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A randomized controlled trial of brief behavioral activation plus savoring for positive affect dysregulation in university students

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ABSTRACT

Rising rates of depression on university campuses accentuate the need for specific intervention. Interventions targeting disturbances in positive affect, in particular, remain sparse, yet such deficits interfere substantially with functioning and further exacerbate or maintain negative symptoms. The current study aimed to evaluate the impact of a virtual, two-session Behavioral Activation augmented with Savoring (BA + S) intervention compared to an Emotional Awareness (EA) control group in increasing positive affect. Sixty university students with low positive affect were randomized to BA + S or EA and completed 21 days of experience-sampling of positive affect. Weekly measures of positive and negative valence symptoms were assessed at baseline, sessions one and two, and at one-week follow-up. Through *a prori* analyses utilizing multilevel and multivariate multilevel models, our results demonstrate that daily positive affect measured via experience-sampling significantly improved in BA + S, whereas positive affect did not change for those receiving EA, though the interaction of condition and time was not significant. Furthermore, interactions in weekly variables were significant. Increases in positive valence symptoms (affect, anhedonia, etc.) were only reported for students receiving BA + S but not EA. Negative valence symptoms (affect, depression, general distress) improved in both conditions but with superior improvements in BA + S compared to EA. BA + S shows promise for a scalable and accessible intervention to university students with clinical levels of positive and negative affect. ClinicalTrials ID: NCT05234476.

Major depressive disorder (MDD) is estimated to be a core contributor to global disability and is linked to adverse psychological and physical health outcomes (Hawton et al., 2013; Seligman & Nemeroff, 2015; Stringaris, 2017). University students experience depression at higher rates than the general population (Ibrahim et al., 2013). Despite efforts to increase access to mental health care and reduce stigma, rates of depression are continuing to rise on college campuses (Xiao et al., 2017), particularly during the COVID-19 pandemic, which increased prevalence rates of the disorder on campuses (Chang et al., 2021). The development is alarming, as depression in university students is associated with poorer academic performance (Hysenbegasi et al., 2005), greater likelihood of dropping out (Eisenberg et al., 2009), and reduced ratings on quality of life (Jenkins et al., 2021). Dissemination of psychological treatment on university campuses is challenging due to limited resources available at counseling centers, leading to growing waitlists, session limits, and outside referrals (Xiao et al., 2017; Zimmerman, 2015). Consequently, improving treatment formats to increase access and decrease the burden on university campus resources remains an urgent priority.

Brief interventions are a promising avenue to address the need for broader dissemination (Schleider, Dobias, et al., 2020; Schleider, Mullarkey, & Chacko, 2020). Among those, brief behavioral activation (BA) successfully reduces depressive symptoms (Lejuez et al., 2001). Meta-analyses of BA confirm reductions in depressive symptomology in treatment-seeking individuals (Cuijpers et al., 2007; Mazzucchelli et al., 2009; Stein et al., 2021; Wang & Feng, 2022). Notably, the greatest improvement in symptoms (i.e., biggest reductions in depressive scores) are seen in the first three sessions (Hopko et al., 2009), providing support for the utility of fewer sessions. Brief BA has been manualized for five sessions (Lejuez et al., 2001), but reductions in depression symptoms have been noted in as little as a single session with university students (Armento et al., 2012; Gawrysiak et al., 2009). Given the systemic barriers to accessing mental health services on college and university campuses (Eisenberg et al., 2011), brief format BA holds promise

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for reducing distress in treatment-seeking university students.

While early evidence for brief BA in university students is encouraging, it remains unclear to what extent the intervention improves positive affect. According to the Diagnostic and Statistical Manual (DSM-5; American Psychiatric Association, 2013) diagnostic criteria, depression is characterized by both negative emotional experiences like sadness (feeling down, blue, or depressed) as well as a reduced or lack of positive affect, associated with the symptom of anhedonia (lack of pleasure or interest in activities that used to be rewarding). Extant psychological interventions focus on reducing negative valence symptoms; less compelling evidence exists that positive valence symptoms (such as anhedonia) are effectively modified (Craske et al., 2016). Indeed, research has demonstrated that positive valence symptoms remain largely unaffected following traditional treatment, such as cognitive-behavioral therapy (Craske et al., 2016; Dunn et al., 2020; Demyttenaere et al., 2021).

In concept, BA is a treatment that focuses on the associations between one's behavior and one's mood, emphasizing the idea that changes in mood can follow continued behavior. Patients, with the aid of a therapist, are instructed to choose activities that tap into the domains of enjoyment and mastery, create an activity schedule, and monitor changes in their mood both before and after completing the activity in order to establish or re-establish the links between them. Importantly, to aid with reinforcing behavioral change, the therapist draws the patient's attention towards noting how the changes in their behavior then results in changes in mood. Patients are asked to continue implementing positive activities into their daily lives and increase their frequency and duration over time as part of the treatment. Potential barriers to engagement in planned activities are discussed and problem-solved collaboratively in session. Emerging evidence using modified BA in adolescents (Webb et al., 2023) and adults (Cernasov et al., 2021) demonstrates decreases in anhedonic symptoms. However, other studies of the effect of BA in samples of non-depressed caregivers (Moore et al., 2013) as well as in depressed individuals (Alsayednasser et al., 2022) on the experience of positive affect or anhedonia showed minimal effects. To our knowledge, no studies investigating the efficacy of BA in university students have reported treatment effects on positive affect. Given that low positive affect is a predictor of future depression and anxiety (Khazanov & Ruscio, 2016; Rackoff & Newman, 2020), coupled with university students' greater risk of developing these disorders, there is an unmet need to examine interventions targeting it in this population. Some trials have, however, included other measures of positive valence (reward or cognitions) as a treatment outcome measure and reported mixed results regarding their modifiability by BA (Armento et al., 2012; Gawrysiak et al., 2009; Takagaki et al., 2016a, 2016b; Zemestani et al., 2016). Newer BA models have proposed integrating other strategies to more effectively target positive affect, such as scheduling values-based activities and incorporating mindfulness (Cernasov et al., 2021; Hopko et al., 2016). Augmenting traditional BA therapy with strategies to enhance positive valence symptoms may boost treatment efficacy. A recent meta-analysis of the effect of BA on depression noted that adding values discussion to treatment did not significantly affect depressive symptoms (Stein et al., 2021), pointing to the need for further investigation into positive emotion regulation strategies to augment the therapy.

Savoring is one strategy linked to positive affect (Bryant, 2021; Pellas et al., 2022). A cognitive skill originally drawn from the positive psychology literature, savoring targets the ability to draw attention towards, appreciate, and expand upon positive experiences (Bryant et al., 2005; Quoidbach et al., 2010). Savoring, as such, involves several different processes that target each of these components when retrospectively recalling an event with positive emotions, as well as in-the-moment during an event. Studies utilizing savoring as a positive emotion regulation strategy have noted reductions in depression and increases in reward following its implementation (Irvin et al., 2022). Further, there is evidence from more recent psychotherapy trials that combining BA strategies with savoring an activity results in increases in positive affect (Cernasov et al., 2021; Craske et al., 2019; Craske et al., 2023; LaFreniere & Newman, 2023a, 2023b; Nagy et al., 2020; Taylor et al., 2017). These trials include multiple sessions and incorporate additional strategies to increase positive affect (such as cognitive exercises and gratitude logging). Therefore, it remains essential to investigate how the combination of BA and savoring strategies in brief format and on their own modify positive affect.

In response, we developed a brief, two-session behavioral activation intervention, augmented with the integration of savoring techniques, for university students with low positive affect. While extant trials of BA in the general population have noted minimal improvements in positive affect, we hypothesized that adding a savoring component to the intervention would directly target and modify this symptom. With research suggesting that anhedonia may be related to working memory deficits in depression (Rutherford et al., 2023), we examined outcomes on both a daily level (using ecological momentary assessment (EMA) to assess for daily affect) as well as retrospective weekly ones. Further, the intervention was conducted entirely virtually (telehealth) to reduce the barriers to accessing therapeutic services on a university campus.

The primary aim of the present study was to examine the effects of behavioral activation combined with savoring (BA + S) on daily changes in positive affect compared to an active control group (Emotional Awareness, EA). Given the link between savoring and enhancement of positive experiences noted in the literature, we hypothesized that only BA + S would significantly improve daily levels of positive affect compared to EA. A secondary aim of the study was to examine changes in positive valence symptoms (positive affect, and anhedonia) assessed retrospectively on a weekly basis. Consistent with the theoretical links to targeting reward from the original brief BA protocol, as well as links between savoring and increases in positive affect, we hypothesized that only BA + S would result in significant improvements in positive valence. We also examined improvements in negative valence (negative affect, depression, and general distress symptoms), and consistent with the results from prior studies of behavioral activation in university settings, we expected more significant improvements in BA + S compared to EA.

1. Methods

1.1. Participants

Prior studies examining brief BA interventions for depression in university students reported medium-to-large effect sizes on depressive symptoms (ds = 0.77–1.61) and environmental reward (d = 1.14) measures (Gawrysiak et al., 2009; McIndoo et al., 2016). We conducted an *a priori* power analysis based on a desired power of 0.80, alpha error rate of 0.05, estimated attrition of 0.05% between the study timepoints, and a medium-to-large effect size on RMASS2 (Hedeker et al., 1999) to determine a sample size of 60 individuals.

Participants were recruited via the Southern Methodist University (SMU) SONA systems platform between September 2021 and April 2022. The study, titled "Positive Resiliency Training," offered students to learn techniques to experience whether they affect overall mood. Interested individuals aged 18 and older completed the Positive and Negative Affect Schedule (Watson et al., 1988); those with positive affect levels below a score of 32 (corresponding to a score below the 50th percentile based on population norms; Crawford & Henry, 2004) were invited to participate in the study. A participation requirement was access to a smartphone (to complete EMA assessments). The study was conducted virtually using secure online platforms, including HIPAA-compliant Zoom and REDCap. Eligible individuals were contacted by study staff to schedule a 30-min Zoom call. During this meeting, participants completed all self-report questionnaires on REDCap and downloaded the experience-sampling application onto their smartphones. The SMU Institutional Review Board approved the

study, and all participants signed consent and received course credit for participation.

Individuals were randomized via computer-generated allocation (Pocock, 1983) using permuted block randomization to BA + S (n = 30) or EA (n = 30) per CONSORT guidelines (Schulz et al., 2011) by the primary author of this manuscript. All participants received two virtual therapy sessions with a therapist one week apart from each other. Only one individual (1.67%) withdrew from the BA + S group due to difficulties with the time commitment, thereby missing data for the second session and follow-up (see Fig. 1 for consort diagram, Fig. 2 for flowchart of study procedure).

1.2. Interventions

The treatments were identical regarding duration (2 sessions), participant-therapist contact via telehealth format, assessment schedule, and the between-session, twice-daily EMA monitoring. BA + S differed from EA by including in-session and between-session behavioral activities with savoring and a treatment rationale that linked behaviors to mood. Study therapists were comprised of two clinical psychology program doctoral students, trained and supervised by a licensed psychologist.

