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Bachelor's Thesis

Actively shaping a positive stress response: The moderation effect of stress mindset on the association between stressor intensity and distress and eustress

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Abstract

Background: Psychological stress is a considerable problem in Western society as stressors are an inevitable part of life. One can distinguish between a distress response with negative effects and a eustress response with beneficial effects on health, cognition and well-being. Stressor intensity is a key factor in determining which stress response takes place, and stress mindset could be a useful resource in endorsing a eustress response. Moreover, a stress-is-enhancing (SIE) mindset advocates the belief that experiencing stress has enhancing consequences for performance, while a stress-is-debilitating (SID) mindset appraises these consequences to be debilitating. The present study hypothesized that stressor intensity is more strongly related to eustress when having a SIE mindset and more strongly related to distress when having a SID mindset.

Method: A convenience sample of 160 participants consisting out of students and non-students from the Dutch and German communities was taken. After exclusion, 72 students and 4 non-students were randomly assigned to three conditions: (1) SIE mindset condition, (2) SID mindset condition or (3) control condition. In an attempt to manipulate their stress mindset, participants in the former two conditions watched three informational videos advocating either a SIE or SID mindset over the course of one week.

Results: Stress mindset was not found to be a significant moderator in the association between the intensity of stressors and distress nor in the association between the intensity of stressors and eustress. Still, outcomes did support the notion that stress mindsets can be manipulated over the short-term using informational videos.

Conclusion: While some trends went into the expected direction, stress mindset was not found to have a significant moderation effect. Nevertheless, results indicated that stress mindsets are malleable and this may prove to become a useful tool in stress management interventions. Further research examining the role of stress mindset in the stress process is therefore necessary.

1. Introduction

Psychological stress is a considerable problem in Western society. Prevalence rates for stress ranged between 5% and 27% in the Western population between 2000 and 2006 (Drapeau, Marchand & Beaulieu-Prévost, 2012), but have been found to be higher for certain population segments due to stressful work conditions and other related factors. For example, it was found that stress negatively affected between 15% and 20% of workers in Europe and North America (International Labour Office, 2000). Moreover, stress has been causally related to harmful effects on one's health, well-being and overall functioning. Chronic stress can lead to mental health problems including depression, anxiety and personality disorders. It has also been associated with cardiovascular disease, obesity and other chronic diseases (McLachlan & Gale, 2018).

Contemporary stress management and stress prevention methods attempt to tackle stress in a variety of settings to improve people's health, well-being and productivity. Since stress can occur in different contexts and each person has their own stress response (DeLongis, Folkman & Lazarus, 1988), intervention can range from encouragement to confront problems, prioritize or read self-help books, to releasing tension by exercising or finding support with social connections or professionals (Brunet, 2019). While such stress management interventions have been found to be effective (Alborzkouh, Nabati, Zainali, Abed & Shahgholy Ghahfarokhi, 2015; Yazdani, Rezaei & Pahlavanzadeh, 2010), many people are still experiencing stress (Drapeau, Marchand & Beaulieu-Prévost, 2012). Further improvements are therefore needed, and to achieve these it is important to gain insight into the workings of stress.

When examining stress, it is important to make a distinction between different forms of stress. Selye (1975) distinguished between distress and eustress in his pioneering stress research. Stress with negative consequences may be characterized as distress or negative stress. Oppositely, eustress can be defined as positive stress having beneficial effects on health, cognition, motivation and emotional well-being (Lifer, 2013). It is thus important to note that not all stress is harmful and it can potentially be used to one's benefit (Le Fevre, Matheny & Kolt, 2003). Gaining insight into different forms of stress and how they are associated with mental health outcomes is important because stressors are an inevitable part of life.

1.1 Stress process

To understand how stressors are connected with these mental health outcomes, one may review the stress process model in *Figure 1* that was based on the recent model of Aneshensel and Avison (2015). This model proposes that stressors, affected by societal and cultural influences, can lead to mental health outcomes through two indirect pathways. The first pathway is mediated by the stress response, distinguishing between the possibility of a eustress or distress response (Hargrove, Quick, Nelson & Quick, 2011). Stressor characteristics play a role in determining which of these stress responses takes place. For instance, manageable stressors with low chronicity, moderate intensity and high controllability are associated with eustress, while severe stressors with high chronicity and intensity and low controllability are associated with distress (Penley, Tomaka & Wiebe, 2002). Consequently, eustress may be related with positive mental health outcomes such as a flourishing well-being (Nelson & Simmons, 2005). Distress may be related with negative mental health consequences such as depressive or anxiety symptoms (Miller, Pallant & Negri, 2006).

