



A Test of the Growth Mindset Compensatory Message in the Context of Youth Mental Health

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Abstract

Identifying effective, efficient, and scalable mental health growth mindset interventions that harness the benefits of growth mindsets without the costs is critical. In the current work, we tested the potential to leverage compensatory messaging in a growth mindset intervention to improve mental health in youth. The intervention seeks to foster a stronger belief that people and emotions can and do change, while de-emphasizing self-blame. We developed and tested “Healthy Minds,” an interactive single-session 30-minute online growth mindset intervention, with high-school youth ($N=457$, age range: 13–19) in a rural southern community. We randomly assigned participants to take Healthy Minds or an attention-matched health-oriented control. Results indicate that Healthy Minds is a promising intervention for fostering stronger growth mindsets and greater self-efficacy for managing depressive symptoms, while also reducing self-blame and avoidant coping. These results can improve the delivery of growth mindset interventions designed to address adolescent mental health issues. We conclude with a discussion of potential boundary conditions and future directions.

Keywords Growth mindset · Intervention · Adolescent · Mental health · Depression

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Mental health problems are increasingly prevalent. Adolescents in particular face many challenges to their mental health, with an estimated 25.2% of adolescents experiencing depression at the height of the COVID-19 pandemic (Racine et al., 2021). Depression is an especially prevalent mental health concern in adolescence (National Institute of Mental Health, 2020). These high rates of depression among adolescents come with serious consequences and risks to individuals and society, including suicide, isolation, disability, and more (Stewart et al., 2003).

Given the prevalence and gravity of depression and other mental health problems in adolescence, it is important for researchers to identify effective, efficient, and scalable interventions that improve both the proximal and more distal predictors of mental health. One approach that has been successful focuses on fostering growth mindsets with the goal of facilitating the processes that can ultimately improve mental health (e.g., Lipsey et al., 2023; Schleider & Weisz, 2016). Yet, recent work highlights how growth mindsets, in stigmatized contexts, can increase stigma, body shame, and unhealthy weight-control behaviors by increasing self-blame (Hoyt & Burnette, 2020). This work highlights why growth mindsets may have double-edged sword effects. Specifically, although growth mindsets can reduce stigma and improve motivation by increasing self-efficacy, they can also increase self-blame. However, work has identified a message helps to harness the benefits without the costs which has been referred to as compensatory messaging and tested in the context of addiction (Burnette et al., 2019). The compensatory label comes from the helping literature which outlines the importance of encouraging people to take actions to improve their outcomes without blaming themselves for needing help. The goal of the current work is to test a compensatory-driven growth mindset intervention in the context of youth mental health and to explore potential boundary conditions of effects.

1 Growth Mindset Interventions

Growth mindset interventions seek to foster a belief in the malleable nature of traits, attributes, and experiences. Growth mindset interventions can improve outcomes in various domains, from academic performance (Paunesku et al., 2015) to mental health (Miu & Yeager, 2014). For example, individuals who more strongly believe attributes can change and be developed (e.g., growth mindsets of anxiety, emotion, or people) tend to respond with more adaptive coping such as help-seeking and treatment-seeking, likely because they believe those efforts will help them achieve the change they desire. In contrast, individuals who more strongly believe attributes are stable (fixed mindset) report more avoidant coping, greater symptomology, and more pronounced mental health problems, likely because they believe their efforts will not result in desired outcomes (Burnette et al., 2020a; Schleider et al., 2015). Although there is debate about growth mindset intervention efficacy within academic contexts (e.g., Brez et al., 2020; Macnamara & Burgoyne, 2022; Sisk et al., 2018), their effect on mental health is more robust, especially when targeted to the right populations and implemented with high fidelity (Burnette et al., 2023).

In stigmatized contexts such as mental health, one component that contributes to intervention fidelity is the specific messaging used in the intervention. In the current

work, we outline psychological processes that may be tied to a key implementation strategy called compensatory messaging. The theory for this type of messaging stems from differences outlined in the double-edge sword model of growth mindsets in stigmatized contexts such as obesity and addiction (e.g., Hoyt & Burnette, 2020). The model differentiates onset self-blame from offset efficacy. Onset self-blame results from feeling responsible for the stigmatized attribute, whereas offset efficacy involves feeling confident about the potential to offset the stigmatized attribute in the future (Hoyt & Burnette, 2020).

