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UTILIZING ACT DAILY AS A SELF-GUIDED MOBILE APP INTERVENTION FOR
DEPRESSION AND ANXIETY IN A COLLEGE COUNSELING CENTER

by

Jack A. Haeger

A thesis submitted in partial fulfillment
of the requirements for the degree

of

MASTER OF SCIENCE

in

Psychology

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2016

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ABSTRACT

Utilizing ACT Daily as a Self-Guided Mobile App Intervention for
Depression and Anxiety in a College Counseling Center

by

Jack A. Haeger, Master of Science

Utah State University, 2016

Major Professor: Michael E. Levin, Ph.D.
Department: Psychology

College counseling centers (CCCs) have experienced funding and staffing setbacks in recent years, resulting in higher caseloads, counselor burnout, and bloated waitlists. Mobile Health (mHealth) interventions may offer a cost-effective and innovative solution. The authors developed ACT Daily, a prototype mHealth app based in Acceptance and Commitment Therapy (ACT). This study examined the feasibility and possible efficacy of ACT Daily as a brief intervention for individuals placed on CCC waitlists.

A sample of 11 depressed/anxious clients waitlisted at a local CCC enrolled in the study, which followed a pre-post, open trial design. Participants received a brief online training that covered the basics of ACT and introduced the app's functions and features. For the following 2 weeks, participants were asked to use ACT Daily every day. Results displayed high acceptability, usability, and satisfaction ratings across users. Significant

improvements were observed on most ACT process measures, including overall psychological inflexibility. Findings from app usage and self-report measures supported ACT Daily's ability to promote skill use in the moment. Analyses of in-app data indicated that ACT Daily's skills were potentially effective in the moment and increased in strength over time. Furthermore, ACT Daily appeared to serve as a helpful pre-therapy tool due to significant reductions in depression and anxiety symptoms, as well as improvements in emotional self-awareness. Finally, the online training appeared to equip users with a sufficient comprehension of core ACT components and app training.

While this pilot study suffered from a low sample size, this pattern of results encourages the application and dissemination of ACT mHealth apps as an added support for waitlisted CCC clients suffering from depression or anxiety. Moreover, it appears that ACT Daily may have enabled users to acquire, strengthen, and potentially generalize useful ACT skills. It is theorized that the app facilitated in-the-moment learning of skills that could then be applied directly to real-world contexts. Future research is advised to target larger, more diverse samples, implement a randomized controlled trial design, add objective behavioral and physiological measures, incorporate all six ACT processes, and integrate client feedback into future iterations of ACT Daily.

PUBLIC ABSTRACT

Utilizing ACT Daily as a Self-Guided Mobile App Intervention for Depression and Anxiety in a College Counseling Center

Jack A. Haeger

Mental health issues are prevalent within college populations, in which anxiety and depression rank as the top diagnoses amongst undergraduate students across U.S. campuses. Recently, college counseling centers (CCCs) have experienced funding and staffing setbacks while caseloads and waitlists have continued to grow. As a result, there is a need for cost-effective and innovative solutions that avoid depleting already stressed CCC resources. Mobile Health (mHealth) applications are a promising technology for improving mental health services. These programs are readily available throughout the day, provide a convenient system to monitor and prompt skill use, and can tailor content based on clients' responses. In response, the authors of this study developed ACT Daily, a prototype mobile application based on Acceptance and Commitment Therapy (ACT), an evidence-based treatment for anxiety and depressive disorders. This study implemented a pre-post, open trial design to examine if ACT Daily, along with a compressed online ACT training, could serve as an effective, brief self-guided intervention for individuals suffering from anxiety/depression on a CCC waitlist.

Results indicated that ACT Daily was acceptable and sufficiently usable as a self-guided application, based on a sample of 11 depressed/anxious students on a CCC waiting list. Additionally, participants improved on most ACT-specific processes (e.g.,

overall psychological inflexibility, acceptance, defusion, and value-living) except for the process of present-moment awareness. Results also signaled that ACT Daily promoted ACT skill use. In-app data indicated that skills were effective in the moment and became more impactful over time. Furthermore, ACT Daily appeared to serve as a helpful pre-therapy tool based on improvements on emotional self-awareness (an essential skill used across interventions and theoretical orientations) and decreased depression and anxiety ratings. Finally, current findings supported the companion introduction website's ability to provide sufficient training on core ACT processes and ACT Daily app functionality.

Although the strength and generalizability of this study's findings are limited by a small sample size, the pattern of results indicate that ACT Daily and its companion website could serve as an effective, brief support for depressed/anxious students on CCC waitlists. By integrating EMA prompting and tailored skill coaching, it appears ACT Daily may have equipped users with the ability to acquire, strengthen, and generalize new ACT skills in a relatively short amount of time. Future studies will benefit from targeting a larger sample size, implementing a randomized controlled trial design, adding more objective behavioral and physiological measures, and integrating client feedback into future iterations of ACT Daily.

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Additionally, I appreciate my committee members, Dr. Michael Twohig and Dr. Scott DeBerard, for reviewing and providing invaluable feedback on this document. Finally, to my parents, Carol and Jack, thank you for your love and support over the years.

Regardless of the situation or distance between us, you have always been there for me. I will never forget all of those late-night hockey practices, tournament road trips to the middle of nowhere, and great moments we shared at 170 Rex.

Jack A. Haeger

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CHAPTER I

INTRODUCTION

Although college is often depicted in the media as a carefree time of exploration and learning, research has shown that roughly 50% of college students have a diagnosable psychological disorder in a given year (Blanco et al., 2008). A more recent survey of 79,266 students found that 32% reported feeling so depressed that it was difficult to function, more than half endorsed having overwhelming anxiety, and about 86% felt overwhelmed by their workload (American College Health Association [ACHA], 2014). These high rates of overall distress make sense when accounting for challenges often faced in college (e.g., increased independence from parents/caretakers, heightened academic demands, financial concerns tied to college loans, school/work balance, and unfamiliar social groups). When left untreated, mental health issues in a university setting commonly lead to academic performance issues, along with a decrease in retention and graduation rates (Kitzrow, 2003).

Unfortunately, female students often face more severe challenges during their college education due to the pervasive nature of sexual assault on campus; 23% of female undergraduates are sexually assaulted per year, and are three times more likely to be sexually assaulted compared to other women (Sinozich & Langton, 2014). Resulting trauma can often lead to more severe mental health issues such as post-traumatic stress disorder (PTSD), major depressive disorder, or anxiety-related disorders when professional support is unavailable (American Psychiatric Association, [APA], 2013). Further adding to the complexity and significance of college mental health issues,

roughly 20% of students endorse engaging in intentional self-injury (ACHA, 2014), and suicide is consistently ranked as the second leading cause of death for college-aged individuals (Suicide Prevention Resource Center, 2014). Given these findings, it appears that an increasing level of accountability has been placed on college counseling centers (CCCs) to address the substantial mental health needs of students.

Despite escalating accountability, demand for services, and rates of severe psychological problems (Beamish, 2005; Gallagher, 2014), 69% of CCC directors reported that their resources have failed to expand appropriately (Gallagher, 2014). Nowhere is this more apparent than in the ratio of counselors to clients, with an average of 1 counselor to every 2,081 students—a discrepancy that has widened in recent years by almost 500 students (Gallagher, 2013, 2014). As a result, directors have highlighted issues such as overflowing paperwork, escalating counselor workload, counselor burnout, and swelling waitlists (Gallagher, 2014). Long waitlists are particularly problematic due to their adverse impact on client attrition, often resulting in decreased client follow-through on recommended counseling (Levy, Thompson-Leonardelli, Smith, & Coleman, 2005). These difficulties have been echoed throughout the field (Cooper, 2005; Kay & Schwartz, 2010), indicating this is a growing, pervasive issue requiring cost-effective and innovative solutions.

As advances in mobile technology and smartphone ownership continue to rise (ComScore, 2014), mobile health (mHealth) apps present a promising alternative support for overburdened CCCs by employing simple, low-cost mHealth interventions to fill gaps in treatment. The current study examined the potential feasibility and impact of providing

an acceptance-based mHealth app, ACT Daily, as a support for waitlisted depressed/anxious clients at a local CCC. Such an application has the potential to distribute support and initial training on general skills common across therapies, provide tailored mental health support in the moment, familiarize clients with the act of tracking emotional experiences, and lower psychological symptoms. Importantly, these potential improvements do not require any form of commitment (e.g., financial, time, or effort) from CCC counselors or staff.

CHAPTER II

REVIEW OF THE LITERATURE

Mobile Technology

Mobile technology has grown exponentially over recent years, with global mobile phone penetration reaching 91% in 2012 (Source Digit, 2012), smartphone penetration in the US reaching 72% in 2014, and estimates of continued growth in the coming years (ComScore, 2014). Thus, mobile health (mHealth) applications focused on the prevention and treatment of mental health issues have the potential to be easily disseminated to massive amounts of users worldwide. Furthermore, a recent survey of US citizens reported that 79% of users keep their smartphones with them for 22 hours per day and 89% of college-aged users (18-24 years old) pick up their phone to use it within 15 minutes of waking (International Data Corporation [IDC], 2013). Essentially, it appears that smartphones are not only increasingly prevalent, but have become ingrained in our daily lives. Thus, smartphone technology provides a unique vehicle for delivering therapy that is typically reserved for a single, hour-long session each week. Additionally, recent surveys have reported that 76% of the general public would consider using a mHealth application for mental health monitoring and self-management (Proudfoot et al., 2010) and roughly 90% of therapists are interested in using computerized interventions (Whitfield & Williams, 2004). Thus, mHealth psychological interventions may be acceptable amongst potential clients and practitioners. While smartphone applications (“apps”) as we know them today have grown at an exponential rate since their formal

introduction in 2008, a recent review of the Apple app store reported that of the store's roughly 1,300,000 available applications (Statista, 2014), only around 6% of those apps targeted mental health issues specifically (Proudfoot et al., 2010). Thus, while the psychotherapeutic mHealth market is growing, it is still in its infancy.

Benefits of psychotherapeutic mHealth apps include improved participant engagement, adherence to treatment, intervention accessibility, mobility and adaptability of use, and customized feedback and support (Bennett-Levy et al., 2010; Carter, Burley, Nykjaer, & Cade, 2013; Harrison et al., 2011; Warmerdam et al., 2012; Whittaker et al., 2012). A recent systematic review found that mHealth apps are effective in significantly reducing depression, stress, and substance use while increasing intervention accessibility (Donker et al., 2013). Another advantage of mHealth apps is their ability to provide real-time monitoring and tracking with ecological momentary assessments (EMA), a system that prompts users and acquires persistent, immediate reports of users' mood and behavior throughout the day. Numerous studies have highlighted the importance of self-monitoring and its ability to improve mood and behavior, as well as adherence to treatment (Bennett-Levy et al., 2010; Thiele, Laireiter, & Baumann, 2002). For years, paper diaries were the leading form of self-monitoring. Unsurprisingly, many users reported that these diaries were cumbersome, which has resulted in compliance levels as low as 11% (Stone, Shiffman, & Schwartz, 2002). Conversely, compliance to a computer-based diary in the same study was 94% (Stone et al., 2002). That said, computer-based diary self-reports still rely on users being at their computers at scheduled times throughout the day, which can be a major drawback and result in noncompliance

after a short period of monitoring (Stone et al., 2002). Mobile phone EMA apps can address this issue, along with retrospective recall problems prevalent amongst self-report measures. This is achieved by augmenting the convenience and routine utilization of mobile devices, and prompting the user throughout the day to collect data in the moment, thereby increasing ecological validity (Heron & Smyth, 2010). Research has suggested that this approach decreases user burden while also providing more accurate reports of transitory states than assessments distributed rigidly throughout the day (Proudfoot et al., 2010; Smyth & Stone, 2003). Additionally, recent studies have found that the act of self-monitoring through an EMA smartphone application itself resulted in improved emotional self-awareness (ESA) and reduced depressive symptoms (Kauer et al., 2012; Reid et al., 2011).

Despite these positive findings and potential benefits, many of the available psychotherapeutic mHealth apps on the market suffer from a shortage of scientific evidence and most are not rooted in evidenced-based treatment or theory (Donker et al., 2013). Furthermore, the majority of the applications that are evidence-based appear to be disorder-specific as opposed to transdiagnostic, an approach that could yield a better fit for the heterogeneous, comorbid presentations typical in clinical practice (Rush et al., 2005). Two of the most highly comorbid disorders are also the most prevalent diagnoses in college students; depressive and anxiety disorders (ACHA, 2014; Center for Collegiate Mental Health [CCMH], 2015; Kessler, Chiu, Demler, Merikangas, & Walters, 2005). Because of their high rate of comorbidity and overlapping therapeutic techniques used to treat these disorders (Harvey, 2004; Hayes, Villatte, Levin, & Hildebrandt, 2011), it

appears that anxiety and depressive disorders potentially share common pathological processes and might benefit from targeting a core collection of transdiagnostic mechanisms of change.

Psychological Inflexibility is a Central Target

One such transdiagnostic pathological process that applies across anxiety, depression, and a variety of other disorders is psychological inflexibility (PI). PI is the phenomenon wherein inner experiences (i.e., thoughts, feelings, urges, sensations) take excessive priority over chosen values and direct contingencies in guiding behavior (Bond et al., 2011; Hayes, Strosahl, & Wilson, 2011). This process occurs when individuals “fuse with evaluative and self-descriptive thoughts and attempt to avoid experiencing unwanted internal events, which has the ‘ironic’ effect of enhancing people’s distress, reducing their contact with the present moment, and decreasing their likelihood of taking values-based actions” (Bond et al., 2011, p. 7).

Numerous studies have discovered that PI is a strong predictor of depressive and anxiety disorder symptomatology (Bond et al., 2011; Hayes, Luoma, Bond, Masuda, & Lillis, 2006; Ruiz, 2010), even after accounting for other known predictors including emotion dysregulation (e.g., Kashdan, Barrios, Forsyth, & Steger, 2006) and anxiety sensitivity (e.g., Kämpfe et al., 2012). High levels of PI have also been linked to decreased overall well-being (Kashdan & Rottenberg, 2010) and increased dropout rates (Rüsch et al., 2008), an issue that is all too familiar within CCCs.

Acceptance and Commitment Therapy

Acceptance and Commitment Therapy (ACT; Hayes et al., 2011) is an evidence-based treatment (EBT) for anxiety and depressive disorders that explicitly targets PI by fostering its psychologically-healthy opposite, psychological flexibility (PF). PF is 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). ACT increases PF (and decreases PI) through six core components that rely on acceptance, mindfulness, and values-based skills training (Hayes et al., 2006; Ruiz, 2010). Recent meta-analyses have reported that ACT is as effective (Powers, Zum Vorde Sive Vording, & Emmelkamp, 2009) or potentially even more effective (Ruiz, 2012) than other EBTs for anxious and depressive disorders.

Altogether, it appears that integrating the effective, transdiagnostic approach of ACT with the abundant positive features of mHealth apps and EMA monitoring could result in a uniquely impactful treatment. Such an intervention may be especially useful when targeting highly comorbid disorders (i.e., depression and anxiety) prevalent amongst college students, most of whom already rely heavily on mobile technology in their daily lives. However, as of this writing, no ACT apps have been tested with clinical populations besides an application designed to address smoking cessation (Bricker et al., 2014).

ACT Daily Mobile Phone Application

This study aimed to pilot test an initial prototype of the ACT Daily mobile app

with depressed and/or anxious individuals currently on the waitlist of a local CCC at Utah State University (Counseling and Psychological Services [CAPS]). The app was designed to reduce PI by implementing a high frequency / low intensity tailored ACT skill coaching program that can be conveniently carried with the user on a smartphone. Previous studies have noted that such an app design could improve the client's acquisition, strengthening, and generalization of therapeutic skills, in addition to increasing the efficiency, accessibility, and effectiveness of treatment (Donker et al., 2013; Heron & Smyth, 2010).

ACT typically focuses on six core components of inflexibility/flexibility including: (1) experiential avoidance/acceptance, (2) fusion/defusion, (3) attentional rigidity to the past and future/present moment awareness, (4) conceptualized-self/noticing-self, (5) unclear, compliant, or avoidant motives/values connection, and (6) inaction, impulsivity, or avoidant persistence/committed action (Hayes, Pistorello, & Levin, 2012). This study sought to adapt a mobile app designed to target four of these components (components 1, 2, 3, and 5) due to the integral role they play within depression and anxiety (Addis & Jacobson, 1996; Hayes et al., 2012; Kashdan et al., 2006; Kashdan & Rottenberg, 2010). The PF and PI definition of each component targeted within the app is presented within Table 1. In combination, these components help to foster overall flexibility and provide a path towards living a more vital, meaningful life.

ACT Daily was originally designed as an adjunctive tool for clients actively participating in face-to-face ACT therapy. Thus, the mobile app provides minimal initial

Table 1

ACT Processes Included in ACT Daily

Component #	Inflexible	Flexible
1	Experiential avoidance: Efforts to alter the frequency or form of unwanted private events, including thoughts, memories, emotions, and bodily sensations, even when doing so causes personal harm.	Acceptance: The active and aware embrace of private experiences without unnecessary attempts to change their frequency or form.
2	Fusion: Excessive literal relationship with human thought resulting in behavior that is narrow, rigid, and less guided by experience. In other words, when behavior is overly regulated and influenced by cognition.	Defusion: Altering the undesirable functions of cognitions related to their literal context, rather than trying to alter their form, frequency, or situational sensitivity. Therefore, decreasing the believability of, or attachment to, cognitions rather than an immediate change in their frequency.
3	Attentional rigidity to the past and future: Focusing rigidly on the past and future instead of the present. This type of behavior is often observed within rumination about the past and worry about the future.	Present moment awareness: Non-judgmental contact with psychological and environmental events as they occur (i.e., focused, voluntary, and flexible contact with the present moment). Thus, allowing for one to experience the world more directly so that behavior is more flexible and actions are consistent with values.
5	Unclear, compliant, or avoidant motives: When behavior change is motivated primarily by guilt, compliance, fear, or other unclear motives, achievement of said goals is much less likely (Elliot & Sheldon, 1997; Sheldon & Elliot, 1999; Sheldon, Kasser, Smith, & Share, 2002).	Values connection: Linking behavior to values: chosen, verbally constructed, consequences of patterns of activity, for which the predominant reinforce becomes intrinsic to the behavioral pattern itself. Values are lived out, moment to moment.

