

Implementing a Web-Based Cognitive Defusion Program to Target Negative Self-Referential
Thoughts in College Students:
A Pilot Study

Clarie-Ann Henriques Wollach, M.S., M.A.¹, LeeAnn Cardaciotto, Ph.D.², Michael Levin,
Ph.D.³ & Sharon Lee Armstrong, Ph.D.⁴

¹*Corresponding author: La Salle University, Department of Psychology, 1900 W Olney Ave,
Philadelphia, PA 19141, USA, henriquesc1@student.lasalle.edu

² La Salle University, Department of Psychology, 1900 W Olney Ave, Philadelphia, PA 19141,
USA, cardaciotto@lasalle.edu

³ Utah State University, Department of Psychology, 2810 Old Main Hill, Logan, UT 84322,
USA, michael.levin@usu.edu

⁴ La Salle University, Department of Psychology, 1900 W Olney Ave, Philadelphia, PA 19141,
USA, armstrong@lasalle.edu

Abstract

Cognitive defusion may enhance healthy coping with negative self-referential thoughts amongst college students. However, research is needed to examine how to effectively introduce and teach defusion to this population. The current pilot study tested the usability of and satisfaction with the D-FUSE program, a single-session, web-based program for a mixed sample of undergraduates and its effectiveness in producing improvements in cognitive defusion and self-criticism. In an undergraduate sample ($N = 141$), the D-FUSE program was found to be usable and satisfactory. Program engagement rendered significant reductions in the believability of and emotional discomfort produced by negative self-referential thoughts. Further improvements to program development and administration are considered.

Keywords: Cognitive defusion; ACT; Web-based; College students

Implementing a Web-Based Cognitive Defusion Program to Target Negative Self-Referential Thoughts in College Students: A Pilot Study

Cognitive defusion strategies, which emphasize the process of observing thoughts with objectivity, have been shown to be beneficial for various populations, including college students. Most of the literature on college students has focused on negative self-referential thoughts, and has shown that cognitive defusion training can produce positive outcomes, including decreased believability and discomfort associated with such thoughts (Healy et al., 2008; Larsson, Hooper, Osborne, Bennett, & McHugh, 2016; Masuda, Hayes, Sackett, & Twohig, 2004; Masuda, Twohig et al., 2010). A self-focus emerges during the college experience when students are often trying to gain an understanding of their identities and what their capabilities and beliefs are (Arnett, 2012). Addressing self-critical thoughts is especially important due to the prominence of maladaptive perfectionism in this age group, consisting of unrealistic expectations of the self and problematic evaluations of self-worth and performance (Pirbaglou et al., 2013). Cognitive fusion with such negative self-referential thoughts has been found to be associated with greater psychological distress among college students (Duff, Larsson, & McHugh, 2016). Therefore, addressing these thoughts through methods that target cognitive defusion can serve as a protective factor against the development of distressing psychological symptoms in this population.

Levin, Pistorello, Seeley, and Hayes (2014) designed a web program for college students that taught the values and acceptance components of acceptance and commitment therapy (ACT; Hayes, Strosahl, & Wilson, 1999), which significantly reduced stress, improved intrinsic motivation, and reduced mood symptoms among students with minimal symptoms. The inclusion of cognitive defusion in another online ACT program produced positive effects on

college student's overall well-being (Räsänen, Lappalainen, Muotka, Tolvanen, & Lappalainen, 2016). Levin, Pistorello, Seeley et al. (2014) point out that developing web-based self-help programs for every type of issue and disorder would be costly and complex, emphasizing the need for more general preventative programming. Studying defusion in isolation can shed light on its mechanisms for change and increase understanding on how to streamline web interventions, since this construct directly addresses negative self-referential thoughts. Additionally, Internet-delivered programs are accessible and maintain privacy (Rickwood & Bradford, 2012). To date, no research has examined the impact of a cognitive defusion web-based program for college students. The current pilot study evaluated the Distancing From Unhelpful Self Evaluations (D-FUSE) program for a mixed sample of college students with negative self-referential thoughts to see its effects on defusion abilities.

Cognitive Defusion in College Students

Cognitive defusion, one of ACT's six core processes, refers to the process of stepping back and observing thoughts and images (Hayes et al., 1999). This process is important because individuals often become fused (i.e., caught up) with the content of their distressing thoughts, which often leads to maladaptive behaviors and ineffective attempts to cope (Stoddard & Afari, 2014). When cognitive defusion is utilized, thoughts are not evaluated or restructured, but rather noticed with objectivity and separate from one's sense of self (Pilecki & McKay, 2012). Cognitive defusion has been thought of as both a trait, meaning a general tendency to form distance from thoughts, and as a state when the process is more transient (Donald, Atkins, Parker, Christie, & Guo, 2016). Training aims to increase state defusion experientially by having individuals observe their mind's content and by deliteralizing language through viewing it as a verbal process (Stoddard & Afari, 2014). Doing so changes the unwanted quality of the thoughts

and ultimately attempts to reduce the literal meaning associated with undesirable thoughts (Hayes, 2006).

Studies looking at the effect of cognitive defusion practice on negative self-referential thoughts in college students have yielded promising findings. Defusion training has been found to significantly reduce the discomfort and believability of negative self-referential thoughts and increase willingness to have such thoughts, and does so more than comparison groups (e.g., self-talk, breathing, thought distraction, cognitive restructuring; Healy et al., 2008; Larsson et al., 2016; Mandavia et al., 2015; Masuda et al., 2004; Masuda, Twohig et al., 2010). Defusion training also results in decreased mood symptoms and improvements in self-esteem and psychological flexibility among clinically distressed college students (Hinton & Gaynor, 2010). These findings are promising and suggest defusion is an effective tool for coping with negative self-referential thoughts in college students. Specifically, a defusion protocol that consists of rationale, training, and experiential exercise has the most significant impact on distress resulting from negative self-referential thoughts (Masuda, Feinstein, Wendell, & Sheehan, 2010).

