Bachelor's Thesis

Mindset matters, but can it be changed? - A Randomized Controlled Trial

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Abstract

Stress mindset can be conceptualized as the mental frame or lens that selectively organizes and encodes information (Crum, Salovey, & Anchor, 2013). It can affect one's motivation, learning and achievements in different domains. Previous research demonstrated that it is possible to change people's mindset. Therefore, the present study aimed to investigate if a stress mindset can be positively changed after watching a video about the enhancing effects of stress and if this change is moderated by levels of trait anxiety. A randomized controlled trial was conducted among 136 German-speaking participants based on convenience sampling. Data were collected at baseline, directly after the intervention, and one week following the intervention, using online questionnaires. Repeated-measures analysis of variance (ANOVA) revealed that the change in stress mindset over time was significantly different for both conditions ($F (2, 97) =14.61$, $p<.001$, $n^2=.23$, indicating that the positive change in stress mindset over time was effective in the experimental group. Furthermore, the effect of the intervention on stress mindset was not moderated by levels of trait anxiety ($\beta= -.14$, $s.e =.29$, $p= .535$, 95% CI [-.62; .54]). The intervention can be effectively changed with additional courses and materials to examine if an enduring change in stress mindset can be achieved. Furthermore, concepts that might moderate the effectiveness of the intervention should be examined to explore the need for tailored interventions in the future.

Keywords: stress mindset, stress-is-enhancing, trait anxiety, video manipulation

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Introduction

Stress is a central concept in human life. Considering the last century alone, the world suffered from stressful life events such as civil wars, world wars, or major infectious disease epidemics leading to threatened world order. At an individual level, stress is experienced through the insecurities of daily existence including job stress and marital stress for example (Schneiderman, Ironson & Siegel, 2008). Stress has a major influence on well-being, behavior, mood and health in general. Studies show that stressful life events can be causal for the onset of depression (Hammen 2005, Kendler et al. 1999) and can precede anxiety disorders as well (Faravelli & Pallanti 1989). Further potential consequences are cognitive impairment (Hammen, 2005), aggression and relational conflict (e.g Bodenmann, Meuwly, Bradbury, Gmelch, & Ledermann, 2010). The major impact of stress becomes clear as it has been linked to the six leading causes of death, which are heart disease, accidents, cancer, liver disease, lung ailments and suicide (Schneiderman, Ironson, & Siegel, 2008). Because of the negative impact stress has on an individual, it has been considered as a "growing plague" and an "epidemic", demonstrating its negative manifestation in society (Schneiderman, Ironson & Siegel, 2008).

Even if stress is considered to be negative in society, it is a rather broad but often used concept. The concept that is generally considered in society is psychological stress. According to Cohen et al. (2017), psychological stress occurs when an individual perceives that the environmental demands exceed his or her adaptive capacity (Cohen et al., 2017). Meaning that environmental events can overload an individual's ability to cope with it.

Even though the negative consequences of stress are well documented, stress can also have a more positive side and may serve as a motivating force. From an evolutionary standpoint, the stress response is necessary to improve physiological and mental functioning to enable the survival of an individual (Crum et al., 2013). This can be defined as "eustress" because a form of stress is experienced that gives a benefit (Crum et al., 2013). When an individual encounters a threatening situation, physiological arousal is raised and the attention is focused on helpful resources to deal with the task at hand (Crum et al., 2013).

The concepts of eustress and distress were first introduced to indicate different types of responses to stress. According to Lazarus (1993), eustress is a positive cognitive response to a stressor, that is associated with positive feelings and a healthy

physical state, instead of negative feelings and physical impairment resulting from distress (Lazarus, 1993). While the destructive effects of distress are more under investigation in scientific literature, the adaptive features of eustress, remain rather unexplored. An examination of the PubMed database illustrated that only a few studies of stress were in regard to the concept of eustress (Kupriyanov & Zhadanow, 2014).

