

A randomized dismantling trial of the open and engaged components of acceptance and commitment therapy in an online intervention for distressed college students

Highlights

- Compared Full ACT website to Open components-only, Engaged-only, or waitlist
- All 3 ACT conditions improved mental health symptoms relative to waitlist
- Open condition equivalent to waitlist on reliable change and positive mental health
- Full ACT improved more than Engaged or Open on cognitive fusion

Abstract

This dismantling trial compared the effects of a full online Acceptance and Commitment Therapy (ACT) intervention to the isolated effects of the Open (i.e., acceptance, cognitive defusion) and Engaged (i.e., values, committed action) components of ACT. A sample of 181 distressed college students were randomized to one of four conditions: a 12-session full ACT website (Full), a version targeting the Open components (Open), a version targeting the Engaged components (Engaged), or waitlist. Participants in active conditions were also randomized to receive phone coaching or just email prompts to increase program adherence. All three ACT conditions significantly improved over time relative to the waitlist condition on the primary outcome of mental health symptoms. The Engaged and Full conditions had greater rates of reliable change on the primary outcome relative to waitlist, but not the Open condition. Similarly, only Engaged and Full conditions improved on positive mental health relative to waitlist. The Full condition had greater improvements on a few ACT process measures relative to Engaged and Open conditions, particularly cognitive fusion. Overall, results indicate targeting only the Open components of ACT was somewhat less effective, and that including both the Open and Engaged components led to greater decreases in cognitive fusion.

Keywords: Acceptance and commitment therapy; mindfulness; values; dismantling; eHealth; College student mental health.

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Evaluating the treatment components underlying cognitive behavioral therapies (CBTs) is critical for a progressive science of behavior change. Component research can lead to improved efficiency by identifying inert or unnecessary components (possibly making treatment simpler or shorter), and improved efficacy by identifying components that may be emphasized or added to protocols. Beyond these more proximal treatment development goals, component research can serve longer term knowledge development by challenging and refining the underlying theoretical models for how to bring about meaningful clinical outcomes. Such an approach makes it possible to develop a more refined understanding of how a treatment works (including the specific components and processes of change that impact outcomes) rather than simply knowing whether a multicomponent treatment protocol is efficacious. Over time, component research could support a more process-based approach to therapy in which components matched to therapeutic processes can be applied to given presenting problems (Hofmann & Hayes, 2019).

One CBT that has received considerable attention at the level of treatment components and processes of change is Acceptance and Commitment Therapy (ACT; Hayes et al., 2012). ACT is a modern CBT, which based on the psychological flexibility model (Hayes et al., 2006), includes a combination of treatment components seeking to alter the impact of maladaptive, internal sources of behavioral regulation such as experiential avoidance and cognitive fusion (through acceptance and cognitive defusion, also called the “Open” components; Hayes et al., 2011) and to increase more adaptive sources of behavioral regulation (through values and committed action, also called the “Engaged” components; Villatte et al., 2016). ACT also includes components targeting flexible attention to the present moment and a flexible sense of

self, called self-as-context (the “Aware” components; Hayes et al., 2011). These Aware components are highly overlapping with other ACT components and are part of the broader foundation and context in which therapy occurs (e.g., attending to internal experiences is necessary to develop openness, attending to the present supports identifying and engaging in valued activities; Villatte et al., 2016).

The components of ACT have been extensively evaluated in laboratory-based studies, with results indicating their isolated efficacy on proximal laboratory outcomes (Levin et al., 2012). Similarly, the combination of these components within ACT protocols has been found effective for a wide range of clinical presentations in over 300 randomized controlled trials (RCTs; ACBS, 2019; A-Tjak et al., 2015). Mediation analyses further indicate that clinical improvements through ACT are accounted for by processes of change closely connected to the underlying treatment components (Hayes et al., 2006; Twohig & Levin, 2017) including overall psychological inflexibility (e.g., Twohig et al., 2015), and more specific processes including acceptance (e.g., Levin et al., 2017), cognitive defusion (e.g., Zettle, Rains & Hayes, 2011), and values (e.g., Gloster et al., 2017).

However, neither research on the isolated components of ACT or on full ACT protocols addresses the critical question of whether all of the components of ACT are necessary to produce meaningful clinical outcomes. It may be that some of the components of ACT are redundant and not needed to produce meaningful outcomes, or even to engage targeted processes of change. There is a long list of surprising findings from dismantling and mantling studies of other CBTs indicating that adding or removing components theorized to be critical does not change outcomes (e.g., Dimidjian et al., 2006; Newman et al., 2011; Schmidt et al., 2000). Furthermore, ACT is differentiated in part from some other modern CBTs through its focus on both

acceptance/mindfulness and behavior change methods, which can be contrasted with other evidence-based therapies that only emphasize acceptance/mindfulness (e.g., Mindfulness-Based Therapies; Hofmann et al., 2010) or behavior change (e.g., Behavioral Activation; Ekers et al., 2014). Direct research is needed evaluating the efficacy of the acceptance and behavior change components of ACT in isolation versus their combination.

Despite the plethora of component and process research on ACT, there have been very few studies to-date directly comparing ACT components within a treatment context (e.g., *citation removed for blind review*; Villatte et al., 2016). In a multiple-baseline study, a sample of 15 adults seeking treatment for a mental health concern were randomly assigned to either receive in-person therapy focusing on the Open components of ACT (cognitive defusion, acceptance) or the Engaged components of ACT (values, committed action; Villatte et al., 2016). Of note, Aware components were integrated within both the Open and Engaged conditions, but in the context of targeting distinct ACT processes (e.g., present moment awareness of difficult thoughts and feelings versus valued action). Results indicated that the ACT components functioned differently, with participants receiving the Open components improving on mental health symptoms, acceptance, and defusion more than Engaged, while participants in the Engaged condition improved more on quality of life and valued action. Although results suggested that these ACT components function differently in ways consistent with the underlying theoretical model, they do not yet determine whether treatment is more effective when including the combination of these components in a full ACT protocol.

Based in part on the Villatte et al. (2016) study, we conducted a pilot evaluation comparing web-based versions of ACT that include Full ACT, only the Open, or only the Engaged components (*Citation removed for blind review*). As in prior research (Villatte et al., 2016), the

Aware components naturally overlapped across conditions. Such online research, in which the intervention is delivered in an automated format, allows for a highly replicable, controlled evaluation of specific treatment procedures without the added variability introduced by in-person therapy. Furthermore, once a website is created, there are minimal costs per end user, thus offering a more cost effective, feasible pathway for conducting dismantling research, which typically requires substantial resources.

