. The study investigated the predictors and moderators of behavioural intention in adopting mental health apps. Based on the findings, this study suggests that effective interventions should focus on features related to performance expectancy (usefulness) and social influence (norms) when developing and testing mental health apps. Moreover, the study highlights the negative impact of mental health stigma on the adoption of such apps, emphasising the need for stigma considerations in the implementation of mental health interventions targeting university students.

The existing studies mentioned above primarily consisted of quantitative research conducted in developed, high-income countries (HICs) such as the UK, USA, Canada, and

New Zealand. There is an absence of studies, both quantitative and qualitative, specifically addressing the use of MMH apps among university students in Africa or South Africa. While there is an example of an online, semi-assisted CBT program used for depression among South African university students (Gericke et al., 2021), it does not fall under the category of MMH apps.

In the context of mobile health apps in South Africa, there are studies that focus on physical health interventions, such as promoting physical activity (Smith & Volkwyn, 2022), examining the acceptability of mobile phone use among students to seek health information (Cilliers et al., 2018), and investigating the usability and efficacy of a mobile health app in influencing dietary choices (Slazus et al., 2022). However, the specific exploration of MMH app usage among university students in African or South African contexts remains limited, and further research is warranted.

In 2018, approximately 60% of the South African population owned smartphones, with 73% of these owners falling within the 18 to 34 age range (Pew Research, 2019), which aligns with the university student demographic. Given the high prevalence of smartphone ownership and the likelihood of university students being part of this demographic, even in an LMIC like South Africa, using MMH apps to provide services, where there is a high prevalence of CMDs (Bantjes et al., 2019) and a well-established shortage of resources (Jack et al., 2014), seems promising.

With that in mind, conducting qualitative research on MMH app user experience may offer valuable insights such as understanding user needs and preferences, identifying usability issues, exploring satisfaction and engagement, uncovering user insights, supporting iterative app development, and enhancing adoption and adherence. It may provide a deeper understanding of user needs, improve app usability, guide app customisation, and foster user-

centred development. Ultimately, qualitative research on MMH apps has the potential to improve interventions and contribute to better mental health outcomes for app users.

The Psychology of User Experience Design: A Theoretical Framework

To ensure effectiveness and user engagement in these interventions, it is crucial to consider the psychology of user experience (UX) design. UX design encompasses the principles and strategies aimed at enhancing the usability, satisfaction, and overall experience of individuals interacting with digital platforms (O'Brien & Toms, 2008). By incorporating a theoretical framework that integrates psychological principles and understanding of human behaviour, such as cognitive psychology and human-computer interaction, designers can create applications that are intuitive, engaging, and promote positive user experiences (Desmet & Fokkinga, 2020). This approach recognises the importance of user-centred design, customises interventions to individual needs, and considers factors such as motivation, usability, information presentation, and visual aesthetics (Ng et al., 2019). Understanding the psychology of UX design can contribute to the development of MMH app interventions that are not only effective but also appealing, fostering long-term engagement, and promoting positive mental health outcomes.

In this section, a theoretical framework will be proposed for better understanding the psychology of UX design, focusing on the persuasive attributes of digital products, user needs, engagement, affective design, and trust in intelligent systems.

Persuasion is a crucial component of UX design that seeks to influence users' attitudes and behaviours. In a systematic review by Matthews et al. (2016) persuasion is defined as the process of designing digital and mobile technologies to change users' attitudes, behaviours, and intentions. They argue that the designers of mobile applications can incorporate persuasive attributes into digital products by using design elements such as colour,

typography, and layout. In these researchers' analysis of the impact of persuasive technologies on promoting physical activity, self-monitoring was the most persuasive design feature. From an aesthetic perspective, some studies included apps where self-monitoring was recorded in the form of manual logging, similar to journaling, or visual representations of physical activity such as calories burned featuring a fire emoticon as further examples.

Understanding user needs is another essential feature of UX design. Desmet and Fokkinga (2020) propose a model of user needs that designers can use to design and evaluate digital products. The model incorporates Abraham Maslow's (1943) hierarchy of needs: physiological, safety, love and belonging, esteem, and self-actualisation, and then expands on this by categorising and describing 13 fundamental needs: autonomy, beauty, comfort, community, competence, fitness, impact, morality, purpose, recognition, relatedness, security, and stimulation. They propose that designers can use this model to identify the user's primary needs and design digital products that meet those needs. For example, a user may have a physiological need for a product that provides comfort or convenience, such as an app that delivers ready-made meals to your residence. However, in some cases, more than a single need may be met too. An app that facilitates communication between friends could meet the user's needs for relatedness, recognition and stimulation is another such example. Relatedness may be met by mutual self-generated texts, while recognition could be the respective parties' profile pictures and how they are embedded in the text exchange, and finally, both the act of texting and the design of the app itself could be stimulating.

Engagement is another important facet of UX design. O'Brien and Toms (2008) define engagement as "a quality of user experiences with technology that is characterised by challenge, aesthetic and sensory appeal, feedback, novelty, interactivity, perceived control and time, awareness, motivation, interest, and affect" (p. 949). Designers can promote engagement by creating digital products that are visually appealing, intuitive to use, and offer

feedback and rewards for user actions. For example, a social media app may offer notifications and rewards for users who share content, comment on posts, and interact with other users.

Affective design is another essential attribute of UX design that focuses on the emotional aspects of the product design. Gan et al. (2021) note that designers can create affective designs by understanding the fundamentals of emotions and incorporating emotional elements into the product design. These emotional elements include colour, shape, typography, sound, and other sensory aspects that can create a positive emotional response from users. Affective design can create a positive emotional response from users, leading to increased engagement and a better user experience overall.

Trust is also an essential component of UX design, particularly in the design of intelligent systems. Holliday et al. (2016) argue that designers must create designs that foster trust between the user and the intelligent system. They suggest several design strategies for building trust, including transparency, explanations, and accountability. Transparency involves providing users with information about how the intelligent system works and how it makes decisions. Explanations provide users with information regarding how the intelligent system arrived at a particular decision or recommendation. Accountability involves providing users with a mechanism for reporting errors or problems with the intelligent system. In this way, the user is able to feel safer or more comfortable in interacting with such a system.

In summary, understanding the psychological factors that influence UX is critical for designers when designing digital products. Incorporating persuasive attributes, meeting user needs, promoting engagement, creating affective designs, and fostering trust in intelligent systems are all essential considerations for designers to create digital products that offer a satisfying user experience. By considering these factors, designers can create digital products

that meet users' needs, provide a satisfying user experience, and drive engagement and loyalty. Similarly, when designing mental health apps, it is crucial for designers to comprehend the psychological factors that contribute to user experience, ensuring that the apps incorporate persuasive attributes, meet the specific needs of users, promote engagement, employ affective designs, and foster trust in the digital intervention, ultimately leading to a satisfying user experience and increased user engagement with the app.

Conclusion

University students are at high risk for mental health difficulties and face numerous barriers to accessing treatment. While MMH apps have the potential to increase access to mental health support for university students, particularly in resource-constrained settings, existing research on students' user experience with these apps is limited, concentrated in high income countries and largely quantitative in nature. Therefore, it is crucial to initiate research in LMICs like South Africa, particularly using a more qualitative framework to explore users lived experiences of using MMH apps. Such research can enhance understanding of the benefits and limitations of MMH app usage in a university setting, providing valuable insights for improving mental health support in these contexts.

CHAPTER THREE: METHODS

3.1 Research Aim

This purpose of this study was to inquire into the phenomenon of university students' experience in engaging with MMH apps designed to address depression and anxiety. The primary objective was to methodically examine and better understand the phenomenon of user experience, focusing specifically on the use of Woebot and Headspace. The overarching research question guiding this investigation was: "What constitutes the user experience among university students engaging with mobile mental health applications, with a specific emphasis on Woebot and Headspace, in the context of managing depression and anxiety?"

Within this broader inquiry, a pivotal sub-question sought to illuminate the prominent features and functionalities of Woebot and Headspace that resonated with the university students who participated in this study. Moreover, an additional query was aimed at revealing the perceptions of university students regarding the use, acceptability, and efficacy of Woebot and Headspace in not only addressing their individual mental health needs but also in catering to the mental health requirements of their peers.

Given the scarceness of existing literature on this subject, especially within the African context, this study aimed to establish a baseline understanding of this subject. By exploring an under-researched topic at the intersection of technology and psychology, this research endeavoured to lay the groundwork for potential future investigations and advancements in the understanding, design, and application of technology-based interventions for the mental health challenges students face, particularly within the African university settings.

3.2 Research Design

Qualitative research methodology was selected due to its applicability to the research objectives. The study's primary aim was to undertake an explorative approach to understanding how university students engage with MMH apps, particularly those designed to alleviate symptoms of depression and anxiety. This methodology empowered the researcher to capture participants' perspectives in their own authentic voices, facilitating a more in-depth portrayal of their lived experiences.

In accordance with the assertion by Teherani et al. (2015), qualitative methods provide a valuable means of attaining more nuanced data regarding individual experiences. This aligned with the study's primary objective, as it aspired to take an exploratory approach to better understand the participants' interactions with these mental health applications. Given the intersection of technology, psychology, and sociocultural factors related to university settings, the implementation of qualitative methods was therefore deemed a sensible and congruous choice. This approach allowed the researcher to analyse and interpret the participants' responses, revealing some of their overt and covert preferences and aversions, their narratives regarding their respective experiences, and assisted in identifying factors that affected their interactions with both Woebot and Headspace. This inquiry and analysis were instrumental in addressing the fundamental research question, which sought to investigate the multifaceted experiential landscape encompassing the use of these applications.

While the interview questions were partly framed by existing user experience principles as outlined previously in the literature review chapter, they were phrased openly and allowed scope for participants to introduce their own unique experiences in relation to their respective engagements with the apps. During the data analysis phase, there was no predefined coding framework; instead, codes and categories organically emerged from the

data itself. These emerging data points were subsequently examined in the context of existing literature to identify commonalities and disparities with prior research results.

3.3 Sample

A sample of 25 undergraduate university students within the Psychology Department at the University of Cape Town (UCT) were recruited to participate in the study. They were chosen due to both the convenience and accessibility of the participants, with their interest in psychology being a potential means of sustaining engagement in the study. This involved a one-stage sampling process. At first, undergraduate and postgraduate students within the Psychology Department of UCT were emailed and invited to participate in the study. Following that, a selection of the first 25 participants who were at least 18 years old and were representative of the diverse UCT student population demographic was implemented. No postgraduate students expressed interest in participating. The demographics for the selection were based upon age, gender, and race/ethnicity to include as close an approximation of the larger student population as was possible. To attain as accurate and representative sample as possible, a calculation was made by using the university's database on the demographic makeup of students within the institution. The participants were required to have their own mobile device that could install both of the apps being used in the study. Recruiting 25 participants provided a suitable number of participants to make up for possible attrition. An advert (see Appendix C) was created inviting students to participate in the study.

3.4 Procedures

The sample was selected using predetermined selection criteria, which was based upon a representative demographic model of UCT. An email was then sent to interested participants that explained the study, including the purpose of the study; what would be required of participants; and the risks and benefits associated with participating. This would

cover one week of the use of a CBT-chatbot called Woebot and one week of a mindfulness meditation app called Headspace. Volunteers were requested to email the researcher with their basic demographic information (their age and how they identify in terms of gender and race/ethnicity) to select a sample that was demographically representative and inclusive of the UCT student population. No mental health screening was done on the participants as this was not suitable for the purpose of this study. An advert was designed by the researcher and approved by the supervisors of the study as well as the ethics research committee.

Participants interested in volunteering in the study contacted the researcher by email to express their interest. They were then contacted by the researcher, as per their preference, through a phone call, text, or email, with instructions as to how to proceed with the study. The instructions included how to download and make use of the apps, while any further assistance was offered by the researcher, in the event they encountered any difficulties.

Through this contact, the researcher became acquainted with each of the participants of the study in the process. While coaching was offered with regards to app use, all participants were able to access, download and use the apps without any assistance of that nature.