Note. Component definitions from Hayes et al. (2006, 2012).

training on ACT skills, and rather assumes some prior acquisition of basic ACT concepts and strategies in ACT through therapy. This raises the question of whether the ACT Daily app could be used as a stand-alone intervention for those on a waitlist. Given that face-to-face therapy can vary significantly between clinicians, examining the ACT Daily app in a stand-alone format may also allow for a clearer understanding of the app's effectiveness and overall impact.

This study tested an adaptation of ACT Daily by implementing the application in

a purely self-guided format, in which clients instead relied on a website (i.e., the ACT Daily companion introduction website) to learn the core ACT concepts that are applied in the form of skills within the app. ACT Daily could be an especially useful tool for clients who are waiting for services, given that it aims to provide some initial support to these clients and a chance to start engaging in practicing psychological skills with brief, targeted opportunities designed not to be overwhelming. Moreover, ACT Daily may have a positive impact on client motivation, readiness for therapy, and willingness to engage in therapy without requiring additional funding, time, or effort from CAPS counselors and staff.

Research Hypotheses

Primary research question: Can ACT Daily, along with a compressed online ACT training serve as an effective, brief self-guided intervention for individuals suffering from anxiety/depression who are waiting for services at a CCC? More specifically, the study hypothesized that:

1. ACT Daily will be acceptable/usable as a self-guided application for depressed and anxious clients waiting for therapy at a college counseling center.
2. ACT Daily will significantly lower the core transdiagnostic process of psychological inflexibility in individuals suffering from depression/anxiety, in addition to improving specific ACT processes targeted within the app (e.g., acceptance, defusion, present moment awareness, and values-based living) from baseline to post.
3. ACT Daily will promote increased ACT skill use by providing effective coaching sessions in the moment.
4. ACT Daily will increase emotional self-awareness and reduce psychological symptoms while on the waitlist.

5. The added ACT Daily companion introduction website will equip users with a sufficient comprehension of core ACT components and knowledge of how to use the app.

CHAPTER III

METHODS

Participants

Eleven college students (9 women, 2 men, $M_{age} = 23.55$, $SD = 5.11$, age range: 20-38) from the USU CAPS waiting list contacted the research team to participate in the study. All eleven individuals met eligibility criteria, enrolled in the study, and completed all study procedures (i.e., no participant dropout was observed). The sample identified as being White (91%) with only one participant describing themselves as Hispanic/Latino ethnicity. Most participants were undergraduates (91%), with two students in their second year (18%), four in their third year (36%), four in their fourth year (36%), and one in graduate school (9%). There was a broad range in annual income amongst participants, ranging from less than \$20,000 to \$99,000 with most participants reporting a gross annual income lower than \$20,000 (54%). Four participants were seeking treatment for the first time, while the other seven had previous experience in therapy (four had seen a therapist within the last year, and three had seen a therapist 3.5 years ago or longer). None of the participants endorsed engaging in face-to-face therapy during the 2-week treatment period (i.e., while using the ACT Daily app and on the CCC waitlist).

Eligibility criteria included being 18 years of age or older, current enrollment at USU, placement on the CAPS waiting list with at least 2 weeks before their first scheduled face-to-face therapy appointment, possessing a presenting problem of depression and/or anxiety, fluency in English, and clinical stability (i.e., not currently

suicidal or experiencing manic or psychotic symptoms). For individuals to be deemed “not currently suicidal,” they must not have endorsed frequent suicidal thoughts or a suicide plan. Given that CAPS clinicians screened for suicidal ideation prior to waitlist placement and provided immediate intervention for those deemed “currently suicidal,” none of the participants provided with recruitment materials met criteria for current suicidality. The study did not actively screen participants for depression and anxiety, and instead relied on the CAPS clinician’s discretion to provide materials to individuals with these presenting problems. This methodology was followed to mimic real-world settings in which CCC clinicians rarely have enough time to make a formal diagnosis during their brief initial consultation meeting before placing clients on the waitlist. Furthermore, the study’s aim was to test a mobile app tailored to depression and anxiety for anyone who CCC clinicians believed fit the study’s requirements. That said, based on empirically derived cutoff scores from the Depression, Anxiety, and Stress Scale (DASS; Lovibond & Lovibond, 1995), 100% of participants fell within moderate or higher scores on either depression or anxiety (i.e., DASS-D > 13, DASS-A > 9), indicating that a clinical sample was targeted within this study.

Recruitment

Therapists and office workers at CAPS were oriented to the study by Mr. Haeger and were given flyers to provide to potentially eligible and interested clients during intake/consult sessions (see Appendix E for a copy of the flyer). Mr. Haeger reinforced that participation was completely voluntary (i.e., “it is imperative that clients not feel

coerced to participate”), and reviewed eligibility criteria with CAPS staff. Clients who were interested in participating contacted Mr. Haeger by phone/email to discuss the details of the study, assess eligibility, and schedule a timeslot for the in-person lab session. A second recruitment procedure was added in the spring 2016 semester to address issues with under-accrual and streamline the signup process for interested participants. Specifically, CAPS was provided with an iPad pre-loaded with the signup survey, “The ACT Daily Recruitment Survey” (see Appendix E). The brief Qualtrics-based survey allowed for interested waitlist clients to enter their name, phone number, and email address securely after completing their consultation session at CAPS. Once the client entered their contact information, Qualtrics automatically notified Mr. Haeger, who would follow up with these individuals via email or phone.

Study Procedures

The study utilized an open-trial pretest-posttest design, in which all participants completed an initial pretest (a set of baseline self-assessment questionnaires), followed by an experimental treatment condition (the ACT Daily application and web-based introduction), and a posttest (a set of post self-assessment questionnaires and a 30-minute phone interview). Participants were entered into a drawing for a \$100 Amazon gift card that was awarded at the end of the study.

Interested participants contacted Mr. Haeger via email, phone, or through the ACT Daily Recruitment Survey, at which point Mr. Haeger discussed the details of the study, screened for eligibility, and scheduled a 1.5 hour in-person meeting with the client.

This meeting took place in Dr. Levin's Contextual Behavioral Science (CBS) laboratory on the USU Logan campus. Those who screened as ineligible were offered the option to receive a packet of relevant materials for self-help over email. The in-person meeting began with informed consent (see Appendix C), at which point the participant was provided as much time as required to review the details of the study and ask any questions before consenting to participate. After providing informed consent, participants completed a series of baseline self-report questionnaires on the laboratory computer through the Qualtrics online survey platform, which assessed demographics, mood/anxiety symptoms, and processes associated with PI and ACT components (i.e., acceptance, defusion, present-moment awareness, and values-based living). After completing the baseline survey, participants engaged in the ACT Daily online introduction session on a CBS lab computer. After completing the 40-minute online training session, Mr. Haeger installed the ACT Daily mobile application on the participant's smartphone and addressed any technological issues at that time. Participants were asked to use the app for the following 2 weeks and contact Mr. Haeger about any technological issues. Mr. Haeger also conducted a brief check-in call after the user completed two days of initial app usage to assess any issues with ACT Daily. These phone calls typically lasted approximately 2 to 3 minutes, during which time Mr. Haeger confirmed that the mobile app was working properly (e.g., the app prompted three times per day and no glitches had occurred) and answered any remaining questions about the study. Participants who did not currently own a compatible Android smartphone at the time of the study were provided one by the CBS lab.

Two weeks after this initial in-person meeting, participants were emailed a link for the online post-assessment. The post-assessment included the same set of questions on the baseline survey with additional measures related to program satisfaction/usability. After completing the post-assessment, participants engaged in a brief 30-minute phone interview in which the participant was asked questions about their overall experience with the application, usability patterns, and improvement recommendations (e.g., exercises they did not use, technical issues, style recommendations, etc.). Participants were provided with continued access the application after the study concluded, but no further data collection occurred.

Program Specifications for ACT Daily

ACT Daily was created by Dr. Michael Levin and Mr. Haeger during the 2014-2015 academic year with an aim to construct an adjunctive mHealth app with prompting, EMA monitoring, and brief, tailored ACT skills coaching sessions. The application was designed to prompt the user randomly three times per day through push notifications to fill out a brief EMA self-monitoring assessment. This assessment screened for current anxiety and depression, along with current PI via the four ACT components targeted by the app (i.e., acceptance, defusion, present-moment awareness, and values-based living).

The EMA survey asked respondents to rate six items on a visual analogue scale from 0 to 100. Additional popup text could be selected for clarification of each item (presented in parentheses within the following text). Users were asked to rate “How much are you” on the following items:

1. “Feeling depressed” (popup text: “down, sad, hopeless, unhappy”)
2. “Feeling anxious” (popup text: “nervous, worried, frightened, jittery, afraid”)
3. “Fighting your feelings” (popup text: “trying to control or get rid of feelings, struggling with emotions, denying unwanted feelings, avoiding what brings up difficult emotions”)
4. “Stuck in thoughts” (popup text: “caught up in thoughts, believing or “buying into” thoughts, treating thoughts as completely true/accurate, pushed around by thoughts, struggling with thoughts”)
5. “On autopilot” (popup text: “doing things without awareness, inattention, missing the present, difficulty concentrating, distracted from what’s happening now”)
6. “Disconnected from values” (popup text: “lacking meaning, don’t know what’s important, not sure what to do, not doing what matters”).

In addition to being prompted randomly three times a day, the user had the option to “check-in” by clicking on the app from the home screen. This action automatically initiated the same self-monitoring sequence as the program-initiated monitoring feature (see Image A1 within Appendix A for a screenshot of the EMA assessment).

After completing the EMA pre-assessment (pre-EMA), ACT Daily analyzed the results and prompted the user to do one of three things: (1) engage in a recommended “quick skill,” (2) browse a list of available skills within the app, or (3) end the session. Selecting option three (“end session”) logged the user’s pre-EMA scores and closed ACT Daily, effectively ending the user’s session without requiring the user to complete a skill. This opt-out option was included to augment overall EMA responding by minimizing expected participation cost associated with answering prompts (e.g., a user could receive a prompt, answer the pre-EMA, and close the app quickly). Additionally, this option aimed to increase overall user engagement by enabling greater freedom and autonomy

during app use, while maintaining the “paradox of choice” by restricting choice to a small set of available user actions. The “paradox of choice” posits that presenting users with too many options can complicate user experience, create a “choice overload,” reduce satisfaction, leave users thinking about unselected choices, and result in avoidance or debilitation (Bowman, Jöckel, & Dogruel, 2015; Schwartz, 2004).

When users selected “quick skills,” they were immediately presented with a brief skill coaching session automatically chosen by the application based on the user’s pre-EMA responses. When the user clicked on “browse skills,” the app presented the user with a list of different skill menus, each one focusing on a core component of ACT measured by the pre-assessment (e.g., acceptance, defusion, present moment awareness, and values). The most relevant of these skill menus was highlighted based on the user’s pre-assessment results. The user could then select any skill from these menus, including brief “quick skills” or longer skills. All ACT Daily skills were designed to be short, lasting anywhere from under one minute to ten minutes in total engagement. “Quick skills” involved less than one minute of reading brief, text-based skill instructions. Longer skills accessible from the “browse skills” menu involved five-to-ten minutes of engagement in audio-guided meditation, interactive worksheets, and writing exercises (see Table 2 for a list of skills covered within the ACT Daily app).

After completing a skill, users were prompted to complete another EMA assessment (i.e., the post-EMA) including the same questions as the pre-EMA as well as an additional question inquiring about the helpfulness of the skill. All data collected within the app were sent directly to InterVision Media’s secure database and were not

Table 2

ACT Daily Skills List

Component	Skill title
Opening up to feelings (i.e., acceptance)	<ul style="list-style-type: none"> • Quick skills: acknowledge your emotion, self-compassion, dropping the rope, breathe into it, catching control. • How to sit with emotions (<i>audio guided & text-based</i>) • Approaching emotions (<i>interactive exercise</i>)
Getting unstuck from thoughts (i.e., defusion)	<ul style="list-style-type: none"> • Quick skills: has this worked for me? label your thoughts, say it out loud, the overeager assistant metaphor, objectifying your thoughts. • Leaves on a stream (<i>audio guided and text-based</i>) • Flexibility with a thought (<i>interactive exercise</i>)
Getting present (i.e., present moment awareness)	<ul style="list-style-type: none"> • Quick Skills: observing closely, notice 5 things, being curious, four deep breaths, returning your attention. • Breathing mindfulness (<i>audio guided and text-based</i>) • Mindfulness in activities (<i>interactive exercise</i>)
Connecting with your values	<ul style="list-style-type: none"> • Quick Skills: What's on your tombstone? finding values in actions, a few questions, one tiny step, savoring the moment. • Brainstorming valued activities (<i>interactive exercise</i>) • Goal setting (<i>interactive exercise</i>)

stored locally on the phone. Thus, if the user lost their phone or allowed someone else to use their phone, the alternate user would have no way to access ACT Daily data. See Appendix A for a flowchart of ACT Daily's design logic and screenshots of the mobile application.

Program Specifications for ACT Daily Companion

Introduction Website

A brief online introduction to ACT Daily was created with Qualtrics Survey Software, a secure web-based survey development program. The first portion of the

introduction session lasted approximately 30 minutes. This portion of the web-based training reviewed the four ACT components covered within ACT Daily in greater depth (i.e., acceptance, defusion, present moment awareness, and values-based living). The program made use of brief experiential exercises, metaphors, interactive assessments, didactic text-based content, and multimedia content to create an engaging learning experience designed to provide a basic conceptual and experiential understanding of ACT. ACT Daily was originally created as an adjunctive app to be used alongside face-to-face therapy. Within this context, it is assumed that most of the essential ACT metaphors and experiential exercises would typically be implemented by a trained therapist. This online skills training session aimed to address this gap by providing the user with a basic understanding of ACT and familiarizing the user with common metaphors and exercises within the ACT Daily mobile app. Users completed a brief multiple-choice quiz (i.e., the “ACT Daily Online Introduction Quiz”) before and after this first section of the introduction website to assess the user’s acquisition of core ACT components.

The second portion of the online training featured a brief video training on the ACT Daily app. The video provided an overview of ACT Daily’s features and exhibited how to use the mobile application over a period of seven minutes (training video link <https://www.youtube.com/watch?v=rWJjDi5xU5k>). This brief, online introduction aimed to sufficiently prepare participants to use ACT Daily on their own, with only minimal guidance from researchers whose primary role was to install the application and provide initial technical support. This training was provided in an online format to ensure that the

entire intervention (both the ACT Daily companion website and the ACT Daily mobile app) was implemented as a purely self-guided intervention. Thus, mimicking what could be expected during unsupported public use of the ACT Daily app (i.e., the entire training/intervention could be automated in future iterations without having to rely upon an ACT-trained researcher or provider to facilitate its use). Thereby, improving external validity, mundane realism, and treatment fidelity, while minimizing the potential impact of demand characteristics linked to the researcher. The online training session took place in Dr. Levin's CBS laboratory on the USU main campus in Logan, UT. It was necessary for participants to engage in the online training session within the CBS lab due to the prototype nature of the app. This allowed Mr. Haeger to assist in installing the app, address any technical issues, and set up Android loaner phones as needed. Screenshots of the web-based introduction and the introduction quiz can be found in Appendix B.

Measures

Online self-report outcome measures were provided at baseline and post (2 weeks later) time points, except when noted otherwise in the following section (e.g., demographics questions were assessed only at baseline). Full versions of the survey instruments utilized within this study are found in Appendix D.

Demographics

A series of items assessed key demographic features including age, gender, ethnicity/race, education level, marital status, socioeconomic status, and amount of potential therapist visits. These items were only assessed at baseline with the exception of

the number of therapist visits, which was also assessed at post to check if a face-to-face intervention had occurred during the course of the 2-week study. Simultaneous face-to-face intervention could risk confounding the results of the ACT Daily intervention.

Acceptance and Action Questionnaire-II

The 7-item Acceptance and Action Questionnaire-II (AAQ-II; Bond et al., 2011) was used as the primary self-report measure of PI. The AAQ has proven to be predictive of depressive/anxiety disorders and mediates treatment effects with ACT (Hayes et al., 2006; Hooper & Larsson, 2015). Participants rated each item on a 7-point scale ranging from 1 (*never true*) to 7 (*always true*), with a total score range of 7 to 49 (items are summed to create a final score). Higher scores indicate a higher level of PI. The AAQ-II has been found to have adequate reliability and validity in past research with a Cronbach's alpha of .84 and a test-retest reliability of .81 at 3-month follow-up (Bond et al., 2011). Past research has also indicated adequate discriminant and convergent validity with the AAQ-II on measures of psychological distress, functioning, and related variables (e.g., thought suppression; Bond et al., 2011). In this study, the Cronbach's alpha for the AAQ-II was acceptable ($\alpha = .79$).