Compensatory messaging can be used in growth mindset interventions to mitigate the potential increase in onset self-blame that comes with developing a growth mindset, while still maintaining the benefits of offset efficacy. For example, in the context of weight management, compensatory messaging encourages change and growth, while also emphasizing to participants to not blame themselves or others (Burnette et al., 2017). The compensatory messaging recognizes the complex etiologies of the onset of the condition, whether it be addiction, obesity, or mental health challenges. In the current work, compensatory messaging emphasized to students that they are not to blame for the onset of mental health challenges, while also emphasizing that they have agency when coping with mental health challenges in the future. We expect and test if our implementation strategies do indeed foster stronger growth mindsets and greater self-efficacy for alleviating mental health problems, while reducing self-blame for those problems.

Although compensatory messaging has been tested in the context of weight and addiction (e.g., Hoyt & Burnette, 2020; Burnette et al., 2019), less research has applied this idea to the context of mental health. If the compensatory message can reduce self-blame yet maintain the benefits of stronger growth mindsets and self-efficacy, there should be important downstream implications for wellbeing. For example, growth mindsets are closely linked to psychological flourishing including resilience, grit, and wellbeing (Hoyt et al., 2021). Furthermore, self-efficacy predicts positive mental health outcomes (e.g., Endler et al., 2001; O’Leary, 1992; Parto & Besharat, 2011), whereas self-blame can serve as a barrier to wellbeing, with research showing links between self-blame and internalized stigma (Burnette et al., 2017) and distress (Moulton et al., 1987). Thus, strengthening growth mindsets and self-efficacy, while reducing self-blame could have downstream implications for helping to reduce depressive symptoms.

We also suggest that growth mindsets interventions can reduce avoidant coping, which can help to explain the link between these interventions and more distal mental health outcomes (e.g., fewer symptoms of depression). According to mindset theory, people with stronger fixed mindsets may avoid evidence of poor performance, as such feedback could be interpreted as evidence of innate inadequacies. On the other hand, people with stronger growth mindsets believe that failure can provide valuable information for improving future performance (Burnette et al., 2013). Thus, growth mindsets encourage more approach-oriented strategies and less avoidance-oriented strategies (Burnette et al., 2013; Burnette, Babij, Burnette et al., 2020a, b). In turn, research has also demonstrated that whereas active coping can enhance wellbeing (Taylor & Stanton, 2007), regular use of avoidant coping strategies can lead to

both more frequent and stronger negative emotions (Kashdan et al., 2006), and can increase risk for experiencing depression (Seiffge-Krenke & Klessinger, 2000).

In addition to focusing on potential psychological and behavioral processes driving links to wellbeing, the heterogeneity revolution outlines the importance of discerning meaningful heterogeneity in order to understand boundary conditions (Bryan et al., 2021; Yeager et al., 2019). Large scale studies suggest sizable heterogeneity in the efficacy of growth mindset interventions (Foliano et al., 2019; Yeager et al., 2019). Some of this heterogeneity can be attributed to individual differences—growth mindset interventions do not work equally well for all individuals. Indeed, theory and meta-analyses on academic achievement suggest that certain targeted samples (i.e., samples that are considered “at risk”) demonstrate stronger intervention effects than non-targeted samples (Sisk et al., 2018). However, it is unclear whether individual differences will similarly determine the effectiveness of interventions for psychological and behavioral processes linked to mental health. To test this possibility, similar to other mindset interventions in stigmatizing contexts (e.g., Schleider & Weisz, 2016), we delivered the intervention to all students so as not to further stigmatize those who might need the intervention most. Subsequently, the present research used moderation to test whether students at higher levels of “risk” (i.e., students with higher preexisting levels of depression) benefit more from the intervention than students at lower levels of risk.

2 The Present Intervention

In the present study, we synthesized best-practice information learned from previous growth mindset interventions while testing whether the inclusion of compensatory messaging could further improve the efficacy of a single-session growth mindset intervention aimed at improving mental health among adolescents. We also tested whether the intervention would be equally effective for different populations. In designing this intervention, we attended to intervention implementation in alignment with the Framework for the Implementation of Mindset Interventions (FIMI, Burnette et al., 2022). Although FIMI was not yet published when we designed the present intervention, we found it to be a helpful framework for developing the intervention.

According to FIMI, growth mindset interventions should include two key components: a malleability message (e.g., people and emotions can change) and an attitude change tactic (e.g., using “saying is believing” writing activities to apply what is being learned) (Burnette et al., 2022). FIMI also suggests that effective growth mindset interventions should attend to factors such as delivery competence, adaptations, dose and intervention setting, and participant responsiveness (Burnette et al., 2022). In the present intervention, we attended to delivery competence by using credible sources and evidence to outline the effectiveness of growth mindset messaging while also including easy-to-understand and memorable examples and metaphors. We attended to adaptations by using compensatory messaging to reduce onset self-blame (e.g., Hoyt & Burnette, 2020). In terms of dose and intervention setting, we used a single-session design. Our goal was to produce an intervention that would be easy to implement or distribute outside of the context of this study. Finally, we attended

to participant responsiveness by delivering the intervention in-person. Indeed, while the intervention used an online interface, providing the intervention in-person helped maximize oversight and implementation fidelity.

