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Improving mental wellbeing among university students via a smartphone application based on Acceptance and Commitment Therapy

A thesis
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Abstract

The number of university students experiencing mental disturbances is increasing. Due to the impact it has on students' academic life, there is a need for an efficient, convenient, and cost-effective intervention which can be widely applied to university populations. Acceptance and Commitment Therapy (ACT) is an effective behavioural treatment for a range of psychological disorders. ACT has a transdiagnostic feature, as it focus on educating individuals to be aware of their internal experiences, such as thoughts and feelings and to accept them, instead of suppressing or avoiding them. The fundamental goal of ACT is to promote individuals' psychological flexibility when faced with challenging events by addressing their valued life goals. ACT Companion™ app is an ACT-based smartphone app which incorporates exercises to assist users achieve their treatment goals. I used a single-subject design to examine the efficacy of the ACT Companion™ app in reducing measures of stress, anxiety, depression, and psychological flexibility for 9 university participants. Graphs showed that app use lowered daily stress levels for all participants. At a group level, there was a significant decrease in anxiety, stress, depressive symptoms, and negative emotions. However, no significant effect of app use on mindfulness and psychological flexibility. Overall, the results suggest that the ACT Companion™ app is a promising approach for improving mental wellbeing among university students.

Keywords: Acceptance and Commitment Therapy, anxiety, stress, emotion, University students, mental wellbeing, ACT Companion™ app

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Introduction

Mental health and wellbeing among university students

Mental health and wellbeing-related issues have become more common and impact people's lives across the world. For example, a systematic review noted that the prevalence of anxiety disorder globally is 7.3% (Baxter, Scott, Vos, & Whiteford, 2013). Similarly, mental health and wellbeing concerns among university students are also rising (Blanco et al., 2008), the occurrence and severity of mental disorders appear to be increasing as well (Hunt & Eisenberg, 2010). Across a range of studies, anxiety and depression were two of the prominent symptoms of psychological distress experienced by university students (Sharp & Theiler, 2018). For instance, Eisenberg, Gollust, Golberstein, and Hefner (2007) surveyed that, amongst their undergraduate and graduate respondents, the prevalence of anxiety disorder was 16% and 13% respectively. Hunt and Eisenberg (2010) found 17% of the students taking their survey had the possibility of being diagnosed with depression-related disorders. In a survey conducted in American students, 20.8% of college and university respondents felt overwhelming anxiety at least once in the past 12 months and 16.5% reported feeling so depressed and it was difficult to function at least once in the preceding year (ACHA, 2016). Samaranayake, Arroll, and Fernando (2014) found that 19.7% of New Zealand university students (age range 16-38 years) experienced anxiety and 39.4% had at least 1 month of an imbalanced sleeping pattern caused by anxiety and depression.

Mental distress impact on student performance.

To survive academic life, students have multiple challenges to conquer, including academic success, future career planning, and appropriate social interactions (Beiter et al., 2015; Cooke et al., 2006; Pierceall & Keim, 2007; Vaez & Laflamme, 2008). Pressures and stresses may accumulate when facing such challenges, leading to an increase of struggles and a decrease of quality life (Räsänen, Lappalainen, Muotka, Tolvanen, & Lappalainen, 2016).

Neglecting to deal with mental disturbances may have negative consequences for student health (Adams & Moore, 2007; Hunt & Eisenberg, 2010). Several researchers have indicated that unhealthy behaviours, such as disturbed sleeping patterns (Howell, Jahrig, & Powell, 2004), video gaming (Anand, 2007), excessive internet use (Suhail & Bargees 2006), and alcohol consumption (Singleton, 2007) will negatively impact university students' academic performance. Andrews and Wilding (2004) found that university students diagnosed with depression and anxiety received significantly poorer exam outcomes, compared with non-clinical students. Similarly, Hysenbegasi et al. (2005) found that depression and anxiety were associated with a decrease in university students' GPA.

With regards to the impact on students' social relationships, university students are involved in multiple interactive relationships, such as with their classmates, teachers, families and others, in a social environment on a daily basis (Öztürk & Mutlu, 2010). Thus, students are likely to experience social anxiety, including concern about whether they acted properly (Lewis et al., 2008). They may also feel pressured in academic performances such as public speaking or other situations that require them to get up on stage (Nevid et al., 2003). Schlenker and Leary (1982) pointed out that individuals tend to aim to leave favourable impressions on others during social exchanges, however, if they perceive that it is difficult to do so, anxiety arises.

Fear of negative evaluation from others may contribute to anxiety (Schlenker & Leary, 1982). The consequences of social anxiety normally are withdrawal from, or avoidance of, anxiety provoking situations (Rholes, Simpson, & Oriña, 1999). Behaviours such as escape and avoidance serve as negative reinforcers to temporarily remove anxiety, however, avoidance is counterproductive in the long-run as escape and avoidance minimise the opportunity for the individual to learn the necessary skills to face up to challenging social situations (Nevid et al., 2003). Moreover, socially anxious individuals are more likely to get

involved in worse situations, such as substance addiction and major depression (Saddock & Saddock, 2003). Together, these findings indicate that academic achievement can be compromised by students' unhealthy behaviours and psychological disturbances, leading to the impacted mental wellbeing.

Mental wellbeing-related variables

Anxiety.

Anxiety is an emotional reaction towards stressful events that incorporates physiological, psychological, and behavioural responses (Sakin, Ercan, Irgil, & Sigirli, 2010). Different from the emotion of fear, anxiety includes a kind of fearful sensation that impacts people without the direct presence of threat (Pinel, 2006). Thus, minor anxiety can function as an alert to remind people about potential yet undefined threats, whereas fear functions as a protection from real life threats for individuals (Saddock & Saddock, 2003). Bourne (2004) also stated that in modern society, feelings of anxiety are inevitable through people's lifetime. There are frequent challenges in life that might come with unknown loss or failure in response to which it is reasonable to feel anxious (Richards, 2008). However, excessive anxiety responses severely disturb one's wellbeing, interfere with an individual's adaptation, and lead to diagnoses of an anxiety disorder (Pinel, 2006).

According to Kazdin (2000), physiologically, increased blood pressure, speedy heartbeat, fast breathing, sweating, cold hands and feet, trembling, and dizziness are symptoms of an anxious person. Additionally, people with anxiety disorders are likely to display psychological symptoms such as worried thoughts about the future, stress, and tension. People suffering from anxiety also have the behavioural tendency towards avoiding, or escaping from situations which may cause intrusive concerns, engaging in other unhealthy behaviours, and to experience imbalanced sleeping patterns (Kazdin, 2000). Ercan and colleagues (2008) discovered that anxiety has a negative impact on an individual's

perspectives on thoughts, perceptions, and learning. People suffering from anxiety might encounter difficulties with concentration, memorisation, and relationship establishment with others and among events. A range of disorders that may impact peoples' mental wellbeing are categorized as anxiety disorders, including anxiety and depressive disorders, generalized anxiety disorder, social anxiety disorder, phobias and separation anxiety, and panic disorder (Bandelow & Michaelis, 2015). Spielberger (1972) proposed two "forms" of anxiety; state and trait anxiety. State anxiety is the response to a threat that is psychological and physiological (Pollyana et al., 2017), whereas the proneness response to a perceived danger by the individual is referred to trait anxiety. People suffering from prolonged anxiety have reported a high level of trait anxiety (Hirsch et al., 2013). Moreover, they have difficulty recovering from negative emotions, resulting in the inability to regulate their moods which leads to even more anxiety (Mennin et al., 2005).

Rawson, Bloomer, and Kendall (1994) noted that anxiety is often interrelated with other mental distresses. Some variables contribute to anxiety such as stress and negative emotions, and others are affected by anxiety, such as depression.

Stress.

According to Selye (1974), alarm reaction, resistance reaction, and exhaustion are the three stages of a stress response. The first stage is alarm, an initial adaptive response to life-threatening situations that require the body to find strategies quickly to ensure successful survival. During the second stage, which is resistance reaction, chemical changes within the body occur to support the individual's resistance to threats. The last stage, exhaustion, occurs when all resources are exhausted, leading to an incapacity of relieving the threats. Selye (1974) also mentioned that failed adaptive changes become corrupted, negatively impacting people's wellbeing, for instance, by resulting in impacted immune system, irritable bowel

syndrome, heart disease, burnout, anxiety, and depression (Landy & Conte, 2007; Pinel, 2006; Tortora & Grabowski, 2000).

Stress is a discomfort generated when someone feels incapable of meeting demands set by others in the environment (Caltabiano, Byrne, Martin, & Sarafino, 2002). It is an unwanted reaction when facing negative situations. However, different from worry as a psychological phenomenon, stress is a physiological response towards harmful stimuli (Pinel, 2006). Stress can also be provoked by threatening stimuli, termed stressors (Tortora & Grabowski, 2000). Physical stressors include extreme noise and psychological stressors are depend on an individual's personal experience and expectation such as interpersonal conflict and a perceived lack of control over the negative situation (Landy & Conte, 2007).

Depression.

Depressed individuals experience greater life stress (Kendler, Karkowski, & Prescott, 1998), in addition, they are more sensitive to stress, reacting more severely than healthy individuals even to relatively minor stressors (Vrieze & Claes, 2009). Symptoms of depression appears in dimensional domains, including persist negative thoughts and feelings, low active behaviours and social withdrawal, along with some physical and physiological dysfunction (Nolen-Hoeksema, 2000). On the other hand, a great number of people who suffer from depression also have comorbid anxiety problems (Brown, Campbell, Lehman, Grisham, & Mancill, 2001). Anxiety predicts depressive symptoms (Winer et al., 2017), which means individuals who suffer long-term from anxiety disorders may be at high risk of progressing to depression (Kaufman & Charney, 2000).

Affect.

According to Watson, Clark, and Tellegen (1988), affect is used to refer one's emotional experience. The extent of one's positive emotional experience (e.g., being excited, attentive, or interested) is reflected by positive affect, whereas, negative affect reflects

negative emotions such as being ashamed, jittery, or afraid (Watson et al., 1988). Positive moods are typically associated with more general schematic and relational processing, whereas negative moods tend to be associated with item-specific, detail-oriented processing (Danhauser et al., 2013). Isen (2000) demonstrated that people with higher positive affect were more open to negative life events compared to those with high negative affect. Fredrickson (2001) also proposed that positive affect contributed to being more flexible and creative. Clark and Watson (1991) noted there is a fundamental feature that people with both anxious and depressive symptoms share; negative affect, which is distress in general. Campbell-Sills et al. (2006) stated that psychological distress is described by excessive and persistent negative emotions. Improving the ability of appropriately regulating emotion especially towards negative affect is a target in treatment for anxiety and depression. Clark and Watson (1991) argued that measures of anxiety and depression are also highly related to the exhibition of negative affect. The absence of positive affect (e.g. the lack of attention or excitement) is exclusively used to measure depression. They also suggested that anxious and depressive individuals show high levels of negative affect (e.g., distress, irritability, and mild sleep, appetite, or somatic disturbances), but the exhibited lack of positive affect or hyperarousal are dependent on individual factors.

Behavioural approaches for improving wellbeing

With the development of behaviour therapy through decades, two behavioural interventions, Cognitive Behavioural Therapy (CBT; Beck, 1976) and Acceptance and Commitment Therapy (ACT; Hayes, Strosahl, & Wilson, 1999) have introduced timely and effective treatments for improving individuals' mental health and wellbeing (Barlow & Cerny, 1988; Beck, Emery, & Greenberg, 1985; Arch, Eifert, Plumb, Rose, & Craske, 2012).

Cognitive behavioural therapy (CBT).

The treatment goal of CBT for emotional disorders is to reduce the negative

emotional response generated from disturbing thoughts by replacing those thoughts with more adaptive ones (Hofmann & Asmundson, 2008). For example, individuals with anxiety disorders undergoing CBT will learn to identify negative cognitions that impact their mood. The client recalls the emotional response to the relevant situation. After rating the degree to which they assume the thought is proper and the intensity of the emotion associated with the thought, they are challenged to replace the thought with a more adaptive one (Hofmann & Asmundson, 2008). It is believed in CBT that individuals who can apply the process to different situations will develop a more sensible, adaptive, and less negative understanding of everyday life (Yovel, Mor, & Shakarov. 2014).

Studies have showed CBT to be an effective intervention for variety disorders, such as anxiety and depression (Butler, Chapman, Forman, & Beck, 2006; Hofmann & Smits, 2008; Norton & Price, 2007; Tolin, 2010). However, Loerinc, Meuret, Twohig, Rosenfield, and Craske (2015) argued that many clients do not respond to CBT successfully, as they relapse after treatment, dropout at high rates, and seek additional treatment.

Acceptance and Commitment Therapy (ACT).

Brief description of the development of ACT.