ACT Skills Questionnaire

This ACT Skills Questionnaire (ASQ) was created specifically for ACT Daily, and assessed participant ACT skill usage. A series of 22 items were created to reflect skills taught in the mobile app. Participants indicated how often they practiced various skills over the past 2 weeks on a scale from 1 (never) to 6 (very often). The ASQ was

based on similar measures developed for other technology-based ACT interventions (Levin, Pistorello, Seeley, & Hayes, 2014) and was modified for this study. A preliminary exploratory factor analysis (EFA) was conducted utilizing principal component analysis. The analysis yielded one factor explaining 61% of the total variance for the entire set of variables. All items loaded onto this primary factor at or above .40. The internal consistency of the ASQ was good within the current study ($\alpha = .86$)

ACT Daily Online Introduction Quiz

Participants were asked to complete a brief 10-item multiple-choice quiz before and after engaging in the first portion of the online ACT training that covered the core ACT skill components used in ACT Daily (i.e., acceptance, defusion, present-moment awareness, and valued living). This quiz served as an assessment of the user's knowledge and understanding of core ACT skills based on the material presented within the ACT Daily companion introduction website. Participants also received feedback on their responses (whether each answer is right or wrong and why) after completing the post quiz to provide clarification to the user. The user's first response was recorded for each question on Qualtrics and, therefore, post scores did not risk inflation due to revisions made after receiving quiz feedback. Quiz format and development approach were based on those created for previous self-help ACT studies (e.g., Levin et al., 2014). See Appendix B for a full printout of the quiz.

Cognitive Fusion Questionnaire

The Cognitive Fusion Questionnaire (CFQ; Gillanders et al., 2014) is a 7-item

measure of cognitive fusion, an important subprocess that contributes to psychological flexibility/inflexibility. Items are rated on a 7-point scale ranging from 1 “never true” to 7 “always true.” Although the CFQ is relatively new, the preliminary validation study displayed good reliability, temporal stability, validity, and sensitivity to treatment effects within adult populations (Gillanders et al., 2014). Furthermore, the CFQ correlated as expected with anxiety and depression measures including the Beck Depression Inventory and the Hospital Anxiety & Depression Scale (Gillanders et al., 2014). The internal consistency of the CFQ was excellent within this study ($\alpha = .92$).

Depression, Anxiety and Stress Scale

The Depression, Anxiety and Stress Scale (DASS; Lovibond & Lovibond, 1995) is a 21-item scale composed of three distinct, 7-item subscales assessing depression, anxiety, and stress independently. Previous studies have found that these subscales do not load onto a single latent variable and thus cannot be calculated as an overall total score. Participants were asked how much each statement applied to them over the past week on a 4-point scale ranging from 0, “did not apply to me at all” to 3, “applied to me very much, or most of the time.” Each subscale was summed and multiplied by 3, resulting in a total score range for each subscale of 0 to 42. The DASS has been found to have good reliability in past research (Lovibond & Lovibond, 1995). Previous studies with college students indicated adequate internal consistency with Cronbach’s alphas of .87, .79, and .84 for the depression, anxiety and stress subscales respectively (Lovibond & Lovibond, 1995). Studies have also found that the DASS subscales accurately distinguish depressed and anxious clinical presentations (Lovibond & Lovibond, 1995). In the current study,

the internal consistency of the DASS was adequate: DASS-Depression $\alpha = .78$, DASS-Anxiety $\alpha = .78$, and DASS-Stress $\alpha = .80$.

Emotional Self-Awareness Scale

The Emotional Self-Awareness Scale (ESAS; Kauer et al., 2012) was developed as an overall measure of ESA covering the five areas of emotional self-awareness including recognition, communication, identification, contextualization, and decision-making. These five subscales are combined to make a comprehensive scale with high internal consistency (Cronbach's alpha = .83). In order to reduce assessment burden while targeting ESA, the present study utilized the recognition subscale, which consists of six questions and ranges from 0 to 20, with higher scores reflecting higher levels of emotional self-awareness. Items are rated on a 4-point scale ranging from 1 "never" to 4 "a lot." To obtain the recognition subscale score, all items are summed, divided by 6, and then multiplied by 5. The internal consistency of the ESAS was excellent in the current study ($\alpha = .91$)

Philadelphia Mindfulness Scale

The Philadelphia Mindfulness Scale (PHLMS; Cardaciotto, Herbert, Forman, Moitra, & Farrow, 2008) was used to assess two ACT components: present-moment awareness and acceptance of difficult thoughts and feelings. This 20-item measure has 2 subscales that assess these components (each subscale has 10 items). Items are rated on a 5-point scale ranging from 1 "never" to 5 "very often" according to the frequency each item was experienced over the past week. To obtain the acceptance

subscale score, all even items are reverse-scored and totaled; higher scores reflect higher levels of acceptance. To obtain the awareness subscale score, all odd items are scored and totaled; higher scores reflect higher levels of awareness. The PHLMS has been found to have respectable internal consistency for the awareness subscale with a Cronbach's alpha of .75, and good internal consistency for the awareness subscale ($\alpha = .82$). It is important to note that the PHLMS validation study failed to conduct concurrent validity and predictive validity analyses, thus limiting our ability to assess the quality of validity within the PHLMS (Qu, Dasborough, & Todorova, 2015). In a more recent review of mindfulness questionnaires, the PHLMS awareness subscale displayed a weak correlation ($r = 0.21$) with another well-validated mindfulness scale (the Mindfulness Attention Awareness Scale; MAAS) indicating that the PHLMS may suffer from insufficient validity to assess the component of present moment awareness (Park, Reilly-Spong, & Gross, 2013). Previous ACT intervention studies have found mixed results with the PHLMS awareness subscale (Brown et al., 2011; England et al., 2012; Levin, Haeger, Pierce, & Twohig, 2016; Ruiz, 2012). That said, the PHLMS acceptance scale correlated with the AAQ-II (r 's range from 0.31 to 0.54) in addition to the Beck Depression Inventory (r 's range from -0.28 to -0.51) and the Beck Anxiety Inventory (r 's range from -0.29 to -0.39) in a recent study (Gootzeit, 2014). Thus, supporting concurrent and predictive validity for the PHLMS acceptance subscale. In the current study, the PHLMS displayed good internal consistency: PHLMS-Awareness $\alpha = .88$ and PHLMS-Acceptance $\alpha = .94$.

Valuing Questionnaire

The Valuing Questionnaire (VQ; Smout, Davies, Burns, & Christie, 2014) is a 10-item measure of valued living, another important ACT therapeutic process and skill. Each item is rated on a 7-point scale from 0 (not at all true) to 6 (completely true). The VQ is made up of two subscales assessing progress on valued living and obstruction to valued living. The VQ is a new measure, and has initial research indicating its validity and reliability (Smout et al., 2014). A recent study indicated that web-based ACT within a college population produced a significant impact on the VQ-obstruction subscale, but a lack of an effect on the VQ progress subscale (Levin et al., 2016). The VQ displayed good internal consistency within the current study: VQ-Obstruction $\alpha = .81$ and VQ-Progress $\alpha = .83$.

System Usability Scale

The System Usability Scale (SUS; Bangor, Kortum, & Miller, 2008) was provided as a measure of program acceptability/usability during the post-assessment. The SUS is a widely used 10-item scale, in which each item is rated on a 5-point scale ranging from 1 (strongly disagree) to 5 (strongly agree), with a total score range of 20 to 100 (scores are totaled and multiplied by 2.5 to obtain the overall value of SUS). Over 206 studies have displayed findings that the SUS has good internal consistency (Cronbach's $\alpha = .91$) and can effectively discern the level of usability across programs (Bangor et al., 2008). Empirically derived cutoff scores have been established for the SUS to identify below and above average program usability ratings (Sauro, 2011). The current study displayed good internal consistency ($\alpha = .84$)

Program Satisfaction Questionnaire

The 9-item Program Satisfaction Questionnaire (PSQ) was used to assess overall participant satisfaction with the ACT Daily app at post. The PSQ includes a combination of short response and Likert-scale rating questions (e.g., “Overall, I was satisfied with the quality of the program”; “The app was helpful to me”). The PSQ has been used in prior research on internet-based treatments (Levin et al., 2014), and was modified slightly for the current study. In the current study, the PSQ displayed excellent internal consistency ($\alpha = .95$)

ACT Daily App Data

The application collected EMA data from self-monitoring assessments randomly scheduled throughout the day throughout the course of the 2-week intervention period. This data included self-rated current levels of depression/anxiety, and deficiencies in ACT skill components including acceptance, defusion, mindfulness, and values (i.e., “feeling depressed,” “feeling anxious,” “fighting feelings,” “stuck in thoughts,” “on autopilot,” and “disconnected from values”). The data was collected before and after each skill coaching session (e.g., “pretest” and “posttest”), with an additional item on the posttest asking the participant how helpful the coaching session was. The 6-item measure (7 items on the post-assessment) is rated on a 100-point scale ranging from 0 (*not at all*) to 100 (*extremely*). Higher scores indicate an increased level of depression/anxiety and PI. The application also automatically tracked program usage. A screenshot of the EMA-style assessment can be found within Appendix A (see Image A1).

Data Analysis

ACT Daily program acceptability/usability was assessed by utilizing the following benchmarks: (a) a high level of program usage (e.g., an average of at least 14 skill coaching sessions used over the course of the study), (b) a high degree of system usability (e.g., mean SUS score of 80 or higher), and (c) high program satisfaction (e.g., average rankings of 4 or higher on PSQ items). ACT knowledge and overall effectiveness of the ACT Daily companion website introduction were assessed by achieving a mean score of at least 80% on the post online introduction quiz.

Paired samples *t*-tests compared baseline to post scores (two weeks later) on all self-report measures, examining potential improvements on specific ACT processes (present moment awareness, acceptance, defusion, and values-based living), emotional self-awareness, and ACT skill usage, as well as decreases in overall PI and psychological symptoms (e.g., depression, anxiety, & stress). Effect sizes on pre-post outcome measures were calculated with Hedges' *g*, a variation of Cohen's *d*, that accounts for a positive bias due to small sample sizes (Hedges & Olkin, 1985). Hedges' *g* can be interpreted with Cohen's guidelines of a small (0.2), medium (.5), and large (0.8) effect sizes (Cohen, 1988).

Pretest-posttest EMA data from ACT Daily were analyzed using a latent change score approach (McArdle, 2009). Latent change scores distinguish systematic change from unsystematic change and thus provide more accurate estimates of the "true" intervention effects, as compared with raw difference scores. Latent change scores also provide a flexible modeling framework that allow for the inclusion of covariates and

complex error structures, as described below.

Separate latent change score models were run for each of the six EMA outcomes measured before and after the skill coaching session. Models were estimated with a hierarchical error structure (Raudenbush & Bryk, 2001) to account for the nesting of observations within participants and correlated error terms due to repeated observations. Within each model, the expected value of the latent change across EMA responses and across participants was first estimated without covariates. As illustrated in Figure 1, this model constrained the association between the pretest and posttest scores to 1, and fixed the mean and variance of the posttest variable to 0, such that any variance in the posttest that was not explained by the pretest would be accounted for by the latent change score (Change) or residual change (U) for a given participant. This model also controlled for the relation between the pretest and latent change score to account for autoregressive

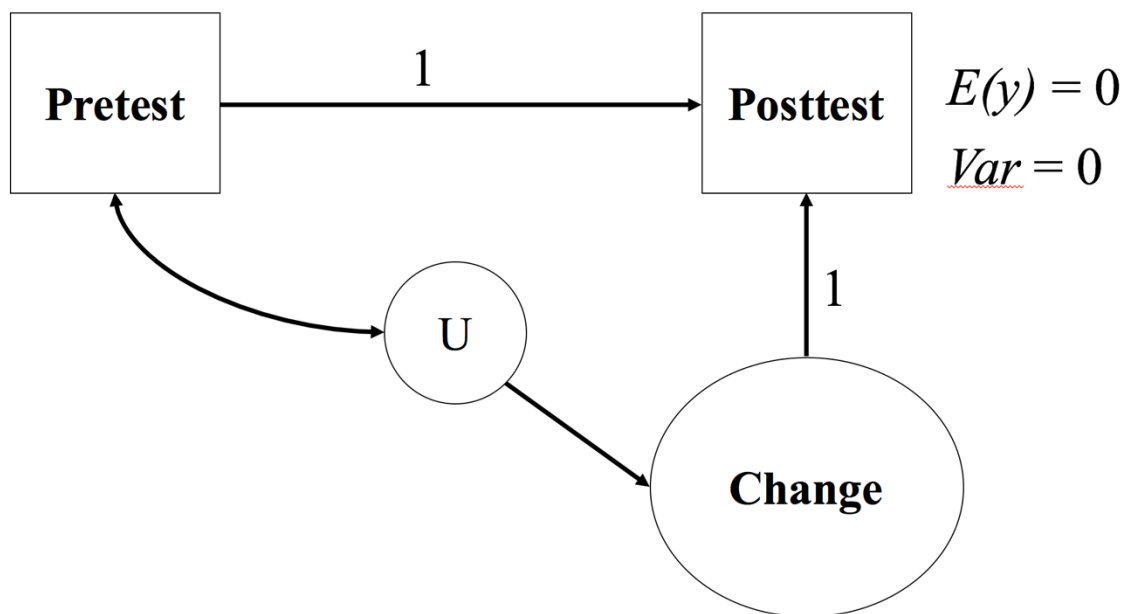


Figure 1. Model 1: Latent change score model (number participants/clusters = 11, number of observations = 275)

effects within each ACT Daily session. Pretest scores are related to the extent to which people can change due to the intervention (e.g., a participant who rated themselves high on the “on autopilot” item of the ACT Daily pre-EMA will have greater room to change as compared to a participant who rated the same item as moderate-to-low on their pre-EMA).

Day of participation was then added to each of the models as a covariate of the latent change scores, as illustrated in Figure 2. The coefficient of day predicting latent change scores (*bchange*) was modeled as a random slope (i.e., slopes were allowed to vary between participants; Figure 3). A statistically significant slope of *bchange* would indicate that the effects of the ACT Daily app skills changed linearly from day 1 to day 14 of the study. It was predicted that this slope would be negative, indicating larger negative (reduction) effects of the skills over time. *bchange* may also indicate the effects of practicing ACT Daily skills, although participants may not have equally practiced skills over time.

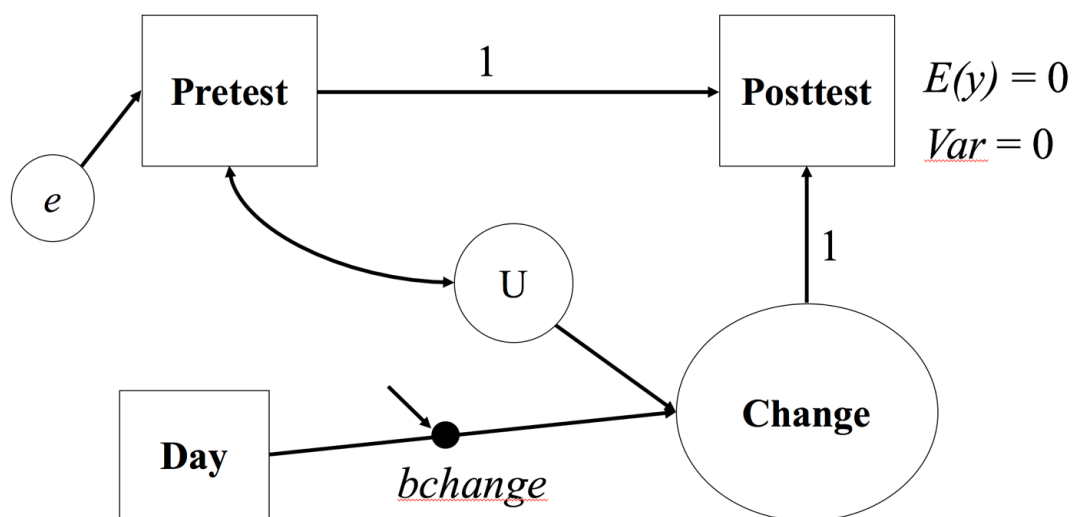


Figure 2. Model 2: Random slopes.

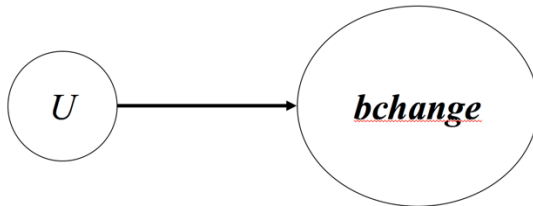


Figure 3. Random slopes variation between participants.

Participant comments from the 30-minute post phone interview were aggregated and reviewed. This aided in identifying areas of the program that require revision in addition to assessing overall satisfaction, acceptability, and engagement with the program. Potential revisions may include clarifying instructions, removing exercises that are not particularly engaging, revising the look and feel of specific screens, technological issues, and adding content to further explain/reinforce various ACT skills. This analysis allows for a continued user-centered design, and informs future iterations of ACT Daily.

CHAPTER IV

RESULTS

Introduction

Survey data were collected during the 2015-2016 academic year and were analyzed using the Statistical Package for Social Sciences version 23 (SPSS 23.0) for all descriptive statistical analyses and paired samples t-tests. No missing data were observed for baseline and post self-report outcome measures. All variables were checked for normality (i.e., skewness & kurtosis), and were normally distributed.

Mplus statistical software (version 7.0) was utilized to analyze EMA data from the ACT Daily app by implementing hierarchical linear modeling (HLM) within the latent change and random slopes models. All EMA data presented below were collected from sessions in which users engaged in a skill (i.e., pre-post EMAs completed before and after skill use). Data from in-app EMAs yielded 275 pre-EMA observations, 157 of which had post-EMA observations. Because 118 observations had missing data on the post-EMA (i.e., participants only completed the pre-EMA and failed to complete post-EMA), maximum likelihood was used to estimate the covariance structure for the full dataset (275). These estimates were based on both, cases with completed pre- and post-EMA (157 observations), and cases with only pre-test information (118 observations), combining for a total of 275 observations used to estimate the covariance structure.