The initial pilot trial included a small sample of 55 adults seeking help for a mental health concern in order to test feasibility of the three ACT websites. The majority of participants actively engaged in each website condition, although only about a third completed the full program. All conditions showed medium to large improvements on psychological distress and ACT process measures. Although the study was underpowered to detect differential effects, a significant time by condition effect was found indicating that the Full ACT website led to greater improvements than Open or Engaged versions on psychosocial functioning. Overall, this pilot suggests the promise of evaluating ACT components in an online format, and for the specific websites tested in the current study. However, findings were limited due to the lack of a waitlist comparison, low program engagement, and a small, heterogeneous sample of adults interested in mental health resources.

The current dismantling trial sought to compare web-based versions of ACT targeting the Open components, the Engaged components, or Full ACT, relative to a waitlist condition, with a sample of 181 university students reporting elevated distress. To increase program engagement, participants assigned to an ACT website were also randomized to receive phone coaching or just email prompts. We predicted that all three ACT conditions would produce greater effects on mental health relative to the waitlist, but that the Full condition would have greater

improvements than the Open or Engaged conditions. We also predicted that the ACT conditions would produce differential effects based on their relevant processes of change: Open and Full would produce greater effects on acceptance and cognitive fusion relative to Engaged and waitlist, while Engaged and Full would produce greater effects on values and committed action relative to Open and waitlist.

Methods

Participants

The final study sample consisted of 181 college students who met inclusion criteria: 18 years of age or older, a current college student, interested in testing a web-based mental health program, and meeting at least one cutoff for clinically significant distress on the 34-item version of the Counseling Center Assessment of Psychological Symptoms (CCAPS-34; Center for Collegiate Mental Health, 2012). Potential participants were excluded if they endorsed significant suicidal or homicidal ideation (as indicated by a score > 2 on the relevant CCAPS-34 items). Initially 182 eligible students were enrolled in the study, but one participant was removed from all analyses due to condition contamination (see Figure 1 for a participant flow diagram).

Participants were young ($M = 22.27$, $SD = 5.08$) and mostly female (72.4%, compared to 25.4% male and 2.2% other). The sample primarily identified as White (92.8%, compared to 3.9% Asian, 1.1% Black/African American, 1.1% American Indian/Alaska Native, 0.6% Native Hawaiian/Pacific Islander, and 2.8% other; participants could select multiple options). Most participants also reported a non-Hispanic/Latinx ethnicity (92.3%, compared to 7.7% Hispanic/Latinx). A number of participants were in their first year of college (29.3%), but year in college was relatively well distributed in the sample (25.4% in their second year, 21.0% in their third year, 9.4% in their fourth year, 6.6% in their fifth year or higher, and 8.3% in graduate

school). There were no exclusion criteria regarding concurrent treatment, and a subset of participants reported recently seeing a therapist (26%) or taking psychiatric medication (29.8%) over the past 6 weeks at baseline.

There were some incentives for participation. Participants could receive course credit and/or extra credit through the SONA research participation platform for participating in this study (specifically for completing the surveys, with no incentives for engaging in the intervention). Participants were also entered into raffles for one of three \$90 gift cards after completing the posttreatment and follow-up surveys. However, most participants reported that they chose to participate to address a psychological problem and/or distress (70%), although some students did participate primarily to obtain research participation credit (27%) or for another reason (3%).

All participants reported elevated distress on one or more subscales of the CCAPS at baseline based on established cutoff scores for college students (CCMH, 2012). Rates of elevated scores for subscales were 54% for depression, 49% social anxiety, 46% general anxiety, 34% academic distress, 28% eating concerns, 15% hostility, and 6% alcohol abuse.

Procedures

Participants were recruited through a variety of methods at a single mid-sized university in the Mountain West region of the United States between March 2016 and March 2018. In collaboration with the University Division of Student Affairs, recruitment materials were distributed widely to students through website postings, email announcements, class announcements, flyers, and referrals from the counseling center. The study was also posted on the SONA platform for relevant courses offering research credits and on the laboratory website maintained by the authors, which listed a variety of online and related self-help studies.

Those who expressed interest in participating were screened for eligibility (based on the inclusion/exclusion criteria) over the phone by a research assistant. Those who were eligible were then sent a link to an online informed consent document. The informed consent and all subsequent surveys were hosted on Qualtrics, a secure web-based survey platform. Those who consented to participate were automatically guided to an online baseline survey. At the end of the baseline survey, participants were automatically randomly assigned by Qualtrics to one of four conditions (waitlist, Open website, Engaged website, or Full website). The allocation ratio was equal across conditions (1:1:1:1), with ongoing randomization occurring in blocks of 24 participants to ensure equal allocation over time. In other words, participants were randomized immediately after completing the baseline assessment, but a counter was used to ensure exactly 6 participants were randomly assigned to each condition over a course of 24 participants enrolling in the study, at which point the block was reset. Those who were assigned to an ACT condition were also randomly assigned by Qualtrics to either receive phone coaching to increase website adherence or just receive email prompts. An equal (1:1) allocation was used within the Qualtrics block randomization to ensure over time that 3 participants were randomly assigned to coaching and 3 to email prompts within each active condition (Full, Engaged, Open) across a course of each 24 enrolled participants.

Participants assigned to one of the ACT website conditions were then asked to complete online sessions each week for the next six weeks. Approximately six weeks after completing the baseline survey, all participants were sent an online posttreatment survey. Ten weeks after completing the baseline survey (four weeks after the posttreatment survey), all participants were sent a final follow-up survey. After completing this survey, waitlisted participants were given

access to the Full version of the website. If participants did not complete surveys promptly, they were sent up to five reminders approximately two to four days apart.

Intervention conditions

Each ACT website was accessed through a landing page hosted on Weebly, a website development platform. The landing page allowed participants to access any session in their intervention condition and to track their progress by checking which sessions they had already completed. The actual intervention sessions and the progress tracker were hosted on Qualtrics. Although Qualtrics is primarily a survey platform, it has sophisticated design features that allow researchers to rapidly develop interactive, multi-component online intervention sessions with an engaging user interface. Online ACT programs delivered through Qualtrics have been found to be effective and engaging to users in several previous trials, including the three ACT websites tested in the current study (e.g., *Citation removed for blind review*). The website sessions could be accessed online through a computer or smartphone. Sessions were designed to be accessed in order, and participants were encouraged to complete them in order, although they were able to access all sessions at any time after their initial assignment to condition.