While CBT has been the most common treatment for variety of psychological disorders, there is increasing interest in mindfulness-based alternatives (Arch & Craske, 2008). Acceptance and Commitment Therapy (ACT) is the result of one of those attempts to incorporate the concept of mindfulness into treatment (Arch, Eifert, Plumb, Rose, & Craske, 2012). ACT originated from functional contextualism, which concentrates on describing and interpreting behaviour in its eliciting environment to deliver a better prediction of and influence on behaviour in a long run (Biglan & Hayes, 1996). Relational Frame Theory (RFT) has provided a strong theoretical basis for ACT. RFT connects human language and cognition (Hayes, 2004). With this foundation, ACT addresses how language and cognition

connections impact human suffering through first identifying the function and context of behaviour that has contributed to the suffering, and then devising strategies to make improvements (Hayes, 2004). ACT emphasizes acceptance of distressing thoughts, with the aim of lessening their regulatory power over behaviour which means it helps by separating struggles with their discomfort, which is anxiety-related and taking charge by engaging in actions directed by the valued life goals (Hayes et al., 1999).

ACT focus.

Hayes and colleagues (2006) emphasised that, similar to CBT, educating people with mental disturbances to recognise negative internal events is the preliminary focus of ACT. However, different from CBT, which focuses on diminishing negative internal events, ACT promotes opening up to those negative thoughts, without necessarily having to act on the literal meaning of the negative thoughts. Not only does this increase psychological flexibility, which is the fundamental treatment goal within ACT, but it also encourages people to keep pursuing a valued life (Hayes et al., 1999). Higher levels of psychological flexibility indicate a higher capacity of staying in contact with the present moment. One is not focusing only on reducing mental distress but becoming increasingly willing to change behaviours to improve quality of life (Hayes et al., 1999).

Psychological flexibility is achieved by lowering occurrences of experiential avoidance (EA), the avoidance of experiences associated with undesired personal events (Hayes et al., 1996). For instance, anxiety, along with other internal experiences, is negatively viewed, as a result, people may not want to experience it again. Individuals may avoid those experiences, by replacing them with other unwanted behaviours to create distraction, suppressing the disturbing thoughts, or even avoiding situations that lead to the unwanted experiences (Hayes et al., 1996). They also argue EA is problematic as it does not work when applied to internal experience. This is because avoidance requires a 'verbal plan'.

For example, to avoid anxiety we create rules like ‘I must not feel anxiety.’ However, as this rule contains the word anxiety, it ends up making thoughts about anxiety more salient (Hayes et al., 1996). This effect has been illustrated in studies that show avoidance strategies, such as thought suppression, actually increase the frequency and saliency of thoughts (Abramowitz, Tolin, & Street, 2001). In particular, avoidance of anxiety impairs individuals’ psychological flexibility when unpleasant thoughts, feelings, and bodily sensations are present and individuals lack the ability to make positive life choices (Forman et al., 2007). Eifert et al. (2009) noted that when applying ACT to problems with anxiety, individuals learn to simply observe distress thoughts and feelings as they are, without putting effort into changing or decreasing the situations.

Mindfulness.

ACT incorporates mindfulness as one of their treatment techniques (Hayes 2004). The focus of being mindful has a close contribution to the six principles of ACT (this is described in the following section).

Attention and awareness in everyday life is termed as mindfulness (Analayo, 2003; Bodhi, 2000). Mindfulness is to observe what is happening by being aware of the experience in the present moment and being attentive in a receptive way of accepting any thoughts and feelings related to the current experience without judging them (Brown & Ryan, 2003; Brown & Cordon, 2009). Individuals who suffer from mental disturbances learn mindfulness is to be aware of maladaptive thoughts and emotions that cause distress and then to direct the focus on attending to those distresses in an accepted way while not forming judgements on the distress (Bishop et al., 2004). Hayes and Shenk (2004) proposed that ACT provide techniques to assist individual to achieve mindfulness by learning to label the thought as an object instead of acting on its literal meaning in terms of contemplating on, controlling, suppressing,

or running away from the thoughts. Eventually, mindfulness involves the ability to accept and to be generally open to any events and internal experiences individual encountered.

ACT Principles.

Hayes et al. (2004) proposes one should develop the willingness of fully accepting experiences as they are. This will help to increase psychological flexibility, leading one's life to a valued direction by making better choices of actions. Six core components of ACT are designed to assist in the achievement of the ultimate treatment goal of increasing psychological flexibility (Hayes et al., 2006). As treatment processes, they are named *Acceptance, Cognitive Defusion, Self-as-Context, Contact with the Present Moment, Values,* and *Committed Action* (Hayes et al., 2006). The interactive components will create a new relation with thoughts (Hayes, Strosahl, Bunting, Twohig, & Wilson, 2004). The ACT intervention process is divided into two processes: First, mindfulness and acceptance (*Acceptance, Defusion, and Self-as-Context*) and, second, commitment and behaviour change (*Contact with the Present Moment, Values, and Committed Action*) (Blackledge & Hayes, 2001). The components are portrayed on a 6-faceted diagram, called the ACT Hexaflex (Bach & Moran, 2008; Hayes et al., 2006) shown in Figure 1.

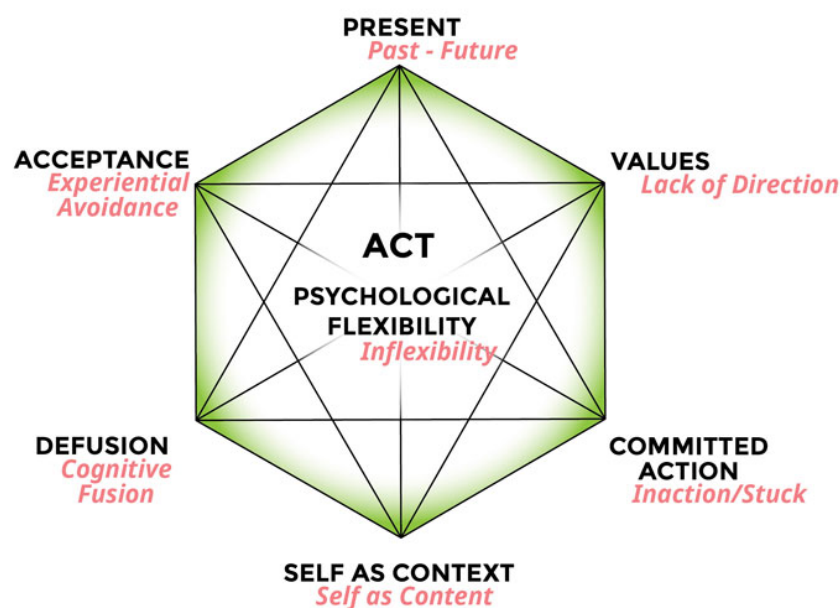


Figure 1. The ACT Hexaflex Diagram.

Acceptance is defined as the willingness to keep in touch with private experiences including thoughts, emotions, or memories. It means to accept those experiences as themselves without trying to change their form, frequency, or contexts. Hayes et al. (2004) noted it is the opposite to avoidance. Anxious individuals for instance, are encouraged to fully experience the anxiety as a feeling, being aware of it, not trying to avoid it or escape from it. Thus, the internal experiences are no longer seen as disturbances and individual no longer have to suppress, control, or avoid them (Luoma, Hayes, & Walser, 2007).

Cognitive defusion is a process focused on distancing self from the thoughts; from the literal meaning of those thoughts. For example, one defusion technique is labelling the process of thinking as “I am having the thought that...” instead of purely having thoughts (Hayes et al., 2004). Furthermore, more strategies are focused on helping people to experience the separate thoughts in ways that weaken what they refer to (Hayes et al., 2004). Examples are using people’s non-dominant hand to repeatedly write down their distressing thoughts, or to be mindful of imaging watching the written thoughts on clouds floating in the sky (Hayes et al., 2004).

Self-as-context is the process that assists with defusion, acceptance, and staying in contact with present moment (Harris, 2009). It allows the self to experience different thoughts, feelings, memories, sensations, or urges but not to let those experiences define oneself, but simply observing the self in different contexts (Harris, 2006). This means, in order to access a transcendent consciousness that is unchanging, safe, and always present, the self is seen as an observer of those separated experiences (Harris, 2006; Hayes et al., 2004).

Contact with the present moment means becoming fully aware of your here-and-now experience, and engaging in surroundings and events with full openness, interest, and acceptance (Harris, 2006). It is obtained by the observing the environment and internal experiences and the descriptions of what is present without evaluating and judging them.

(Hayes et al., 2004).

Committed Actions means engaging in behaviours related to set goals which are guided by values to allow for positive behaviour change. More specifically, ACT promotes the development of active actions that connect with chosen values. ACT incorporates traditional behaviour therapy such as exposure, skills acquisition, shaping, and goal setting into therapy work and sets homework for clients with regards to short-, medium-, and long-term behaviour change goals (Hayes et al., 2004).

In ACT interventions, these principles enhance people's ability to thoroughly experience psychological events but not be controlled by them and eventually to take effective action to achieve valued life goals (Luoma et al., 2007). ACT adopts metaphors, paradox, and mindfulness exercises to promote this transformation. These processes in ACT are applied in different situations, leading towards the success of treatment (Hayes et al., 1999).

ACT Efficacy.

ACT have shown promising results in different areas, including decreased stress and increased general mental health among social workers (Brinkborg, Michanek, Hesser, & Berglund, 2011); symptoms of insomnia (Ong, Ulmer, & Manber, 2012); effective treatment for depression (Richardson & Bramwell, 2017) and substance abuse such as alcohol (Svanberg, Munck, & Levander, 2017). Specifically, case studies, multiple-baseline treatment studies, and single randomized clinical trials have also applied ACT to the treatment of anxiety disorders (Eifert & Forsyth, 2005; Eifert et al., 2009). These studies have provided evidence indicating that ACT is an effective treatment for the following: obsessive-compulsive disorder (Twohig, Hayes, & Masuda, 2006; Twohig et al., 2010); social anxiety disorder (Dalrymple & Herbert, 2007); panic disorder (Eifert et al., 2009), and posttraumatic stress disorder (Orsillo & Batten, 2005). In addition, an acceptance-based behavioural therapy

for generalized anxiety disorder was effective relative to a wait-list control condition (Roemer, Orsillo, & Salters-Pedneault, 2008).

ACT with university students

Many university students face psychological pressures, such as the stress of academic success, pressures about future careers, or social relationship issues. Few however, will be diagnosed with specific mental disorders (Grégoire, Lachance, Bouffard, & Dionne, 2017). Thus, an intervention that features transdiagnostic treatment function is needed, that is, the intervention is not tailored for restricted psychological disturbances but suitable for a broad of diagnoses of mental disorders as it applies the same fundamental treatment principles across them (McEvoy, Nathan, & Norton, 2009). ACT could be an appropriate tool for the growing needs of university populations given the approach is not limited by diagnostic presentations, severity and duration of the disturbance, or student demographics (Hayes, Pistorello, & Levin, 2012). According to Levin, Haeger, Pierce, and Twohig (2017), rather than using a series of programmes targeting one specific problem, ACT can provide a “one-stop” service for tertiary education students who suffer from psychological distress. For instance, ACT addresses students’ most valued goals and encourages them to directing their life along a rich and meaningful path. Students who take part in ACT are educated to be aware of having thoughts which are intrusive, to pay attention to the following emotions, not to suppress or avoid but to face them (Grégoire, Lachance, Bouffard, & Dionne, 2017). Grégoire et al. (2017) stated that ACT helps students foster a better tolerance of distress, higher engagement in a more accepted and compassionate attitude towards thoughts and emotions, with increased psychological flexibility to organize their life around meaningful academic and professional goals.

ACT effectiveness among university students.

According to Levin et al. (2017), ACT has promising treatment outcomes for a variety of psychological problems that are also commonly found within university populations and can help with increasing psychological flexibility. A meta-analysis (Regehr, Glancy, & Pitts, 2013) of over 20 studies showed that cognitive, behavioural, and mindfulness-based interventions are effective in reducing psychological distress, including anxiety and depression of university students. Danitz and Orsillo (2014) examined psychological wellness in first-year university students and reported that students who received an acceptance-based behavioural therapy gained more acceptance and less depression, and some decrease in stress and anxiety at follow up. Grégoire et al. (2017) found positive results of ACT in promoting university students' school engagement and their general mental health. These studies provide indications that ACT may be helpful for students dealing with stressful, anxious, or depressive issues and generally enhancing student mental health.

The difficulties of face-to-face therapy for university students.

Universities often offer student health services including counselling support (MacKean, 2011). Some students are willing to seek psychological help to solve the intrusive mental concerns, the most common ones being depression and anxiety (Krumrie, Newton, & Kim, 2010). However, those counselling sessions are limited as, firstly, they are often understaffed or staffed by less qualified therapists (Jaworska, De Somma, Fonseka, Heck, & MacQueen, 2016). Secondly, students may lack time if their study schedule is tight (Hunt & Eisenberg, 2010). In addition, due to the increasing counselling demands, long waiting lists lead to insufficient receipt of needed help (Räsänen et al., 2016). According to Levin, Hayes, Pistorello, and Seeley (2016), the challenge remains as to how to efficiently apply a range of intervention programmes to the wide range of university students' problems. Certain programmes target different issues and contain complex procedures, requiring long-term commitment to complete, which can be untenable for students (Levin et al., 2014).