In summary, our goals were two-fold. First, we empirically tested if a compensatory growth mindset intervention could improve processes that are linked to improved mental health (i.e., growth mindsets, self-efficacy, coping) while also reducing self-blame. Second, we tested theoretically derived moderators of intervention effectiveness to delineate meaningful boundary conditions. In other words, we used moderation analyses to test whether the intervention was equally effective among different populations. Specifically, we assessed intervention efficacy among students at differing levels of depressive symptoms, gender, and grade level. Assessing these boundary conditions can help to address for whom these interventions may work best.

3 Methods

Originally, our recruitment efforts were aimed at testing the efficacy of improving mental health in youth over the course of 18-months, but the onset of the COVID-19 pandemic prevented us from re-entering schools after our initial data collection efforts. We thus shifted the focus to implementation-related short-term outcomes.

4 Participants

We recruited high school adolescents in 9th and 11th grade from four high schools in a rural southern county of the U.S. to participate in our study. Our process of recruitment included working directly with school administrators and teachers to make school-wide announcements and to speak to classes of students and provide them with consent forms. We offered small raffle incentives to encourage students to return their consent forms (regardless of whether parents granted consent or not). Of approximately 1600 eligible students, 616 returned consent forms signed by their parents. Of the 616 forms returned, 488 parents granted consent for participation. Of the 488 eligible participants, 457 completed the study ($M_{age} = 15.06$, age range=13–18, $SD=1.09$, see Fig. 1). 61.1% of the participants were in 9th grade and 38.9% were in 11th grade. In terms of gender, 182 (39.8%) identified as boys, 268 (58.6%) identified as girls, and 7 (1.5%) identified as non-binary, transgender, or another gender identity. In terms of race, 158 (34.6%) participants identified as White, 114 (24.9%) identified as Black, 151 (33%) identified as Hispanic, and 34 (7.4%) identified as another racial/ethnic group. Additionally, 54% of participants reported receiving free/reduced lunch.

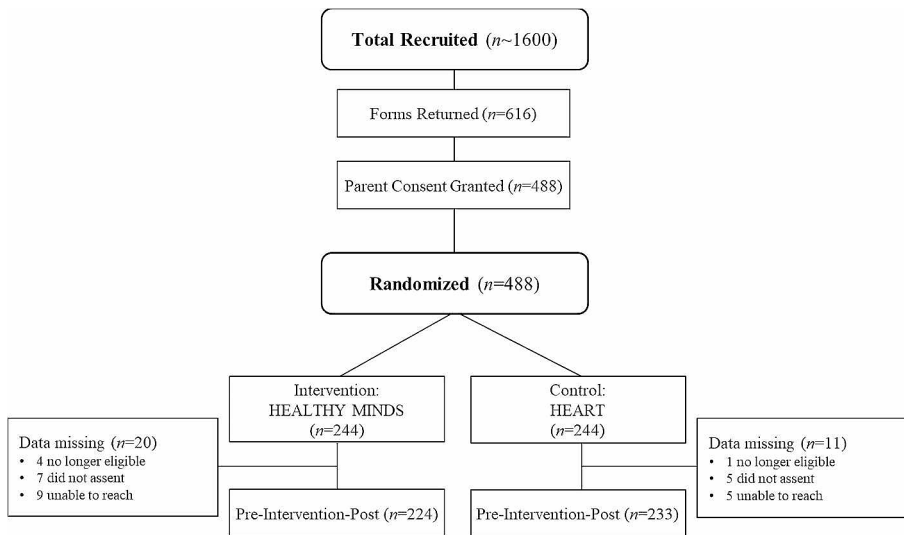


Fig. 1 Consort Diagram

5 Procedure

Participants completed the study on netbook computers at their school library, cafeteria, or classrooms, with the maximum possible distance to maintain privacy. After consenting to participate, participants reported basic demographic information, completed pre-intervention measures, and then began the intervention. Prior to arrival, all participants were assigned a participant number. The participant numbers were sent to a collaborator who had no direct interaction with students. The collaborator used SPSS to randomly allocate each participant a “1” or “2”, designating which condition that participant would be assigned. Thus, each participant was randomly assigned to complete either the growth mindsets intervention (Healthy Minds) or an attention-matched control intervention about sexual health (Health Education and Relationship Training– HEART; Widman et al., 2020). After the intervention, participants completed post-intervention measures. When participants finished the study, they received a \$5 gift card and returned to class.

