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The Effectiveness of an ACT App in Promoting Wellbeing and Psychological Flexibility

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Murray State University Honors College

HONORS THESIS

Certificate of Approval

The Effectiveness of an ACT App in Promoting Wellbeing and Psychological Flexibility

Brooke Short
December 2021

Approved to fulfill the
requirements of HON 437

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Approved to fulfill the
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The Effectiveness of an ACT App in Promoting Wellbeing and Psychological Flexibility

Submitted in partial fulfillment
of the requirements
for the Murray State University Honors Diploma

Brooke Short

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Abstract

While mental health apps could potentially increase access to mental health resources, only 3.05% of depression and anxiety apps on the Apple App store had published research support as of 2018 (Marshall et al., 2019). The present study aims to evaluate an Acceptance and Commitment Therapy (ACT) mental health app. ACT aims to cultivate psychological flexibility, the ability to fully experience and accept one's present context while engaging in behavior that aligns with one's values (Hayes et al., 2006). Gloster et al. (2020) reviewed ACT meta-analyses and found it to be efficacious for a range of conditions. Past research has also suggested that ACT is effective in promoting wellbeing (Fledderus et al., 2010; Wersebe et al., 2018). The app "ACT Coach" was evaluated for effectiveness in promoting psychological flexibility and wellbeing while decreasing levels of depression, anxiety, and stress in a college student sample. A potential relationship between self-compassion and duration of app use was also examined. Participants ($N = 32$) were randomized to an experimental app group and a waitlist control group. The app group did not show increases in psychological flexibility, increases in wellbeing, or decreases in depression, anxiety, or stress. In addition, those higher in self-compassion at pre-intervention did not report a significant difference in app use. Explanations for the lack of improvements and implications for future research directions are discussed.

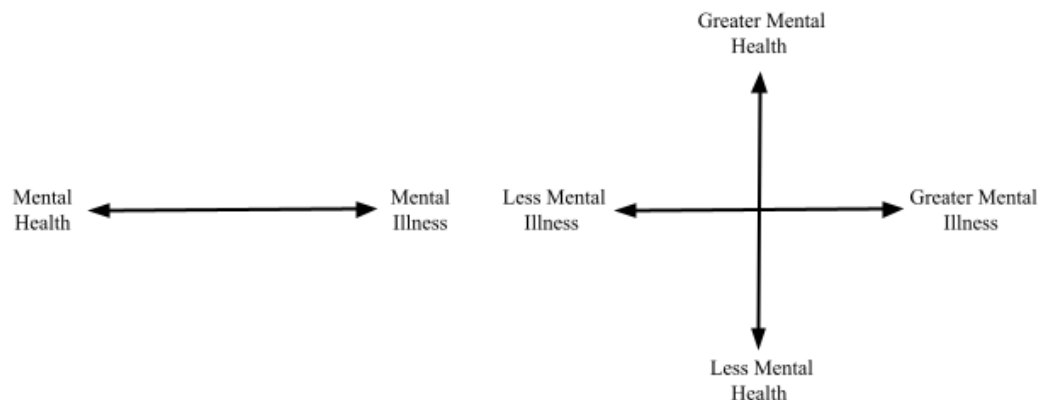
Keywords: psychological flexibility, mobile intervention, wellbeing, positive mental health, mental health app, self-compassion.

The Effectiveness of an ACT App in Promoting Wellbeing and Psychological Flexibility

A primary aim of our mental healthcare system is to improve mental health by reducing psychopathological symptoms (Iasiello et al., 2019). Diagnoses are made based on specific sets of symptoms that form criteria for specific mental illnesses, enabling treatment of those symptoms and the presumed underlying condition as a whole. Traditionally, mental health has been conceptualized and defined by the absence of psychopathology, but research indicates that the concept of mental health (also referred to as wellbeing) is more complicated and cannot be reduced to the absence of symptomology. Keyes (2005) has proposed that mental health and mental illness are two correlated but separate constructs, which can be referred to as the two-continua model. This model posits that mental health and mental illness are not two ends of the same continuum (see Figure 1), and therefore, mental health cannot simply be reduced to the absence of mental illness. For instance, an individual who is not experiencing sadness is not definitively experiencing high levels of happiness (Keyes, 2005). The two-continua model has been developing and garnering support across decades and has been supported empirically on multiple occasions (e.g., Keyes, 2005; Lamers et al., 2015).

Figure 1

Comparison of the Traditional Bipolar Model of Mental Health (Left) and the Two-Continua Model of Mental Health (Right)



There have been several conceptualizations of wellbeing as the line of research has developed (Westerhof & Keyes, 2010), requiring clarification. One tradition of thought is known in the literature as hedonic wellbeing, which entails feelings of happiness and satisfaction with life (Keyes, 2007). Hedonic wellbeing will hereon be referred to as *emotional wellbeing*. Another conceptualization of wellbeing is eudaimonic wellbeing, which emerged from concerns that emotional wellbeing was too narrow of a conceptualization and research found that there were integral components of wellbeing that were not yet being accounted for (Ryff, 1989).

Eudaimonic wellbeing is the aggregation of six elements: self-acceptance, purpose in life, autonomy, positive relations with others, environmental mastery, and personal growth (Ryff, 1989; Ryff & Keyes, 1995). Eudaimonic wellbeing will hereon be referred to as *psychological wellbeing*, and it primarily emphasizes optimal functioning within the individual (Westerhof & Keyes, 2010). In addition to emotional and psychological wellbeing, yet another perspective has been argued; Keyes (1998) posits that the social functioning of an individual is an additional important factor within the construct of positive mental health, since individuals are embedded in social structures. To only look within the individual at internal functioning is not a full examination of positive mental health. Therefore, another perspective is social wellbeing.

Keyes (2002) has combined these preceding perspectives on wellbeing into a single wholistic conceptualization consisting of three domains: emotional wellbeing, psychological wellbeing, and social wellbeing. A relevant term is subjective wellbeing, which is the overall perception one holds about their life in regard to their emotional states and their functioning both socially and psychologically (Keyes, 2002). Operationalizing mental health as a syndrome of symptoms, Keyes (2002) established what could be considered a diagnosis of mental health. *Flourishing* is a state of high overall subjective wellbeing accompanied by ideal levels of

psychological and social wellbeing. *Languishing* is a state of low overall subjective wellbeing accompanied by inadequate levels of psychological and social wellbeing. Key to all of these positive mental health perspectives is the acknowledgement that the construct cannot be reduced to an absence of psychopathological symptoms. The term *wellbeing* hereon will refer to the combination of emotional, psychological, and social wellbeing; these components of wellbeing have been supported empirically (Lamers et al., 2011). Wellbeing will also be used interchangeably with positive mental health.

It is pertinent that we recognize both the distinction and relationship between mental health and mental illness established by the two-continua model for several reasons. First, we have an additional avenue for identifying those at risk for mental illness (Grant et al., 2013; Keyes, 2002; Lamers et al., 2015). Grant et al. (2013) followed students beginning medical internship, a time of significant stress when depressive symptoms have been shown to increase. Results showed that subjective wellbeing was a significant predictor for depression risk and also suggested that lower wellbeing scores before internship were correlated with higher depression scores throughout the internship year. Another study has found similar results suggesting that low wellbeing is a risk factor for depression (Wood & Joseph, 2010). Identifying those at risk to develop psychopathological symptoms allows the opportunity to intervene before mental illness develops. Prevalence of mental illness has been increasing as a whole (e.g., depression; Weinberger et al., 2018), as well as within groups such as adolescents (Lu, 2019) and college students (Oswalt et al., 2020). This increasing prevalence, along with the literature suggesting low wellbeing can be predictive of mental illness, hint at a potential method of prevention for psychopathological symptoms that are on the rise.

In addition, recognizing the two-continua model has implications for a large portion of the population. Studies have found that only approximately 18% of participants have met the criteria of flourishing, which Keyes identifies as the highest status of wellbeing (Keyes, 2005, 2007). This suggests that there might be room to improve the mental health of a significant portion of the population. Suldo and Shaffer (2019) also examined a dual factor of mental health, focusing on middle school students specifically, and found that 17% of the sample exhibited low psychopathology scores but still exhibited low subjective wellbeing scores. This study differs from Keyes's (2005) because they conceptualized subjective wellbeing as a combination of life satisfaction and more frequent positive affect than negative affect, whereas Keyes (2005) conceptualized wellbeing into the three categories previously discussed: emotional, psychological, and social. Therefore, despite both studies measuring wellbeing in different ways, both showed support for the two-continua model and suggested room to improve positive mental health within the portion of the population who do not have diagnosable psychopathology.