Regarding assistance, some students were given data, however, as a means to complete their participation in the study. Google Forms' links to mini-questionnaires (see Appendix A: Headspace and Appendix A: Woebot), consent to participate and permission for external transcription documents (see Appendix D) were also emailed to the participants selected for this study. At the end of the respective students' two-week app use, individual interviews were arranged and recorded via the use of mobile cellular phones or personal computers and recording software. Once the interviews were completed, they were transcribed using Microsoft OneNote, allowing for the analysis process. All transcriptions were completed by the researcher alone.

3.5 Description of MMH apps

Woebot uses CBT as its modality (Fitzpatrick et al., 2017), while Headspace uses mindfulness and meditation (Zollars et al., 2019), which are both evidence-based approaches (Hofmann et al., 2012; Yogeswaran & El Morr, 2021). The outcomes of their usage have also been researched, which made them viable selections for this study. Furthermore, they are also highly popular as evidenced by download counts and ratings (Apple App Store, 2020a; Apple App Store, 2020b; Google Play, 2020a; Google Play, 2020b), an indication of their widespread usage at the time of the study. Additionally, with both apps using different therapeutic modalities, each was believed to be able to provide valuable information regarding what students were looking for, rather than what researchers believed students were looking for. Woebot is a chatbot that responds in pre-programmed ways according to the user's responses which are often a selection from a static multiple-choice menu. For example, it could ask the user to do a check-in and inquire about how the user is feeling, and the user will be given a set of emotions from which they may choose one selection. Woebot would then respond according to the chosen emotion, expressing its closest approximation of understanding and warmth. It is not intelligent in the manner that more sophisticated artificial intelligence, deep learning, or machine learning are, where novel responses can be offered based upon analysis of previous dialectical user-software interaction. Woebot offers an 8-week CBT program that features mood check-ins, psychoeducational videos, typical CBT exercises such as reality testing and cognitive distortion identification, while a toolkit is available for various skills the user may want to develop. It is currently only offered in English. The chatbot itself is robotic- rather than human-looking but is cartoonish and friendly in appearance with round eyes and a friendly smile, with blue, turquoise, and mustard-yellow being the predominant colours of both the bot itself and the application interface.

Headspace uses an orange circle within a rounded white square for its logo, and its interface largely retains this colour theme. It does however also feature colourful cartoon characters for educational videos about the underlying principles of meditation and mindfulness. The rest of the app makes use of a variety of themes and colours with videos, daily meditations, live group meditations, sleep-related content, movement-centred content, and an explore tab that allows the user to search for specific themes for which Headspace may have material related to that particular topic. Currently, it also has other languages available: German, Spanish, French, and Portuguese. Further, it offers some content with a female voice instead of a male one, though all English accents are British English only. Lastly, while Woebot is available at no cost, Headspace only has limited features available for free and requires a subscription payment fee for the full suite of its features.

3.6 Data Collection

Participants were emailed Headspace-specific or Woebot-specific mini-questionnaires (see Appendix A: Headspace and Appendix B: Woebot) via Google Forms to be completed at the end of each week of using either of the apps. The questionnaires focused on user experience and were aimed at extracting information related to each participant's unique experience of using these apps. This was also a useful exercise in orienting the participant for the next phase of the study which involved an interview, made either telephonically or through video-call platforms such as Skype or Zoom. However, the content obtained from the mini-questionnaires was planned to be used in a separate analysis from the interview data and treated as such. The questions within the questionnaires covered ground related to the possible previous experience of MMH app usage; changes in perceptions before and after, during the respective weeks of use; what, if anything, was learned and applied; what was liked and not liked; overall impressions; and quantitative rating scales of between 1-10

related to participants' desire for future use. This data was not used in the end due to a lack of meaningful responses, which were mostly too brief, but the mini-questionnaires still served a purpose in orienting the participants for the interviews.

Individual interviews were conducted via telephone or video-call using Zoom, What's App or Skype. A semi-structured interview schedule (see Appendix B) was used to direct the dialogue, but spontaneity was both allowed and encouraged. After establishing some rapport, participants were asked to describe their experience of using Headspace and Woebot in more detail than the questionnaires. The interviews typically lasted between twenty to thirty minutes, allowing for off-script questions, unconstrained responses, and a more conversational feel than a strictly structured interview would have, were that format to be used. Questions regarding the design, look, feel, comprehensibility and app-specific features were explored dialogically. The interviews were recorded on Microsoft OneNote and then transcribed by the researcher alone.

3.7 Data Analysis

The data corpus consisted of weekly questionnaires followed by semi-structured individual interviews conducted remotely. Content analysis was going to be used to analyse responses to the weekly questionnaires, where patterns among participants' responses were noted making use of Hsieh and Shannon's (2005) suggested methodology. However, due to a lack of meaningful data from the questionnaires, it was deemed appropriate to only use the interview transcripts. Of the 25 recruited participants, only 23 interview transcripts were used for the analysis as two of the interviews failed to provide sufficiently meaningful data in their responses.

The interviews were carefully transcribed verbatim to prevent any chance of misrepresenting what the participants said. The next step involved a comprehensive

examination of these transcripts to make them ready for coding. During this phase, the researcher removed any typos and added missing words. Additionally, important sections were marked for easier data analysis during the initial reading (Creswell, 2013; Creswell, 2015). Data from the interviews were analysed using Braun and Clarke's (2006) approach to thematic analysis. Braun and Clarke's (2006) method proposed six steps to the analysis of data. Step one required that the researcher become familiar with the data by immersing himself in it. Since the researcher collected the data and transcribed all of the interviews, in-depth engagement with both the voice of the participant and the content produced by those particular voices was permitted. The second step involved a preliminary coding of data where the material was ordered into clusters of significance. Following that process, the codes were then assembled into more encompassing themes and sub-themes to complete step three, which enabled the fourth step of reviewing the themes. It was in the reviewing of themes and sub-themes that categories merged or fell away once sufficiently scrutinised. Meaningful patterns would have been evident at this point, enabling refinement of both an overarching theme and the more subtle ideas embedded within. If the previous stage had been satisfactorily completed, themes could be defined and named in step five, allowing for a coherent narrative to be assembled in step six, which was to produce the report.

Every participant played different roles in the coding process, which was utilised to produce references. These references reflect the quantity of quotations extracted from each transcript, essentially representing each participant's input. Atlas.ti, a software for qualitative data analysis, was employed to obtain these references.

Electronic coding was carried out using the Computer Assisted Qualitative Data Analysis Software (CAQDAS) known as Atlas.ti version 22. This software was employed to code and organise the information supplied by the participants. The reason for opting for CAQDAS was its ability to function as a unified repository, containing all the data, codes,

notes, and discoveries related to the same project within a single platform. This feature greatly aids in the organisation, extraction, comparison, and exploration of textual data, streamlining and simplifying the analysis process (Ngalande & Mkwinda, 2014). Moreover, the software aided in constructing connections and associations, leading to the development of a visual representation of the data (Ngalande & Mkwinda, 2014). While the software enabled the organisation of transcript data in readiness for analysis, it did not conduct the analysis itself; the analytical aspect remained the duty of the researcher. From this process, themes and sub-themes were established under the guidance of the researcher's supervisors. These were then refined and the themes with the most significant data were used. The report was then produced by synthesising the results with existing literature.

3.8 Ethical Considerations

Before commencing with the study, ethics approval was sought from the Department of Psychology's Research Ethics Committee at UCT (Reference Number PSY2020-007). All participants were informed of the voluntary nature of participation in the study. They were advised that they were free to drop out of the study at any time, without penalty. The data collection proceeded via remote individual interviews, while informed consent and consent to record (see Appendix D) were explained and obtained through the use of Google Forms. Confidentiality was assured by providing pseudonyms for participants, while any other identifying information was removed. All data were stored on a password-protected laptop until the completion of the study. Anonymised transcriptions, however, will be stored for at least five years. Participants were informed of the risks and benefits of participating in the study. Minimal risks were associated with participation. This included possible feelings of distress prompted by questions asked by Woebot related to the participant's current mental state. It also included the possibility of distress as a result of becoming more mindful of one's internal world because of Headspace and its purported functionality of enhancing awareness.

To mitigate this, participants were provided with a resource list of support services offered by UCT as well as external sources (see Appendix F). There were no direct benefits to the participating in the study, although there may have been indirect benefits such as reduced anxiety or increased mindfulness, for which the apps had an evidence base.

This chapter described the methods used to answer the study's questions. In the upcoming section, the study's findings will be examined in light of the relevant literature.

CHAPTER FOUR: RESULTS AND DISCUSSION

The analysis yielded four main themes, each with two to four subthemes. Table 1 provides an overview of the main themes and their associated quotations. These themes encompassed participants' user experience of the two apps, the standout features of each app, their perceptions of the app designs, and their suggestions for enhancing the overall user experience. In the following sections, we will delve into the results under the respective themes and subthemes.

Table 1: Themes Derived from the Analysis

Main Themes	Subthemes	Total Participant Frequency
User Experience of the Two MMH Apps	Facilitation of Self-Awareness and Insight	17/23
	Supportive, Encouraging and Convenient	18/23
Features of the MMH Apps	<i>Most Valued Features of Headspace</i>	
	Meditation Skills	18/23
	Versatility and Uniqueness	15/23
	<i>Most Valued Features of Woebot</i>	
	<i>Chatbot as AI Therapist</i>	
	Empathic Style	12/23
	Woebot Provides a Safe Space	13/23
Perceptions of the MMH Apps' Designs	Colour Scheme Enhanced User Experience	18/23
	Ease of Navigation	16/23

Recommendations for Other MMH Apps	Combination of Both Apps' Features	17/23
	Importance of Affordability	18/23

1. User Experience of the Two Mobile Mental Health Applications

Upon asking the participants what they experienced during the two weeks of using Headspace and Woebot, two primary sub-themes emerged regarding their interactions with the respective apps. The first was concerning enhanced self-awareness, while the second encompassed the convenience of using the apps, accessing information, and receiving encouragement. These two sub-themes are explained and discussed below.

1.1 Facilitation of Self-Awareness and Insight

Many participants shared positive experiences with these apps, expressing how they found them helpful for self-monitoring and managing their mental health difficulties. For instance, Participant 7 described how the apps contributed to his personal growth, stating, "That's definitely the way to summarise it for me. Um, being more in touch with my emotions and, um, building a little bit of a different perspective in the way of most things."

Likewise, Participant 1 emphasised the significance of the psychoeducation provided by Woebot. She appreciated how the app offered valuable insights into common thinking patterns, making her more aware of cognitive distortions she had not been previously familiar with:

Woebot, because it had knowledge on so many psychological phenomena. So, they were like tiny, tiny things in my thoughts like I would always be using always and never even though I hadn't tried it yet. And it would be like, "okay, but this is the use of absolutes. (Participant 1, 21-year-old female)

The above extract illustrates how Woebot helped the participant identify problematic thinking and recognise her patterns of cognitive distortions, leading to improved awareness in this regard. Specifically, she learned about the phenomena of using absolutes, as described by Beck (1979), which highlights the strong link between thoughts, feelings, and cognitive distortions associated with mood and anxiety disorders. Notably, a study by Al-Mosaiwi and Johnstone (2018) found that absolutist language serves as a marker for anxiety, depression, and suicidal ideation. Identifying cognitive distortions is crucial in treating and managing these difficulties, showcasing the valuable role a mental health app can play in this aspect.

Moreover, attending to emotional states is another vital aspect of psychological well-being. Participant 3 reported that these apps facilitated a deeper exploration of her emotional world, enhancing her understanding of how feelings impact her life and, importantly, how to manage certain emotions in a healthier way:

I think what I really liked about it was, I think, it got me to be more involved with [my] emotions and probably figuring out how they affect me in my day-to-day life and also, how I can manage them better. (Participant 3, 20-year-old female)

Participant 14 shared a similar experience with the apps. He noticed that their functioning encouraged him to be more introspective than usual. This newfound introspection proved beneficial as it deepened his insights into the emotional and cognitive aspects of his mind:

I guess these apps kind of kind of helped me to understand where I was at. Mostly, I guess it made me analyse where I was. I guess it kind of forced me to analyse where I was. And that is not something I do all the time. It's obviously not like I sit around thinking about what am I feeling now with this moment in time and things like that.