Many students, moreover, do not seek psychological services for reasons such as existing stigma towards mental problems (McKinney, 2009); ignoring the need for professional help (Zivin, Eisenberg, Gollust, & Golberstein, 2009); negative attitudes towards potential treatment outcomes (Eisenberg, Golberstein, & Gollust, 2007); as well as concerns about the expense of treatment (Gulliver, Griffiths, & Christensen, 2010). Given these reasons, effective implementation of face-to-face help in universities remains limited. Thus, an approach which targets shared risk factors of many mental disorders, is more convenient, efficient, and cost-effective for university students is necessary.

Self-help Interventions (SHI) for university students

Within psychological interventions, “self-help” is described as a self-administered means whereby people can manage their mental wellbeing using accessible materials and techniques that incorporate standardised psychological principles (Richards, 2004). With minimal or no interaction with related professionals, SHI are used across a variety of disorders, such as depression, anxiety disorders, and eating disorders (Clum & Watkins, 2008). Johnston, Foster, Shennan, Starkey, and Johnson (2010) proposed that large numbers of individuals will benefit from SHI intervention as it costs much less than traditional face-to-face therapies.

Self-help books.

Newman and colleagues (2003) found that self-help materials were efficacious for people with different anxiety diagnoses. Muto, Hayes, and Jeffcoat (2011) offered a self-help book based on ACT to Japanese students attending American university who subsequently demonstrated decreased clinical levels of distress after use compared with a no-intervention group. However, the effect sizes for self-help books remain small compared to face-to-face therapy (Haug, Nordgreen, Öst, & Havik, 2012). In addition, other forms of SHI designed

with audio, visual, or multimedia formats such as computer programmes and phone applications are starting to gain popularity (Cavanagh, Strauss, Forder, & Jones, 2014).

Internet-based/Technology self-help approaches.

Over the decades, the widespread use of the internet has promoted the implementation of internet-based SHI for people's mental wellbeing (Proudfoot, et al., 2011). According to Cuijpers and Schuurmans (2007), those interventions have become more appealing as the advancing technology allows for better user experiences through added audio, graphics, and video through mediums such as computers and smartphones. Many of the interventions also include self-report assessment, which can provide real-time feedback in regards to the programme usage (Cuijpers & Schuurmans, 2007). Internet-based SHI can enhance the interaction between the programme and the user and provide a convenient means of data collection. In addition, internet-based SHI can be aimed at mental health problems that have shared risk factors, so that the intervention is suitable for a range of psychological disorders (Cuijpers & Schuurmans, 2007).

Internet-based SHI has great potential to provide mental health care to university students, given that students attending higher education are likely to use the internet regularly compared to the general population groups (Chiauzzi, Brevard, Thurn, Decembrele, & Lord, 2008). Additionally, students regularly use the internet to search for health information (Hanauer, Dibble, Fortin, & Col, 2004.) According to Levin et al. (2017), students who are hesitant to try counselling due to perceived stigma, lack of time, or feasibility, may be willing to try internet-based SHI, as it can be accessed privately anytime and anywhere. If students who would otherwise have to wait for face-to-face consultation benefit from the SHI, demand for student health services is reduced. All in all, internet-based SHI could increase the number of students receiving mental health support (Levin et al., 2017). This alternative intervention may also be beneficial for students gaining degrees through online courses who

have no access to support services. Given the practicality and cost-effectiveness of the interventions (Levin et al., 2014), it is expected to be well received by, and easily distributed to, a majority of university students with high acceptance and participation.

Computer SHI and its effect.

Researchers have started developing and evaluating internet-based SHI among university populations, with promising results. For instance, a randomized clinical trial by Cukrowicz and Joiner (2007) provided psychology undergraduates from Florida State University with a computer programme based on CBT for 8 weeks. The result revealed lower depression and anxiety symptom scores for students who accessed the programme compared with those in control groups. Later, Brathwaite and Fincham (2009) replicated the former research. First-year psychology students had improved mental health outcomes compared to students who had a placebo intervention at a 10-month follow up. Furthermore, Day, Mcgrath, and Wojtowicz (2013) invited university students to use a web-based, self-help, program designed for students who have mild-to-moderate conditions of depression, anxiety, or stress. The programme is CBT-supported and students used it for 6 weeks. Results indicated that participants who had immediate access to the programme experienced greater reductions, in scores of the above three conditions, compared with the wait group, specifically in stress. The improvements were maintained at a 6-month follow-up. Some of the internet-based SHIs using ACT were also implemented in higher education institutions. For instance, Levin et al. (2016) developed an ACT self-help website containing six online sessions and provided it to American university students for 4 weeks. Compared to a control group, the self-help group demonstrated an improvement in overall distress, general anxiety, social anxiety, and depression. Similarly, a 7-week online ACT programme used by Finnish university students produced lower stress and depressive symptoms maintained over a year at follow-up, compared to a wait-list group (Räsänen et al., 2016).

Smartphone-delivered SHIs.

Recently, the development of smartphone applications for mental wellbeing has escalated followed the commercial success of the iPhone and android system mobile devices (Sandholzer, Deutsch, Frese, & Winer, 2015). Torous, Levin, Ahern, and Oser (2017) searched the smartphone application (app) marketplace and found hundreds of available apps using CBT. Smartphone healthcare apps present a global, cost-effective, and convenient approach to increasing demands for mental healthcare and are able to be delivered in real time, given that internet and technology have transformed the mobile communication device to a handheld-sized wellbeing self-help tool (Aboujaoude, Salame, & Naim, 2015). With the base of cognitive behavioural medicine, smartphone apps have already been adopted to effectively deliver interventions aimed at promoting physical activity (Fanning, Mullen, & McAuley, 2012); weight loss (Carter, Burley, Nykjaer, & Cade, 2013); and smoking cessation (Whittaker et al., 2012). Evidence has also shown that apps can provide programmes which positively affect those with mental health conditions, such as stress reduction (Ly, Asplund et al., 2014); depression (Ly, Trüschel et al., 2014); and anxiety reduction (Firth, Torous, et al., 2017). Specifically, some smartphone apps provided to university populations demonstrated effectiveness for improving their wellbeing. For instance, Gajecki et al. (2017) provided a skill-training app on a smartphone to university students with excessive alcohol consumption for about 12 weeks and found positive outcomes for reducing the excessive alcohol use. Lee and Jung (2018) introduced full-time undergraduates at a Canadian university to a mindfulness-based app for 8 weeks, however, the results did not significantly reduce stress or anxiety or increase physical or social functioning. So far, there is a lack of research investigating the efficacy of ACT-based self-help apps for improving mental health and wellbeing among university populations.

The current study

To summarise, improving mental wellbeing among university students is important and has positive influences on their academic success (Mazzucchelli & Purcell, 2015). Anxiety, stress, and depression among university students is increasing globally (Blanco et al., 2008; Hunt & Eisenberg, 2010; Sharp & Theiler, 2018). Anxiety, stress, affect, and depression are the main variables that negatively impact student academic performance and interfere with students making decisions to pursue their valued life goals. ACT has shown promising treatment outcomes for people with different mental health conditions. However, the implementation of ACT in university populations has encountered difficulties such as limited counselling sessions, students' hesitation to seek mental help, due to concerns about expenses of the treatment and existing stigma towards mental problems (Gulliver et al., 2010; Jaworska et al., 2016; McKinney, 2009). Thus, alternatives that are preventive, cost-effective, and easily accessible are needed for this population. Providing self-help interventions through smartphone apps for university students fits the demand, as the handy-sized devices create opportunities for behavioural training in everyday life, as well as for real-time self-monitoring (Yuen, Goetter, Herbert, & Forman, 2012). Self-help apps may help students develop a range of skills that could support good mental health and self-care (Ivanova, Lindner, et al., 2016).

Despite the rapid pace in smartphone app development and growing empirical support for their utility, few studies have specifically explored the implementation of self-help apps based on ACT within university populations who are experiencing stress and anxiety. To facilitate broader adoption and implementation of effective self-help apps among university students, more research on the effectiveness of smartphone-app-delivered ACT among university students is needed. It is essential that smartphone apps for university students are subject to research evaluation because their influence is likely to be significant as apps can be

adopted by a large number of university individuals who may be in distress but are not availing professional help.

For the current study, I used an app based on ACT named ACT Companion, the happiness trap app™ (ACT Companion™ app in short) by psychologist Anthony Berrick and Dr. Russ Harris who authored the content in the app. The app contains a range of exercises aiming at improving the mental wellbeing of their users. The app has four parts (Appendix D) corresponding to the six core principles of ACT. The first part, “Be present”, contains exercises based on the ACT core principles of defusion and being present, in this part, mindfulness recordings, together with some instructive exercises aiming to train users to distance their thoughts from their feelings. “Open up” is the second part relating to the ACT principles of acceptance and self-as-context. It includes exercises such as “Face your fears” in which users come to realise that avoiding scary things in life does not make them disappear. The exercises aid users to make plans to face those scary things. “Self-compassion steps” support users to go through steps when encountering painful thoughts and feelings. The third part, “Do what matters”, reflects the ACT principles of values and committed action. Within this section, exercises help users to discover their valued goals by creating a value list, which can motivate users to overcome barriers and assist their decision making. Along with other related exercises, the last part of the app is the “actometer”. It is a real-time tool designed for users to apply learned ACT skills to real-life situations and get immediate feedback with a ‘flexibility score’ indicating how well the user has been flexible towards certain life situations.

In the current research, I provided the ACT Companion™ app to undergraduate participants and I aimed to examine whether the app was helpful in reducing students’ anxiety. I hypothesised, firstly, that scores of anxiety and related measures assessed by Daily Anxiety Scale-Adult, State Trait Anxiety Inventory, Hospital Anxiety and Depression scale,

Perceived Stress Scale, and The Positive and Negative Affect Scales would decrease with app use. Secondly, I predicted that participants would increase in mindfulness, psychological flexibility, and acceptance and wellbeing identified by measuring with Mindful Attention Awareness Scale and Acceptance & Action Questionnaire-II.

Method

Study design

I adopted a single-subject design which contains three phases in this research. Firstly, a baseline condition. Secondly, an intervention condition and lastly a post-intervention condition.

Ethics approval

Before I conducted the current research, I applied the ethics review for human research and gained the approval from the School of Psychology Research and Ethics Committee, University of Waikato (Ethics approval number #17:37).

Recruitment

I determined the target population of undergraduate psychology students who enrolled in Faculty of Arts and Social Sciences, University of Waikato to be the participants in this study. To recruit participants, I printed out and posted the study advertisements (Appendix A) containing my email address on the notification boards within faculty building. I also emailed the electronic poster to several psychology lecturers who were willing to post the advertisements online through Moodle. All respondents contacted me via emails expressing their initial interest in participating. I then sent an information sheet (Appendix B) and a consent form (Appendix C) containing detailed study information back individually. If the respondents wished to proceed, they read and signed the form. The students participated in return for extra course credit.

Inclusion and exclusion criteria

The inclusion criteria for prospective participants to meet were: (A) enrolled in psychology programme as either full- or part-time students; (B) have a smartphone with Android or iOS system; and (C) not undergoing psychological treatments and medications. I contacted the participants who met initial inclusion criteria and asked them to complete two assessments for screening; a daily anxiety assessment (Appendix E) each day for about a week and a package of questionnaire measuring anxiety and mindfulness (Appendices F-L). I excluded the respondents if their average score on the daily anxiety assessment was under 50. Participants with scores at or above 50 continued to the next stage of the experiment.

Sample size

Initially 50 students contacted me. A total of 12 students started the daily assessment and 10 respondents met the inclusion criteria. One participant dropped out during the intervention stage. Finally, a total sample of nine participants met the research criteria and completely finished all experimental procedures. See Table 1 for more participant characteristics.

Table 1
Participant Characteristics

Participant	Age	Gender	Ethnicity	Year of study	Smartphone
1	19	F	European New Zealander	1	Android
2	23	M	European New Zealander	2-3	Android
3	23	F	European New Zealander	2	Android
4	21	F	European New Zealander	1	Android
5	33	F	European New Zealander	1	Android
6	19	F	European New Zealander	2	iOS
7	28	F	European New Zealander	1	iOS
8	20	F	Māori	3	Android
9	26	F	European New Zealander	3	iOS

Procedure

Baseline.

After I recruited the participants, I sent a link contained the daily anxiety assessment and the battery of questionnaires on Qualtrics® (a web-based survey platform) to them via emails. All participants completed the battery and filled in the daily anxiety assessment every night before bedtime for between 7 and 15 days.

ACT app Intervention.

After daily assessment had been finished, I guided participants to install the ACT Companion™ app (Appendix D). Participants were instructed to use the app as much as they wanted but to complete at least one activity per day for 6 weeks. In the meantime, the daily anxiety assessment continued to be completed till the experiment period ended.

Post-Intervention.