5.1 Healthy Minds

Healthy Minds is a 30–45-minute self-paced online intervention programmed in Qualtrics modeled after past successful interventions (e.g., Schleider & Weisz, 2016; Miu & Yeager, 2014). For example, participants learned about the connection between personality and the brain, using examples such as the story of Phineas Gage to highlight malleability. A key message is that people and emotions can and do change, with scientific evidence to support the claims. The intervention also included information about why people change, including memorable and relatable stories from adolescents of similar ages. Throughout the intervention, participants completed saying-is-believing writing activities that asked them to apply what they were learning to

specific scenarios—these saying-are-believing strategies can help participants adopt growth mindsets (e.g., Good et al., 2003).

Importantly, the intervention also included compensatory messaging throughout. Specifically, in addition to letting participants know that people and emotions can change, we also included compensatory messaging to reduce onset self-blame, for example: “One key to success is to remember that you should never blame yourself for the emotions you feel because everyone’s brain is a ‘work in progress;’” “People don’t need to blame themselves for having negative emotions, and instead they can use new feelings and experiences to make a change.” All materials are available on OSF (https://osf.io/x98kb/?view_only=e7504332ccce452e91adf70ded917b94).¹

5.2 Control Condition

The attention-matched control was also a self-paced online intervention. In this control intervention, participants proceeded through attention-matched modules, each targeting a different area of sexual health and decision-making. Participants learned through reading, audio and video clips, and interactive games and quizzes (for more information on this program see McCrimmon et al., 2023; Widman et al., 2020).

6 Measures

Participants completed all measures at both pre- and post-test. Unless noted otherwise, all measures were scored by calculating the average of the items from that measure.

6.1 Mindsets of Personality

Participants completed a three-item mindsets of personality scale (Yeager et al., 2011), which measured participants’ beliefs about the malleability of their personality (e.g., “You have a certain personality, and it is something that you can’t do much about”). Items were measured on a 6-point Likert scale [1=strongly disagree, 6=strongly agree]. We reverse-coded all three items so higher scores indicated more of a growth mindset of personality (pre-test $\alpha=0.76$; post-test $\alpha=0.91$).

6.2 Mindsets of Emotion

Participants completed a three-item mindsets of emotions scale (Tamir et al., 2007), which measured participants’ beliefs about the malleability of their emotions (e.g., “No matter how hard they try, people can NOT really change the emotions they have”). Participants responded using a 6-point Likert scale [1=strongly disagree, 6=strongly agree]. We reverse-coded all three items so higher scores indicated a stronger growth mindset of emotions (pre-test $\alpha=0.75$; post-test $\alpha=0.86$).

¹ For complete access to the Healthy Minds program, please contact the first author.

6.3 Self-Efficacy

Participants completed an 11-item Self-Efficacy Questionnaire for Depression in Adolescents (Gordon et al., 2012), which measured participants' beliefs about their ability to cope with negative emotions (e.g., "If you were feeling sad, how sure are you that you could help yourself feel less sad?"). Participants responded using a 5-point Likert Scale [1=Really Sure I Couldn't, 5=Really Sure I Could]. Higher scores indicated greater self-efficacy (pre-test $\alpha=0.86$; post-test $\alpha=0.92$).

6.4 Self-Blame

Participants completed a four-item adapted self-blame scale (Janoff-Bulman, 1979) to measure participants' sense of personal responsibility for feeling sad or depressed (e.g. "You are personally responsible for the way you feel"). The measure consists of four items measured on a 6-point Likert Scale [1=strongly disagree, 6=strongly agree]. Higher scores indicate greater self-blame for depression (pre-test $\alpha=0.65$; post-test $\alpha=0.81$).

6.5 Avoidant Coping

Participants completed the 10-item cognitive non-social subscale of the Cognitive Behavioral Avoidance Scale (Ottenbreit & Dobson, 2004) to measure general tendencies towards avoidant coping (e.g., "Think about if you face problems at school in the next two weeks: I will avoid tasks and assignments that are really important"). Items were measured on a 5-point Likert Scale [1=not at all true for me, 5=extremely true for me]. Higher scores indicate greater tendency to engage in avoidant coping (pre-test $\alpha=0.87$; post-test $\alpha=0.94$).

6.6 Depressive Symptoms

Finally, participants completed the Short Moods and Feelings Questionnaire (SMFQ; Angold et al., 1995) to measure depressive symptoms (e.g., "I feel miserable or unhappy"). The measure consists of 13 items measured on a 3-point Likert Scale [0=not true, 1=sometimes, 2=true]. Scores were summed, with higher scores indicating greater symptoms of depression (pre-test $\alpha=0.93$; post-test $\alpha=0.94$).^{2,3}

² Notably, although we included this measure at post-test, we did not expect depression symptoms to change from pre-test to post-test (see OSF for pre-registered analysis plan: <https://osf.io/x98kb/>). The analysis plan originally aimed to test the effects of the intervention over time, but due to COVID-19 restrictions, we were unable to collect follow-up data as planned.