1.3. Behavioral activation plus savoring (BA + S) intervention

The BA + S intervention combined strategies from the brief BA for depression protocol (Lejuez et al., 2001) and savoring as an emotion regulation technique from Positive Affect Treatment (see treatment manuals for further explanation of savoring: Craske et al., 2022; Meuret et al., 2022) to augment the positive emotional experience of the BA activities. The treatment period was selected to mirror two prior brief BA interventions for university students (Armento et al., 2012; Gawrysiak et al., 2009). BA + S consisted of two 60-min individual telehealth sessions, one week apart, and between-session self-guided behavioral activation and savoring strategies.

The first session comprised i) psychoeducation, ii) creating a positive activity hierarchy and choosing activities to complete for homework, and iii) discussing how to use savoring. The treatment rationale encompassed behavioral activation (detailing links between mood and behavior, denoting that action precedes emotional change, and stating the benefits of activity scheduling and completion) and savoring (noting the tendency of the mind to wander/focus on "what is not working," moving attention towards the positive and expanding upon these positive experiences, etc.).

Participants were then oriented to a list of positive emotions falling into categories of enjoyment-based emotions (e.g., happy, joy, content, relaxed) as well as mastery-based ones (e.g., accomplished, proud).

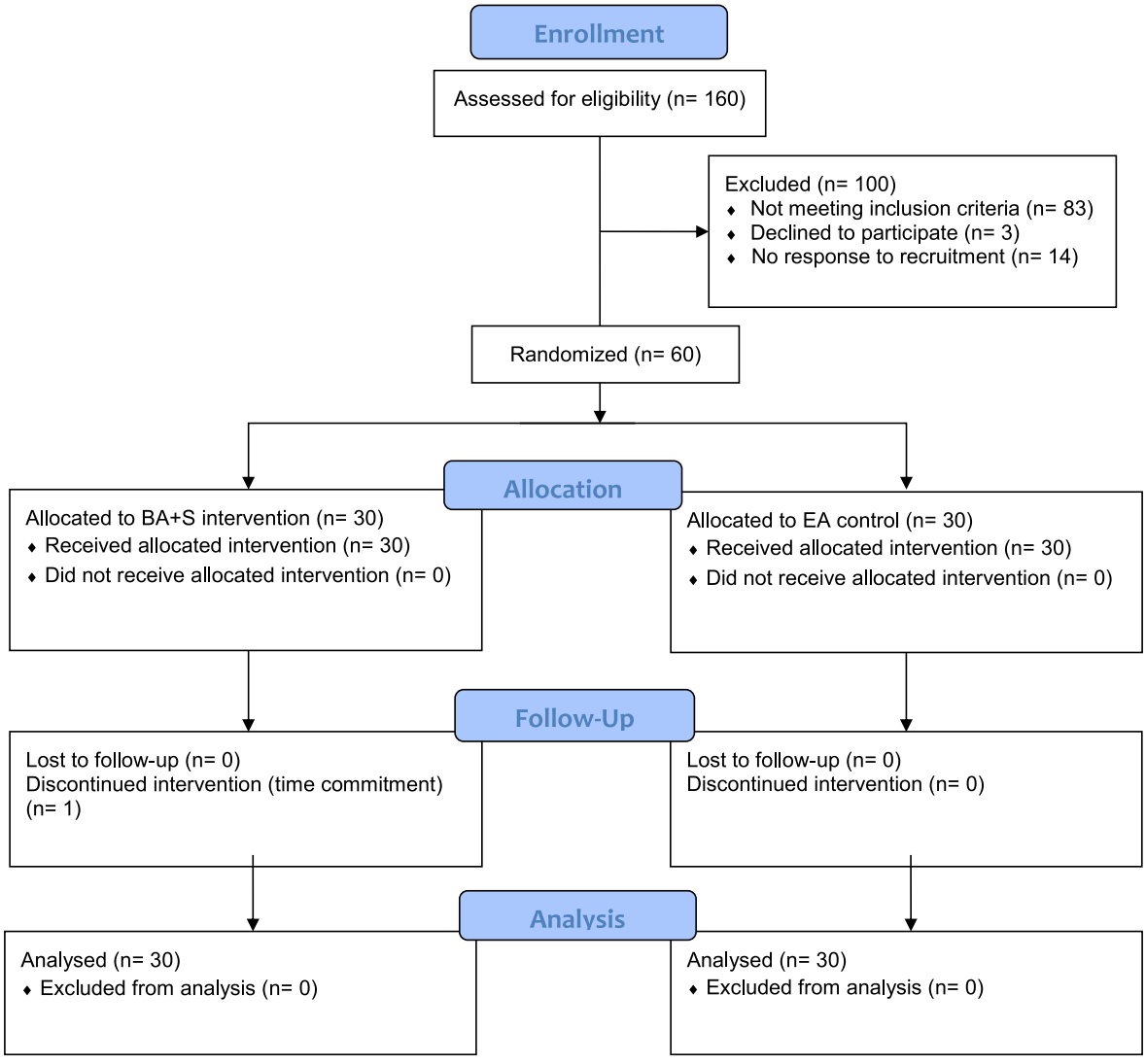

Fig. 1. Consort diagram depicting participant recruitment and attrition.

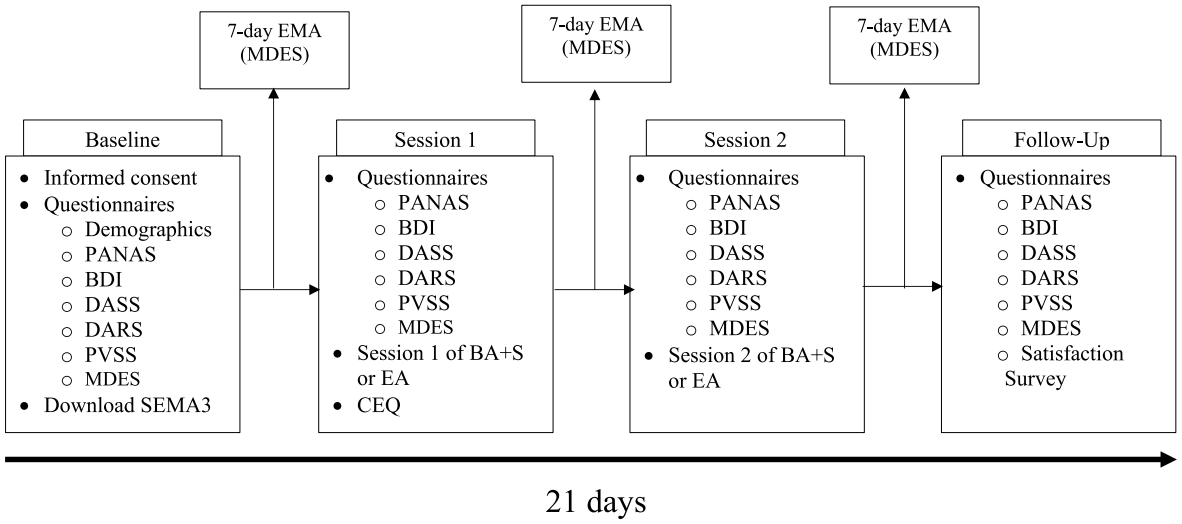

Fig. 2. Flowchart of study procedures. *Note.* PANAS = Positive and Negative Affect Schedule; BDI = Beck Depression Inventory; DASS = Depression, Anxiety, and Stress Subscale; DARS = Dimensional Anhedonia Rating Scale; PVSS = Positive Valence Systems Scale; MDES = Modified Differential Emotions Scale; EMA = Ecological Momentary Assessment; BA + S = Behavioral Activation plus Savoring; EA = Emotional Awareness; CEQ = Credibility and Expectancy Questionnaire.

Participants chose three emotions (either from the list or ones they generated themselves) and listed activities that would elicit them (i.e., patients who wished to feel more "relaxed" listed example activities like taking a bath, going on a walk, lighting a candle; see Appendix Fig. A1). An activity hierarchy was then constructed on activities rated on their importance, enjoyment, and feasibility, and the participant selected one or two to engage in over the next week by highlighting them on the virtual form. Activities were often encouraged to be new and were not already regular parts of the participants' schedule, but also sometimes included activities participants already engaged in but wished to increase the frequency/duration. The therapist and participant also discussed possible barriers when initiating or engaging in the selected activities and worked out solutions. Participants were also instructed to monitor changes in mood prior to and after their activity (on a rating scale from 0 to 10, 10 being the highest) to reinforce the salience between the activity and mood changes.

Lastly, the rationale for savoring was presented, with the therapist noting the benefits of savoring to enhance the positive emotional experience. In our study, savoring was conceptualized as a training aimed at re-orienting a participant's attention away from the negative/neutral and towards the positive aspects of past pleasurable or empowering events. The expressed goal is to deepen the event's positive emotional experience, thereby increasing future attentional orientation and preference toward positive stimuli. This was done by instructing participants to actively "re-live" the pleasant activity in the present moment, for example, verbalizing it aloud or writing it down, using augmenting attention strategies (e.g., labeling emotions, noticing how an emotion might appear in their body). Alternative capturing-the-moment strategies, such as self-talk, writing out the experience, or taking a photo/video and watching it later, were discussed to help participants choose the most feasible method(s) to practice over the next week. Participants practiced their selected savoring strategy while completing the activity ("in-the-moment") and when prompted by the EMA application.

Between-session homework entailed completing 1–2 daily pleasant activities plus savoring. In addition, participants were asked to practice savoring twice daily when prompted by the EMA application (and right after providing the mood rating). The number and frequency of activities varied based on the participants' specific goals (i.e., some chose multiple shorter pleasant activities to complete daily, whereas others selected more extended activities completed less frequently).

At the second session, content comprised of i) homework and EMA compliance review, ii) practice of in-session savoring, and iii) discussion of continued practice of engagement in pleasant activities and savoring. The therapist and participant reviewed the effect of the pleasant activities and savoring on their mood. Barriers to completing the pleasant activities were worked out collaboratively. Then, an out-loud savoring exercise based on prior-week activity was practiced, with before and after mood ratings. The therapist provided an example to illustrate the exercise (see below):

> "I am walking through White Rock Lake. It's a sunny day, and I can feel the sun's warmth on my arms and shoulders. I can hear the sounds of people running or walking by me, the birds and ducks swimming, and the waves from the water hitting the side of the lake. Right now, I'm thinking how peaceful it is to hear water and see the sun reflecting off it. As I continue walking, I feel myself becoming more energetic and thinking less about moving, getting lost in my own thoughts."

The participant then engaged in an out-loud savoring practice guided by the clinician, with occasional prompts to "pause" and "reflect upon what emotion is coming up," focusing specifically on positive emotional experiences.