Each ACT condition consisted of 12 self-guided online sessions that participants were asked to complete over six weeks. These sessions were designed to be brief, requiring approximately 15-30 minutes to complete. This bi-weekly design with brief sessions was selected based on feedback from previous trials indicating participants disliked lengthier weekly sessions (45-60 minutes once a week; *Citation removed for blind review*). Session content was presented primarily through text and interactive exercises. The majority of pages included an interactive element to teach or apply ACT concepts and skills. Interactive elements included worksheets with responsive feedback (e.g., identifying the costs of user-identified experiential

avoidance strategies, goal setting with a review of criteria for SMART goals), writing exercises (e.g., writing why a value is personally relevant to you), “choose your own adventure” exercises with ACT metaphors where users can see the effects of various choices, and a variety of other targeted exercises (e.g., values card sorting exercise, defusion exercises where users interact in various flexible ways with a self-generated thought). These interactive elements made heavy use of tailoring based on user responses and carrying forward user responses into future content. Sessions also included some use of video content and audio content (the latter primarily for audio-guided mindfulness exercises).

Website content was developed by ACT experts based on existing, empirically validated ACT protocols and online ACT programs (*Citation removed for blind review*). All website sessions followed a similar structure: an initial overview of what the session covered, followed by an introduction of the core skill/concept for the session, then a series of metaphors and/or exercises to help participants learn the skill/concept and apply it to their life, and finally a homework exercise and summary of the session, which was customized to include individual responses through the use of piped text (i.e., text “carried forward” from user data entered in previous exercises). Homework assignments involved practicing the core skill learned in the session to support generalization. For example, one defusion session concluded by encouraging participants to “practice stepping back from thoughts” with the option to set a goal to either practice a thought labeling or “leaves on a stream” meditation exercise.

Additional contact to increase program engagement. All participants assigned to use an ACT website were sent regular email prompts with the website link at least once a week to support engagement. Those who fell behind (i.e., completed sessions less than every three to four days) were sent email reminders to complete sessions, approximately every two to four days.

Half of participants assigned to a website condition also received phone coaching (by random assignment), which targeted increasing adherence to the assigned website. Coaches were two doctoral students in clinical/counseling psychology. The coaching protocol was developed by a licensed clinical psychologist (the first author), adapted from an established protocol for phone coaching to support adherence to web-based interventions (Duffecy, Kinsinger, Ludman, & Mohr, 2011) based on the supportive accountability model (Mohr, Cuijpers, & Lehman, 2011). The supportive accountability model posits that coaches can support adherence to interventions by establishing a bond and demonstrating expertise, benevolence, and reciprocity, which provide a basis for accountability. Accountability is established through clear expectations, goal setting, and monitoring.

The phone coaching procedure consisted of an initial, 10-15 minute phone call and 5-10 minute follow-up phone calls approximately every week during the six-week intervention period. The initial phone call focused on establishing the coach as a legitimate and benevolent figure, collaboratively establishing expectations for phone coaching and use of the program, eliciting motivation to adhere to using the program, and establishing an initial goal for using the program. Subsequent phone calls focused on reviewing and reinforcing use of the program, collaboratively problem-solving to address barriers to program use that may have been encountered, enhancing motivation to use the program as needed, and setting new goals to use the program for the following week. Phone coaching explicitly excluded introducing new intervention content or otherwise engaging in therapeutic interactions except as they applied to increasing adherence to using the website (e.g., problem solving barriers to non-adherence, reinforcing adherence).

Full ACT condition. The Full ACT website was designed to target the combination of Open, Engaged, and Aware components, the latter of which were included primarily in the

context of acceptance, defusion, and values strategies (see “Overlapping aware components” section). The sequence was based on a common approach used in ACT protocols (Hayes, Strosahl & Wilson, 1999) in which the first set of sessions target experiential avoidance and cognitive fusion through primarily acceptance and defusion processes (in combination with Aware components), followed by later sessions targeting values clarification and committed action (in combination with Aware components). Sessions 1-6 focused on the Open components of ACT including: 1) noticing experiential avoidance and its short-term and long-term impacts, 2) introducing acceptance as an alternative and teaching how to break experiential avoidance patterns, 3) treating unwanted internal experiences as “passengers on the bus,” a part of one’s experience that does not have to determine action, 4) identifying cognitive fusion and its negative effects, 5) practicing meditation exercises to defuse from thoughts, and 6) defusing from thoughts with brief skills (e.g., labeling it, saying it backwards). Session 7-12 focused on the Engaged components of ACT including: 7) identifying personal values, 8) connecting values to qualities of action, 9) exploring and discovering new values, 10) setting SMART goals, 11) learning how to make commitments, and 12) noticing when one drifts from commitments and recommitting.

Open (acceptance and defusion) condition. The Open condition included the same set of six acceptance and defusion focused sessions included in the Full intervention. In order to balance active conditions in terms of dosage, six additional sessions were created for the Open condition to similarly target the Open components of ACT including 1) practicing acceptance of emotions in the present, 2) attending to the functions of emotions (i.e., what they are telling you), rather than avoiding emotions, 3) engaging in “bold moves” to practice acceptance of emotions, 4) distancing oneself from one’s mind through the use of metaphors, 5) defusing from

judgments, and 6) defusing from rigid self-stories. Thus, the Open condition was matched with the Full and Engaged conditions on number of sessions, but without any sessions that included Engaged components of ACT.

Engaged (values and committed action) condition. The Engaged condition similarly consisted of the six values and committed actions sessions that were in the Full ACT website, with six additional sessions created to further target the Engaged components of ACT. These new sessions included 1) learning strategies to connect with one's values, 2) using values to guide choices, 3) focusing on the process of valued activity rather than its outcomes, 4) connecting values to actions and goals, 5) identifying and addressing practical, external barriers for goals, and 6) building valued habits.