So, I guess this was kind of a very good way of like, forcing me to acknowledge the things that were going on in my head and to try to understand what was going on and why these things happen. (Participant 14, 18-year-old male)

The self-analysis and heightened awareness facilitated by these apps appear to be particularly valuable for students' mental health, especially considering the vulnerability of this subpopulation as evidenced by various studies (Bantjes et al., 2019; Haile et al., 2017; Sharp & Theiler, 2018). Possessing and enhancing insight is a valuable tool for students to identify and address the challenges that they may be facing (Jennissen et al., 2018). The data presented above strongly suggests that these apps offer effective tools for developing a broader perspective and deeper insight, even in the absence of real-life therapists. Specifically, they were found to be effective in helping users identify cognitive distortions and understand their emotions, as well as providing guidance on how to cope with these phenomena and their underlying causes.

1.2 Supportive, Encouraging and Convenient

Most participants (n = 18; 78%) reported that they experienced these applications as reassuring and convenient. The applications encourage users to prioritise their mental health more earnestly and provide the means to do so with both psychological information and evidence-based tools. Participants reported that these apps were also convenient to utilise as they were immediately available at any given time and location without requiring input from another person. They could simply open their apps and make use of them at the time they wanted or needed. When asked about the utility of these apps for the student population specifically, Participant 6 explained the impact of these apps in her own life but also how she could see the value of their use among her peers:

Because it's always encouraging us to take care of our mental health and I think these apps and the way of doing it in this space, but in your own space, so you feel comfortable with your phone in your hand and maybe in your room, so I think it does. (Participant 6, 20-year-old female)

Participant 9 shared how these applications significantly influenced her way of observing and analysing events, resulting in a different daily experience. She said, "Um, I would definitely say that both had an impact on my cognitions and how I was experiencing the day." Expanding on her response, she particularly appreciated Woebot's daily reminder notifications that encouraged her to check in regularly. She expressed her admiration for this feature, stating, "With Woebot, I appreciated that every day it sent me a reminder. Like, "hey, don't you wanna check in?" I thought that was really impressive."

As mentioned earlier in this paper, stigma often acts as a barrier to accessing mental health services, despite many universities offering such support. Participant 5 shed light on this issue by explaining how, in her culture, discussing mental health problems is considered taboo, even with close family members such as parents. In the absence of a mental health professional or a supportive family member, these apps served as a convenient and supportive alternative, albeit imperfect, where discussions about mental health could take place. She expressed her thoughts as follows:

So, what stood out to me positively I'd say if I was somebody that, um, suffered like intensely with those anxiety and depression and all of that, I would definitely recommend using these apps because, apart from the fact that you are given a space to let go of your feelings, it's one of those things where- I'll give you an example. In my culture it's taboo for to talk about mental health issues. It's taboo to have a mental health illness. So, imagine there's somebody who wants to tell your parents that you

know what, I'm suffering, because of this. They don't want to embrace; they don't want to listen to what you have to say. You can just download the app and deal with it quietly. Of course, there's still other things that need to be spoken about, um, with a professional. But you can slowly start to ease your way into handling your feelings and handling yourself. That is one positive that I liked about it. (Participant 5, 20-year-old female)

The data provides compelling evidence of the significant value that MMH apps can play in motivating users to prioritise their mental well-being. These apps' convenience, independence, and supportive features make them an attractive choice for individuals seeking accessible and discreet support for their mental health concerns, which is particularly important considering the barriers associated with traditional services. However, it remains crucial to base recommendations for these apps on their efficacy, with research playing a pivotal role in determining their effectiveness.

A meta-analysis of 11 randomised controlled trials (RCTs) examining the effectiveness of the 'MoodGYM' app in reducing symptoms of depression and anxiety revealed several key factors contributing to its success (Twomey & O'Reilly, 2017). The app's free availability and user-initiated access were significant contributors to its efficacy, providing convenience for its users. Furthermore, the structured and supportive design of the program played a vital role in its positive outcomes. The study also highlighted the potential of MMH apps like 'MoodGYM' to bridge the gap in mental health services for individuals in rural areas who may face challenges accessing traditional therapy more readily available in urban and suburban regions. This potential is particularly relevant given the widespread ownership of mobile phones capable of downloading such apps.

In the context of South Africa, these findings hold particular significance due to the well-documented challenges in delivering healthcare, including mental health services (Jack et al., 2014; Ruffieux et al., 2021). The country faces a higher prevalence of mental health issues compared to other LMICs, and university students, in particular, experience an even higher prevalence of psychological disorders (Bantjes et al., 2019). Therefore, the utilisation of such apps shows promise in addressing the gaps in service provision by the national government and has the potential to make a meaningful impact on mental health support for individuals in need.

2. Features of the Mobile Mental Health Apps

Participants in the study expressed their preferences for specific features of each app, reflecting the distinct design and intended functionality of the apps. The features discussed varied, and participants not only highlighted the discrete elements but also the overall characteristics of how the apps operated. For example, some participants praised the impact of Headspace's breathing techniques and meditation on their wellbeing, while others appreciated the app's versatility and unique offerings. In contrast, Woebot's chatbot feature received positive feedback for its empathic and humorous quality, making user engagement feel more meaningful. This suggests that users valued not only the individual features but also the overall experience provided by the apps' functionalities and the range of features available.

2.1 The Most Valued Features of Headspace

Overall, the majority of participants (n =15; 65%) expressed a preference for Headspace over Woebot. Their reasons for choosing Headspace were diverse, including factors such as the app's visual appeal, design, and colour scheme, which they found more pleasing. The user-friendly interface of Headspace was also highly appreciated by many

participants. Additionally, the meditation aspect offered by Headspace, with guidance from a human voice, was favoured over interacting with a chatbot such as Woebot. Despite the overall preference for Headspace, certain features of both apps were highlighted as particularly useful, enjoyable, and engaging by the participants. These features seemed to resonate with them, even if they ultimately favoured one app over the other.

2.1.1 Meditation Skills.

This was one of the primary features of Headspace available for free; an introductory course aimed at teaching some of the fundamentals of meditation. The participants in this study reported differing reviews about this feature with some finding it useful and others experiencing little or no impact from its use.” For example, Participant 7 explained that he did not gain anything from its use, though he admitted that he did not complete the course:

Um, ja that’s the thing. I only did the Basics one. Um, I do remember pre-COVID-19 when I used them- the app, a couple of months ago- I think I did one motivation, um, meditation. Uh, ja, but only the one that was free, like, just the first one. So, it didn’t have much of an impact on me because I didn’t go through a whole course of doing it.
(Participant 7, 21-year-old male)

On the other hand, Participant 4 expressed her enjoyment of this feature and even reported that it could entice users to purchase the full version of Headspace. What she found particularly helpful was the educational aspect of the course, which served as a supportive guide into something relatively unknown to her before. She shared the following:

Um, yes, so I did the 7-day Basics of Meditation. So, I thought those were really good and that would probably make people want to buy the full version afterwards.

Because it really did give you a glimpse into that; how the tips they can give you, and how it can guide you, to learn how to meditate. (Participant 4, 18-year-old female)

Participant 4 further elaborated on the aspects of the information provided by Headspace that she found particularly beneficial. Specifically, she highlighted that the app taught her the fundamentals of selecting an appropriate meditation location, the proper method of breathing, and the right approach towards meditation. Additionally, the app encouraged her to make meditation a habitual practice to fully experience its benefits. For her, these teachings were crucial in shaping her perception of both meditation and the app. The non-threatening and user-friendly nature of the interaction and lessons made it easier for her to grasp the tenets and engage in the practice of meditation. She reported:

“Um, so I think with Headspace, it was really the breathing, and the key things out where you should be when you want to meditate, and how it's okay not to put pressure on yourself if you feel your thoughts going away. And it's just you have to get the time in and be open to it and ja, it mustn't be a stressful situation for you where you put pressure on yourself to learn how to... be blank. So, I thought it was nice that it had a... it put in place, a nice place for you to just relax and learn for a while, and not have to think you're doing it wrong or doing it right. You just learn how to feel comfortable. And I liked the tips of the counting of your breath and the different parts of breathing you could do.” (Participant 4, 18-year-old female)

Participants 9 and 17 also expressed their appreciation for the meditation feature on Headspace, finding it to be very helpful and informative. Participant 9 simply stated, "Like, the meditations that I listened to on Headspace were very helpful...", while Participant 17 reported, "The basic meditation. I used that because it introduces you to meditating and it teaches you from the basics like how to do it. Yeah, it was really enlightening."

Moreover, the breathing techniques and meditation skills taught within Headspace were highly valued by the participants. Participant 1, for instance, expressed how this feature helped her in self-soothing. With only ten minutes of meditation and a variety of breathing exercises, she was able to redirect her attention by focusing on her breath cycle (inhalations and exhalations) and her somatic response to the exercise. This ability to self-regulate and find a sense of calm through the app's offerings was seen as particularly beneficial. She shared the following about her experience:

Then, with Headspace, I really liked the- I did like a whole course on letting go of stress, and I really liked that because it would just be 10 minutes and then there would be like this really soothing audio and it would be like: “you’re breathing in and out”, and it would help you focus on your breathing and your body and I really, really liked that. I felt it helped me a lot. (Participant 1, 21-year-old female)

Participant 2 echoed similar sentiments and expressed that Headspace provided relief in a very brief period of time. She reported appreciating the feature that allowed users to adjust the length of time for learning meditation and breathing skills. This flexibility was particularly useful for individuals facing time constraints, which is a common experience among students. She had the following to say:

Whereas Headspace targeted ways from which you, if you’re having an anxiety attack, you can meditate. I used the meditation one in particular, and their one was really nice in that you had like, a few sessions that you could download within like the first package. Which was really nice and then you could choose between what you wanted to do, whether it was 3 minutes or 5 minutes. So, I think if you’re definitely a busy person, that is like perfect because you can just

sit in your car or you can sit somewhere just say, okay 3 minutes of meditation is also what I need right now to help me cope with like, what's going on, and sometimes it is just 3 minutes or 5 minutes that can help you make or break an anxiety attack or a panic attack. So, I thought that was perfect... (Participant 2, 18-year-old female)

The role of stress in mental disorders is significant, and incorporating evidence-based practices such as meditation through accessible apps has proven to be helpful and effective in reducing stress and promoting awareness of bodily sensations. A meta-analysis conducted by O'Driscoll et al. (2017) demonstrated that mindfulness-based interventions for health and social care undergraduates yielded short-term benefits for stress and mood. However, to reap these benefits, active engagement with such apps is crucial. In a study by Laurie and Blandford (2016), participants perceived Headspace, an app offering customisable meditation times, more positively when they were able to seamlessly integrate its use into their busy schedules. By providing shorter meditation options, Headspace sustained user engagement, when they might have otherwise chosen not to engage if fixed meditation durations were imposed. Another study by Zollars et al. (2019) explored the use of Headspace and found that all participants who completed the study exhibited improved mindfulness, enhanced wellbeing, and reduced perceived stress. These findings align with the results of this research.