Usually, the amount of stress in terms of frequency and intensity are considered to determine the stress response (Crum et al., 2017). A study of Lazarus and Folkman (1984) found that cognitive appraisal is important in determining the stress response. According to the Transactional Model of Stress, there are two cognitive appraisals an individual goes through before responding to stress. First, individuals appraise the degree to which the situation is demanding, called the primary appraisal. Second, it is assessed whether they have adequate resources like knowledge or skills to cope with the situation, called the secondary appraisal (Crum et al., 2017). The intensity and frequency vary according to both external conditions and individual characteristics (Manning, Motowidlo & Packard, 1986). Meaning that some individuals can experience stressful events more frequently than others and people with certain characteristics are more likely to behave in ways that increase or decrease the frequency the events occur (Manning, Motowidlo & Packard, 1986). The intensity of a stressful event is considered to reflect how the individual characteristics of a person dispose one to react more strongly to stressors. Therefore, people that evaluate some events as intensely stressful are likely to find other events intensely stressful as well (Manning, Motowidlo & Packard, 1986). According to La Fevre et al. (2006), the individual perception and interpretation of the situation determine whether a stressor will cause distress or eustress. Furthermore, how an individual copes with stress, motivates the person to either overcome, withstand or minimize the demands of a particular stressor (Kilby & Sherman, 2016; Salehi et al. ,2010).

These varying perceptions, experiences and "trait- like" interpretations towards stress can be considered as different mindsets. According to Crum et al. (2015), peoples' mindsets orient individuals toward a particular way of understanding information and taking the corresponding actions towards it. In this approach, the mindset is defined as the mental frame or lens that selectively organizes and encodes information. Research in social and educational psychology has shown that mindsets shape meaning-making processes and give rise to different goals, motivations and behaviors (Dweck, Chiu, & Hong, 1995). In the past 20 years of research on this topic,

it is demonstrated that adopting a particular mindset can positively influence psychological, behavioral, and physiological outcomes in a variety of domains (Kilby and Sherman, 2016).

There is already ample evidence that mindsets have an impact in domains such as intelligence, emotions and health (Crum et al., 2013). In the domain of intelligence, it was found that students with the so-called growth mindset as opposed to a fixed mindset, demonstrated improvements in both behavior and attitude, for example with a greater appreciation of academics, increased effort, motivation and enhanced enjoyment of learning (Crum et al., 2013). In the case of aging, for example, it was found that individuals with a negative mindset about aging are less likely to engage in healthy behaviors such as eating well, engaging in physical exercise or visiting a physician (Levy & Myers, 2004). Generally, results revealed that these individuals had a diminished will to live.

Given the impact of mindset in domains such as intelligence, emotions, and health, it seems reasonable to hypothesize that mindsets could have a similar influential effect in the domain of stress. More specifically, people's stress mindset has been shown to influence the way information is drawn from a stressful situation according to whether the individual holds a "stress-is-debilitating" or "stress-is enhancing" belief (Crum et al., 2013). When holding a "stress-is-debilitating" mindset, the focus of an individual is on negative information from stressors, reinforcing negative beliefs and ending in actions avoiding stress. In contrast, holding a "stress-is enhancing" mindset directs the focus on positive information about stressors that reinforces their beliefs. In addition, it is also possible to hold a mix of both enhancing and debilitating beliefs. The way stress is perceived also determines how an individual responds to it (Crum et al., 2013). Regarding this, covariations between the frequency and intensity of subjectively experienced stress and the emotional responses of anxiety and depression were revealed (Manning, Motowidlo & Packard, 1986).

Especially anxiety is one common negative emotional response experienced by individuals. The focus on levels of anxiety is important because of two main reasons; first anxiety is inevitably linked to stress as it is a reaction to it, and second, anxiety represents an important risk factor for the onset of future psychological problems (Schroder, Courtney, Clallahan, Gornik & Moser, 2019). While stress is a response to a threat in a situation, anxiety is a reaction to the stress, meaning that the response can result in various coping mechanisms while reaction refers to how a person feels about it

(ADAA, 2010-2018). Consequently, the way a stress-generating stimulant is perceived by an individual changes the anxiety level of that individual (Arslan, Dilmaç & Hamarta, 2009). Fewer symptoms of anxiety were found in a stress-is-enhancing mindset compared to a stress-is-debilitating mindset in a study by Crum et al. (2013). Based on this, a stress-is-enhancing mindset was found to reduce avoidance behavior as well as general anxiety levels (Crum et al. (2013).