Together with some review questions (see Table 4a, 4b) on experiences, adherence to, and satisfaction with, the app, I sent a post-test measurement which contained the same questionnaire content as pre-test (Appendix F-L) at the end of the 6th week when participants had completed the intervention.

Measures

I compiled a battery of questionnaires and a single daily assessment as the measurements for this study. In the battery, I used State-Trait Anxiety Inventory for Adults (STAI; Appendices F and G), Hospital Anxiety and Depression Scale (HADS; Appendix H), Perceived Stress Scale-10 (PSS-10; Appendix I), and The Positive and Negative Affect Scales (PANAS; Appendix J) to measure participants' anxiety, stress, and depression. I adopted the Mindful Attention Awareness Scale (MAAS; Appendix K), and the Acceptance and Action Questionnaire (AAQ-2; Appendix L) to measure psychological flexibility and acceptance. I also asked participants to fill the Daily Assessment of Symptoms-Anxiety (DAS-A; Appendix E) during the intervention condition to monitor the daily change of

individual's anxiety level. Table 2 describes information about the measures used in the study.

Table 2
Measures used in the study

Measurement	What it measures	Daily or Pre/Post
DAS-A	Anxiety level in the past 24hr	Daily
STAI –Y 1	Current state of anxiety	Pre and post
STAI –Y 2	Disposition to react anxiously	Pre and post
HADS- A	Anxiety symptoms	Pre and post
HADS- D	Depression symptoms	Pre and post
PSS	Perceived stress	Pre and post
PANAS	Positive and negative affect	Pre and post
MAAS	Mindfulness, attention and awareness	Pre and post
AAQ-II	Psychological flexibility	Pre and post

Process measure.

Daily Assessment of Symptoms-Anxiety (DAS-A).

The DAS-A (Morlock et al., 2008) measures daily anxiety scores. It is designed as a self-reported measurement to simply and quickly capture early and rapid anxious responses to daily events. Items in DAS-A cover anxiety, worries, stress, as well as concentration. The 8-item DAS-A is used to detect if there is a change in symptoms during anxiety-related treatment. Participants rate each item on a 0- to 10-point scale and the total score is summed to a 0- to 80-point score in which a higher total score means more severe anxiety symptoms. According to Morlock and colleagues (2008), DAS-A test–retest reliability ranges between 0.84 and 0.91 and is satisfactory. In addition, the Guyatt's responsiveness statistic and Cohen's effect size estimates suggest that the 8-item DAS-A scale is moderately to highly responsive (Morlock et al., 2008). As I investigated the effectiveness of the intervention on anxiety, I adopted the DAS-A to track any daily changes of anxiety in participants while the intervention was ongoing.

Symptom measures.

State-trait Anxiety Inventory for Adults (STAI).

The State-Trait Anxiety Inventory (STAI; Spielberger et al., 1983) measures two types of anxiety, state and trait. The 40-item self-report questionnaire with two 20-item subscales is measured on a 4-point scale. Test takers respond to which point is most closely related to their anxiety state. State anxiety is measured on the STAI Form Y-1; the questions ask how test takers feel at the exact moment they are filling the questionnaire (i.e. statements on the form are “I feel nervous”, “I feel at ease”, and “I feel indecisive”). Respondents may choose from the 4-point response; they are “not at all”, “somewhat”, “moderately so”, and “very much so” (Spielberger et al., 1983). Trait anxiety is measured on the STAI Form Y-2. The items focus on how test takers generally feel for a period of time (i.e., statements on the form include; “I have disturbing thoughts”, “I am content”, and “I take disappointments so keenly that I can’t put them out of my head”). Respondents may choose from “almost never”, “sometimes”, “often”, and “almost always (Spielberger et al., 1983). The scores for each subscale range from 20-80, with higher scores indicating higher anxiety. According to Spielberger et al. (1983), Cronbach’s alpha for STAI Form Y-1 was between .86 - .95 and for STAI Form Y-2 between .89 - .96, indicating very good internal consistency and validity (Grant et al., 2008). As the participants in the current study were constantly monitoring their anxiety during the app use, this questionnaire helped gain a clearer picture of their anxiety levels before and after app use.

Hospital Anxiety and Depression Scale (HADS).

HADS has 14 items divided into two subscales. Seven focus on anxiety symptoms and the rest are depressive symptoms (Zigmond & Snaith 1983). For example, a question in the anxiety scale is “I feel restless as I have to be on the move” while, in the depression scale, a question is “I can laugh and see the funny side of things”. Each item is scored from 0-3. According to the Snaith and Zigmond (1994), HADS scores for both anxiety and depression

scales of 8-10 reflect mild symptoms, 11–15 moderate, and 16 or above indicate severe symptoms. Bocéréan and Dupret (2014) stated the correlation between the two constructs was .62. Cronbach's alpha for the two subscales were 0.81 and 0.78 respectively (Bocéréan & Dupret, 2014). HADS was originally designed to determine anxiety and depression in psychiatric and medical clinics. However, it is now also used in different practices and in research to detect emotional distress (Poole & Morgan, 2006). Hence, I adopted this scale to measure anxiety and depression in the current study.

Perceived Stress Scale-10 (PSS-10).

The PSS-10 assesses an individual's general stress, meaning the extent to which the individual perceives their daily life events to be hard to predict, control, and overwhelming (Maroufizadeh, Zareiyan & Sigari, 2014). The 10-item questionnaire is focused on how often have the respondents felt and thought in a certain way over a past period. The questions asked are both positively and negatively worded (e.g. "In the last month, how often have you felt that things were going your way?"; "In the last month, how often have you felt nervous and "stressed"?"). The items are measured on a 5-point scale, in which 0 = never, 1 = almost never, 2 = sometimes, 3 = fairly often, 4 = very often. All 10-item scores are added together to produce a total score ranging between 0 – 40. High PSS-10 scores show a high degree of perceived stress. Maroufizadeh and colleagues (2014) reported Cronbach's alpha coefficients for the 10 items at .90, indicating it is a reliable instrument for measuring the perception of stress. Hence I use this questionnaire to identify the perceived stress of the participants for the current study.

The Positive and Negative Affect Scales (PANAS).

The PANAS self-report scale has 20 items, 10 of each measuring positive and negative affect. Item ratings vary from 1 to 5, from *very slightly* or *not at all* to *extremely*. For example, respondents can rate themselves as "a little excited" or "extremely afraid". Total

scores for both scales range from 10-50. Higher scores indicate higher levels of positive or negative affect. According to Watson and colleagues (1988), Positive Affect (PA) indicates the degree to which people may feel positively, such as, attentive, enthusiastic, and active. Higher PA scores reflect that people are energetic, concentrate, and happily engaging, whereas lower PA scores that the person is characterized by tiredness and gloom. In contrast, Negative Affect (NA) shows individual's perceived distress and unpleasant feelings. High NA scores means the person is in a range of aversive emotion states, such as anger, fear, and nervousness, low NA indicates a person is calm and composed. Watson, Clark, and Tellegen (1988) compared PANAS results with non-clinical students, adults, and an inpatient sample, resulting in above 0.85 Cronbach's alpha statistics for both affect subscales in three samples. The test-retest reliability is .68 for PA and .71 for NA (Watson, Clark, & Tellegen, 1988). I used the PANAS in the current study to measure participants' moods before and after the intervention.

Mindfulness, acceptance and psychological flexibility measures.

Mindful Attention Awareness Scale (MAAS).

This scale was conceptualised by Brown and Ryan (2003) to assess the construct of individual's mindfulness, which is the extent to which an individual can attend to, and stay focused on, present life events and experiences (Osman et al., 2016). The scale asks its respondent to rate how frequently they experience mindlessness. For example, Item 14 is "I find myself doing things without paying attention". The scale has 15 items and the score for each item ranges from "almost always" (1) to "almost never" (6). Higher scores reflect higher mindfulness. Internal consistency levels (Cronbach's alphas) generally range from .80 to .90. (Brown & Ryan, 2003; Carlson & Brown, 2005). I used this scale to measure whether the ability of mindfulness changed among participants before and after intervention.

The Acceptance and Action Questionnaire-II (AAQ-II).

The AAQ-II is a 10-item self-report questionnaire using a 7-point Likert scale from 1 (“never true”) to 7 (“always true”). It evaluates an individual’s degree of experiential avoidance, acceptance, and action with lower scores indicating better acceptance and psychology flexibility and higher scores reflecting more experiential avoidance (Ciarrochi & Bilich, 2006). An example (Item 4) is “I worry about not being able to control my worries and feelings”. Bond et al. (2011) evaluated the measure and it had good reliability of .81 at 3- and 12-month follow-ups and good validity and reliability with the alpha coefficient value of .84.

Confidentiality

I assigned each participant a code to protect their confidentiality. No names were linked to any data that I recorded. I did not have access to any personal information participants might have entered into the app.

Data analysis

I conducted repeated-measures *t*-tests in Excel by Microsoft® to compare questionnaire measures before and after app use. In addition, I graphed the daily anxiety scores using Excel by Microsoft® to show each participants’ daily anxiety level through the study.

Results

In this section, I will present the results of the study. First the daily anxiety measure of the participants is discussed and shown graphically. In the next section, I compare the before and after scores of the battery of questionnaire measures.

Daily anxiety measurement

I monitored the daily anxiety level of all participants ($n = 9$) via the DAS-A, and graphed the individual daily scores in Figures 2a and b across baseline and intervention (app

use). I separated the conditions using the dotted vertical condition break lines. Anxiety scores above 50 indicate a high anxiety level.

Figure 2a shows stable anxiety scores for Participant 1, close to 60 and peaking at 68.75 during baseline. After the participant began the app, the score immediately dropped to 48.75. The intervention line started lower than the baseline and was slightly downward sloping with a few days with higher scores.

According to Figure 2a, before Participant 2 began using the app, their anxiety level was relatively stable, around 56, with an immediate score decrease to 40 after they began the app, and a large drop to 7.5 towards the end of the intervention. The intervention line stayed slightly lower than baseline.

Figure 2a indicates a fluctuating anxiety score for Participant 3, ranging from 48.75 to 72.5, with an instant decrease to 41.25 when app was started. Anxiety scores during the intervention were lower than baseline with a clear decreasing trend down to 23.75, followed by a fluctuating anxiety scores ending at 37.5.

For Participant 4, Figure 2a shows anxiety scores in baseline varied between 51.25 and 72.5. After the participant began the app, the score dropped to 47.5. The intervention line was slightly below baseline with a minor downward tendency.

With a rise of anxiety score from 45 to 66.25 before app use in Figure 2a, Participant 5's score dropped to 57.5 shortly after the app was introduced and gradually decreased, with a few days with higher scores during the intervention.

A stable baseline score around 57.5 is seen for Participant 6 in Figure 2b. After the intervention began, the participant's score declined immediately to 51.25 and was lower than baseline with a distinct downward sloping to 0 by the end of the intervention.

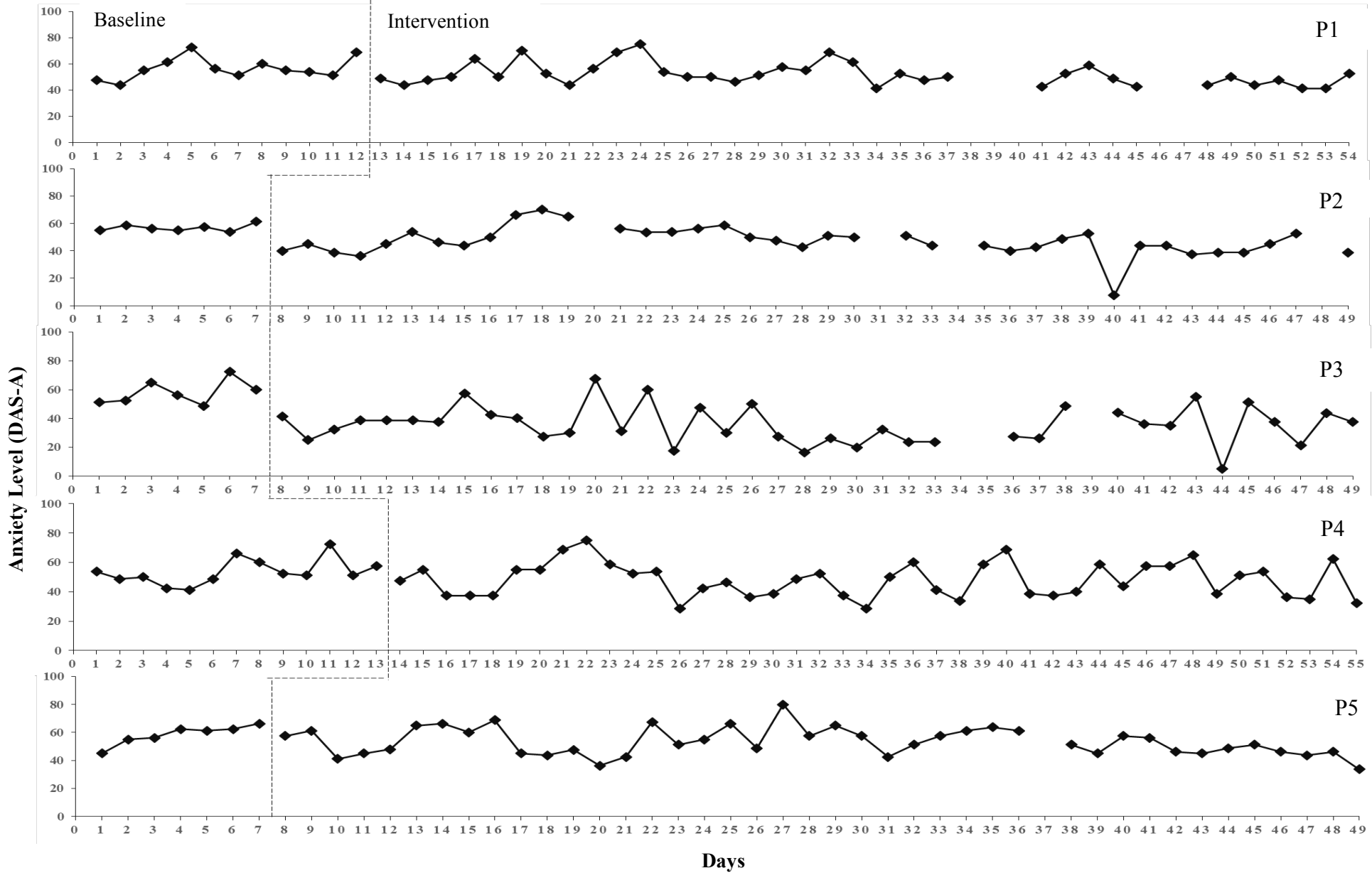


Figure 2a. Anxiety level of each participant for each day across baseline and app use.