³ The pre-test SMFQ score was published in other related work examining pre-COVID and post-COVID rates of depression in youth (Lipsey et al., 2023).

7 Analytic Plan

Our goal was to examine whether participants in the Healthy Minds condition, compared to those in the control condition, experienced greater changes in (a) growth mindsets of personality, (b) growth mindsets of emotion, (c) self-efficacy, (d) self-blame for depressive symptoms, and (e) avoidant coping. We estimated five separate three-level models in HLM 7.03 (Raudenbush et al., 2013), in which participants' reports were nested within participants who were nested within four different schools within the same district. The second level of the model contained a randomly varying intercept and controlled for the repeated assessments from each participant. The third level of the model also contained a randomly varying intercept and controlled for the non-independence of schoolmates' data. For each model, the outcome (e.g., mindsets) was regressed onto a dummy-code indicating the time of assessment (0=*pre-test*, 1=*post-test*), a dummy-code indicating the condition (0=*control*, 1=*Healthy Minds*), and the Time x Condition interaction. The latter effect addresses whether the rate of change from pre- to post-test differed for participants in the two conditions. To examine whether participants' depressive symptoms at pre-test moderated the effects of condition on changes in the four outcomes, five similar models were estimated in which one of the five outcomes was regressed onto the dummy-code indicating the time of assessment, the dummy-code indicating the condition, participants' mean-centered depressive symptoms scores, and the two- and three-way interactions of those variables. The Time x Condition x Depressive Symptoms interaction addresses whether depressive symptoms determine the implications of condition for changes in the outcomes. All significant interactions were deconstructed with simple effects tests that followed the recommendations of Aiken and West (1991).

8 Results

8.1 Preliminary Analyses

Descriptive statistics and correlations between variables at both pre- and post-test are presented in Tables 1 (Healthy Minds Intervention) and 2 (control condition). As those tables reveal, the means of participants' reports of their growth mindsets of both personality and emotions were above the midpoint at both pre- and post-test, suggesting that, these participants, on average, endorsed stronger growth mindsets. Similarly, the mean of participants' reports of self-efficacy was slightly above the midpoint at both times and the mean of their reports of self-blame and avoidant coping were slightly below the midpoint at both times, suggesting that participants, on average, believed that they were capable of addressing any symptoms of depression that they might encounter, did not believe that people were to blame for feelings of depression, and did not believe that they would engage in much avoidant coping.

At pre-test, participants in the Healthy Minds condition did not differ from those in the control condition in regard to their endorsement of mindsets of personality [$t(455)=0.84$, $p=.401$, $d=0.08$]; self-blame [$t(455)=1.21$, $p=.226$, $d=0.11$]; and avoidant coping [$t(455) = -1.53$, $p=.127$, $d=0.07$]. Nevertheless, at pre-test, partici-

Table 1 Descriptive statistics and correlations among participants in the healthy minds condition

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|-----------------|-------------|--------------------|-------------|-------------|-------------|--------------------|-------------|-------------|-------------|-------------|-------------|-------------|
| (1) Pre-PGM | 0.81 | | | | | | | | | | | |
| (2) Pre-EGM | 0.34** | 0.71 | | | | | | | | | | |
| (3) Pre-SE | 0.21** | 0.19** | 0.87 | | | | | | | | | |
| (4) Pre-blame | -0.19** | -0.16* | -0.03 | 0.61 | | | | | | | | |
| (5) Pre-AC | -0.21** | -0.18** | -0.36** | 0.24** | 0.87 | | | | | | | |
| (6) Pre-DS | -0.28** | -0.11 | -0.49** | 0.22** | 0.36** | 0.93 | | | | | | |
| (7) Post-PGM | 0.54** | 0.38** | 0.19** | -0.19** | -0.26** | -0.13 [†] | 0.93 | | | | | |
| (8) Post-EGM | 0.30** | 0.58** | 0.19** | -0.15* | -0.17** | -0.03 | 0.59** | 0.84 | | | | |
| (9) Post-SE | 0.19** | 0.21** | 0.80** | -0.06 | -0.40** | -0.41** | 0.26** | 0.27** | 0.92 | | | |
| (10) Post-blame | -0.21** | -0.22** | -0.08 | 0.65** | 0.20** | 0.19** | -0.35** | -0.33** | -0.06 | 0.77 | | |
| (11) Post-AC | -0.19** | -0.12 [†] | -0.34** | 0.16* | 0.76** | 0.30** | -0.29** | -0.20** | -0.37** | 0.24** | 0.93 | |
| (12) Post-DS | -0.31** | 0.12 [†] | -0.47** | 0.15* | 0.34** | 0.91** | -0.21** | -0.09 | -0.40** | 0.20** | 0.33** | 0.94 |
| <i>M</i> | 3.54 | 4.44 | 3.50 | 2.90 | 1.88 | 8.10 | 4.50 | 4.83 | 3.62 | 2.57 | 1.71 | 7.99 |
| <i>SD</i> | 1.16 | 1.01 | 0.76 | 0.94 | 0.76 | 6.91 | 1.32 | 1.04 | 0.87 | 1.08 | 0.81 | 7.25 |