Finally, the therapist assigned another set of pleasant/empowering activities to be engaged in on an ongoing basis, with the instruction to continue using savoring strategies. Lastly, a brief maintenance discussion entailed continuing to engage in skills following treatment completion. Participants were also provided with a form (the same used to plan pleasant activities, troubleshoot barriers, and plan for how they would savor the activity; see Appendix Figs. A1 and A2) to use and instructed to continue practicing skills, even after the formal end of the intervention.

1.4. Active control condition, emotional awareness (EA)

Individuals randomized to the control condition participated in an Emotional Awareness (EA) intervention. The EA treatment rationale denoted the potential benefits of observing, monitoring, and reflecting upon one's positive and negative mood. The content of both sessions centered on the therapist engaging in empathic listening (which included strategies of active listening and validation). Following the instructions of the EMA protocol and app usage, participants were asked to reflect upon their daily positive and negative mood-tracking experiences since downloading the app at the start of the study. In order to do

this, the therapist posed questions such as "What was it like to notice your negative mood? What about your positive mood", "What was your week like overall?", "What was it like to deliberately track your mood?". Participants were also encouraged to share their current level of positive and negative mood in the session. Therapists were instructed to engage in active listening techniques (through the use of emotional paraphrases such as "You felt overwhelmed" and content paraphrases such as "This week had a lot of different stressors for you") and utilize validation strategies to respond to participant reflections on their mood. There was no emphasis on establishing links between behaviors/events across the week and participant's moods, nor were therapists instructed to probe upon cognitions or ask participants to gain flexibility around them. Both EA sessions followed the same content, with the rationale of noticing mood states as a potential therapeutic strategy being emphasized.

Unlike the BA + S group, the EA condition did not have homework other than using the EMA app; no maintenance instructions were discussed. Participants were instructed to continue using the app and report on their mood at designated time points as homework to be then discussed at the next session. Following the second session, participants were told that they could continue to monitor both positive and negative mood in the same way in the future.

2. Measures

Participants in both conditions completed the same study measures.

2.1. Primary outcome

2.1.1. Positive affect (experience sampling)

Study participants downloaded the SEMA3 (Smartphone Ecological Momentary Assessment; Koval et al., 2019) application onto their smartphones. SEMA3 is an open-sourced software created for researchers for experience sampling protocols. Participants received push notifications through the SEMA3 twice daily (10:00 a.m. and 5:00 p.m.) and had up to 3 h to complete the Modified Differential Emotions Scale (mDES, Fredrickson et al., 2003). Participants rated how they felt in-the-moment when they responded to the prompt. The mDES for positive affect in our sample demonstrated psychometrically solid properties with a Cronbach's alpha of 0.91 and an average inter-item correlation of 0.50. The mDES-P measure includes ten items to assess for in-the-moment positive affect. Each item contains three words to capture an overall emotion (i.e., "*surprised, amazed, astonished*"), which are rated on a five-point scale from "*not at all*" to "*extremely*." The 10-item positive emotions were summed into a positive affect composite score (see Fig. A3 for an example of a participant survey view on a cell phone).

2.2. Secondary outcomes

Secondary (retrospective) outcomes were assessed at baseline, weeks one and two, and one-week follow-up.

Anhedonic Symptoms. The Dimensional Anhedonia Rating Scale (DARS; Rizvi et al., 2015) is a 17-item scale that assesses for anhedonia based on four domains: desire, motivation, effort, and consummatory pleasure. The DARS is broken up into domains of hobbies, food/drink, social activities, and sensory experience, tapping into different types of anhedonia individuals can experience. Participants chose an activity that fell within each of these categories that was salient to them over the past week and rated to what extent the activity would be pleasurable for them "right now" on a 5-point scale ranging from "*not at all*" to "*very much*." Lower scores indicate more severe anhedonia. The DARS has shown good convergent and divergent validity with the Snaith-Hamilton Pleasure Scale and has shown additional utility in predicting treatment-resistant status in patients with major depressive disorder (Rizvi et al., 2016). The timeframe of the DARS also allows for repeated testing to assess the stability of anhedonia over time. The alphas for the domains of the DARS range from 0.83 to 0.91. It has an average inter-item correlation of 0.41 for the overall scale (with subscale AICs ranging between 0.59 and 0.72).

Positive Valence Symptoms. The Positive Valence Systems Scale (PVSS; Khazanov et al., 2020a, 2020b) is a 21-item scale designed to broadly measure changes to each subdomain of the Positive Valence System of the Research Domain Criteria (Insel et al., 2010a, 2010b). The scale captures reward valuation, expectancy, effort valuation, reward anticipation, initial responsiveness to reward, and reward satiation. Additionally, different types of rewards (e.g., hobbies, food, touch) are delineated. Participants rated how true of themselves in the last week using a 9-point scale ranging from"*extremely untrue of me*" to "*extremely true for me*"), with higher scores indicating less dysregulation of the positive valence system. The PVSS has demonstrated sound psychometric properties, with an alpha of 0.93 and test-retest reliability across two weeks of $r = 0.83$.

Positive and Negative Affect. The Positive and Negative Affect Schedule (PANAS; Watson et al., 1988) is a 20-item self-report measure containing ten items measuring negative and positive affect. The PANAS has established psychometric properties, with a coefficient alpha of 0.89 and test-retest reliabilities of $r = 0.71$ for the positive affect subscale and $r = 0.68$ for the negative affect subscale. Normative values (50th percentile) for positive affect in non-clinical samples are around a raw score of 31 and are around a raw score of 15 for negative affect (Crawford & Henry, 2004). Items on the negative affect subscale include those such as distressed, guilty, and nervous, whereas those on the positive affect subscale include interested, excited, and enthusiastic. Participants rated how they feel about each emotion on a scale from 1 ("*very slightly or not at all*") to 5 ("*extremely*") over the past week, with higher scores indicating higher levels of negative and positive affect.

Depressive Symptoms. The Beck Depression Inventory – Second Edition (BDI-II; Beck et al., 1996) is a self-report scale assessing the severity of depressive symptoms, measured across the last week. The 21 items in the measure assess for DSM-defined symptoms of major depression and are rated from 0 to 3, where 0 represents no endorsement and 3 represents full endorsement. Higher summed scores indicate greater severity. The BDI-II has a test-retest reliability of 0.93 across one week and a coefficient alpha of 0.92 for depressed individuals in outpatient settings. We added the BDI-II to compare our study to prior brief BA interventions for depressed university students.

General Distress. The 21-item version of the Depression, Anxiety, and Stress Scale (DASS-21; Lovibond & Lovibond, 1995) contains seven items for each respective index. Items were rated on a scale from 0 to 3 ("*did not apply to me at all*" to "*applies to me very much or most of the time*") over the last week with higher scores indicating more distress. The depression subscale captures constructs such as sad mood and anhedonia, the anxiety subscale captures components of physiological symptoms of anxiety, and the stress subscale captures general anxiety and stress. The DASS-21 has demonstrated good test-retest reliability ($r = 0.81$). Cronbach alphas range from 0.96 to 0.97 for depression, 0.84-0.92 for anxiety, and 0.90-0.92 for stress. The DASS-Total is a reliable and valid measure of general distress (Gloster et al., 2008; Page et al., 2007).

2.3. Treatment measures

Treatment Credibility. The Credibility/Expectancy Questionnaire (CEQ; Devilly & Borkovec, 2000) was used to determine participant expectations about treatment. This six-item self-report questionnaire asked participants to rate how much they believe and feel treatment would aid their symptoms from "*not at all*" to "*very*." Participants completed the CEQ at the end of the first therapy session. The CEQ has demonstrated sound psychometric properties, with an internal consistency of $\alpha = 0.86$ and test-retest reliability of $r = 0.82$.

Homework Compliance. After completing the daily emotion ratings on their smartphone application, those in the BA + S condition were also

asked whether they had completed a pleasant activity that day and were prompted to take a moment to practice savoring. Participants and investigators were able to monitor compliance with EMA responses on the online portal.

Treatment Satisfaction. Participants completed a 9-item satisfaction survey at the end of the study as part of the final questionnaires. Six items, rated on a Likert scale from "*not at all*" to "*extremely*," assessed how much the intervention impacted participants' mood, behaviors, enjoyment in the intervention, perceived help and control, and continued usage of skills in the future. A brief qualitative survey encouraged participants to share ways to improve the intervention, what specific aspects of the intervention participants enjoyed, and any additional comments.

3. Analytic approach

The study was pre-registered on ClinicalTrials.gov (NCT05234476); however, the analytic plan was not detailed in the pre-registration due to researcher error, which is noted as a limitation of our current investigation. The study analytic plan, as follows, was based on *a priori* hypotheses. All study analyses were conducted on IBM SPSS version 25. We investigated whether participants missing session data differed from those who were not missing data by comparing them on demographic and pretreatment variables; we also utilized pattern mixture modeling to note whether growth curves differed between those with compared to those without missing data. We examined variables of interest for non-normal distribution and skewness, and residuals of the primary dependent variables for normality. Multilevel modeling (MLM) was utilized across the primary and secondary aims of the study. MLM is an intent-to-treat analysis that includes all randomized participants in the study, regardless of missing data, thereby increasing the ability to detect effects (Hollis & Campbell, 1999).

To examine our primary aim (changes in daily positive affect), we utilized EMA responses to the mDES-P from session one until the study end as our dependent variable. Our MLM model's predictors included treatment condition, time (centered at the end of the study, the last time point holding a value of "0"), and the interaction of treatment condition and time, with a random intercept included. We controlled for baseline scores on the mDES-P (the average of the first seven days of experience sampling of affect), age, and gender. We also controlled for the time of day of the survey (coded as AM/PM). Time was analyzed linearly, as this model best fit the data compared to all the models tested (quadratic, log, hyperbolic, and piecewise). We utilized an AR1 covariance matrix after testing multiple to determine the best fit.

To analyze our secondary aim, we utilized multivariate multilevel modeling (MMLM) to increase power and minimize inflation of Type I error (Hox et al., 2018). The MMLM modes were 3-levels: measures (level-1) nested within repeated assessments (level-2) nested within individuals (level-3). The error covariance matrix was modeled as unstructured, and both models included a random intercept for individuals. Individual measures were z-scored across all assessments, and maximum likelihood estimation was used in both analyses. Baseline levels of the measures were included as covariates in both analyses. We completed two MMLM analyses: the first model examined changes in positive valence symptoms, comprised of the DARS, PVSS, and PANAS-P; the second model assessed changes in negative valence symptoms, comprised of the DASS-total, BDI-II, and PANAS-N. Identical to our primary outcome analysis, predictors in both MMLM models included treatment condition and time (centered at the final study visit, Session 4) and the interaction of treatment condition and time. We controlled for age and gender in both models. In both models, time was analyzed linearly, with the growth-curve model beginning at Session 1. The multivariate tests were corrected for false discovery rate using the Benjamini-Hochberg approach (Benjamini & Yekutieli, 2001), which corrects for multiple tests while not increasing Type II error rates as much as other corrections for multiple tests (e.g., Bonferroni). The false discovery rate (q-value) is reported for each p-value. A q-value greater than 0.05 indicates that the corrected false discovery rate is greater than 0.05. We used the t to d conversion to estimate effect sizes for all significant effects (Becker, 2000).