Since negative self-referential thoughts and poor self-concept can impact various aspects of functioning and adjustment to college (Arnett, 2012), cognitive defusion can serve as an effective skill for coping with these unhelpful cognitions. Habitual negative self-thinking has been found to predict low self-esteem in college students (Verplanken, Friborg, Wang, Trafimow, & Woolf, 2007). A negative self-focus is a risk factor for anxiety, disordered eating (Yiend, Parnes, Shepherd, Roche, & Cooper, 2014), self-harm behaviors (Batey, May, & Andrade, 2010), and depression (Pirbaglou et al., 2013). Therefore, addressing negative self-referential thoughts through the teaching of cognitive defusion with college students can serve as a protective factor. Specifically, by targeting negative self-referential thoughts initially, later

symptomatology stemming from these cognitions may not arise or could become less severe because students have skills to cope.

Prevention Web-Based Efforts for College Students

Given the technological and internet age that so heavily defines Generation Z, web-based programming could be a promising route to deliver prevention programming to college students. Web-based programs are highly accessible and maintain students' privacy and independence (Rickwood & Bradford, 2012). Use of the internet is frequent in higher education, making it convenient and accessible. Additionally, these programs can contain and target sensitive material, which can be accessed in a private environment and anonymously through the web (Davies, Morriss, & Glazebrook, 2014). Technology also presents information using multimedia, audio, interactive lessons and games, and simulations to engage its users (Carey, Scott-Sheldon, Elliott, Bolles, & Carey, 2009). Web-based self-help programs for depression and anxiety (Arpin-Cribbie, Irvine, & Ritvo, 2012; Botella et al., 2008; Braithwaite & Fincham, 2007; Day, McGrath, & Wojtowicz, 2013; Kenardy, McCafferty, & Rosa, 2003; Lintvedt et al., 2013; Orbach, Lindsay, & Grey, 2007; Radhu, Daskalakis, Arpin-Cribbie, Irvine, & Ritvo, 2012), relationship functioning (Braithwaite & Fincham, 2007, 2009), overall well-being (Räsänen et al., 2016), and valued-living (Firestone et al., 2019; Levin, Pistorello, Seeley et al., 2014) have been successfully developed for college students.

Although not focused on college students, Levin, Haeger, An, and Twohig (2018) looked at the delivery of a 2-week cognitive defusion program through a mobile app with interactive features. This group was compared to a cognitive restructuring and waitlist group, all consisting of a distressed adult sample markedly high in self-criticism. Both restructuring and defusion groups produced improvements in cognitive decentering, self-compassion, and dysfunctional

attitudes. Importantly, this study showed that cognitive defusion can be delivered successfully through a mobile app-based format. Further study of cognitive defusion has great potential as a way to address negative self-referential thoughts. However, cognitive defusion has not yet been studied in a web-based format for college students.

The Current Study

The current study aimed to examine an interactive web-based defusion program (D-FUSE program) targeting negative self-referential thoughts in a mixed sample of college students. The proposed program was hypothesized to be usable and satisfactory, as well as provide user feedback on how to refine future programming. Additionally, it was hypothesized to produce improvements in self-reported cognitive defusion and self-criticism. Finally, increased engagement in practice goals after completing the program was hypothesized to be positively associated with increases in cognitive defusion.

Method

Participants

Data collection took place at a medium-sized Catholic university in the northeast United States that is comprised of a student body which is primarily female (61%) and ethnically diverse (51% White). Participants were required to be undergraduates between 18 and 30 years old, English-speaking, have a computer with internet access, and enrolled at the university where the study took place. Although 153 students consented to participate, 12 participants' data were excluded due to high amounts of missing data caused by study termination. The participant flow diagram exhibits dropout rates at each stage of the study (see Figure 1).

The final sample consisted of 141 students (88.7% female) and included 59 freshman, 31 sophomores, 28 juniors, 20 seniors, and 3 students who considered their standing was “not

listed.” Participants’ mean age was 19.61 ($SD = 1.58$). Most participants self-identified as White (68.1%), followed by Black/African American (12.1%), Asian (7.8%), not listed (7.1%), Multiracial (2.1%), American Indian/Alaskan Native (1.4%), and Pacific Islander/Hawaiian (1.4%); 15.6% of participants identified as Hispanic. 75% of participants indicated having some form of meditation practice (i.e., meditation, yoga, Tai Chi, prayer), with yoga being the most identified.

Pilot Study Design and Procedure

Following Institutional Review Board approval, undergraduate students were recruited from classes where instructors agreed to allocate extra-credit as compensation for their participation in this study. Participants who completed 100% of Part 1 (i.e., pre-program measures, defusion intervention, and post-program measures) were entered into a raffle to win a \$150 Amazon gift card. Compensation for full completion of Part 2 (follow-up measures) was extra credit in one course. Students who expressed interest in participating were provided a link to the study in Qualtrics. After consent was provided, participants were directed to complete pre-program questionnaires: Cognitive Fusion Questionnaire (CFQ), questions from the demographics questionnaire, and Functions of Self-Criticizing/Attacking Scale (FSCS). The order of the CFQ and FSCS was randomized.

Next, the approximately 30-minute web-based defusion-focused program for college students, D-FUSE program (see Appendix), was administered. The program design is based on a web-based ACT intervention package for college students developed by Michael Levin, Ph.D. and his research team at Utah State University. Defusion exercises within the package were edited and adapted to fit the current study’s target of negative self-referential thoughts. Believability and emotional discomfort ratings of a negative self-referential thought were

completed early in the D-FUSE program before engaging in defusion exercises. They were completed again after engaging in defusion exercises. The end of the program required participants to identify goals in order to practice the learned skills over the next 2 weeks.