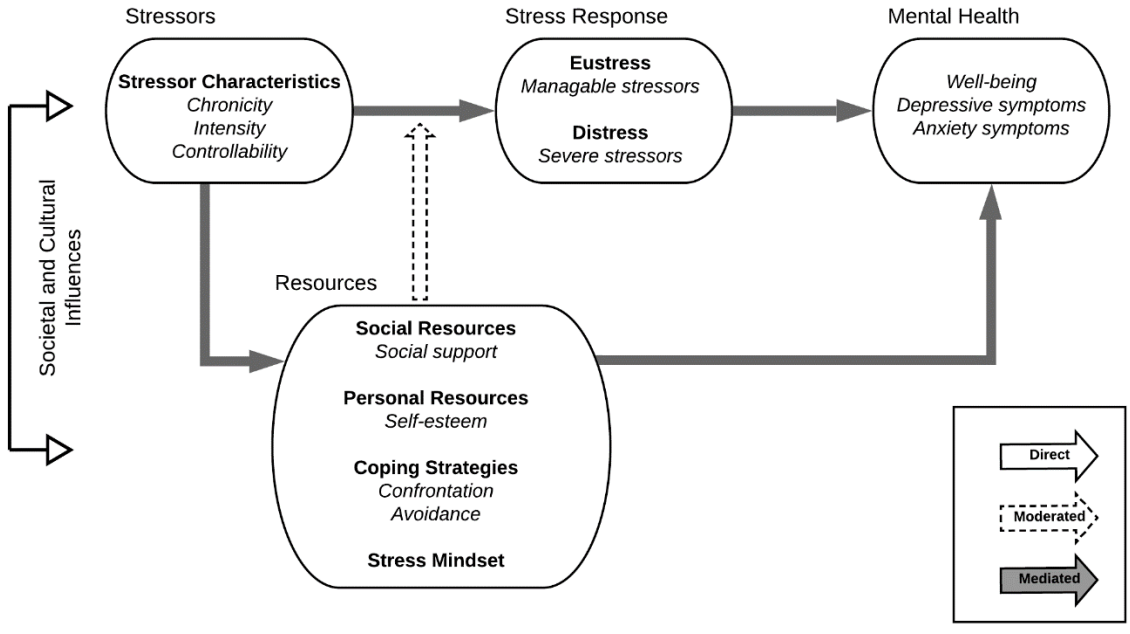

Figure 1. The stress process model.

The second pathway proposes that stressors may also be mediated by one's resources such as social support, personal self-esteem and coping strategies, indirectly leading to mental health outcomes (Aneshensel & Avison, 2015). For example, one may have a low self-esteem

to deal with stressors, leading to more depressive symptoms. Resources are also directly affected by societal and cultural influences. Finally, it is important to note that the mentioned resources may also moderate the relationship between stressors and the stress response, potentially affecting mental health outcomes (Aneshensel & Avison, 2015). For example, avoidance coping strategies may increase the intensity of stressors leading to higher levels of distress while adequate social support can increase the manageability of stressors leading to higher levels of eustress (Aneshensel & Avison, 2015). Depending on the stress response as discussed before, this moderation effect can then lead to more positive or negative mental health outcomes.

1.2 Intensity of stressors

For the current study, stressor intensity and its connection with the stress response is of particular interest. Moreover, recent findings pointed at the notion that the intensity of stressors is a key factor in determining the development of either the distress or eustress response (Kupriyanov & Zhdanov, 2014; Weiman, 1977). This is asserted to be a nonlinear relationship illustrated in the form of an inverted U-shaped diagram, where a link exists between the impact of stressor intensity and health outcomes: high and low stressor intensities are associated with distress, while moderate intensity is related with eustress. An explanation for this may be that when a stressor is too intense, habituation of the adrenocortical stress response does not occur successfully with overwhelming stress, anxiety and unhappiness as a result (Natelson et al., 1988). Conversely, low stressor intensity can lead to understimulation and boredom forming negative health outcomes. Finally, a moderate stressor intensity is associated with moderate cortisol levels which lead to optimal arousal levels associated with eustress and positive health outcomes (Crum, Salovey & Achor, 2013). Not only do stressor characteristics determine the stress response, but recent findings point at the notion that resources might also shape the stress response (Aneshensel & Avison, 2015).

1.3 Stress mindset

Research by Crum et al. (2013) shed light on new mechanisms which may help to manipulate the stress response and thereby improve the outcomes of stress management. They showed in an American sample that stress mindset may play an important role in determining one's stress response. A stress mindset is "the extent to which one holds the belief that stress has enhancing consequences for various stress-related outcomes such as performance and productivity, health and wellbeing, and learning and growth (referred to as a "stress-is-

enhancing mindset" [SIE mindset]) or holds the belief that stress has debilitating consequences for those outcomes (referred to as a "stress-is-debilitating mindset" [SID mindset])" (Crum et al., 2013, p.716).

There is growing evidence that stress mindset shapes the stress response and that it is related to perceived health and life satisfaction (Crum et al., 2013). Crum, Akinola, Martin and Fath (2017) found that a SIE mindset produced greater increases in growth hormones in stressful situations compared to a SID mindset. Furthermore, SIE mindsets were associated with increased positive affect, heightened attentional bias towards positive stimuli, and greater cognitive flexibility whereas SID mindsets produced negative cognitive and affective outcomes (Crum et al., 2017).

Providing an explanation for this phenomenon, it was theorized that if one holds a SIE mindset one will be more likely to choose behaviors that help meet the demand underlying the stressful situation in such a way that the stress is actively used to fulfill that demand (Crum et al., 2013). Conversely, people with SID mindsets tend to behave in ways to suppress or deny the stress, leading to mediocre performance during stressful situations. Stress mindset may therefore be a crucial variable in determining both psychological symptoms and performance in stressful situations. Finally, important to note is that Crum et al. (2013) found that stress mindset can be manipulated by showing informational videos that oriented participants to enhancing or debilitating consequences of stress. The current study repeated part of this research by employing the same videos to manipulate stress mindset.

Looking back at the stress process model in *Figure 1*, it is expected that stress mindset can be integrated into the resource pool because of its suspected relationship with the stress response. By retraining a SID mindset into a SIE mindset, stress mindset could act as a resource and moderate the association between intensity of stressors and distress and eustress.