3.1. Data availability statement

Anonymized data can be made available upon request.

4. Results

4.1. Sample characteristics

Participants were predominately female (n = 50, 83.3%) full-time undergraduate students with an average age of 19.60 years (SD = 0.94, range: 18–22). The majority were white (n = 52, 86.7%), with five individuals identifying as Asian (8.3%) and three as Black (5.0%). Six individuals (10.0%) identified as Hispanic. The majority identified as heterosexual (n = 48, 80.0%). One-third (35.0%) endorsed having received a psychiatric diagnosis, albeit the date and assessment method were not ascertained. There were no significant differences in any of the demographic or clinical variables across conditions (Tables 1 and 2). Positive affect (PANAS-P) at screener was at the 24th percentile (M = 25.93, SD = 4.24, range: 14–31) significantly below the 50th percentile population norms (Crawford & Henry, 2004), and did not differ between

Table 1
Demographic characteristics.

Characteristics	Value[a]		
	Total (N = 60)	Intervention (n = 30)	Control (n = 30)
Age, M (SD), years	19.60 (0.94)	19.70 (1.06)	19.50 (0.82)
Female sex	50 (83.33)	25 (83.33)	25 (83.33)
Race			
White	52 (86.66)	24 (80.00)	28 (93.33)
Asian	5 (8.33)	4 (13.33)	1 (3.33)
Black	3 (5.00)	2 (6.67)	1 (3.33)
Multiracial	0 (0.00)	0 (0.00)	0 (0.00)
Other	0 (0.00)	0 (0.00)	0 (0.00)
Ethnicity			
Hispanic	6 (10.00)	4 (13.33)	2 (6.67)
Non-Hispanic	54 (90.00)	26 (86.67)	28 (93.33)
Relationship status			
Married	0 (0.00)	0 (0.00)	0 (0.00)
Single, in a relationship	20 (33.33)	10 (33.33)	10 (33.33)
Single, not in a relationship	40 (66.67)	20 (66.67)	20 (66.67)
Separated	0 (0.00)	0 (0.00)	0 (0.00)
Divorced	0 (0.00)	0 (0.00)	0 (0.00)
Sexual Orientation			
Asexual	1 (1.67)	0 (0.00)	1 (3.33)
Bisexual	6 (10.00)	3 (10.00)	3 (10.00)
Heterosexual	48 (80.00)	23 (76.67)	25 (83.33)
Homosexual	1 (1.67)	1 (3.33)	0 (0.00)
Queer	1 (1.67)	1 (3.33)	0 (0.00)
Questioning	2 (3.33)	2 (6.67)	0 (0.00)
Other identity not listed	1 (1.67)	0 (0.00)	1 (3.33)
Student full time	60 (100.00)	30 (100.00)	30 (100.00)
Undergraduate education level			
First year	16 (26.67)	5 (16.67)	11 (36.67)
Second year	20 (33.33)	10 (33.33)	10 (33.33)
Third year	16 (26.67)	11 (36.67)	5 (16.67)
Fourth year	8 (13.33)	4 (13.33)	4 (13.33)
Familial Socioeconomic Status			
Lower class	0 (0.00)	0 (0.00)	0 (0.00)
Lower middle class	9 (15.00)	6 (20.00)	3 (10.00)
Middle class	16 (26.67)	7 (23.33)	9 (30.00)
Upper middle class	26 (43.33)	14 (46.67)	12 (40.00)
Upper class	9 (15.00)	3 (10.00)	6 (20.00)

[a] Data are presented as number (percentage) of individuals unless otherwise indicated.

Table 2
Clinical characteristics at baseline.

Characteristics	Value[a]		
	Total (N = 60)	Intervention (n = 30)	Control (n = 30)
Self-Reported Diagnoses			
Any diagnosis	21 (35.00)	7 (23.33)	14 (46.67)
Major depressive disorder	14 (16.67)	4 (13.33)	10 (33.33)
Anxiety	18 (30.00)	6 (20.00)	12 (40.00)
Attention-deficit/ hyperactivity disorder	3 (5.56)	1 (3.33)	2 (6.67)
Obsessive compulsive disorder	1 (1.67)	0 (0.00)	1 (3.33)
Eating disorder	2 (3.33)	1 (3.33)	1 (3.33)
Adjustment disorder	1 (1.67)	0 (0.00)	1 (3.33)
mDES-P, *M* (*SD*)	1.66 (0.77)	1.60 (0.73)	1.72 (0.81)
DARS, *M (SD)*	67.84 (11.38)	65.59 (11.75)	70.00 (10.78)
PVSS, *M (SD)*	6.37 (1.05)	6.35 (0.92)	6.39 (1.18)
PANAS-P, *M* (*SD*)	24.83 (7.14)	23.30 (6.60)	26.37 (7.43)
PANAS-N, *M* (*SD*)	21.75 (6.53)	21.10 (6.53)	22.40 (6.57)
BDI-II, *M* (*SD*)	14.22 (8.29)	13.17 (7.69)	15.27 (8.78)
DASS-Total, *M* (*SD*)	14.36 (8.35)	13.07 (7.78)	15.69 (8.85)

Note. mDES-P = Modified Differential Emotions Scale – Positive; DARS = Dimensional Anhedonia Rating Scale; PVSS = Positive Valence Systems Scale; PANAS-P = Positive and Negative Affect Schedule – Positive; PANAS-N = Positive and Negative Affect Schedule – Negative; BDI-II = Beck Depression Inventory II; DASS-T = Depression, Anxiety, Stress Scale - Total.

[a] Data are presented as number (percentage) of individuals unless otherwise indicated.

conditions (t (58) = −0.30, p = 0.76). Likewise, baseline positive affect was low at the 21st percentile while negative affect (PANAS-N) was high (86th percentile), again without condition differences (t (58) = −1.69, p = 0.10 and t (58) = −0.77, p = 0.45, for PANAS-P and PANAS-N respectively). General distress (DASS-Total) was in the "normal" range and depression (BDI) was in the "mild" range per cutoffs on the measures, with no condition differences (*ps* = 0.20 - 0.58) (Tables 1 and 2 for demographics and clinical characteristics). As expected, our primary and secondary outcome measures significantly correlated at baseline, except for DARS with DASS-Total/mDES-N and the PANAS scales (Table A1 for correlation matrix).

A total of 12 assessments (5.0%) out of 240 possible data points were missing (1 at session one, 10 at session two, and 1 at one-week follow-up). There were no significant differences among those who were missing assessments compared to those who did not across all demographic and clinical variables at baseline (*ps* > 0.05). Likewise, pattern mixture modeling did not indicate significant differences in the growth curve models for those with missing data versus those without (*ps* > 0.05). With all participants completing the baseline session and at least one intervention session, the final analyses included the data of the full sample of 60 individuals.

EMA compliance was high: out of the 42 possible EMA surveys (14 of which were used as "baseline" and the rest were used as outcome data), individuals in the BA + S group completed 82% (M = 34.44) of surveys, while those in EA completed an 81% (M = 34.02).

4.2. Improvements in primary outcome

Daily Positive Affect. The interaction of time and condition was not significant (b = −0.14, p = 0.10, 95% CI [-0.30, 0.03]), indicating the conditions did not have significantly different slopes across time in daily positive affect (Fig. 3). Notably, there was a trend for superior improvements in positive affect for BA + S compared to EA. Time was a significant predictor of daily positive affect (b = 0.16, p = 0.01, d = 0.35, 95% CI [0.05, 0.28]), such that those in BA + S reported significant increases in daily positive affect. Positive affect did not change in those receiving EA (b = 0.03, p = 0.64, 95% CI [-0.09, 0.14]). Participants in both conditions reported higher positive affect in the evening than in the morning (b = 0.88, p < 0.001, d = 0.27). Gender (i.e., female) (b = 4.30, p < 0.001, d = 0.61) and age (i.e., younger) (b = 1.37, p = 0.001, d = 0.48) were significant predictors for higher positive affect, as was higher baseline positive affect (b = 4.86, p < 0.001, d = 1.42).

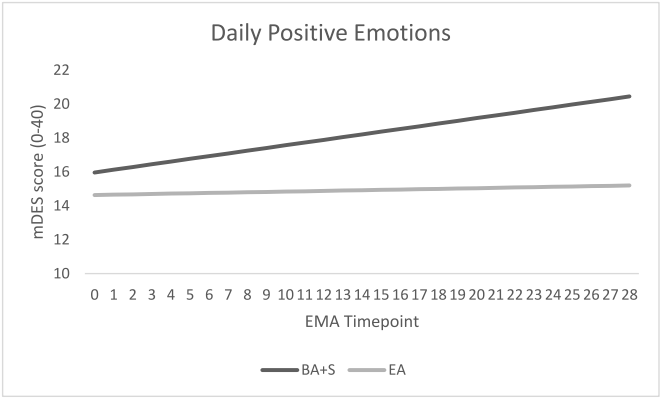

Fig. 3. Changes in daily positive emotions (mDES-P) across intervention to follow-up. *Note.* mDES-P = Modified Differential Emotions Scale – Positive; EMA = Ecological Momentary Assessment; BA + S = Behavioral Activation plus Savoring; EA = Emotional Awareness; EMA time point 0 = 7 day/14 assessment baseline; 1–28 = 14 day/28 assessment intervention period.

4.3. Improvements in secondary outcomes

Positive Valence Symptoms. Our MMLM analyses revealed a significant interaction between treatment condition and time (b = −0.18, 95% CI [-0.27, −0.09], t = −3.81, p < 0.001, d = 0.59), with BA + S and EA resulting in significant different slopes across treatment in multivariate positive valence symptoms (Fig. 4). Condition was a significant predictor (b = −0.46, 95% CI [-0.68, −0.24], t = −4.18, p < 0.001, d = 0.70), indicating that at one-week follow-up, positive valence symptoms were significantly different across conditions with BA + S demonstrating significantly higher multivariate positive valence scores than EA. For BA + S, but not EA, time was a significant predictor (b = 0.20, 95% CI [0.13, 0.26], t = 5.86, p < 0.001, d = 0.90 vs. b = 0.02, 95% CI [-0.05, 0.08], t = 0.51, p = 0.61), indicating that positive valence symptoms only changed for individuals receiving BA + S. Baseline PANAS-P (b = 0.58, p < 0.001, d = 1.48), DARS (b = 0.72, p < 0.00,1 d = 2.09), PVSS (b = 0.68, p < 0.001, d = 2.40), and gender (b = 0.22, p = 0.048), d = 0.54 were all predictors of changes in positive valence symptoms

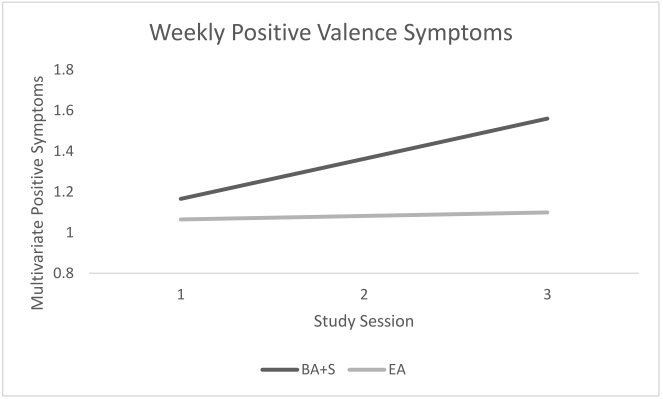

Fig. 4. Weekly changes in multivariate positive valence symptom scores. *Note.* BA + S = behavioral activation plus savoring; EA = emotional awareness.