Overlapping aware components. All three ACT conditions included aspects of the Aware components of ACT. Flexible attention to the present moment from an observing self perspective (i.e., self-as-context) provide the foundation for implementing many ACT techniques and delivering ACT-adherent Open and Engaged components. The specific Aware strategies used did not overlap directly between the Open and Engaged conditions. For example, Open sessions included present moment-based meditation exercises (e.g., leaves on a stream, mindfulness of emotions), strategies to practice acceptance and defusion in the present (e.g., how to identify and label emotions in the present, how to identify fusion in the moment), and defusion from "self stories." Similarly, the Engaged sessions included meditative exercises focused on connecting with values (e.g., the sweet spot exercise), strategies to connect with values in the present (e.g., how to identify when connected or disconnected with your values, practicing savoring with meaningful activities), and differentiating chosen values from "self stories" regarding what one should be doing.

Outcome Measures

Mental Health Symptoms. The total distress score from the 34-item CCAPS (Locke et al., 2011) was included as the primary outcome measure of mental health symptoms. The CCAPS assesses a range of mental health concerns relevant to college student populations including depression, general anxiety, social anxiety, academic distress, and hostility, which can be calculated into a total index of distress. Items on the CCAPS are rated on a 5-point scale from 0 to 4, with higher numbers indicating higher levels of distress. The CCAPS has been found to have good reliability and validity in past studies with both non-clinical and distressed college students (CCMH, 2012). In the current study the CCAPS total distress score had good internal consistency ($\alpha = .88$).

Positive Mental Health. The Mental Health Continuum – Short Form (MHC-SF; Keys et al., 2008) was included as a secondary outcome measure of positive mental health. This 14-item measure assesses emotional well-being, psychological well-being, and social well-being (Keys et al., 2008). Items are rated on a 6-point scale, with higher scores indicating more positive mental health. The MHC-SF has been validated and shown to have strong reliability with a variety of samples (e.g., Keys et al., 2008; Lamers et al., 2011), with excellent internal consistency in the current study ($\alpha = .92$).

Process of Change Measures

Psychological Inflexibility. The Acceptance and Action Questionnaire-II (AAQ-II; Bond et al., 2011) is a 7-item measure of psychological inflexibility, the overarching pathological process targeted by each component of ACT in which behavior is rigidly governed by internal experiences rather than direct contingencies or values. This measure was expected to improve in each ACT condition, although potentially with larger effects for the Full condition. The AAQ-II

items are rated on a 7-point scale, with higher scores indicating higher levels of psychological inflexibility. The AAQ-II has demonstrated adequate validity and reliability in a variety of samples including college students (Bond et al., 2011) with good internal consistency in the current study ($\alpha = .86$).

Cognitive Fusion. The Cognitive Fusion Questionnaire (CFQ; Gillanders et al., 2014) measures cognitive fusion, a component of psychological inflexibility that is targeted through the Open components of ACT. This measure was expected to improve to a greater extent in the Open and Full conditions relative to the Engaged condition, which did not include a cognitive defusion component. Each item is rated on a 7-point scale, with higher scores indicating higher cognitive fusion. The CFQ has been shown to have good validity and reliability with samples including college students (Gillanders et al., 2014), with good internal consistency in the current study ($\alpha = .93$).

Acceptance. The 10-item acceptance subscale of the Philadelphia Mindfulness Scale (PHLMS; Cardaciotto et al., 2008) measures the acceptance process targeted by the Open components in ACT. This measure was expected to improve to a greater extent in the Open and Full conditions relative to the Engaged condition, which did not include an acceptance component. Each item is rated on a 5-point scale, with higher scores indicating higher levels of acceptance. The PHLMS has demonstrated adequate reliability and validity with a variety of samples (Cardaciotto et al., 2008) and good internal consistency in the current study ($\alpha = .87$).

Values. The Valuing Questionnaire (VQ; Smout et al., 2014) measures values, which are specifically targeted through the Engaged components of ACT. This measure was expected to improve to a greater extent in the Engaged and Full conditions relative to the Open condition, which did not include values. The VQ includes two distinct subscales that assess progress in

valued living (i.e., the degree to which one is engaging in meaningful activities) and obstruction to valued living (i.e., the degree to which internal experiences are barriers to meaningful activities). The VQ has been found to have sufficient reliability and validity amongst college students (Smout et al., 2014), with good internal consistency in the current study (VQ Progress $\alpha = .81$; VQ Obstruction $\alpha = .80$).

Committed Action. The 8-item Committed Action Questionnaire (CAQ; McCracken & Norton, 2015) was used to measure committed action as the other process targeted through the Engaged components of ACT. This measure was expected to improve to a greater extent in the Engaged and Full conditions relative to the Open condition, which did not include committed action. Each item was rated on a 6-point scale such that higher scores indicate greater committed action. The CAQ has been shown to have adequate validity and reliability (McCracken & Norton, 2015) and had good internal consistency in the current study ($\alpha = .85$).

Program Acceptability. The 10-item System Usability Scale (SUS; Brooke, 1996) was used to assess program acceptability. The SUS is a gold-standard measure of usability that has been widely used to assess programs within and outside of health contexts, showing strong reliability and validity (Bangor, Kortum & Miller, 2008). The SUS had adequate internal consistency in the current study ($\alpha = .76$).

Data Analysis Plan

Participants were recruited over two years (from 2016 to 2018). The resulting sample size of 181 participants was not an a priori defined target sample size, but rather represented the sample feasibly recruited over the available two year recruitment window for the study. This sample size provided adequate power (.80) to detect a time by condition Cohen's d effect size of

.22 at a $p < .05$, with three time points and four conditions, and a medium effect size ($d = .60$) between two conditions (with $n = 45$ per condition) at a given time point.

Preliminary analyses included checking skewness and kurtosis for each outcome and process variable. Rates of missing data were compared between conditions using chi-square tests. Chi-square and analysis of variance (ANOVA) were used to test for baseline differences in categorical and continuous variables by condition, respectively.

Descriptive statistics on program usage (i.e., the count of online sessions completed) were used to characterize participant engagement, with usage rates compared between conditions through ANOVA and chi-square tests. Descriptive statistics on self-reported program usability were used to characterize program acceptability, with differences on acceptability between conditions examined through one-way ANOVA.