Participants were notified prior to starting the program that they had 72 hours to complete it, and were encouraged to complete it in one sitting but were able to resume participation within the 72-hour period. Participants who failed to complete the program within this time frame were unable to complete the program and were excluded from data analysis. After completion of the program, participants were directed to the post-program measures: PSFQ, SUS, and demographics questionnaire (in this order). Two weeks after completing the program, participants were emailed a link and asked to complete follow-up measures: CFQ, FSCS, and FUQ (all randomized).

Measures

Functions of Self-Criticizing/Attacking Scale (FSCS). The FSCS (Gilbert, Clark, Hempel, Miles, & Irons, 2004) is a 21-item self-report questionnaire designed to measure why people think they self-attack. Responses are given on a 5-point Likert scale ranging from 0 (*not at all like me*) to 4 (*extremely like me*). The measure is made up of two subscales which highlight different functions for being self-critical: trying to improve the self through self-correction (SC) versus wanting to harm the self through self-persecution (SP), with higher scores reflecting greater identification with respective area. Gilbert et al., 2004 report Cronbach alphas of .92 respectively for both scales. In the current study, internal consistency for the SC subscale was $\alpha = .88$ and the SP subscale was $\alpha = .87$.

Cognitive Fusion Questionnaire (CFQ). The CFQ (Gillanders et al., 2014) is a 7-item self-report questionnaire designed to assess trait cognitive fusion. Participants were asked to rate

each question on a 7-point Likert scale ranging from 1 (*never true*) to 7 (*always true*). Higher scores reflect higher cognitive fusion. Unlike other measures of defusion that are problem-specific (e.g., depression, anxiety), the CFQ is a general and nonclinical measure of defusion. In a college sample, the CFQ showed good construct validity, internal consistency, test-retest reliability, and construct validity (Gillanders et al., 2014). Internal consistency of the CFQ within the present study was $\alpha = .93$.

Believability and emotional discomfort ratings. Emotional discomfort and believability ratings were taken from Masuda et al. (2004; Masuda, Twohig et al., 2010) research on negative self-referential thoughts. Participants answer two Likert-scale questions pre- and post-intervention. The level of emotional discomfort and the believability of the thoughts was assessed with Likert scales ranging from 0 to 100, with 0 being *not at all uncomfortable* and *not at all believable* to 100 being *very uncomfortable* and *very believable*.

System Usability Scale (SUS). The SUS (Brooke, 1996) is a 10-item self-report questionnaire designed to evaluate program usability. Immediately after completion of the program, participants were asked to rate each question on a 5-point Likert scale ranging from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*). Total scores can range from 0 to 100, with higher scores indicating greater usability. Results of studies using the SUS support its internal consistency ($\alpha = .91$; Bangor, Kortum, & Miller, 2008). Internal consistency for the SUS in the present study was $\alpha = .80$.

Program Satisfaction and Feedback Questionnaire (PSFQ). Immediately following completion of the program, participants were asked to answer questions regarding their satisfaction with the program based on similar items generated for other self-help programs (e.g., Firestone et al., 2019; Levin, Pistorello, Hayes et al., 2014). Program satisfaction was assessed

quantitatively by asking participants if they would recommend the program to a friend (yes or no format) and to rate their satisfaction with each section of the program (rationale, what defusion is, defusion exercises, defusion practice assignments, and session summaries) on a Likert scale from 1 (*Strongly Disliked*) to 6 (*Strongly Liked*). Satisfaction was qualitatively assessed through open-ended questions about aspects of the program participants liked the least and the most (e.g., exercises, look and feel, content). Program usability was evaluated qualitatively by asking for feedback on technical issues experienced while completing the program and the length/duration of the program.

Follow-Up Questionnaire (FUQ). At the 2-week follow-up, participants were asked to answer questions regarding the frequency and overall experience of completing their goals/homework exercise(s) since completing the program. They were asked to identify the frequency (i.e., times per day, days per week) in which they practiced defusion exercises to assess for actual engagement in their goals. Practice effectiveness was assessed quantitatively by asking participants to rate how successful exercise engagement was in producing a defused state (i.e., ability to “step back”, reduction in discomfort) on a Likert scale from 1 (*Not at all*) to 4 (*Strongly*). Program satisfaction was assessed through open-ended qualitative questions which assessed for aspects of the goal setting and overall program liked the least and the most.

Results

Program Attrition and Completion

Some attrition occurred between assessment phases (see Figure 1). Out of the 153 participants who initiated the study, 11 individuals discontinued or did not engage in the program. One additional participant completed the program but did not complete post-program

measures. Although most participants who completed Part 1 also completed Part 2 ($n = 95$), 46 (33%) did not complete Part 2.

Preliminary Data Analysis

A series of initial analyses were performed to ensure data validity and integrity. First, missing values analyses were conducted for the primary measures. Participants with more than 60% missing data across Part 1 and Part 2 were excluded from the final sample; 12 participants met this criterion. Two of these 12 participants were unable to identify an uncomfortable thought and were not delivered the program. The remaining 10 participants did not fully engage and exhibited high amounts of missing data across the two parts of this study. Since all these individuals discontinued participation, no feedback was available regarding liked and disliked aspects on the PSFQ. There were no indicators specific to these participants to indicate higher likelihood of drop out.

Random/careless responding and task inattention were then investigated by examining whether participants had repeatedly marked the same response option within and across self-report measures and were consistently non-adherent during the program (i.e., participants who did not respond to any exercise). Invariant responding within measures was interpreted within the context of response time. For example, a participant who repeatedly marked the same response throughout a measure and had significantly shorter response time would be considered for exclusion (DeSimone, Harms, & DeSimone, 2015; Huang, Curran, Keeney, Poposki, & DeShon, 2012). The amount of time participants spent on the program was assessed using program usage data. Deviant times possibly indicated inattention or multi-tasking while engaging in the program. Sixteen participants on Part 1 and 10 participants on Part 2 evidenced

significantly deviant (higher or lower) time spent on the program; however, since their responses indicated engagement and adherence, they were included in analyses.