Note PGM=personality growth mindsets, EGM=emotion growth mindsets, SE=self-efficacy, DS=depressive symptoms, AC=avoidant coping, Reliabilities (α) of each scale are on the diagonal in bold; [†] $p < .10$, * $p < .05$, ** $p < .01$

Table 2 Descriptive statistics and correlations among participants in the Control Condition

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|-----------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| (1) Pre-PGM | 0.70 | | | | | | | | | | | |
| (2) Pre-EGM | 0.33** | 0.77 | | | | | | | | | | |
| (3) Pre-SE | 0.22** | 0.32** | 0.84 | | | | | | | | | |
| (4) Pre-blame | -0.28** | -0.30** | -0.09 | 0.68 | | | | | | | | |
| (5) Pre-AC | -0.27** | -0.13* | -0.38** | 0.25** | 0.87 | | | | | | | |
| (6) Pre-DS | -0.31** | -0.12† | -0.42** | 0.27** | 0.44** | 0.93 | | | | | | |
| (7) Post-PGM | 0.56** | 0.43** | 0.15* | -0.45** | -0.24** | -0.22** | 0.86 | | | | | |
| (8) Post-EGM | 0.25** | 0.53** | 0.15* | -0.32** | -0.13 | -0.12† | 0.53** | 0.87 | | | | |
| (9) Post-SE | 0.12† | 0.29** | 0.76** | -0.09 | -0.38** | -0.35** | 0.11† | 0.12† | 0.92 | | | |
| (10) Post-blame | -0.26** | -0.21** | -0.01 | 0.72** | 0.27** | 0.20** | -0.45** | -0.41** | 0.06 | 0.85 | | |
| (11) Post-AC | -0.19** | -0.12† | -0.27** | 0.19** | 0.59** | 0.26** | -0.20** | -0.29** | -0.22** | 0.34** | 0.94 | |
| (12) Post-DS | -0.27** | -0.11† | -0.44** | 0.22** | 0.47** | 0.92** | -0.17** | -0.11 | -0.35** | 0.19** | 0.30** | 0.94 |
| <i>M</i> | 3.45 | 4.18 | 3.33 | 2.79 | 1.99 | 8.81 | 3.74 | 4.22 | 3.40 | 2.69 | 2.01 | 8.13 |
| <i>SD</i> | 1.04 | 1.11 | 0.68 | 1.00 | 0.77 | 6.82 | 1.23 | 1.18 | 0.78 | 1.15 | 0.93 | 6.96 |

Note PGM=personality growth mindsets, EGM=emotion growth mindsets, SE=self-efficacy, DS=depressive symptoms, AC=avoidant coping, Reliabilities (α) of each scale are on the diagonal in bold; † $p < .10$, * $p < .05$, ** $p < .01$

pants in the Healthy Minds condition reported stronger growth mindsets of emotion [$t(454)=2.66, p=.008, d=0.25$], and self-efficacy [$t(455)=2.53, p=.012, d=0.24$], than did participants in the control condition. Because of these pre-test differences, the primary analyses reported below examined whether the two conditions differed from one another in regard to how much *change* participants experienced from pre- to post-test, rather than simply examining whether the two conditions differed between groups at post-test.

Finally, as expected, the psychological processes correlated in expected ways with depression. Preexisting depressive symptoms correlated negatively with mindsets of personality ($r=-.18, p<.001$) and self-efficacy ($r=-.39, p<.001$). Preexisting depressive symptoms correlated positively with self-blame ($r=.20, p<.001$). However, preexisting depressive symptoms did not correlate significantly with mindsets of emotions, although the correlation trended in the expected direction ($r=-.09, p=.062$).