Mixed models repeated measures analyses of covariance (MMRM) were used to examine changes in the primary outcome (CCAPS), secondary outcome (MHC-SF), and process of change measures (AAQ-II, CFQ, PHLMS, VQ, CAQ). Each MMRM analysis included 3 within-subjects measurements (pre, post, and follow-up) and 4 between-subjects conditions (Open, Engaged, Full, and Waitlist). Covariates in the analyses included any baseline measures and demographic variables identified as differing significantly across conditions. Significant omnibus time by condition effects were further examined with post hoc analyses to clarify where there were differences between conditions on a given variable. Planned contrasts tested the extent of change over time between each pair of conditions and time points (pre to post, pre to follow up). Effect size estimates were used to quantify the magnitude of significant differences. Missing data in the SPSS MMRM algorithm was handled through a restricted-information maximum likelihood estimation procedure. This approach to missing data modeling accounts for

correlations among repeated measurements within subjects and relies on the multivariate distribution of observed variables to arrive at a hypothetical covariance structure for the full data set. Maximum likelihood estimation is preferred over traditional imputation techniques for missing data, such as last observation carried forward or multiple imputation under normal assumptions (Black, Harel, & McCoach, 2010; Enders, 2012).

Reliable change indices (RCIs) were computed for the CCAPS distress index score, such that participants received a binary score of 0 = nonsignificant change or 1 = clinically significant change based on previously established cutoffs (CCMH, 2012). The frequencies of clinically significant change from pre- to post-assessment within each condition were then compared using chi-square tests.

Results

Preliminary analyses

In terms of missing data, 89% of the sample completed the posttreatment assessment and 85% of the sample completed follow up (see Figure 1). There were no differences in rates of missing data between conditions. None of the process or outcome variables were highly skewed or kurtotic at any time point.

ANOVA and chi-square tests examined baseline differences between conditions on outcome, process, and demographic variables (see Tables 1 and 2). There was a significant difference between conditions on baseline positive mental health (MHC-SF; $F[3,177] = 3.09, p = .028$). Post hoc analyses indicated that the Open condition had significantly higher baseline positive mental health than either the Engaged ($M_{diff} = 7.25, p = .009$) or Full conditions ($M_{diff} = 6.31, p = .023$). Significant differences were also found between conditions on ethnic minority status ($\chi^2[3, N = 181] = 11.44, p = .010$) and recent therapy or psychiatric medication ($\chi^2[3, N =$

181] = 10.32, $p = .016$). There were more non-White and Hispanic/Latinx participants in the Engaged (24%) and Full conditions (22%) relative to the Open (7%) and waitlist conditions (4%). There were more participants receiving recent therapy or medication in the Engaged (41%) and waitlist (40%) relative to the Full (18%) and Open conditions (20%). Thus, baseline positive mental health, minority status, and recent therapy/medication were included as covariates in subsequent MMRM analyses testing for between-condition effects over time.

Program Usage and Acceptability

The average number of sessions completed in each condition (out of a possible 12) were 9.22 for Open ($SD = 3.39$), 7.57 for Engaged ($SD = 4.10$), and 8.51 for Full ($SD = 3.97$). An ANOVA comparing these three conditions was non-significant ($p > .10$), but a post hoc comparison indicated participants in the Open condition completed more sessions than the Engaged condition ($M_{diff} = 1.66$, $SE = .83$, $p = .048$). There was no difference between conditions on the rate of participants who completed all 12 sessions (53% Open, 37% Engaged, 42% Full) or the rate who completed half (6/12) of the sessions (84% Open, 67% Engaged, 73% Full).

Participants reported high program acceptability based on the SUS (Open $M = 87.06$, $SD = 8.79$, Engaged $M = 85.26$, $SD = 8.79$, Full $M = 85.63$, $SD = 10.30$). A SUS score between 85 and 87 is in the “excellent” rating range based on established benchmarks (Bangor et al., 2008) and is equal to ratings we have found in previous professionally developed online ACT programs for college students ($M = 84.55$ and $M = 85.14$; *Citation removed for blind review*). There was no difference between conditions on SUS scores.

Outcome Analyses

A MMRM analysis tested for an overall time by condition effect on the primary outcome of mental health symptoms (CCAPS) between all four conditions and over three time points (pretreatment, posttreatment, follow up), while controlling for baseline differences in MHC-SF, ethnic minority status, and recent treatment as covariates (see Tables 2 and 3). A significant time by condition effect was found, with post hoc analyses indicating medium to large effect sizes for each ACT condition improving mental health relative to waitlist from pretreatment to posttreatment and pretreatment to follow up. There were no differences on mental health symptom improvement between ACT conditions.

Rates of improvement from pretreatment to posttreatment were calculated for the CCAPS total distress score based on published RCI cutoffs (CCMH, 2012). Rates of reliable improvement were significantly lower for the waitlist condition (17%) relative to the Full condition (40%; $\chi^2 = 5.23, p = .02$) and the Engaged condition (46%; $\chi^2 = 7.87, p = .005$). Rates of reliable change in the Open condition (27%) did not significantly differ from either the waitlist or other ACT conditions ($p > .10$).

A significant time by condition effect was also found for the secondary outcome of positive mental health (MHC-SF; see Tables 2 and 3). Significant medium effect sizes were found for the Full and Engaged condition relative to the waitlist from pretreatment to posttreatment and pretreatment to follow up. However, there were no significant differences between the waitlist and Open conditions. Furthermore, there was a significant medium effect size for participants in the Engaged condition improving more at posttreatment on positive mental health relative to the Open condition. No other differences were found between the three active conditions on positive mental health.

Process of Change Analyses

Another set of MMRM analyses tested for time by condition effects on process of change variables, while controlling for baseline MHC-SF, minority status, and recent treatment (see Tables 2 and 3). There were significant overall time by condition interactions for psychological inflexibility (AAQ-II), cognitive fusion (CFQ), obstruction to valued action (VQ subscale), and acceptance (PHLMS), but not for committed action (CAQ) or progress in valued action (VQ subscale). Medium to large effect sizes were found for each ACT condition from pretreatment to posttreatment and pretreatment to follow up relative to the waitlist. The only two exceptions were that there was no significant difference between the Open and waitlist conditions from pretreatment to posttreatment on psychological inflexibility (AAQ-II) and no difference between the Engaged and waitlist condition from pretreatment to follow up on acceptance (PHLMS).