A recent study also found that mindsets moderate the link between the number of stressful life events and the adjustment of the individual in the clinical domain (Schroder, Yalch, Dawood, Donnellan & Moser, 2017). People with a growth mindset experience less psychological symptoms such as anxiety and depression than people with a rather fixed mindset (Schroder et al., 2017). Results revealed that correlations with symptoms were stronger for mindsets of emotion and anxiety in comparison to the mindsets of personality and intelligence.

From these results, Schroder et al. (2017) point out the need for future research to identify the corresponding attributions relevant to emotion and anxiety. In the domain of research, it is important to differentiate between the two distinct forms of anxiety, which are state anxiety and trait anxiety. State anxiety is situational and reflects the reaction related to a specific and undesirable situation. Trait anxiety, however, refers to a stable core disposition as an anxious person despite the transient dynamics of the particular situation (Schroder et al., 2017). In personality research, both forms of anxiety are characterized by a lack of control (Williams et al., 1988).

Even if the role of state anxiety is more explored in literature as it is linked to a situational context, it can also be assumed that the disposition of an individual plays a significant role in the general perception and interpretation of events, referring to their mindset. The mindset of an individual is not situational, it is rather a general perception and interpretation of people, therefore it makes sense to examine its connection with the constant attention of individuals, namely their trait anxiety. While there is a great body of evidence for the causes and consequences of stress and people's state anxiety during stressful events, the evidence for changing a particular stress mindset is limited and the potential moderating role of an individual's trait anxiety even more. Therefore, this research gap will be investigated in the present study.

The study of Crum et al. (2013) showed that participant's stress mindset could be changed after watching a video about enhancing as well as debilitating effects of stress. Participants that positively changed their mindset into a "stress-is-enhancing" mindset

reported fewer symptoms of anxiety and depression, resulting in better health status as well as a higher quality of life (Crum et al., 2013). Furthermore, a study by Wegmann, Moshman and Ruby (2017) found supporting results on the changeability of student's stress mindsets with a stress management course. Generally, prior studies that aimed at changing mindsets used either videos (Crum et al., 2013) or other more elaborate programs (Wegmann, Moshman & Ruby, 2017).

The main goal of this research is to confirm if a mindset can be changed by watching videos about the enhancing effects of stress and if this change can be linked to levels of trait anxiety of a person. Therefore, the change in stress mindset in a randomized controlled experiment was investigated. First, it is expected that people who watch a video about the enhancing effects of stress scored higher on stress mindset compared to people who watched a video about the categorical imperative of Kant. In addition, it was examined whether the effectiveness of the intervention is moderated by levels of trait anxiety. It could be expected that individuals with high levels of trait anxiety could hold a stress-is-debilitating mindset while individuals with lower levels of trait anxiety may hold a stress-is-enhancing mindset

Methods

Design

The current study used an online randomized controlled experimental design. The study was conducted in the Netherlands and in Germany. The study was performed from October 2019 to December 2019. Eligible participants were randomly assigned via randomization.org to an experimental stress mindset condition or a control condition with an allocation ratio of 1:1. Furthermore, online surveys were administered at three different time points: at baseline (T0), at post-test one week later (T1), one follow-up test two weeks after baseline (T2) .The study was approved by the ethical committee of the University of Twente in the Netherlands.

Power Analysis. Considering the dropout rates, G*Power 3.1 was used before and after the conduction of the present study in order to conduct the power analysis.

A priori analysis revealed that a total sample size at 128 participants would be required in order to detect medium effect sizes (t (126) =1.97, $1 - \beta$=.8, d=.5, α= 0.05).