Missing data were handled by implementing maximum likelihood estimation (ML) within Mplus. ML utilizes available data from complete and incomplete cases to

estimate parameters for incomplete variables (Enders, 2013). ML initiates this analysis with an iterative process to estimate the most likely parameters for each incomplete variable, by referencing the multivariate distribution of observed (non-missing) data. Then, these parameters are used to estimate the covariance matrix for a hypothetical complete dataset. Theoretically, missing data produces distorted parameter estimates. If a certain subset of scores are left out of the sample (e.g., cases with extreme scores), then parameter estimates are significantly biased. Thus, ML attempts to create hypothetical samples based on observed data where different values are missing at the same rates as they are observed to be missing in the actual dataset. Therefore, by aggregating parameters from the hypothetical samples, ML arrives at more unbiased and stable estimates of the relations between variables. Simulation studies have concluded that the accuracy of ML is higher than multiple imputation when a normal distribution is assumed, and equal to multiple imputation when a linear mixed model is assumed (Black, Harel, & McCoach, 2011).

ACT Daily Program Usage and Satisfaction

On average, participants utilized the ACT Daily coaching skills for an adequate amount of time (i.e., at least once per day), resulting in an average of 14.3 times over the course of the 2-week treatment window,). Only two participants used less than one skill per day; both of whom were not Android phone owners. As such, these individuals were provided with CBS lab-owned Android phones so that they could access the Android-only ACT Daily app over the course of the study. Both participants noted that they would

have used the app more often if it was available on their personal smartphone (i.e., an iPhone), and attributed their lower rates of engagement to forgetting the extra phone at home during everyday activities, not hearing or recognizing notification sounds, and lacking overall experience with the Android operating system.

System usability ratings fell within the “excellent” range ($M = 90$, $SD = .0.66$). Additionally, individual program satisfaction ratings on the PSQ displayed positive responses to the app’s ease of use, overall satisfaction ratings, practice of previously learned skills, and recommendation of the app to others (see Table 3 for individual items and average ratings).

The ACT Daily online companion website also appeared to provide sufficient training on core ACT components based off of high average scores on the ACT Daily online introduction quiz at post ($M = 87\%$, $SD = 7\%$). Furthermore, results indicated

Table 3

Program Satisfaction Questionnaire Satisfaction Ratings

Item	<i>M</i>	<i>SD</i>	≥ 4 “slightly agree” (%)
Overall, I was satisfied with the quality of the app	5.36	.51	100
The app was helpful to me	4.82	.75	100
The app was easy to use	5.91	.30	100
I felt the app was made for someone like me	4.82	1.25	73
I would like to use the app again in the future	4.64	1.50	82
I think the app would be helpful for other clients in therapy	5.36	.81	82
I would recommend the app to a friend who was struggling	4.91	1.30	73
The app helped me to work on things that I learned in the web-based ACT training	5.36	.81	100
I would recommend my therapist use this app with other clients like me	5.09	1.04	91

significant improvement on the condensed training quiz from pre ($M = 78\%$, $SD = 13\%$) to post ($M = 87\%$, $SD = 7\%$), $t(11) = -2.283$, $p = .046$.

Pre to Post Outcome Measure Changes

Paired samples t tests were conducted to explore changes from baseline to post on a variety of measures assessing psychological symptoms (i.e., depression, anxiety, and stress), PI, ACT processes targeted within the app (i.e., defusion, obstruction to valued living, progress on valued living, acceptance, and awareness), ACT skill usage, and emotional self-awareness. Overall, the paired samples t tests indicated significant improvements across all measures (see Table 4) with medium-to-large effect sizes

Table 4

Descriptive Statistics and Paired Sample t-Test Results from Baseline to Post (2 weeks later) on Self-Report Outcome Measures

Measure	Pretest		Posttest		t	Hedges' g	RCI (%)
	M	SD	M	SD			
DASS-Depression	20.55	8.72	11.27	7.81	2.40**	1.08	55
DASS-Anxiety	14.18	9.05	8.73	4.76	2.23*	0.73	27
DASS-Stress	22.36	9.20	15.09	8.01	2.28**	0.81	55
AAQ-II	30.81	6.14	26.82	5.86	2.51**	0.64	36
VQ - Obstruction	25.00	5.08	17.73	5.42	3.64**	1.33	82
VQ - Progress	18.09	5.43	22.36	4.29	2.24**	0.84	64
CFQ	35.82	7.21	26.91	5.41	5.48**	1.34	82
PHLMS - Awareness	35.27	7.56	34.27	3.66	.50	0.17	27
PHLMS - Acceptance	23.45	9.23	29.73	6.16	2.41**	0.77	45
ASQ	64.00	13.97	99.54	10.86	5.93**	2.73	91
ESAS	13.63	5.48	17.00	2.76	2.96**	0.75	36

Note. DASS = Depression, Anxiety and Stress Scale, AAQ-II = Acceptance and Action Questionnaire – II, CFQ = Cognitive Fusion Questionnaire, VQ = Valuing Questionnaire, PHLMS = Philadelphia Mindfulness Scale. RCI = Reliable change index, reported in terms of the percent of the sample demonstrating reliable improvements (t score > 1.96) over the 2-week app testing period.

* $p < .05$ (2-tailed), ** $p < .01$ (2-tailed).

(Hedges' $g = .73 - 2.73$). The only measure that did not improve significantly from pre-to-post was the PHLMS-Awareness subscale, which assessed present moment awareness $t(10) = 0.50, p = 0.63$. Seven participants (64%) moved from the clinical to nonclinical range on depression and anxiety scores as measured by the DASS-A and DASS-D subscales. Furthermore, 100% of participants fell within the moderate range or lower for anxiety severity at post and 82% of participants fell within the moderate range or lower for depression severity. Reliable change indexes (RCIs) revealed that 27%-55% of participants demonstrated reliable improvements on symptom measures (i.e., DASS-D, DASS-A, & DASS-S), 27%-82% ($M = 55%$) on ACT process measures, 91% on ACT skill use (i.e., ASQ), and 36% on emotional self-awareness (i.e., ESAS).

Mobile App EMA Data

ACT Daily prompted users to rate their current level of distress (i.e., depression & anxiety), along with ACT skill deficiencies (i.e., fighting feelings, being stuck in thoughts, on autopilot, and disconnected from values) directly before and after each ACT Daily skill coaching session. Hierarchical linear modeling using latent change scores, with coaching data nested by participant, was used to examine changes in ACT Daily EMA scores from before and after each coaching session. The results of this model indicated statistically significant improvements across all outcome domains, as presented within Table 5.

In the second model of this analysis, a count variable (days elapsed in the study) was included as a covariate of the latent change scores. The slope of the regression of the latent change score on days elapsed was used to account for linear changes in

Table 5

Model 1: Latent Change Model Results

Variable	Pretest		Posttest		$E(\Delta Y)$	SE	p	Cohen's d
	M	SD	M	SD				
Anxiety	41.46	26.26	38.11	23.13	-6.432	1.140	<.001	0.34
Depression	34.07	23.60	33.23	21.96	-3.154	0.440	<.001	0.43
Fighting feelings	31.13	25.11	27.20	21.59	-5.548	1.531	<.001	0.22
Stuck in thoughts	32.97	25.37	29.55	22.11	-4.616	0.970	<.001	0.29
On autopilot	32.65	26.39	28.55	21.78	-6.085	2.037	.003	0.18
Disconnected from values	32.75	25.53	30.71	19.84	-4.24	0.892	<.001	0.29

$E(\Delta Y)$ = Latent change score estimate.

intervention effects over time. The random slope of the regression of change scores on days elapsed was modeled to account for individual differences in the intervention effects over time. This model displayed statistically significant outcomes across all outcomes, indicating that the effectiveness of the ACT coaching sessions grew over time (see Table 6). This pattern of results may support a “practice effect,” in which the user not only learns new skills but also strengthens their skills through repeated practice over time.

Qualitative Data

Data pulled from the online post survey provided an opportunity for users to report their experiences with the app in their own words. In response to the question, “what was the most important thing you learned from the ACT Daily app?” the most common themes amongst participants included: building mindfulness/present moment awareness (30%), defusion (30%), awareness of and the ability to acknowledge inner experiences (40%), overall psychological flexibility (20%), acceptance (10%), and

Table 6

Model 2: Random Slopes Model

Variable	Coefficient	SE	p	Cohen's d
Anxiety	-0.686	0.110	<.001	0.37
Depression	-0.270	0.088	.002	0.19
Fighting feelings	-0.550	0.176	.002	0.19
Stuck in thoughts	-0.478	0.069	<.001	0.42
On autopilot	-0.753	0.236	.001	0.19
Disconnected from values	-0.434	0.150	.004	0.18

connection with values (10%). One participant in particular provided a response

highlighting the broad range of possible learning points from using ACT Daily:

I didn't realize that I was even operating on autopilot, but it's really helpful to be aware. I think it also has been pretty helpful just to realize that my thoughts are just thoughts, and they don't have to dictate anything to me. Thinking about what my values are and how they inform my thoughts and actions was also really, really eye-opening.

In this example, themes of present moment awareness, defusion, and connection with values can be observed; a finding that signals the potential broad impact of this self-guided intervention in a relatively short period of time. Another positive piece of user feedback indicating psychological flexibility reads:

I love this app. I totally still use it. I have seen a huge improvement in my life. It's been a really shitty semester and it's ended really well. It's because I have been able to center myself more, take a step back, and really engage in my life. I've been doing what's important to me and that's what matters.

This particular quote signals a client who appears to connect with and make use of the four core ACT components presented within ACT daily (i.e., present moment awareness, defusion, acceptance, and valued living).

In terms of what participants reported liking most about the app on the post survey, the most common positive features included the variety of skills within the app (40%), the prompts and the act of checking-in (30%), specific exercises (30%), and the overall flexibility of the app (30%). Flexibility of the app referred to participants noting that the skills “were applicable to almost any emotion or situation,” having the option to “try out multiple techniques if one didn’t work,” and being able to choose from skills of different lengths. Within post interviews, all participants noted that the app was easy to use, provided a quick intervention that could be applied in the moment, and that the app could be implemented across different settings (i.e., clients learning acceptance and mindfulness skills in face-to-face therapy or as a standalone program). Furthermore, all participants noted that the app’s prompting feature “caught” them at a time when they were struggling (i.e., when they were stuck in their thoughts, fighting their feelings, on autopilot, or feeling disconnected from their values).

When asked how well they knew the skills covered within the app, 56% of the participants stated that they had previously heard about similar skills (e.g., mindfulness, or ACT-specific skills of acceptance and defusion), but had never practiced using them in the moment up until using ACT Daily over the course of this study. One participant remarked that they knew the skills and had heard about their benefits, “...but never actually committed to using them, [and] now I had to use them and they worked well.” Moreover, all of the participants reported that they felt the app helped them to use brief ACT skills in the moment. Responses supporting this finding included one participant who noted that the app “brought skills into regular life. It has you do it in the moment,

instead of thinking about ‘when I’m in this situation I’ll do X.’ It helps to generalize.” Another participant enjoyed “how instant it was. It wasn’t super in depth, but a simple reminder that I needed in the moment that seemed to help. [It was] pretty short term but had long term effects.” The majority of participants who used their personal devices reported enjoying having increased accessibility to these skills. One such example of this trend can be identified in the following quote, “having that information right there, based off of your emotion was really beneficial. Just because I had it on my phone – I found it easy to access, so I was more likely to engage.” Finally, several participants reported that they knew most of the skills contained within the app by the end of the 2-week treatment period and were using these skills more often without needing to rely on the app.

Overall, feedback was supportive across post interviews and participants noted seeing some improvement in their lives that they attributed to using the app. Additionally, all of the participants agreed that they would recommend the use of this app as a standalone program for individuals on a CCC waitlist and as an adjunctive program with face-to-face therapy. One participant reportedly left the CCC waitlist after using the app over the course of the study. This participant explained that their experience with the app was extremely beneficial, and that by the end of the two-week intervention, they felt they had learned the skills necessary to handle their anxiety / depression and were “doing a world better than 6 weeks ago” as a result.

Conversely, issues with the app were reported less frequently with only 30% of participants mentioning issues at post. The most common responses included having difficulties with prompting (20%), issues with the lab-owned Android phone (10%),

disliking the act of completing the EMA assessment twice (i.e., before and after using a skill; 10%), not enjoying the longer skills (10%), feeling that the techniques did not always match up with their emotion (10%), and desiring more skills (10%). Prompting issues were reported several times during post interviews, in which participants noted that the prompts to check in with the app would often occur at inopportune times (e.g., during class). In response, these participants recommended including an option to schedule prompts or to block out busy times of the day. Another common recommendation was to allow users to access the “browse skills menu” without requiring users to complete the pre-EMA check-in so that one could share exercises with friends or review exercises freely. The participant who noted the issue with the lab-owned Android phone explained that she had difficulty reminding herself to look at the phone, “I think it would have been a lot easier if it was on an iPhone so I wouldn’t have to remind myself that I had to do it if I didn’t hear [the notification].” No issues were reported in relation to the app’s suitability for individuals from a diverse range of cultures (race, ethnicity, sexual orientation, etc.).

CHAPTER V

DISCUSSION

Summary of Outcomes

This study aimed to explore the ability of a mobile application (ACT Daily) and a companion introduction website to provide a brief, effective, self-guided intervention for anxious and depressed clients on the waitlist at a CCC. Prior to this study, minimal research had been conducted on ACT-based mobile apps and no research had been implemented specifically focusing on mobile ACT interventions targeting depression / anxiety within a college sample.

Profound effects were observed across pre-post outcome measures, with all but one measure exhibiting medium-to-large effects (Hedges' $g = 0.64 - 2.73$). A recent systematic review of mHealth research (Donker et al., 2013) identified a wide range of effect sizes on outcome measures (Cohen's $d = 0.29 - 2.28$). However, when studies were limited to those assessing standalone mHealth apps without added support from mental health professionals (i.e., following an intervention methodology similar to the current study), effects dropped to small-to-medium (Cohen's $d = 0.29 - 0.59$). Interestingly, most mHealth interventions included in this review were 4 weeks or longer, roughly twice as long as ACT Daily. Only the longer, therapist-supported interventions displayed large effects (Cohen's $d = 1.56 - 2.28$), while shorter interventions provided smaller effect sizes across the board. Although the only published ACT mHealth research to date displayed small effects on smoking cessation outcomes (Bricker et al., 2014), another CBS lab trial

of ACT Daily exhibited similar medium-to-large effect sizes across outcome measures when applied as an adjunct to face-to-face therapy. Thus, ACT Daily's observed effects are impressive for such a brief self-guided mHealth app, but are not unprecedented for this technology.

Because of the study's small sample size and open-trial design, it is important to note that other, relevant sources may have contributed to these results (e.g., regression to the mean due to repeated observations, demand characteristics, previous exposure to ACT, and spontaneous remission). While this study did not control for all of these confounding variables, demand characteristics may have been partially mitigated by facilitating strict confidentiality policies and assuring participants that outcomes would not be shared with CCC clinicians. Although spontaneous remission cannot be accounted for in full, potential remission associated with the elimination of end-of-semester environmental stressors was unlikely (e.g. only one participant enrolled in the study before finals and completed their post assessment during break). In regards to previous exposure to ACT, roughly 56% of participants claimed to have previously heard about some of the skills covered within the app. However, most of these individuals explained they had only heard about "mindfulness" broadly and none claimed to have previous experience using these skills in the past; indicating that the sample wasn't positively biased with ACT experts.

While these concerns remain relevant and may limit the generalizability of these findings, it is important to note that this study displayed a clear pattern of results established from a series of large effect sizes and RCI rates on pre-post measures,

significant improvement across pre-post EMA scores calculated from a substantial set of observations, and generally positive qualitative outcomes. Taken together, these findings point to ACT Daily's potential usefulness, acceptability, and effectiveness within this population of anxious/depressed college students waiting for treatment. In conclusion, ACT Daily and its companion introduction website were successful in achieving this study's aims, which may indicate that future iterations of this app could be effective on a larger scale and may be worth examining in a more formal randomized control trial design. The following sections discuss specific findings in relation to each hypothesis, as well as limitations and future directions.

Hypothesis 1: ACT Daily Acceptability and Usability

The first hypothesis pertained to ACT Daily's acceptability and usability with clients on the CAPS waiting list. System usability ratings on the SUS fell within the "excellent" range and achieved a score that was notably higher than any of the USU CBS lab's past web-based trials (Levin, Haeger, et al., 2016; Levin, Pistorello, Hayes, Seeley, & Levin, 2015; Levin et al., 2014; Levin, Hayes, Pistorello, & Seeley, 2016). The app also scored highly on the PSQ, indicating elevated user satisfaction with the app. Open-ended post questionnaire responses and post phone interviews further supported this finding with most users commenting on how easy, well-designed, and satisfactory the app was to use. The app also received a unanimous recommendation across users for its use as an intervention for anxious/depressed clients, both as a standalone app for those on a CCC waitlist and as an adjunct to face-to-face therapy. Minimal usability issues were

reported, most of which emanated from the users who owned iPhones and had to rely on CBS Lab loaner phones running Android OS software. Often, these users reported forgetting to bring the second phone with them, which resulted in missed prompts. That said, participants used the app for an adequate amount of time on average (at least 1 skill used per day) and typically responded to at least 1 additional pre-assessment without completing a coaching skill per day. Altogether, findings from multiple measures and observations support that ACT Daily is acceptable and usable as a standalone program for depressed/anxious clients waiting for therapy.