1.4 Current research

The current research aimed to extend the stress mindset theory by Crum et al. (2013) by examining the moderation effect of stress mindset on the association between stressor intensity and distress and eustress. It is hypothesized that with a SIE mindset, the effect of intensity of stressors on eustress is stronger while the effect on distress is weaker. Oppositely, with a SID mindset it is expected that the effect of intensity of stressors on distress is stronger while the effect on eustress is weaker. SIE mindsets would therefore reinforce the eustress response while SID mindsets reinforce the distress response due to the perceived outcomes of these mindsets. If changes in stress mindsets are associated with more optimal stress

responses, interventions aimed at decreasing the negative consequences of stress may benefit from actively reshaping stress mindsets.

Taken altogether, a model is proposed in *Figure 2* in which stress mindset manipulation videos create either a SIE or SID mindset through cognitive retraining, moderating the association between the intensity of stressors and distress and eustress levels.

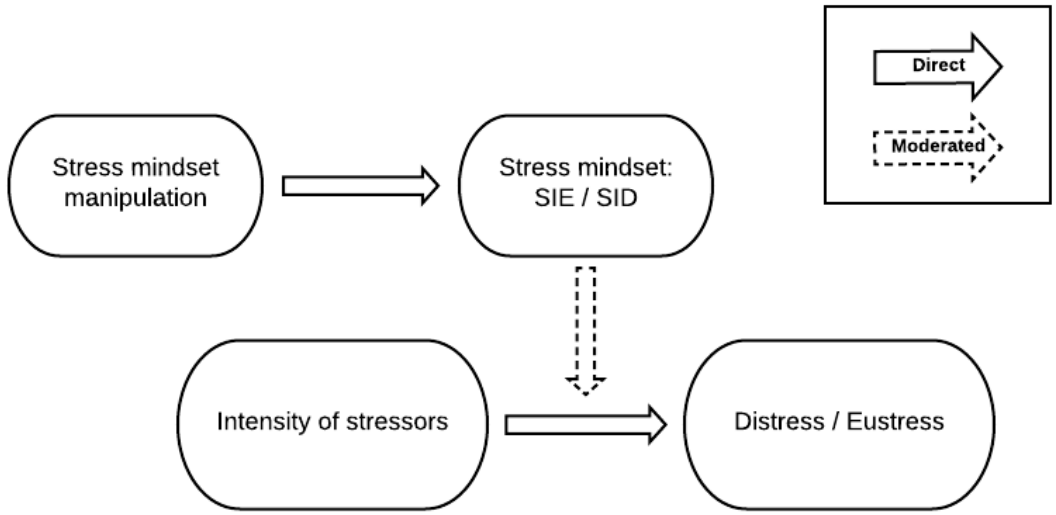

Figure 2. Model with proposed mechanisms. Stress mindset manipulation videos create a stress-is-enhancing (SIE) or stress-is-debilitating (SID) mindset through cognitive retraining, moderating the association between the intensity of stressors and distress and eustress levels.

Based on the discussed information, the following **main research question** was formulated for the current research:

- To what extent do stress mindsets moderate the association between the intensity of stressors and distress and eustress levels?

Based on this research question, the following **hypotheses** were formulated:

- The association between the intensity of stressors and distress is moderated by stress mindset.
- The association between the intensity of stressors and eustress is moderated by stress mindset.

2. Method

2.1 Design

A pretest posttest between-subjects design was employed with randomized allocation to three conditions: (1) stress-is-enhancing mindset (SIE) condition, (2) stress-is-debilitating mindset (SID) condition, or (3) control group condition. Intensity of stressors at pretest was used as an independent variable while the dependent variables were distress and eustress at posttest, with stress mindset as moderator.

2.2 Participants

A convenience sample of 160 students from the University of Twente and Dutch and German community members was taken. Of these participants, 84 were considered as dropouts as they did not complete the posttest questionnaire, and were therefore excluded from the data analysis. This resulted in a final sample of 76 participants: 23 in the SIE condition, 24 in the SID condition and 29 in the control group condition. Randomization was found to be successful as indicated by the p-values of ANOVA and Chi-square tests (Table 1). The majority of the sample consisted out of highly educated female students with a German nationality (M_{age} = 21.93). Descriptive statistics of the total sample and the stress mindset conditions can be found in Table 1.

2.3 Materials

Stress mindset manipulation using informational videos. To achieve stress mindset manipulation, the study employed six videos created by Crum et al. in two studies from 2013 and 2017. Participants in the SIE condition watched three three-minute videos over the course of one week emphasizing the positive effects of stress supported by empirical research. Moreover, they watched videos emphasizing the benefits of stress on cognitive performance and learning and growth. Examples include statements such as "*The stress response is designed to enhance cognitive performance, especially when it matters most*" and "*The feeling of constraint can help you be more creative and motivate you to find new solutions*". While reading such statements, participants were shown uplifting and motivating pictures with inspirational music in the background.

Conversely, participants in the SID condition watched three three-minute videos over the course of a week emphasizing the negative effects of stress supported by scientific findings. Moreover, they watched videos emphasizing the debilitating effects of stress on

Table 1

Demographics of the total sample and the stress mindset conditions.