There were no differences between active conditions from pretreatment to posttreatment on process of change measures. However, from pretreatment to follow up the Full condition improved significantly more than either the Open or Engaged condition on cognitive fusion (CFQ). The Full condition also improved significantly more than the Engaged condition from pretreatment to follow up on acceptance (PHLMS). There were no differences on process measures between the Engaged and Open conditions.

Discussion

This dismantling trial compared a full online ACT intervention to the isolated effects of the Open and Engaged components of ACT in a sample of distressed college students. All three ACT conditions produced equivalent medium to large improvements on the primary outcome of mental health symptoms relative to the waitlist condition. However, only the Engaged and Full conditions demonstrated greater reliable change than the waitlist at posttreatment on this measure. Similarly, only the Engaged and Full conditions improved the secondary outcome of

positive mental health relative to the waitlist. In terms of processes of change, the Full condition had greater effects than either the Engaged or Open condition on cognitive fusion at follow up and greater effects than the Engaged condition on acceptance. Overall, results suggest that delivering the Open components of ACT without the Engaged components produced weaker effects on mental health than ACT websites that included these components. Furthermore, it appears that the combination of ACT components led to greater improvements in some key processes, particularly cognitive fusion and acceptance.

The most notable finding from this dismantling trial was that a website focused on only the Open components of ACT appeared to have a weaker effect on mental health than versions that included the Engaged components. Theoretically, this may indicate that targeting acceptance and cognitive defusion may be less effective absent additional procedures targeting behavior change and motivational processes. This is consistent with the psychological flexibility model underlying ACT in which acceptance and cognitive defusion are means of increasing valued activities (Hayes et al., 2011). It may be that reducing maladaptive, internal sources of behavioral regulation is less effective unless clients are also taught how to identify and engage in valued activities as an alternative. These results are consistent with a previous laboratory-based component study indicating that combining values with acceptance is more effective than acceptance alone (Branstetter-Rost, Cushing, & Douleh, 2009).

That said, there are other potential explanations for these findings including that the Open sessions were simply less effective at targeting relevant processes of change than the Engaged sessions. This is supported by the weaker effect on cognitive fusion in the Open versus Full condition at follow up, despite cognitive fusion being a primary target for the Open components, as well as the lack of effect for the Open condition on psychological inflexibility at posttreatment

relative to the waitlist. Although online ACT has been found efficacious in several studies (Spijkerman, Pots & Bohlmeijer, 2016), prior research has not evaluated the Open components of ACT alone when delivered in a website format. It may be that the Open components of ACT are less effective in a website format due to the experiential nature of acceptance and cognitive defusion, typically delivered in a flexible, fluid, and relational way with a therapist. Although other mindfulness-based treatments that focus only on the Open and Aware components have been found effective when delivered in an online format (Spijkerman et al., 2016), this may be supported by their use of carefully refined meditation exercises that are ideal for a self-guided format. Future research may be needed to further refine the effective delivery of the Open components of ACT when delivered in online formats.

The main difference between ACT conditions on outcomes was for positive mental health. It may be that the Open components alone are insufficient for improving positive psychosocial functioning, but are adequate for addressing psychological symptoms and distress. Theoretically, identifying and engaging in valued activity may be critical for improving positive mental health and functioning (which requires building adaptive behavior patterns), while cognitive defusion and acceptance alone may be sufficient for reducing some forms of psychological distress (which may only require disrupting maladaptive patterns). This is consistent with some previous component research on ACT, finding positive results for improving psychosocial functioning with just the Engaged components (Chase et al., 2013) and for improving psychological distress with just the Open components (Levin et al., 2018). Thus, differences in components may emerge depending on the population being studied and the outcomes of interest. Future research may benefit from evaluating the Open and Engaged components in the context of more specific clinical populations, or based on other variables

relevant to tailoring treatment components, to further examine these effects and to inform clinical decision making.

Surprisingly, this study found that the Full condition did not outperform the Engaged condition on improving mental health. However, the Full ACT condition had greater improvements in cognitive fusion and acceptance than the Engaged condition at follow up. Thus, the Full ACT condition did impact a broader set of ACT processes than the Engaged condition consistent with the inclusion of the Open component sessions. However, including these additional Open components that disrupt maladaptive, internal sources of behavior regulation did not result in greater improvements in mental health.

These findings suggest that in the context of an online intervention for college student mental health the Engaged components of ACT may be sufficient. Although this contrasts with the psychological flexibility model, it is consistent with some other forms of modern CBT such as behavioral activation. It may be that generally among distressed college students, identifying and engaging in valued activities is sufficient to improve mental health, and that students on average do not require additional acceptance and defusion procedures aiming to reduce maladaptive internal sources of behavioral regulation. If replicated, this could inform more targeted online programs and possibly face-to-face interventions for students. Yet, these findings differ somewhat from our previous pilot trial with a general adult sample, in which we found that the Full website outperformed both the Engaged and Open websites on psychosocial functioning (*Citation removed for blind review*). Research is needed to determine if the current findings replicate and generalize outside of college student samples.

One notable limitation in dismantling trials is that they seek to test the average between-group effect of combining versus isolating given treatment components. In other words, these

designs test if adding or excluding a component *generally* improves outcomes or not. This may be useful in answering the question of whether a component is *generally* or *always* needed to improve outcomes. However, such a question may not apply well to the heterogeneous set of pathological processes that may contribute to various idiographic clinical presentations and the resulting challenges posed for clinical decision making. A more apt question proposed in process-based CBT is *when* a given treatment component such as acceptance or values might be indicated for a given client (Hoffman & Hayes, 2019). Although the full set of ACT components may not have been generally needed for improving mental health, there may be moderators such that subsamples benefit more from particular ACT components. Research is needed with a larger sample to test for potential moderating variables that could guide clinical decision making for when to include what ACT components. Similarly, research might focus on more precise units of analysis such as testing within participants what components are needed *at what times* with a given client based on in-the-moment variables (Levin et al., 2019).

Although the expected differences were found between the Full and Engaged conditions on processes of change, other process findings were not consistent with predictions. Notably, the Open and Engaged conditions had equivalent effects on acceptance and cognitive fusion, despite this being the primary focus of the Open condition while not being targeted directly at all in the Engaged condition. It may be that the Open components of ACT are less effective at targeting cognitive fusion and experiential avoidance without also including procedures that establish a motivational context for applying acceptance and defusion to valued actions. For example, cognitive fusion may improve more if clients are taught not only how to defuse from unhelpful thoughts, but also to apply these skills to engage in meaningful activities (providing a context

and motivator for applying defusion). This is evidenced by the Full condition having greater effects on cognitive fusion than both the Engaged and Open conditions.