The existence of univariate outliers was evaluated through the use of Z -scores ($z > 3.0$) and box and whisker plots. Identified outliers were examined to see the impact of each data point on the normality assumption, which further informed decisions regarding removal. Seven participants were considered significant outliers on the FSCS; however, their scores on other measures fell in the normal range. These outliers were winsorized and the cases were included in analyses.

Patterns of missing data for all included cases were analyzed for multiple imputation, which was implemented to handle remaining missing data. Thus, 141 participants were retained for analyses. Data were then tested to ensure the respective paired sample t -test assumptions were met; the Part 1 and Part 2 FSCS-SP, believability, and emotional discomfort ratings were non-normal. Assumptions were otherwise met.

Program Impact

Usability. The D-FUSE program's average usability rating (i.e., the degree to which participants found the program easy to use /navigate and be satisfactory) was 80.27 ($SD = 14.41$), which translates to a *good* program rating per the SUS (Bangor et al., 2008). Sauro (2011) examined 500 studies and reported the average SUS score was 68. Out of 128 participants, 92.1% ($n = 118$) denied experiencing any technical issues, although four participants indicated difficulty initially accessing the program due to being required to manually type in the long program URL (students were given the option to email the researcher directly to get the link emailed to them).

After engaging in the approximately 30-minute program, 76.6% ($n = 108$) of the sample identified the program length as “just right” (“too long”: 22.7%, “too short”: .7%). However, there was a great deal of variability with Part 1 completion time ($M = 1.9$ hours, $SD = 6.2$ hours), with a range from 13.9 minutes to 54.2 hours. Participants were given 72 hours to complete Part 1, which likely resulted in intermittent engagement.

Participants’ understanding of the program purpose was assessed at the end of Part 1, to which 55.3% ($n = 78$) identified was “to change unhelpful thoughts to more positive thoughts,” 24.8% ($n = 35$) selected “to step back from and observe unhelpful thoughts without reacting,” 17.7% ($n = 25$) selected “to identify unhelpful thoughts and figure out if they are true or false,” and 2.1% ($n = 3$) selected “to ignore unhelpful thoughts and pretend they are not there.”

Satisfaction. When participants were asked if they would recommend the D-FUSE program to a friend at the conclusion of Part 1, 94.3% ($n = 133$) of the sample said “yes.” During Part 2, 96 participants indicated whether they used what they learned from the program in their life, to which 93.8% ($n = 90$) indicated “yes.” Among responders who said “no,” they indicated having difficulty or a lack of time in implementing the exercises. Quantitative rating scales from the PSFQ assessed satisfaction with different areas of the program (see Table 1). Ratings at post-intervention ranged from 4.42 to 5.18 ($SD = .98$ to 1.71), reflecting *slightly liked* to *moderately liked* ratings.

Participants were asked to describe which aspects of the program they liked and found the most helpful, to which 133 responded. At the conclusion of Part 1, 93% ($n = 124$) of the positive feedback was about the program content (i.e., exercises, education, audio, examples). This positive response to program content was also found among 96% ($n = 88$) of the 92

participants who responded when assessed during Part 2. A small percentage of Part 1 respondents commented on usability and aesthetics of the program.

One hundred and fourteen participants reported on disliked aspects of the program. After completing Part 1, although 35% ($n = 40$) could not identify disliked aspects, 24% ($n = 27$) of comments focused on opinions and preferences with various exercises. Some participants (13%; $n = 15$) felt there was too much reading and information, and/or the program was too long (.07%). However, some felt the program should have been longer and included more exercises (.05%). A few comments expressed a desire to have more self-critical thoughts to choose from. These same themes were displayed among the 75 participants assessed during Part 2, with 39% ($n = 29$) not disliking anything, 24% ($n = 18$) feeling it was too long and/or content-heavy, and 19% ($n = 14$) indicating exercise specific preferences. See Table 2 for responses about liked and disliked program aspects.

Goal-Setting Practice Engagement

Out of the 97 participants who provided feedback on the FUQ at Part 2, 81 (84%) indicated practicing the learned exercises at follow-up. Among these individuals, 63 practiced “I’m having the thought that...,” 47 practiced the Lean Back exercise, 32 engaged in the Leaves on a Stream exercise, and 24 practiced Creativity with Thoughts exercises. Note that individuals could select more than one practice. Participants’ average success and engagement ratings ranged from 2.83 to 3.06 ($SD = .61$ to $.66$), indicating *slightly successful/engaged* to *moderately successful/engaged* ratings (see Table 1). Out of 86 participants who provided qualitative feedback on the FUQ regarding liked aspects of the goal setting and practice, 51% ($n = 44$) percent of participants highlighted they found using the exercises in a general and less structured way to be beneficial. Thirty-seven percent ($n = 32$) indicated they liked setting reminders and

working practice into their schedule. A few respondents commented on specific exercises they liked.

Out of 82 respondents, 32% ($n = 26$) did not identify any disliked components of goal setting. Of those that expressed areas of dislike, 18% ($n = 15$) indicated forgetting to do the exercises over the two-week time. Twelve percent ($n = 10$) identified specific challenges they encountered while practicing, such as having trouble focusing and fully engaging in the exercise, feeling silly while doing it, or having personal emotional reactions during the process. Eleven percent ($n = 9$) reported on specific practice exercises they disliked. A smaller portion of respondents commented on disliking the scheduling aspect and preferring to use the approach when unhelpful thoughts emerged, being too busy to practice the exercises, and experiencing the practice as interfering with their usual routine. See Table 3 for responses regarding liked and disliked aspects of practice.

