Multilevel Associations of Daily Skill Use and Effectiveness With Anxiety, Depression, and Stress in a Transdiagnostic Sample Undergoing Dialectical Behavior Therapy Skills Training

Matthew W. Southward¹, Jeremy William Eberle², & Andrada D. Neacsiu³

¹Department of Psychology, University of Kentucky

²Department of Psychology, University of Virginia

³Department of Psychiatry and Behavioral Sciences, Duke University Medical Center

Author Note

Matthew W. Southward: <https://orcid.org/0000-0002-5888-2769>

Jeremy W. Eberle: <https://orcid.org/0000-0003-0119-2879>

Andrada D. Neacsiu: <https://orcid.org/0000-0002-9779-7276>

We would like to thank the research assistants and staff at the Behavioral Research and Therapy Clinics at the University of Washington for their assistance with conducting the study, entering the data, and providing support.

Funding statement: This research was partially supported by an American Psychological Association Dissertation Research Award given to the last author.

Conflicts of interest: The last author also receives fees for DBT trainings. The other authors declare no financial or personal conflicts of interest.

Correspondence concerning this article should be addressed to Matthew W. Southward, Department of Psychology, University of Kentucky; 343 Waller Avenue, Suite 303, Lexington, KY 40504; Phone: 859-562-1569; E-mail: southward@uky.edu

In press at Cognitive Behaviour Therapy, <https://doi.org/10.1080/16506073.2021.1907614>

Abstract

Dialectical Behavior Therapy (DBT) is effective at treating disorders of emotion dysregulation. However, it is unclear which mechanisms contribute to these effects. The aim of this study was to characterize the within-person associations of two theoretically relevant mechanisms of change, skill use and skill effectiveness, with anxiety, stress, and depression. Participants ($n = 19$, $M_{\text{age}} = 31.8$, 68% female) with a primary anxiety or depressive disorder completed daily reports ($N = 1344$) of DBT skill use, perceived effectiveness, anxiety, stress, and depression during a 16-session DBT skills training group. DBT skill use increased across treatment, $p < .01$, but effectiveness did not, $p = .64$. Within persons, participants used more skills on days with greater stress and anxiety, $p < .01$, which predicted next-day decreases in stress and anxiety, $p = .03$. On days when participants reported higher effectiveness, they used more skills than their personal average when experiencing more intense negative affect, $p < .01$. These results suggest using more skills, especially when used more effectively, is a mechanism by which DBT skills groups address emotional dysfunction for those with transdiagnostic emotional disorders.

Keywords: emotion regulation, DBT skills, transdiagnostic, depression, anxiety

Multilevel Associations of Daily Skill Use and Effectiveness With Anxiety, Depression, and Stress in a Transdiagnostic Sample Undergoing Dialectical Behavior Therapy Skills Training

Emotional disorders (e.g., depression and anxiety), account for the largest percentage of disability-adjusted life years among psychiatric disorders (Murray et al., 2013). Although cognitive-behavior therapy (CBT) is effective for these conditions (Cuijpers et al., 2013), 47-62% of those with depressive or anxiety disorders do not remit by the end of treatment (Cuijpers et al., 2014; Springer et al., 2018). Given the high degree of comorbidity among these disorders (Brown et al., 2001), treatments that target transdiagnostic processes and provide greater access to care may be needed to improve these rates (Southward et al., 2020).

One key transdiagnostic process in emotional disorders is *emotion dysregulation*, defined as the lack, or non-use, of adaptive skills or the overuse of maladaptive strategies to modify emotional responses (Kring & Sloan, 2010). Emotion dysregulation may be the mechanism by which stressful, external events promote the development of these disorders in people biologically predisposed to develop them (Hofmann et al., 2012). Dialectical Behavior Therapy (DBT; Linehan, 1993) was developed to target emotion dysregulation by teaching patients several adaptive skills to practice in relevant contexts. Full-model DBT includes both weekly individual therapy sessions and weekly skills training group sessions, although skills training (DBT-ST) in particular may be necessary to reduce depression and anxiety (Linehan et al., 2015). DBT-ST led to greater reductions in depression than waitlist (Harley et al., 2008) among those with depressive disorders and more rapid reductions in anxiety than an activities-based support group (ASG) among those with anxiety disorders (Neacsiu et al., 2014). These findings suggest DBT is efficacious for depressive and anxiety disorders. However, it is unclear which

aspects of skill use actively impact emotional outcomes in DBT-ST and should thus be prioritized to optimize this multifaceted treatment.

Emotion Regulation Skill Use and Effectiveness

The primary aim of DBT-ST is to teach patients a variety of adaptive skills to regulate various aspects of negative emotions depending on the complexity or intensity of the situation. DBT-ST teaches patients four categories of skills: Mindfulness (MI; fostering present-moment awareness and effective decision-making); Distress Tolerance (DT; managing shorter-term crisis situations with fewer maladaptive longer-term consequences); Emotion Regulation (ER; promoting effective coping with daily emotional responses); and Interpersonal Effectiveness (IE; developing and maintaining healthy social support). Using more skills more frequently mediated the difference in reductions in depression, anxiety, and emotion dysregulation between DBT-ST and an ASG among people with emotional disorders (Neacsiu et al., 2014). In this study, participants with elevated emotion dysregulation and a primary depressive or anxiety disorder received 16 weeks of DBT-ST or ASG, to control for common therapy factors. Both groups met weekly for two hours. Patients learned DBT skills in DBT-ST and practiced social support in ASG. The mediation findings above suggest that improvements in DBT-ST above and beyond ASG were partially explained by participants' more frequent use of more DBT skills. However, participants retrospectively reported their DBT skill use every two months using a measure that conflated skill frequency and number of skills used, making it difficult to draw strong conclusions about these effects.