Characteristic	Total	Condition			p-value
		SIE mindset	SID mindset	Control group	
Subjects (%)	76 (100%)	23 (30.3%)	24 (31.6%)	29 (38.2%)	
Gender					.70a
Male (%)	22 (28.9%)	8 (36.4%)	7 (31.8%)	7 (31.8%)	
Female (%)	54 (71.1%)	15 (27.8%)	17 (31.5%)	22 (40.7%)	
Occupation					.36a
Student (%)	72 (94.7%)	21 (29.2%)	24 (33.3%)	27 (37.5%)	
Employed (%)	4 (5.3%)	2 (50.0%)	-	2 (50.0%)	
Nationality					.31a
Dutch (%)	8 (10.5%)	1 (12.5%)	3 (37.5%)	4 (50.0%)	
German (%)	63 (82.9%)	19 (30.2%)	19 (30.2%)	25 (39.7%)	
Other (%)	5 (6.6%)	3 (60.0%)	2 (40.0%)	-	
Marital status					.31a
Single or unmarried	75 (98.7%)	22 (29.3%)	24 (32.0%)	29 (38.7%)	
Married	1 (1.3%)	1 (100%)	-	-	
English proficiency					.79a
Beginner	2 (2.6%)	1 (50.0%)	-	1 (50.0%)	
Intermediate	26 (34.2%)	9 (34.6%)	7 (26.9%)	10 (38.5%)	
Advanced	48 (63.2%)	13 (27.1%)	17 (35.4%)	18 (37.5%)	
Age (M, SD)	21.93 (2.46)	21.93 (2.41)	22.21 (2.32)	21.84 (2.68)	.84b

Note. a = Chi-square. b = ANOVA. p-values were used to examine randomization.

cognitive performance and learning and growth. Examples include statements such as "*Your focus is at its worst under pressure*" and "*Stress can lead to mood swings, irritability, loss of enjoyment, fears* […]". In this case, participants were shown pictures of stressful situations and negative bodily processes with dramatic music in the background.

Control group filler questions. When participants in the video conditions watched the relevant videos, participants in the control group were asked to complete three filler questions on current affect, such as "*How are you feeling today?*"

2.4 Measures

Apart from the measures that are explained in detail below, the study also administered the Mental Health Continuum-Short Form (Keyes, 2005), State Self-Esteem Scale (Heatherton & Polivy, 1991) and Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983), although the outcomes of these tests were not relevant for the data analysis of the current research.

Demographics and general information. First, participants had to indicate their age, gender, nationality, occupation, marital status and self-rated English proficiency level.

Stress Mindset Measure (SMM). The SMM is an eight-item self-administered questionnaire developed by Crum et al. (2013) to measure one's stress mindset. It also evaluates signs and symptoms related to both enhancing and debilitating consequences of stressors. A sample statement was: "*Experiencing stress enhances my performance and productivity*". Participants had to indicate on a 5-point Likert-scale to what extent they agreed with the statements (0 = *Strongly disagree*; 4 = *Strongly agree*). Findings indicate good reliability and test-retest reliability was found to be adequate (Crum et al., 2013). Cronbach's alpha for the current study was found to be good with a value of .79 for the pretest and .89 for the posttest.

Perceived Stress Scale (PSS). The PSS is a ten-item self-administered questionnaire measuring the degree to which one appraises situations in one's life as stressful (Cohen, Kamarck & Mermelstein, 1983). Although the scale was originally developed to measure stress in general, it can also be used to measure the amount of distress and eustress separately using a two-factor solution (Lee, 2012). The mean of the six negatively formulated items was used to measure the degree of perceived distress. The mean of the four positively formulated items was used to measure perceived eustress. For this study, participants were asked about their experiences in the past week and a sample question for distress was*: "In the last week, how often have you found that you could not cope with all the things that you had to do?"* A

sample question for eustress was: "*In the last week, how often have you felt confident about your ability to handle your personal problems?*" Participants indicated their answers on a 5-point Likert-scale (0 = *Never*; 4 = *Always*). Cronbach's alpha indicated good construct validity (Cohen, Kamarck & Mermelstein, 1983). Cronbach's alpha for the current study was found to be good for both the distress and eustress scales with values of .85 and .80 for the pretest and .89 and .80 for the posttest, respectively.

Survey of Recent Life Experiences (SRLE). The self-administered 41-item short form of the SRLE was administered to measure participants' daily hassles and the perceived intensity of stressors in their lives (Kohn & Macdonald, 1991). In this case the measure focused on stressors in the upcoming week. A sample statement was as follows: *Please indicate how much 'Disliking your work' will be a part of your life in the next week.* Participants had to react to such statements on a 4-point Likert-scale (1 = *Not at all part of my life*; 4 = *Very much part of my life*). A good reliability was found (Kohn & Macdonald, 1991). Although the complete form with 51 items had a slightly better reliability (Kohn & Macdonald, 1991), the current study employed the short form to decrease participant burden. Cronbach's alpha for the current study was found to be excellent with a value of .95 for the pretest and .92 for the posttest.

2.5 Procedure

Recruitment and informed consent. The study was ethically approved by The Ethics Committee of the Faculty of Behavioral, Management and Social sciences (BMS; request number 190356). After voluntary recruitment through the Sona system, Reddit and social media, respondents were directed with an anonymous link to Qualtrics where they were partially informed about the research. They were briefed on the general procedure and setup of the study, but not about the randomization into different conditions. Subsequently, participants were given the opportunity to provide informed consent. Thereby, they indicated that they thoroughly read the description of the study, were aware of the possibility to withdraw from the study at any time, were over the age of eighteen, and that they agreed with the terms as described.

Pretest and randomization. After filling out their demographics, providing their e-mail addresses and creating a unique participant code, they were directed to fill out the pretest with the first self-reported questionnaire including the discussed measures. Participants were then randomly assigned to one of the three discussed conditions. Participants in the SIE and SID conditions were instructed to carefully watch the first video corresponding to their

condition on ‘Cognitive Performance’. Participants in the control condition were asked to complete the three filler questions on current affect. All participants were then reminded about receiving follow-up e-mails after three and seven days from the moment of participation.