Participant 3 experienced significant benefits when confronted with personal challenges that triggered distressing emotions by utilising mindfulness practices. Particularly, in times of stress, Headspace's meditation proved instrumental in helping the student redirect her focus and prevent her from being overwhelmed by negative thoughts or emotions:

I think sometimes it'd be anxiety or stress and with both the apps, I will start with Headspace. You know, the meditation was good because it made me

channel and focus on what was going on instead of all the other external factors. (Participant 3, 20-year-old female)

Indeed, this feature of Headspace was highlighted as valuable by multiple study participants. Participant 5 particularly emphasised its importance in helping her stay calm amidst significant stress, using the example of exam situations, which are typically anxiety-inducing events for students and occur frequently during the course of obtaining a degree:

Okay so I made use of, and it was this, green, I've forgotten what it was called, but basically you use it when you're like super stressed. So, for example if I needed to write a test and I was feeling, like, overwhelmed in my head, I would do that one. And that one would help me like- like I said that it would calm me down and breathe and like, you know before you write an exam? When you just close your book, and you are about to enter and you're trying to remember every single small little feature that you just read. But your brain is fully acting it out one by one. So, those moments you like- I would need to really diary down which is green one, it was the green button, and would just breathe... (Participant 5, 20-year-old female)

As numerous studies have demonstrated, university students face a multitude of stressors in their lives (Blows & Isaacs, 2022; Engelbrecht et al., 2020; Mason, 2017). These stressors encompass increased academic demands, adjustments to being away from home (for those changing residence), and changes in social relationships, among others (Akram et al., 2020). The data collected from the participants in this study highlighted the effectiveness of mindfulness and meditation techniques as brief and accessible means of managing stress and anxiety in a health-promoting manner. This finding is further supported by several systematic reviews (Daya & Hearn, 2018; Kriakous et al., 2021; Solano Lopez, 2018; Yogeswaran & El Morr, 2021). The participants' responses revealed how these techniques enabled them to

somatically experience the positive effects of managing stress and anxiety. Learning to take deep breaths and narrow their focus allowed them to approach their tasks more efficiently, a benefit experienced through engaging with Headspace.

2.1.2 Versatility and Uniqueness.

User engagement was a prominent aspect discussed by several participants, with Headspace standing out for its originality and variety of features that drew them in. The app's diverse selection of themed meditations allowed users to reflect on their current needs and choose the most suitable option for their situation. This ability to make personalised selections appeared to be highly appreciated by many users, empowering them to tailor their meditation experience to their specific preferences and requirements. Participant 4 elaborated on this aspect, explaining how the app's offering of choices made the experience more meaningful:

What I did like about Headspace was all the categories. They had sleep, they had exercise, they had thoughts at your desk if you needed a morning wake up routine. They had a huge venue and that library of sources, so I liked that. For whatever mood you are in or any time of day. So, I think I would include that in my own app. (Participant 4, 18-year-old female)

Participant 15 (20-year-old female) had a similar view:

I liked the variety of ways in which you could use it. Um, so, there are exercising things in there. There are mindful things and there's also courses. So, I just liked the variety of ways you could use Headspace.

In a related way, Participant 17 alluded to the fact that although it has an impressive array of features, just as impressive was that it was incomparable to other apps at the time of

her experience: “Headspace, I don't know, just everything about it, it's different. It is just different from others.”

Participant 9 also appreciated the fact that Headspace offered more than just traditional meditation. She particularly liked the app's inclusion of an exercise feature, which she believed could further aid in relaxation and enable users to engage in mindful-based physical fitness. This user had a conceptual understanding that mindfulness and meditation could extend beyond typically associated passive seated practices with closed eyes and include physical activity. Indeed, the literature supports the benefits of both meditation and physical exercise in mental health recovery and maintenance (Chekroud et al., 2018; Fossati et al., 2021; Grasdalsmoen et al., 2020; Hudziak, 2018; Totzeck et al., 2020; Tsui et al., 2020; Yela et al., 2020). Although the participant had not yet tried this specific feature of Headspace, she expressed a high degree of motivation to do so, suggesting that based on consistent research findings, she could potentially benefit from engaging in this aspect of the app:

Ja, that would be great, and Headspace does have a feature where you can do like, exercises and do mindful running and that type of thing, which I think is very useful, which I haven't used but I am going to definitely try out sometime.
(Participant 9, 20-year-old female)

The interviews with the participants highlighted several advantageous aspects that enhanced the experience of using Headspace. The novelty of the app's functioning, its variety of features to choose from, and the presence of unexpected elements were all positively received. In particular, the availability of situation-specific guided meditations was highly appreciated. The participants valued not only the autonomy to make their selection but also the relevance of themed meditations such as "Stress SOS," "Falling Back To Sleep," or

"Mindful Miles," among many other examples offered by Headspace. These themed options added a level of personalisation and practicality to the app, making it more engaging and relevant to their specific needs and circumstances.

2.2 The Most Valued Features of Woebot

The study revealed several themes related to the valuable features of Woebot that resonated with the participants. One significant aspect was Woebot's ability to appear empathic and humorous, creating a sense of connection and comfort for the users. This emotional aspect played a crucial role in building a positive user experience. Moreover, the participants expressed a feeling of safety in disclosing personal and sensitive information to Woebot, which they found preferable to interacting with another human. The chatbot's non-judgmental and non-threatening nature seemed to encourage openness and self-disclosure, fostering a supportive environment for the users. These aspects will be further discussed in the following sections.

2.2.1 Chatbot as AI Therapist.

Woebot's main feature, its chatbot function, offered users a confidential space to engage in conversations with an AI-programmed therapist, where they could freely discuss their thoughts and feelings. This privacy of communication and the opportunity to talk about personal issues were positively viewed by some participants. Several aspects of interacting with the chatbot were highlighted by the study participants, including viewpoints on cognitive restructuring, limited support, and referral assistance.

The participants appreciated the chatbot feature's capacity to help them reframe negative thoughts through cognitive restructuring. This process, a well-established theory in CBT, has proven effective in treating CMDs such as anxiety and depression. Participant 4

emphasised the value of this skill in their mental health journey, stating, "But I do like the feature of Woebot where you chat with someone or just express your thoughts, and you really go into rewording negative thoughts, and I think that would- was a really cool skill...".

Research supports the efficacy of incorporating cognitive restructuring techniques through the use of a CBT-based chatbot in supporting mental well-being among university students (Fitzpatrick et al., 2017).

While Participant 14 acknowledged that Woebot couldn't provide the same level of help as a therapist or friend, he appreciated that it encouraged self-reflection. This indicates that while the participant found Woebot useful in identifying intrapersonal dynamics, he recognised the limitations in comparison to professional support. It also highlights the importance of users' attitudes towards using MMH apps and their belief in the apps' effectiveness in reducing symptoms of CMDs. Such attitudes are crucial factors influencing the uptake and continued engagement with these apps. Participant 14 shared the following thoughts:

I think it is useful, right. But I also don't think that... nothing can be added... as useful as a therapist, obviously. But I think it was kind of good in a way that it showed... it kind of forced you to, um... just simply think about what's going on with you. So, I think that that's the most positive point about Woebot, I think. In my opinion, to force you to think about how you are feeling. I think other than that I don't think it can provide the help that... even as close to something that a therapist or even your friend can provide. In the end, it's just an app, so... (Participant 14, 18-year-old male)

Participant 16 expressed appreciation for Woebot's capability to direct her to relevant resources when it couldn't fully address her concerns. This feature highlights the potential

value of incorporating additional mental health resources within an MMH app, addressing the limitations of AI-programmed chatbots. Knowing that the app provides alternative avenues for support may instil confidence in users, assuring them that they can access other helpful resources through the same platform. Participant 16 elaborated on this aspect by saying:

I liked it because there was a time when, uh, I was talking and then he asked me what the problem was and then I tell him and then he like, searched for, um, like, something that can help me. And then he's like, if it can't help me, it gives me a list of places that I can contact. (Participant 16, 19-year-old female)

Conversely, it is also essential to acknowledge that studies have shown that access to resources alone may not eliminate barriers such as long waitlist times, limited availability during crises, logistical difficulties, or scheduling conflicts (Eisenberg et al., 2013; Marsh & Wilcoxon, 2015). Consequently, there remains a level of risk for vulnerable users who may find that neither an AI chatbot nor the provided resources can offer the necessary help in a timely and meaningful manner.

In summary, the participants appreciated Woebot's chatbot feature for its cognitive restructuring abilities. While recognising that Woebot cannot replace the support of a therapist or friend, users found value in the chatbot's capacity to encourage self-reflection and offer referral assistance when needed. Nevertheless, it is crucial to consider the limitations of the chatbot's effectiveness in addressing all potential issues and the potential obstacles users may face when accessing recommended resources through the app.

2.2.2 Empathic Style.

Among the important factors highlighted by the interviewed participants, Woebot's empathic style of interaction stood out. Silberman (2021) explored empathy in clinical

settings and identified two forms: cognitive empathy, where the clinician understands the patient's thought processes and perspective, and affective empathy, which involves being attuned to the patient's emotional states. Empathy is considered a vital aspect of healthy interpersonal relationships and has a significant correlation with CMDs (Premkumar et al., 2018), making it universally important for one's wellbeing.

Despite Woebot being a chatbot and a relatively new technology, many participants were surprised by its ability to respond sensitively and accurately, offering a meaningful interaction during their engagement. Empathy has long been recognised as important in therapeutic relationships (Altimir, 2017; Freud, 1935; Shattel et al., 2007) and is considered a primary common factor in psychotherapy (Wampold, 2015), along with components like therapeutic alliance, goal consensus, and positive regard.

The data revealed that some participants perceived Woebot's AI programming as capable of replicating empathy during their interactions, suggesting the potential for AI technology to provide therapeutic services in the absence of a human mental health professional. Participant 4 exemplified this by expressing surprise at the app's interactive nature and appreciating its ability to respond to various inputs. This indicates a feeling of being understood, irrespective of the shared content, highlighting the importance of responsiveness in establishing an empathetic connection, even with an intelligent but limited and inanimate object like a chatbot. She reported the following:

And Woebot, I didn't expect it to be like that at all. So, I really enjoyed how it was like, an interactive process really. I do not know if I'm answering that right... Um, I think with Woebot what really stood out to me was how I think the makers had thought of so much. Like, so many different responses that somebody could have expressed, how they dealt with like, quite an all-rounded,

you know, what people's issues may be. So, you could click any answer or say anything, and they had, like, quite a sturdy response. (Participant 4, 18-year-old female)

Woebot was also seen as potentially beneficial to people who may be lonely or isolated and feel the need for some measure of contact, such as with a chatbot that could demonstrate a level of care and respond with adequately sensitive understanding. As social creatures, human beings have a need for interaction with others and its deficiency or absence has been shown to have a strong association with mental illness (Ingram et al., 2020; Wang et al., 2018). In this regard, Woebot was viewed by Participant 7 as being an effective stand-in for a therapist or known person who could usually provide support:

With Woebot, if you are in need of some interaction, that could be very useful. And it asks you how you are feeling. It comes up with a little, um, task for you to do. And, so I think, it can depend on the context whether you should use the one app or the other... yeah, I thought they did a great job, um, making it again seem like you're talking to a real person. You're actually in a chat and when you write something and you wait for a response there's, uh, little three dots indicating that, um, Woebot's thinking about the writing whatever. (Participant 7, 21-year-old male)

Participant 2 also described having such an experience but added that she associated Woebot's empathic style with being a woman. She explained that she had unknowingly assigned it a gender based upon her view of the differences between the genders. "I think it's because normally we identify like, a person that speaks to you more in-depth about your feelings and that, being a woman. Like the majority of the time, rather than a male, so maybe that's why." It is interesting to note that most of the participants viewed Woebot as male or non-gendered such as described by Participant 4: "Also, like reading your stuff, like it's just a

computerised thing. So, I think it– I really grew to like the character the designers had made for him – or her – and just like, I really grew to like it.” Either way it seemed as though it was important to personify the chatbot to make their interactions more genuine, perhaps facilitating the experience of the app as more of a human, empathic one.

The data revealed that Woebot's perceived ability to sustain a conversation, offer relevant responses, and provide practical advice and emotional support were essential components in establishing a connection with users. Additionally, participants exhibited an unconscious inclination to anthropomorphise the chatbot, indicating a desire for a more human-to-human-like interaction to reduce the sense of artificiality. Conversely, knowing that the chatbot was not human seemed to create a sense of comfort, encouraging users to share more freely. While participants appreciated Woebot's empathic style, it is crucial to recognise the limitations of AI technology in fully replicating human empathy. Relying solely on chatbots for emotional support may have potential consequences, emphasising the importance of maintaining a balanced approach to mental health care that incorporates human-driven services.

Moreover, the insights from user experiences underscore the significance of user-centred design in developing mental health apps. Ethical considerations, such as transparently communicating the chatbot's non-human nature to users and ensuring data privacy, also warrant careful attention. Given the study's limited duration (fortnight), future research should explore the long-term effects of Woebot's empathic style on users' mental health and wellbeing. Conducting longitudinal studies in diverse populations could provide valuable insights into the sustained impact of AI-based interventions.