In their recent theory of emotion polyregulation, Ford et al. (2019) note that more intense emotional episodes prompt the use of more skills to regulate those emotions across several experimental studies. These findings suggest that, whereas teaching and practicing more skills

may lead to decreases in depression, anxiety, and emotion dysregulation across months in DBT-ST, people may use more skills in response to more intense negative emotions when measured on shorter timescales (e.g., minutes or hours within a day). To our knowledge, researchers have yet to compare the relations between skill use and emotional intensity on these different timescales in DBT or DBT-ST.

Of course, teaching patients a range of skills is time-consuming which may limit access to care, and using more skills may only lead to symptom reduction if they help people effectively achieve their goals. Among participants in CBT for social anxiety disorder, greater cognitive reappraisal effectiveness, but not frequency, was associated with lower social anxiety and predicted next-week decreases in social anxiety (Goldin et al., 2014). Here, effectiveness was defined as the degree to which reappraisal decreased anxiety. These results suggest skill effectiveness may be a stronger predictor of symptom change than skill frequency. However, the authors did not test the interaction of these aspects of emotion regulation. In a naturalistic daily diary study of community adults, using reappraisal more frequently was associated with lower depression only among participants experiencing greater life stress who used reappraisal more effectively (Ford et al., 2017). Together, these results suggest that using more skills may only be related to lower psychopathology if the skills are used effectively.

Current Study

The current study is a secondary data analysis of the DBT-ST arm of a randomized controlled trial for patients with depressive and/or anxiety disorders (masked for review). We first explored how skill use, effectiveness, anxiety, depression, and stress changed over treatment. We then hypothesized that greater within-person use of DBT skills, defined as the number of unique skills used per day, would be associated with lower daily negative affect. We

conducted a planned exploratory analysis of the relation between daily skill use and effectiveness. We hypothesized that within-person effectiveness would moderate the relation between skill use and same-day negative affect, such that the relation between skill use and negative affect would be stronger at higher levels of effectiveness.¹ As a secondary hypothesis, we expected greater within-person skill use would predict decreases in next-day anxiety, depression, and stress. Finally, we conducted robustness checks regarding patterns of missingness and outliers (Section S2, Supplemental Materials).

Methods

Participants

We analyzed data from the DBT-ST arm of a randomized controlled trial (masked for review). Twenty-four community participants with elevated emotion dysregulation² and a primary diagnosis of current depressive or anxiety disorder were randomized to DBT-ST. Two participants withdrew before the first session, and three further participants completed no diary cards, leaving 19 participants for analysis (MDD: $n = 6$; dysthymic disorder: $n = 1$; GAD: $n = 8$; social phobia: $n = 4$), four of whom missed four consecutive weeks of DBT-ST and were considered dropouts but included in analyses.

Participants were 31.70 years old on average ($SD = 8.95$), mostly female (68.4%), White (94.7%), and college educated (68.4%). They met criteria for 2.47 ($SD = 1.12$) *DSM-IV* Axis I

¹We conducted planned exploratory analyses of specific skills and same-day negative affect outcomes (Tables S1-S3) and effectiveness (Table S4). We also conducted unplanned exploratory analyses, developed after the initial results were known, of baseline skill use moderating skill use over treatment (Table S5) and primary diagnosis moderating same-day skill use and negative affect (Tables S6-S8). We include our planned exploratory analyses regarding effectiveness and next-day changes in negative affect (Tables S9-S11) to provide full transparency regarding analyses run on this dataset.

²Scoring ≥ 97 on the Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004). See (masked for review) for psychometrics of this measure. The mean score at phone screening was 118.53 ($SD=12.68$) in the present sample.

disorders³ on average using the Structured Clinical Interview for *DSM-IV* Axis I Disorders (First et al., 1995).

Participants under 18 years old, actively suicidal, mandated to treatment, unable to attend group regularly, unwilling to maintain a stable dosage of psychotropic medication, or refrain from ancillary psychotherapy were excluded. They were also excluded if they had received more than five sessions of outpatient DBT; met criteria for bipolar, psychotic, or life-threatening disorders; had a verbal IQ<70 on the Peabody Picture Vocabulary Test-Revised (Dunn & Dunn, 1981); scored >2.5 on the Borderline Symptom List-23 (Bohus et al., 2009); or met *DSM-IV* criteria for BPD. All participants provided informed consent for protocols approved by the University of Washington Human Subjects Division.

Treatment and Assessment Schedule

Participants completed a pretreatment assessment, for which they were compensated. Participants then attended one 2-hr skills training group per week for 16 weeks.

Dialectical Behavior Therapy Skills Training (DBT-ST)

DBT-ST retains the essence of standard DBT skills group (Linehan, 1993). Each category of DBT skills is taught as a 3-5 week module. Groups were conducted by a leader (DBT-trained master's-level therapist) and co-leader (bachelor's-level assistant), who attended weekly supervision and DBT team meetings. Sessions were rated for adherence (see [masked for review] for details). DBT-ST groups included two modifications to standard DBT groups: (a) the co-leader was not a trained DBT therapist, and (b) the protocol was shortened from 24 to 16 sessions. Each session consisted of MI practice; homework review; skills instruction; and

³MDD ($n=12$), dysthymic disorder ($n=1$), depressive disorder NOS ($n=1$), GAD ($n=14$), social phobia ($n=7$), obsessive-compulsive disorder ($n=3$), posttraumatic stress disorder ($n=2$), specific phobia ($n=1$), panic disorder ($n=1$), agoraphobia ($n=1$), anxiety disorder NOS ($n=1$), alcohol abuse disorder ($n=2$), cannabis abuse disorder ($n=1$).

homework assignment. Two groups were simultaneously run, and participants paid \$0-65 for treatment on a sliding scale.