Follow-up task. After three days, all participants received an e-mail directing participants in the SIE and SID conditions to watch a second video relevant to their condition on ‘Learning / Growth’, and participants in the control condition to complete another three questions on current affect.

Posttest and debriefing. After seven days since the start of participation, participants in the SIE and SID conditions received another e-mail directing them to the third video relevant to their condition with a more recent version of ‘Learning / Growth’. On the same day, directly after completing the third video in the SIE and SID conditions, all participants were asked to complete the final self-reported questionnaire on Qualtrics which included the same measures as the pretest. Participants in the control condition completed the three questions on current affect once more. Upon full completion, respondents were thanked for participating and debriefed on the purpose of the research. They were also given the opportunity to contact the researchers to gain more insight into the study if they wished to do so. Finally, participating students were awarded with Sona credits for their participation, which they required to pass their studies.

2.6 Data analysis plan

Statistical analyses were performed with SPSS 25.0. The collected data was explored in more depth by calculating mean scores and standard deviations for the participants in the different conditions. Differences between conditions on the variables distress, eustress and stressor intensity were examined at pre- and posttest using ANOVA analyses with between-subjects factor condition. To examine whether the videos were effective in changing stress mindset, an ANOVA analysis with between-subjects independent variable condition and dependent variable stress mindset was conducted. Furthermore, aggregated correlational analyses were conducted to examine the associations between the mentioned variables as well as demographic variables. Finally, to be able to separately assess the correlations between low, moderate and high stressor intensities at pretest and distress and eustress at posttest, the stressor intensity scores of participants were split. Moreover, Survey of Recent Life Experiences scores lower than 2, in-between 2 and 3, and higher than 3 were considered to be

low, moderate and high, respectively (Kohn & Macdonald, 1991). Correlational analyses were then conducted to examine the associations between the variables.

To examine the moderation effect of stress mindset with the association between the intensity of stressors and distress and eustress, the bootstrap moderation procedure with 95% confidence intervals was employed (Preacher & Hayes, 2008). This nonparametric resampling procedure does not require the assumption of normality of the sampling distribution because it involves repeated sampling of the dataset for a great number of times, estimating the moderation effect in each resampled dataset. Demographic variables associated significantly with the examined variables were added as covariates to the bootstrap moderation procedure (Preacher & Hayes, 2008). The estimate of the moderation effect was derived from the mean of 5000 bootstrap samples. Moderation was established when the 95% confidence interval of the indirect effect did not include zero (Preacher & Hayes, 2008). This approach was used in two separate moderation analyses to examine both distress and eustress at posttest as dependent variables, with stressor intensity at pretest as independent variable and condition group including the SIE, SID and control conditions as moderator. Stressor intensity at posttest was added as covariate to control for current stressors.

3. Results

3.1 Exploring the data

In Table 2, the descriptive statistics of the total sample and the stress mindset conditions are displayed for pre- and posttest. The outcomes of the ANOVA analysis showed that the stress mindset manipulation was effective as there were significant differences between the conditions in stress mindset levels at posttest [F (2,73) = 7.73, $p < .001$] but not at pretest [F (2,73) = .42, $p = .66$]. Participants in the SIE condition had a significantly higher stress mindset score than participants in the SID and control condition at posttest (mean difference = .84, $p < .001$ and .056, $p = .03$, respectively). Participants in the SID condition had a significantly lower stress mindset score than participants in the SIE condition (mean difference = -.84, $p < .001$), but this difference was not significant compared to participants in the control condition (mean difference = -.28, $p = .19$).

Table 2

Descriptive statistics of the total sample and the stress mindset conditions at pre- and posttest.

		Condition			p-value
	Total M (SD)	SIE mindset M (SD)	SID mindset M (SD)	Control group M (SD)	
Pretest					
Distress	1.69 (0.71)	1.80 (0.85)	1.64 (0.70)	1.65 (0.60)	.69
Eustress	2.34 (0.68)	2.38 (0.83)	2.37 (0.71)	2.28 (0.51)	.82
Stress mindset	1.78 (0.60)	1.87 (0.57)	1.77 (0.61)	1.71 (0.62)	.66
Stressor intensity	1.76 (0.46)	1.86 (0.59)	1.70 (0.43)	1.74 (0.35)	.48
Posttest					
Distress	1.64 (0.78)	1.78 (0.83)	1.63 (0.73)	1.55 (0.79)	.59
Eustress	2.45 (0.65)	2.51 (0.60)	2.48 (0.62)	2.39 (0.72)	.78
Stress mindset	1.67 (0.75)	2.15 (0.85)	1.31 (0.59)	1.59 (0.58)	<.001
Stressor intensity	1.78 (0.39)	1.84 (0.39)	1.67 (0.37)	1.82 (0.40)	.25

Note. p-values were calculated using ANOVA analyses. N = 76.

In Table 3, the aggregated correlations between variables are displayed. The correlational analysis revealed that the demographic variable of nationality was significantly associated with stress mindset (r = -.17) and stressor intensity (r = .27). This means that German participants experienced higher stressor intensities and lower Stress Mindset Measure scores compared to Dutch participants. Furthermore, English proficiency was significantly associated with distress (r = -.18), eustress (r = .18) and stressor intensity (r = -.16). Finally, age was also significantly associated with stressor intensity (r = -.16). Consequently, nationality, English proficiency and age were added as additional covariates to the moderation analyses.