The two-continua model may also have implications for those who are seeking treatment. Iasiello et al. (2019) examined a representative sample of U.S. adults that provided data on their mental illness along with data on their positive mental health in 1995 and again ten years later. Among these individuals diagnosed with a mental illness, those who maintained a flourishing state of positive mental health, along with those who improved from either languishing or moderately mentally healthy to flourishing, displayed significantly higher rates of recovery from their mental illness. Additionally, those who maintained moderate mental health or improved to reach moderate mental health also displayed significantly higher rates of recovery. This is groundbreaking in that it suggests wellbeing is not a fixed phenomenon. In psychotherapy, recovery is defined by falling beneath a threshold of symptoms (Widnall et al., 2020), but the

literature has shown that depressed patients also consider positive mental health to be an integral feature of remission (Zimmerman et al., 2006), going so far as considering it to be a better indicator of remission than absence of symptoms. These studies suggest that levels of positive mental health are susceptible to change and that strategies for promoting positive mental health may also have implications for those who are seeking treatment for a mental illness.

It is necessary to recognize that although the vast majority of research on the two-continua model has supported it empirically (see Iasiello et al., 2020 for a review), one study found contradictory findings in a clinical sample that might prompt researchers to adjust their approach in future investigation. Van Erp Taalman Kip and Hutschemaekers (2018) evaluated the three components of wellbeing in a sample of adult psychiatric outpatients and found their correlations to be much stronger than in investigation by Lamers et al. (2011), suggesting inadequate discriminant validity. The explanation was offered by Van Erp Taalman Kip and Hutschemaekers (2018) that their clinical participants did not differentiate between emotional, psychological, and social wellbeing. Results from the clinical sample that Van Erp Taalman Kip and Hutschemaekers (2018) surveyed also suggested that wellbeing did not explain enough variance in the posited two-factor model to confirm that wellbeing and psychopathology are two separate but correlated constructs. They reasoned that in their sample of out-patients, their mental illness might have been so pervasive in their internal experience that distinguishing their wellbeing from their mental illness was not possible. These findings do not warrant discarding the two-continua model as a whole, since it still holds a breadth of research support, but rather prompt future investigations to consider limiting their sample to below a set threshold of psychopathological symptoms.

Acceptance and Commitment Therapy and Psychological Flexibility

Since the support of the two-continua model and the importance of positive mental health has been well-established in the literature, exploring potential methods of promoting levels of positive mental health may prove to be valuable. One type of therapy that possesses overlap with the field of positive psychology is Acceptance and Commitment Therapy (ACT). Positive psychology and ACT both aim to foster flourishing; positive psychology asserts that living a satisfying life holds significance beyond the mere absence of mental illness, and ACT involves committing to the behaviors that result in a more meaningful life. Important to both of these is the emphasis on a satisfying and meaningful life (Ciarrochi et al., 2013), suggesting that both fields are interested in more than the alleviation of symptomology. Gloster et al. (2020) reviewed ACT meta-analyses and found it to be efficacious for a variety of conditions ranging from mental illness to chronic pain. They also found ACT to have small to large effect sizes in its targeted process, psychological flexibility, along with small to medium effect sizes for wellbeing and functioning. ACT has an extensive list of randomized controlled trials supporting its efficacy, which now consists of several hundred individual studies (ACBS, 2021). It has been researched in areas such as chronic pain (Vowles & McCracken, 2008), obsessive compulsive disorder (Twohig et al., 2010), depression (Bohlmeijer et al., 2011), and mixed anxiety disorders (Arch et al., 2012). Further, ACT has been investigated as a potential strategy for increasing wellbeing (Fledderus et al., 2010; Wersebe et al., 2018).

ACT and psychological flexibility warrant deeper description and explanation. The progression of behavioral therapy has occurred in what some refer to as “waves”. The first wave, behavior therapy that originated from developments made in animal laboratories, lacked careful consideration of cognition and emotion that subsequent waves incorporated (Hofmann & Hayes,

2019). From the second wave came traditional Cognitive Behavioral Therapy (CBT), and from the third wave emerged several new approaches, one of these being ACT (Marshall & Brockman, 2016; Wersebe et al., 2018). ACT is a process-based therapy, and it holds enhancement of the psychological flexibility process as a main objective (Hayes et al., 2006). Throughout the therapeutic process, clients learn to accept unwanted experiences and commit to engage in value-aligned behaviors to improve their lives, as opposed to working to alter the content of these experiences (Fledderus et al., 2010; Hayes et al., 2006). Enhancement of psychological flexibility is an essential goal of ACT, and the construct has been defined as “the ability to contact the present moment more fully as a conscious human being, and to change or persist in behavior when doing so serves valued ends” (Hayes et al., 2006, p. 7). Psychological flexibility is comprised of six components that serve as the six core issues that are targeted by ACT, and each of these components overlap and support one another.

Acceptance

It is not uncommon for those who are experiencing psychological distress to attempt to alter or avoid their aversive experience. This is a process known as experiential avoidance, and acceptance is considered to be its inverse (Hayes et al., 2006, 2012). Acceptance is one component promoted by ACT, and it involves purposefully allowing private events (i.e., thoughts and cognition) to take place without interference, regardless of aversiveness. For example, an individual experiencing social anxiety at a social gathering would display acceptance by allowing themselves to feel the anxiety fully as opposed to engaging in drinking behavior as an attempt to mitigate the negative experience of the private event.

Being Present in the Moment

Humans use language, often through thoughts and cognition, to interpret their world and

construct stories about what is and is not possible for them (Hayes et al., 2012). Engagement with these stories can sometimes be problematic, especially when they include inflexible rules about how the world works or how one should behave. For example, the individual experiencing social anxiety at a social gathering may direct their focus towards deeply interpreting the actions of others and evaluating how they are being perceived. ACT aims to decrease this behavior and increase nonjudgmental contact with the present environment (Hayes et al., 2006, 2012). When one is present in the moment without interpretation and analysis of events, behavior can become increasingly flexible and value-aligned (Hayes et al., 2006, 2012).

Cognitive Defusion

When the content of a thought is distressing, it can result in attachment to that thought. It may also result in holding that thought to be true and accurate, when in actuality it is just a thought. ACT aims to promote cognitive defusion in order to alter the function of our thoughts, which are also referred to as private events. Increasing cognitive defusion changes our interaction with our thoughts as opposed to changing the content of our thoughts themselves (Hayes et al., 2006). For the individual who has social anxiety, they may experience the thought, “I am so awkward,” after a social interaction. They might display cognitive defusion through repeating that thought to themselves until it loses its meaning or through labelling the private event in their head (Hayes et al., 2006, 2012). Both of these strategies serve to decrease their adherence to the thought and reframe it as what actually is: just a thought.

Self as Context

Mainstream psychology tends to view the “self” as the amalgamation of interpretations and beliefs that amount to a story that we hold to be true about ourselves; an example of this is self-concept. On the other hand, the psychological flexibility model posits that the sense of self is

simply the context from which one experiences the world, enabling us to let go of attempts to refine a story of ourselves (e.g., improving self-esteem) and instead focus on engaging in valued behaviors (Hayes et al., 2012). ACT encourages self as context through several strategies, including mindfulness exercises and metaphors (Hayes et al., 2006, 2012). For the individual experiencing social anxiety, the literature has posited that they may take the perspective of others and view themselves from their viewpoint in order to contemplate how they are being perceived (Heimberg et al., 2014). ACT would utilize various strategies that aim to increase self as context for this individual in order to shift the perspective of the self from being a story that they believe to be true about themselves to simply being a context where events are experienced and can be observed.

Values

Values are verbal statements about what matters most to us in life. They are not things to be obtained or goals that can be met, rather, they are verbal statements that guide us to engage in patterns of behaviors that we hold to be personally important. Within the framework of ACT, valuing guides behavior, leading the individual to live a more fulfilling life. Encouraging value-aligned behavior is intended to reduce behaviors that may be problematic such as avoidance (Hayes et al., 2006, 2012), since it can provide sufficient reasoning to engage in acceptance even when it might be difficult. The individual with social anxiety may value being a good friend and show it through a variety of behaviors such as defending their friend when someone is rude to them, accompanying their friend to a social event like a banquet, or giving a short speech at their friend's wedding.

Committed Action

While values themselves are not things to be obtained or goals to be accomplished, they

can be transformed into longitudinal patterns of behavior (Hayes et al., 2006, 2012). Committed action can be understood as purposefully engaging in value-aligned behavior over time. The individual with social anxiety might consistently accompany their friend to social events since it makes their friend happy and allows them to spend time together. While social events may typically be avoided, it aligns with their values of being a good friend. Psychological flexibility would be displayed by engaging in this valued behavior instead of displaying avoidance.