Relationships between frequency of practice (i.e., number of days per week that practice took place), practice success and engagement ratings, CFQ, FSCS-SC, and FSCS-SP scores were examined. Given that the frequency, success, and engagement ratings were all non-normal, Spearman correlational analyses were run. No predictable relationships were evidenced between FUQ items (i.e., frequency, success, engagement) and self-report measures. Results ($n = 96$) indicated that frequency of practice ($M = 2.89$, $SD = 1.39$) was significantly related with success in stepping back from thoughts ($r_s = .35$, $p = .000$), success in reducing discomfort of thoughts ($r_s = .27$, $p = .009$), and overall engagement in practice ($r_s = .40$, $p = .000$) (see Table 1). Thus, practice frequency exhibited small to moderate relationships with success and engagement in practice.

Cognitive Defusion

Paired sample *t*-tests assessed changes in cognitive defusion from pre-program to follow-up. Due to non-normality, Wilcoxon signed-ranks tests assessed changes in believability and emotional discomfort. Consistent with expectations, results showed a significant decrease in believability from pre-program ($M = 49.72, SD = 23.57$) to follow-up ($M = 36.67, SD = 22.35$), $Z(140) = -6.72, p = .000$, with a medium effect size ($r = .40$). Similarly, there was a significant decrease in emotional discomfort related to the identified negative self-referential thought from pre-program ($M = 70.64, SD = 17.2$) to follow-up ($M = 41.63, SD = 23.4$), $Z(140) = -9.35, p = .000$, with a large effect size ($r = .56$). Inconsistent with expectations, the decrease in CFQ scores from pre-program ($M = 27.98, SD = 10.17$) to follow-up ($M = 26.91, SD = 9.24$) was not significant, $t = 1.47, p = .14$; results reflect a trivial effect size (Cohen's $d = .13$).

Self-Criticism

A Wilcoxon Signed-Ranks Test assessed changes in self-persecution (FSCS-SP), or participants' understanding of how likely they are to self-attack through the function of self-persecution. A Wilcoxon Signed-Ranks Test, used due to the non-normality of the FSCS-SP data, indicated that follow-up scores ($M = 6.80, SD = 5.70$) were statistically significantly higher than pre-program scores ($M = 5.08, SD = 5.05$), $Z = -3.22, p = .004$, with a small effect size ($r = .19$). A paired sample *t*-test revealed no significant changes in the self-correction subscale (FSCS-SC) from pre-program ($M = 24.23, SD = 10.25$) to follow up ($M = 23.61, SD = 9.2$).

Discussion

The current study investigated the usability and satisfaction associated with the D-FUSE program, a web-based defusion-focused program, and its effectiveness in improving cognitive defusion and self-criticism among undergraduates. Although web-based programming has been

shown to positively impact college students (e.g., Firestone et al., 2019; Levin, Pistorello, Seeley et al., 2014), more research is needed looking at cognitive defusion as a primary focus of study. Although defusion training has been effective in targeting distress resulting from negative self-referential thoughts in college students, to date, no studies have evaluated the utility of a completely web-based, single-session program allowing college students to engage in defusion exercises with a negative self-referential thought.

Overall, the program was found to be satisfactory and usable with an absence of significant technical problems. Although a majority of the sample indicated satisfaction with the program length, interpretative caution should be taken due to the high variability in Part 1 completion times. Participants were given 72 hours to complete Part 1, which likely resulted in individuals leaving the program open on their devices and attending to the program or surveys intermittently, taking breaks, or waiting to start it once opened. This time variability likely reflects the reality of this age group flexibly engaging in the web-based program at the leisure of their own chosen spaces. Additionally, due to the plethora of content in the program, participants may have taken breaks as a means of digesting information, as one would with a self-help book. Future research may allow less time for completion in order to prevent such high variability. However, research has shown that distributed practice (i.e., spaces of time between taking in information) leads to greater retention of information over time compared to massed practice, or learning information all at once (Cepeda et al., 2009; Küpper-Tetzl, 2014).

Findings regarding participants' understanding of the program purpose highlighted the subjectivity in their experiences. Only one-fourth of the sample understood the most optimal program lesson, whereas over half indicated that the purpose was to make thoughts positive even though this was not something the program explicitly taught. These participants may have

experienced a positive shift in their thinking or worked to replace their thoughts after gaining a distance from distressing judgmental thoughts. For those who indicated the purpose was to figure out if thoughts are true or false, the program stimulated reflection on the personal consequences of believing an unhelpful self-critical thought as true, which may have led to this response. More training on the automaticity of general verbal language may have highlighted the goal is not to judge (e.g., true/false, positive), but to observe in a nonjudgmental way. Masuda, Feinstein et al. (2010) accomplished this by having participants repeat the word “milk” until the meaning disappeared, prior to working with their own self-relevant thoughts. Additionally, highlighting that defusion can be used with neutral (e.g., milk) and positive thoughts would further clarify the purpose.

Concerning satisfaction with program content, ratings ranged from *slightly* to *moderately liked*. Most participants (93% at post-program, 95% at follow-up) provided positive feedback about content when reflecting on most liked aspects of the program. Factors that may have diminished satisfaction were program length and experiencing the content as redundant or dense, which was reported among disliked aspects. No themes emerged in terms of exercise preference even though participants expressed preferences for some exercises over others. Although it is not important to empirically test each defusion technique since their goal is universal (Masuda et al., 2009), it appears important in an interactive program to have an array of options.