Furthermore, several significant correlations between the main variables were found. Distress had a moderately strong negative relationship with eustress (r = -.62), a weakly negative relationship with stress mindset (r = -.20) and a moderately strong positive relationship with stressor intensity (r = .59). Conversely, eustress had a moderately negative association with stressor intensity (r = -.45).

Table 3

Aggregated correlations between the variables.

Variables	N	1	2	3	4	5	6	7	8	9
1. Gender	76	-								
2. Occupation	76	.11	-							
3. Nationality	76	-.13	-.17	-						
4. Marital status	76	.07	.03	.01	-					
5. English proficiency	76	.12	.16	.05	.08	-				
6. Age	76	-.31**	-.39**	.06	.05	.09	-			
7. Distress	152	.15	.03	.16	-.04	-.18*	-.05	-		
8. Eustress	152	-.03	.01	.04	.06	.18*	.03	-.62**	-	
9. Stress mindset	152	-.12	-.11	-.17*	.07	-.13	.03	-.20*	.09	-
10. Stressor intensity	152	.06	-.01	.27**	.07	-.16*	-.16*	.59**	-.45**	.02

Note. Pearson's *r* was calculated to examine the association between the variables.
** $p < .01$. * $p < .05$. N = 76.

In Table 4, the correlations between stressor intensity at pretest, for low, moderate and high intensities, and distress and eustress at posttest are displayed. Low stressor intensity had a weakly positive association with distress ($r = .22$) and a weakly negative association with eustress ($r = -.18$), both insignificant. Moderate stressor intensity had a significantly strong positive correlation with distress ($r = .68$) and an insignificant weakly negative correlation with eustress ($r = -.002$). Correlations for high stressor intensities could not be observed as only two participants experienced high stressor intensities.

Table 4

Correlations between stressor intensity at pretest, for low, moderate and high intensities, and distress and eustress at posttest.

Stressor intensity	N	Distress	Eustress
Low	56	.22	-.18
Moderate	15	.67**	-.002
High	2	-	-

Note. Pearson's *r* was calculated to examine the association between the variables.
** $p < .01$. * $p < .05$. N = 76.

3.2 Moderation analyses

The outcomes of the moderation analysis revealed that neither stressor intensity at pretest [β = .07, *t* (68) = .24, *p* = .81] nor condition [β = -.10, *t* (68) = -1.01, *p* = .31] had a significant effect on distress at posttest. Similarly, neither stressor intensity at pretest [β = .25, *t* (68) = .10, *p* = .33] nor condition [β = -.05, *t* (68) = -.63, *p* = .53] had a significant effect on eustress at posttest.

Covariates were also examined. The bootstrap moderation procedure indicated that the covariate stressor intensity at posttest was significantly associated with both distress [β = 1.09, *t* (68) = 3.72, *p* < .001] and eustress [β = -1.01, *t* (68) = -3.85, *p* < .001] at posttest. The covariates nationality [β = -.03, *t* (68) = -.12, *p* = .90], English proficiency [β = -.13, *t* (68) = -.91, *p* = .37] and age [β = .03, *t* (68) = .91, *p* = .37] did not have a significant effect on distress at posttest, nor did nationality [β = .11, *t* (68) = .63, *p* = .53], English proficiency [β = .04, *t* (68) = .30, *p* = .77] and age [β = -.001, *t* (68) = -.04, *p* = .97] have a significant effect on eustress at posttest.

The outcomes of the moderation analyses showed that stress mindset was not a significant moderator in the association between intensity of stressor and distress [β = -.003, *t* (68) = -,01, *p* = .99] and in the association between intensity of stressors and eustress [β = .19, *t* (68) = .96, *p* = .34]. Moreover, the bootstrap moderation procedure indicated that the 95% confidence interval for the moderation effect for distress [-.45, .44] and eustress [-.21, .59] did not exclude zero. The first and second hypothesis therefore had to be rejected.

The outcomes of the moderation analyses are shown in *Figure 3* and *Figure 4*. Although the results were not significant, some effects were in the expected direction. The negative association between stressor intensity and distress increased when participants were in the SIE condition while it remained relatively stable for participants in the SID condition. Opposite to expectation, the positive association between stressor intensity and eustress increased in all conditions.

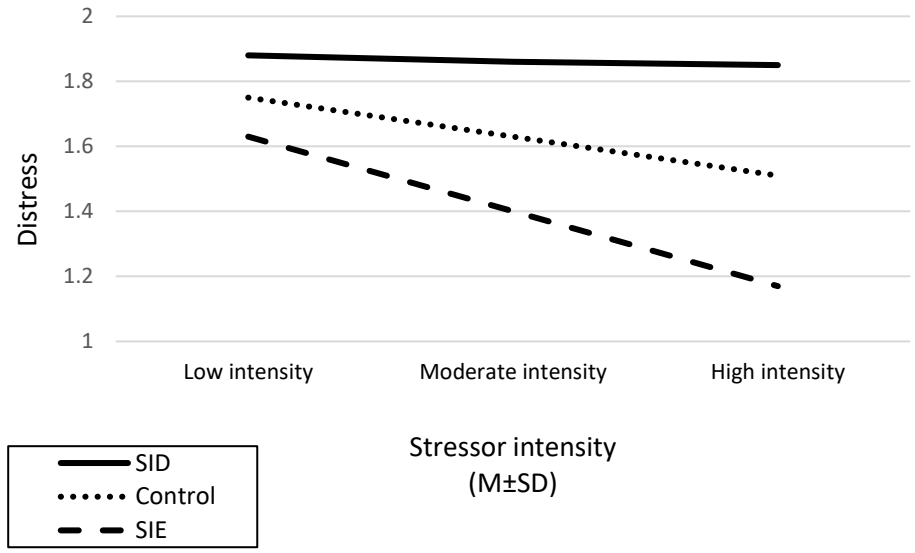

Figure 3. The change in association between the intensity of stressors and distress under influence of stress mindset. Stressor intensity levels were determined by subtracting one standard deviation below (low intensity) and adding one standard deviation above (high intensity) the mean (moderate intensity).