8.2 Primary Analyses

First, the Time x Condition interaction predicted *mindsets of personality*, $b=0.67, SE=0.11, t(450)=6.31, p<.001, r=.28$. Simple effects analyses (Aiken & West, 1991) revealed that participants in the Healthy Minds condition experienced greater increases in mindsets of personality from pre- to post-test, $b=0.96, SE=0.08, t(450)=12.56, p<.001, r=.51$, than did participants in the control condition, $b=0.29, SE=0.07, t(450)=3.82, p<.001, r=.18$.

Second, the Time x Condition interaction predicted *mindsets of emotion*, $b=0.35, SE=0.10, t(449)=3.62, p<.001, r=.17$. Simple effects analyses revealed that participants in the Healthy Minds condition experienced increases in mindsets of emotions from pre- to post-test, $b=0.39, SE=0.07, t(449)=5.59, p<.001, r=.26$; however, participants in the control condition did not experience significant increases in mindsets of emotion, $b=0.04, SE=0.07, t(449)=0.55, p=.581, r=.03$.

Third, the Time x Condition interaction did not predict *self-efficacy*, $b=0.04, SE=0.05, t(449)=0.92, p=.358, r=.04$. Nevertheless, we deconstructed the non-significant interaction to examine the pattern of change among participants in each condition. Results suggested that whereas participants in the Healthy Minds condition experienced increases in self-efficacy, $b=0.11, SE=0.03, t(449)=3.18, p=.002, r=.15$, participants in the control condition only experienced marginal increases in self-efficacy, $b=0.07, SE=0.03, t(449)=1.93, p=.055, r=.09$; however, as previously noted, the amount of change did not significantly differ between the two conditions.

Fourth, the Time x Condition interaction predicted *self-blame*, $b=-0.23, SE=0.08, t(449)=-2.96, p=.003, r=-.14$. Simple effects analyses revealed that whereas participants in the Healthy Minds condition experienced declines in self-blame from pre- to post-test, $b=-0.33, SE=0.06, t(449)=-5.96, p<.001, r=-.27$, participants in the control condition did not, $b=-0.10, SE=0.05, t(449)=-1.86, p=.064, r=-.09$.

Finally, the Time x Condition interaction predicted *avoidant coping*, $b=-0.19, SE=0.06, t(447)=-3.02, p=.003, r=-.14$. Simple effects analyses revealed that whereas participants in the Healthy Minds condition experienced declines in avoidant coping from pre- to post-test, $b=-0.17, SE=0.05, t(447)=-3.78, p<.001, r=-.14$.

-.18, participants in the control condition did not, $b=0.02$, $SE=0.04$, $t(447)=0.46$, $p=.646$, $r=.02$.⁴

Next, we conducted supplemental analyses examining whether participants' depressive symptoms at pre-test moderated the effects of the Time x Condition interaction. Depressive symptoms did not further moderate the effect of the Time x Condition interaction on growth mindsets of personality, $b=0.01$, $SE=0.02$, $t(438)=0.82$, $p=.415$, $r=.04$, growth mindsets of emotions, $b=0.01$, $SE=0.01$, $t(438)=0.66$, $p=.507$, $r=.03$, self-efficacy, $b<0.01$, $SE=0.01$, $t(437)=0.06$, $p=.956$, $r<.01$, self-blame for depressive symptoms, $b=0.01$, $SE=0.01$, $t(437)=0.60$, $p=.550$, $r=.03$, or avoidant coping, $b=0.01$, $SE=0.01$, $t(435)=1.35$, $p=.178$, $r=.06$, suggesting these results did not vary depending on participants' preexisting depressive symptoms.

9 General Discussion

Healthy Minds demonstrated promising initial results as a scalable mental health growth mindset intervention with compensatory messaging by strengthening growth mindsets, improving self-efficacy, and reducing self-blame and avoidant coping. Further, these results corresponded with mental health outcomes. Namely, pre-existing levels of depression correlated significantly and in expected ways with mindsets, self-efficacy, and self-blame. These correlations replicate past work. For example, growth mindsets (Hoyt et al., 2021) and self-efficacy (Endler et al., 2001; O'Leary, 1992; Parto & Besharat, 2011) are linked to mental wellness and positive mental health outcomes, whereas self-blame is linked to mental illness and negative mental health outcomes (Burnette et al., 2017; Moulton et al., 1987). By successfully targeting these cognitive processes linked to mental wellness/mental illness, the Healthy Minds intervention aims to change the way adolescents think and respond to adverse events, which in turn should positively impact future mental health.