ACT and its targeted process, psychological flexibility, may have significant implications beyond the mitigation of psychopathological symptoms. Fledderus et al. (2010) examined whether enhancing psychological flexibility would be effective in increasing levels of wellbeing, and wellbeing was defined as the wholistic perspective previously discussed that included emotional, psychological, and social components. In the randomized study of adults with mild or moderate psychological distress, the treatment group received an intervention implemented by therapists that incorporated Acceptance and Commitment Therapy (ACT) with mindfulness, a construct related to psychological flexibility. Fledderus et al. (2010) found that the increase observed in wellbeing in the treatment condition was mediated by an increase in psychological flexibility, suggesting that the ACT and mindfulness intervention increased wellbeing through changes that occurred in the process of psychological flexibility. Therefore, principles involved in ACT, particularly the targeting of psychological flexibility, may play a role in promoting positive mental health that the literature has suggested buffers against mental illness (Grant et al., 2013; Wood & Joseph, 2010).

Another study extended the research support for ACT's utility in enhancing wellbeing by examining an intervention that was self-help based and did not involve trained therapists. Wersebe et al. (2018) evaluated an Acceptance and Commitment Therapy (ACT) self-help

intervention by examining its effects on several variables, including stress, psychological flexibility, and wellbeing. They defined wellbeing as the all-encompassing perspective previously discussed (Keyes, 2002) that included emotional, psychological, and social components. Findings included that during the intervention, increases in psychological flexibility were associated with decreases in stress and increases in wellbeing across all three components of wellbeing. Therefore, this supports the suggestion of the Fledderus et al. (2010) study that ACT has potential as a means of promoting positive mental health.

The findings of Wersebe et al. (2018) holds value for many populations, including college students, since the study included stress within its evaluation of the ACT intervention. College freshmen are leaving home to live in a new environment with new people, responsibilities, and independence. While the college experience as a whole can be stress-inducing, younger college students have been found to experience greater stress than older college students (Bayram & Bilgel, 2008). Because younger college students generally experience higher stress levels, they are an ideal population to examine within the study of an ACT intervention since increasing psychological flexibility has been shown to reduce stress (Wersebe et al., 2018). Further, fostering an increased wellbeing in this population through the process of psychological flexibility is worthwhile, since wellbeing may be protective against future psychopathology (Grant et al., 2013).

Connections Between Psychological Flexibility, Self-compassion, and Wellbeing

The third wave of therapy encompasses a wide range of treatment, including compassion-based therapies. Self-compassion is a construct that has emerged in the Western literature during the twenty-first century. It can be defined as treating oneself with kindness as opposed to judgement, recognizing pain and failure to be a common human experience as opposed to

isolating oneself, and engaging in conscious awareness of one's feelings as opposed to ruminating on them (Neff, 2003). Self-compassion has a growing body of research in a variety of areas including social anxiety (Werner et al., 2012) and post-traumatic stress disorder (Braehler & Neff, 2020).

Marshall and Brockman (2016) examined correlational relationships between self-compassion and the various components of psychological flexibility and found self-compassion to be positively correlated with defusion, acceptance, valued living, as well as psychological flexibility as a whole. On top of this, Marshall and Brockman (2016) also measured emotional wellbeing and found that self-compassion accounted for significant additional variance in emotional wellbeing beyond that accounted for by psychological flexibility. Since it is recognized that ACT interventions, which aim to enhance psychological flexibility, have utility for promoting wellbeing (Fledderus et al., 2010; Wersebe et al., 2018), the displayed associations between self-compassion and psychological flexibility suggest that self-compassion is an additional component that could be examined when evaluating ACT interventions for wellbeing enhancement. Examining self-compassion in adjacency to psychological flexibility could potentially help to obtain a wholistic understanding of the mechanisms underlying levels of wellbeing.

It is worthwhile to examine the overlap and the distinctions between self-compassion and psychological flexibility. The self-compassion scale (Neff, 2003) contains a self-judgement subscale as well as a mindfulness subscale. Self-judgement suggests an inverse connection to the "being present in the moment" component of psychological flexibility, which involves nonjudgmental contact with events. Additionally, mindfulness exercises may be used to increase the "self as context" component of psychological flexibility (Hayes et al., 2006), displaying some

overlap between the two processes. While self-compassion and psychological flexibility share some overlap, they also share differences. The conceptualization of the self between both processes might not be identical; in psychological flexibility, the self is simply the perspective from which events occur, while in self-compassion the self is considered deserving of kindness and relatable to all other people through a shared human experience. Both overlap and distinctions considered, research displaying a positive correlation between self-compassion and psychological flexibility remains (Marshall & Brockman, 2016).

Mental Health Apps: Are They Revolutionizing the Field of Mental Health?

The array of mental health apps has been expanding in recent years. Available in both the Apple App Store and the Google Play store, they have the potential to make management of mental health more accessible than ever before through self-help methods. It is vital to note that there is a significant need for research on the efficacy of these apps in regard to both psychopathology and wellbeing; this body of research is actively expanding. Currently, the Food and Drug Administration does not enforce mandatory regulatory requirements for apps that help patients with diagnosed psychiatric conditions such as PTSD, depression, anxiety, and OCD (U.S. Food and Drug Administration, 2019). Since mental health apps are not regulated, and evaluation of their efficacy is not required prior to being offered to the public, users are not protected. In one study, college students voiced concerns about apps being evidence-based and their efficacy (Kern et al., 2018), and reasonably so. Treatments can sometimes cause harm, such as deterioration (Lilienfeld, 2007), emphasizing the need for their thorough investigation. Since apps are made widely accessible to a wide range of people regardless of diagnosis or user characteristics, research is needed to provide evidence that they are safe and effective. As of 2018, only 3.05% of the depression and anxiety apps on the Apple App Store had published

research support (Marshall et al., 2019). Empirical evidence is needed to establish which mental health apps are effective along with the processes by which they are effective so that the public can download them as informed consumers.

While research is expanding on the utility of mental health apps to address psychopathological symptoms, mental health apps also have the potential to address and promote wellbeing in individuals who are not experiencing symptoms that constitute a diagnosis. Even though increasing rates of college students are seeking help (Gallagher, 2014; Lipson et al., 2018), barriers still persist. Some of the most common reasons college students were not receiving mental health services included a lack of perceived need, a belief that stress is normal, and a lack of time (Eisenberg et al., 2007). Though one might not feel the need to seek professional help for psychological difficulties, they may be an ideal candidate for interventions that promote their wellbeing and positive mental health. It is pertinent to reexamine the point that studies have found only approximately 18% of their samples meet the threshold to qualify as flourishing, and the majority of the sample tends to fall somewhere in the mid-range of positive mental health (Keyes, 2005, 2007). This suggests room for growth. Individuals who are not seeking professional services for their psychological difficulties due to lack of perceived need may benefit from, and may be open to trying, mental health apps that promote wellbeing.

Some studies have found various ACT apps to be useful in increasing levels of psychological flexibility among participants (e.g., Haeger et al., 2020; Mattila et al., 2016), and one study also found an ACT app intervention that was supported by therapist guidance to be useful in decreasing levels of stress (Ly et al., 2014). Mattila et al. (2016) conducted a randomized controlled trial for an ACT app and found that the intensity of app use, as measured by total duration of use in addition to several other measures, was related to gains in

psychological flexibility. Because of this finding, it may be necessary to measure duration of app use across the intervention period when evaluating ACT app effectiveness, a strategy the present study will adopt. These findings suggest that investigation into ACT based apps is worthwhile, since psychological flexibility has been shown to increase with app use and previous research has found that the changes that occur in psychological flexibility may be the means through which ACT can promote wellbeing (Fledderus et al., 2010).

The present study aimed to evaluate a single ACT app among college students, ACT Companion: The Happiness Trap™. The app was designed according to Dr. Russ Harris' book, *The Happiness Trap* (Harris, 2008), and is owned by a registered psychologist. Therefore, the app is designed by individuals with a high level of expertise and knowledge in the fields of ACT and psychotherapy. Croom (2018) designed a workshop for college students based on the original book (Harris, 2008) to promote stress management skills. Most participants reported they would use the skills they learned and that they would recommend the workshop, suggesting high acceptability. It remains unknown whether an intervention based on *The Happiness Trap* is effective in improving student responses to stress (Croom, 2018), which is one question that the present study aimed to address through evaluation of the ACT Companion™ app.