Hypothesis 2: Psychological Inflexibility and ACT Processes

The second hypothesis of the study focused on ACT Daily's ability to ameliorate the core pathological process of psychological inflexibility in addition to impacting the four ACT processes targeted by the app (e.g., acceptance, defusion, present moment awareness, and valued-living). Paired samples *t* tests of baseline and post self-report measures largely supported this hypothesis, displaying significant pre-to-post changes with medium-to-large effect sizes on measures of psychological inflexibility (AAQ-II), acceptance (PHLMS-acceptance), defusion (CFQ), and valued living (VQ). The one exception was the measure of present-moment awareness (the PHLMS-awareness subscale), which moved in a positive direction, but remained insignificant. As was mentioned previously, the PHLMS validation study failed to conduct concurrent validity and predictive analysis, limiting assessment of its validity quality (Qu et al., 2015). Additionally, the awareness subscale of the PHLMS focuses on awareness of perceptions,

sensations, and feelings, and fails to assess the aspect of “acting with awareness” (Bergomi, Tschacher, & Kupper, 2013). Acting with awareness plays a significant part in ACT’s conceptualization of present moment awareness. Accordingly, ACT Daily promotes this process of acting with awareness through a number of skills (e.g., the “Mindfulness in activities” skill). Similar issues have been observed in recent ACT intervention studies that have relied on the PHLMS-awareness subscale as a measure for present moment awareness, often culminating in inconsistent results (Brown et al., 2011; England et al., 2012; Levin, Haeger, et al., 2016). Based on latent change scores from EMA app data, it appears that present moment awareness (as assessed by the item “on autopilot”) reflected significant improvement in the moment. Additionally, 30% of participants reported that the most important thing they learned from ACT Daily was building mindfulness/present moment awareness skills at post. Therefore, while it is possible that ACT Daily may not have impacted present moment awareness according to the PHLMS-awareness subscale, the lack of significant improvement may be related to a measurement issue.

Hypothesis 3: ACT Skill Use and Effectiveness in the Moment

The third hypothesis centered on ACT Daily’s ability to engender ACT skill use and provide effective coaching sessions (i.e., skills) in the moment. Latent change score analyses supported in-the-moment effectiveness of ACT Daily’s skill coaching sessions derived from significant improvements on depression, anxiety, and the four ACT components covered within the app from the pre-EMA to the post-skill-use-EMA (post-

EMA). That said, these improvements were relatively small, suffered from low effect sizes, and may have been subject to demand characteristics. Researchers have noted that it is reasonable to assume that individuals receiving EMA-based interventions may be motivated to “respond as they are ‘supposed to’ when asked about symptoms or behavior change” (Heron & Smyth, 2010, p. 28). However, the ACT Daily application provided users with flexible response options on EMA assessments, which may have reduced the overall impact of demand characteristics. Within the current study, users were presented with the option to quit out of the ACT Daily pre-EMA assessment without completing a skill, and if a user scored highly on the post-assessment, they were not prompted to engage in another skill coaching session. Thus, demand characteristics motivated by avoiding skill use may have been weakened given that providing lower scores on ACT Daily EMAs did not impact the amount of prompted skills. Users were also unable to observe their pre-EMA scores while filling out the post-EMA, which may have resulted in a more authentic response that was less likely to be influenced by awareness of pre-EMA scores (all of which were based on a 100-point scale). Finally, ACT Daily did not provide users with the option to view and track improvements over time, meaning that users were likely to be unaware of subtle changes in their ratings from day 1 to day 14 in the study. Taken together, demand characteristics may have been reduced in the current study, however due to the short timeframe between pre- and post-EMA, which included an active intervention (i.e., an ACT skill), it is important to acknowledge that demand characteristics remain a potentially strong contributor to the observed effects. Fortunately, responses on the post survey and post interview echo the effectiveness of

ACT Daily in the moment, indicating that most of the available data suggests ACT Daily provides an impactful intervention in the moment.

In relation to ACT Daily skill use, the ASQ indicated significantly increased ACT skill use at post. While the ASQ is an unvalidated measure developed specifically for this study based on previous questionnaires created for technology-based ACT interventions (Levin et al., 2014), it appears that this measure has a one factor solution and adequate internal consistency. Furthermore, usage data from ACT Daily indicated that participants engaged in at least one skill per day throughout the study (an average of 14 skills used on the ACT Daily app over the course of 2 weeks). Additionally, post interview responses indicated that the app prompted more frequent skill use across participants. These individuals included those who were familiar with some ACT skills covered within the app, but who had never fully committed to using them in real-life. This last finding may signal an especially important role for ACT Daily; the app does not rely solely on teaching or familiarizing users with skills that can easily be forgotten in the moment, but instead presents tailored skills that can be implemented in the moment. This approach allows for the user to learn about the specific skill directly through experience while applying the skill within a real-world context.

Further analysis of EMA responses supported the app's ability to not only teach and generalize skills, but also strengthen these skills over time. Within the random slopes model, the effects of the ACT Daily app increased linearly from day 1 to day 14, indicating that users may have experienced practice effects (i.e., the more clients used these skills, the better they became at implementing them). That said, it is important to

note that this analysis did not account for the specific skills users practiced throughout the study, meaning that participants may not have practiced skills equally and engaged in all four of the ACT components provided throughout the study (e.g., a participant may have practiced defusion skills more than values skills). Post interview responses reinforced practice effect findings; users noted that they became more familiar with ACT skills over time and began using them on their own without having to rely on the app. Altogether, results indicated that ACT Daily increased ACT skill use and provided effective skills in the moment, providing users with the technology to acquire, strengthen, and generalize ACT skills to real-life situations.

Hypothesis 4: Emotional Self-Awareness and Symptom Reduction

The fourth hypothesis of this study concerned ACT Daily's ability to impact both emotional self-awareness and psychological symptoms. Emotional self-awareness is a useful psychological process often lacking with individuals seeking psychological services, and it plays a significant role across a variety of therapies (Kauer et al., 2012). According to paired samples *t* tests, participant scores on emotional self-awareness (assessed by the ESAS) increased significantly. Furthermore, significant improvement was observed on depressive, anxious, and stress-related symptoms at post, and the majority of participants (64%) dropped from clinical to non-clinical levels on anxiety and depression ratings at post. This may indicate that ACT Daily could serve as a sufficient stand-alone intervention for some individuals by producing significant symptom improvement during waitlist and reducing the need for face-to-face therapy. Additionally,

EMA-based depression and anxiety ratings displayed significant improvement in the moment according to the latent change model. Thus, based on quantitative data, it appears that the app increased the universally useful skill of emotional self-awareness, and decreased negative psychological symptoms.

Post interviews support the general usefulness of the ACT Daily app within this population, in which all participants recommended the app for use with others on the waitlist and adjunctively with face-to-face therapy. Adding to this point, all users felt the application was helpful overall and one participant improved so much they elected to withdraw from the CCC waitlist for face-to-face therapy. Altogether, these findings suggest that ACT Daily could serve as a beneficial pre-therapy tool that prepares participants for face-to-face therapy by providing general skills such as emotional self-awareness, and effectively lowering psychological symptoms. ACT Daily may also have the potential to decrease the overall size of the waitlist by providing a brief, yet effective intervention that is impactful enough to treat certain cases.

Hypothesis 5: ACT Daily Companion Website

The final hypothesis investigated the ACT Daily companion introduction website's ability to provide a sufficient comprehension of core ACT components (i.e., acceptance, defusion, present-moment awareness, and valued living) and training on using the mobile app. Results on the ACT Daily online introduction quiz indicated that participants improved in their knowledge of ACT components after using the website. Importantly, this quiz has not been validated and was developed specifically for this

study, therefore limiting the interpretability of these results. That said, post interview results were encouraging with all participants confirming that the website provided a sufficient introduction on ACT components and app training.

Overall, these findings suggest that an initial online training can feasibly supplement a skills-based mobile app. Importantly, by splitting up the conceptual training component from the skills component, this methodology allows for apps to remain “light” and streamlined (i.e., it reduces the amount of content in the app, resulting in a more concise presentation of skills). Previous mHealth apps have often combined both pieces within the app, resulting in a more cumbersome program that functions like an online course or self-help book. Within such apps, conceptual content is taught alongside skills and a user must read through longer conceptual explanations each time they want to review or use a skill. By keeping ACT Daily “lighter” in this sense, users engaged in a high frequency / low intensity app that was theoretically less cumbersome to use in the moment

Limitations and Future Directions

The current study suffered primarily from the limitation of participant under accrual. Originally, the study proposed a sample size of twenty students, and the final enrollment came to a total of eleven participants. Reasons for under accrual may be related to several factors. First, because of a programming issue with the USU IRB’s content management website, the study remained hidden from IRB staff for several months, resulting in the study not obtaining approval until several months into the fall

semester. As a result of this delayed IRB approval, time-sensitive recruitment efforts were constrained and researchers were unable to enroll eligible participants from the CAPS waitlist early in the fall semester (i.e., when the waitlist is typically at its largest). Second, CAPS office staff reportedly referred more clients (i.e., they had provided a paper flyer to new depressed/anxious clients) than the number of individuals who followed through with contacting research staff to enroll in the study. This disparity may have resulted from waitlisted clients losing paper-based recruitment flyers or becoming overwhelmed with the amount of information covered within their consult session and forgetting/avoiding the research study. Additionally, several interested clients waited to contact research staff after being placed on the CAPS waitlist for numerous weeks, at which point they no longer met eligibility criteria (participants were required to be on the waitlist throughout the entirety of the two-week study and these clients had fewer than two-weeks remaining). To address this issue, Mr. Haeger created the ACT Daily recruitment survey, which aimed to reduce these barriers by streamlining the enrollment process. Essentially, this survey allowed for interested clients to immediately get in touch with Mr. Haeger by entering their contact info instead of having to rely on the paper-based flyer. However, this recruitment method was not introduced until the spring semester, resulting in only two participants being recruited through this method.

Similar issues with recruitment were identified in other CBS Lab mHealth research; including a study testing the use of ACT Daily adjunctively with face-to-face ACT therapy, and another study exploring the adjunctive use of an ACT Matrix app with face-to-face ACT therapy. This could be related to limited referral support or overall

training of therapists. For example, some therapists may be reluctant to enroll clients in an ACT mHealth study if they are not trained in ACT, are concerned that the app will detract from their intervention in some way, or if they plan on conducting a different type of therapy that is based on an opposing theoretical orientation. Although clinicians have endorsed the “acceptability” of adjunctive web programs in previous research (Levin et al., 2015), a recent survey of ACT clinicians indicated that the majority did not believe that providing ACT-based apps to clients on a face-to-face waitlist would be particularly helpful (Pierce, Twohig, & Levin, 2016). It is also possible that clients may have lacked interest in engaging in a mobile app research study, perhaps due to disinterest in using a mobile app intervention altogether, or disinterest in engaging in a clinical research study while on a CCC waitlist. Altogether it seems that there may be growing support for the hypothesis that clinicians and clients are either concerned and/or reluctant to use mHealth apps while on a waitlist, resulting in recruitment issues and under-accrual.

Future research should address under accrual by increasing outreach efforts with local CCCs and clinicians. By collaborating during the development process of future iterations of mHealth apps, clinicians and treatment teams may become more familiar with the app under development and the recruitment methods involved. Such a collaboration could address potential concerns associated with referring clients to adjunctive or self-help applications. Furthermore, collaboration could result in more tailored and impactful interventions informed by clinician experiences with specific populations. In order to increase participant interest, more integrative recruitment tactics could be introduced such as promoting the intervention within dorms, informing

residential advisors of the available programs, posting on social media, advertising across different university health services and student events, and providing materials at CCC outreach events.

To reduce the potential for demand characteristics and further improve ecological validity, more objective outcome measures could be utilized such as physiological or behavioral assessments linked to positive, psychologically flexible behavior (e.g., GPS data to assess depressed clients' movement and social engagement, cortisol levels and heart rate to assess anxiety, grade changes over the semester, or objective observers assessing changes in behavior in a lab-based setting). Additionally, future studies should aim to remove all human interaction and allow users to complete all study procedures online (i.e., consent, baseline/post questionnaires, ACT training, and using/installing the app). This approach may aid in minimizing any potential for human error on behalf of the researcher who could inadvertently provide cues in relation to the experimental manipulation or the study's expected outcome. Similar proposals have been discussed in other web-based and EMA research studies (Heron & Smyth, 2010; Kazdin, 2003).

The study was also limited by the use of several unvalidated measures including the ASQ, the ACT Daily Online Introduction Quiz, and EMA items. As was mentioned previously, the ASQ was developed from previous iterations measuring ACT skill use within web-based interventions (Levin et al., 2014), it displayed adequate internal consistency, and an initial EFA supported a one-factor solution for this questionnaire. Future studies could seek to validate this measure with a larger, more diverse sample. EMAs typically include a brief set of simplified, unvalidated items. As such, these items

enable quick responses and reduce the potential for response burnout given that users are asked to respond to multiple EMAs each day over the course of a study (Heron & Smyth, 2010). That said, future research would benefit from a larger sample size, and additional EMA observations, which would account for more variability and allow for stronger conclusions at post. To further strengthen the validity of clinical and user engagement conclusions, it is recommended that future studies expand the intervention period and provide a follow up assessment, facilitating a long-term evaluation of ACT Daily's impact.

Another concern related to the interpretability of this study's findings involves ACT Daily's functional design, which incorporates an EMA component directly into ACT skill coaching components. Because these two functions are inseparable within the current app and study design, it is difficult to identify which component (i.e., EMA vs. ACT skill) has a significant impact on the outcomes, and which one is the primary source of change. Previous studies examining the impact of EMA-only apps on emotional self-awareness (ESA; Kauer et al., 2012; Reid et al., 2011) reported low-to-medium effect sizes at post (Cohen's $d = 0.27$). Thus, it appears that implementing EMA alone may impact ESA to a lesser degree, however when it is combined with skills that also promote ESA (i.e., ACT skills related to defusion, present moment awareness, and acceptance) effects are multiplied. Therefore, while it is impossible to fully parse-out the impact of EMA versus ACT skills within the current study, it is feasible to note that ACT Daily's use of EMA and ACT skills combine to create a more impactful mHealth intervention. Additionally, while several EMA items pertained to ACT components, it is unlikely that

answering EMAs alone would lead to large effects on ACT process measures at post. However, it is possible that engaging in regular EMAs may have augmented the impact of ACT skills given that users were essentially practicing the ACT processes of present-moment awareness during EMA check-ins (i.e., EMAs may have functioned as an experiential exercise, prompting users to employ a more psychologically-flexible perspective in the moment while answering EMAs). Future studies should prioritize testing multiple versions of the app: EMA + ACT skills vs. EMA-only vs. ACT skills-only.

Issues associated with the PHLMS-awareness subscale failing to measure the process of “acting with awareness” may be addressed in future studies by providing an alternative mindfulness assessment, such as the Five Facet Mindfulness Questionnaire (FFMQ; Baer, 2006). Importantly, this measure includes items that assess for the process of acting with awareness (Bergomi et al., 2013). That said, it is still important to take this study’s findings into consideration, and note that a lack of significant improvement on the PHLMS-awareness subscale may indicate an area of weakness for ACT Daily. Thus, future iterations of ACT Daily may benefit from revisions to present-moment awareness skills content to improve its effectiveness. Potential improvements to this process may include adding more audio-guided exercises in an effort to increase engagement and expanding the variety of available present-moment awareness exercises.

Although participant feedback was generally positive and participant engagement was over the two-week intervention period, participants provided useful feedback on numerous improvements that could be integrated into future iterations of ACT Daily.

These included: providing users with the option to customize their prompting schedules (while still including random prompts within the limits of this schedule), increasing the amount of audio-guided interventions across components to increase engagement, removing the post-EMA questionnaire to decrease response burden, allowing users to browse skills without answering the pre-EMA questionnaire, providing feedback to users on their progress within the app, adding “gamification” features to promote engagement through an in-app reward system, including more skills to help improve the variability and novelty of skills when utilizing the app over a longer period of time, and including all six components of ACT (i.e., adding committed action and self-as-context) to foster a more well-rounded ACT intervention.

Finally, limitations were identified with individuals who borrowed an Android phone during their participation in the study. Overall, these participants encountered technical issues and were less inclined to use the app. This was attributed to being unfamiliar with the Android OS system, forgetting to keep the phone on-hand or close by, and unknowingly leaving the phone on vibrate/silent. Essential features across mHealth apps are that they are accessible, brief, and easy-to-use. By using a participant’s personal smartphone, barriers to accessibility and ease of use should, theoretically, be reduced. Users typically ensure they have access to their own smartphone throughout the day (given its function as a primary communication device), are more likely to interact with their smartphone frequently (e.g., checking notifications, talking to others, etc.), and will be more familiar with its functions due to a longer history of use. Adding another device further convolutes the process of utilizing an mHealth app and creates unnecessary

barriers to engagement. Future iterations of ACT Daily should make a multi-platform release a priority (i.e., both Apple iOS and Android OS development).