To conclude, Woebot's empathic style appeared to be significant for some participants in providing emotional support and establishing a connection. While AI technology may hold

promise in addressing mental health concerns, a mindful approach to recognising its limitations and ensuring responsible implementation is thus essential. Furthermore, the preferences and perspectives of users should guide the design of future AI-based mental health apps to ensure effectiveness and ethical considerations are prioritised. These issues will be discussed in more depth in the following sections.

2.2.3 Woebot Provides a Safe Space.

The data revealed another noteworthy theme: participants appreciated the ability to communicate freely and without reservations, feeling safer to do so with a chatbot rather than a human. This highlighted a potential advantage of using an MMH app as an alternative to seeing a mental health professional. It shed light on a common barrier that often hinders people from accessing services – the fear of judgment and shame, in other words, the fear of stigma. Stigma, in this context, encompasses society's negative attitudes and beliefs towards mental health conditions, which can lead to discrimination, prejudice, and social exclusion (Corrigan et al., 2014). This fear appears to outweigh the willingness to seek help through more traditional means available in private or public settings. Research has shown that mental health stigma is associated with lower rates of help-seeking behaviour (Schnyder et al., 2017). Participant 6 articulated this sentiment, stating, "I suppose the fact that I could, like with Woebot, I could—it was easier to speak about things I do not usually speak about," highlighting the benefit of confiding in a chatbot instead of another person.

In a study by Xu et al. (2018), individuals with mental health issues reported experiencing stigma from family members, friends, and co-workers, which caused delays in seeking professional help. The participants in that study cited fear of judgment and discrimination as the primary reasons for avoiding help. Participant 14 in the current study provided a similar example in their response, expressing both the fear of disclosing sensitive

information to another person and the potential shame associated with it. It was believed that removing the human element provided a space for immediate vulnerability and honesty, without the anxiety of how a real person might perceive it. He stated the following on the matter:

Because, and it was obviously, I am talking to a computer, so I don't have to worry about the judgement. I think that was the best part of the app. We did not have to worry about any kind of judgment or anything. Now I think we all, deep down, kind of care about what other people think. So, I think having a space where you just do not have to worry about that... I think that that was interesting and much nicer than speaking to your average Joe about how you're feeling. (Participant 14, 18-year-old male)

Participant 4 concurred with the sentiments and emphasised an additional advantage of the app for individuals who cannot afford professional therapy sessions. The literature review provides evidence that the cost of accessing mental health services often acts as a barrier for many people seeking mental healthcare. This issue was highlighted by Dunley and Papadopoulos (2019) who detailed the impact of insufficient funds. Additionally, Eisenberg et al. (2013) noted that some students lacked or had inadequate health insurance coverage, resulting in limited or no access to therapy. This challenge is particularly prominent in LMICs such as South Africa. Research indicates that slightly over one in four students living with CMDs sought assistance, with historically marginalised students being the least likely to access such services (Bantjes et al., 2020). Participant 4 expressed the following thoughts on the matter:

I thought it was a clever idea because people that also cannot afford therapy and may be feeling uncomfortable with having to talk with a human. I thought

it was quite a clever way for people like that. (Participant 4, 18-year-old female)

The participants commonly expressed their comfort in speaking freely about their true thoughts and feelings, particularly when discussing perceived obstacles to using professional mental health services. Several barriers were identified, including apprehension about disclosure, anxiety regarding negative perceptions from therapists, shame associated with personal challenges, and the affordability of services. These barriers have been extensively discussed in existing literature, as demonstrated in a study by Apolinário-Hagen et al. (2016), which found negative associations between attachment avoidance, self-stigma, and seeking traditional face-to-face therapy. These considerations are especially relevant for potential mental healthcare users, such as university students, where personal and internal factors significantly influence help-seeking behaviour.

Similarly, Rosenrot and Lewis (2020) identified shame about non-suicidal self-injury (NSSI) and concerns about the recipient's response as central themes in their study on young adults and this behaviour. Moreover, Tesfaye et al. (2020) examined community attitudes towards mental health in an African country and found that nearly half of the participants held unfavourable attitudes towards mental illness, over a third believed in avoiding individuals with mental illness, and around 60% exhibited poor help-seeking behaviour. In this context, the use of an MMH app could be particularly beneficial for such individuals if they are able to use such apps privately and at their own discretion, potentially helping them become more comfortable with the idea of seeking professional help in the future, especially if the app includes psychoeducation.

In this study, the participants generally regarded Woebot as a viable alternative to traditional forms of professional therapy, effectively addressing many, if not all, of the

obstacles previously mentioned. This positive impression appears to be a crucial factor for students to fully engage with the app and experience its benefits. While the majority of participants acknowledged that professional mental healthcare services would still be the ideal choice, the literature highlights the challenges faced by those in need, with various factors contributing to the inaccessibility or undesirability of these services. Although MMH apps may not offer the same extent of benefits as a human therapist, the findings from this study suggest potential ways in which these apps can be advantageous. The concept of MMH apps serving as the initial point of contact for mental health services may provide a better understanding of what mental healthcare entails and help build confidence among users for future interactions with professionals.

2.2.4 The Role of Humour.

The study participants expressed appreciation for the inclusion of humour and levity in Woebot, recognising its ability to potentially alleviate some of the difficulties associated with living with a mental health issue and seeking professional help. Extensive literature supports the value of humour in therapeutic settings and approaches (Dionogi & Canestrari, 2018; Gibson & Tantam, 2017; Zhao et al., 2019). This research has highlighted various benefits, including the enhancement of the therapeutic alliance, the release of nervous energy, improvements in mood, sleep quality, and even pain management. Several participants in this study reported experiencing these benefits, noting that humour had a positive impact on their emotional wellbeing. Notably, Participant 6 also found humour to be a valuable therapeutic tool in shifting her perspective, with Participant 14 pointing out how the use of jokes and GIFs positively impacted his affect.

I like the jokes. Ja, it is bad jokes, but for an app, I thought it was funny... Ja, it was kinda like motivational jokes. Okay, this is helping you, um, just to see things different, man. (Participant 6, 20-year-old female)

It was nice and comforting to have, instead of having like a serious talk about your mental wellbeing, I think it's good to have these little jokes and GIFs.

They lighten your mood. (Participant 14, 18-year-old male)

Participant 4's quotes below demonstrate that the incorporation of humour not only provided relief when discussing personal challenges but also normalised the experience of interacting with a chatbot. The ability to take what the participant shared seriously and balance that with light-heartedness was appreciated by her. This instilled a sense of confidence in using the app, as conversing with Woebot felt more meaningful than a superficial exchange with an inanimate object. Participant 4 further elaborated on her experience, expressing gratitude for Woebot's transparency about being a "robot" rather than a human. Paradoxically, this authenticity made her perceive Woebot as genuine, thereby enhancing its relatability and grounding the interaction in a sense of reality. This also had implications for a therapeutic alliance, which in the context of a relationship with a chatbot may more appropriately be termed user engagement.

I thought that it like dealt with you in a way that was so unique, because it poured some humour into it, and would also like to tell you that it was not a human, that you must not rely on it. Obviously, some answers will be weird. So, I liked how they designed it and that you did not feel like this is a waste of time, this is weird. (Participant 4, 18-year-old female)

And ja, I like the GIFs and stuff, like, they were sometimes a bit silly and unrelated, but it was just funny, they would have this humorous component to

it, that removed it a little bit... Like it was also taking what you are experiencing seriously. I thought that was a good balance... I like the fact that it doesn't pretend it wasn't a robot. So, I really liked how it made robot jokes and silly things like that, I don't know, it made it easier to- it didn't make me ask "this is just a robot?" like it's not taking anything seriously. It was nice to acknowledge that need for me to know that there isn't a person behind this, maybe... I did like the quirks and jokes, and also found that the robot didn't take itself seriously, which was funny and ja, I really grew to like it.

(Participant 4, 18-year-old female)

Participant 7 expressed appreciation for Woebot's sense of humour, noting that it went beyond simply offering random pre-programmed jokes. Instead, the app had the capability to respond with relevant humorous comments based on the content shared by the user. This ability blurred the line between an AI chatbot and a typical human interaction in an intelligent manner, making it feel like a more natural and familiar exchange. This phenomenon is reminiscent of the well-known ELIZA experiment, where a computer using basic software imitated a Rogerian style of therapy and convincingly made people believe they were talking to a human therapist (Weizenbaum, 1976).

However, it's essential to acknowledge that the ability to mimic human interaction has raised ethical concerns, as it may be perceived as deception, particularly when the mimicry is highly effective and tricks users into believing they are interacting with a human (Grodniewicz & Hohol, 2023). Participant 7 emphasised how humour contributed to creating a more human-to-human interaction without mentioning the subject of deception explicitly. This observation suggests that Woebot's use of humour struck a delicate balance, avoiding potential concerns related to deception, while maintaining a sense of realness that did not make engagement seem like an altogether meaningless exercise.

...the app asks you: “oh what are you doing?” I just say I'm making coffee, and then it makes like a clever joke and pun about coffee. It gets the conversation going... Ja. That's the thing. It makes it like a person in a way, is a sense of humour. Not just having a robot tell you... um, ask you standardised questions and stuff like that. It's really a good touch. If you want to make something human, you gotta give it a sense of humour. (Participant 7, 21-year-old male)

An intriguing irony emerged when examining Woebot's features. Despite being an AI chatbot explicitly stating its non-human nature, participants found its humanlike qualities, such as empathy and humour, to be particularly appealing. Paradoxically, the fact that Woebot was not human made users feel more comfortable sharing sensitive information with it compared to another person. This apparent conflict within the participants can be understood in two aspects. On one hand, Woebot's inherent inanimate nature eliminated the risk of feeling ashamed or rejected, creating a sense of safety. On the other hand, users seemed to unconsciously project human qualities onto Woebot, making it more relatable, possibly reflecting their underlying need for genuine human connection.

Despite this paradox, the findings suggest that having a chatbot with enough carefully programmed elements, such as humour, to mimic real human-to-human interaction without being deceptive, could prove beneficial for individuals who do not access professional therapy. Such an app could offer a unique balance between safety and relatability, potentially bridging the gap for those who face barriers to seeking traditional mental health services.

3. Perceptions of the Applications' Designs

Design is a critical aspect of any application or software, and its impact on users' experiences cannot be overstated. Therefore, understanding users' perceptions of application designs is essential for creating effective and user-friendly applications. Recent academic

studies have investigated the relationship between design and user perceptions. For instance, a study by Rui and Gu (2021) measured study participants' brain's responses to aesthetic design in human-computer interaction (HCI) using electroencephalography (ECG) and functional magnetic resonance imaging (fMRI). Their findings seemed to indicate a relationship between aesthetic design and user engagement that they believe will be useful for designers, engineers, and artists alike.

Similarly, research by Law et al. (2009), while seeking to define UX, also highlighted that a user-centred design approach can enhance user experiences and increase the likelihood of user engagement. Another study by Alsswey et al. (2020) explored the influence of cultural factors on users' perceptions of application designs, finding that it had a significant impact on users' inclination towards engagement. This section aims to analyse these perceptions from the perspectives of the participants in this study.

3.1 Colour Scheme Enhanced User Experience

Many users praised the aesthetic appeal of both apps, with special attention to their colour palettes. Woebot's colours were perceived as soothing, while Headspace's palette was considered warmer and more inviting, preferred by most participants in the study. Numerous studies have explored the impact of colours on individuals. This knowledge has been applied in various settings, including educational, professional, and therapeutic facilities, to enhance user experience and engagement.

For instance, Eaton and Tieber (2017) focused on undergraduate students and found that colouring tasks positively influenced anxiety reduction and task perseverance. Jonauskaite et al. (2018) examined the popular belief that certain colours evoke specific moods, with brighter and warmer colours associated with positive feelings and darker, cooler colours linked to negative emotions. Their results revealed that colour choices indeed differed

depending on the induced mood. For instance, participants experiencing joy tended to choose yellow hues, while those feeling relaxed preferred yellow-green hues. Lighter colours were often associated with positive moods like joy and relaxation, while more chromatic colours were matched to joy, followed by relaxation, fear, and sadness. The study concluded that colour choices are related to the felt mood to some extent, but the associations were not highly specific, challenging the simplicity of the popular belief.