Within the app, there are three prominent sections: "Be present," "Open up," and "Do what matters." The "Be present" section was designed to guide the user to observe their private events and mindfully contact the present moment. Next, the "Open up" section included defusion strategies as well as self-compassion activities. Finally, the "Do what matters" section of the app was concerned with valuing and committed action. The individual components of psychological flexibility are not distinctly separated between the sections of the app, but this is reasonable

because these components are all believed to interact with one another and are not mutually exclusive (Hayes et al., 2006).

One study has already evaluated ACT Companion™ in New Zealand. Li (2018) primarily utilized a single-subject design to evaluate the app in relation to stress, anxiety, depression, and psychological flexibility in undergraduate psychology students who reached a set threshold of anxiety level and were not receiving treatment. Because they used a single subject design, participants completed a daily assessment, and this showed that daily stress decreased for all participants. After intervention, at a group level, decreased levels of anxiety, stress, and depressive symptoms were observed, but the small sample ($N = 9$) limits the extent to which these findings can be generalized. Therefore, the study observed promising findings that warrant further investigation into the app.

The present study sought to extend the findings of Li (2018) in a few ways. First, a different approach to experimental design was taken. Since both single-subject and group designs have their benefits and drawbacks, the present study adopted a randomized group design to provide an additional perspective. Specifically, a waitlist control group was utilized. By adopting a group design, daily measures were avoided. This is beneficial in that the present study aimed to prioritize effectiveness over efficacy; gathering daily information can provide unique data on how values change over time, but it also would introduce a new variable into the equation. Namely, would participants still use the app to the same extent with minimal involvement from researchers and would their app use still have an effect on the variables of interest? In the real world, individuals are not always reminded to use a mental health app that they downloaded. Next, measures of positive mental health were included to evaluate the effect of the app on a wholistic view of wellbeing that encompasses emotional, psychological, and

social components. Additionally, while Li (2018) examined psychological flexibility, the study did not examine self-compassion. In the present study, both constructs were also examined in order to gain a second perspective of the processes by which the ACT app may be effective. Finally, information regarding app acceptability and duration of use were collected, with acceptability questions inspired by those used by Li (2018).

The intervention period was set at two weeks, since a previous study (Haeger et al., 2020) evaluated a two-week self-guided ACT app and found that participants displayed improvements in components of psychological flexibility, depression, anxiety, and stress. Hypotheses for the present study included the following:

- (1) Measures of positive mental health (as measured by the Mental Health Continuum Short Form and the Satisfaction with Life Scale) will increase more for those in the experimental group than those in the control group.
- (2) Levels of psychological flexibility (as measured by the Multidimensional Psychological Flexibility Inventory) will increase more for those in the experimental group than those in the control group.
- (3) Individual measures of depression, anxiety, and stress (as measured by the Depression Anxiety and Stress Scale 21) will decrease more for those in the experimental group than those in the control group.
- (4) Within the experimental group, those with higher self-compassion at pre-intervention (as measured by the Self-Compassion Scale Short-Form) will report a longer duration of app use across the two-week intervention period.

Method

Participants

Undergraduate students ($N = 32$) enrolled in an introductory psychology course at Murray State University were recruited through the Sona system, an online recruitment program for research. The sample was primarily female ($N = 30$) and primarily white ($N = 27$). Further demographic information by sample and condition is presented in Table 1. Classroom announcements were also made to potential participants to inform them of the study and the benefits to participating. They earned class credit for their psychology course to compensate them for their participation. The study was divided into two parts and listed in the Sona system under the titles “Mental Health App Intervention Part 1” and “Mental Health App Intervention Part 2.” The description for part 2 in Sona stated that ownership of an iPhone was required to participate. This study was approved by the Murray State University IRB (see Appendix A). Informed consent was obtained prior to participation in Part 1 and was reviewed again prior to participation in Part 2.

Table 1*Sample Demographics*

	Total		App		Control		Fishers Exact p value
	N	%	N	%	N	%	
Gender							1.00
Female	30	93.7%	16	94.1%	14	93.3%	
Male/Nonbinary ^a	2	6.3%	1	5.9%	1	6.7%	
Class							.209
First year	25	78.1%	15	88.2%	10	66.7%	
Second year or above ^b	7	21.9%	2	11.8%	5	33.3%	
Race							1.00
White	27	84.4%	14	82.4%	13	86.7%	
BIPOC ^c	5	15.6%	3	17.6%	2	13.3%	
Diagnosed mental illness							.198
Yes	7	21.9%	2	11.8%	5	33.3%	
No	24	75%	15	88.2%	9	60%	
Currently in therapy							.083
Yes	6	18.8%	1	5.9%	5	33.3%	
No	25	78.1%	15	88.2%	10	66.7%	
Has ever been in therapy							1.00
Yes	12	37.5%	6	35.3%	6	40%	
No	20	62.5%	11	64.7%	9	60%	
Has used mental health app							.161
Yes	5	15.6%	1	5.9%	4	26.7%	
No	27	84.4%	16	94.1%	11	73.3%	

^aOne participant identified as male, and one identified as nonbinary. ^bOnly one participant identified as a third year student. ^cBlack Indigenous and People of Color. One participant identified as Asian and four participants identified as biracial.

Measures

Demographic data was collected from both groups regarding age, gender, ethnicity, experience with therapy, and experience using mental health apps (see Appendix C). Next, a

psychometric battery was delivered to both groups pre- and post-intervention, consisting of the following measures.

Multidimensional Psychological Flexibility Inventory (MPFI)

The MPFI contains 30 items measuring psychological flexibility and 30 items measuring psychological inflexibility across the past two weeks (Rolffs et al., 2018). Among young adults, the internal consistency was strong for the psychological flexibility scale ($\alpha = .96$). The psychological flexibility items are divided into 6 dimensions: acceptance ($\alpha = .86$), present moment awareness ($\alpha = .90$), self as context ($\alpha = .89$), defusion ($\alpha = .88$), values ($\alpha = .89$), and committed action ($\alpha = .91$), with five items assessing each dimension. The internal consistency was also strong for the psychological inflexibility scale among young adults ($\alpha = .96$). The inflexibility items are divided into 6 dimensions: experiential avoidance ($\alpha = .89$), lack of contact with the present moment ($\alpha = .93$), self as content ($\alpha = .91$), fusion ($\alpha = .92$), lack of contact with values ($\alpha = .86$), and inaction ($\alpha = .90$), with five items assessing each dimension. Factor analysis confirmed the 12-factor solution. The MPFI has also displayed correlations with the Acceptance and Action Questionnaire II, a common measure used for psychological inflexibility, on both the flexibility scale ($r = -.59$) and the inflexibility scale ($r = .87$). Participants indicate their level of agreement with statements such as “I was receptive to observing unpleasant thoughts and feelings without interfering with them” on a six-point Likert scale ranging from one (never true) to six (always true). Higher scores on the flexibility items indicate higher psychological flexibility. Higher scores on the inflexibility items indicate higher psychological inflexibility. In the present sample, the MPFI displayed excellent internal consistency for both flexibility items ($\alpha = .93$) and inflexibility items ($\alpha = .95$).

Mental Health Continuum Short Form (MHC-SF)

The MHC-SF consists of 14 items measuring wellbeing across three subscales: emotional, psychological, and social (Keyes, 2009). Factor analysis confirmed the three-factor solution (Lamers et al., 2011). The scale has displayed strong internal consistency as a whole ($\alpha = .89$), as well as within the emotional wellbeing subscale ($\alpha = .83$) and the psychological wellbeing subscale ($\alpha = .83$). The social wellbeing subscale has displayed adequate internal consistency ($\alpha = .74$). The emotional wellbeing subscale of the MHC-SF has displayed a moderate correlation with the Satisfaction With Life Scale ($r = .49$) and the other subscales displayed low to moderate correlations with their related validation measures. Lamers et al. (2011) reasoned that this weaker correlation was because the validation measures were not intended to measure exactly what the subscales of the MHC-SF were intended to measure. For example, the Satisfaction With Life Scale was only moderately correlated with the emotional wellbeing subscale, which makes sense since the emotional wellbeing subscale consists of *both* satisfaction with life and feelings of happiness. MHC-SF utilizes a six-point Likert scale ranging from zero (never) to five (every day), with higher scores indicating greater wellbeing. Participants indicate how often they felt particular ways over the past month, such as “happy” or “interested in life.” The MHC-SF displayed excellent internal consistency in the current sample ($\alpha = .95$).