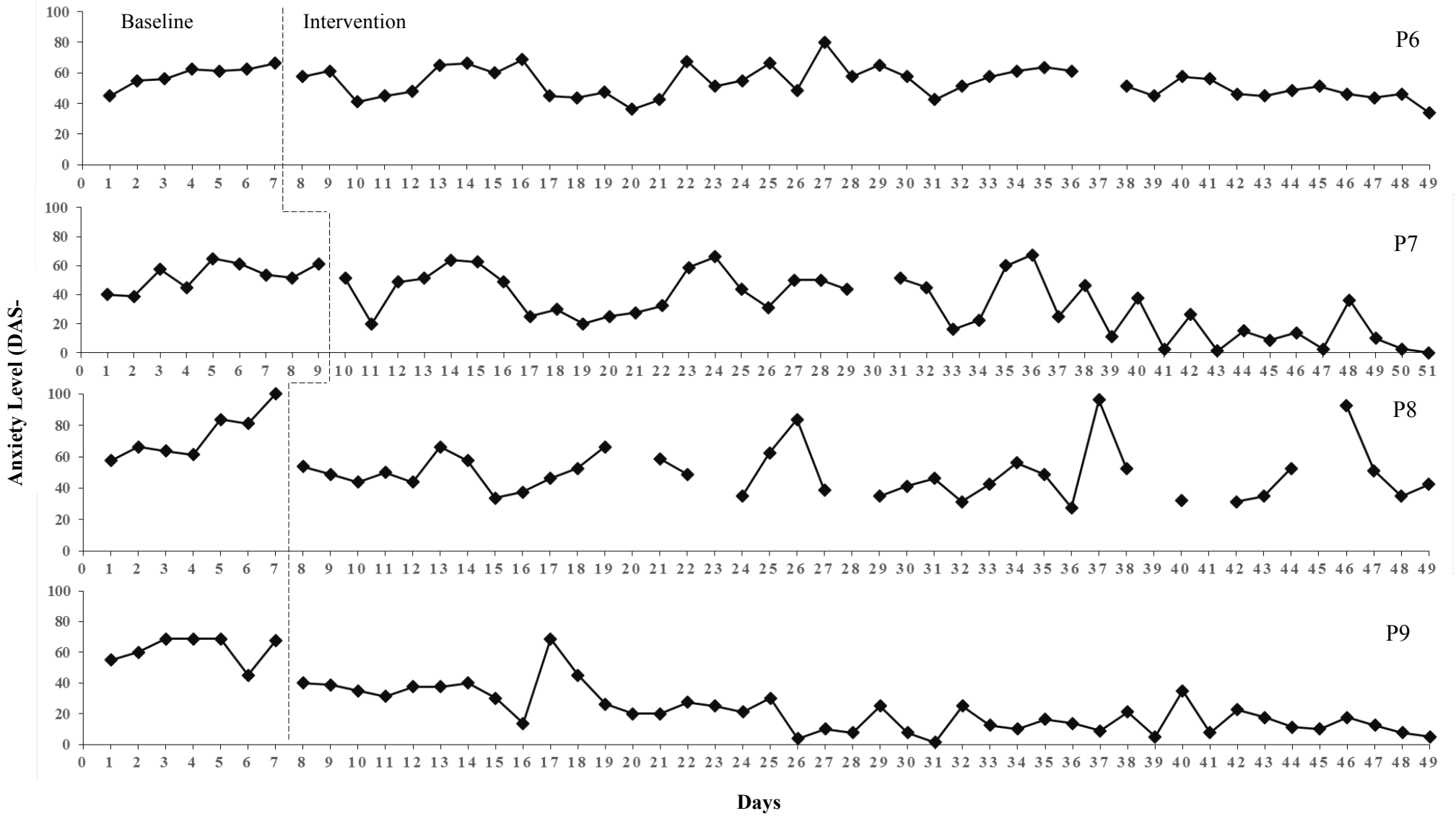


Figure 2b. Anxiety level of each participant for each day across baseline and app use.

Figure 2b shows an increase in Participant 7's scores, which began at 57.5 ended at 100 in baseline, with an immediate drop when the intervention began. The intervention line was lower than baseline, hovering around 50 with a slightly decreasing trend.

Before Participant 8 began the app, their anxiety score hovered around 70 (Figure 2b), but began decreasing during the intervention. The clear decreasing trend continued until the end of the intervention.

According to Figure 2b, Participant 9's baseline anxiety score was stable at about 68.75 followed by a drop to 40 after they started the app. Apart from one day with a particularly high anxiety score, the intervention line stayed lower than during baseline, and scores kept dropping towards the end of this condition.

Overall, I observed a decline in anxiety scores in the intervention condition for all nine participants. The scores of Participants 3, 4, 5, 6, 8, and 9 clearly decreased compared to baseline. The decreasing trend in scores for Participants 1, 2, and 7 was less clear, especially near the end of the study, where the scores of Participants 1 and 7 rose slightly. In baseline, average anxiety score for all nine participants was above 60, implying that, before app use, all participants were experiencing high anxiety. Overall, all nine participants who completed the app use showed promising results as they all reported a decreased level of daily anxiety through the intervention condition.

I calculated the average anxiety scores of the last 3 days of both baseline and intervention conditions and conducted a paired-samples *t* test. Daily anxiety scores decreased significantly after app use, $M = 32.01$, 95% CI[21.42, 42.61], compared to before, $M = 63.76$, 95% CI[57.16, 70.37], $t(8) = 5.62$, $p < .001$, $d = 3.14$. The effect size of $d = 3.14$ met Cohen's (1988) criteria for a large effect ($d > .80$). Note that the obtained *p* value remained significant after application of a Bonferroni correction (see below).

Comparisons before and after app use via questionnaire assessments

I conducted a series of paired-samples t tests on questionnaire scores before and after app use. The results of all t tests can be seen in Table 3 and the notation is therefore not repeated in the text.

Table 3
Results of Paired-Samples t tests on each of the Before-and-After Measures

Scale Name	Before Mean [95% CI]	After Mean [95% CI]	t value	df	p value	Cohen's d
STAI Y-1	49.22	37.33	2.48	8	.04	1.37
STAI Y-2	55.44	43.11	3.15	8	.001*	1.60
HADS-Anxiety	13	9.5	4.15	8	.003*	1.44
HADS- Depression	6.78	3.67	2.90	8	.02	0.94
PSS	27.22	18.89	4.27	8	.003*	1.48
PANAS-Positive	26.67	30.44	-1.71	8	.13	-0.72
PANAS- Negative	30.22	17.44	4.70	8	.002*	2.35
MAAS	2.98	3.32	-0.86	8	.42	-0.65
AAQ-II	40	45.78	-1.5	8	.17	-0.62

*Significant at an alpha level of $p < .01$ (after Bonferroni correction) where appropriate.

Due to the fact that multiple t tests were conducted on anxiety data, a Bonferroni correction was applied whereby the standard critical p value of .05 was divided by four, which is the number of t tests conducted, one repeated-measures t test was conducted for each of the following scale measures; DAS-A, STAI Y-1, Y-2, and HADS-Anxiety. The corrected critical value was $p < .01$. Thus, for measures of anxiety, the obtained p value needed to be less than .01 to be considered significant. The dependent data for other measures were considered to be unrelated to each other, negating the need for further Bonferroni corrections.

State-Trait Anxiety Inventory (STAI) Y-1. The t test on scores for the Y-1 measure of anxiety before and after the intervention was not significant indicating no change in scores of this measurement.

State-Trait Anxiety Inventory (STAI) Y-2. Mean scores on the Y-2 inventory decreased significantly after the intervention (Table 2). The effect size of $d = 1.60$ was large. The significant results indicate a significant decrease in scores with regards to internal disposition to develop anxiety symptoms.

Hospital Anxiety and Depression Scale (HADS) – Anxiety. The scale scores decreased significantly after app use. The effect size of $d = 1.44$ was large. The significant decrease in scores indicates that anxiety was lower after the intervention than baseline.

Hospital Anxiety and Depression Scale (HADS) – Depression. The mean score for the HADS-Depression scale decreased significantly after app use, and the effect size was large. The significant decrease in scores indicates fewer depressive features were detected after the intervention condition.

Perceived Stress Scale-10 (PSS-10). The mean score of the PSS decreased significantly after app use, and the effect size was large. The significant difference indicates lower stress level compared to baseline.

Positive and Negative Affect Schedule (PANAS). The t test for positive affect scores was not significant, showing no change in PANAS scores. Negative affect scores decreased significantly after app use, and the effect was large. The significant difference indicates a decreased degree of feeling distressed at the present moment.

Mindful Attention Awareness Scale (MAAS). The scores of this scale did not change significantly after app use. This result means there was no change of mindfulness, or awareness of what is happening in the present moment.

Acceptance & Action Questionnaire-II (AAQ-II). The t -test result showed no significant change in scores for the AAQ-II.

Experiences with the use of ACT Companion™ app

When participants finished the battery of questionnaires at the end of the intervention condition, all participants also answered some questions about their general experiences of the app, such as their use of the app, whether they found the app helpful, and whether they plan to continue using the app after the research. See Tables 4a and b for these responses from all participants.

Table 4a

Participants reported app use experiences

Participants	App use frequency	Most used exercises	Most liked exercises	Least Liked exercises	Which exercise helped with your distress?	In general, do you find this app helpful?	Will you continue using the app?
1	3-4 times a week at night	Open up and Do what matters	The writing out my own answers more than the listening cause it not only made me think about different ways to use these skills but apply them to my life	Some of the listening ones just because of the length	Being present and aware of my thoughts trying to not be in them. More aware of them, acknowledging them.	Yes, gave me skills and little things that help me every day, being more aware of these thoughts and how to think about them	Yes
2	Twice a day in the morning and night	Be present	The meditations. It's usually a pleasant experience.	Nothing	The meditations on thoughts. These exercises helped me to release my attachment to worrying thoughts.	Yes. It helped me to feel more okay with the anxiety.	Yes
3	3 times a week at night	Be present	The mindfulness exercises, they really make me calm and relaxed	Do what matters section, I find goal setting isn't that relevant or interesting to me	Probably mindfulness because it taught me how to keep more focused when I have anxiety and calm my thoughts	A bit, it helped me build up skills that helped my anxiety ease	Sometimes, if I need to
4	Every day at night	Open up	Meditation. It was relaxing	none	Breathing meditation exercises	Yes. It helped my awareness and recognising boundaries	Yes

Table 4b

Participants reported app use experiences

Participants	App use frequency	Most used exercises	Most liked exercises	Least Liked exercises	Which exercise helped with your distress?	In general, do you find this app helpful?	Will you continue using the app?
6	Every day at night	Do what matters	The ones that made you think about what was going on in your head	The meditation ones as it was hard to sit still and commit to the time period	Not sure	Not really. But it helped me think. I think I was less stressed now because exams have finished and its summer	Yes
7	Every second day at night	Be present	Meditation because it helps me focus and take time out	Open up because having to speak	All the ones in Be present because it helps focus and relax	Yes, taking time out to think about what's been said and done around me to how I react	Yes
8	Everyday once in the morning and once at night	Open up	Observing your thoughts & Letting go	Silent meditation	Cost of control - it made me identify what I could do in unpleasant situations	Yes, it made me think about the most important things in my life and how to focus my energy in the positives of life	I think I will. It has become part of a routine for me to use it when I wake up (start the day off on a positive)
9	2-5 times a week at night	Open up	The ones where you write things down as I have always been someone that enjoys writing	The meditation ones as I often cannot find the time to sit there and listen as I have a very busy life with family always over	Letting go and worry time as they helped me to not only let go of some of my worrisome thoughts but also to acknowledge them	Yes, I think it did as it made me become more present within my daily activities. The little daily notifications were great as if I didn't have time to do an exercise I could just spend a minute or two doing what the notification said. Also the weekly reminders were great to recollect how present I was during each week and to acknowledge what I could work on for the next week.	Yes

Discussion

My purpose was to examine the efficacy of a smartphone app for relieving anxiety among university students. I recruited 9 undergraduate participants and adopted a single-subject design to explore whether the app would have an effect on stress and anxiety regulation. Overall, data analysis confirmed that the ACT Companion™ app had positive outcomes on improving students' mental wellbeing both during and after app use.