Interestingly, Rizomyliotis et al. (2018) conducted research on how background colours in promotional activities influence people's attitudes and behavioural intentions, revealing contrasting results. They considered the moderating role of mood and involvement in shaping these effects, finding that cool background colours had a more positive impact on attitudes and behavioural intentions compared to warm colours. This effect was particularly pronounced when individuals were in a positive mood and had low involvement with the promotional activity.

Overall, the choice of colour palettes in mental health apps appears to be an important part of the overarching UX design. It plays a significant role in attracting users and improving their overall experience. Further, different colours can evoke varying emotional responses, which can be beneficial for users' engagement and wellbeing. However, research has conflicting views, which was also borne out in the data of this study with most participants preferring the warmer colour palette of Headspace, but a few preferring Woebot's colour scheme. This seems to indicate that though there may be certain colours that would be preferred by the majority of users, it is not a straightforward design decision and perhaps further research is needed particularly in the field of UX design for MMH apps. Participant 1 shared their view on colour and her affective response to it:

I really liked Headspace because I love the vibrant colour. I really, really liked it. I just feel like it was so, like, just looking at it made me feel like I was, you know, my mood was going to improve. (Participant 1, 21-year-old female)

This quote illustrates how the participant's positive emotional response towards the Headspace app was influenced by the vibrant colours used in the app, which they believed had a positive impact on their mood. This aligns with findings from previously mentioned studies and underscores the significance of visual aesthetics in user experience, as well as how visual design can influence emotional states. It emphasises the need to consider the emotional impact of design choices when developing technology and highlights the potential for design to positively enhance user experience, particularly in the case of MMH apps where the benefits are contingent on its sustained use. Participants 2 and 10 shared their thoughts on this subject:

Yeah, so I have to say Headspace definitely won hands down. That's especially with everything being rounded, and that tone of orange, and it wasn't even white that was used; I think it's like a bit of an off-white on the app... Um, so they made everything pretty straightforward and very visually appealing. (Participant 2, 18-year-old female)

Okay, so starting with Headspace, they use very warm colours. Like, they use orange and yellow and like it's very warm. It kind of feels, like, very cuddly, very happy... And as I said with Headspace, the shapes are really cute where it's like circles and that type of thing. And I enjoyed that, it's also very warm. Um, ja, very like warming, very calming. So, Woebot, they used... I didn't even think about the colours when I was using it. But they did use blues and that type of thing. I think I prefer yellow-orange, like warm colours, compared to cool colours. I think it's just a

lot more warming. A lot more like inviting to the app. (Participant 10, 21-year-old female)

As the quotes above indicate, the use of rounded shapes and off-white, orange, and yellow colour tones were noted as visually appealing and easy on the eyes. The participants also highlighted the importance of simplicity and ease of use when in a state of panic or distress, indicating that the app considered the user's emotional state. Additionally, it could be analysed in the context of mental health and wellness, as the participant discussed their experience of using an app geared towards meditation and mindfulness and the importance of design in promoting relaxation and stress relief. The participants also reported on their preference for the warmer colours used by Headspace over the cooler colours used by Woebot. Participants 13 and 20 reported similarly, indicating there may be something preferable about warmer colour palettes for people experiencing anxiety and stress in comparison to cooler ones.

I thought that Headspace was really aesthetically pleasing. Like, I loved the colours and it kind of gave like a warm feel, you know. It was like oranges, like pastel colours. I mean, not for the sleep tab, but... yeah, I liked it, the rest was good. I really liked the Headspace, also I think that's maybe why I liked it more, because it was like, really nice on the eyes, you know. (Participant 13, 18-year-old female)

Headspace, I did like it. Especially the structure of the app I liked the most because Woebot was simple. But the way just like how it was set up for Headspace, I liked more because... it's the colours also; it puts you in a better mood automatically sometimes. (Participant 20, 21-year-old, gender queer)

In conclusion, the data obtained made apparent how the colour schemes of the respective apps played an important part not only in how the users felt in the moment but also

how they felt about the app they were using. Having distinctly different colour schemes also pointed to a preference among the cohort for warmer, pastel colours when compared to the cooler colours of Woebot. Some participants even acknowledged that the appearance of the app was most likely what led to their preference, indicating how important aesthetics was in the hierarchy of factors related to overall user experience and engagement.

3.2 Ease of Navigation

Another influential aspect of using these apps was user-friendliness. Both apps were favourably viewed in that regard with ease of navigation being commented on the most. This meant that it was uncomplicated to access the various features of the respective apps described previously. This enabled the users to gain a broader understanding of what both apps offered in terms of features geared towards mental health. While many of the participants reported on both apps' user friendliness, Participant 10 described initial difficulty in working out how Headspace functioned, even if it only took a brief period to do so. This appeared to be an important consideration if such an app were to be recommended as a mental health tool because difficulty in its use could have proven to be a barrier to its utility.

And I also like how there are like, almost, little tabs where you can say like, okay, meditation or sleep, or it's quite... So, at first, I went onto the app, and I was like, I have no idea what's going on. I was very confused, but I sat for like 10 minutes and just tried to work through it and after, it became very easy to use, and very easy to navigate. (Participant 10, 21-year-old female)

Participant 20 spoke specifically about Woebot and what made it user-friendly. Having a chat-based bot that resembled the well-known and globally used text communication app What's App (Apple, 2020c; Google, 2020c) appeared to provide a sense of familiarity for her. This in turn led her to feeling comfortable with what was a novel

experience in interacting with a chatbot; an important factor in encouraging sustained communication.

Ja, I think it was user-friendly because it was easy to navigate everything. And it was also very simple. So, it's like a chat and I think everyone has had like, What's App or some type of message app, so it's easier for everyone to understand... Ja. It's not as simple as Woebot. But it is like nice because of the way everything is set up. So, it's easy to find what you want for your next session...I haven't used a chatbot before. It was new for me. (Participant 20, 21-year-old, gender queer)

The simplicity of functioning revealed itself as a valued component of using either Headspace or Woebot. It also seemed as though having a feature that felt familiar and/or that mimicked an established and widely used application facilitated comfort with using a novel app. The importance of user-friendliness in sustaining engagement also came across with none of the participants having notable difficulties. This could have implications for people living with anxiety and depression as feeling overwhelmed is often the case with both disorders (APA, 2013) and working with an app that is difficult to navigate could lead to dropout of use. While perceptions of the study participants about these apps' respective designs have been discussed, the following section will more closely look at the specific features that these users interacted with, and what they believed could improve the overall experience and use of an MMH app.

4. Recommendations for Other Apps

From the data analysis process, participants outlined the elements they felt needed to be added or improved in the mental health apps. The data in this study suggested that most participants found Headspace and Woebot to be effective and beneficial in improving their mental health and believed that it could be so for others too. They therefore suggested

incorporating certain features from both apps to create a comprehensive app for mental health. Another recommendation that was reported by many participants was around affordability of the applications in order to make it widely accessible.

4.1 Combination of Both Apps' Features

Many participants expressed the idea of integrating features from both apps into a single app, as they believed it would create a more comprehensive and complementary experience. They highlighted the benefits of having all the features in one place, making navigation and access easier for users. In addition, some participants suggested incorporating elements like games, videos, and a social aspect to enhance the app's engagement and interactivity.

With regards to gamification, a meta-analysis of studies exploring the impact of app-based therapies, including CBT, Acceptance and Commitment Therapy, and mindfulness, on depressive symptoms, found that both mental health apps with and without gamification elements were effective in reducing depressive symptoms (Six et al., 2021). The study revealed no significant difference in the effectiveness of mental health apps with gamification elements concerning depressive symptoms or intervention adherence. However, it is crucial to acknowledge that advancements in research and software development may bring about changes in these findings in the future. Additionally, it is also worth noting that this meta-analysis solely focused on MMH apps for depression, and gamification might play a significant role in addressing other CMDs such as anxiety.

Participant 14 highlighted the importance of daily check-ins and meditation as essential features that could be integrated into other MMH apps, with Participant 23 in agreement. This observation was based on their own positive experience of using both apps, finding them beneficial in improving their mental state. Combining these features in an app

could offer a similar positive experience for other users. They described their experiences as follows:

Well, I think Woebot and Headspace were two very different apps, but I think they complemented each other very well. So, I think using certain aspects like meditation for example, and the daily check-ins. I think those two are very... they helped me a lot with where I was at, so I think that could be for other people as well. Just kind of... show people that— yes so, I think the main thing about Headspace is we take a chill pill, don't do anything for about a few minutes, then start to feel better, and I did feel better. So, I think that coupled with the daily check-ins: “how are you feeling today?”, I think those two are the most important things that I think I would have in my app. So, you see, as different as those two apps are, they complemented each other very well. (Participant 14, 18-year-old male)

I think I would like to see features of both apps into one, instead of just certain features on one app and other features on another app. I would like, to combine the two and make it one app so it's also easier for a user. (Participant 23, 20-year-old female)

Participant 10 also shared their perspective on combining both apps, believing that it would be the most effective approach in addressing mental health concerns. However, they specifically expressed their appreciation for Woebot's content, finding it resonated with them and believed it could positively contribute to the mental health journey of others. They highly valued the inclusion of informative and engaging content that provided psychoeducation, going beyond simple meditation exercises. Taking into account the earlier mentioned studies in this paper, psychoeducation appears to be an especially valuable component, particularly for university students who have not previously sought help for their mental health

difficulties. It could address their uncertainty about seeking help, provide insight into what mental health support entails, and alleviate concerns about disclosure and potential stigma.

She stated:

Um, I think also... I really liked Woebot's content. So maybe like, I don't know, like a section on like... I want to say articles, but that would be so lengthy. But, um, ja, what would be cool would be to just combine them both. (Participant 10, 21-year-old female)

Participant 5 suggested incorporating games and adding a social element, emphasising how gamification would be an effective way of sustaining user engagement. She was critical of the fact that Woebot was limited in its offerings, highlighting its journaling capabilities as an example. On discussing the value that adding games to an MMH app would have, she proposed:

Maybe if Woebot could have some games, like, if you could play against Woebot. That would be so cool. So, like if that happens just a little bit more then I would never leave the app. I really would never leave the app. Um, just a little bit more introduction other than your journaling, your um, what else, your positive affirmations, what you call the gratitude thingy, and something else. It was something like three main things that you could choose to do, which is a bit boring. But it was okay, I guess. That's the whole point; it was like keeping a diary; it's not like you can tell your diary to transform into a board game, so ja, ha-ha. (Participant 5, 20-year-old female)

She also highlighted the importance of discussing mental health issues with other users on an app, emphasising how meaningful it can be for individuals who feel isolated in their struggles. This underscores the value of relationships and the sense of connection with

others, which is commonly recognised as a protective factor in mental health. Research by Oliveros et al. (2022) supports this view. From this perspective, this technology could serve as a valuable tool to facilitate genuine connections with real people, resembling the experience of participating in a human support group. However, it also raises important ethical concerns, particularly related to privacy and the absence of oversight by a mental health professional. There is a risk involved if the app's users are all struggling with mental health issues without adequate supervision and protection that software alone may not be able to provide. Ensuring the safety and wellbeing of users should be a top priority when considering the development and implementation of such apps.