Satisfaction with Life Scale (SWLS)

The SWLS consists of five items intended to assess general judgements of an individual’s satisfaction with their life (Diener et al., 1985). The scale has displayed strong internal consistency ($\alpha = .87$) and it is moderately correlated with the MHC-SF ($r = .49$). Participants indicate their level of agreement with statements using a seven-point Likert scale ranging from one (strongly disagree) to seven (strongly agree). For example, one item states, “In most ways

my life is close to ideal.” Higher scores indicate higher levels of life satisfaction. The SWLS displayed very good internal consistency in the current sample ($\alpha = .90$).

Depression Anxiety Stress Scale (DASS21)

The DASS21 consists of 21 items intended to assess distress across three subscales of depression, anxiety, and stress (Henry & Crawford, 2005). The scale as a whole has displayed strong internal consistency ($\alpha = .93$), as have the depression subscale ($\alpha = .88$), the anxiety subscale ($\alpha = .82$), and the stress subscale ($\alpha = .90$). The DASS21 has been shown to correlate with positive affect ($r = -.40$) and negative affect ($r = .69$) as measured by the Positive and Negative Affect Scale. An item targeting depression states, “I couldn’t seem to experience any positive feeling at all.” The scale uses a four-point Likert scale ranging from 0 (never) to 3 (almost always), and higher scores indicate higher levels of distress. Participants indicate how much the statements applied to them across the past week. All subscales of the DASS21 displayed very good to excellent internal consistency in the present sample (depression, $\alpha = .91$; anxiety, $\alpha = .87$; stress, $\alpha = .81$).

Self-Compassion Scale Short Form (SCS-SF)

The SCS-SF consists of 12 items intended to assess self-compassion (Raes et al., 2011). The six subscales in the measure include self-kindness, self-judgement, common humanity, isolation, mindfulness, and over-identification subscales. For example, an item targeting self-kindness states, “I try to be understanding and patient towards those aspects of my personality I don’t like.” The full scale has displayed high internal consistency ($\alpha = .87$), and each of the subscales have displayed moderate to high internal consistency (self-kindness, $\alpha = .55$; self-judgement, $\alpha = .81$; common humanity, $\alpha = .60$; isolation, $\alpha = .77$; mindfulness, $\alpha = .64$; over-identification, $\alpha = .69$). The correlation between the full Self-Compassion Scale and the SCS-SF

is very strong ($r = .97$). The scale uses a five-point Likert scale ranging from 1 (almost never) to 5 (almost always), and higher scores on the SCS-SF indicate higher levels of self-compassion. The instructions for the scale ask how often the individual behaves in the stated manner. In the current sample, the SCS-SF displayed acceptable internal consistency ($\alpha = .75$).

User Experience Survey

A set of user experience questions were chosen to gather app acceptability data and were given to the experimental group post-intervention (see Appendix D). This consisted of nine questions. Two questions were inspired from those used by Li (2018); one inquired which exercises they liked the most within the app, and one inquired which exercises they liked the least within the app. Another question was included to evaluate whether there was any language barrier due to dialectal differences that impede comprehension, however, these questions were omitted from study analyses as the replacement app (see experimental condition section below) was developed by a team in the United States for speakers of American English.

Procedure

Experimental Condition

After completing the pre-intervention psychometric battery, participants who elected to sign up for Part 2 were electronically randomized to the experimental or waitlist control group. Those who were placed in the experimental group were all contacted on the same day and instructed to download and begin using the ACT Companion app. They also received instructions for how to adjust their phone settings to begin tracking screen time and were encouraged to use the app as much as they would like. Unfortunately, a technical error on the ACT Companion's authentication server prevented participants from creating accounts needed to access the app. Participants were notified within 24 hours of the start of the intervention to

standby and wait for further instructions and the ACT Companion owner was contacted for technical assistance. The owner responded that the error was new and that they would attempt to correct the problem. Unfortunately, the error persisted, and the decision was made to switch to a new app after waiting five days. IRB approval for the amended experimental protocol was obtained prior to notifying the experimental group of the new app approximately one week after the planned start of the intervention (see Appendix B).

The ACT Coach app (Owen et al., 2018) was selected as the new app. Developed by the National Center for PTSD in the Department of Veteran Affairs, ACT Coach became available for download in 2014. The app includes educational information about the goals of Acceptance and Commitment Therapy, located in a section of the app titled “Learn.” Within this section, the user can click on various questions they might have, such as “What is ACT?” and “What is Defusion?” The app also includes mindfulness exercises, located in a section of the app titled “Practice Mindfulness,” that can be practiced in an audio-guided format or in a self-guided format consisting of text descriptions of the activity. Next, there is also a “Live Your Values” section, which prompts the user to select a value category and then type in a value that they hold. After doing so, the user can write in a specific action directly under that value and can even tap a calendar icon to add the specific action to the calendar on their device. As they complete actions, the user can check it off within this section of the app. Another section of the app is the “Track your ACT Moments” section, which contains a mindfulness log to record the instances that the user practices mindfulness, a coping strategies log to record the user’s strategies and allow them to consider whether they align with their values, and a willingness log to record the user’s willingness to contact aversive experiences when doing so aligns with their values. The logs allow the user to document their experience, but questions asked in the coping strategies log and

willingness log also prompt some self-reflection that aligns with the ACT approach. Finally, the last main section of the app is “Take ACTION.” This section of the app has tips, metaphors, and examples of “barriers to action” that the user can click on for relevant tips.

After approximately one week of app engagement, this group received a brief survey to collect data on app screen time for week one. The intervention period began on a Tuesday, and the first screen time report sent to participants that Friday was intended to capture screen time for the first four days of the intervention. This data was collected from the Settings app, which participants set to begin tracking screen time at the beginning of the study. They were also reminded that they will receive a final survey in about a week, and that completion of this survey will earn them credit for their participation in Part 2.

On day 14 of app engagement for the experimental group, they received a survey with the same psychometric battery that they completed pre-intervention along with the user experience survey to collect opinions on the app. The experimental group also reported screen time again, and this report captured the last three days of the intervention period. The experimental group was then debriefed.

Waitlist Control Condition

The waitlist control group was contacted every time the experimental group was contacted, but the message differed. On day one of the intervention period, the control group received a reminder that they signed up for Part 2 and that they would receive another message in one week. They were also told they would receive a final survey in two weeks that will be required to earn participation credit for Part 2. Finally, they were informed that they would receive app information on this same day.

Approximately one week into the intervention period, the control group received a message explaining that the study would be extended one week due to a technical problem. One week later (i.e., day 7 of the intervention period) they received a brief reminder that there would be a final survey in about one week that is required to earn participation credit for Part 2.

On day 14 of the intervention period, they received the final survey with the same psychometric battery that they completed before the intervention period. They were then given app information and invited to use the app. Data collected from this group after this time point is beyond the scope of the present study. The control group was then debriefed.

Results

Demographics, Cleaning, and Attrition

99 participants provided informed consent and completed part 1, the pre-intervention survey. Only 41 participants (41% of the original sample) signed up to participate in part 2, the intervention period. Of the 41 participants signed up for part 2, 21 were randomly assigned to the intervention condition and 20 to the waitlist control condition. Only 32 participants completed the final survey at the end of part 2 (78% of those who signed up for part 2). A consort diagram is presented in Figure 2. After data collection was complete, the data was examined for outliers. No univariate or multivariate outliers were identified, and the final data set consisted of 32 participants. No participants were found to have significant missing data. Ten participants were missing a single value, and in each of these instances a value was calculated and imputed by averaging their responses to the other items on the relevant scale. 22 attention check questions were also included at pre- and post- intervention; 81.3% of the sample answered all attention questions correctly, and 96.9% missed no more than one attention question. One participant missed a single attention check on both the pre- and post-intervention psychometric battery but

was not removed from the sample as they answered most attention check items correctly across both surveys. No participants were excluded from analyses due to failing attention checks.

To assess for baseline differences between experimental conditions, demographic variables and pre-intervention scores on the psychometric battery were examined. Frequencies and chi-square tests of independence were calculated for categorical demographic variables (see Table 1) and independent samples t-tests were conducted for each measure in the pre-intervention psychometric battery (see Table 2). No statistically significant differences were observed between conditions. The significance level for all analyses was set at .05.