I had two hypotheses in this study. The first was that scores of anxiety, stress, depression and negative affect, assessed using the DAS-A, HADS, STAI, PSS, and PANAS, would decrease as a result of app use. Secondly, given that the app is underpinned by ACT philosophy, and the treatment goal for ACT is to promote psychological flexibility, I expected mindfulness, acceptance, and psychological flexibility, measured using the AAQ-II and MAAS, would increase after the intervention. I discuss the findings in detail below.

Daily anxiety

To evaluate the efficacy of ACT Companion™ app, I monitored each participant's daily anxiety level using DAS-A (Appendix E) at least a week before, and then every day during, ACT Companion™ app use. I found all participants reported a decrease in anxiety through 6 weeks of app use (Figures 2a and b). Compared to baseline, most of their anxiety scores started to reduce when the intervention was introduced, except for Participant P3 whose anxiety level had already dropped at the end of Phase A and continued to decrease at the beginning of intervention. I observed a gradual decrease with some fluctuations of the anxiety data over intervention phase. The average anxiety level of the last 3 days in intervention was significantly lower than the average anxiety of the last 3 days in baseline. Given all participants' anxiety levels remained high prior to ACT Companion™ use, I suggest that the downward changes during intervention

are related to this intervention. These results, of decreases in anxiety level for all participants, are comparable to those from Levin et al.'s (2016) study, which involved a web-based ACT self-help intervention for university students. Though the current study used a different mechanism through which to deliver the ACT self-help intervention (i.e., the ACT intervention was delivered by a smartphone app rather than computer), the results indicate that SHI can produce changes in anxiety levels.

Anxiety

I also measured anxiety using the STAI and HAD-Anxiety at both pre- and post-intervention stages. The scores under HAD-Anxiety and one of the STAI subscales the Trait Anxiety (Y-2) significantly dropped, suggesting positive effects of app use on participants' anxiety. However, I did not see a significant change in participants' State Anxiety (Y-1), perhaps because Y-1 measures an individual's anxiety symptoms at the present moment that they fill in the scale, while Y-2 assesses the general anxiety over a period, which reflects their inherent propensity towards anxious situations (Spielberger et al., 1983). Participants took the battery of measurements twice, once before the intervention and again on the last day of the 6th week when app use was completed. It is reasonable that there was no change between the exact two moments when the tests were taken but the reduction was clear as the intervention was introduced to individuals at least over a month. The decreased Y-2 score indicated the intervention had a positive impact on participants' anxiety. Additionally, participants had decreased symptoms of anxiety measured by HAD-Anxiety. My findings were consistent with those of other researchers who found that, as well as traditional cognitive behavioural methods, ACT is a highly viable treatment in reducing anxiety (Arch, et al., 2012; Forman et al., 2007; Zettle, 2003). In addition, Levin et al. (2017) found similar results when they tested their web-

based self-help prevention programme with university students. Thus, my study supports the use of smartphone apps delivering ACT as an effective tool for improving mental wellbeing among university students.

Stress

Part of my first hypothesis was that the ACT Companion™ app would help to reduce participants' perceived stress. I measured stress using the PSS. The comparison of scores achieved on the scale before and after the intervention supported the hypothesis. There was a significant decrease in scores of perceived stress after using the app. The current study adds to the increasing number of studies on SHI for university students. My findings are consistent with those of Day, McGrath, and Wojtowicz (2013) who invited university students in Canada to use a web-based self-help program designed for students with mild-to-moderate symptoms of depression, anxiety, or stress. Day et al. (2013) used a different measure than I did (they used the Depression Anxiety and Stress Scale-21, DASS-21), however, they noted that the scores, especially for anxiety and stress, were extremely inter-correlated, causing complications to effectively evaluating their self-help programme. Hence, I adopted different scales to measure the variables individually to more clearly articulate the effectiveness of the app intervention and I chose PSS to measure changes in stress level.

Biglan et al. (2008) argued that an individual's stress may be affected by experiential avoidance. Avoiding the experience of stressful events will increase the risk of developing more prolonged stress over time. Given that part of ACT treatment is aimed at reducing experiential avoidance, the therapy can help to minimise the consequences of stress. ACT in stress reduction encourages the acceptance of distressing thoughts and feelings rather than eliminating stressful events (Bond & Bunce, 2000). Thus, the ACT Companion™ app holds promise as it contains

exercises to assist the user to actively cope with stress, and successful coping may lead to reduced symptoms of stress.

Depression

I hypothesised that depression ratings would decrease following the intervention. Consistent with the hypothesis, depressive symptoms measured using HAD-Depression significantly declined compared to before app use. My findings extended the support for smartphone-app approaches in reducing depressive symptoms as ACT has already been found effective for depression using other approaches, including self-help books (Jeffcoat & Hayes, 2012) and internet-based self-help programmes (Andersson & Cuijpers, 2009; Berger et al., 2011; Carlbring, 2013; Molander et al., 2015). Danitz and Orsillo (2014) examined an ACT-influenced therapy programme on first-year university students, and they reported that students who received the intervention experienced significantly less depression and more acceptance. My findings align with their research with respect to benefiting university students' wellbeing.

Positive and negative affect

Excessive and persistent negative emotions can cause psychological distress. To improve the treatment for anxiety and depression, emotion regulation has become a topic of interest (Campbell-Sills et al., 2006). ACT posits that maladaptive attempts to control unwanted experiences associated with negative emotions lead to psychological distress such as anxiety and depression (Hayes, Strosahl, & Wilson, 1999). In this research, I expected that participants would gain increased emotion regulation abilities after using the ACT Companion™ app. I rated emotional scores using PANAS and the results showed no significant change for positive affect, however, negative affect (NA) scores significantly decreased for all participants. The findings indicated participants' improved ability to regulate negative emotions. Blackledge and Hayes

(2001) stated that in ACT, instead of suppressing negative emotions by avoiding or escaping the situation that generated those feelings, individuals are educated to observe and accept the negative emotions, and allow the emotion to come and go of its own accord. The therapy also guides them to focus on valued life goals. In fact, ACT Companion™ contains several exercises to aid users to “open up” to negative emotions, such as “letting go” and “labelling thoughts and feelings” and with practise through the instructions, users would identify the feelings they currently hold onto and be able to let them come and go.

Mindfulness and psychological flexibility towards app use

My second hypothesis was that mindfulness and psychological flexibility would increase over the intervention. I used two questionnaires to investigate this hypothesis. I adopted MAAS to examine mindfulness and AAQ-II to measure acceptance and psychological flexibility. Unfortunately, scores on neither measurement significantly changed between baseline and intervention conditions, suggesting the effectiveness of the app for improving participants' mindfulness, acceptance, and psychological flexibility remains unclear.

Looking at individual scores, for MAAS, over half of the participants' mindfulness scores had increased at the end of app use. MAAS assesses the individual's ability to attend to and remain aware of present events and experiences (Brown & Ryan, 2003). My finding was unlike that of Hahs, Dixon, and Paliliunas (2018), who used the MAAS to measure the effect of a brief ACT training for parents of children with autism. Hahs et al. found a large effect and significant increase in mindfulness after training. Although the MAAS is commonly used to measure mindfulness and to reflect more adaptive behaviour regulation, higher commitment, lower stress, and lower self-reported anxiety (Barnes et al., 2007; Brown & Ryan, 2003), Hahs et al. were the first researchers to adopt the MAAS to evaluate an ACT-based training programme on parents.

Whether the MAAS is an appropriate measure of university students' mindfulness remains unknown. More informative studies are needed for a better comparison.

Acceptance is one of the core components of ACT and contributes heavily to improving an individual's psychological flexibility (Hayes, et al., 2012). The ultimate treatment goal of psychological flexibility is increasing acceptance, meaning an increased willingness to face psychological distress, use appropriate coping skills, and to no longer avoid or attempt to control the unpleasant situation (Flaxman et al., 2013). The AAQ-II is used to assess acceptance to indicate the extent of psychological flexibility. Lower scores indicate excessive acceptance and action, where higher scores identify inflexibility as excessive immobility and experiential avoidance. Opposite to my hypothesis, which was that the AAQ-II score for would decrease, of nine participants, one score stayed the same before and after app use, and only two of the remaining participants had reduced scores. In contrast to previous studies that showed evidence of increased psychological flexibility after ACT interventions (e.g., Hayes et al., 2012; Levin et al., 2016; Levin et al., 2017; McCracken & Gutiérrez-Martínez, 2011; Pinto et al., 2017; Räsänen et al., 2016), my participants did not significantly improve in acceptance.

My results were similar to those of Sandoz, Kellum, and Wilson (2017), where low-income students improved significantly in academic performance after an ACT programme with no changes in overall psychological flexibility. They explained this finding by saying that their participants demonstrated low-to-moderate inflexibility before the intervention and individually had variable patterns of changes in flexibility, which could be understood as each participant might have different learning abilities in relation to the content offered in the programme. It could be that my participants were educated by the app to different degrees. Given that there are a variety of exercises in different formats in the app, and participants in the current study could

choose any exercise to practise, they might not have adequately experienced every exercise multiple times, which might be related to the obscure acceptance outcome. This non-significant finding is possibly also because the short period of ACT intervention may not be significantly beneficial (Bach, Hayes, & Kendall, 2002). A longer-term intervention may have been more effective.

Experience with ACT Companion™ app

At the end of the last week of the intervention, after participants completed the post-test questionnaire battery, I also asked them several questions related to their own app use experiences, all answered via Qualtrics® (Table 4a, 4b).

All participants reported that they used the app at least 3 times a week, and two participants reported that they used it twice every day. The majority reported using the app at bed time, with the two, twice-daily, participants using the app once in the morning and once at night.

Four participants reported that the “Be present” exercise was their most-used exercise category, three said they often used “Open up”, one mostly used “Do what matters”, and one participant used the latter two categories together most of the time.

The majority of participants’ most-liked exercises were the remaining participants’ least-liked exercises, suggesting that different exercises appeal to different users. The meditation exercises often had long audio tracks that some participants reported they did not have time to listen to, whereas exercises in “Do what matters” category are more interactive and often required users to write down answers, which some participants preferred. However, those who liked meditation reported that listening to the audios made them calm, relaxed, and focused.

For the question asking what exercises they accessed when distressed, six out of nine participants used mindfulness exercises in “Be present” and all but one participant reported that

the app helped them to be aware of their thoughts but not “in the thoughts”; the app released them from worrisome thoughts, and helped them to act differently when distressed again.

One participant noted that her lower stress might have been related to the fact that exams had finished and summer came. However, in general, the rest of the participants responded that they found the app helpful and intended to keep using the app after the research. Seven mentioned that the app made them realise it is okay to feel distress, to be more aware of recognising thoughts, and gave them skills that helped their daily life. Two participants mentioned that the app made them focus on the positives and the important things in life, and they became more present in daily activities. One participant said it is very helpful that the notifications in the app reminded her what to do every day according to her plans for the week and she could choose small exercises if she did not have much time.

Strengths

I adopted a single-subject, non-concurrent, baseline design across multiple subjects for the current research. A concurrent-baseline design requires that individuals begin the baseline condition at the same time, however, using a non-concurrent design made recruiting participants more convenient as each participant could start as they were recruited. This design was practical and flexible as not all individuals were available at the same time. In my research, the first participant I recruited started the research 2 months before the last participant started baseline with others starting between those times. In addition, each individual served as their own control, as I compared data for each participant across baseline and intervention conditions. The length of this study gave participants insight to make use of the app and incorporate it into their everyday life, thus the design minimised drop-out which impacts research efficacy. Random variability was reduced by using participants as their own control group, increasing the validity for this

study (Barker, Pistrang, & Elliot, 2002). Additionally, single-subject designs allow for repeated data collection over time, which can be used to assess change (Singh, Starkey, & Sargisson, 2017). The daily reports of anxiety enriched the analysis and made it possible to draw strong conclusions (Alnahdi, 2015; Dallery, Cassidy, & Raiff, 2013).