Table 3
Regression results for multivariate positive valence symptom measures.

	b	*SE*	*t*	95% CI	*p*
Intercept	1.56	0.93	1.67	[-0.31, 3.42]	0.100
Age	−0.08	0.05	−1.80	[-0.17, 0.01]	0.078
Gender	0.22	0.11	2.02	[0.00, 0.45]	0.048
PANAS-P Baseline	0.58	0.05	11.84	[0.49, 0.68]	<0.001
DARS Baseline	0.72	0.05	15.81	[0.63, 0.81]	<0.001
PVSS Baseline	0.68	0.04	17.96	[0.61, 0.76]	<0.001
Condition	−0.46	0.11	−4.18	[-0.68, −0.24]	<0.001
Time	0.20	0.03	5.86	[0.13, 0.26]	<0.001
Condition x Time	−0.18	0.05	−3.81	[-0.27, −0.09]	<0.001

Note. PANAS-P = Positive and Negative Affect Schedule – Positive; DARS = Dimensional Anhedonia Rating Scale; PVSS = Positive Valence Systems Scale.

Table 4
Regression results for the multivariate negative valence symptom measures.

	b	*SE*	*t*	95% CI	*p*
Intercept	−2.62	1.01	−2.60	[-4.63, −0.60]	0.012
Age	−0.08	0.05	2.39	[0.02, 0.21]	0.020
Gender	0.22	0.12	−1.07	[-0.38, 0.11]	0.288
BDI-II Baseline	0.58	0.05	16.12	[0.58, 0.74]	<0.001
DASS Baseline	0.72	0.04	17.65	[0.61, 0.76]	<0.001
PANAS-N Baseline	0.68	0.04	13.07	[0.50, 0.68]	<0.001
Condition	−0.46	0.11	4.17	[0.25, 0.70]	<0.001
Time	0.20	0.03	−8.39	[-0.33, −0.21]	<0.001
Condition x Time	−0.18	0.05	2.13	[0.01, 0.18]	0.035

Note. BDI = Beck Depression Inventory; DASS = Depression, Anxiety, and Stress Scale; PANAS-N = Positive and Negative Affect Schedule – Negative.

(Table 3 for regression results).

Negative Valence Symptoms. A significant interaction between treatment condition and time ($b = 0.10$, 95% CI [0.01, 0.18], $t = 2.13$, $p = 0.035$, $d = 0.33$) was also shown for negative valence symptoms, indicating that BA + S and EA had significantly different slopes across treatment in multivariate negative valence scores (Fig. 5). Condition was also a significant predictor ($b = 0.48$, 95% CI [0.25, 0.70], $t = 4.17$, $p < 0.001$, $d = 0.74$), indicating that at one-week follow-up, negative valence symptoms were significantly different between the conditions, with BA + S demonstrating significantly lower multivariate negative valence scores than EA. Time was a significant predictor for both BA + S ($b = -0.27$, 95% CI [-0.33, −0.21], $t = -8.38$, $p < 0.001$, $d = 1.28$) and EA ($b = -0.17$, 95% CI [-0.23, −0.11], $t = -5.47$, $p < 0.001$, $d = 0.85$), indicating that negative valence symptoms significantly changed throughout treatment in both conditions; however given the significant interaction, the rate of improvement was significantly greater for BA + S than EA. Baseline negative affect symptoms, BDI, DASS, and PANAS-N ($b = 0.66$, $p < 0.001$, $d = 2.12$, $b = 0.69$, $p < 0.001$, $d = 2.06$ and $b = 0.59$, $p < 0.001$, $d = 1.54$, respectively), and age ($b = 0.12$, $p = 0.020$, $d = 0.63$) were all significant predictors of changes in negative valence symptoms (Table 4 for regression results).

4.4. Treatment credibility, compliance, and satisfaction

Treatment credibility per the CEQ was high ($M = 5.58$, $SD = 1.46$), with 96.6% of participants rating their treatment as "somewhat" to "very" logical, and 89.9% of participants rating that they thought treatment would be "somewhat" to "very" useful in reducing their symptoms. Treatment credibility did not significantly differ between conditions (t (57) = 1.90, $p = 0.06$). Due to cited scheduling conflicts, one individual (1.67%) missed the first BA + S session, and ten (16.67%) missed the second BA + S session; thus most received the full treatment dosage. Only one individual in the BA + S group (3.33%) reported not completed their assigned activities for homework (1–2 activities/weekly), supporting overall participant compliance with treatment. Participants in both conditions reported overall high study satisfaction ($M = 16.45$, $SD = 4.61$, $M = 12.4$, $SD = 5.17$, for BA + S and EA, respectively), with higher levels for BA + S compared to EA ($ps = 0.001$-0.02). Qualitative reports of satisfaction from those in the BA + S group reported enjoying the intervention and feeling as though the skills could be carried forward into daily life. Those receiving EA reported enjoyment from tracking their mood, though some individuals reported wanting more concrete strategies, perhaps accounting for differences in satisfaction ratings (Table A2 for quantitative results from the satisfaction survey).

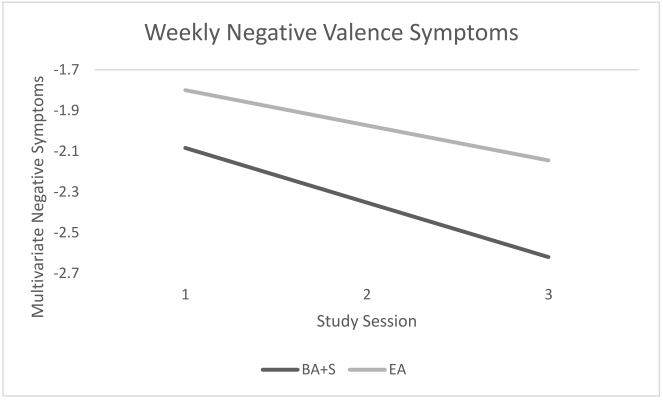

Fig. 5. Weekly changes in multivariate negative valence symptom scores. *Note.* BA + S = behavioral activation plus savoring; EA = emotional awareness.

5. Discussion

The current investigation examined if a novel, brief Behavioral Activation plus Savoring (BA + S) intervention conducted virtually significantly increased daily positive affect compared to a mood-monitoring Emotional Awareness (EA) control group. We also examined changes in weekly assessments of positive (such as anhedonia and positive affect) and negative valence (depression, general distress, and negative affect) symptoms across conditions. Results demonstrated that daily positive affect measured via experience-sampling only improved in students receiving BA + S, whereas positive affect did not significantly change in EA, though the interaction was not significant (suggesting rates of change were not significantly different between groups). Furthermore, significant improvements in measures of weekly positive valence symptoms (affect, anhedonia, and symptoms more broadly) were only reported for students receiving BA + S, but not EA. Negative valence symptoms (affect, depression, general distress) improved in both BA + S and EA, but with superior improvements in BA + S compared to EA. Positive affect was higher than in the evening than in the morning in both conditions. Our findings provide promising first evidence that brief BA + S increases in-the-moment positive affect and positive and negative valence symptoms more generally.

The observed benefits of BA + S for both our primary and secondary aims align with extant findings on positive activity scheduling and savoring (Cernasov et al., 2021; Craske et al., 2019; Craske et al., 2023; LaFreniere & Newman, 2023a, 2023b; Taylor et al., 2017) within the context of multimodal intervention protocols for adults. Our findings extend upon prior studies by demonstrating treatment success in college students using an ultra-brief (vs. several months), fully virtually administered format, with BA + S being the sole therapeutic skill. The study design most closely aligned with ours is that of LaFreniere and Newman (2023a, 2023b) who tested a 7-day EMA savoring intervention compared to an active self-monitoring control in students diagnosed with generalized anxiety disorder. Posttreatment (Day 8) demonstrated more significant improvements in PANAS-X Joviality (used to assess positive affect) for active vs. control condition ($d = 0.68$) but non-significant condition differences at the 30-day follow-up. These findings, similar to ours, note how brief intervention employing

savoring helps improve positive affect and depressive symptoms. In contrast to their design, our study used multiple measures of positive affect and anhedonia, including a baseline monitoring period. Additionally, our student sample was selected for reporting low positive affect (rather than based on diagnostic criteria), the intervention was therapist-guided, and was delivered via telehealth format. The latter is critical, as one may hypothesize that the effort of coming to the session in person, in and of itself, is a form of behavioral activation. We also uniquely tested BA plus savoring as the sole intervention components rather than in conjunction with other skills to increase positive affect (e.g., Craske et al., 2019; Craske et al., 2023; Taylor et al., 2017) and those used by LaFreniere and Newman (2023a, 2023b), who employed additional skills such as anticipating future positive events. These promising results replicate and extend prior findings on the efficacy of brief behavioral activation interventions for adolescents and college youth in producing symptom changes (Gawrysiak et al., 2009; Schleider et al., 2022; Takagaki et al., 2016a, 2016b) while specifically demonstrating changes in daily positive affect and positive valence symptoms more generally.

Importantly, however, we did not include specific activation or savoring outcome measures such as the Savoring Beliefs Inventory (SBI; Bryant, 2003). Given the primary hypotheses and to curb participant burden, we prioritized using multiple measures of positive valence symptoms in addition to traditionally assessed negative symptom measures to generalize our results. Assessing the direct addition of savoring above behavioral activation skills only would be an important future extension and our findings should be interpreted with caution as to how much the added benefit of savoring was above behavioral activation on its own. Further, part of the benefits of savoring may be due to elements related to memory specificity (remembering positive aspects in particular) or sustained attention to the positive. Understanding the degree to which memory for the positive and attention to the positive, as well as savoring overall, are active mechanisms of the BA + S intervention is a crucial next step. As was outlined in the introduction, we chose empathic awareness as our active control group, as opposed to traditional BA without savoring, due to prior evidence from studies that demonstrated limited effects of BA only (in its original form) on positive affect and anhedonia (Alsayednasser et al., 2022; Craske et al., 2019; Craske et al., 2023; Moore et al., 2013; Sandman & Craske, 2022). Based on the extant literature, we aimed to test an augmented form of behavioral activation with modifications (e.g., brief format, virtual). Our active control condition was designed to control for treatment non-specific factors (i.e., mood-monitoring, assessments, therapist contact). An extension of future studies could be the comparison of brief BA + S with brief BA without savoring in order to examine the unique effect of savoring.