Measures

Diary Cards

Diary cards were assigned for homework and reviewed by group leaders the following week. Participants kept daily records of their average intensities of anxiety, depression, and stress from 0 (*no intensity*) to 10 (*greatest intensity ever felt*); whether they practiced each of 34 DBT skills (e.g., “Wise Mind”); and how effectively they used these skills (range 0-10; Figure S1). Effectiveness was defined as “using skillful means to achieve one’s goals” (Linehan, 2015).

Diary card data were double-entered, and conflicting entries were resolved by random selection of one entry (Section S1). Uncircled days indicated no skill use when the participant responded to any other question for that day and indicated missing data when the participant did not respond to any questions for that day.

Statistical Analyses

We first examined descriptive statistics of DBT skills use, effectiveness, and affect. We tested whether daily number of skills and daily ratings of effectiveness, anxiety, depression, and stress changed each week over treatment using hierarchical linear modeling (HLM) with the *nlme* package (Version 3.1-141; Pinheiro et al., 2019) in R Version 3.6.1 to regress each variable above, in separate models, on the number of weeks in treatment.⁴ We used restricted maximum likelihood estimation with random intercepts and autoregressive lag-1 residual covariance structures in all HLM analyses. Finally, we examined between- and within-person correlations

⁴We examined linear and quadratic changes in these daily measures based on previous research (Lindenboim et al., 2007). We did not include a quadratic term representing time in subsequent analyses, because the model fit, judged by AIC, was worse in all models with quadratic terms.

among demographics and the measures above. We calculated within-person correlations using the *rmcorr* package (Version 0.3.0; Bakdash & Marusich, 2017) in R, which uses a modified ANCOVA framework with subjects as a between-person factor to convert the ratio of the sums of squares of within-person variability of each measure to r (Bakdash & Marusich, 2017).

To test associations between daily skill use and same-day effectiveness and affect, we first disaggregated between- and within-person variability in skill use (Wang and Maxwell, 2015). We determined between-person skill use by (a) calculating each participant's mean daily skill use across treatment, (b) calculating a grand sample mean from these mean scores, and (c) subtracting the grand mean from each person's individual mean. We calculated within-person skill use by subtracting each person's individual mean across treatment from that person's raw daily skill use score. We then regressed daily anxiety, depression, stress, and effectiveness, in separate HLM models, on between- and within-person skill use, number of weeks in treatment, and negative affect not captured by the dependent variable.

To test the effects of DBT modules, we first summed the skills used from each module on each day, and then repeated the disaggregation process above for each module. We then re-ran the HLM models above, replacing between- and within-person total DBT skill scores with between- and within-person skill use variables for all modules. To test next-day changes in affect, we regressed next-day negative affect on these independent variables, including same-day negative affect as a covariate.

To test whether within-person effectiveness moderated the relations between within-person skill use and same-day negative affect, we regressed daily anxiety, stress, and depression, in separate models, on (a) effectiveness, (b) skill use, (c) their interaction, (d) weeks in treatment, and (e) negative affect not captured by the dependent variable. All analyses were two-tailed with

an alpha level of .05, uncorrected for multiple comparisons. Reported effects are unstandardized.

Finally, to determine whether missing data was missing completely at random, we explored correlations between patterns of missingness in our variables of interest and all demographic variables in our dataset. We re-ran analyses with variables that were significantly correlated with patterns of missingness as covariates. To determine the effect of outliers, we also re-ran analyses with outliers removed after re-calculating the relevant group- and person-mean-centered variables. Code is available at

https://osf.io/ndfv3/?view_only=c30f74e39a6040d9b146ba77d22d29d8 (Section S3).

Results

Descriptives, Correlations, and Change Over Treatment

Skill Use

Participants used a mean of 3.15 skills each day ($SD = 1.88$; range: .64-9.19; Table 1) on 1344 days out of a possible 1995 (67.4%). Participants' skill use increased linearly each week over treatment, $B = .14$, $SE = .02$, $p < .01$, 95% CI [.10, .18] (Figure 1A; Table S12).⁵ MI skills were used most frequently (55.9%), followed by ER (21.9%), DT (19.4%), and IE skills (2.9%; Table S14), matching the order in which skills were taught. Most of the variability in individual skills was within-person ($ICCs < .50$; Table S14).

Negative Affect

Participants reported relatively low levels of daily anxiety, depression, and stress (Table 1), although they used the full scale for all measures. Between-persons, total skill use demonstrated small-to-medium negative correlations with anxiety, depression, and stress ($rs: -.28$ — $-.17$); within-persons, skill use demonstrated small, positive correlations with anxiety and

⁵Although the quadratic term was significant, $B = -.02$, $SE = .01$, $p = .04$, 95% CI $[-.02, -.0004]$ (Table S13), this model demonstrated a worse fit ($AIC = 5979.72$) than the linear-only model ($AIC = 5973.35$).

stress (r s: .09-.11) but not depression ($r = -.01$; Table 1). Anxiety, stress, and depression did not exhibit significant changes over treatment, p s $> .61$ (Figure 1B-1D; Tables S15-S17).⁶

Effectiveness

Participants reported moderate levels of daily effectiveness (Table 1) that did not significantly change over treatment, $B = .01$, $SE = .02$, $p = .64$, 95% CI $[-.02, .04]$ (Table S21). Within-persons, greater effectiveness on a given day was related to using more MI and ER skills and lower anxiety, depression, and stress (Table 1).

Is Skill Use Associated With Effectiveness and Negative Affect?