There was also no overall effect for the two primary Engaged process measures (committed action and progress toward values), and thus no differences found between conditions that included or excluded the Engaged components. Although obstruction to valued action did improve in all three ACT conditions relative to the waitlist, this VQ subscale is more representative of psychological inflexibility broadly, capturing the degree to which valued action is impeded by difficult internal experiences. The findings from this study suggest the Engaged components of ACT primarily worked through general psychological inflexibility processes, rather than more targeted values and committed action processes. Alternatively, it may be that the values and committed action measures used were not sensitive to detecting the effects of an ACT intervention, which has also been found in prior online ACT research with the VQ progress subscale (e.g., Levin et al., 2017).

More generally, this study adds to a growing literature indicating that ACT can be delivered in an online format to improve college student mental health. All of the ACT conditions improved mental health symptoms relative to the waitlist condition. Importantly, this was achieved through a highly scalable online format that can be accessed privately at any time, and is available wherever students may live. Such online resources can potentially circumvent a wide range of barriers students regularly encounter for seeking help such as stigma, time, and access. Online resources are a promising way to improve students' access to mental health services (Lattie, Lisbon & Eisenberg, in press), and dismantling research may serve to improve these resources over time by informing more efficient, targeted interventions.

There were some notable limitations with the current study. Although the study included 181 participants, there were four experimental conditions, which combined with attrition and engagement rates might have limited power to detect differences between active comparison conditions. Due to limited power, the study did not employ any alpha-corrections to adjust for running multiple secondary outcome analyses, which increased the potential for Type I errors. Future research would benefit from a larger sample size and additional methods to increase power (e.g., increasing engagement and retention rates, decreasing within condition variability).

Although this study did require elevated psychological distress for inclusion, it did not specify the form of distress, which introduced heterogeneity in clinical presentations. This may have further reduced statistical power. Furthermore, it may be that the comparative effects of ACT components differ based on clinical presentations, and that differing results for dismantling research may be found based on various client characteristics. Future research is needed in more specific clinical populations as well as research aiming to answer tailoring questions regarding what clinical presentations would benefit from what treatment components.

The present study sample had limited sociodemographic representation. Specifically, participants were largely younger adults, white, non-Hispanic/Latinx, and female-identified, and all participants were college students. This may limit the extent to which findings generalize to individuals in other contexts and with underrepresented social identities in the present sample.

Another limitation is that it is not clear the degree to which the effects of ACT relative to waitlist were due to the self-guided sessions versus contact with a phone coach. Phone coaching specifically focused only on increasing adherence to the online program. However, some previous research does indicate that coach guidance can improve the outcomes of online interventions (Richards & Richardson, 2012), although the literature is mixed (Shim, Mahaffey,

Bleidistel & Gonzalez, 2017). Future research might benefit from testing a purely self-guided intervention to improve experimental control in evaluating ACT components, particularly if a larger sample can be recruited to adjust for the potentially lower program adherence rates. Beyond phone coaching, there are a number of other uncontrolled variables that might account for the effects of the ACT components relative to a waitlist condition (e.g., placebo, demand characteristics). Future research would benefit from including a placebo control condition or other active comparison to further evaluate the efficacy of online ACT. Finally, phone coaching was randomly assigned within each condition to ensure this factor was balanced between ACT conditions. However, this may have introduced additional variability within each ACT condition, which might have reduced statistical power in detecting between condition effects.

The study was limited due to its reliance on self-report measures. Ideally objective measures of psychosocial functioning would be included to evaluate the efficacy of ACT. Furthermore, a greater frequency of process measurement, at least at mid-treatment, would have provided a more refined examination of ACT processes and their causal effect on treatment outcomes. This study may also have been limited with regards to the ACT process measures used. It is unclear the degree to which the included process measures can precisely detect and distinguish between the effects of ACT components engaging separate, but related processes. Furthermore, some measures such as the VQ progress subscale may blend assessment of values as a process and valued action success as an outcome. Future research might benefit from using multidimensional assessments that have been developed to comprehensively assess the distinct ACT processes of change within a single measure (e.g., Multidimensional Psychological Flexibility Inventory; Rolffs, Rogge & Wilson, 2018).

Finally, this study did not include a separate Aware condition and rather integrated the Aware components within each of the other ACT conditions. This is consistent with prior ACT component research in a treatment context (Villatte et al., 2016) in which the Aware components provide the context in which other ACT components are engaged. For example, it is unclear the degree to which acceptance and defusion could be competently delivered in a bona fide way for a course of treatment while excluding attending to these processes in the present moment and relating to internal experiences from an observing self-perspective (i.e., self-as-context). Similarly, it is unclear how the Aware components could be delivered as a full course of treatment without including Open components addressing how to respond to internal experiences that arise. Although the Aware components have been independently tested in laboratory-based studies (e.g., Foody, Barnes-Holmes, Barnes-Holmes & Luciano, 2013), it is unclear how these components alone could be isolated in a credible intervention course involving 12 sessions. This naturally led to a version of an ACT protocol in which the Aware components were introduced in the context of targeting other ACT components, which is consistent with many full ACT protocols, but does reflect a version where self-as-context interventions are less explicitly emphasized. It may be that the full ACT website would have been more impactful relative to the Open and Engaged conditions if the Aware components were more heavily emphasized. Similarly, this design limited the evaluation of the Open and Engaged components when delivered completely alone (without any Aware processes). Future research might further refine and disentangle the effects of the Open, Aware, and Engaged components of ACT, particularly if supported through careful conceptual work that further operationalizes and distinguishes these components for independent comparison in a treatment context.

Overall, this study represents one of the first dismantling evaluations of ACT. Results suggest the Open components of ACT may be less effective without the Engaged components, and that the Engaged components are particularly important for improving college student mental health. Furthermore, including both the Open and Engaged components appears to more effectively target the full range of psychological flexibility processes targeted in ACT, particularly cognitive fusion. More broadly this study offers a potential, feasible pathway for conducting dismantling research on the components of ACT, or other treatments, through online formats.