The general consistency between findings from our experience-sampling measures (primary aim) and retrospective reports (secondary aims) of positive valence symptoms (demonstrating increases in both for the BA + S group) supports using both modalities to capture treatment response. Despite the commonly-reported retrospective memory deficits in individuals with depression, particularly those that are positively valenced (Claúdio et al., 2012; Dillon & Pizzagalli, 2018a, 2018b; Rutherford et al., 2023), our findings strongly suggest similar patterns of improvement. Notably, BA + S demonstrated superior improvements to EA in weekly measures of positive valence symptoms but not for positive affect measured via EMA in the moment (wherein the slopes of change were not different for groups, though BA + S saw significant increases in affect while the EA group did not). The discrepancy between significant group differences in daily measures versus weekly ones could be due to differences in model fit (linear trajectory of change in daily positive affect, as this model fit the data best); despite the notable variability in positive affect throughout the day, with individuals reporting higher positive affect in the evening than in the morning. Our weekly composite measure also captured a more comprehensive spectrum of positive valence symptoms, which may account for differences not observed with daily measures. Notably, our EMA measurement timeframe was different than some other studies (which may assess symptoms more frequently, with smaller periods in-between assessments). To minimize participant burden, EMAs were twice-daily (10:00 a.m. and 5:00 p.m.), though this may result in a less fine-grained picture of affect as it may have changed throughout the day.

Prior examinations of single-session behavioral activation interventions for university students have demonstrated mixed results when examining improvements in reward sensitivity and positive cognitions (Armento et al., 2012; Gawrysiak et al., 2009; Takagaki et al., 2016a, 2016b; Zemestani et al., 2016) while being generally effective in reducing negative valence symptoms (i.e., depressive symptoms using the BDI). We also noted significant decreases in negative valence symptoms in both conditions as part of our secondary aim. Research demonstrates that the positive and negative valence systems are related, yet distinct (Dejonckheere et al., 2018a, 2018b). The observed improvements in negative valence symptoms in EA, but not positive valence symptoms, provide further evidence for their independence. In such, it is notable that our BA + S intervention designed to target positive affect also resulted in more significant decreases in negative valence symptoms than the control group. This finding is consistent with prior literature demonstrating the potent effect of boosting positive affect on reductions of negative affect (Craske et al., 2019; Craske et al., 2023; Riskind et al., 2013).

The improvements in negative valence symptoms in both conditions were interesting to note. Our active control condition had identical non-specific intervention factors, including the number of sessions with a therapist and the daily self-monitoring of mood. Indeed, it is well-established that mood monitoring in and of itself can be an effective intervention for behavioral change (Bruhn et al., 2015). Because EA explicitly encouraged participants to reflect on their experiences of tracking positive and negative emotions daily, our active control condition arguably included a mood-monitoring component. Relatedly, recipients of our EA active control condition indicated satisfaction with the study, with several reporting enjoying the aspect of becoming more aware of their mood. Consequently, the intense nature of mood monitoring in our study may have minimized differences in therapeutic benefits. In support, adding EMA self-monitoring to intervention protocols has demonstrated augmented treatment benefits (Kramer et al., 2014; van Os et al., 2017), though notably, EMA emotion monitoring alone has not been shown to affect self-report mood symptoms (De Vuyst et al., 2019). Confounding effects that may have accounted for some of our group differences in our intervention condition include the natural tendency to reflect on and ruminate on negative mood more heavily (which may have occurred in the EA sessions, as opposed to an explicit emphasis and focus on the positive in our BA + S sessions). The potential for these confounds, along with the promising therapeutic findings for EA, encourage future investigations into the potency of daily mood monitoring with the support of meetings with a therapist using empathic listening skills as a treatment augmenter or sole intervention strategy.

Our sample was exclusively recruited and participated during the COVID-19 pandemic. While the pandemic resulted in increased levels of depression and anxiety on academic campuses (Chang et al., 2021), it may also have lowered positive affect, resulting in a sample with situationally low positive affect. However, based on our recruitment, roughly 51% of individuals were not eligible due to reporting positive affect above the population average. This points to the fact that reduced positive affect was not a university-wide experience during the crisis, and there was still a notable subset of individuals who experienced little or no reductions in positive affect. The rise of mental illness in youth, specifically during the pandemic (Chang et al., 2021), may have also resulted in students seeking therapeutic services at higher rates. Thus, our study offer may have increased overall expectancy and willingness to engage in a way that might not reflect pre- or post-pandemic times. Additionally, COVID-19 restrictions may have hampered pleasant activities like socializing. Future studies are needed to ensure replication.

The observed improvements in daily positive affect and positive and

negative valence scores more generally across the weeks of the study in those in the BA + S condition have several implications. First, brief BA + S is a promising intervention to employ in college settings. The number of individuals seeking therapeutic services on college campuses often outweighs the available providers (Xiao et al., 2017; Zimmerman, 2015). Brief and virtual BA + S could help reduce wait time for care. Given the brevity of the intervention and evidence that BA + S can be administered effectively and at a lower cost than often lengthier (e.g., 8–20 weeks) empirically supported protocols (Richards et al., 2016a, 2016b), BA + S utilized at college counseling centers promises to effectively reduce both positively- and decrease negatively-valenced symptoms in a relatively short time (i.e., 2 weeks). Despite our inclusion criteria of positive affect below population average (≤50th percentile), the sample mean was considerably lower (i.e., in the 24 percentile), thus comparable to clinical trials of individuals with moderate-to-severe clinical symptoms of depression and anxiety (e.g., Craske et al., 2019). This severely low clinical level further highlights the need to target low positive mood through interventions in college students. Second, study recruitment was open and unrestricted to diagnosis or exclusion criteria (other than below-population average positive affect). Notwithstanding, BA + S was beneficial for improving negative affect for students with clinical and sub-clinical negative affect and could be investigated as a preventative approach. Third, we conducted the intervention via telehealth; given the significant findings in increasing positive affect, this supports the utility of using such a modality to increase access and reach to student populations.

Despite many study strengths, such as low attrition, high compliance with the EMA protocol, and a powered low baseline positive affect sample, several limitations are noteworthy. First, we did not have an extended follow-up period and, as such, cannot ascertain the durability of the observed clinical changes. Whereas prior trials utilizing strategies to increase positive affect (including savoring and pleasant activity scheduling) have noted continued improvement beyond the active treatment phase (Craske et al., 2019; Craske et al., 2023), those were considerably longer in treatment duration (i.e., 15 weeks). Second, although participants had considerably low average positive and high negative affect (PANAS-N in 86th percentile), general distress (DASS-Total) and BDI were only in a mild range. Future studies should investigate the efficacy of brief BA + S in students with moderate to severe levels of depression, anxiety, and stress, and include formal diagnostic assessments, to compare to prior multimodal and lengthier investigations. Third, our active control group was selected to control for treatment unspecific factors, including empathic listening, daily symptom monitoring, and therapist contact. We opted against a traditional BA condition as prior studies have not successfully corrected positive affect (Sandman & Craske, 2022). Notwithstanding, comparing brief BA + S to brief BA using a daily affect monitoring design could provide valuable insights into the value of savoring as an augmenting ingredient of BA. Additionally, our control condition had one less prompt during the EMA and did not have homework. Future studies should add formal "homework" (e.g., prompts to reflect on current mood) to the control condition protocol to ensure equal treatment dosage. Fourth, individuals in the study participated for course credit; thus, motivation and engagement to participate in the intervention may differ in non-compensated treatment-seeking students. Fifth, while we pre-registered our study's aims and procedures, our analytic plan was not detailed. Finally, as mentioned above, we did not include standardized measures of savoring such as the Savoring Beliefs Inventory (SBI; Bryant, 2003), or memory and attention, which would allow to assess mechanisms of change.

In conclusion, our brief, virtual, two-session BA + S intervention demonstrated superior benefits in positive and negative valence compared to an active control condition (EA). Daily monitoring of emotions may be therapeutic in and of itself, as shown by the valence improvements in EA. The findings of this trial have the potential to enhance clinical practice by providing a scalable and accessible intervention to university students with clinical levels of positive and negative affect.

CRediT authorship contribution statement

Divya Kumar: Writing – review & editing, Writing – original draft, Visualization, Validation, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Sarah Corner:** Writing – review & editing, Visualization, Formal analysis. **Richard Kim:** Software, Data curation. **Alicia Meuret:** Writing – review & editing, Validation, Supervision, Resources, Methodology, Conceptualization.

Declaration of competing interest

The research in our manuscript "A randomized controlled trial of brief Behavioral Activation plus Savoring for positive affect dysregulation in university students" did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Data availability

Data will be made available on request.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.brat.2024.104525.

References

Alsayednasser, B., Widnall, E., O'Mahen, H., Wright, K., Warren, F., Ladwa, A., … Dunn, B. D. (2022). How well do cognitive behavioural therapy and behavioural activation for depression repair anhedonia? A secondary analysis of the COBRA randomized controlled trial. *Behaviour Research and Therapy, 159*, Article 104185.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.).

Armento, M. E., McNulty, J. K., & Hopko, D. R. (2012). Behavioral activation of religious behaviors (BARB): Randomized trial with depressed college students. *Psychology of Religion and Spirituality, 4*(3), 206–222. https://doi.org/10.1037/a0026405

Beck, A. T., Steer, R. A., & Brown, G. K. (1996). Manual for the Beck depression inventory-II. *Psychological Corporation*.

Becker, L. A. (2000). *Effect size calculators*. University of Colorado Colorado Springs. https://lbecker.uccs.edu/.

Benjamini, Y., & Yekutieli, D. (2001). The control of the false discovery rate in multiple testing under dependency. *Annals of Statistics, 29*(4), 1165–1188. https://doi.org/10.1214/aos/1013699998, 1124.

Bruhn, A., Mcdaniel, S., & Kreigh, C. (2015). Self-monitoring interventions for students with behavior problems: A systematic review of current research. *Behavioral Disorders, 40*(2), 102–121. https://doi.org/10.17988/BD-13-45.1

Bryant, F. (2003). Savoring Beliefs inventory (SBI): A scale for measuring beliefs about savouring. *Journal of Mental Health, 12*(2), 175–196.

Bryant, F. B. (2021). Current progress and future directions for theory and research on savoring. *Frontiers in Psychology, 12*, Article 771698.

Bryant, F. B., Smart, C. M., & King, S. P. (2005). Using the past to enhance the present: Boosting happiness through positive reminiscence. *Journal of Happiness Studies, 6*, 227–260.