Total Skill Use

Because anxiety and stress demonstrated a numerically stronger within-person correlation together ($r = .67$; large effect) than with depression (r s: .37-.46; medium effect; Table 1), and to control our Type I error rate, we combined anxiety and stress into one variable by taking the mean of both ratings at each observation. We used this anxiety/stress variable in all further analyses. Consistent with our hypothesis, greater within-person skill use was associated with lower depression, $B = -.06$, $SE = .02$, $p < .01$, 95% CI $[-.09, -.02]$ (Table 2). However, contrary to our hypothesis, greater within-person skill use was associated with greater anxiety/stress, $B = .09$, $SE = .01$, $p < .01$, 95% CI $[.06, .12]$ (Table 2). That is, when using more skills than their personal average, participants reported lower depression but greater anxiety/stress than their personal average. Between-person skill use was not significantly associated with anxiety/stress or depression, p s $> .20$ (Table 2). That is, participants who used more skills on average did not have significantly different average levels of anxiety/stress or depression than those who used

⁶Although anxiety exhibited quadratic change, $B=.01$, $SE=.003$, $p=.01$, 95% CI $[.002, .02]$, this model exhibited worse fit (AIC=4274.49) than the linear-only model (AIC=4269.33; Tables S18-S20).

fewer skills across the study. Within-person skill use was associated with greater effectiveness, $B = .08$, $SE = .02$, $p < .01$, 95% CI [.04, .13], but between-person skill use was not significantly associated with effectiveness, $p = .43$ (Table 2).

Skill Use by Module

Greater within-person MI, ER, and DT skill use was associated with greater anxiety/stress, $ps < .05$ (Table 3). Similarly, greater within-person MI and ER skill use was associated with greater effectiveness, $ps < .02$ (Table 3). In contrast, greater within-person MI skill use was associated with lower depression, $p < .01$ (Table 3). Between-person skill use was not significantly related to negative affect or effectiveness, $ps > .05$ (Table 3).

Does Effectiveness Strengthen the Relation Between Skill Use and Negative Affect?

Consistent with our hypothesis, within-person effectiveness moderated the association between within-person skill use and depression, $B = .03$, $SE = .01$, $p < .01$, 95% CI [.02, .04] (Figure 2; Table S26). When less effective than their personal average ($z_{\text{effectiveness}} < -.65$), participants used more skills on days of lower depression. When more effective than their personal average ($z_{\text{effectiveness}} > 1.29$), participants used more skills on days of higher depression. However, contrary to our hypothesis, effectiveness did not significantly moderate the association between within-person skill use and anxiety/stress, $B = -.001$, $SE = .01$, $p = .89$, 95% CI [-.01, .01] (Table S29). Instead, within-person skill use, $B = .12$, $SE = .02$, $p < .01$, 95% CI [.09, .16], and within-person effectiveness, $B = -.13$, $SE = .02$, $p < .01$, 95% CI [-.18, -.09], were independently associated with anxiety/stress in opposite directions.

Does Skill Use Predict Next-Day Decreases in Negative Affect?

Greater within-person total skill use predicted next-day decreases in anxiety/stress, $B = -.04$, $SE = .02$, $p = .03$, 95% CI [-.07, -.003] (Table S22), but not depression, $B = -.01$, $SE =$

.02, $p = .49$, 95% CI $[-.05, .02]$ (Table S23). The effect on next-day changes in anxiety/stress was driven by greater within-person ER skill use, $B = -.11$, $SE = .05$, $p = .02$, 95% CI $[-.20, -.02]$ (Table S24-S25).

Robustness Checks

Robustness to Missingness

Primary diagnosis was significantly correlated with all missing daily measures, $ps < .01$. We thus re-ran our HLM models with primary diagnosis as a covariate using effect coding (-0.5 = depressive disorder, $+0.5$ = anxiety disorder). Only one result substantively differed (Tables S30-S41): between-person MI skill use was negatively related to depression, $B = -.65$, $SE = .30$, $p = .049$, 95% CI $[-1.29, -.01]$ (Table S34).

Robustness to Outliers

Given three outlier observations from one participant (Figure 1A), we also re-ran our HLM models excluding these three observations (Tables S28-S43). The substantive differences were as follows. First, there was no longer a significant quadratic effect of time predicting skill use over treatment, $B = -.01$, $SE = .005$, $p = .12$, 95% CI $[-.02, .002]$ (Table S29). Second, within-person skill use was not significantly related to depression, $B = -.04$, $SE = .02$, $p = .06$, 95% CI $[-.08, .002]$ (Table S31), although within-person MI skills remained significantly related to lower depression, $B = -.11$, $SE = .03$, $p < .01$, 95% CI $[-.16, -.05]$ (Table S34). Third, within-person DT skills, $B = .07$, $SE = .04$, $p = .05$, 95% CI $[-.001, .15]$, and ER skills, $B = .06$, $SE = .04$, $p = .14$, 95% CI $[-.02, .14]$, were not significantly related to anxiety/stress (Table S33). Similarly, neither total within-person skills, $B = -.01$, $SE = .02$, $p = .64$, 95% CI $[-.05, .03]$ (Table S36), nor within-person ER skills, $B = -.09$, $SE = .05$, $p = .07$, 95% CI $[-.18, .01]$ (Table S38), significantly predicted changes in next-day anxiety/stress. Finally, although within-person

effectiveness did not moderate the relation between within-person skill use and depression, $B = .01$, $SE = .01$, $p = .20$, 95% CI $[-.01, .03]$ (Table S40), within-person effectiveness did moderate the relation between within-person skill use and anxiety/stress, $B = .02$, $SE = .01$, $p = .02$, 95% CI $[.004, .04]$ (Table S41). Specifically, the positive relation between within-person skill use and anxiety/stress was stronger when participants reported greater effectiveness than their personal average (Figure S2).

Discussion

In this secondary data analysis, we examined the between- and within-person associations of DBT skill use and effectiveness with daily ratings of depression, anxiety, and stress among participants with elevated emotion dysregulation in DBT-ST. Contrary to our main hypothesis, participants used more skills (specifically, MI, ER, and DT skills) when experiencing greater anxiety/stress, but not depression. Consistent with one of our main hypotheses, the use of more MI skills was associated with lower depression.