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Table 1. Participant demographics by condition

Baseline Variable	Waitlist <i>M(SD)</i> or %	Open <i>M(SD)</i> or %	Engaged <i>M(SD)</i> or %	Full <i>M(SD)</i> or %
Age	21.69 (3.28)	21.76 (5.91)	22.33 (4.60)	23.31 (6.05)
Gender				
<i>Female</i>	77.8%	75.6%	69.6%	66.7%
<i>Male</i>	20.0%	22.2%	26.1%	33.3%
<i>Other</i>	2.2%	2.2%	4.3%	0%
Ethnicity				
<i>Hispanic/Latinx</i>	4.4%	4.4%	8.7%	13.3%
<i>Not Hispanic/Latinx</i>	95.6%	95.6%	91.3%	86.7%
Race				
<i>White</i>	97.8%	97.8%	87.0%	88.9%
<i>Asian</i>	0%	0%	10.9%	4.4%
<i>Black/African American</i>	0%	0%	2.2%	2.2%
<i>American Indian/Alaska Native</i>	0%	0%	2.2%	2.2%
<i>Native Hawaiian/Pacific Islander</i>	0%	0%	2.2%	0%
<i>Other</i>	2.2%	2.2%	2.2%	4.4%
Recent therapy or psychiatric medications	40%	20%	41%	18%

Table 2. Estimated marginal means from MMRM controlling for MHC-SF, minority status, and recent treatment.

	Waitlist Condition			Open Condition			Engaged Condition			Pre <i>M (SE)</i>
	Pre <i>M (SE)</i>	Post <i>M (SE)</i>	Follow <i>M (SE)</i>	Pre <i>M (SE)</i>	Post <i>M (SE)</i>	Follow <i>M (SE)</i>	Pre <i>M (SE)</i>	Post <i>M (SE)</i>	Follow <i>M (SE)</i>	
<i>Outcome Measures</i>										
CCAPS	1.75 (.10)	1.54 (.11)	1.57 (.12)	1.84 (.11)	1.25 (.12)	1.11 (.13)	1.71 (.10)	1.03 (.11)	.99 (.12)	1.92 (.10)
MHC-SF	53.76 (2.30)	56.08 (2.36)	55.89 (2.44)	55.11 (2.35)	58.79 (2.41)	61.32 (2.51)	48.39 (2.05)	57.53 (2.13)	58.82 (2.27)	48.32 (2.19)
<i>Process Measures</i>										
AAQ-II	29.68 (1.32)	27.68 (1.39)	27.71 (1.52)	30.57 (1.39)	26.18 (1.45)	24.54 (1.58)	28.28 (1.26)	22.37 (1.35)	22.07 (1.51)	30.81 (1.22)
CFQ	33.91 (1.53)	32.13 (1.60)	30.90 (1.73)	33.39 (1.60)	27.33 (1.67)	25.62 (1.81)	31.93 (1.46)	24.15 (1.56)	24.01 (1.71)	36.18 (1.41)
PHLMS	37.82 (1.37)	37.12 (1.41)	34.32 (1.51)	38.24 (1.43)	30.36 (1.48)	29.96 (1.58)	35.11 (1.31)	29.74 (1.39)	28.38 (1.50)	37.63 (1.27)
VQ-Obs	22.42 (1.00)	21.55 (1.09)	20.25 (1.06)	22.19 (1.05)	17.90 (1.14)	17.51 (1.11)	20.65 (.96)	16.14 (1.07)	15.85 (1.00)	22.88 (.93)
VQ-Pro	21.29 (.86)	22.00 (.97)	21.66 (.97)	20.86 (.90)	23.82 (1.00)	23.43 (1.02)	22.77 (.83)	26.21 (.96)	26.57 (.98)	21.59 (.80)
CAQ	34.36 (1.20)	36.15 (1.19)	35.54 (1.25)	34.83 (1.25)	37.86 (1.25)	38.83 (1.31)	36.07 (1.15)	40.74 (1.17)	39.52 (1.24)	35.38 (1.11)

CCAPS = Counseling Center Assessment of Psychological Symptoms; MHC-SF = Mental Health Continuum – Short Form; AAQ-II = Questionnaire-II; CFQ = Cognitive Fusion Questionnaire; VQ-Obs = Valuing Questionnaire Obstruction subscale; VQ-Pro = Valuing Questionnaire Pro subscale; PHLMS = Philadelphia Mindfulness Scale-Acceptance subscale; CAQ = Committed Action Questionnaire.

Table 3. MMRM time by condition effects and post hoc comparisons between conditions on outcome and process measures.

	MMRM Time * Cond F	Pre to posttreatment between condition Cohen's <i>d</i> effect sizes						Pre to follow up between condition Cohen's <i>d</i> effect sizes					
		WL vs. Full	WL vs. Eng	WL vs. Open	Full vs. Eng	Full vs. Open	Eng vs. Open	WL vs. Full	WL vs. Eng	WL vs. Open	Full vs. Eng	Full vs. Open	Eng vs. Open
<i>Outcome Measures</i>													
CCAPS	5.14***	.84***	.86***	.71**	-.02	.13	.15	1.03***	.92***	.93***	.12	.11	-.01
MHC-SF	2.90*	.51*	.69**	.14	-.18	.37	.56*	.52*	.79**	.39	-.27	.13	.40
<i>Process Measures</i>													
AAQ-II	3.59**	.71**	.64**	.39	.07	.32	.25	.95***	.62**	.60**	.32	.35	.03
CFQ	5.12***	.92***	.81***	.57*	.12	.35	.23	1.11***	.62**	.60**	.49*	.51*	.02
PHLMS	6.17***	1.06***	.66**	1.01***	.40	.05	-.35	1.03***	.41	.61**	.62**	.42	-.20
VQ-Obs	3.46**	.81***	.64**	.60**	.17	.21	.04	.88***	.62**	.46*	.26	.43	.17
VQ-Pro	1.97	-	-	-				-	-	-			
CAQ	2.02	-	-	-				-	-	-			

Notes: * $p < .05$; ** $p < .01$; *** $p < .001$. WL = Waitlist. Eng = Engaged. Time * Condition MMRM tests include all four conditions and all three time points controlling for baseline MHC-SF, minority status, and recent treatment as covariates. Positive effect sizes indicate expected finding of the ACT conditions improving more than waitlist and of the Full condition improving more than Open or Engaged. Positive effect sizes for Engaged versus Open indicate greater improvements in the Engaged condition.

Figure 1. Participant flow diagram