In addition to positive feedback to the program itself, there is evidence to suggest there were shifts in cognitive fusion of negative self-referential thoughts. Results showed a significant pre- to post-program decrease in believability in and emotional discomfort of negative self-referential thoughts. These findings are consistent with previous studies that found specific changes in believability and emotional discomfort after defusion training (Healy et al., 2008;

Larsson et al., 2016; Mandavia et al., 2015; Masuda, Feinstein et al., 2010; Masuda et al., 2004). However, decreases in trait cognitive fusion were not statistically significant, which is consistent with another technologically-based cognitive defusion intervention that did not produce improvements on cognitive fusion, measured by the CFQ (Levin et al., 2018). It is likely that a brief single-session cognitive defusion program was not strong enough to render larger effects on trait cognitive fusion as measured by the CFQ. This measure may have needed to be more specific to fusion with negative self-referential thoughts to detect effects. Alternately, more intensive everyday practice of defusion and a longer follow-up period may have produced enduring changes in cognitive fusion, which would have been better captured by the CFQ.

FSCS-SP scores significantly increased from pre-program to follow-up; however, this was not the case for FSCS-SC scores. Although a significant increase in identification of persecutory self-criticism was counter to the study's hypothesis, this finding can be understood with a deeper look at the concept of cognitive defusion. The FSCS measures why people think they self-attack, which requires some level of self-awareness and attention to thought process. It is possible that the program fostered increased awareness of unhelpful thought processes, which allowed participants to take more notice of, and thus more accurately report, their persecutory self-criticisms. This may also be why no significant changes were evidenced in the self-correction scale, as these thoughts may not be perceived as persecutory, distressing, and unhelpful.

Greater engagement in practice was hypothesized to be associated with increases in cognitive defusion at follow-up. Despite being a majority of the sample, only 81 (57%) individuals reported engaging in practice. Their rankings ranged from *slightly* to *moderately successful/engaged*. A majority of participants indicated benefiting from practicing exercises in

a less structured/scheduled way and using defusion strategies in moments of need. Among disliked feedback, some participants reported they forgot to practice at times, whereas others had trouble fully engaging during times set aside for practice. Although the program provided structure and guidance when it came to identifying a self-critical thought with which to practice, since participants were not required to record their activities in the 2-week interval between the program and follow-up, it is unclear what or how participants practiced. Given that 37% of participants reported liking the planning aspect of goal-setting and that frequency of practice was positively correlated with success and engagement outcomes, future research should continue to utilize goal-setting and practice. However, participants may benefit from specific goal-setting strategies (e.g., identifying frequency of daily practice; setting alerts/reminders). Strategies, such as automated practice notifications, check-ins, and/or an e-coach component, can be used to enhance accountability and adherence to future web-based programs (Mohr, Cuijpers, & Lehman, 2011; Räsänen, Lappalainen, Muotka, Tolvanen, & Lappalainen, 2016). Levin et al. (2018) maintained good adherence and positive feedback to their cognitive defusion mobile app, which included check-ins and notifications.

Limitations

There are several limitations with this study. First, the current sample consisted of students who were mostly female and White, with percentages higher than the undergraduate demographics of this university. Second, compensation of extra credit and the opportunity to win a gift card raffle could have served as a demand characteristic even though participants were reminded that their personal responses to the study were not linked to compensation. Third, this study did not include a comparison group, thus limiting the conclusions that can be drawn about causality and leaving room for alternative hypotheses concerning the findings (e.g., relief in

external stressors leading to self-critical thoughts). Fourth, since there was no significant change in the CFQ, future research may need to utilize fewer broad outcome measures or have longer follow-up periods to reveal how the program impacts trait-like outcomes. Last, this study's heterogeneous sample prevented the use of behavioral measures, which could assess specific behavioral consequences of increased cognitive defusion. Future programs could focus on subsets of the general undergraduate population, such as distressed students or those experiencing academic difficulties. Targeting these specific issues allows for the inclusion of behavioral measures for symptomatology or academic avoidance and engagement, respectively.

Conclusion

Overall, the current study found that the D-FUSE program was usable, experienced as satisfactory, and successful in reducing cognitive fusion of specific negative self-referential thoughts in college students. This type of preventative and accessible programming could be a valuable tool to increase healthy coping and well-being in undergraduates, especially those fused with unhelpful self-critical thoughts. However, further research and revisions to the D-FUSE program are needed to address the study limitations. Findings highlight the importance of continued development of defusion-specific web-based programs, as defusion is a digestible and understandable ACT proponent for this age group. Knowledge of such skills is beneficial and can be a great standalone as preventative care or addition to other mental health services.

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Table 1

Means and Standard Deviations for Self-report Variables

Program Satisfaction Feedback Questionnaire (<i>n</i> = 141)	<i>Mean</i>	<i>SD</i>
Having the Glass On/ Getting Hooked	5.08	.98
Description of Taking the Glasses Off and Stepping Back	5.18	1.07
Strategy 1: Label It	4.79	1.33
Strategy 2: Leaves On a Stream	4.42	1.64
Strategy 3: Lean Back	4.67	1.47
Strategy 4: Creativity With Thoughts	4.43	1.71
Practice Goals/ Setting Reminders	4.85	1.49
Program Summary	4.87	1.31
<hr/>		
Follow-up Questionnaire (<i>n</i> = 81)	<i>Mean</i>	<i>SD</i>
How successful was the exercise(s) in helping you to “step back” from your thoughts?	2.98	.63
Overall, how successful was the exercise(s) in reducing the discomfort caused by your thoughts?	2.83	.61
Please rank your overall ability to engage with the exercise(s).	3.06	.66

Note. Ratings of D-FUSE Program Components (Program Satisfaction and Feedback Questionnaire; PSFQ): 1 (*Strongly disliked*), 2 (*Moderately disliked*), 3 (*Slightly disliked*), 4 (*Slightly liked*), 5, (*Moderately liked*), and 6 (*Strongly liked*).