Due to this study's open-trial design and small sample size, findings should be taken with caution. That said, the consistent pattern of results observed across measures and assessment technologies within this study signal that ACT Daily and its companion introduction website are a potentially impactful, acceptable, and usable self-guided intervention for depressed/anxious individuals waiting for therapy. Researchers have previously commented on the expected usefulness of incorporating EMA with tailored in-the-moment interventions (Heron & Smyth, 2010). ACT Daily relied heavily upon this methodology and it appears to have resulted in significant positive outcomes within this sample. Future research may involve seeking additional funding through the NIMH R34 mechanism, which could allow ACT Daily to be refined and compared to treatment as usual within a pilot randomized controlled trial (RCT). Such a RCT would target a much larger, more diverse sample. With further development and research, a mobile application approach such as this could provide a central resource for depressed/anxious clients on CCC waitlists. mHealth apps modeled after ACT Daily could deliver a cost-effective intervention that offers immediate, impactful, and brief support at a time when clients are typically struggling without active psychological support.

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APPENDICES

Appendix A

ACT Daily Mobile App Content

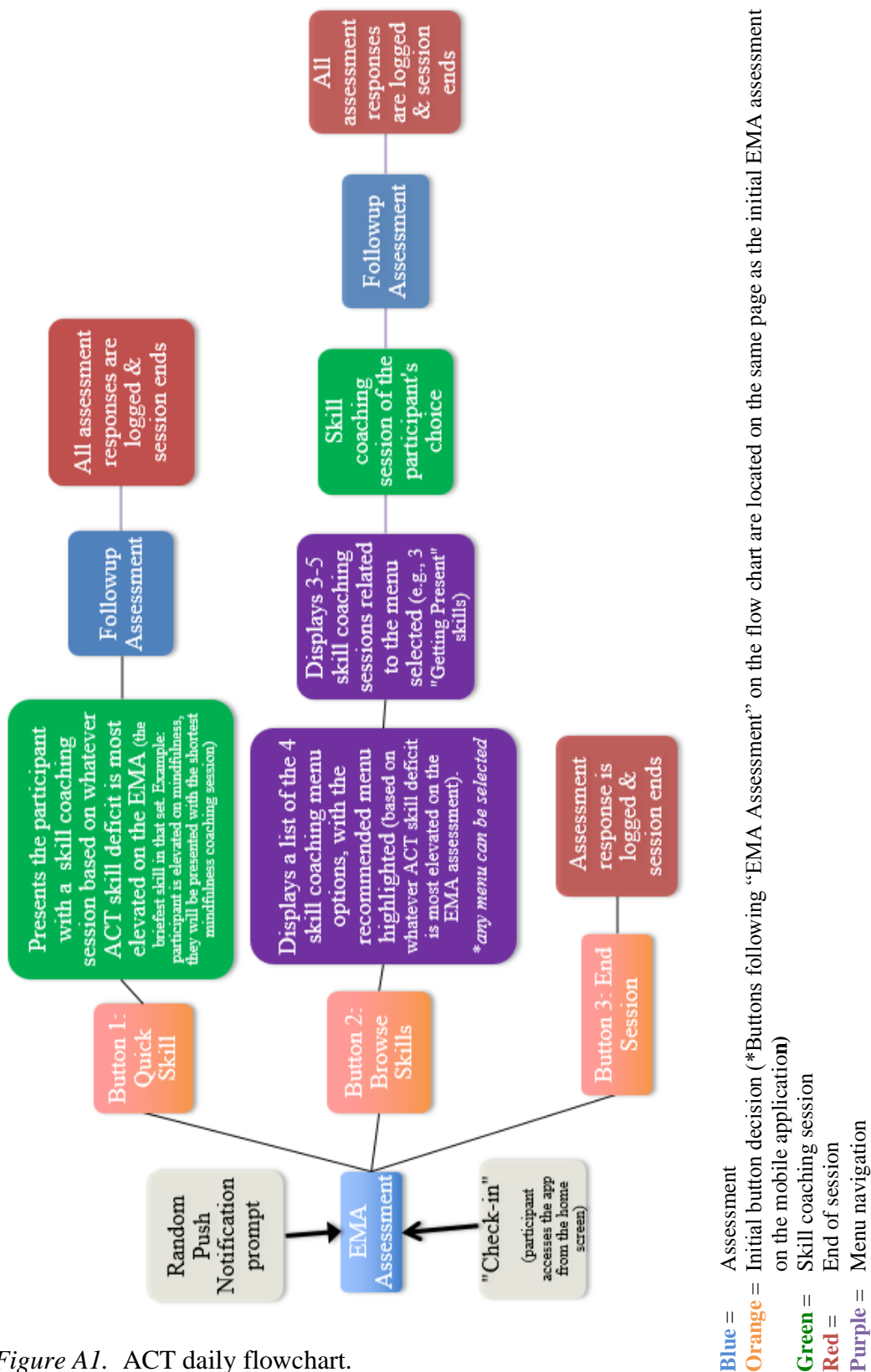
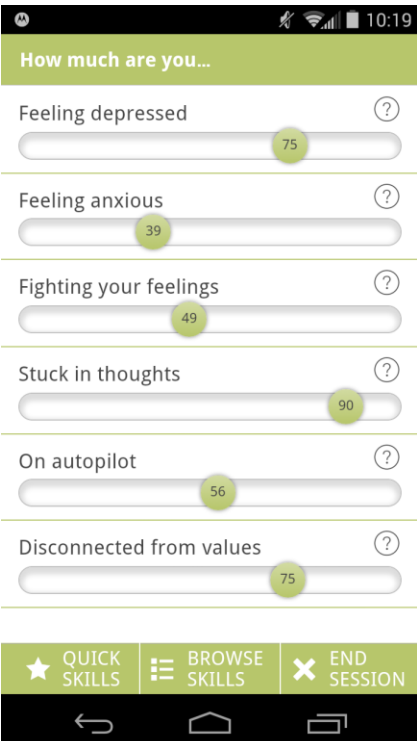
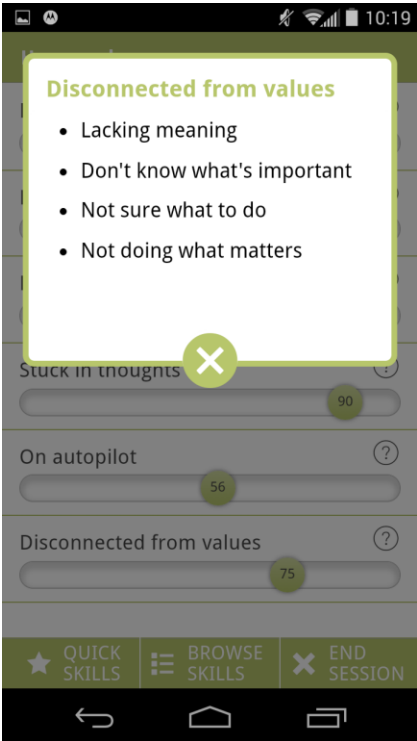


Figure A1. ACT daily flowchart.

A2.a: Pre-assessment screen



A2.b: Assessment popup when user clicks “?” button



A2.c: Browse skills and submenu

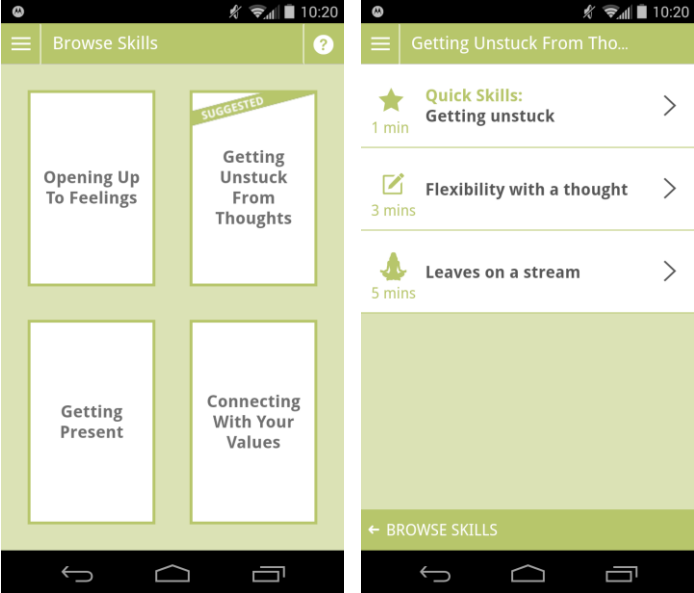
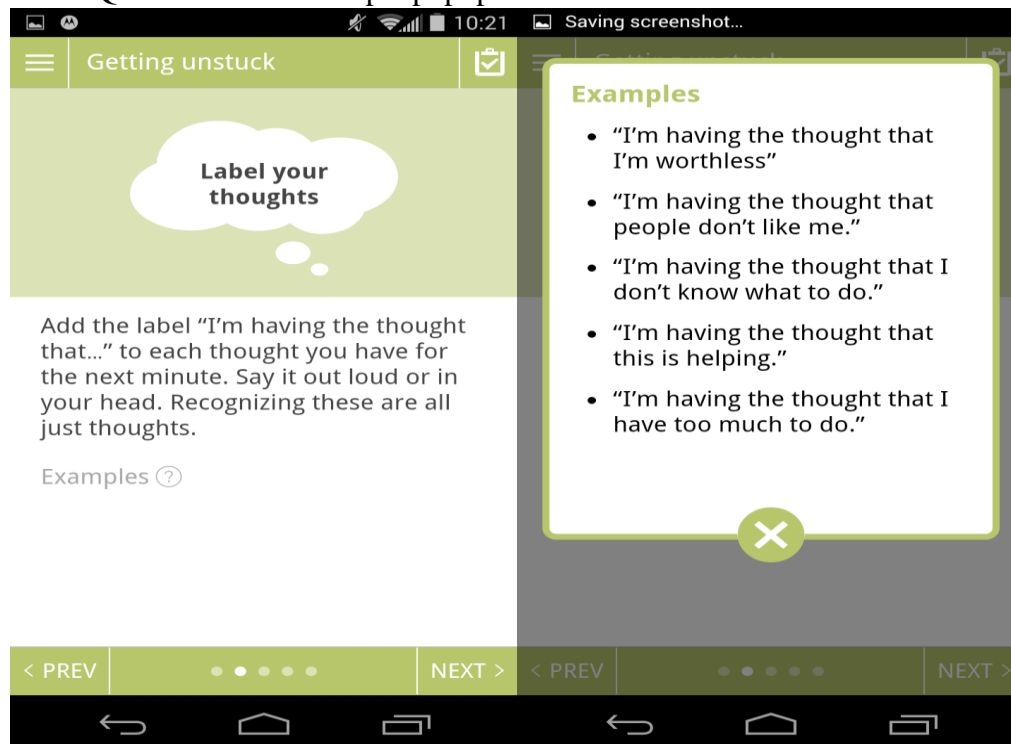


Figure A2. ACT daily screenshots.

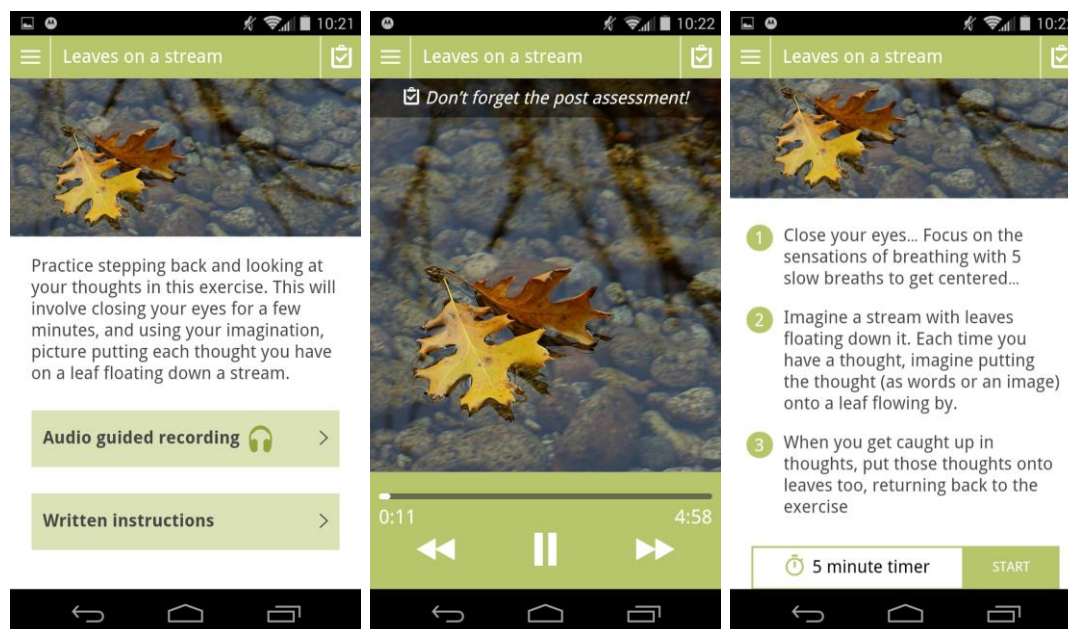
(Figure continues)

Figure A2 (continued)

A2.d: Quick skill and example popup window



A2.e: Audio and text-based versions of leaves on a stream exercise



Appendix B

ACT Daily Companion Introduction Website Content

ACT Daily Online Introduction Quiz
(ACT Knowledge Quiz)

Now that you have learned some of the basics of ACT, let's revisit the same questionnaire you completed at the start of the module. Please answer the following multiple-choice questions. ***Note that if you answer incorrectly, you will receive feedback in red text.**

- 1) Opening up to feelings means to:
- a. Give into difficult thoughts and feelings
 - b. Acknowledge and allow difficult thoughts and feelings to be what they are**
 - c. Control or suppress difficult thoughts and feelings
 - d. Agree with difficult thoughts and feelings

Feedback popup (presented if correct answer "B" is not selected): Within ACT, "opening up to feelings" involves letting go of trying to control thoughts and feelings. Instead of control, it means acknowledging these experiences and "making room" for them psychologically. However, it isn't giving into or agreeing with difficult thoughts and feelings, it's more like acknowledging and allowing them to be there simply for what they are.

- 2) According to this training module, thoughts and feelings:
- a. Can be controlled with willpower
 - b. Are hard to control**
 - c. Are easy to control when you try hard enough
 - d. Are controllable once you have the right strategy

*Feedback (if correct answer "B" is not selected): We find that actually "controlling" unwanted thoughts and feelings (i.e., "fighting your feelings" by actively trying to get rid of, deny, change, or otherwise control these negative inner experiences) **is extremely difficult and it ultimately leads to becoming "stuck" in your suffering.** Just like you can't remove a memory from your mind, maybe you can't stop yourself from having certain thoughts. Just like you can't feel happy through sheer force of will, maybe you can't get rid of your depression or anxiety by willing it away. Furthermore, if you try to control your inner experiences by avoiding specific activities that bring up difficult emotions (avoiding going on a date because you are worried it might increase your anxiety), your life will start to feel like it is "narrowing" as you continue to further limit your actions to those that are "safe" from negative feelings.*

This means that if you are unwilling to experience certain thoughts and feelings and excessively try to remove or control them, you get exactly what you don't want - more of those thoughts and feelings.

*It's explained within the "Scratching a Nasty Rash" example:
Many of us have had a rash at some point in our lives. Do you remember the urge to scratch this rash? If you did scratch it, sure you got some brief satisfaction. However, the effect of scratching actually causes more itching – in addition to damaging the skin. In reality, the best thing that you could do for yourself is to not scratch and learn to live with these urges without acting on them - as counterintuitive and unnatural as that might seem.*

- 3) What is the point of the “leaves on a stream” exercise?
- To step back and notice your thoughts as just thoughts
 - To control the speed of the stream (AKA your thoughts)
 - To notice when you get stuck and return to the exercise, putting each of your thoughts on leaves
 - To engage in a relaxing mindfulness exercise and connect with your values.

e. Choices A and C

Feedback (if correct answer “E” is not selected): The point of the “leaves on a stream” exercise is to practice noticing when you have a thought and imagine placing it on a leaf and watching it float down the stream. This is like looking at the thought from an “unstuck” perspective. The key is to step back and notice your thoughts as just thoughts and notice when you get “stuck” and return to the exercise, putting each of your thoughts on leaves.

- 4) What is not a core ACT strategy?
- Opening up to feelings
 - Getting “unstuck” from thoughts
 - Thinking positively**
 - Connecting with your values

Feedback (if correct answer “C” is not selected): Thinking positively is not a core ACT strategy because it implies that an individual needs to change their thoughts in order to do go on with living a meaningful life (i.e., using a control strategy). ACT argues that although fighting to control or change difficult emotions can result in temporary relief in the short term, it ultimately leads to feeling even more stuck and it can get in the way of living a vital, values-driven life. Essentially, you would end up having to “win the war” with your thoughts every time a negative thought came up and “will” yourself into being happy. Even if this was possible, you would be spending so much of your time caught up with changing your thoughts that you would likely miss out on important things going on in the moment.

- 5) What does “being present” mean?
- To be in a relaxed mental state
 - Noticing your experiences that are occurring in the world around you**
 - Meditating to increase your positive emotions
 - None of the above

Feedback (if correct answer “B” is not selected): Within ACT, “being present” involves noticing your experiences that are occurring in the world around you - regardless of whether these are positive or negative experiences; relaxing or stressful. Furthermore, it means that you notice when you begin to get lost in your thoughts and bring your attention back to whatever you were focusing on in the first place.