I would love to see, um, I'm assuming let's say people could not necessarily Instagram it, but people can post videos and stuff... like let's say, um, I've always had it be a weekly programme but our topic for this month is... I don't know... um, being sad. Then people will be like when I'm sad, this is what I do. Blah blah blah. So, you have people posting from all over the world and what they do so you're not alone. I'll give you an example of um this page that was created by a friend of mine, and what it is, it's an Instagram page called *CreateZim*, and it's hooked on mental health issues that are faced by young Zimbabwean children as well as African children because a lot more countries are starting to create their own, like there's Nigeria, this app and that. (Participant 5, 20-year-old female)

Participants also emphasised the importance of having access to mental health professionals for immediate support. Some suggested adding a feature that allows users to contact psychologists or other professionals in real-time. They believed that this feature would be particularly helpful for people struggling with anxiety or other mental health issues. Participant 8 expressed a belief that face-to-face interaction, particularly with strangers, is

important for effective support. He perceived apps as lacking the necessary human touch and stressed the need for real-time conversations with other individuals. He reported:

I'm kind of in between, because... um, people- I can pick- there are apps used to help people, to help the students. So, this generation they're not much with the- with help from apps. It's not the help they need. You see, I'm trying to explain but... they need like, face-to-face, but more with strangers. Even though it is easier to talk to a chatbot like Woebot. It's just that they need that human touch. (Participant 8, 18-year-old male)

Participant 16 expressed a desire for immediate access to mental health professionals or psychologists through the app. She emphasised the importance of having a platform that could facilitate direct contact with real people who can provide professional services and support to the user:

I would like a place where they would be, um, where you can contact someone, like, someone real immediately to talk to that person and provide those kinds of services, like, direct contact with psychologists or something like that. (Participant 16, 19-year-old female)

Participant 18 acknowledged the value of chatbots like Woebot, which are able to provide a conversational experience. However, they also emphasised the need for apps to incorporate real faces and real people: "Mental health professionals. Ja, I don't know. But Woebot is on to something. I just think there need to be apps out there with real faces, real people", suggesting that a combination of automated chatbot interactions and direct human connection could be important for an optimally functional mental health app.

Upon reviewing the data it appeared important to participants that mental health apps should combine features from different apps, adding games, videos, and human interactions. Incorporating immediate access to mental health professionals was another recommendation. Overall, the analysis highlighted the need for comprehensive mental health apps that can cater to different needs and preferences of users and the data reflected the participants' belief in the importance of human touch and personal interaction in mental health support. This aligns with the earlier finding where participants seemed to express a desire to anthropomorphise the chatbot, with others reporting their preference for the use of Headspace due to the presence of actual humans guiding their meditations.

4.2 Importance of Affordability

Affordable MMH apps could offer university students accessible and cost-effective solutions to proactively manage their mental wellbeing. In this study, the majority of participants highlighted the importance of affordability when discussing MMH apps. In an era where the demand for mental health support is surging within academic communities, these budget-friendly or freely accessible MMH apps offer potential to serve as invaluable resources. They may provide students with guidance, self-assessment tools, and coping strategies to navigate the stresses of university life. This section highlights the significance of affordable MMH apps in facilitating improved mental health outcomes for university students.

Participant 1 suggested that the cost of the app could be a barrier to usage for some people, and therefore, it would be beneficial to make the app free or donation-based:

So, I think my peers would be open to using these apps. Um, if they didn't have to pay ha-ha... Yeah, I would probably set it up as something that people could donate to, instead of having to subscribe to. I would try and make it free for most people

because most people don't have the means out there, so I would try to do that.

(Participant 1, 21-year-old female)

Participant 18 agreed with most participants highlighting the unaffordability of a subscription to access Headspace's full set of features: "not being expensive...but that is still going to be affordable for the masses" and "...unlike Headspace, I wouldn't charge for sessions and that's basically it." In this regard, Woebot was widely regarded as a more suitable model to create a mental health app as it allowed anyone with a smart mobile device to download it at no cost. In an LMIC like South Africa, this appears to be a crucial factor as to whether students will make use of apps in the mental health space or not. However, it also points to a potential opportunity for universities to fund or supplement payment for the subscription to an appropriate, high quality MMH app.

Overall, it appeared that most participants believed mental health apps should be accessible to as many people as possible, and that cost is a significant barrier to achieving this goal. Participants recommended making apps either free or affordable for the masses, with alternatives to subscriptions or paid sessions. The implication was that more attention needed to be given to ensuring that mental health apps were inclusive and reasonably priced, rather than only accessible to those who could afford them. Decision makers at universities could also play a role in creating policies that allow for either partially or completely funding the cost of MMH app subscriptions for vulnerable students who request such support.

CHAPTER FIVE: CONCLUSION

This thesis sought to explore and understand the user experience of university students regarding two popular MMH apps, Headspace and Woebot, and to identify potential improvements for future app development. The study examined participants' experiences with both apps, their perceptions of the apps' designs, as well as their recommendations for enhancing the effectiveness and accessibility of MMH apps. This was determined through the use of online questionnaires and semi-structured interviews with the participants. The findings illuminated the significance of design, user-friendliness, what was useful about each app, and affordability in shaping user experiences with MMH apps.

The study revealed that most participants had positive perceptions of both Headspace and Woebot, though there were some exceptions. Users reported finding value in using these apps as complementary tools to traditional mental health services or self-help resources. They appreciated the convenience and accessibility of MMH apps, which provided them with instant support and strategies for managing stress, anxiety, and other mental health challenges. Participants' willingness to engage with chatbots like Woebot could indicate a growing acceptance of AI in mental health interventions, potentially bridging gaps in mental health care delivery. It also pointed to the utility of these types of apps as first-contact experiences with mental health interventions, providing potential mental healthcare users with psychoeducation thus potentially normalising mental health problems and seeking help for such challenges. Furthermore, it offered an experience where there would be minimal, if any, stigma involved in disclosing such difficulties. However, ethical concerns have been raised about the ability of AI to mimic therapy with a human being, as it could potentially deceive users and be exploited for malicious purposes by bad actors. Moreover, as demonstrated by O'Loughlin et al. (2019), the data and security apps of mobile apps for

depression were mostly shown to provide inadequate protection for its users, and it is possible there are shortcomings in this regard with other MMH apps too.

The design of MMH apps was identified as a critical factor influencing user experiences. Participants praised the aesthetic appeal of both Headspace and Woebot, though most preferred Headspace, highlighting the importance of colour schemes in enhancing user experience. Warm colour palettes, such as those used by Headspace, were favoured by most participants, as they elicited positive emotions and a sense of comfort. The preference for warmer colours over cooler ones pointed to the importance of visual aesthetics in promoting relaxation and stress relief for most of the participants in this study. However, the sample size was too small to determine whether warmer colours would always be preferred over cooler ones, and this could be an area where further research is required.

Additionally, the ease of navigation was a prominent feature appreciated by users. Participants found both apps user-friendly, enabling them to explore various features and resources with ease. The simplicity and clarity of design were particularly valued, especially during moments of panic or distress. User-friendliness emerged as a significant factor in sustaining engagement with MMH apps and could be crucial in encouraging users to continue using the app for ongoing mental health support. Again, Headspace was preferred in this regard, but it is important to note that with Woebot being an AI-programmed chatbot, its functioning would by nature be inherently more complex than an app that offers guided meditations only. With the advancement of AI, this may increasingly be the case, although it is difficult to determine from this study whether a more advanced chatbot would be more or less likely to improve user experience and engagement, and thus the potential benefits of its usage.

Based on their experiences with Headspace and Woebot, participants also offered valuable recommendations for improving future MMH apps. The idea of combining features from both apps to create a comprehensive and complementary mental health app received widespread support. Participants suggested integrating elements such as meditation, daily check-ins, psychoeducational content, and gamification. Incorporating games and adding a social element, where users could interact and share their experiences, was also recommended to enhance engagement, and create a supportive community. However, with no such app being identified at the time of writing, it is worth bearing in mind that an app with so many features may be overwhelming for some users, and the notion of adding features is contradictory with the reports of users enjoying the simplicity of the respective apps. Furthermore, there may be some risks involved in having a community of users being able to be in contact with each other, as described in the previous chapter.

Moreover, participants emphasised the importance of affordability in MMH apps. Many believed that cost could be a barrier to usage, particularly for students with limited financial resources. Participants recommended making the app free or donation-based to ensure wider accessibility to mental health support. The significance of affordability aligns with the goal of making mental health resources more inclusive and reaching a broader audience. With literature pointing to the extent of the shortages of availability of mental health services along with the many barriers to accessing such services, this seems especially pertinent if this goal is to be achieved. Universities may also benefit from considering funding high quality, evidence-based MMH apps for struggling students as a means of increasing student mental health resources.

Implications and Future Directions

The findings of this study have several implications for the development and implementation of future MMH apps. The study revealed that designers and developers would benefit from the prioritisation of creating visually appealing and user-friendly interfaces that evoke positive emotional responses. Warm colour palettes, simplicity of design, and ease of navigation were identified as being able to enhance user experiences and encourage sustained engagement with apps.

Combining features from different apps, such as meditation exercises, psychoeducational content, and gamification, may lead to more comprehensive, engaging, and effective mental health interventions. If such apps are developed, they would need to be created with the wellbeing of its users in mind, rather than the bottom line being sustained engagement. The addition of a social element, where users can share experiences and support each other, could foster a sense of community, and reduce feelings of isolation. However, adding this element would also need safeguarding and careful design to prevent harm among a vulnerable community of mental healthcare users.

Affordability also emerged as a critical consideration in the development of MMH apps, especially in the context of LMICs such as South Africa. Making apps accessible and cost-effective could significantly increase their reach and impact, benefiting a larger population in need of mental health support. However, this should not come at the cost of quality, and how low-cost or free MMH apps are funded ought to be carefully managed to ensure its users are protected and provided with an adequate alternative to professional services should they be unable or have difficulties in accessing them.

It is essential for future research to continue exploring the effectiveness and user experiences of MMH apps. Longitudinal studies, in particular, could also assess the impact of

app usage on mental health outcomes over time, providing insights into the sustainability and efficacy of these interventions. Furthermore, investigating the cultural and contextual factors that influence users' perceptions and preferences could lead to more tailored and culturally sensitive MMH apps. The consideration of language and sociodemographic factors are also important considerations if such apps are to reach their goal of inclusive and accessible mental healthcare services made available through technology.

Limitations

This study has some limitations that should be considered. The sample consisted of 25 university students based in Cape Town, which may limit the generalisability of the findings to other populations. The study also did not screen for mental health issues in its potential participants, and thus it is not known whether these apps would have had more or less of an impact with participants with known CMDs. Additionally, the study focused on two specific MMH apps, Headspace and Woebot, and the participants' experiences with these apps only. Other MMH apps with different features and approaches may have yielded different results and likewise with the same apps but with a different sample.

Summary

MMH apps have the potential to revolutionise mental health care by providing accessible and convenient support to individuals in need. This study has demonstrated the positive perceptions of university students toward Headspace and Woebot, highlighting the significance of design, user-friendliness, and affordability in shaping user experiences.

By combining features from different apps, incorporating gamification and social elements, and prioritising affordability, future MMH apps can be designed to better cater to a broader range of users' needs and preferences. Such apps can serve as effective complements

to traditional mental health services, reaching individuals who may not have sought help otherwise.

As technology continues to evolve, the development of MMH apps should be guided by rigorous research and ethical considerations. These apps have the potential to play a vital role in promoting mental health and wellbeing globally, making support and resources more accessible to diverse populations. By incorporating user feedback and continuously evaluating app effectiveness, developers, in collaboration with mental health professionals and researchers, can contribute to the ongoing advancement of MMH apps and their positive impact on mental health outcomes. Further research into this topic is therefore recommended.

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Appendices

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Appendix A: Weekly Questionnaire

Please select one app for use per week and complete the questionnaire provided at the end of each week. You may use them in whichever order you would prefer.

Headspace

- 1) Have you ever used a mental health app like this before? What was that like?
- 2) How did your perceptions of the app change between the first and last session?
- 3) What did you learn from using this app?
- 4) Have you been able to apply what you've learned from using this app this week? How so?
- 5) What did you like about Headspace?
- 6) What did you not like about Headspace?
- 7) What was difficult and what was easy about using the app?
- 8) What was your overall impression of using this app?
- 9) What effect, if any, did using this app have on you?
- 10) Would you recommend this to other students? Why/why not?
- 11) What would you have liked to be different about this app?
- 12) How likely are you to continue using an app like this?