This study is the first that I know of to attempt to evaluate the efficacy of the ACT Companion™ app on reducing psychological distress especially stress, anxiety, and emotion regulation among university students. The positive outcomes found in this study will help university students find a new, convenient, and cost-effective way to improve their mental health and wellbeing.

Limitations and future research

Overall, the findings in the current research suggested ACT Companion™ app is promising for improving individuals' mental wellbeing. However, several limitations are worth mentioning for future research considerations.

I found improved psychological wellbeing among participants but no change in the mindfulness, acceptance, and psychological flexibility. This may be because of the lack of knowledge of ACT concepts among university students. Brown and Ryan (2003) argued that people without training about mindfulness demonstrate less mindfulness. I provided participants with the ACT app without educating them on what ACT is beforehand. While most of them reported that the mindfulness exercises in the app were helpful, they only made them feel calm, relaxed, and started to realise to open up to internal experiences. It might require a longer period for them to get used to being aware of thoughts and feelings. This could explain the non-significant changes in their mindfulness scores. Future research could explore whether providing prior education about ACT before beginning intervention would affect scores related to ACT concepts. However,

participants in the study used the app as any other consumer might, so my results are indicative of the change that might be expected by general app users who purchase the app and complete the programme without supervision.

Secondly, several researchers maintain that guided SHI is more effective than self-help alone (Johansson & Andersson, 2012; Newman, et al., 2011; Richards & Richardson, 2012). Carlbring et al. (2009) also found that treatment effects were maintained longer with professional guidance. As these researchers found, some extent of professional support can produce better outcomes of SHI (Newman et al., 2003). There is also some evidence that better SHI treatment outcomes are associated with higher levels of therapist support (Hirai & Clum, 2006; Menchola et al., 2007). That the current study resulted in no clear improvements of psychological flexibility might be because the large number of exercises in the app were overwhelming to the participants, as no guidance was provided to allocate needed exercises. Future research could consider including some level of contact from therapists to tailor the app to the needs of the user.

When it comes to evaluating SHI efficacy, it is necessary to consider the level of compliance or adherence the individual had when using the SHI (Varley et al., 2011). I did ask several questions about the experience of using the app, however, I did not include specific measures for treatment fidelity, and thus the accuracy of their reports remained uncertain. Future research could adopt assessments of treatment fidelity to measure the adherence and determine whether the efficacy of treatment is related to the use of the intervention.

Summary and Conclusion

I used a single-subject design to investigate whether an ACT self-help app would be a helpful intervention for improving mental health and wellbeing among university students. Despite the limitations, some findings in the study were strongly promising. Participants

displayed a significant downward trend in their daily anxiety level during their use of the ACT Companion™ app. Given that daily anxiety remained high during baseline across all subjects, and that anxiety scores started decreasing during the intervention, I suggest that the intervention played a role in reducing anxiety. Furthermore, at post treatment, the participants showed improvements on a battery of measures as their anxiety, stress, negative affect, and depressive symptoms reduced significantly compared to before the intervention, indicating the app is effective for managing different psychological distresses. The changes in mindfulness, acceptance, and psychological flexibility, however were not apparent, suggesting that education about the ACT concept before the intervention or some degree of professional guidance could be beneficial for future research. Overall, the positive results do support the use of the ACT Companion™ app by individuals who have psychological distress.

In conclusion, ACT Companion™ app is a helpful, easily accessible, and cost-effective self-help approach for university students who are keen to improve their general mental wellbeing.

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Appendix A

POSTER

Feel a little bit stressed out?
 Want to gain more precious time with yourself?
Then come along!

Participants Wanted!

I am looking for **Psychology Students** who are **Smartphone Users** to take part in a study investigating the effects of a smartphone app which adapts Acceptance and Commitment Therapy strategies and aims to help users to release stress and improve well-being.

Free code will be provided for you to download the app!

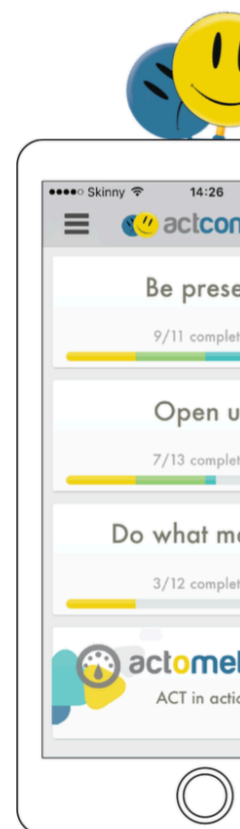
What you are going to do?

- This is a handy app, only a few minutes a day to play with for about 6 weeks.
- Fill in some questionnaires regarding anxiety and stress.

Participants will receive either course credits (only applicable for undergraduate psychology papers) or enter a draw to win one of five \$20 vouchers!

For more information, feel free to contact : Cedar Li (f195@students.waikato.ac.nz), postgraduate student and the researcher of the study, University of Waikato

This research has been approved by the school of Psychology Research and Ethics Committee. This study is under the supervisions of Dr. Rebecca Sargisson and Dr. Maree Roche.



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Appendix B

INFORMATION SHEET

A Research Project: Improving mental wellbeing among university students via a smartphone app based on Acceptance and Commitment Therapy

What is it about?

The research is designed to examine whether the ACT Companion app affects the level of anxiety and stress among students. The app can be downloaded from the app store when provided with free code. The code will be used to fill in the activities and hence anonymity will be maintained. You will be asked to fill in some questionnaires before you begin the app as well as a brief daily self-report questionnaire which will have to be returned to the researcher at the end of each day. The activities within the app include completing some simple tasks and then attempting to explain your thoughts, feelings and emotions while doing those tasks as well as listening to a few mindfulness recordings that could help relax and calm yourself while learning to deal with any stressful events. After you have finished the app, the same set of questionnaires will be given to you to complete again.

This is a Master's thesis research project supervised by Drs. Rebecca Sargisson (rebeccas@waikato.ac.nz) and Maree Roche (maree.roche@waikato.co.nz). The researcher in this study is Fengshan Li (fl95@students.waikato.ac.nz)

Description of the tasks you will need to do

Within this app, there are tasks for you to practice to “be present”, “open up”, and “do what matters”. These involve defusion and acceptance techniques, tools for setting and clarifying your life goals, and powerful ‘observing self’ and self-compassion exercises.

There is a rich variety of mindfulness recordings (from under 5 minutes to over 30 minutes) to choose from, for you to experience meditation. You can get started with traditional mindfulness exercises, like mindfulness of the breath and body-scan meditations. Then practice mindfully observing thoughts and emotions, as well as ‘active’ mindfulness exercises, like mindful eating and mindful walking. Practice silent meditation on your own when you're ready, with the handy timer and meditation bells.

How much of your time will participation involve?

1. About 20 minutes in the beginning and the end of the study for the questionnaires.
2. At least once everyday and just for a few minutes for about 6 or more weeks.
3. An 8-item daily assessment.

Will your participation in the project remain confidential?

If you agree to take part, you will be given codes to protect your identity. Your name will not be linked to any data that will be recorded. No information about you will be disclosed to other parties. You can be assured that if you take part in this project you will remain anonymous.

Questionnaire information will be collected through and stored in Qualtrics. Information from the questionnaires will be available to the researchers. The app developers will provide us information regarding the data on how often and for how long the participants used the app, the number of tasks completed, and frequency of use, but all personal information provided by the participants while using the app will remain anonymous. All the data will be password protected and stored in the computer. Following APA guidelines (Section 8.14), the data will be handed over to the supervisors for indefinite use once we complete the study and given to researchers interested in the study when requested.

What kind of materials and tasks will be involved in the process?

- Smartphone (ios or android)
- Questionnaires regarding anxiety and stress to be completed at the beginning and end of the project.
- A daily report questionnaire that will be sent to your email and expected to filled and send back to the researcher at the end of each day.
- Manoeuvre through the small tasks on the ACT App at any time through the day for a period of 6 or more weeks.

What are the benefits of participating in this research?

- It is a convenient app that can be used at any time and any place.
- The activities within the app are simple yet will help you to relax in times of stress.
- You will gain lifetime access to the app.
- A chance to enter a draw to win a voucher.
- As you go along, if you are interested to know more about the studies of Acceptance and Commitment therapy, a list of references will be provided for your information.
- For undergraduate psychology student participants only, maximum 2% course credit could be provided.
- Please notice: participants can withdraw from the study at any time and still be eligible for the benefits.
- For more, please contact the researcher for details.

What happens now?

If you agree to participate, I will ask you to sign a consent form and will provide further instructions.

This research project has been approved by the School of Psychology Research and Ethics Committee of the Faculty of Arts and Social Sciences, University of Waikato. Any questions about the ethical conduct of this research may be sent to the convenor of the Research and Ethics Committee (currently Dr. Jaimie Veale, email: jveale@waikato.ac.nz)

Appendix C



CONSENT FORM

Research Project: Investigating whether the ACT (Acceptance and Commitment Therapy) mobile app affects the level of anxiety and stress among those at a workplace setting and university students.

Please complete the following checklist. Tick (✓) the appropriate box for each point.	YES	NO
1. I have read the Participant Information Sheet (or it has been read to me) and I understand it.		
2. I have been given sufficient time to consider whether or not to participate in this study		
3. I am satisfied with the answers I have been given regarding the study and I have a copy of this consent form and information sheet		
4. I understand that taking part in this study is voluntary (my choice) and that I may withdraw from the study at any time without penalty		
5. I have the right to decline to participate in any part of the research activity		
6. I know who to contact if I have any questions about the study in general.		
7. I understand that my participation in this study is confidential and that no material, which could identify me personally, will be used in any reports on this study.		
8. I wish to receive a copy of the findings		

Declaration by participant:

I agree to participate in this research project and I understand that I may withdraw at any time. If I have any concerns about this project, I may contact the convenor of the Psychology Research and Ethics Committee (currently Dr. Jaimie Veale, email: jveale@waikato.ac.nz).

Participant's name (Please print): _____

Signature: _____

Date: _____

Declaration by member of research team:

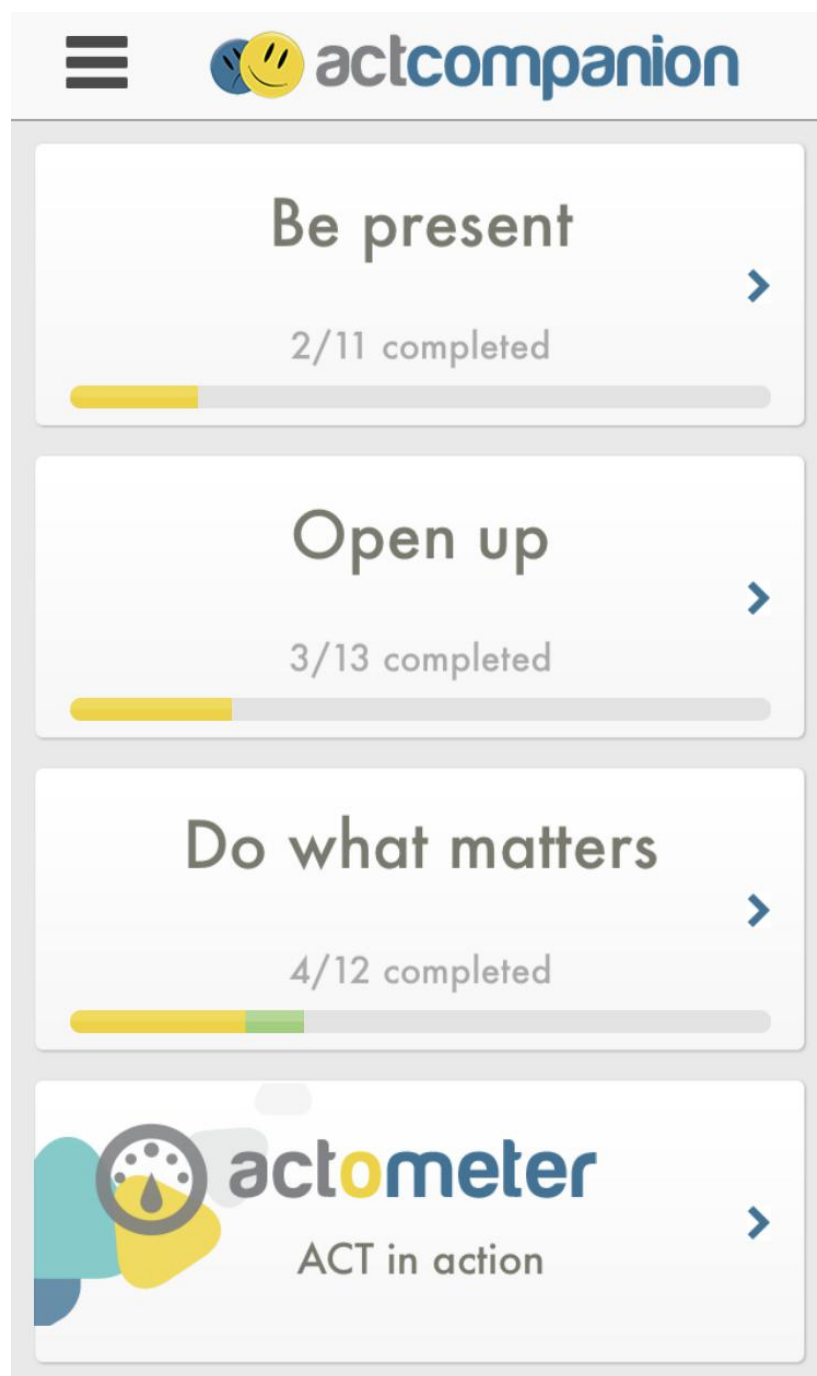
I have given a verbal explanation of the research project to the participant, and have answered the participant's questions about it. I believe that the participant understands the study and has given informed consent to participate.