- 6) “Values” are:
- Important goals that can be achieved
 - A guide for living a life that is meaningful to you
 - Something that you feel you should have to do
 - They are more about how you act rather than specific outcomes or feelings

e. Choices B and D

*Feedback (if correct answer "E" is not selected): Within ACT, we think of values as a **useful guide for living a life that is meaningful to you**. Living a meaningful life means focusing on what you would care about if you could freely choose anything, rather than what society, your parents, or what anyone else tells you to value. What is important to you and how you want to act, rather than what you feel you "should" or "have to" do. The idea is to find something that you feel you are moving towards that really matters to you, rather than just trying to avoid feeling overwhelmed and letting others down.*

*Values are also **more about how you act rather than specific outcomes or feelings**. Sure we all want to get good outcomes and to feel good, but that's not always under our control. Your actions can still be meaningful to you, even if things don't turn out perfectly (can you still be a caring friend, even if you aren't able to take care of everyone all of the time or even if you sometimes don't feel like doing it?). We can lose sight of what matters to us when we focus too much on reaching a certain outcome. Values re-orient you to the question "How do I want to act right now?"*

- 7) When you are in a “tug of war” with difficult thoughts (i.e., the “monster”), you should:
- a. Try to pull harder so that you can beat your thoughts
 - b. Let your thoughts pull you
 - c. Let go of the rope**
 - d. Convince the monster to stop fighting you.

Feedback (if correct answer "C" is not selected): The best option is to disengage from the struggle with the monster (difficult thoughts) by dropping the rope. This means that you leave the tug of war with the monster, choosing to neither win nor lose but simply stop the competition. This would be like letting go of trying to control your thoughts and feelings and simply allowing them to be there.

Notice that this is different from surrendering to the monster and letting it pull you in; you are not completely giving in to thoughts and feelings as you let go of control strategies. It's more like acknowledging what is there and then getting back to the task of living.

B1.a: Screenshot of ACT knowledge quiz.

0% 100%

ACT Knowledge Quiz

Let's start by assessing your base knowledge of ACT. Please answer the multiple choice questions below.

1. Opening up to feelings means to:

- Give into difficult thoughts and feelings
- Acknowledge and allow difficult thoughts and feelings to be what they are**
- Control or suppress difficult thoughts and feelings
- Agree with difficult thoughts and feelings

2. Thoughts and feelings:

- Can be controlled with willpower
- Are hard to control**
- Are easy to control when you try hard enough
- Are controllable once you have the right strategy

3. What is the point of the "leaves on a stream" exercise?

- A. To step back and notice your thoughts as just thoughts
- B. To control the speed of the stream (AKA your thoughts)
- C. To notice when you get stuck and return to the exercise, putting each of your thoughts on leaves.
- D. To engage in a relaxing mindfulness exercise and connect with your values.

Figure B1. ACT Daily companion introduction website screenshots.

(Figure continues)


Figure B1 (continued)

B1.b: Screenshot of an overview of how people “get stuck” in their suffering via the four different processes covered within the ACT Daily app

How People Get "Stuck" in Their Suffering

First, let's take a look at how people get "stuck" in their suffering at a more detailed level. These sticking points typically include:

- Fighting your feelings
- Running on autopilot
- Getting stuck in your thoughts
- Being disconnected from your values



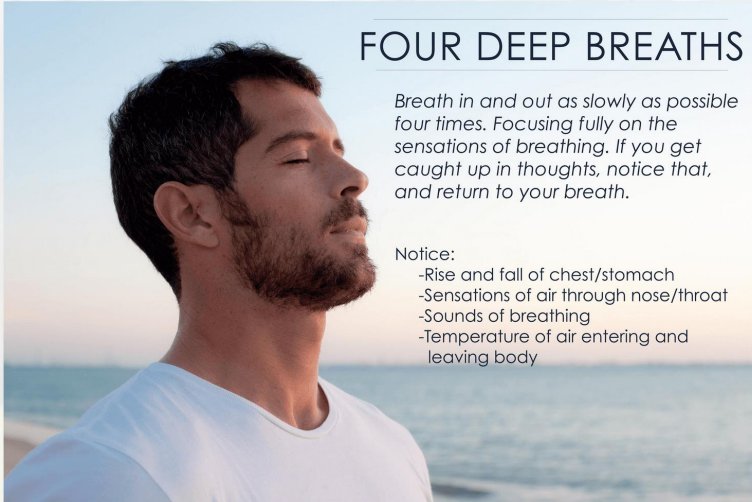
The ACT Daily app will check-in throughout the day on these psychological "sticking points" (in addition to checking in on depression/anxiety levels). Your responses to this check-in will guide the skills that the app automatically provides for you to try out in the moment.

In the following slides we will explore each of these potential sticking points, and discuss how to address them with skills offered within the ACT Daily app.

B1.c: Screenshot of “Four Deep Breaths” exercise, one of the skills covered within ACT Daily

ACT Skill: Getting Present

Let's try one of the **getting present** ACT skills that could be helpful if you find yourself running on autopilot.



FOUR DEEP BREATHS

Breath in and out as slowly as possible four times. Focusing fully on the sensations of breathing. If you get caught up in thoughts, notice that, and return to your breath.

Notice:

- Rise and fall of chest/stomach
- Sensations of air through nose/throat
- Sounds of breathing
- Temperature of air entering and leaving body

(Figure continues)

Figure B1 (continued)

B1.d: Screenshot of a page covering all of the available “Getting Present Skills within the ACT Daily app

Available "Getting Present" Skills

By using the ACT Daily app, you have access to numerous "getting present" skills including:

- **Quick Skills:**
 - **Observing closely** (pick an object and focus all of your attention on it)
 - **Notice 5 things** (focus on different things you can see, hear, and feel)
 - **Being curious** (approach whatever you are noticing in the moment with curiosity)
 - **Returning your attention** (focus on a sensation/activity and return your focus).
- **Longer Skills:**
 - **Breathing mindfulness** (audio-guided mindfulness exercise where you focus on your breath - similar to the "four deep breaths" exercise above)
 - **Mindfulness in activities** (interactive exercise where you select daily activities and find ways to approach them mindfully - such as "mindful eating").


B1.e: “Getting Unstuck” skill page and audio-guided exercise popup

**ACT Skill: Getting Unstuck
(Leaves on a stream)**

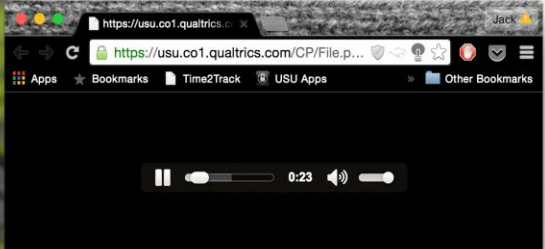
Let's try one of the "getting unstuck" skills provided within ACT Daily called "leaves on a stream." Within this exercise, you will practice stepping back and looking at your thoughts. This will involve closing your eyes for a few minutes and imagining a stream with leaves floating down it.

During the exercise, you will practice **noticing when you have a thought and imagine placing it on a leaf and watching it float down the stream.** This is like looking at the thought from an "unstuck" perspective.

The key is to notice when you get "stuck" and return to the exercise, putting each of your thoughts on leaves.



When you are ready, click [here](#) to follow an audio recording of the exercise or if you can't play the audio file you can follow the text instructions [here](#).



(Figure continues)

Figure B1 (continued)

B1.f: Summary of the four main ACT components covered within ACT Daily

Summary

To recap, we have covered the following psychological skills found within ACT Daily:

- Skill #1: **Opening up to feelings**
 - Noticing experiences for what they are, without judging them as good or bad, right or wrong, or whether they should or shouldn't happen. Essentially, *letting go of trying to control your thoughts*.
- Skill #2: **Getting present**
 - Noticing your experiences in the present moment, where you can experience the world more directly.
- Skill #3: **Getting unstuck from thoughts**
 - Noticing thoughts as just thoughts rather than getting entangled in them.
- Skill #4: **Connecting with your values**
 - Clarifying and connecting with what matters to you & how you want to be in the world

These skills aren't ends in themselves – they combine to help you achieve mental flexibility and clear the way for a more meaningful, vital life.

B1.g: Screenshot of the ACT-Daily training YouTube video presented at the end of the training module

ACT Daily App Training Video

Now it is time to get oriented to how the ACT Daily app works on a smartphone. Please press play on the video below to watch a brief training video.

ACT Daily Training

ACT-DAILY
TRAINING MODULE

MICHAEL LEVIN & JACK HAEGER

0:02 / 7:26

Appendix C
Informed Consent

Informed Consent

Utilizing ACT Daily as a self-guided mobile app intervention for depression and anxiety in a college counseling center waitlist

Introduction/ Purpose Dr. Michael Levin and Mr. Jack Haeger in the Department of Psychology at Utah State University are conducting a research study testing a mobile app for depressed/anxious clients on the waitlist of a college counseling center. You have been asked to take part because you are currently on a waitlist at Counseling and Psychological Services (CAPS) and presented with anxious/depressive symptoms during your intake session. There will be approximately 20 total participants in this research.

Procedures If you agree to be in this research study, you will be asked to first complete a set of questionnaires on the computer assessing psychological symptoms and other processes related to the app (e.g., mindfulness, acceptance of emotions, etc...). We will then orient you to the ACT Daily mobile app through a condensed online training, install the app on your phone, and address any questions or technological issues at that time. This app is only available for Android, but if you do not have an Android phone we can provide you with one to use for the next two weeks.

We will ask that you then use the ACT Daily app for two weeks. This app will involve completing brief assessments throughout the day for the two-week period. We also ask that, when relevant, you use the suggested skill coaching features to practice different ACT skills during your day. This will involve various suggestions for how to practice being mindful of the moment, focusing on what is important to you, accepting difficult emotions, and getting unstuck from thoughts.

Two weeks from now we will email you a link to complete a second online survey asking various questions about your psychological symptoms and reactions to using the app. You can complete this survey from home and you will *not* need to come back to the lab for this step. After you complete this second online assessment, we will ask you to also complete a 30-minute phone interview with one of the researchers. During this call we will ask you questions about your experiences using the app and how we might improve it.

Alternative Procedures Instead of participating in this research, an alternative for you to consider would be to wait for your first face-to-face treatment session at CAPS without using this experimental mobile app and use any of the suggested materials provided by CAPS prior to your first session. Please note however that participating in this study does not exclude you from using any alternative therapeutic/supportive materials provided to you by CAPS during your time on the waitlist.

New Findings During the course of this research study, you will be informed of any significant new findings (either good or bad), changes in the procedures, risks or benefits

resulting from participation in the research, or new alternatives to participation that might cause you to change your mind about continuing in the study. If necessary, your consent to continue participating in this study will be obtained again.

Risks Participation in this research is considered minimal risk; however, as with all research, there is a small risk for loss of confidentiality due to someone who is not authorized seeing the information we collected from you. We will take the following precautions to prevent any unauthorized person from having any access to the information you give us:

- a. Any information you give us will be kept strictly confidential. We will not share the information you provide or whether you are participating in the study with your therapist or anyone else.
- b. Your personal information, such as IP address and email, will not be associated with your responses to the online questionnaires.
- c. We will remove your name from all the information we receive (except this consent form). You will be assigned a random study ID, which will be used to identify all of the data you provide across assessments and other research steps. This ID will be stored separately from the data collected for the duration of the study.
- d. All research personnel are trained in procedures to protect confidentiality.
- e. There is no way to review your previous responses on the mobile app once you have finished an app “session.” This means that if someone uses your phone, they cannot see what you have entered in the past app. However, we recommend you put a password on your phone to protect your privacy so that others do not know you are using this app.

There is a slight risk of experiencing distress in relation to completing questionnaire related to experiences of mental health problems. To address this, you always have the option to not answer any question you do not feel comfortable answering. Although this risk is very unlikely to occur, if you do find yourself experiencing unhealthy levels of distress as a result of completing the questionnaires, please contact our research staff so they can assist you.

As this is an experimental mobile use, additional unforeseen risks could occur. It is very important to us that we know of any such unexpected negative reactions to participating in the study so that we can be sure to address them with you and other participants in the future. *If you do encounter a negative reaction to the program, please contact our program coordinator, Jack Haeger, as soon as possible by email jack.haeger@aggiemail.usu.edu or phone 970-343-4450.*

Research-Related Injuries There is a very unlikely risk of minor psychological distress as a result of participating in the study. You will not receive treatment or compensation if you do experience an increase in distress.

Benefits Although we cannot guarantee it, there could be some potential benefits to you

for taking part in this research project. During the study you will review ACT materials that have been found to be helpful for those struggling with depression and / or anxiety. In addition, your participation could directly impact the development and refinement of a mobile-based program designed to support individuals who are waiting for therapy.

Explanation & offer to answer questions Jack Haeger has explained this research study to you and answered your questions. If you have other questions or research-related problems, you may reach Michael Levin at (435) 797-3274 or by email at Michael.Levin@usu.edu.

Extra Cost(s) There is no cost to you to participate in the study.

Payment/Compensation You will be entered to win a \$100 Amazon gift card for your participation in this study. A drawing will occur after the study has concluded and a winner will be selected at random out of the 20 participants. The gift card will be emailed directly to the winner.

Voluntary nature of participation and right to withdraw without consequence Participation in research is entirely voluntary. You may refuse to participate or withdraw at any time without consequence or loss of benefits. If you choose to withdraw from the study after you begin participation you will not be removed from the Amazon gift card drawing. You may be withdrawn from this study without your consent by the investigator if you are having an unexpected adverse reaction (i.e., become notably distressed as a result of using the mobile app).

Confidentiality Research records will be kept confidential, consistent with federal and state regulations. Only the investigator and research staff will have access to the data which will be kept on password protected computers as well as secure, encrypted website servers through Qualtrics.com and InterVision Media. To protect your privacy, personal, identifiable information will not be collected with the exception of the initial study contact information and this consent form. Instead your data will be identified using a random study ID for all research steps. Identifying information will be stored separately from data and will be kept in a secure file on password-protected computers. Personally identifying information will be kept until the study has concluded (approximately 3-6 months), after which time they will be destroyed (i.e., shredding paper documents and deleting electronic data with identifying information).

***IRB Approval Statement** The Institutional Review Board for the protection of human participants at Utah State University has approved this research study. If you have any questions or concerns about your rights or a research-related injury and would like to contact someone other than the research team, you may contact the IRB Administrator at (435) 797-0567 or email irb@usu.edu to obtain information or to offer input.

Copy of consent You have been given two copies of this Informed Consent. Please sign

both copies and keep one copy for your files.

Investigator Statement “I certify that the research study has been explained to the individual, by me or my research staff, and that the individual understands the nature and purpose, the possible risks and benefits associated with taking part in this research study. Any questions that have been raised have been answered.”

Signature of Researcher(s)

Michael E. Levin, Ph.D.
Principal Investigator
435-797-3274
Michael.Levin@usu.edu

Jack Haeger, B.A.
Student Researcher
970-343-4450
jack.haeger@aggiemail.usu.edu

Signature of Participant By signing below, I agree to participate.

Participant's signature

Date

Appendix D
Survey Instruments

Demographics Questionnaire

The next step for participating in this study will be to complete an initial assessment. The following pages will list a series of questions, designed to assess your general functioning and various psychological processes. Please do your best to answer all of the questions carefully and honestly.

1. Gender
 - Female
 - Male

2. How old are you? _____

3. Marital status:
 - Married
 - Living with someone as if married
 - Widowed
 - Separated
 - Divorced or annulled
 - Never married

4. For your primary household, please estimate the gross annual income (before taxes) for the last year. If unknown, choose unknown.
 - less than \$20,000
 - \$20,000 - \$39,999
 - \$40,000 - \$59,999
 - \$60,000 – \$79,999
 - \$80,000 - \$99,999
 - \$100,000 or more
 - unknown

5. Hispanic or Latino origin:
 - No
 - Yes

6. Race
 - White
 - Black, African American or Haitian
 - Asian
 - Portuguese
 - Native Hawaiian or Other Pacific Islander
 - American Indian or Alaskan Native
 - Other (describe below) _____

7. What year are you in college? (if you are in-between years such as Summer term you can round up to the next year)
 - First year (Freshman)
 - Second year (Sophomore)
 - Third year (Junior)
 - Fourth year (Senior)
 - Fifth year or higher
 - Graduate student
 - I'm not comfortable answering this question

8. Employment status
 - Employed Full Time
 - Employed Part Time
 - Full Time Student
 - Unemployed
 - Retired
 - Stay-at-home parent
 - Disability

9. Have you gone to therapy before?
 - Yes
 - No
 - I do not feel comfortable answering this question

10. When was the last time you went to a therapy session (excluding your intake session at CAPS)? Please list this in weeks, months, or years

11. How many weeks do you have until your first scheduled session with a CAPS therapist?

Depression, Anxiety and Stress Scale (DASS)

Please read each statement and circle a number 0, 1, 2 or 3 which indicates how much the statement applied to you over the past week. There are no right or wrong answers. Do not spend too much time on any statement.