Using more skills than one's personal average was also associated with greater effectiveness. Consistent with our hypothesis, effectiveness moderated the relation between skill use and depression and, when outliers were removed, anxiety/stress. At higher levels of effectiveness, skill use was more strongly positively associated with depression and anxiety/stress. Contrary to our hypothesis, at lower levels of effectiveness, skill use was more strongly negatively associated with depression.

Consistent with our secondary hypothesis, using more skills than one's personal average predicted next-day decreases in anxiety/stress, which was driven by ER skills. However, contrary to our other secondary hypotheses, skill use did not significantly predict changes in next-day depression.

Changes in Skill Use and Negative Affect Over Treatment

Daily skill use doubled during DBT-ST, from about two to four per day, replicating previous work (Lindenboim et al., 2007; Neacsiu et al., 2014; 2010). These converging findings in independent samples suggest that DBT-ST leads to increases in skill frequency.

By contrast, anxiety, stress, and depression did not significantly change over treatment. This result contrasts with Neacsiu et al.'s (2014) findings that anxiety, measured every two months with the Overall Anxiety Severity and Impairment Scale (OASIS), and depression, measured every two months with the Patient Health Questionnaire-9 (PHQ-9), decreased over DBT-ST. Our daily, single-item assessments of average anxiety, stress, and depression intensity may only tap one aspect of these constructs, whereas the OASIS measures both anxiety intensity and impairment and the PHQ-9 measures depression intensity and physiological, cognitive, and behavioral aspects of depression. Alternatively, our single-item assessments may have been less reliable than the multi-item OASIS and PHQ-9; participants may have responded differently knowing their diary cards, and not their OASIS or PHQ-9 scores, would be reviewed by their therapist; or responses to the OASIS and PHQ-9 may have been subject to retrospective recall bias. Given the importance of intensive measurement in detecting within-person changes, we encourage future researchers to clarify the relations among brief, intensive measures and longer, less frequent measures of emotional outcomes.

Skill Use and Negative Affect

People used more skills on days of greater anxiety/stress and fewer skills when experiencing greater depression, although these associations were small. Given that anxiety indicates greater arousal and depression indicates lower arousal (Posner et al., 2005), our findings suggest that negative, high arousal emotions prompt the use of more skills, whereas

negative, low arousal emotions prompt the use of fewer skills.

It is also possible that using more skills leads to greater anxiety/stress but lower depression, perhaps by giving patients more behaviors to practice other than engaging with an anxiety-prompting stimulus, leading to a rebound effect. Because DBT-ST led to reductions in anxiety, assessed via the OASIS, and these reductions were mediated by skill use (Neacsiu et al., 2014), we believe this interpretation is less likely. We encourage future researchers to experimentally manipulate the number of strategies patients use to compare the effects of strategy use on emotions.

Skill Use and Effectiveness

Using more skills than one's personal average was associated with greater perceptions of effectiveness, and greater effectiveness than one's personal average was associated with lower anxiety, stress, and depression. Effectiveness moderated the relation between skill use and depression in the full dataset and moderated the relation between skill use and anxiety/stress after removing outliers. When reporting higher effectiveness than their personal average, participants experienced (a) lower anxiety, stress, and depression and (b) a stronger positive relation between skill use and anxiety, stress, and depression. When reporting lower effectiveness than their personal average, participants experienced (a) higher anxiety, stress, and depression and (b) a stronger negative relation between skill use and depression. These results suggest that, when people perceive their skills to be more effective, more intense negative affect prompts the use of more skills, in line with Ford et al. (2019). However, when people perceive their skills to be less effective, more intense depression prompts the use of fewer skills, in contrast to Ford et al. (2017) in which more intense depression was associated with using more skills among community members experiencing greater life stress who perceived their skills to be less

effective. These results suggest therapists should target not only how many skills patients use but also how effectively they use their skills. Future researchers should clarify how skill use, effectiveness, and quality (i.e., how well a person uses skills; Southward & Cheavens, 2020a) impact emotional outcomes in naturalistic settings and interventions (Southward et al., 2021).

Skill Modules

When experiencing greater anxiety/stress than their personal average, participants used more MI and DT skills, in line with DBT-ST recommendations (Linehan, 2015). When reporting greater effectiveness than their personal average, participants used more MI and ER skills, which promote a sense of mastery over behavioral responses. Finally, when experiencing greater depression, participants used fewer MI skills than their personal average.

Using more skills than one's personal average, particularly ER skills, predicted next-day decreases in anxiety/stress in the full dataset but were not robust to missing data. Although in line with the function of ER skills (i.e., to adaptively manage more consistent experiences of emotional difficulty), these results suggest the effects of skill use may not typically persist beyond the day used. Although nonsignificant, people who used MI, ER, and DT skills more frequently than others reported lower average anxiety, stress, and depression, in line with previous research (Neacsiu et al., 2014; Southward & Cheavens, 2020b). Within the broader literature, these results suggest people who habitually use more skills (between-person effects) experience lower negative affect, even if using more skills than one's personal average (within-person effects) does not necessarily impact day-to-day changes in negative affect.

Limitations

These results should be considered in light of the study's limitations. The small sample of participants with similar gender, racial, and socioeconomic characteristics limited our power to

detect between-person effects and the generalizability of our findings. The timing of our assessments limits our ability to draw causal claims, so we encourage future researchers to use more intensive assessments to gain greater temporal resolution. Our use of single-item measures of negative affect and effectiveness were potentially less reliable than multi-item measures, although they may have enhanced participant compliance. Diary cards also asked participants about their use of specific DBT skills. Because participants did not learn all skills until the end of treatment, they may have been using certain skills without realizing it or indicating their use on the diary cards. Finally, DBT-ST was led by the last author with supervision from the treatment developer, suggesting the treatment was of very high quality and may not generalize to typical community settings.