Figure 2

Participant Flow Diagram

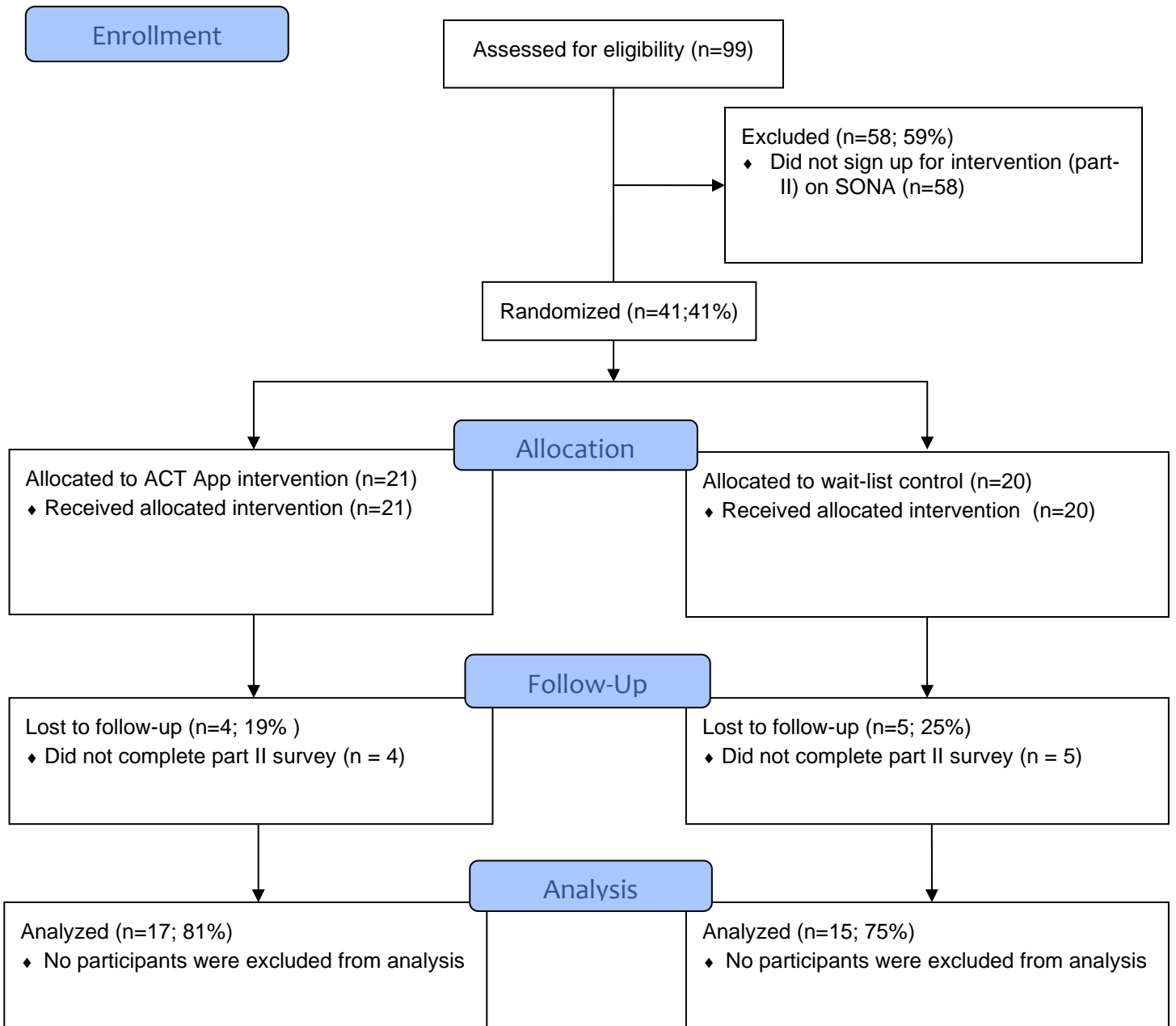


Table 2*Descriptive Statistics of Baseline Measures and Mean Comparisons*

	Overall Sample		App Condition		Control Condition		t	p
	M	SD	M	SD	M	SD		
Age	18.38	.554	18.29	.47	18.47	.64	.877	.388
MPFI Flexibility	3.78	.69	3.70	.77	3.86	.60	.660	.514
MPFI Inflexibility	3.04	.93	2.92	.92	3.18	.95	.801	.430
MHC-SF	41.90	16.10	42.80	16.88	40.88	15.70	-.332	.742
SWLS	23.50	7.82	23.29	7.47	23.73	8.46	.156	.877
DASS21 Depression	12.94	9.74	12.24	9.35	13.73	10.44	.428	.672
DASS21 Anxiety	15.44	11.58	13.06	9.70	18.13	13.21	1.249	.221
DASS21 Stress	17.50	9.17	16.00	9.95	19.20	8.20	.984	.333
SCS-SF	2.75	.57	2.78	.70	2.71	.38	-.387	.702

Evaluating Between-Group Differences on Outcome Variables

Hypotheses one, two, and three were each evaluated with an analysis of covariance (ANCOVA). For each test, the relevant pre-intervention score served as the covariate. ANCOVA is an extension of the analysis of variance procedure (ANOVA), allowing a variable that is known to be correlated with the dependent variable to be accounted for when determining the effect of the independent variable. Since pre-intervention scores are expected to be correlated with post-intervention scores, they are an effective covariate to use in the ANCOVA to evaluate the first three hypotheses. For example, since hypothesis two is evaluating whether levels of psychological flexibility increased more for the experimental group, scores for the MPFI at pre-intervention served as the covariate in the analyses for this hypothesis. Additionally, two

separate ANCOVAs were conducted to evaluate hypothesis two: one using the MPFI's flexibility subscale, and one using the MPFI's inflexibility subscale. Individual ANCOVAs were also conducted on the DASS21 subscales to examine individual changes that may have occurred in depression, anxiety, and stress.

Scores for each measure in the psychometric battery at baseline were significant predictors of scores at post intervention. No statistically significant differences were observed by condition at post-intervention. A summary of the ANCOVAs conducted is presented in Table 3. Descriptive statistics are presented in Table 4 for all variables pre- and post-intervention by condition.

Table 3*Results of ANCOVA Analyses*

	F	p	Partial eta ²
Mental Health Continuum Short Form			
Baseline	40.651	<.001	.584
Condition	0.270	.608	.009
Satisfaction with Life Scale			
Baseline	28.645	<.001	.497
Condition	1.106	.302	.037
MPFI – Flexibility			
Baseline	18.725	<.001	.392
Condition	0.698	.410	.024
MPFI – Inflexibility			
Baseline	20.71	<.001	.417
Condition	0.305	.585	.010
DASS21 – Depression			
Baseline	41.444	<.001	.588
Condition	0.805	.377	.027
DASS21 – Anxiety			
Baseline	35.918	<.001	.553
Condition	0.074	.788	.003
DASS21 – Stress			
Baseline	35.616	<.001	.551
Condition	1.156	.291	.038

Note. Baseline refers to the covariate (pre-intervention scores) and condition refers to group assignment.

Table 4*Pre- and Post-Intervention Descriptive Statistics for All Measures by Condition*

	Pre-intervention		Post-intervention	
	M	SD	M	SD
MPFI Flexibility				
ACT App	3.70	0.77	3.68	0.84
Control	3.86	0.60	3.95	0.56
MPFI Inflexibility				
ACT App	2.92	0.92	3.05	1.30
Control	3.18	0.95	3.08	0.90
MHC-SF				
ACT App	42.80	16.88	40.17	19.44
Control	40.88	15.70	40.70	14.12
SWLS				
ACT App	23.29	7.47	24.06	7.40
Control	23.73	8.46	26.20	6.41
DASS21 Depression				
ACT App	12.24	9.35	14.35	13.33
Control	13.73	10.44	13.20	11.63
DASS21 Anxiety				
ACT App	13.06	9.70	12.35	10.45
Control	18.13	13.21	15.47	13.34
DASS21 Stress				
ACT App	16.00	9.95	17.65	10.78
Control	19.20	8.20	17.60	8.79
SCS-SF				
ACT App	2.78	0.70	2.81	0.81
Control	2.71	0.38	2.87	0.50

Self-Compassion and Screen Time

Hypothesis four was evaluated with a linear regression analysis between levels of self-compassion at pre-intervention and reported screen time for the app during the intervention period for the experimental group. All participants in the experimental group reported screen time at least once across the two assessments. For those that reported twice, the times for each assessment were summed. One participant reported a total of 886 minutes of screen time. Since this was an extreme univariate outlier and not a reasonable data point, it was winsorized and

replaced with the next highest in bound value (189 minutes). The regression model was not significant, $R^2 = .02$, $F(1, 15) = .33$, $p = .58$.