Ratings of Goal Practice Success (Follow-Up Questionnaire; FUQ): 1 (*Not at all successful*), 2 (*Slightly successful*), 3 (*Moderately successful*), 4 (*Strongly successful*)

Table 2

Sample Open-Ended Responses of Liked and Disliked Aspects of the D-FUSE Program

Post-Intervention Feedback	Follow-Up Feedback
<p>“I liked how there was an introduction before each section of questions. I also liked how I was able to pick a thought that is pertinent in my life.”</p>	<p>“I think the format was made well, and I liked the interactivity of the whole program. Instead of just reading a quick set of instructions and moving on, practicing the different exercises was helpful and made it easier to understand.”</p>
<p>“I liked that every so often, a page popped up with information about counseling and hotlines. I also liked how there were a variety of examples and exercises.”</p>	<p>“Realizing that my negative inner dialogue is just me beating myself up and I have to acknowledge that they are just thoughts. They are not facts. And making sure I am able to distinguish when I am looking at myself with either a negative or positive lens.”</p>
<p>“As I was assigning different colors, shapes and features to my negative thought, I was imagining the image I was creating and giving the thought such features helped me realize that the thought is just that..a thought! It can only have as much power as I allow it and the manner in which I painted it made the thought look weak and worthless, which helped me better realize it as just a mental thought and not an actual fact about myself. I very much enjoyed this program and found it very helpful in labeling and coping with negative thoughts.”</p>	<p>“I liked the accepting and calming nature of the program (comments, encouragements, etc.). It was motivation for me to be completely truthful in my responses. The detailed explanations of what each mindfulness tactic was and how to apply them helped as well.”</p>
<p>“I really enjoyed the creative exercises with my thoughts and I truly will use this theory in the future-it helped me to distance myself from my thoughts and see them as objects rather than all-consuming entities.”</p>	<p>“I enjoyed the different strategies provided to give a variety of options to those who want the help. The leaf and stream and the symbols strategy may not be helpful to me, but they could be helpful to someone else. I enjoyed having different options that I could pick and choose from. I often get trapped in my thoughts and get carried away with them, so being able to think about the thought and take myself away from it was very helpful from keeping me from getting stuck in it.”</p>
<p>“The program was user friendly and the language was easy to understand as well.”</p>	<p>“I found that the stepping back exercise did not work for me.”</p>
<p>“It was extremely easy to navigate, very interactive, and aesthetically pleasing. I appreciated the pictures as well as the flexibility of the format.”</p>	<p>“I did not like how the first part took an extended amount of time to complete. I think it could be shorter but either way I enjoyed it.”</p>
<p>“I disliked the “Leaves on the Stream” exercise but I can see how that might help some people.”</p>	<p>“Sometimes the examples were a bit wordy.”</p>
<p>“I did not like how it was a semi-limited set of choices to pick from for what bothers me.”</p>	

Table 3

Sample Open-Ended Responses of Liked and Disliked Aspects of Goal Setting

Liked Aspects	Disliked Aspects
<p>“I like that stepping back is a tactic you can use anywhere, anytime you have an intrusive thought. It usually is effective in calming me down in the moment and not over-catastrophizing.”</p>	<p>“I think because I placed unrealistic expectations on myself that everytime i did it it would work it caused me more anxiety at times.”</p>
<p>“I liked recognizing my thoughts and realizing they’re just thoughts.”</p>	<p>“I did not like the shape exercise.”</p>
<p>“I ended up setting up a schedule so that I could fit it into my schedule; that made me more inclined to do the exercises.”</p>	<p>“One thing I disliked about the goal setting and practice was that some days I did forget to do the exercise. I think it would be helpful if there was some sort of reminder.”</p>
<p>“Doing the exercises at night allowed me to clear my head and get a better night’s rest.”</p>	<p>“It was difficult to remind myself to use these exercises. Sometimes I forgot to use them.”</p>
<p>“I found the thoughts on leaves exercise to be the most effective.”</p>	<p>“I didn't like to be reminded I just like to do it on my own.”</p>
<p>“Every time I looked in the mirror, I would remember what I had learned from the exercises and applied them at my moments where it would normally be difficult for me to "lean back".”</p>	<p>“Some of it felt a little silly, and some of it felt a bit abstract.”</p>
<p>“It allowed me to focus on what was important vs worry about little stuff that didn’t even matter.”</p>	