Participants

A total of 136 participants completed the baseline questionnaires and were randomized to the experimental (n=68) and control condition (n=68). 106 participants completed the post-test and 108 filled out the follow-up assessment (Figure 1). A total of 100 participants were used in the current analysis that completed both the baseline, post-test and follow-up test. Inclusion criterions were German speaking adults older than 18 years. Participants at baseline encompassed 47 (34.6 %) male, 87 (64%) female and 2 (1.5%) participants with no indication of their gender. The age ranged between 19 and 74 years (*M*=34.1; *SD*= 15.37). The educational qualification ranged from secondary school level, possessed by 6 (4.4 %) of the participants, to a master's degree, obtained by 21 (15.4%) participants. The majority of the participants achieved a bachelor's degree (n=35. 25,7%). Regarding the occupational status, the majority were students (n=53, 39%). 33 participants worked full time at least 38 hours a week (24.3%) and 30 worked part-time (22.1%).
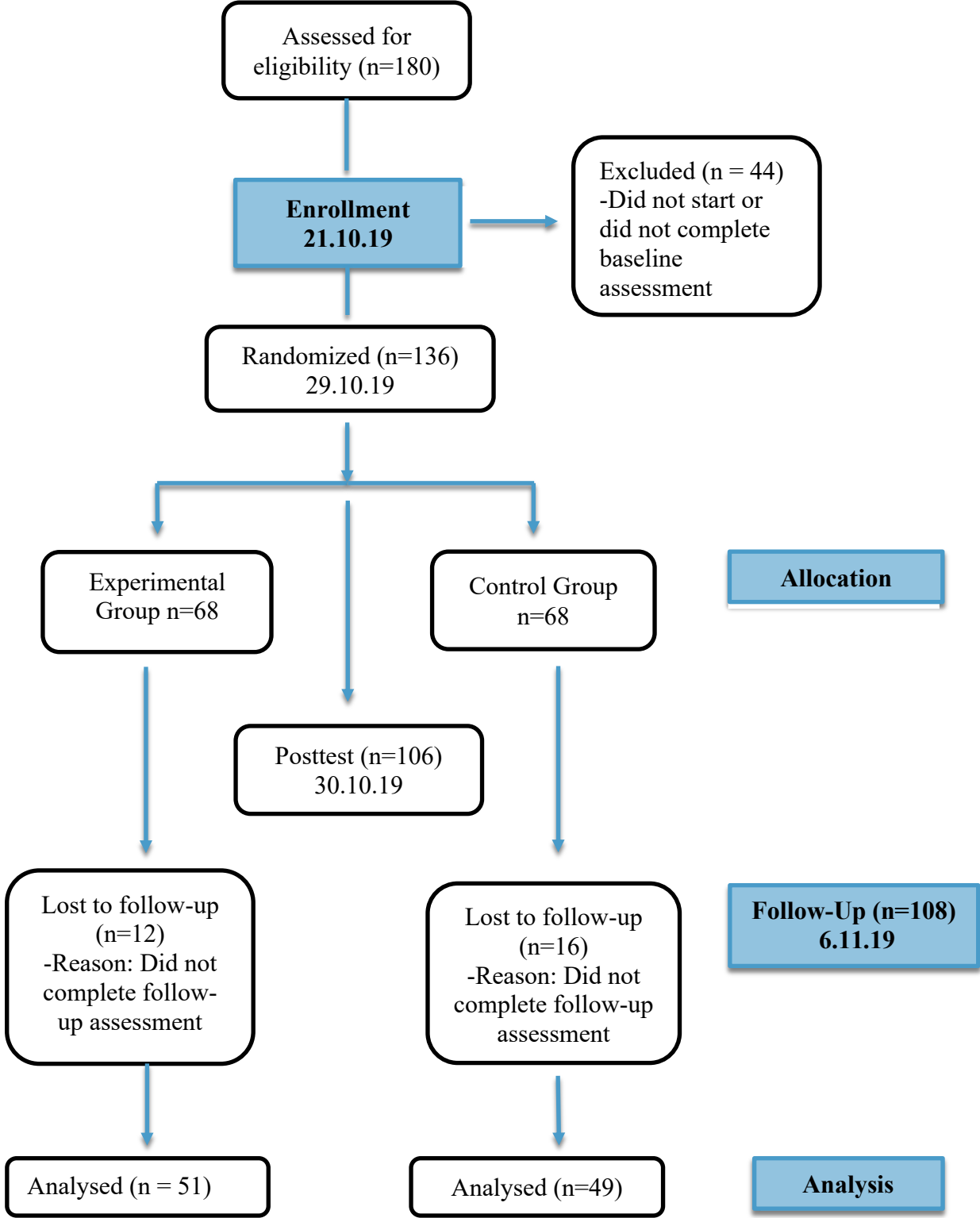
Figure 2. Flow-chart of participants in the RCT mindset study