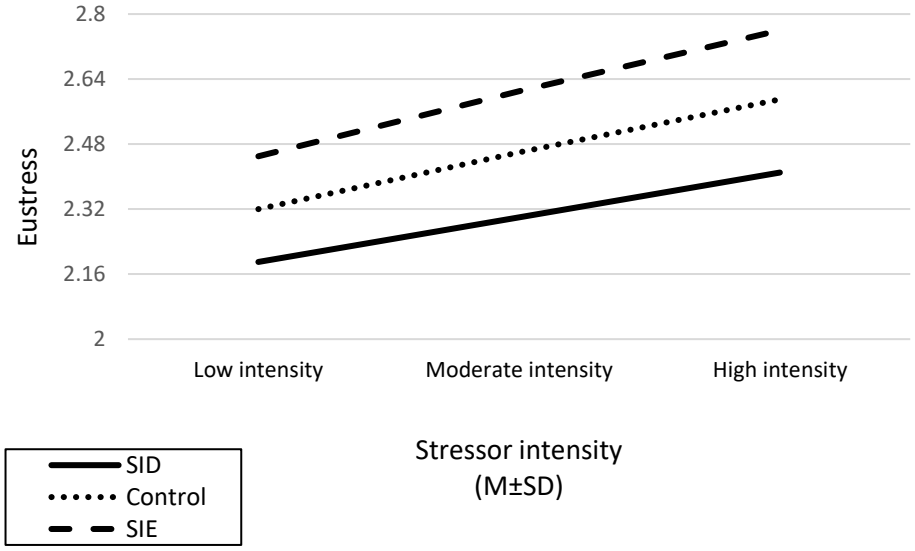

Figure 4. The change in association between the intensity of stressors and eustress under influence of stress mindset. Stressor intensity levels were determined by subtracting one standard deviation below (low intensity) and adding one standard deviation above (high intensity) the mean (moderate intensity).

4. Discussion

The current research aimed to extend the stress mindset theory by Crum et al. (2013) by examining the moderation effect of stress mindset on the association between stressor intensity and distress and eustress. A pretest posttest between-subjects design was employed with randomized allocation to three conditions: (1) SIE mindset condition, (2) SID mindset condition, or (3) control condition in an attempt to modify stress mindset and examine the moderation effects.

4.1 General discussion

To summarize the findings, stress mindset was not found to be a significant moderator in the association between the intensity of stressors and distress nor in the association between the intensity of stressors and eustress. However, looking at the outcomes of the analyses one may note that some effects still went in the expected direction and certain inferences can be made with caution.

First, to examine the role stress mindset plays in the stress process, one may review the stress process model that was depicted in *Figure 1*. In this model, the resources pool functions as both a mediator and moderator for the stress response outcomes (Aneshensel & Avison, 2015). Attempting to place stress mindset in this model, it may be added under this pool because stress mindset is a cognitive appraisal of attributes of stress that can be personally used to deal with stressors (Crum et al., 2013). It may therefore be regarded as a personal resource or base to make coping strategies more effective. However, the outcomes of the current research contradict this notion as stress mindset was not a significant moderator. More research will therefore be required to assess how stress mindset functions within the stress process model.

The outcomes of the current study may also be compared with the propositions of the stressor intensity model. As mentioned before, the latter was asserted to be a nonlinear relationship between stressor intensity and health outcomes illustrated in the form of an inverted U-shaped diagram: high and low stressor intensities are associated with distress, while a moderate intensity is related with eustress (Kupriyanov & Zhdanov, 2014; Weiman, 1977). Comparing this proposition with the outcomes of the current study, the significant aggregated correlations indicated that the higher the intensity of the stressors, the more distress and less eustress was experienced by participants (Table 3). Similar results were found when the correlations between low, moderate and high stressor intensities and distress and eustress were assessed (Table 4): although distress was positively associated with low

stressor intensities as proposed by the model, this association only grew stronger as stressor intensity increased to moderate. Moderate stressor intensities were not associated with eustress, and correlations for high stressor intensities were not observed (Table 4). Altogether, the current study therefore does not support the stressor intensity model (Kupriyanov & Zhdanov, 2014; Weiman, 1977). An explanation for this outcome may be that the participants in the current sample, consisting mainly out of female students, were more prone to distress than eustress as a result of their environment (Ross, Niebling & Heckert, 1999). This notion is further discussed in the limitations section. Further research is needed to examine the correlations for high stressor intensity levels, particularly under influence of stress mindset.

The trends of the moderation analyses in *Figure 3* and *Figure 4* also suggested effects that may be discussed, although this should be done with much caution as none of these outcomes were significant. It seems that participants in the SIE condition did not only tend to experience lower levels of distress and higher levels of eustress independent of stressor intensity levels compared to participants in the SID condition, but as the intensity of stressors increased the negative association with distress also seemed to increase. For respondents in the SID condition, distress levels seemed to stay virtually the same independent of the intensity level of stressors. Eustress levels tended to increase as stressor intensity increased in all conditions. For participants in the SID condition it is rather contradictory to experience more eustress with an increased stressor intensity (Crum et al., 2013; Kupriyanov & Zhdanov, 2014), and this may be explained by bodily processes in which increased stressor intensities lead to moderate cortisol levels and optimal arousal levels which are associated with eustress (Crum et al., 2013). Still, a more plausible way to interpret the discussed effects is that there was no association present, and the insignificant outcomes only pointed in the expected direction due to chance.