Cernasov, P., Walsh, E. C., Kinard, J. L., Kelley, L., Phillips, R., Pisoni, A., Eisenlohr-Moul, T. A., Arnold, M., Lowery, S. C., Ammirato, M., Truong, K., Nagy, G. A., Oliver, J. A., Haworth, K., Smoski, M., & Dichter, G. S. (2021). Multilevel growth curve analyses of behavioral activation for anhedonia (BATA) and mindfulness-based cognitive therapy effects on anhedonia and resting-state functional connectivity: Interim results of a randomized trial. *Journal of Affective Disorders, 292*, 161–171. https://doi.org/10.1016/j.jad.2021.05.054

Chang, J. J., Ji, Y., Li, Y. H., Pan, H. F., & Su, P. Y. (2021). Prevalence of anxiety symptom and depressive symptom among college students during COVID-19 pandemic: A meta-analysis. *Journal of Affective Disorders, 292*, 242–254.

Claúdio, V., Aurélio, J. G., & Machado, P. P. P. (2012). Autobiographical memories in major depressive disorder. *Clinical Psychology & Psychotherapy, 19*(5), 375–389.

Craske, M. G., Dour, H., Treanor, M., & Meuret, A. E. (2022). *Positive Affect Treatment for depression and anxiety: Therapist guide*. Oxford University Press.

Craske, M. G., Meuret, A. E., Echiverri-Cohen, A., Rosenfield, D., & Ritz, T. (2023). Positive affect treatment targets reward sensitivity: A randomized controlled trial. *Journal of Consulting and Clinical Psychology, 91*(6), 350.

Craske, M. G., Meuret, A. E., Ritz, T., Treanor, M., & Dour, H. J. (2016). Treatment for anhedonia: A neuroscience driven approach. *Depression and anxietyAnxiety, 33*(10), 927–938. https://doi.org/10.1002/da.22490

Craske, M. G., Meuret, A. E., Ritz, T., Treanor, M., Dour, H., & Rosenfield, D. (2019). Positive affect treatment for depression and anxiety: A randomized clinical trial for a core feature of anhedonia. *Journal of Consulting and Clinical Psychology, 87*(5), 457–471. https://doi.org/10.1037/ccp0000396

Crawford, J. R., & Henry, J. D. (2004). The positive and negative affect schedule (PANAS): Construct validity, measurement properties and normative data in a large non-clinical sample. *British Journal of Clinical Psychology, 43*(3), 245–265. https://doi.org/10.1348/0144665031752934

Cuijpers, P., Van Straten, A., & Warmerdam, L. (2007). Behavioral activation treatments of depression: A meta-analysis. *Clinical psychology Psychology reviewReview, 27*(3), 318–326. https://doi.org/10.1016/j.cpr.2006.11.001

De Vuyst, H. J., Dejonckheere, E., Van der Gucht, K., & Kuppens, P. (2019). Does repeatedly reporting positive or negative emotions in daily life have an impact on the level of emotional experiences and depressive symptoms over time? *PLoS One, 14*(6), Article e0219121. https://doi.org/10.1371/journal.pone.0219121

Dejonckheere, E., Mestdagh, M., Houben, M., Erbas, Y., Pe, M., Koval, P., Brose, A., Bastian, B., & Kuppens, P. (2018a). The bipolarity of affect and depressive symptoms. *Journal of Personality and Social Psychology, 114*(2), 323–341. https://doi.org/10.1037/pspp0000186

Dejonckheere, E., Mestdagh, M., Houben, M., Erbas, Y., Pe, M., Koval, P., … Kuppens, P. (2018b). The bipolarity of affect and depressive symptoms. *Journal of Personality and Social Psychology, 114*(2), 323.

Demyttenaere, K., Kiekens, G., Bruffaerts, R., Mortier, P., Gorwood, P., Martin, L., & Di Giannantonio, M. (2021). Outcome in depression (I): why Why symptomatic remission is not good enough. CNS Spectrums, 26(4), 393–399. https://doi.org/10.1017/S1092852920001418 CNS spectrums, 1-7.

Devilly, G. J., & Borkovec, T. D. (2000). Psychometric properties of the credibility/expectancy questionnaire. *Journal of Behavior Therapy and Experimental Psychiatry, 31*(2), 73–86. https://doi.org/10.1016/s0005-7916(00)00012-4. Journal of behavior therapy and experimental psychiatry, 31(2), 73-86.

Dillon, D. G., & Pizzagalli, D. A. (2018a). Mechanisms of memory disruption in depression. *Trends in Neurosciences, 41*(3), 137–149. https://doi.org/10.1016/j.tins.2017.12.006

Dillon, D. G., & Pizzagalli, D. A. (2018b). Mechanisms of memory disruption in depression. *Trends in Neurosciences, 41*(3), 137–149.

Dunn, B. D., German, R. E., Khazanov, G., Xu, C., Hollon, S. D., & DeRubeis, R. J. (2020). Changes in positive and negative affect during pharmacological treatment and cognitive therapy for major depressive disorder: A secondary analysis of two randomized controlled trials. *Clinical Psychological Science, 8*(1), 36–51.

Eisenberg, D., Golberstein, E., & Hunt, J. B. (2009). Mental health and academic success in college. *The B.E. Journal of Economic Analysis & Policy, 9*(1). https://doi.org/10.2202/1935-1682, 2191 *The BE Journal of Economic Analysis & Policy*, 9(1).

Eisenberg, D., Hunt, J., Speer, N., & Zivin, K. (2011). Mental health service utilization among college students in the United States. *The Journal of Nervous and Mental Disease, 199*(5), 301–308. https://doi.org/10.1097/NMD.0b013e3182175123

Fredrickson, B. L., Tugade, M. M., Waugh, C. E., & Larkin, G. R. (2003). What good are positive emotions in crises? A prospective study of resilience and emotions following the terrorist attacks on the United States on September 11th, 2001. *Journal of Personality and Social Psychology, 84*(2), 365–376. https://doi.org/10.1037//0022-3514.84.2.365

Gawrysiak, M., Nicholas, C., & Hopko, D. R. (2009). Behavioral activation for moderately depressed university students: Randomized controlled trial. *Journal of Counseling Psychology, 56*(3), 468–475. https://doi.org/10.1037/a0016383

Gloster, A. T., Rhoades, H. M., Novy, D., Klotsche, J., Senior, A., Kunik, M., … Stanley, M. A. (2008). Psychometric properties of the Depression Anxiety and Stress Scale-21 in older primary care patients. *Journal of Affective Disorders, 110*(3), 248–259. https://doi.org/10.1016/j.jad.2008.01.023

Hawton, K., i Comabella, C. C., Haw, C., & Saunders, K. (2013). Risk factors for suicide in individuals with depression: a A systematic review. *Journal of Affective Disorders, 147*(1–3), 17–28. https://doi.org/10.1016/j.jad.2013.01, 004 Journal of affective disorders, 147(1-3), 17-28.

Hedeker, D., Gibbons, R. D., & Waternaux, C. (1999). Sample size estimation for longitudinal designs with attrition: Comparing comparing time-related contrasts between two groups. *Journal of Educational and Behavioral Statistics, 24*(1), 70–93. https://doi.org/10.2307/1165262

Hollis, S., & Campbell, F. (1999). What is meant by intention to treat analysis? Survey of published randomised controlled trials. *BMJ, 319*(7211), 670–674. https://doi.org/10.1136/bmj.319.7211.670. *Bmj*, 319(7211), 670-674.

Hopko, D. R., Robertson, S. M., & Carvalho, J. P. (2009). Sudden gains in depressed cancer patients treated with behavioral activation therapy. *Behavior Therapy, 40*(4), 346–356. https://doi.org/10.1016/j.beth.2008.09.001

Hopko, D. R., Ryba, M. M., Mclndoo, C., & File, A. (2016). Behavioral activation. In C. M. Nezu, & A. M. Nezu (Eds.), *The Oxford handbook of cognitive and behavioral therapies* (pp. 229–263). Oxford University Press.

Hox, J. J., Moerbeek, M., & Van de Schoot, R. (2018). *Multilevel analysis: Techniques and applications*. New York, NY: Routledge.

Hysenbegasi, A., Hass, S. L., & Rowland, C. R. (2005). The impact of depression on the academic productivity of university students. *The Journal of Mental Health Policy and Economics, 8*(3), 145–151. Journal of mental health policy and economics, 8(3), 145.

Ibrahim, A. K., Kelly, S. J., Adams, C. E., & Glazebrook, C. (2013). A systematic review of studies of depression prevalence in university students. *Journal of Psychiatric Research, 47*(3), 391–400. https://doi.org/10.1016/j.jpsychires.2012.11.015. Journal of psychiatric research, 47(3), 391-400.

Insel, T., Cuthbert, B., Garvey, M., Heinssen, R., Pine, D. S., Quinn, K., Sanislow, C., & Wang, P. (2010a). Research domain criteria (RDoC): Toward a new classification framework for research on mental disorders. *American Journal of Psychiatry, 167*(7), 748–751. https://doi.org/10.1176/appi.ajp.2010.09091379

Insel, T., Cuthbert, B., Garvey, M., Heinssen, R., Pine, D. S., Quinn, K., … Wang, P. (2010b). *Research domain criteria (RDoC): Toward a new classification framework for research on mental disorders*.

Irvin, K. M., Bell, D. J., Steinley, D., & Bartholow, B. D. (2022). The thrill of victory: Savoring positive affect, psychophysiological reward processing, and symptoms of depression. Emotion, 22(6), 1281–1293. https://doi.org/10.1037/emo0000914.

Jenkins, P. E., Ducker, I., Gooding, R., James, M., & Rutter-Eley, E. (2021). Anxiety and depression in a sample of UK college students: a A study of prevalence, comorbidity, and quality of life. Journal of American College Health, 69(8), 813–819. https://doi.org/10.1080/07448481.2019.1709474 *Journal of American college health*, 1-7.

Khazanov, G. K., & Ruscio, A. M. (2016). Is low positive emotionality a specific risk factor for depression? A meta-analysis of longitudinal studies. *Psychological Bulletin, 142*(9), 991–1015. https://doi.org/10.1037/bul0000059

Khazanov, G. K., Ruscio, A. M., & Forbes, C. N. (2020a). The positive valence systems scale: Development and validation. *Assessment, 27*(5), 1045–1069. https://doi.org/10.1177/1073191119869836

Khazanov, G. K., Xu, C., Dunn, B. D., Cohen, Z. D., DeRubeis, R. J., & Hollon, S. D. (2020b). Distress and anhedonia as predictors of depression treatment outcome: A secondary analysis of a randomized clinical trial. *Behaviour Research and Therapy, 125*, Article 103507.

Koval, P., Hinton, J., Dozo, N., Gleeson, J., Alvarez, M., Harrison, A., Vu, D., Susanto, R., Jayaputera, G., & Sinnott, R. (2019). *SEMA3: Smartphone ecological momentary assessment, version 3*. Melbourne eResearch group.). *SEMA3: Smartphone Ecological Momentary Assessment, Version 3* [Computer software]. Retrieved from http://www.sema3.com.

Kramer, I., Simons, C. J., Hartmann, J. A., Menne-Lothmann, C., Viechtbauer, W., Peeters, F., … Wichers, M. (2014). A therapeutic application of the experience sampling method in the treatment of depression: A randomized controlled trial. *World Psychiatry, 13*(1), 68–77.