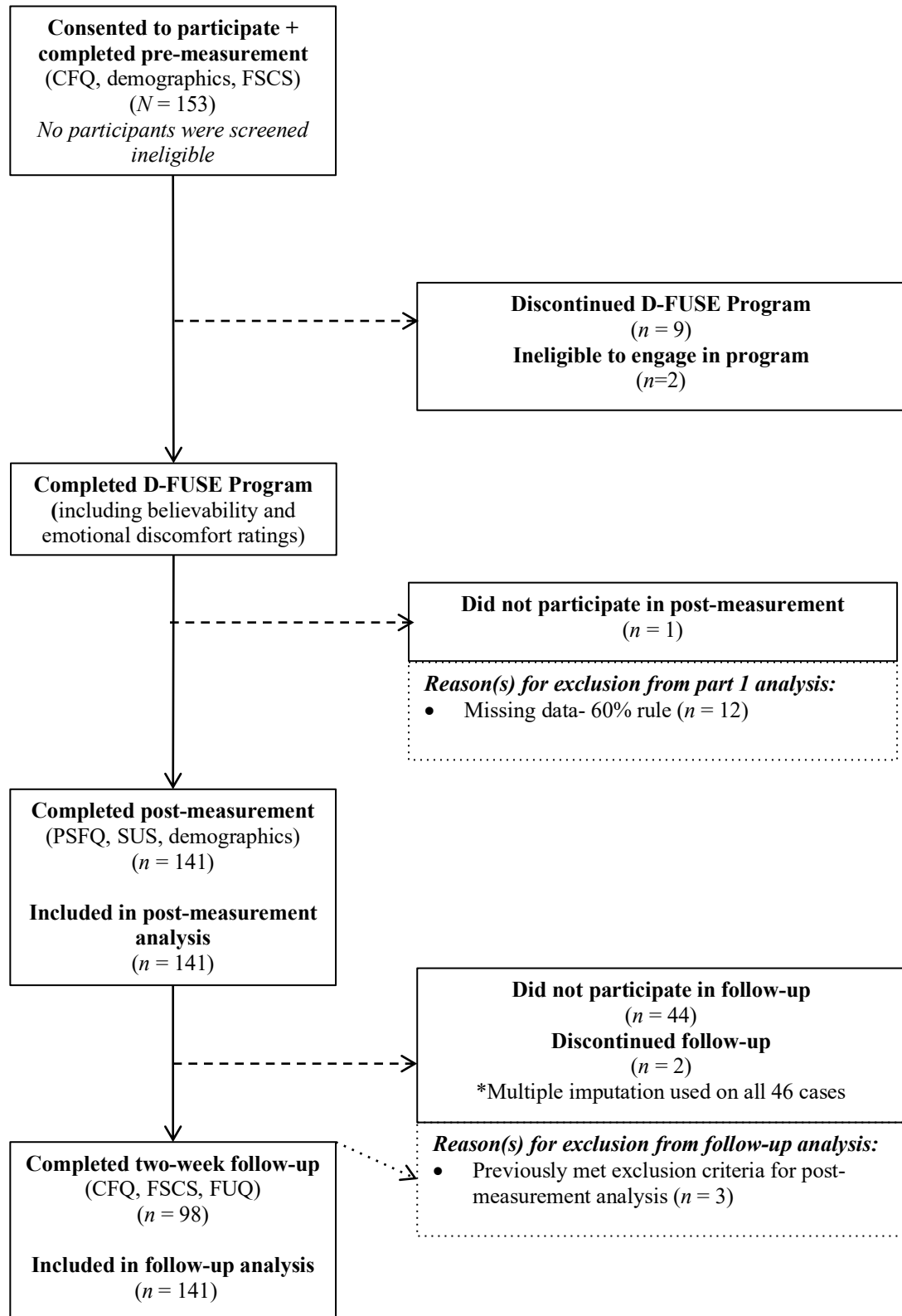


Figure 1. Diagram detailing participant flow, dropout, and reasons for exclusion.

Appendix

D-FUSE Program Structure, Components, and Content

Component	Objectives & Example Exercises/Content
1. Introduction to D-FUSE Program	<p data-bbox="570 464 1395 569">Introduction to program intentions (“this program will help you learn helpful and adaptive strategies to cope with uncomfortable and unhelpful negative self-referential thoughts.”)</p> <p data-bbox="570 611 1395 680">Recommendations for program use (e.g., private space, access to headphones, completing in one sitting)</p>
2. Education on defusion concepts	<p data-bbox="570 758 1409 863">Understanding fusion with thoughts as “getting hooked” and highlighting consequences of being hooked to unhelpful and self-critical thoughts (e.g., assuming thoughts are literally true)</p> <p data-bbox="570 905 1409 1045">Metaphor (i.e., <i>Wearing Rose Colored Glasses vs. Taking the Glasses Off</i>) to show how believing unhelpful thoughts can color experiences and guide actions, however one can take the glasses off and step back from thoughts</p> <p data-bbox="570 1087 1409 1157">Examples provided, such as, self-critical thoughts causing social avoidance and isolation</p> <p data-bbox="570 1199 1409 1304">Education (here and throughout program) provided using a combination of section relevant pictures (e.g., rose colored sunglasses) and text</p> <p data-bbox="570 1346 1409 1409">Questions and answer-based feedback assessing understanding of being hooked vs. stepping back from thoughts</p>
3. Identifying negative self-referential thoughts	<p data-bbox="570 1486 1252 1522">Identification of one negative self-referential thought</p> <p data-bbox="570 1564 1425 1633">Emotional discomfort and believability ratings related to identified thought</p> <p data-bbox="570 1675 1425 1810">Identification/exploration of ways the identified thought influences how they see themselves and others, how it guides their actions, signs they are getting hooked, and what they are missing out on because of being hooked</p>

Choices provided in various formats, including drop down lists, slider scales, and multiple choice

Summary of selections (i.e., negative thought, consequences of thought)

4. Strategy 1: Label it

Education on the defusion labeling strategy- adding the phrase “I’m having the thought that…” before a negative self-referential thought

Examples of labeling strategy

Exercise prompt to type “I’m having the thought that…” before the negative self-referential thought in a text box and repeat to self for 10 seconds

5. Strategy 2: Leaves on a stream

Introduction to visualization defusion strategy- imagining placing thoughts on leaves floating down a stream

3-minute audio or text instructions visualization exercise

6. Strategy 3: Lean back

Introduction to metaphor of how the mind is like a computer, constantly trying to solve problems, constant, and automatic

Interactive exercise entails bringing face close to screen and staring at displayed negative self-referential thought for up to 10 seconds, then bringing further back and staring at thought for up to 10 seconds

Explanation of how leaning back puts less focus on thought and increases perspective

7. Strategy 4: Creativity with thoughts

Explanation of mentally playing around with thoughts so they are just mental activity and not taken literally

Exercise consists of interactive selections that display thought on screen in different ways (i.e., smaller, pink, different font)

Exercise with prompts to type the thought backwards in a text box, say backwards thought aloud, and write every other letter of the thought in a text box

Exercise with prompts to type in text boxes what the thought would look like as a painting (i.e., colors, shapes, details) and then imagine it

8. Reassessment

Interactive slider scales to select emotional discomfort and believability ratings related to identified thought

9. Session summary and practice

Review of selections and basic overview of strategies

Prompts to select liked strategies to practice over the course of 2 weeks; can choose 1-4 strategies

Prompts to set reminders (e.g., calendar, phone, notes) to practice desired strategies

10. Conclusion

Review of selections and strategies

Information about follow-up and introduction to post-assessments

Information for support/counseling in the case of distress