Measures

After the sociodemographic data was obtained, participants had to complete six questionnaires at baseline. The questionnaires administered in this study were: Stress Mindset Measure (SMM), State-Trait Anxiety Inventory (STAI), Mental Health Continuum Short Form (MHC-SF), Positive and Negative Affect Schedule (PANAS), Locus of Control (LoC) and Perceived Stress Scale (PSS-10). Table 1 shows the assessment points of measurements and which questionnaires were used.

Table 1

Assessment points of measurements

	Baseline (T0)	Posttest (T1)	Follow-up (T2)	Follow-up (T3)
SMM	X	X	X	X
PSS-10	X	X	X	X
MHC-SF	X		X	X
PANAS	X	X	X	X
LoC	X	X	X	X
STAI	X			

Note. Stress Mindset Measure (SMM), State-Trait Anxiety Inventory (STAI), Mental Health Continuum Short Form (MHC-SF), Positive and Negative Affect Schedule (PANAS), Locus of Control (LoC) and Perceived Stress Scale (PSS-10).

In order answer the research questions of the current study, only the SMM and STAI-I are of relevance. All questionnaires were administered in German.

Sociodemographics. Participants had to indicate their gender (male, female), age (in years), nationality, their currently highest completed educational level and their occupational status before starting with the first questionnaire.

The Stress Mindset Measure (SMM) is an 8-item self-administered questionnaire evaluating an individual's stress mindset developed by Crum, Salovey, and Achor (2013) (see Appendix A). It measures whether an individual holds a stress is enhancing ("Experiencing stress enhances my performance and productivity") or a stress is debilitating mindset ("The effects of stress are negative and should be avoided."). The SMM has shown good internal

consistency, discriminant and criterion validity (Crum et al., 2013). Participants had to agree to statements on a 5-point-Likert-scale (0 = Strongly Disagree; 4 = Strongly Agree). While higher scores indicate a stress-is-enhancing mindset, lower scores point out a stress-is-debilitating mindset. In a group of faculty graduate students at Yale University, the SMM proved to have good psychometric properties, n= 335 (α = .86) (Crum et al. 2013). A Study of Schollmayer, König and Cornelius (2014) found good psychometric properties for the German version. Cronbach's α was in the current study 0.88 at the baseline, 0.91 at post-test and 0.89 at the follow-up assessment, respectively.

The State-Trait Anxiety Inventory (STA-I) contains 20-items and is a self-administered questionnaire measuring state and trait anxiety (see Appendix B). For the current study, only the trait scale with 10 items was administered. STAI-I exhibits excellent internal consistency, good test-retest reliability and concurrent, discriminant, construct and convergent validity for the trait scale (Gunning, Denison, Stockley, Ho, Sandhu, & Reynolds, 2010, Grös, Antony, Simms, & McCabe, 2007, Spielberger, 1983). Items are rated on a 4-point Likert scale ranging from 1=not at all to 4=very much, with higher scores indicating more anxiety. An item of the STA-I trait scale would be "I lack self-confidence ". Furthermore, a study of the University in Trier in Germany found good psychometric properties for the German version, n=260 (α = .9) (Universität Trier, 2002). Cronbach's α was in the current study 0.67 at the baseline assessment.

Procedure

A convenience non-probability sampling procedure was applied to collect a targeted total of 180 participants. Data collection was conducted between October to December 2019.To be able to take part in the study, participants needed to have a valid email address and an internet connection. Participants signed up with their e-mail address via a link for the study. After that, they received an email with the instructions, a link to the informed consent procedure (see Appendix C) and the baseline assessment. Participants were asked to fill out the six questionnaires as the pretest of the study. One week after the baseline assessment, the sample was randomized by an independent researcher into two conditions. After randomization, participants in the experimental group received a video intended to manipulate their "stress-i -enhancing" mindset while the control group received a video about Kant's categorical imperative which did not intent to achieve any change in perception or belief

about stress. One week after completion of the posttest, the link to the first follow up study was sent to the participants. Again, participants had one week to finish the questionnaire's before they received the last link to the final follow-up assessment. In between times, reminders were sent to the participants e-mail address in order to increase participation.