Conclusion

In this study of within-person processes in DBT-ST for transdiagnostic emotional disorders, we replicated the finding that DBT-ST leads to more frequent skill use (Neacsiu et al., 2014) using more intensive measures of skill use that are less susceptible to recall bias. We also found that skills were used more frequently on days of more intense anxiety and stress, suggesting that participants implemented this treatment principle effectively. Importantly, participants' effectiveness in using skills moderated this relation, emphasizing the need to consider skill effectiveness, in addition to how frequently and in what contexts skills are used. Our exploratory findings highlight how MI and DT skills in particular are used in relation to negative affect, suggesting that skills may function differently on days with more (i.e., anxiety/stress) versus less arousing (i.e., depression) emotions. Overall, these results offer insight into how key theoretical processes in DBT (i.e., skill use and effectiveness) relate to changes in negative affect that therapists can prioritize to better optimize DBT-ST.

References

- Bakdash, J.Z., & Marusich, L.R. (2017). Repeated measures correlation. *Frontiers in Psychology*, 8, 456. <https://doi.org/10.3389/fpsyg.2017.00456>
- Bohus, M., Kleindienst, N., Limberger, M.F., Stieglitz, R.D., Domsalla, M., Chapman, A.L., Steil, R., Philipsen, A., & Wolf, M. (2009). The short version of the Borderline Symptom List (BSL-23): Development and initial data on psychometric properties. *Psychopathology*, 42(1), 32–39. <https://doi.org/10.1159/000173701>
- Brown, T.A., Campbell, L.A., Lehman, C.L., Grisham, J.R., & Mancill, R.B. (2001). Current and lifetime comorbidity of the DSM-IV anxiety and mood disorders in a large clinical sample. *Journal of Abnormal Psychology*, 110(4), 585–599. <https://doi.org/10.1037/0021-843X.110.4.585>
- Conklin, L.R., & Strunk, D.R. (2015). A session-to-session examination of homework engagement in cognitive therapy for depression: Do patients experience immediate benefits? *Behaviour Research and Therapy*, 72, 56–62. <https://doi.org/10.1016/j.brat.2015.06.011>
- Cuijpers, P., Cristea, I.A., Karyotaki, E., Reijnders, M., & Huibers, M.J.H. (2013). How effective are cognitive behavior therapies for major depression and anxiety disorders? A meta-analytic update of the evidence. *World Psychiatry*, 15(3), 245–258. <https://doi.org/10.1002/wps.20346>
- Cuijpers, P., Karyotaki, E., Weitz, E., Andersson, G., Hollon, S.D., & van Straten, A. (2014). The effects of psychotherapies for major depression in adults on remission, recovery and improvement: A meta-analysis. *Journal of Affective Disorders*, 159, 118–126. <https://doi.org/10.1016/j.jad.2014.02.026>

- Dunn, L.M., & Dunn, L.M. (1981). *Manual for the Peabody Picture Vocabulary Test-Revised*. American Guidance Service.
- First, M.B., Spitzer, R.L., Gibbon, M., & Williams, J.B.W. (1995). *Structured Clinical Interview for DSM-IV Axis I Disorders - Patient Edition (SCID-I/P)*. Biometrics Research, New York State Psychiatric Institute.
- Ford, B.Q., Gross, J.J., & Gruber, J. (2019). Broadening our field of view: The role of emotion polyregulation. *Emotion Review*, 11(3), 197–208.
<https://doi.org/10.1177/1754073919850314>
- Ford, B.Q., Karnilowicz, H.R., & Mauss, I.B. (2017). Understanding reappraisal as a multicomponent process: The psychological health benefits of attempting to use reappraisal depend on reappraisal success. *Emotion*, 17(6), 905–911.
<https://doi.org/10.1037/emo0000310>
- Goldin, P.R., Lee, I., Ziv, M., Jazaieri, H., Heimberg, R.G., & Gross, J.J. (2014). Trajectories of change in emotion regulation and social anxiety during cognitive-behavioral therapy for social anxiety disorder. *Behaviour Research and Therapy*, 56, 7–15.
<https://doi.org/10.1016/j.brat.2014.02.005>
- Gratz, K.L., & Roemer, L. (2004). Multidimensional assessment of emotion regulation and dysregulation: Development, factor structure, and initial validation of the Difficulties in Emotion Regulation Scale. *Journal of Psychopathology and Behavioral Assessment*, 26, 41–54. <https://doi.org/10.1023/B:JOBA.0000007455.08539.94>
- Harley, R., Sprich, S., Safren, S., Jacobo, M., & Fava, M. (2008). Adaptation of dialectical behavior therapy skills training group for treatment-resistant depression. *Journal of Nervous and Mental Disease*, 196(2), 136–143.

<https://doi.org/10.1097/NMD.0b013e318162aa3f>

Hofmann, S.G., Sawyer, A.T., Fang, A., & Asnaani, A. (2012). Emotion dysregulation model of mood and anxiety disorders. *Depression and Anxiety*, 29(5), 409–416.

<https://doi.org/10.1002/da.21888>

Kring, A.M., & Sloan, D.M. (2010). *Emotion regulation and psychopathology: A transdiagnostic approach to etiology and treatment*. Guilford Press.

Lindenboim, N., Comtois, K.A., & Linehan, M.M. (2007). Skills practice in Dialectical Behavior Therapy for suicidal women meeting criteria for borderline personality disorder.

Cognitive and Behavioral Practice, 14(2), 147–156.

<https://doi.org/10.1016/j.cbpra.2006.10.004>

Linehan, M.M. (1993). *Cognitive-behavioral treatment of borderline personality disorder*.

Guilford Press.

Linehan, M.M. (2015). *DBT skills training manual* (2nd ed.). Guilford Press.

Linehan, M.M., Korslund, K.E., Harned, M.S., Gallop, R.J., Lungu, A., Neacsiu, A.D.,

McDavid, J., Comtois, K.A., & Murray-Gregory, A.M. (2015). Dialectical behavior therapy for high suicide risk in individuals with borderline personality disorder: A randomized clinical trial and component analysis. *JAMA Psychiatry*, 72(5), 475–482.