User Experience Survey

Participants in the experimental condition ($n = 17$) were asked to rate their various opinions on the app on a Likert scale ranging from one to five, with one being “not at all” and five being “very.” They rated the app moderately helpful ($M = 3.53$, $SD = 1.18$). They also indicated that they are moderately likely to recommend it to other college students ($M = 3.76$, $SD = 1.15$). However, participants also seemed to indicate that they were not very likely to continue using the app after conclusion of the study ($M = 2.59$, $SD = 1.00$).

Qualitative feedback on the app was also collected. When asked what they liked most about the app, several participants mentioned mindfulness aspects of the app, and one mentioned that they liked becoming more self-aware. One participant who found the intervention very helpful explained, “I like the breakdown of it and how I was able to use the app they provided that gave me a sense of calm when I needed it most.” When asked what they liked the least about the intervention, some participants noted that the format of the app was not ideal, and some noted that they did not find it engaging. One participant who found the intervention only moderately helpful explained, “The app did not have anything interactive, like a short video with a breathing exercise to do while following the video that teaches the exercise, for example.” Participants were also asked what emotions or circumstances stopped them from using the app on days that they did not engage with it, and several participants indicated that they were not motivated to use it or that they were too busy to use it. Others noted that they didn’t think they needed to use it or that they didn’t think it would help. Interestingly, one participant explained, “most days I would simply forget, but other days I just didn’t want to think about how I was feeling.”

Discussion

In the present study, no significant differences were found between the ACT app group and the waitlist control group at post-intervention on measures of positive mental health, depression, anxiety, stress, or psychological flexibility and inflexibility. In addition, self-compassion at pre-intervention was not a significant predictor of app engagement during the intervention period. Because the hypotheses have not been supported, possible explanations for the intervention failure are proposed and discussed.

Integral to ACT is the objective of enhancing psychological flexibility, the process through which additional positive changes are thought to be produced (Hayes et al., 2006). Results from the investigation of ACT Coach in the present study did not suggest that participants who were assigned to use the app experienced increases in the targeted process of psychological flexibility. In light of this, it is logical that other variables of interest also did not show improvements. If psychological distress had decreased or positive mental health had increased without any changes observed in the process of psychological flexibility, this would be theoretically inconsistent with the ACT model that holds psychological flexibility as a process of change. Therefore, the failure to find significant gains in wellbeing and reductions in depression, anxiety, and stress is theoretically consistent with the integral role that psychological flexibility plays in the ACT model.

The hypothesis that self-compassion would predict duration of app use also did not find support in the present study. Those who were more self-compassionate did not engage with the app longer than participants who were less self-compassionate. These findings do not align with what previous research might suggest. Greater self-compassion has been associated with greater intent to seek professional help (Dschaak et al., 2021), which could potentially extend to the

seeking of other mental health resources. In addition, self-compassion has displayed positive correlations with current health behaviors and intentions to engage in health behavior (Sirois, 2015). Our inability to detect a connection between self-compassion and app engagement could stem from low app engagement in general within the present sample. Dosage is discussed further in a later section.

Next, potential explanations will be explored for why psychological flexibility remained unchanged among participants who were assigned to use the app. One previous study that evaluated a two-week, self-guided ACT app intervention did find increases in psychological flexibility. Haeger et al. (2020) evaluated ACT Daily in a college student sample of individuals experiencing anxiety, depression, or both who were on the waitlist for a college counseling center. Before the intervention began, participants completed an orientation that included an educational component about ACT. Additionally, the app used in this study utilized personalized components. For example, it reminded the individual to check-in three times a day to assess anxiety, depression, and components of psychological inflexibility. After assessment, the app provided them with an opportunity to do a personalized a “skill coaching session.” Haeger et al. (2020) found that their participants improved on measures of psychological flexibility, depression, anxiety, and stress.

In contrast, the sample for the present study was recruited from a nonclinical population, and no inclusion criteria was set other than ownership of an iPhone. Despite recruiting this population, the baseline means on the DASS21 are notable, such that the overall sample could be described as mildly depressed, severely anxious (at the lower end of this categorization), and mildly stressed (Lovibond & Lovibond, 1995). This indicates moderate distress, which may make sense in the context of the current COVID-19 pandemic that has been related to an increase

in college student distress (Zimmermann et al., 2021). While recruiting from a nonclinical population was appropriate to assess whether a specific ACT app could be beneficial for college students with and without psychopathological symptoms, this could have been a sample that lacked sufficient motivation to use the app or clarity on how they would benefit from using the app. Within the user experience survey, some participants did suggest that they were not motivated to use it. Others indicated that they didn't think they needed to use the app or that they didn't think it would help. It is possible that some participants considered mental health apps to be only for individuals experiencing psychological difficulty, rather than for any person interested in promoting their wellbeing. Future research may explore whether communicating potential benefits to participants or whether briefly educating participants before intervention has an impact on engagement or usage.

Further in contrast to Haeger et al. (2020), the present sample was not a help-seeking population. In the present study, participants voluntarily chose to participate, but their reinforcement for doing so was participation credit that went towards their grade for their introductory psychology course. Individuals in help-seeking or clinical populations may have stronger motives to engage in app use, as compared to non-help-seeking populations, making them preferable to examine in research on the effectiveness of various mobile interventions. Non-help-seeking populations could still be valuable to examine in mobile intervention research, but future research could integrate reminders into the intervention or precede the intervention with an educational component, which were both aspects of the Haeger et al. (2020) intervention. Future research evaluating mental health apps could also compare app engagement and opinions between help-seeking and non-help seeking samples, which may reveal differing motivations for app use. This exploration could also inform how future apps could be geared towards nonclinical

populations to enhance wellbeing, a construct that the literature has suggested is separate from mental illness (Iasiello et al., 2020) and is a predictor of depression (Grant et al., 2013; Wood & Joseph, 2010).

Inadequate dosage could have also played a role in the lack of observed change in psychological flexibility, as approximately half of the experimental group reported using the app for only thirty minutes or less. This is a limited amount of app use for a 14-day period. Previous research has suggested factors such as duration of use are related to gains in psychological flexibility (Mattila et al., 2016). In an eight-week mobile ACT intervention study, Mattila et al. (2016) found that their participants who displayed increases in psychological flexibility from pre- to post-intervention used the app for about two hours longer than those who did not improve in psychological flexibility. It is also notable that participants in this sample used the intervention for hours, rather than minutes as did many participants in the present study. Future research examining the effectiveness of mobile interventions in college student samples may consider strategies to increase dosage.

Changes also may not have occurred within the process of psychological flexibility due to app-related factors. It is important to note that the alternative app used in the present study was designed to be used by those who are currently in ACT therapy, and it was never intended to serve only as self-help. Since ACT Coach was not designed to stand alone as an intervention, this could be a significant reason why the experimental group did not experience benefits from app use. For example, the “Track Your ACT Moments” section of the app contains a “Coping Strategies Log” where participants can record the strategies they use and consider whether the strategies serve their values. This section of the app states, “You may want to review this log with your therapist.” Discussing logs in the app with a therapist could have been an integral

piece of this intervention. The discrepancy between the intentions behind ACT Coach's design and the way ACT Coach was used in the present study could aid in explaining why the process of psychological flexibility did not increase with app use. The technical difficulty experienced with the original app that required the present study to shift to an app that was not intended to be self-help emphasizes the need for more self-help apps owned by and developed by reputable sources. Future research should continue to evaluate existing apps and seek to make effective apps more available to the public to serve as safe options for those interested in self-help resources.

Other qualitative feedback to user experience questions hinted at reasons why some participants may not have engaged with the app. Some participants indicated that they disliked the format of the app or that they did not find it engaging. Another participant mentioned they did not like that it lacked interactive components, such as a guided breathing exercise. In actuality, the app did offer six different audio-guided mindfulness exercises within the "Practice Mindfulness" section (Owen et al., 2018). While it is possible that this was not the kind of exercise that the participant was interested in, it is also possible that they did not contact these exercises within the app. This second possibility is reasonable when considered in adjacence to the reported dissatisfaction with the app's format. Comments from these participants suggest that the format and interactive components of an app might be of importance to those using self-help. Torous et al. (2018) used an adapted Delphi method to reach an agreement on five theories to explain low engagement with mental health apps, and these theories included poor usability (lack of easy use and enjoyment) and app design that doesn't meet the needs of users. Feedback from participants in the present study aligns with these theories of low engagement. Participants in the present study were also asked what circumstances prevented them from using the app on days

that they did not engage; one participant explained that they usually simply forgot, but that at other times they did not want to think about how they were feeling. It is unclear whether this was due to a lack of interest in self-reflection or a lack of willingness to fully contact emotions, which would indicate inflexibility (Hayes et al., 2006).