Notably, results revealed that adolescents under the highest levels of duress benefitted equally well (in terms of psychological processes) from the intervention as adolescents with lower levels of depressive symptoms. As the heterogeneity revolution makes clear, it is important to understand under what conditions and for whom interventions are most effective (Bryan et al., 2021; Yeager et al., 2019). Growth mindset interventions are not always one-size-fits-all (Foliano et al., 2019; Yeager et al., 2019) and targeted interventions may sometimes show stronger effects than non-targeted interventions (Sisk et al., 2018). Although the current study suggests that both depressed and nondepressed adolescents benefit equally from this intervention, more work is needed in the realms of mental health to delineate which populations may benefit most.

The current work provides further evidence that online, single session interventions are effective in promoting positive outcomes for youth that may ultimately result in beneficial downstream effects on mental health (Schleider et al., 2022). This especially matters in environments in which access to mental health care is limited

⁴ Supplemental results reported in the online supplemental materials (OSM) revealed that controlling for participants' gender and grade did not change this pattern of results.

(Schleider et al., 2022). Given that our study took place in a rural school district in which over half of the student population receives free/reduced lunch, this work provides further evidence of the positive outcomes that transpire when students are provided with access to short, single session interventions, particularly for individuals who may not have access to or the financial resources to seek professional help. This work paves the way for future research designed to test the efficacy of single session interventions in other populations who may have limited access to resources that support their mental health.

Additionally, this work reveals the immediate post-intervention effects on mindsets, self-efficacy, self-blame and avoidant coping, providing evidence for the efficacy of our intervention. However, it is unclear how long the effects of the intervention may last, with previous work showing effects lasting up to two years (Lai et al., 2022). Future work should examine the duration of our intervention's effects, in addition to exploring the inclusion of a booster after the original intervention is administered. Boosters in other mental health interventions to have beneficial effects on the intended outcomes such as lengthening the amount of time the intervention is effective, and mindset literature could draw on these techniques to promote valuable long-term results for adolescents' beliefs, self-efficacy, self-blame, and coping (Czyz et al., 2021; Gearing et al., 2013). Overall, an online single-session mindset intervention shifted adolescents' cognitions and behaviors, namely, promoting stronger growth mindsets of personality and emotions, greater self-efficacy, and less self-blame and avoidant coping for depression.

9.1 Limitations

Although one of the original aims of the current work was to test whether the effects of a growth mindset intervention would last over time, the COVID-19 pandemic limited our ability to test this question. Due to this limitation, we were also unable to test whether the cognitive process effects persisted over time and whether or not the intervention directly or indirectly impacted rates of depression in youth. Thus, the current research cannot provide evidence that changes in growth mindsets, self-efficacy, self-blame, and threat appraisals predict lower levels of depression. Nevertheless, previous research supports this idea (e.g., Burnette et al., 2020a, b).

Additionally, over half our sample identified as girls. While adolescent girls often report worse mental health than boys, future work should utilize more diverse samples as boys may be more prone to other mental health challenges (Campbell et al., 2021; Rice et al., 2018). Additionally, adolescents who identify as gender or sexual minorities are also more likely to report mental health challenges compared to gender conforming and heterosexual peers (Fox et al., 2020). Given that mindset interventions tend to work best when they target individuals who need it most (e.g., individuals experiencing mental health challenges; Burnette et al., 2023), future work should explore how the current intervention may be tailored to better address the mental health needs of a diverse range of adolescents.

Finally, it is also important to note that this study randomly assigned participants to one of two interventions designed to improve health in a potentially stigmatized context: mental health (Healthy Minds) and sexual health (control intervention).

Although means among both groups suggest that the interventions affected specific outcomes the interventions were designed to target, we cannot rule out the potential for demand characteristics or other complexities that come with comparing two different intervention groups.

10 Conclusion

Results demonstrated that Healthy Minds, a growth mindset intervention targeting adolescent mental health with compensatory messaging, significantly and positively impacted growth mindsets and self-efficacy, while reducing self-blame and avoidant coping. Understanding the potential benefits and costs of growth mindsets helped us to craft a nuanced message that reaped the advantages but avoided the blame-related disadvantages. Importantly, the cognitive outcomes outlined in the present studies correlated significantly and in expected ways with depression. Finally, continuing to contribute to the heterogeneity revolution, we tested whether effects of the intervention on the targeted psychological processes was stronger for youth at higher levels of depressive symptomology, finding in this case no significant moderation. We encourage future empirical inquiries to continue to outline both the mechanisms and moderators of intervention effectiveness and to highlight key implementation strategies such as compensatory framing for growth mindset messaging. We hope this initial line of work focusing on these key issues in the context of youth mental health helps to provide a platform for such future research.

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Data Availability The IRB agreement prevents publicly sharing this dataset online. However, the authors are able to make the data available upon request with IRB approval. Please contact the first author for access to the dataset.

Declarations

Ethical Approval The North Carolina State University Institutional Review Board approved this study.

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

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