LaFreniere, L. S., & Newman, M. G. (2023). Upregulating positive emotion in generalized anxiety disorder: A randomized controlled trial of the SkillJoy ecological momentary intervention. *Journal of consulting and clinical psychology, 91*(6), 381.

LaFreniere, L. S., & Newman, M. G. (2023b). Reducing contrast avoidance in GAD by savoring positive emotions: Outcome and mediation in a randomized controlled trial. *Journal of Anxiety Disorders, 93*, Article 102659. https://doi.org/10.1016/j.janxdis.2022.102659

Lejuez, C. W., Hopko, D. R., & Hopko, S. D. (2001). A brief behavioral activation treatment for depression: Treatment manual. *Behavior Modification, 25*(2), 255–286. https://doi.org/10.1177/0145445501252005

Lovibond, P. F., & Lovibond, S. H. (1995). The structure of negative emotional states: Comparison of the depression anxiety stress scales (DASS) with the Beck depression and anxiety inventories. *Behaviour Research and Therapy, 33*(3), 335–343. https://doi.org/10.1016/0005-7967(94)00075-u

Mazzucchelli, T., Kane, R., & Rees, C. (2009). Behavioral activation treatments for depression in adults: a A meta-analysis and review. *Clinical Psychology: Science and Practice, 16*(4), 383–411. https://doi.org/10.1111/j.1468-2850.2009.01178.x

McIndoo, C. C., File, A. A., Preddy, T., Clark, C. G., & Hopko, D. R. (2016). Mindfulness-based therapy and behavioral activation: A randomized controlled trial with depressed college students. *Behaviour Research and Therapy, 77*, 118–128.

Meuret, A. E., Dour, H., Loerinc Guinyard, A., & Craske, M. G. (2022). *Positive affect Treatment for depression and anxiety: Workbook*. Oxford University Press.

Moore, R. C., Chattillion, E. A., Ceglowski, J., Ho, J., von Känel, R., Mills, P. J., … Mausbach, B. T. (2013). A randomized clinical trial of Behavioral Activation (BA) therapy for improving psychological and physical health in dementia caregivers: Results of the Pleasant Events Program (PEP). *Behaviour Research and Therapy, 51*(10), 623–632.

Nagy, G. A., Cernasov, P., Pisoni, A., Walsh, E., Dichter, G. S., & Smoski, M. J. (2020). Reward network modulation as a mechanism of change in behavioral activation. *Behavior Modification, 44*(2), 186–213. https://doi.org/10.1177/0145445518805682

Page, A. C., Hooke, G. R., & Morrison, D. L. (2007). Psychometric properties of the depression anxiety stress scales (DASS) in depressed clinical samples. *British Journal of Clinical Psychology, 46*(3), 283–297. https://doi.org/10.1348/014466506x158996

Pellas, J., Renner, F., Ji, J. L., & Damberg, M. (2022). Telephone-based behavioral activation with mental imagery for depression: A pilot randomized clinical trial in isolated older adults during the Covid-19 pandemic. *International Journal of Geriatric Psychiatry, 37*(1). https://doi.org/10.1002/gps.5646

Pocock, S. J. (1983). *Clinical trials: A practical approach*. Wiley.

Quoidbach, J., Berry, E. V., Hansenne, M., & Mikolajczak, M. (2010). Positive emotion regulation and well-being: Comparing the impact of eight savoring and dampening strategies. *Personality and Individual Differences, 49*(5), 368–373. https://doi.org/10.1016/j.paid.2010.03.048. Personality and individual differences, 49(5), 368-373.

Rackoff, G. N., & Newman, M. G. (2020). Reduced positive affect on days with stress exposure predicts depression, anxiety disorders, and low trait positive affect 7 years later. *Journal of Abnormal Psychology, 129*(8), 799.

Richards, D. A., Ekers, D., McMillan, D., Taylor, R. S., Byford, S., Warren, F. C., Barrett, B., Farrand, P. A., Gilbody, S., Kuyken, W., O'Mahen, H., Watkins, E. R., Wright, K. A., Hollon, S. D., Reed, N., Rhodes, S., Fletcher, E., & Finning, K. (2016a). Cost and outcome of behavioural activation versus cognitive behavioural therapy for depression (COBRA): A randomised, controlled, non-inferiority trial. *The Lancet, 388*(10047), 871–880. https://doi.org/10.1016/S0140-6736(16)31140-0

Richards, D. A., Ekers, D., McMillan, D., Taylor, R. S., Byford, S., Warren, F. C., … Finning, K. (2016b). Cost and outcome of behavioural activation versus cognitive

behavioural therapy for depression (COBRA): A randomised, controlled, non-inferiority trial. *The Lancet, 388*(10047), 871–880.

Riskind, J. H., Kleiman, E. M., & Schafer, K. E. (2013). ""Undoing" "effects of positive affect: Does it buffer the effects of negative affect in predicting changes in depression? *Journal of Social and Clinical Psychology, 32*(4), 363–380. https://doi.org/10.1521/jscp.2013.32.4.363

Rizvi, S. J., Pizzagalli, D. A., Sproule, B. A., & Kennedy, S. H. (2016). Assessing anhedonia in depression: Potentials and pitfalls. *Neuroscience & Biobehavioral Reviews, 65*, 21–35. https://doi.org/10.1016/j.neubiorev.2016.03.004

Rizvi, S. J., Quilty, L. C., Sproule, B. A., Cyriac, A., Michael Bagby, R., & Kennedy, S. H. (2015). Development and validation of the Dimensional Anhedonia Rating Scale (DARS) in a community sample and individuals with major depression. *Psychiatry Research, 229*(1–2), 109–119. https://doi.org/10.1016/j.psychres.2015.07.062

Rutherford, A. V., McDougle, S. D., & Joormann, J. (2023). "Don't [ruminate], be happy": A cognitive perspective linking depression and anhedonia. *Clinical Psychology Review, 101*, Article 102255. https://doi.org/10.1016/j.cpr.2023.102255

Sandman, C. F., & Craske, M. G. (2022). Psychological treatments for anhedonia. *Current Topics in Behavioral Neurosciences, 58*, 491–513. https://doi.org/10.1007/7854_2021_291

Schleider, J. L., Dobias, M. L., Sung, J. Y., & Mullarkey, M. C. (2020a). Future directions in single-session youth mental health interventions. *Journal of Clinical Child and Adolescent Psychology, 49*(2), 264–278. https://doi.org/10.1080/15374416.2019.1683852

Schleider, J. L., Mullarkey, M. C., & Chacko, A. (2020b). Harnessing wise interventions to advance the potency and reach of youth mental health services. *Clinical Child and Family Psychology Review, 23*(1), 70–101. https://doi.org/10.1007/s10567-019-00301-4

Schleider, J. L., Mullarkey, M. C., Fox, K. R., Dobias, M. L., Shroff, A., Hart, E. A., & Roulston, C. A. (2022). A randomized trial of online single-session interventions for adolescent depression during COVID-19. *Nature Human Behaviour, 6*(2), 258–268. https://doi.org/10.1038/s41562-021-01235-0. Nature human behaviour, 6(2), 258-268.

Schulz, K. F., Altman, D. G., & Moher, D. (2011). CONSORT 2010 statement: Updated guidelines for reporting parallel group randomized trials. *Annals of Internal Medicine, 154*(4), 291–292.

Seligman, F., & Nemeroff, C. B. (2015). The interface of depression and cardiovascular disease: Therapeutic implications. *Annals of the New York Academy of Sciences, 1345*(1), 25–35. https://doi.org/10.1111/nyas.12738

Stein, A. T., Carl, E., Cuijpers, P., Karyotaki, E., & Smits, J. A. (2021). Looking beyond depression: A meta-analysis of the effect of behavioral activation on depression, anxiety, and activation. *Psychological Medicine, 51*(9), 1491–1504.

Stringaris, A. (2017). Editorial: What is depression? *Journal of Child Psychology and Psychiatry, 58*(12), 1287–1289. https://doi.org/10.1111/jcpp.12844

Takagaki, K., Okamoto, Y., Jinnin, R., Mori, A., Nishiyama, Y., Yamamura, T., … Yamawaki, S. (2016b). Behavioral activation for late adolescents with subthreshold depression: A randomized controlled trial. *European Child & Adolescent Psychiatry, 25*(11), 1171–1182.

Takagaki, K., Okamoto, Y., Jinnin, R., Mori, A., Nishiyama, Y., Yamamura, T., Yokoyama, S., Shiota, S., Okamoto, Y., Miyake, Y., Ogata, A., Kunisato, Y., Shimoda, H., Kawakami, N., Furukawa, T. A., & Yamawaki, S. (2016a). Behavioral activation for late adolescents with subthreshold depression: A randomized controlled trial. *European Child & Adolescent Psychiatry, 25*(11), 1171–1182. https://doi.org/10.1007/s00787-016-0842-5

Taylor, C. T., Lyubomirsky, S., & Stein, M. B. (2017). Upregulating the positive affect system in anxiety and depression: Outcomes of a positive activity intervention. *Depression and Anxiety, 34*(3), 267–280.

van Os, J., Verhagen, S., Marsman, A., Peeters, F., Bak, M., Marcelis, M., … Delespaul, P. (2017). The experience sampling method as an mHealth tool to support self-monitoring, self-insight, and personalized health care in clinical practice. *Depression and Anxiety, 34*(6), 481–493. https://doi.org/10.1002/da.22647

Wang, X., & Feng, Z. (2022). A narrative review of empirical literature of behavioral activation treatment for depression. *Frontiers in Psychiatry, 13*, Article 845138. https://doi.org/10.3389/fpsyt.2022.845138

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology, 54*(6), 1063–1070. https://doi.org/10.1037/0022-3514.54.6.1063

Webb, C. A., Murray, L., Tierney, A. O., & Gates, K. M. (2023). Dynamic processes in behavioral activation therapy for anhedonic adolescents: Modeling common and patient-specific relations. *Journal of Consulting and Clinical Psychology*. https://doi.org/10.1037/ccp0000830. Advance online publication.

Xiao, H., Carney, D. M., Youn, S. J., Janis, R. A., Castonguay, L. G., Hayes, J. A., & Locke, B. D. (2017). Are we in crisis? National mental health and treatment trends in college counseling centers. *Psychological Services, 14*(4), 407. https://doi.org/10.1037/ser0000130

Zemestani, M., Davoodi, I., Honarmand, M. M., Zargar, Y., & Ottaviani, C. (2016). Comparative effects of group metacognitive therapy versus behavioural activation in moderately depressed students. *Journal of Mental Health, 25*(6), 479–485. https://doi.org/10.3109/09638237.2015.1057326. Journal of mental health, 25(6), 479-485.

Zimmerman, R. (2015). *Stressed out undergrads and the college mental health crisis*. WBUR: Boston's Boston's NPR News station. Retrieved from https://www.wbur.org/news/2015/09/08/stressed-out-undergrads http://commonhealth.wbur.org/2015/09/stressed-outundergrads.