Researcher's name (Please print): Deborah Ann Lobo & Fengshan Li

Signature: _____

Date: _____

Appendix D
ACT Companion™ app



Appendix E

Daily Assessment of Symptoms- Anxiety

1. During the past 24 hours, on average, how anxious did you feel?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
0	1	2	3	4	5	6	7	8	9	10
Not at all anxious					Moderately anxious					Extremely anxious

2. During the past 24 hours, how anxious did you feel when you were the most anxious?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
0	1	2	3	4	5	6	7	8	9	10
Not at all Anxious					Moderately anxious					Extremely anxious

3. During the past 24 hours, on average, how worried did you feel?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
0	1	2	3	4	5	6	7	8	9	10
Not at all anxious					Moderately anxious					Extremely anxious

4. During the past 24 hours, how much of the time did you feel tense (when you were awake)?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
0	1	2	3	4	5	6	7	8	9	10
None of the time					About half of the time					All of the time

5. During the past 24 hours, how irritable did you feel when you were the most irritable?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
0	1	2	3	4	5	6	7	8	9	10
Not at all irritable					Moderately irritable					Extremely irritable

6. During the past 24 hours, how much of the time did you feel calm or relaxed (when you were awake)?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
0	1	2	3	4	5	6	7	8	9	10
None of the time					About half of the time					All of the time

7. During the past 24 hours, how much of the time did you have trouble concentrating or focusing on what you were doing (when you were awake)?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
0	1	2	3	4	5	6	7	8	9	10
None of the time					About half of the time					All of the time

8. How difficult was it for you to fall asleep last night?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
0	1	2	3	4	5	6	7	8	9	10
Not at all difficult					Moderately difficult					Extremely difficult

Appendix F

State Trait Anxiety Inventory Y-1

SELF-EVALUATION QUESTIONNAIRE STAI Form Y-1

Please provide the following information:

Name _____ Date _____ S _____

Age _____ Gender (Circle) M F T _____

DIRECTIONS:

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you feel *right* now, that is, *at this moment*. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

- | 1. I feel calm..... | 1 | 2 | 3 | 4 |
|--|---|---|---|---|
| 2. I feel secure | 1 | 2 | 3 | 4 |
| 3. I am tense | 1 | 2 | 3 | 4 |
| 4. I feel strained | 1 | 2 | 3 | 4 |
| 5. I feel at ease | 1 | 2 | 3 | 4 |
| 6. I feel upset | 1 | 2 | 3 | 4 |
| 7. I am presently worrying over possible misfortunes | 1 | 2 | 3 | 4 |
| 8. I feel satisfied | 1 | 2 | 3 | 4 |
| 9. I feel frightened | 1 | 2 | 3 | 4 |
| 10. I feel comfortable | 1 | 2 | 3 | 4 |
| 11. I feel self-confident..... | 1 | 2 | 3 | 4 |
| 12. I feel nervous | 1 | 2 | 3 | 4 |
| 13. I am jittery | 1 | 2 | 3 | 4 |
| 14. I feel indecisive..... | 1 | 2 | 3 | 4 |
| 15. I am relaxed | 1 | 2 | 3 | 4 |
| 16. I feel content | 1 | 2 | 3 | 4 |
| 17. I am worried | 1 | 2 | 3 | 4 |
| 18. I feel confused..... | 1 | 2 | 3 | 4 |
| 19. I feel steady..... | 1 | 2 | 3 | 4 |
| 20. I feel pleasant..... | 1 | 2 | 3 | 4 |

NOT AT ALL
 SOMEWHAT
 MODERATELY SO
 VERY MUCH SO

Appendix G

State Trait Anxiety Inventory Y-2

SELF-EVALUATION QUESTIONNAIRE

STAI Form Y-2

Name _____ Date _____

DIRECTIONS

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you *generally* feel. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe how you generally feel.

		ALMOST NEVER	SOMETIMES	OFTEN	ALMOST ALWAYS
21. I feel pleasant.....	1	2	3	4	
22. I feel nervous and restless	1	2	3	4	
23. I feel satisfied with myself.....	1	2	3	4	
24. I wish I could be as happy as others seem to be	1	2	3	4	
25. I feel like a failure	1	2	3	4	
26. I feel rested	1	2	3	4	
27. I am "calm, cool, and collected".....	1	2	3	4	
28. I feel that difficulties are piling up so that I cannot overcome them.....	1	2	3	4	
29. I worry too much over something that really doesn't matter.....	1	2	3	4	
30. I am happy	1	2	3	4	
31. I have disturbing thoughts	1	2	3	4	
32. I lack self-confidence.....	1	2	3	4	
33. I feel secure	1	2	3	4	
34. I make decisions easily	1	2	3	4	
35. I feel inadequate.....	1	2	3	4	
36. I am content	1	2	3	4	
37. Some unimportant thought runs through my mind and bothers me	1	2	3	4	
38. I take disappointments so keenly that I can't put them out of my mind.....	1	2	3	4	
39. I am a steady person.....	1	2	3	4	
40. I get in a state of tension or turmoil as I think over my recent concerns and interests	1	2	3	4	

Appendix H

Hospital Anxiety and Depression Scale (HADS)

Tick the box beside the reply that is closest to how you have been feeling in the past week.
Don't take too long over you replies: your immediate is best.

D	A		D	A	
		I feel tense or 'wound up':			I feel as if I am slowed down:
3		Most of the time	3		Nearly all the time
2		A lot of the time	2		Very often
1		From time to time, occasionally	1		Sometimes
0		Not at all	0		Not at all
		I still enjoy the things I used to enjoy:			I get a sort of frightened feeling like 'butterflies' in the stomach:
0		Definitely as much	0		Not at all
1		Not quite so much	1		Occasionally
2		Only a little	2		Quite Often
3		Hardly at all	3		Very Often
		I get a sort of frightened feeling as if something awful is about to happen:			I have lost interest in my appearance:
3		Very definitely and quite badly	3		Definitely
2		Yes, but not too badly	2		I don't take as much care as I should
1		A little, but it doesn't worry me	1		I may not take quite as much care
0		Not at all	0		I take just as much care as ever
		I can laugh and see the funny side of things:			I feel restless as I have to be on the move:
0		As much as I always could	3		Very much indeed
1		Not quite so much now	2		Quite a lot
2		Definitely not so much now	1		Not very much
3		Not at all	0		Not at all
		Worrying thoughts go through my mind:			I look forward with enjoyment to things:
3		A great deal of the time	0		As much as I ever did
2		A lot of the time	1		Rather less than I used to
1		From time to time, but not too often	2		Definitely less than I used to
0		Only occasionally	3		Hardly at all
		I feel cheerful:			I get sudden feelings of panic:
3		Not at all	3		Very often indeed
2		Not often	2		Quite often
1		Sometimes	1		Not very often
0		Most of the time	0		Not at all
		I can sit at ease and feel relaxed:			I can enjoy a good book or radio or TV program:
0		Definitely	0		Often
1		Usually	1		Sometimes
2		Not Often	2		Not often
3		Not at all	3		Very seldom

Please check you have answered all the questions

Scoring:

Total score: Depression (D) _____ Anxiety (A) _____

0-7 = Normal

8-10 = Borderline abnormal (borderline case)

11-21 = Abnormal (case)

Appendix I

Perceived Stress Scale (PSS)

The questions in this scale ask you about your feelings and thoughts during the last month. In each case, please indicate with a check how often you felt or thought a certain way.

	Never	Almost never	Some-times	Fairly often	Very often
1. In the last month, how often have you been upset because of something that happened unexpectedly?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. In the last month, how often have you felt that you were unable to control the important things in your life?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. In the last month, how often have you felt nervous and "stressed"?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. In the last month, how often have you felt confident about your ability to handle your personal problems?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. In the last month, how often have you felt that things were going your way?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. In the last month, how often have you found that you could not cope with all the things that you had to do?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. In the last month, how often have you been able to control irritations in your life?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. In the last month, how often have you felt that you were on top of things?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. In the last month how often have you been angered because of things that were outside of your control?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Appendix J

The Positive and Negative Affect Schedule (PANAS)

PANAS Questionnaire

This scale consists of a number of words that describe different feelings and emotions. Read each item and then list the number from the scale below next to each word. **Indicate to what extent you feel this way right now, that is, at the present moment *OR* indicate the extent you have felt this way over the past week (circle the instructions you followed when taking this measure)**

1	2	3	4	5
Very Slightly or Not at All	A Little	Moderately	Quite a Bit	Extremely

_____ 1. Interested	_____ 11. Irritable
_____ 2. Distressed	_____ 12. Alert
_____ 3. Excited	_____ 13. Ashamed
_____ 4. Upset	_____ 14. Inspired
_____ 5. Strong	_____ 15. Nervous
_____ 6. Guilty	_____ 16. Determined
_____ 7. Scared	_____ 17. Attentive
_____ 8. Hostile	_____ 18. Jittery
_____ 9. Enthusiastic	_____ 19. Active
_____ 10. Proud	_____ 20. Afraid

Scoring Instructions:

Positive Affect Score: Add the scores on items 1, 3, 5, 9, 10, 12, 14, 16, 17, and 19. Scores can range from 10 – 50, with higher scores representing higher levels of positive affect. Mean Scores: Momentary = 29.7 (*SD* = 7.9); Weekly = 33.3 (*SD* = 7.2)

Negative Affect Score: Add the scores on items 2, 4, 6, 7, 8, 11, 13, 15, 18, and 20. Scores can range from 10 – 50, with lower scores representing lower levels of negative affect. Mean Score: Momentary = 14.8 (*SD* = 5.4); Weekly = 17.4 (*SD* = 6.2)

Appendix K

Mindful Attention Awareness Scale (MAAS)

Please indicate the degree to which you agree with each of the following items using the scale below.		Almost always	Very frequently	Somewhat frequently	Somewhat infrequently	Very infrequently	Almost never
MAAS 1	I could be experiencing some emotion and not be conscious of it until some time later.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6
MAAS 2	I break or spill things because of carelessness, not paying attention, or thinking of something else.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6
MAAS 3	I find it difficult to stay focused on what's happening in the present.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6
MAAS 4	I tend to walk quickly to get where I'm going without paying attention to what I experience along the way.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6
MAAS 5	I tend not to notice feelings of physical tension or discomfort until they really grab my attention.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6
MAAS 6	I forget a person's name almost as soon as I've been told it for the first time.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6
MAAS 7	It seems I am "running on automatic" without much awareness of what I'm doing.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6
MAAS 8	I rush through activities without being really attentive to them.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6
MAAS 9	I get so focused on the goal I want to achieve that I lose touch with what I am doing right now to get there.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6
MAAS 10	I do jobs or tasks automatically, without being aware of what I'm doing.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6
MAAS 11	I find myself listening to someone with one ear, doing something else at the same time.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6
MAAS 12	I drive places on "automatic pilot" and then wonder why I went there.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6
MAAS 13	I find myself preoccupied with the future or the past.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6
MAAS 14	I find myself doing things without paying attention.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6
MAAS 15	I snack without being aware that I'm eating.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6

Appendix L

Acceptance and Action Questionnaire-II

AAQ-II

Below you will find a list of statements. Please rate how true each statement is for you by circling a number next to it. Use the scale below to make your choice.

1	2	3	4	5	6	7
never true	very seldom true	seldom true	sometimes true	frequently true	almost always true	always true

1. Its OK if I remember something unpleasant.	1	2	3	4	5	6	7
2. My painful experiences and memories make it difficult for me to live a life that I would value.	1	2	3	4	5	6	7
3. I'm afraid of my feelings.	1	2	3	4	5	6	7
4. I worry about not being able to control my worries and feelings.	1	2	3	4	5	6	7
5. My painful memories prevent me from having a fulfilling life.	1	2	3	4	5	6	7
6. I am in control of my life.	1	2	3	4	5	6	7
7. Emotions cause problems in my life.	1	2	3	4	5	6	7
8. It seems like most people are handling their lives better than I am.	1	2	3	4	5	6	7
9. Worries get in the way of my success.	1	2	3	4	5	6	7
10. My thoughts and feelings do not get in the way of how I want to live my life.	1	2	3	4	5	6	7