<https://doi.org/10.1001/jamapsychiatry.2014.3039>

Murray, C.J., Atkinson, C., Bhalla, K., Birbeck, G., Burstein, R., Chou, D., ... U.S. Burden of

Disease Collaborators. (2013). The state of US health, 1990-2010: Burdens of disease, injuries, and risk factors. *JAMA*, 310(6), 591–608.

<https://doi.org/10.1001/jama.2013.13805>

Neacsiu, A.D., Eberle, J.W., Kramer, R., Wiesmann, T., & Linehan, M.M. (2014). Dialectical

behavior therapy skills for transdiagnostic emotion dysregulation: A pilot randomized controlled trial. *Behaviour Research and Therapy*, 59, 40–51.

<https://doi.org/10.1016/j.brat.2014.05.005>

Pinheiro, J., Bates, D., DebRoy, S., Sarkar, D., & R Core Team. (2019). *nlme: Linear and nonlinear mixed effects models* (Version 3.1-141). Retrieved from <https://CRAN.R-project.org/package=nlme>

Posner, J., Russell, J.A., & Peterson, B.S. (2005). The circumplex model of affect: An integrative approach to affective neuroscience, cognitive development, and psychopathology. *Development and Psychopathology*, 17(3), 715–734.

<https://doi.org/10.1017/S0954579405050340>

Southward, M.W., Cassiello-Robbins, C., Zelkowitz, R.L., & Rosenthal, M.Z. (2020).

Navigating the new landscape of value-based care: An example of increasing access, improving quality, and reducing costs using the Unified Protocol. *The Behavior Therapist*, 43(4), 134–137. <https://doi.org/10.31234/osf.io/rvbzn>

Southward, M.W., & Cheavens, J.S. (2020a). More (of the right strategies) is better:

Disaggregating the naturalistic between- and within-person structure and effects of emotion regulation strategies. *Cognition & Emotion*, 34(8), 1729–1736.

<https://doi.org/10.1080/02699931.2020.1797637>

Southward, M.W., & Cheavens, J.S. (2020b). Quality or quantity? A multistudy analysis of emotion regulation skills deficits associated with borderline personality disorder.

Personality Disorders: Theory, Research, & Treatment, 11(1), 24–35.

<https://doi.org/10.1037/per0000357>

Southward, M.W., Sauer-Zavala, S., & Cheavens, J.S. (2021). Specifying the mechanisms and

targets of emotion regulation: A translational framework from affective science to psychological treatment. *Clinical Psychology: Science and Practice*. Advance online publication. <https://doi.org/10.1037/cps0000003>

Springer, K.S., Levy, H.C., & Tolin, D.F. (2018). Remission in CBT for adult anxiety disorders: A meta-analysis. *Clinical Psychology Review*, *61*, 1–8.
<https://doi.org/10.1016/j.cpr.2018.03.002>

Wang, L., & Maxwell, S.E. (2015). On disaggregating between-person and within-person effects with longitudinal data using multilevel models. *Psychological Methods*, *20*(1), 63–83.
<https://doi.org/10.1037/met0000030>

DAILY SKILL USE IN DBT SKILLS TRAINING

Table 1

Summary Statistics and Between- and Within-Person Correlations Among Demographics and Variables of Interest

Variable	<i>M (SD), median, or n (%)</i>	1	2 ^a	3 ^a	4 ^a	5 ^a	6	6a	6b	6c	6d	7	8	9	10
1. Age	31.79 (8.95)														
2. Gender (female) ^a	13 (68.4%)	-.31													
3. Race (White) ^a	18 (94.7%)	.32	.35												
4. Annual income ^a	\$30,000- 49,999	.52*	-.13	.31											
5. Primary anxiety Dx ^a	12 (63.2%)	-.44	-.05	-.18	-.29										
6. Total DBT skills	3.15 (1.88)	.36	.12	-.17	.04	-.12		.62**	.69**	.66**	.48**	.11**	-.01	.09**	.11**
6a. MI skills	1.76 (1.09)	.28	.08	-.13	.11	-.04	.91**		.14**	.04	.02	.10**	-.05	.04	.12**
6b. ER skills	.69 (.44)	.07	-.03	.04	.21	-.16	.33	.34		.34**	.26**	.06*	< .01	.04	.08**
6c. DT skills	.61 (.83)	.34	.22	-.04	-.40	.09	.72**	.44	-.23		.37**	.06*	.06*	.08**	< .01
6d. IE skills	.09 (.18)	.37	.12	.17	-.32	-.15	.81**	.58*	.01	.86**		< .01	-.04	.04	-.04
7. Anxiety	3.48 (1.65)	.37	-.35	.26	-.01	-.26	-.18	-.24	-.29	.04	.02		.46**	.67**	-.27**
8. Depression	2.79 (1.81)	.37	-.19	.09	-.16	-.40	-.28	-.36	-.36	.03	.05	.87**		.37**	-.31**
9. Stress	3.38 (1.59)	.29	-.28	.30	-.06	-.20	-.17	-.17	-.41	.05	.05	.95**	.78**		-.24**
10. Effectiveness	5.95 (1.84)	-.24	.62**	.26	-.07	.28	.20	.17	-.26	.32	.18	-.35	-.42	-.16	

Note. Between-person correlations are below the diagonal; within-person correlations are above. Gender: male = 0, female = 1. Race: not White = 0, White = 1. Primary diagnosis: 0 = depressive disorder, 1 = anxiety disorder. DBT-WCCL-DSS measured at baseline. Dx = diagnosis; DBT-WCCL-DSS = Dialectical Behavior Therapy Ways of Coping Checklist – DBT Skills Scale; MI = Mindfulness; ER = Emotion Regulation; DT = Distress Tolerance; IE = Interpersonal Effectiveness.