Questions not explored in the present study that could be explored in future research include what characteristics separate those who decided to sign up for the intervention period from those who did not. For example, were those higher in psychological inflexibility at pre-intervention less likely to choose to participate in the app intervention period? Similar questions could be asked of other variables at pre-intervention, including wellbeing, psychological distress, and self-compassion. Additionally, more in-depth qualitative analyses of responses on open-ended user experience questions were beyond the scope of the present study but could be worthwhile to explore in future research. This could utilize a focus group approach, which may reveal important opinions that could inform the improvement of mental health apps for college students. Because of the generally low dosage of app use observed in the current sample, it could be enlightening to qualitatively analyze responses to a particular question from the user experience survey: “For days that you did not use the app, please state to the best of your ability the emotions or circumstances that stopped you.”

Limitations of the current study include the lack of diversity in the sample and the measurement of variables of interest. The sample was primarily female ($N = 30$, 93.8%) and primarily white ($N = 27$, 84.4%). Because mental health treatment seeking attitudes can differ by gender (Wendt & Shafer, 2016) and race (Narendorf et al., 2018), opinions on the app or engagement with the app may not have been representative of a general college student population. Demographic variables also could have impacted who elected to sign up for the

intervention period after completing the pre-intervention survey and who completed the post-intervention survey, as the literature has suggested that U.S. minorities are less likely to seek mental health services and that African Americans are more likely to terminate services early (McGuire & Miranda, 2008). Some research has also found men to be more likely to drop out of treatment (Zimmermann et al., 2017), which could have impacted the demographics of our final sample that was primarily female. Additionally, ownership of an iPhone was required to participate in the intervention period because the original app was only available on the Apple App Store. This could have led to the exclusion of participants from diverse backgrounds, such as those who are lower socioeconomic status, which is a variable that may be associated with less favorable therapy outcomes (Finegan et al., 2018). Because it is possible that there are disparities in therapy outcomes based on socioeconomic status, the exclusion of socioeconomic diversity that could have occurred in the present study is a disadvantage.

Findings are also limited by the measurement of some of the variables of interest. The intervention period lasted two weeks, and while the MPFI instructions asked about the last two weeks, other measures had instructions that did not precisely line up with the intervention timeframe (e.g., the MHC-SF inquired about the past month). Next, we utilized the “track screen time” function within the iPhone settings, which has a few disadvantages. First, it displays screen time for the current week on Sunday to Saturday intervals, and due to the days of the week that the surveys were sent to participants, the total screen time report did not capture the full intervention period. Participants could have engaged in either significant app use or no app use during the days that were not captured by the screen time report. While the method we employed could have had advantages over simple self-report, a potentially more effective method of collecting data on duration of use that future research might adopt is ecological momentary

assessment. This is a method of collecting information in real time and in a natural context via questions on a mobile device, and it may improve the validity of data by avoiding self-report with a time delay (McDevitt-Murphy et al., 2018).

In the present study, ACT Coach was evaluated for effectiveness in increasing psychological flexibility, promoting positive mental health, and decreasing psychological distress among college students. ACT Coach is targeted towards those who are currently in therapy, but it was nonetheless valuable to examine in a general sample since it is available to the general population. Though no significant differences were found at post-intervention by condition, our findings suggest directions for future research in an area that is lacking. In 2018, Marshall et al. (2019) found that only 3.05% of mental health apps on the Apple App Store possessed published research support. Research elucidating contexts in which specific mental health apps are not helpful extends the literature.

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Appendix A: IRB Protocol Approval Letter



Institutional Review Board

328 Wells Hall
Murray, KY 42071-3318
270-809-2916 • msu.irm@murraystate.edu

TO: Michael Bordieri, Psychology

FROM: Jonathan Baskin, IRB Coordinator 

DATE: 5/5/2021

RE: Human Subjects Protocol I.D. – IRB # 21-173

The IRB has completed its review of your student's Level 1 protocol entitled *Mental Health App Intervention*. After review and consideration, the IRB has determined that the research, as described in the protocol form, will be conducted in compliance with Murray State University guidelines for the protection of human participants.

The forms and materials that have been approved for use in this research study are attached to the email containing this letter. These are the forms and materials that must be presented to the subjects. Use of any process or forms other than those approved by the IRB will be considered misconduct in research as stated in the MSU IRB Procedures and Guidelines section 20.3.

Your stated data collection period is from 5/5/2021 to 5/4/2022.

If data collection extends beyond this period, please submit an Amendment to an Approved Protocol form detailing the new data collection period and the reason for the change.

This Level 1 approval is valid until 5/4/2022.

If data collection and analysis extends beyond this date, the research project must be reviewed as a continuation project by the IRB prior to the end of the approval period, 5/4/2022. You must reapply for IRB approval by submitting a Project Update and Closure form (available at murraystate.edu/irb). You must allow ample time for IRB processing and decision prior to your expiration date, or your research must stop until such time that IRB approval is received. If the research project is completed by the end of the approval period, then a Project Update and Closure form must be submitted for IRB review so that your protocol may be closed. It is your responsibility to submit the appropriate paperwork in a timely manner.

The protocol is approved. You may begin data collection now.

**Opportunity
afforded**

murraystate.edu

Appendix B: IRB Amendment Approval Letter**Institutional Review Board**

328 Wells Hall
 Murray, KY 42071-3318
 270-809-2916 • msu.irm@murraystate.edu

TO: Michael Bordieri
 Psychology

FROM: Institutional Review Board
 Jonathan Baskin, IRB Coordinator *JB*

DATE: 10/15/2021

RE: Amendment to Human Subjects Protocol I.D. – IRB # 21-173

The IRB has completed its review of the amendment submitted for your student's Level 1 protocol entitled *Mental Health App Intervention*. After review and consideration, the IRB has determined that the changes, as described in the amendment application, will be conducted in compliance with Murray State University guidelines for the protection of human participants.

The updated forms and materials that have been approved for use in this research study are attached to the email containing this letter. These are the forms and materials that must be presented to the subjects. It is your responsibility to ensure that only the updated materials are used from this point forward. Use of any process or forms other than those approved by the IRB will be considered misconduct in research as stated in the MSU IRB Procedures and Guidelines section 20.3.

This amended Level 1 protocol is valid until 5/4/2022.

If data collection and analysis extends beyond this time period, the research project must be reviewed as a continuation project by the IRB prior to the end of the approval period, 5/4/2022. You must reapply for IRB approval by submitting a Project Update and Closure form (available at murraystate.edu/irb). You must allow ample time for IRB processing and decision prior to your expiration date, or your research must stop until such time that IRB approval is received. If the research project is completed by the end of the approval period, then a Project Update and Closure form must be submitted for IRB review so that your protocol may be closed. It is your responsibility to submit the appropriate paperwork in a timely manner.

You may begin data collection using the approved changes.

**Opportunity
 afforded**

murraystate.edu

Appendix C: Demographics

1. What is your age?
2. What is your year in college?
 - First year
 - Second year
 - Third year
 - Fourth year
 - Fifth year/other
3. How do you describe yourself?
 - Male
 - Female
 - Non-binary / third-gender
 - Prefer to self-describe: _____ (text entry)
 - Prefer not to answer
4. Are you of Hispanic, Latino, or Spanish origin?
 - Yes
 - No
 - I prefer not to answer
5. Which categories describe you? Select all that apply
 - American Indian or Alaska Native
 - Asian
 - Black or African American
 - Native Hawaiian/Other Pacific Islander
 - White
 - Other: _____ (text entry)
6. Have you been diagnosed with a mental illness?
 - Yes
 - No
7. Are you currently in counselling or therapy?
 - Yes
 - No
8. Have you ever been in counseling or therapy?
 - Yes
 - No
9. Have you ever used a mental health app?
 - Yes
 - No

Appendix D: User Experience Survey

1. How helpful did you find this intervention?
[Likert scale 1 not at all – 5 very]
2. What parts of the intervention did you like the most?
[open text box]
3. What parts of the intervention did you like the least?
[open text box]
4. How likely are you to recommend this intervention to other first semester college freshmen?
[Likert scale 1 not at all – 5 very]
5. Did any slang language within the intervention cause confusion?
[open text box]
6. Please provide any other feedback you'd like or type N/A.
[open text box]
7. Have you used mental health apps in the past?
[Y/N]
8. For days that you did not use the app, please state to the best of your ability the emotions or circumstances that stopped you. If you used the app every day for the past two weeks, type N/A. Your answer will not impact your participation credit in any way, nor will this information be attached to your name.
[open text box]
9. How likely are you to continue using the app now that the study is complete?
[Likert scale 1 not at all – 5 very]