The rating scale is as follows:

- 0 Did not apply to me at all
- 1 Applied to me to some degree, or some of the time
- 2 Applied to me to a considerable degree, or a good part of time
- 3 Applied to me very much, or most of the time

1	I found it hard to wind down	0	1	2	3
2	I was aware of dryness of my mouth	0	1	2	3
3	I couldn't seem to experience any positive feeling at all	0	1	2	3
4	I experienced breathing difficulty (eg, excessively rapid breathing, breathlessness in the absence of physical exertion)	0	1	2	3
5	I found it difficult to work up the initiative to do things	0	1	2	3
6	I tended to over-react to situations	0	1	2	3
7	I experienced trembling (eg, in the hands)	0	1	2	3
8	I felt that I was using a lot of nervous energy	0	1	2	3
9	I was worried about situations in which I might panic and make a fool of myself	0	1	2	3
10	I felt that I had nothing to look forward to	0	1	2	3
11	I found myself getting agitated	0	1	2	3
12	I found it difficult to relax	0	1	2	3
13	I felt down-hearted and blue	0	1	2	3
14	I was intolerant of anything that kept me from getting on with what I was doing	0	1	2	3
15	I felt I was close to panic	0	1	2	3
16	I was unable to become enthusiastic about anything	0	1	2	3
17	I felt I wasn't worth much as a person	0	1	2	3
18	I felt that I was rather touchy	0	1	2	3
19	I was aware of the action of my heart in the absence of physical exertion (eg, sense of heart rate increase, heart missing a beat)	0	1	2	3
20	I felt scared without any good reason	0	1	2	3
21	I felt that life was meaningless	0	1	2	3

Acceptance & 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. 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
2. I'm afraid of my feelings.	1	2	3	4	5	6	7
3. I worry about not being able to control my worries and feelings.	1	2	3	4	5	6	7
4. My painful memories prevent me from having a fulfilling life.	1	2	3	4	5	6	7
5. Emotions cause problems in my life.	1	2	3	4	5	6	7
6. It seems like most people are handling their lives better than I am.	1	2	3	4	5	6	7
7. Worries get in the way of my success.	1	2	3	4	5	6	7

Valuing Questionnaire (VQ)

Please read each statement carefully and then circle the number which best describes how much the statement was for you DURING THE PAST WEEK, INCLUDING TODAY

0	1	2	3	4	5	6
Not at all true						Completely true

Q1) I spent a lot of time thinking about the past or future, rather than being engaged in activities that mattered to me

0 1 2 3 4 5 6

Q2) I was basically on “auto-pilot” most of the time

0 1 2 3 4 5 6

Q3) I worked toward my goals even if I didn’t feel motivated to

0 1 2 3 4 5 6

Q4) I was proud about how I lived my life

0 1 2 3 4 5 6

Q5) I made progress in the areas of my life I care most about

0 1 2 3 4 5 6

Q6) Difficult thoughts, feelings or memories got in the way of what I really wanted to do

0 1 2 3 4 5 6

Q7) I continued to get better at being the kind of person I want to be

0 1 2 3 4 5 6

Q8) When things didn’t go according to plan, I gave up easily

0 1 2 3 4 5 6

Q9) I felt like I had a purpose in life

0 1 2 3 4 5 6

Cognitive Fusion Questionnaire (CFQ)

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. My thoughts cause me distress or emotional pain

1 2 3 4 5 6 7

2. I get so caught up in my thoughts that I am unable to do the things that I most want to do

1 2 3 4 5 6 7

3. I over- analyze situations to the point where it's unhelpful to me

1 2 3 4 5 6 7

4. I struggle with my thoughts

1 2 3 4 5 6 7

5. I get upset with myself for having certain thoughts

1 2 3 4 5 6 7

6. I tend to get very entangled in my thoughts

1 2 3 4 5 6 7

7. It's such a struggle to let go of upsetting thoughts even when I know that letting go would be helpful

1 2 3 4 5 6 7

Philadelphia Mindfulness Scale (PHLMS)

Instructions: Please circle how often you experienced each of the following statements *within the past week.*

1. I am aware of what thoughts are passing through my mind.

1	2	3	4	5
Never	Rarely	Sometimes	Often	Very Often

2. I try to distract myself when I feel unpleasant emotions.

1	2	3	4	5
Never	Rarely	Sometimes	Often	Very Often

3. When talking with other people, I am aware of their facial and body expressions.

1	2	3	4	5
Never	Rarely	Sometimes	Often	Very Often

4. There are aspects of myself I don't want to think about.

1	2	3	4	5
Never	Rarely	Sometimes	Often	Very Often

5. When I shower, I am aware of how the water is running over my body.

1	2	3	4	5
Never	Rarely	Sometimes	Often	Very Often

6. I try to stay busy to keep thoughts or feelings from coming to mind.

1	2	3	4	5
Never	Rarely	Sometimes	Often	Very Often

7. When I am startled, I notice what is going on inside my body.

1	2	3	4	5
Never	Rarely	Sometimes	Often	Very Often

8. I wish I could control my emotions more easily.

1	2	3	4	5
Never	Rarely	Sometimes	Often	Very Often

9. When I walk outside, I am aware of smells or how the air feels against my face.

1	2	3	4	5
Never	Rarely	Sometimes	Often	Very Often

10. I tell myself that I shouldn't have certain thoughts.

1	2	3	4	5
Never	Rarely	Sometimes	Often	Very Often

11. When someone asks how I am feeling, I can identify my emotions easily.

1	2	3	4	5
Never	Rarely	Sometimes	Often	Very Often

12. There are things I try not to think about.

1	2	3	4	5
Never	Rarely	Sometimes	Often	Very Often

13. I am aware of thoughts I'm having when my mood changes.

1	2	3	4	5
Never	Rarely	Sometimes	Often	Very Often

14. I tell myself that I shouldn't feel sad.

1	2	3	4	5
Never	Rarely	Sometimes	Often	Very Often

15. I notice changes inside my body, like my heart beating faster or my muscles getting tense.

1	2	3	4	5
Never	Rarely	Sometimes	Often	Very Often

16. If there is something I don't want to think about, I'll try many things to get it out of my mind.

1	2	3	4	5
Never	Rarely	Sometimes	Often	Very Often

17. Whenever my emotions change, I am conscious of them immediately.

1	2	3	4	5
Never	Rarely	Sometimes	Often	Very Often

18. I try to put my problems out of mind.

1	2	3	4	5
Never	Rarely	Sometimes	Often	Very Often

19. When talking with other people, I am aware of the emotions I am experiencing.

1	2	3	4	5
Never	Rarely	Sometimes	Often	Very Often

20. When I have a bad memory, I try to distract myself to make it go away.

1	2	3	4	5
Never	Rarely	Sometimes	Often	Very Often

ACT Skills Questionnaire (ASQ)

Over the past week, how often did you...

1. Think about your values
 - a. Never
 - b. Very Rarely
 - c. Rarely
 - d. Sometimes
 - e. Often
 - f. Very often
2. Pay attention to your experiences in a mindful way
 - a. Never
 - b. Very Rarely
 - c. Rarely
 - d. Sometimes
 - e. Often
 - f. Very often
3. Notice when you were disconnected from your values
 - a. Never
 - b. Very Rarely
 - c. Rarely
 - d. Sometimes
 - e. Often
 - f. Very often
4. Practice strategies to open up to and accept difficult feelings
 - a. Never
 - b. Very Rarely
 - c. Rarely
 - d. Sometimes
 - e. Often
 - f. Very often
5. Consider the costs of getting stuck in your thoughts
 - a. Never
 - b. Very Rarely
 - c. Rarely
 - d. Sometimes
 - e. Often
 - f. Very often

6. Practice labeling your thoughts as just thoughts
 - a. Never
 - b. Very Rarely
 - c. Rarely
 - d. Sometimes
 - e. Often
 - f. Very often
7. Focus on the present moment
 - a. Never
 - b. Very Rarely
 - c. Rarely
 - d. Sometimes
 - e. Often
 - f. Very often
8. Notice when you were fighting your feelings
 - a. Never
 - b. Very Rarely
 - c. Rarely
 - d. Sometimes
 - e. Often
 - f. Very often
9. Use your values as a guide for making choices
 - a. Never
 - b. Very Rarely
 - c. Rarely
 - d. Sometimes
 - e. Often
 - f. Very often
10. Practice acknowledging your emotions
 - a. Never
 - b. Very Rarely
 - c. Rarely
 - d. Sometimes
 - e. Often
 - f. Very often

11. Notice when you were caught up in your thoughts
 - a. Never
 - b. Very Rarely
 - c. Rarely
 - d. Sometimes
 - e. Often
 - f. Very often
12. Do things that are meaningful to you
 - a. Never
 - b. Very Rarely
 - c. Rarely
 - d. Sometimes
 - e. Often
 - f. Very often
13. Practice mindfulness with formal meditation exercises
 - a. Never
 - b. Very Rarely
 - c. Rarely
 - d. Sometimes
 - e. Often
 - f. Very often
14. Allow difficult thoughts and feelings to be there without trying to control them
 - a. Never
 - b. Very Rarely
 - c. Rarely
 - d. Sometimes
 - e. Often
 - f. Very often
15. Notice when you were on autopilot
 - a. Never
 - b. Very Rarely
 - c. Rarely
 - d. Sometimes
 - e. Often
 - f. Very often

16. Do things that are important to you even though they might bring up difficult emotions
- Never
 - Very Rarely
 - Rarely
 - Sometimes
 - Often
 - Very often
17. Use mindfulness exercises to get unstuck from your thoughts
- Never
 - Very Rarely
 - Rarely
 - Sometimes
 - Often
 - Very often
18. Consider how your actions are linked to what matters to you
- Never
 - Very Rarely
 - Rarely
 - Sometimes
 - Often
 - Very often
19. Practice being mindful during everyday activities
- Never
 - Very Rarely
 - Rarely
 - Sometimes
 - Often
 - Very often
20. Notice the costs of trying to control your feelings
- Never
 - Very Rarely
 - Rarely
 - Sometimes
 - Often
 - Very often

21. Use strategies you learned in therapy (or within the app) for getting unstuck from thoughts
- a. Never
 - b. Very Rarely
 - c. Rarely
 - d. Sometimes
 - e. Often
 - f. Very often
22. Set meaningful goals for yourself
- a. Never
 - b. Very Rarely
 - c. Rarely
 - d. Sometimes
 - e. Often
 - f. Very often

Emotional Self-Awareness Scale (ESAS)

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

1. It's hard for me to tell what mood I'm in
 - a. Never
 - b. Very Little
 - c. Sometimes
 - d. Often
 - e. A lot
2. I frequently take time to reflect on how I feel
 - a. Never
 - b. Very Little
 - c. Sometimes
 - d. Often
 - e. A lot
3. I'm usually aware of my emotions
 - a. Never
 - b. Very Little
 - c. Sometimes
 - d. Often
 - e. A lot
4. I like to go someplace alone to think about my feelings
 - a. Never
 - b. Very Little
 - c. Sometimes
 - d. Often
 - e. A lot
5. I don't often think about my feelings
 - a. Never
 - b. Very Little
 - c. Sometimes
 - d. Often
 - e. A lot
6. I know exactly how I'm feeling
 - a. Never
 - b. Very Little
 - c. Sometimes
 - d. Often
 - e. A lot

System Usability Scale (SUS)

Please answer the following questions regarding the ACT Daily app you used over the last 2 weeks.

	Strongly disagree				Strongly agree
1. I think that I would like to use this system frequently	1	2	3	4	5
2. I found the system unnecessarily complex	1	2	3	4	5
3. I thought the system was easy to use	1	2	3	4	5
4. I think that I would need the support of a technical person to be able to use this system	1	2	3	4	5
5. I found the various functions in this system were well integrated	1	2	3	4	5
6. I thought there was too much inconsistency in this system	1	2	3	4	5
7. I would imagine that most people would learn to use this system very quickly	1	2	3	4	5
8. I found the system very cumbersome (e.g. awkward, difficult) to use	1	2	3	4	5
9. I felt very confident using the system	1	2	3	4	5
10. I needed to learn a lot about this website before I could effectively use it.	1	2	3	4	5

Program Satisfaction Questionnaire (PSQ)

Please answer the following questions regarding the ACT Daily mobile app.

1. Overall, I was satisfied with the quality of the app.
 - a. Strongly disagree
 - b. Mostly disagree
 - c. Slightly disagree
 - d. Slightly agree
 - e. Mostly agree
 - f. Strongly agree
2. The app was helpful to me
 - a. Strongly disagree
 - b. Mostly disagree
 - c. Slightly disagree
 - d. Slightly agree
 - e. Mostly agree
 - f. Strongly agree
3. The app was easy to use
 - a. Strongly disagree
 - b. Mostly disagree
 - c. Slightly disagree
 - d. Slightly agree
 - e. Mostly agree
 - f. Strongly agree
4. I felt the app was made for someone like me
 - a. Strongly disagree
 - b. Mostly disagree
 - c. Slightly disagree
 - d. Slightly agree
 - e. Mostly agree
 - f. Strongly agree
5. I would like to use the app again in the future
 - a. Strongly disagree
 - b. Mostly disagree
 - c. Slightly disagree
 - d. Slightly agree
 - e. Mostly agree
 - f. Strongly agree

6. I think the app would be helpful for other clients waiting for therapy
 - a. Strongly disagree
 - b. Mostly disagree
 - c. Slightly disagree
 - d. Slightly agree
 - e. Mostly agree
 - f. Strongly agree
7. I would recommend the app to a friend who was struggling
 - a. Strongly disagree
 - b. Mostly disagree
 - c. Slightly disagree
 - d. Slightly agree
 - e. Mostly agree
 - f. Strongly agree
8. I would recommend my therapist use this app with other clients like me
 - a. Strongly disagree
 - b. Mostly disagree
 - c. Slightly disagree
 - d. Slightly agree
 - e. Mostly agree
 - f. Strongly agree
9. The app helped me to work on things that I learned in the web-based ACT training
 - a. Strongly disagree
 - b. Mostly disagree
 - c. Slightly disagree
 - d. Slightly agree
 - e. Mostly agree
 - f. Strongly agree

Free Response Questions – *post only*

1. What was the most important thing you learned from the ACT Daily app?

2. What did you like best about the app?

3. What did you like least about the app? Why did you like this the least?

4. Do you have any other comments or suggestions regarding our ACT Daily app?

30-Minute Post Phone Interview Questions

What they liked and didn't like

1. What did you think of the program?
2. What did you like about the program and why?
3. What didn't you like and why?
4. Were there any exercises, metaphors or other content that you found particularly helpful? What were they?
5. Were there any parts that you found particularly unhelpful? What were they?
6. What parts of it seemed particularly engaging?
7. What parts weren't very engaging?
 - a. What could we do to make it more engaging?

Who and how would this be effective

1. Do you think the program would be effective for people with depression or anxiety?
 - a. What parts of the program seemed to be especially effective?
 - b. Which parts seemed to be less effective?
 - c. What could we do to make it more effective?
2. How well did you feel you already knew these skills? Are you new to therapy?
3. Do you think the program would be helpful for clients learning acceptance and mindfulness skills? In what ways? How could it be improved to meet that goal?
4. Do you think this app would be helpful for someone who is depressed or anxious but not in therapy as a stand-alone program? What about someone who is currently in therapy?
5. Do you think the program was appropriate for people from a diverse range of cultures (race, ethnicity, sexual orientation, etc...)?
 - a. Were there any parts that seemed especially culturally inappropriate?
 - b. What could we do to make it more culturally appropriate?"

6. Do you feel that the web-based training during the first session prepared you enough to use the app well?
 - a. If not, how could we improve it?
 - b.

What features did they use in the app and what were their experiences with it

1. Did you use the browse skills feature or quick skills more from the assessment page?
2. Did you notice that the quick skills were tailored based on your assessment?
3. What were your reactions to completing this assessment regularly? Did the questions all make sense? Were they useful? Was anything missing from them?
4. Did the prompting from the app work well? Would you want anything to be different about the prompts?
5. How time consuming was the mobile app to use? (how often/for how long did you use it each day?)
6. What parts of the program were more confusing and/or difficult to use?
7. Was the in-person meeting where you were oriented to how to use the app helpful?
8. Was there anything else you wish you knew before you started using the app that would have improved your experience with it?
9. Did you use the post assessment button when you completed sessions? What were your experiences with that?
10. Did you know you could end a session without completing a skill?
11. What else would you want this app to include to make it more helpful for you?

Look and feel and technical issues

1. “What did you think of the overall layout of the mobile app? Is there anything that didn’t work well for you or that you think we should change?”
2. “What did you think of the overall appearance and graphics for the mobile app? Is there anything that didn’t work well for you or that you think we should change?”

3. “Have you ever experienced any unexpected closing while using this mobile app?”
4. “Have you ever experienced any slow loading while using this mobile app?”
5. “Have you ever experienced any technical issues while using this app?”

Last question: Any other feedback we haven't covered yet?

Appendix E
Recruitment Materials



Test out a new **mobile app** for *depression & anxiety* and be entered to win a **\$100 giftcard!**

In order to be eligible you must:

- Have **received this flyer from a therapist** at USU's Counseling and Psychological Services (CAPS)
- Be on the **CAPS waiting list** for **at least 2 weeks** (2 weeks before your first scheduled appointment with a CAPS therapist)
- Be **18 years** of age or older
- Be **clinically stable** (i.e., not actively suicidal)
- Be **fluent in English**
- **Currently attend USU**



Receive quick, tailored interventions based on daily check-ins



Listen to mindfulness recordings and connect with your values

Participation will involve:

- Completing an **initial assessment** and getting **oriented** on how to use the app **in our lab at USU**
- Using the mobile app **daily for 2 weeks**
- Completing a **second online assessment** and **30-minute phone interview** regarding experiences with the app



How do I sign up?

Email Jack Haeger at: _____

Jack.Haeger@aggiemail.usu.edu.

or call: 970-343-4450

Please note that participation is completely voluntary and will not affect treatment with your therapist in any way.

Figure E1. ACT Daily flyer.

The image displays two versions of a recruitment survey form. On the left is the desktop version, and on the right is the mobile version. Both versions feature the following text: "If you are interested in participating in the **ACT Daily research study**, please enter your information below. Mr. Jack Haeger, the study coordinator, will contact you to follow up about potentially participating in the study." Below this text are three input fields: "Full name:", "Email Address:", and "Phone number:". The desktop version includes a green button with a right-pointing arrow at the bottom right and the text "Powered by Qualtrics" at the bottom center. The mobile version is shown within a smartphone frame, with a status bar at the top displaying signal strength, Wi-Fi, and 100% battery. A QR code is visible in the top right corner of the mobile frame.

Note. Screenshot of the Qualtrics-based ACT Daily recruitment survey with an image of the full website on the left and the mobile version on the right.

Figure E2. ACT Daily recruitment survey.