^aCorrelations involving dichotomous or ordinal variables are Spearman's correlations.

* $p < .05$

** $p < .01$

DAILY SKILL USE IN DBT SKILLS TRAINING

Table 2

Between- and Within-Person Associations of Daily Use of DBT Skills With Negative Affect and Effectiveness

Anxiety & Stress				
Variable	<i>B</i>	<i>SE</i>	<i>p</i>	95% CI
Intercept	2.27	.26	< .01	[1.76, 2.77]
Week	−.01	.01	.25	[−.04, .01]
Depression	.44	.02	< .01	[.40, .49]
DBT skill use (between)	−.03	.13	.84	[−.30, .24]
DBT skill use (within)	.09	.01	< .01	[.06, .12]

Note. DBT = Dialectical Behavior Therapy. Random intercept $\sigma^2 = 1.00$, Residual $\sigma^2 = 1.15$, Lag-1 autocorrelation [AR(1) ρ] = .34, AIC = 3643.69.

Depression				
Variable	<i>B</i>	<i>SE</i>	<i>p</i>	95% CI
Intercept	.93	.30	< .01	[.34, 1.52]
Week	−.003	.01	.83	[−.03, .02]
Anxiety & Stress	.55	.03	< .01	[.49, .60]
DBT skill use (between)	−.19	.15	.21	[−.50, .12]
DBT skill use (within)	−.06	.02	< .01	[−.09, −.02]

Note. DBT = Dialectical Behavior Therapy. Random intercept $\sigma^2 = 1.15$, Residual $\sigma^2 = 1.28$, AR(1) $\rho = .35$, AIC = 3892.57.

Effectiveness				
Variable	<i>B</i>	<i>SE</i>	<i>p</i>	95% CI
Intercept	6.02	.44	< .01	[5.17, 6.88]
Week	−.02	.02	.28	[−.05, .01]
DBT skill use (between)	.19	.23	.43	[−.30, .67]
DBT skill use (within)	.08	.02	< .01	[.04, .13]

Note. DBT = Dialectical Behavior Therapy. Random intercept $\sigma^2 = 1.82$, Residual $\sigma^2 = 1.54$, AR(1) $\rho = .29$, AIC = 4196.23.

Table 3

Between- and Within-Person Associations of Daily Use of DBT Skills Modules With Negative Affect and Effectiveness

Anxiety & Stress					Depression				
Variable	<i>B</i>	<i>SE</i>	<i>p</i>	95% CI	Variable	<i>B</i>	<i>SE</i>	<i>p</i>	95% CI
Intercept	2.24	.28	< .01	[1.70, 2.78]	Intercept	1.03	.29	< .01	[-.46, 1.61]
Week	-.01	.01	.48	[-.03, .02]	Week	-.01	.01	.30	[-.04, .01]
Depression	.44	.02	< .01	[-.40, .49]	Anxiety & Stress	.54	.03	< .01	[-.49, .60]
Between-person					Between-person				
MI	.06	.32	.86	[-.63, .75]	MI	-.66	.33	.06	[-1.36, .04]
ER	-.68	.73	.37	[-2.25, .89]	ER	-.45	.74	.56	[-2.05, 1.15]
DT	-.31	.71	.67	[-1.83, 1.22]	DT	-.41	.72	.58	[-1.96, 1.14]
IE	1.16	3.35	.73	[-6.03, 8.35]	IE	4.18	3.41	.24	[-3.13, 11.49]
Within-person					Within-person				
MI	.11	.03	< .01	[-.06, .16]	MI	-.11	.03	< .01	[-.17, .06]
ER	.08	.04	.046	[-.002, .16]	ER	-.01	.04	.91	[-.09, .08]
DT	.09	.04	< .01	[-.02, .16]	DT	.001	.04	.97	[-.08, .08]
IE	.02	.07	.73	[-.11, .16]	IE	-.10	.08	.21	[-.25, .06]

Note. MI = Mindfulness; ER = Emotion Regulation; DT = Distress Tolerance; IE = Interpersonal Effectiveness. Random intercept $\sigma^2 = 1.08$, Residual $\sigma^2 = 1.15$, Lag-1 autocorrelation [AR(1) ρ] = .34, AIC = 3659.19.

Note. MI = Mindfulness; ER = Emotion Regulation; DT = Distress Tolerance; IE = Interpersonal Effectiveness. Random intercept $\sigma^2 = 1.09$, Residual $\sigma^2 = 1.27$, AR(1) $\rho = .35$, AIC = 3897.56.

Effectiveness				
Variable	<i>B</i>	<i>SE</i>	<i>p</i>	95% CI
Intercept	5.94	.43	< .01	[5.10, 6.79]
Week	-.01	.02	.69	[-.04, .03]
Between-person				
MI	.52	.53	.34	[-.62, 1.66]
ER	-1.11	1.20	.37	[-3.69, 1.46]
DT	1.23	1.17	.31	[-1.27, 3.73]
IE	-5.18	5.50	.36	[-16.98, 6.61]
Within-person				
MI	.14	.04	< .01	[-.07, .21]
ER	.14	.06	.01	[-.03, .25]
DT	-.02	.05	.68	[-.12, .08]
IE	-.11	.10	.31	[-.31, .10]

Note. MI = Mindfulness; ER = Emotion Regulation; DT = Distress Tolerance; IE = Interpersonal Effectiveness. Random intercept $\sigma^2 = 1.79$, Residual $\sigma^2 = 1.53$, AR(1) $\rho = .29$, AIC = 4192.94.

Figure 1*Daily Ratings of DBT Skill Use, Anxiety, Depression, and Stress*

Grey lines represent participant-level responses. Black lines represent the group-level average at each observation.

Figure 2

Effectiveness Moderates the Relation of Within-Person DBT Skills Use and Same-Day

Depression