Woebot

- 1) Have you ever used a mental health app like this before? What was that like? ✓
- 2) How did your perceptions of the app change between the first and last session? ✓
- 3) What did you learn from using this app? ✓
- 4) Have you been able to apply what you've learned from using this app this week? How so? ✓
- 5) What did you like about Woebot? ✓
- 6) What did you not like about Woebot? ✓
- 7) What was difficult and what was easy about using the app? ✓
- 8) What was your overall impression of using this app? ✓
- 9) What effect, if any, did using this app have on you? ✓
- 10) Would you recommend this to other students? Why/why not? ✓
- 11) What would you have liked to be different about this app? ✓
- 12) How likely are you to continue using an app like this?

Appendix B: Interview Schedule

Video/Tele Communication Individual Interviews

1) Welcome and explanation of interview process. Moment to reflect on two weeks with weekly questionnaire in mind.

2) Questions

2.1) What did you experience these past two weeks of using these apps?

2.2) Which app did you prefer and why?

2.3) Could you tell me about what stood out for you in either a positive or negative way in terms of using either of these apps?

2.4) What did you think of the free features Headspace offers?

a) Basics 10-day Course

b) Navigating Change 10-day Course

c) Stressed single meditation

d) Walking at home single meditation

e) Focus single meditation

f) Panicking SOS session

g) Feeling Overwhelmed SOS session

h) Reframe Anxiety Workout (iOS only)

i) Stress Release Workout (iOS only)

j) Doze sleep music

k) Sleeping single meditation

l) Impermanence and change animation

m) Remember the Blue Sky animation

n) Videos

o) Languages (English, French, Portuguese, German and Spanish)

p) Voices (Male British accent, Female British accent)

2.5) Of those, which features did you use the most, and why?

2.6) What did you think of the design of the apps? (Colours, shapes, images, layout, interface)

2.7) Was the content of the apps comprehensible and relevant? (Anything that wasn't clear? Anything not really relatable?)

2.8) What did you think of the features Woebot offers?

- a) Daily check-in reminders
- b) Mood tracker
- c) Jokes
- d) Psychoeducational videos
- e) Toolkits (Challenge Negativity, Challenge Stress, Gratitude Journal)
- f) Stories
- g) The GIFs it uses

2.9) What did you think of Woebot's privacy and data policy?

2.10) What did you think of Woebot as a chatbot?

2.11) What have you learned from using Headspace and Woebot?

2.12) If you could create your own mobile mental health app, what features would you like to see?

2.13) What do you think your peers would think of using these apps? (Would they be open to using them? Why or why not?)

2.14) Would you regard these apps as being useful to the student population you are a part of? (Why or why not?)

3) Close interview and thank participant.

Appendix C: Invitation Letter



Dear Students,

I would like to invite you to take part in a study about how UCT students experience using mobile mental health apps. This study is for my Masters degree in Clinical Psychology.

What is the study about?

Feelings of anxiety and depression are common amongst university students. Right now there are lots of mobile apps that aim to address anxiety and depression without interaction with a counsellor. But we don't know much about how South African university students feel about using these apps, or whether these apps are suitable for students in our context. The purpose of this study is to explore UCT students' user experience of mobile mental health apps for depression and anxiety. The study does not aim to evaluate whether these apps work to reduce anxiety and depression, but rather to explore how students at UCT experience using these apps – what they like, what they do not like, and so on.

Who can participate in the study?

Participation is voluntary. Undergraduate and postgraduate psychology students, who are at least 18 years old, and have daily access to a smart mobile device (phone/tablet) can take part in the study. You do not need to experience anxiety or depression to take part in this study; we are interested in how you experience using the apps even if you do not currently have feelings of anxiety or depression. **You will also need to have about 250MB of data for each week, if you do not have Wifi. We can provide assistance with that if needed.**

What will I need to do if I take part?

If you take part in this study, you will need to:

- 1) download two free mobile apps onto your device. You will use one app for one week, then you will use the other app for the duration of the second week. This should take no more than 10 minutes a day (so about 70 minutes in total for each of the two apps).
- 2) complete a short questionnaire about your user experience of each app at the end of each week.
- 3) take part in an interview with the researcher to discuss in more detail how you experienced each of the apps. The interview will last about 30-45 minutes and will be conducted telephonically if contact learning has not resumed at UCT (the researcher will call you). This interview will be recorded but your name and identifying information will not be included.

What are the benefits of taking part?

If you are selected to participate in the study, a donation will be made in your name to a COVID-19 food relief organisation. You will also potentially learn more about Cognitive Behavioural

INVITATION TO PARTICIPATE

IN PSYCHOLOGY STUDY

Therapy (CBT), mindfulness and meditation, while picking up some skills related to those practices. This research can contribute to developing relevant and user-friendly mobile mental health apps for South African university students. There will be no SRPP credits for participating in this study.

Are there any risks to taking part?

There are minimal risks to taking part in this study. It is possible that some of the exercises on the apps may require you to think about stressors or difficult times in your life so that coping strategies can be suggested. You can, however, choose to withdraw from the study at any point.

How can I volunteer to take part?

This is a small qualitative study that will include 25 participants. Participants need to be demographically representative of the broader UCT student population so we can assess whether the apps are suitable for a diversity of students. The first 25 volunteers that represent a diversity of students at UCT will be selected to participate.

To participate in this study, please email me at CHPWES001@myuct.ac.za with the following information:

- 1) Your age
- 2) How you identify in terms of gender
- 3) How you identify in terms of race/ethnicity

(It is generally accepted that the decision to include or exclude individuals from participating in a study depends on the focus, objective, nature of research and context in which the research is conducted. Some research may be focused on a certain individual (such as a person's life history), or a group of individuals who share a specific characteristic (e.g., an identical group of asthma sufferers who happen to be all of one sex; a religious order that is restricted to one sex). Other examples include research that is focused on specific cultural traditions or languages, or on one age group (e.g., a study of posture corrections in adolescents). These are regarded as appropriate forms of inclusion and exclusion of individuals or groups in research studies - so long as the selection criteria for those to be included in the research are relevant to answering the research question).

I will then email you if you have been selected to take part. If you do not receive an email from me following your application, you can regard that as an indication that you have not been selected for this study.

Thank you kindly for your time.
Wesley Chipps
CHPWES001@myuct.ac.za

Appendix D: Consent Form



CONSENT FORM

TO PARTICIPATE IN STUDY

Dear Students,

Thank you for your interest in taking part in this study!

Please remember that participation is voluntary and you are allowed to drop out at any time.

For this study, we will ask that you download two mobile mental health apps complete two brief weekly questionnaires which will be emailed to you. You may use each app in whichever order you prefer. They will take about 10 minutes to complete. You will be contacted by the researcher for a recorded individual semi-structured, telephonic interview that will take approximately 30-45 minutes.

What are the benefits of taking part?

If you are selected for the study, a food parcel will be donated to an organisation in your name. You will also potentially learn more about Cognitive Behavioural Therapy (CBT), mindfulness and meditation, while picking up some skills related to those practices. This research can contribute to developing relevant and user-friendly mobile mental health apps for South African university students.

Are there any risks to taking part?

There are minimal risks to taking part in this study. It is possible that some of the exercises on the apps may require you to think about stressors or difficulties in your life so that coping strategies can be suggested. You can, however, choose to withdraw from the study at any point without being penalised.

How will your privacy be protected?

In order to ensure that you remain anonymous, your real name will not be used and you will be given a pseudonym instead. Any other identifying information will also be removed. All data will be stored on a password-protected laptop. It is most likely that the researcher will transcribe all recordings. However, it may become necessary to use the services of a professional transcription service. If that is the case, the transcriber will be asked to sign a confidentiality agreement.

Support services

You will be provided with a resource list of support services offered by UCT, as well as external sources, in the event that you experience any distress as a result of this study.

Before you agree to participate in the study, we will answer any questions you have.

Please feel free to email Wesley on chpwes001@myuct.ac.za or the supervisors of this study:

Dr Maxine Spedding on maxine.spedding@uct.ac.za and Dr Debbie Kaminer on debbie.kaminer@uct.ac.za, or UCT's postgraduate administrator Rosalind Adams on rosalind.adams@uct.ac.za, should you have any ethical concerns or if there's anything you don't understand.

Consent statement:

I have read or have been read the consent form for this study. I have been given enough time to consider the above information and to ask for advice if necessary. I have had the opportunity to ask questions that have been answered to my satisfaction. I am voluntarily agreeing to participate in the study by signing this form.

Date (DD/MM/YYYY) _____ Signature _____

I agree that my participation in the interview can be recorded: Yes _____ No _____ (please initial)

I agree that the recordings made of my participation in the study can be transcribed by a professional transcriber:

Yes _____ No _____ (please initial)

Appendix E: Confidentiality Agreement Between Researcher and External Transcriber



UNIVERSITY OF CAPE TOWN
DEPARTMENT OF PSYCHOLOGY

CONFIDENTIALITY AGREEMENT: TRANSCRIPTION

Study Title: *South African university students' user experience of mobile applications for anxiety and depression*

RESEARCHER: Wesley Chipps

SUPERVISORS: Dr Maxine Spedding and Dr Debbie Kaminer

- I understand that my responsibility on this study is to transcribe audio-recorded interviews.
- I agree to keep strictly confidential all information discussed in the research interviews and will not discuss the content of the interviews with anyone else.

Name (printed)

Date

Signature

Appendix F: Resource List of Support Services

- 1) **UCT STUDENT WELLNESS SERVICE:** Health service: 021 6501020Counselling service: 021 6501017
<http://www.students.uct.ac.za/students/support/health-counselling/student-wellness>
- 2) **UCT STUDENT CARELINE:** 0800 24 25 26 (free from a Telkom line) or send an SMS to: 31393 for a "call-me-back" service.
- 3) **LIFELINE WESTERN CAPE:** *Telephone counselling:* WHATSAPP – 063 709 2620 or 021 4611111 (landline call subject to normal Telkom rates) between (09h30 to 22h00) daily *Face to face counselling:* Call 021 4611113 (town) or 021 361 9197 (Khayelitsha) to book an appointment.
- 4) **RAPE CRISIS OBSERVATORY** 021 447 1467 or 24-hour Helpline: 021 447 9762
23 Trill Road, Observatory
<https://rapecrisis.org.za/>
- 5) **HOPE HOUSE**, 021 715 0424, bookingsbergvliet@gmail.com, Cnr Childrens & Silverhurst Way, Bergvliet, <https://hopehouse.org.za/contact>

Appendix G: Ethical Clearance Certificate

UNIVERSITY OF CAPE TOWN



Department of Psychology

University of Cape Town Rondebosch 7701 South Africa
Telephone (021) 650 3417
Fax No. (021) 650 4104

05 May 2020

Wesley Chipps
Department of Psychology
University of Cape Town
Rondebosch 7701

Dear Wesley

I am pleased to inform you that ethical clearance has been given by an Ethics Review Committee of the Faculty of Humanities for your study, *South African university students' user experience of mobile mental health applications for depression and anxiety*. The reference number is PSY2020-007.

I wish you all the best for your study.

Yours sincerely

Signed by candidate

Catherine Ward
Professor
Chair: Ethics Review Committee

Appendix H: Participant Number and Self-Identified Demographics

PARTICIPANT NUMBER	PARTICIPANT DEMOGRAPHICS
Participant 1	Female, 21 years old, International: Pakistani
Participant 2	Female, 18 years old, White
Participant 3	Female, 20 years old, Black
Participant 4	Female, 18 years old, White
Participant 5	Female, 20 years old, Black/African
Participant 6	Female, 20 years old, Coloured
Participant 7	Male, 21 years old, White
Participant 8	Male, 18 years old, Coloured
Participant 9	Female, 20 years old, White
Participant 10	Female, 21 years old, White
Participant 11	Female, 19 years old, Indian
Participant 12	Female, 21 years old, White
Participant 13	Female, 18 years old, Coloured
Participant 14	Male, 18 years old, Coloured
Participant 15	Female, 20 years old, Black
Participant 16	Female, 19 years old, International: Mauritian
Participant 17	Male, 18 years old, Black
Participant 18	Female, 18 years old, Black
Participant 19	Male, 25 years old, Coloured
Participant 20	Gender Queer, 21 years old, Coloured

Participant 21	Female, 18 years old, Black
Participant 22	Female, 20 years old, Indian
Participant 23	Female, 20 years old, White