As the current study aimed to serve as an extension to the research by Crum et al. (2013), it is relevant to mention that it both supported and contradicted their findings in several ways. First, the outcomes of both studies indicated that stress mindset can be modified by letting participants watch informational videos on stress. Second, the favorable psychometric properties of the Stress Mindset Measure were further supported by the current research. Finally, the current research did not support the suggestion by Crum et al. (2013) that stress mindset is related to mental health outcomes as no significant moderation effects were found with the stress response. The most prominent explanation for this outcome is that stress mindset does not moderate the stress response. However, this does not completely rule out the possibility that stress mindset plays a different role in the stress process. For instance,

it may be that stress mindset only influences the stress response under high stressor intensities which were not observed in the current study as discussed. Alternatively, limitations of this study could have influenced the outcomes.

4.2 Strengths and limitations

One may first note multiple strengths that increased the validity of the current study. The inclusion of a control group and a baseline measure in the form of a pretest helped to control for individual differences among the participants that were present before the start of the experiment, as well as account for other potentially confounding variables. Furthermore, systematic error was prevented by randomly assigning the participants to the different conditions. Altogether, these strong points decreased bias of the study and the validity of the experiment was increased.

Several limitations of the current research are also to be mentioned. First, the outcomes were based on self-reported online questionnaires. Participants were not directly monitored during the research and socially desirable and lazy answer tendencies cannot be entirely ruled out. Similarly, one can also not be certain if respondents actually watched the stress mindset manipulation videos with full attention. These factors may have affected the psychometric qualities of the conducted research.

Second, it should be emphasized that the sample consisted mainly out of relatively young and highly educated female students. This may have influenced the observed stressors in such a way that it is difficult to generalize the outcomes to other populations. Moreover, students may experience a different intensity of stressors compared to average community members of society due to their interpersonal, intrapersonal and academic responsibilities at a relatively young age (Ross, Niebling & Heckert, 1999). Overall, this limitation resulted in a decreased external validity.

Third, the manipulation videos with emotive pictures and dramatic music were only used over a relatively short term and could have resulted in an affect manipulation rather than the intended stress mindset manipulation. Similarly, although these were not taken into account in the analyses, participants had to fill out several measures on depression, anxiety, self-esteem and mental health which could also have changed current affect (Heide & Gronhaug, 1991). Another limitation is therefore that the current study did not employ any affect measures and this potentially confounding variable could not be controlled for in the analyses. Consequently, it is possible that changes in stress mindset, distress and eustress levels were due to unobserved changes in affect.

Finally, while the current study assessed stressor intensity at pre- and posttest, it was neither manipulated nor qualitatively monitored. As was displayed in Table 4, the majority of the participants experienced only low to moderate stressor intensities and high stressor intensity were not observed. It was therefore not possible to make inferences of how stress mindset influences the association between stressor intensity and distress and eustress for high stressor intensities.

4.3 Future research

As a first suggestion for future research, one may consider to select participants based on their stressor intensity levels within the different conditions to create a broader range of stressor intensities. Stress mindset can then be more accurately examined for different intensities from low to high. To increase the validity further, it is also encouraged to incorporate more stressor variants such as controllability, chronicity and evaluations of stressors (Penley et al., 2002). One may then be able to determine more specifically what role stress mindset plays within the stress process model.

A second suggestion for future research concerns the implementation of an active stress mindset manipulation. Several studies reported that active interventions were more effective than passive interventions in stress, anxiety and pain management (Lucini, Malacarne, Solaro, Busin & Pagani, 2009; Cosio & Lin, 2018; Ekici et al., 2016). The results of the current study indicated that informational videos are able to change stress mindsets, but since this is a rather passive approach it is encouraged to actively engage the participants to modify their stress mindset. For example, respondents may actively complete exercises over a shorter or longer term in which they practice in appraising their current stressors from the perspective of either stress mindset resulting in an expectedly larger manipulation effect. This change may subsequently also magnify the effect that stress mindset has within the stress process, or could alternatively be used in stress management interventions.

4.4 Practical implications and conclusion

Since the current research did not show stress mindset to have a beneficial effect on the stress response, nor reveal its function within the stress process, it may yet be too ambitious to imply its potential in relieving society from the negative consequences of stress. As mentioned, more research is required to assess how promising stress mindset is in achieving this goal. However, one may still speculate about the potential of stress mindset manipulation exercises in stress management interventions. Such tasks might provide target

groups with a useful resource in dealing with stressors, particularly when used in combination with other currently employed stress management strategies. These target groups may concern companies with many employees since distress is mainly prevalent in working populations (International Labour Office, 2000). Over the long-term, this could then lead to lower levels of chronic distress that is negatively associated with well-being, health and overall functioning (McLachlan & Gale, 2018). Stress mindset might then become an important component in increasing society's quality of life when dealing with stress.

Although the current research did not find any significant stress mindset moderation effects on the association between stressor intensity and distress and eustress, it still contributes to a growing body of research that shows promising results in modifying stress mindsets. Further research is needed to find out what role stress mindset plays. It also supported further the idea that stress mindsets are malleable, and this may prove to become a useful tool in managing stress. Over time, this could revolutionize the way stress is perceived by society, improving stress management and potentially converting people's distress into eustress in the future.

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