Conditions

 Stress Mindset Condition. Participants were directed to an online video about the positive and beneficial effect of stress on cognitive performance and physical as well as psychological health. The video aimed to change people's mindset about stress in an enhancing direction rather than debilitating. Crum's video of his study in 2017 was used and slightly adapted. It was translated to German and the subtitles were added into the video. Moreover, examples of how stressful situations can positively influence the cognitive performance of an individual were given. It takes 3:17 minutes to watch the complete video. The video can be watched at https://www.youtube.com/watch?v=R-x0AMOS4g0&feature=youtu.be.

 Control Condition. Participants in the control condition reviewed a video about Kant's categorical imperative. In the video, the main idea of the categorical imperative is explained, that is "Act only according to that maxim whereby you can, at the same time, wish that it should become a universal law". No change in belief or perception about stress is expected after watching the video, so it aimed to pose a neutral, non-manipulative video. This video takes 3:05 minutes to watch. The video can be watched at https://www.youtube.com/watch?v=w91P_m1203Q&t=23s.

Statistical Analysis

 All analyses were performed using SPSS version 25. Descriptive statistics including the mean and standard deviation of all test variables were obtained. Differences in dropouts at baseline and posttest between both conditions were tested using independent t-tests and $\chi 2$-tests.

 To test for a significant change in stress mindset over time, repeated-measures analysis of variance (ANOVA) with group as between-subject factor, time as within-subject factor and group * time interaction was performed to test whether the experimental condition affected the stress mindset of the participants more compared to the control condition.

Next, post-hoc independent t-test were performed to test whether mindset scores differed significantly between the conditions at different time points.

After that, it was tested whether the effectiveness of the intervention was moderated by levels of trait anxiety. Therefore, the PROCESS macro developed by Hayes and Preacher was used to perform the moderation analysis. The analysis was performed with conditions as an independent variable, the change in stress mindset score as the depended variable and the baseline assessment as the covariate. According to Hayes (2013), there are two methods in probing interactions visually, which are the *Pick-a-Point approach* and the *Johnson-Neyman's region of significance.* When observing the slope of the regression lines with the Pick-a-Point approach, the effects of the independent variable on the depended variable at -1SD, 0SD and +1SD of the moderator are plotted and compared visually. The Johnson-Neyman's region of significance is used to determine at which point exactly the interaction effect of the moderator becomes significant.

Results

Dropout

106 (77,9%) participants completed the post-test and 108 (79.4%) filled out the follow-up assessment. A total of 100 participants were used in the current analysis that completed both the baseline, post-test and follow-up test. There were no significant differences in the number of dropouts between conditions ($\chi2(1) = 0.17$, $p = .679$). Further, there were also no significant differences between dropouts and completers on demographics.

Participant Characteristics

The baseline characteristics of the sample are displayed in Table 2. Results revealed no significant differences between conditions on demographics. Therefore, the participants in the two conditions did not differ significantly in their baseline characteristics. Furthermore, results indicated that the conditions showed a small but significant difference in their level of stress mindset at baseline ($F (1,134) = 5.29$, *MSE*= 2.48, *p*=.023, *d*=.39), with the control group possessing a higher level of positive stress mindset compared to the experimental group.

Table 2

Baseline characteristics of participants in the experimental group, control group, and the total sample

	Experimental Condition (n=51)	Control Condition (n=49)	Total (n=100)	p
Age, *M (SD)*	37.04 (16.05)	35.16 (16.36)	36.05 (16.21)	.512
Gender, n (%)				.582
Male	20 (52.6)	18-(47.4)	38	
Female	31 (50.8)	30 (49.2)	61	
No indication	-	1 (100)	1	
Education, (n%)				.492
Low	21 (56.8)	16 (43.2)	37	
Intermediate	20 (44.4)	25 (55.6)	45	
High	3 (60.0)	2 (40.0)	5	
Employment, n (%)				.536
Student	16 (53.3)	14 (46.7)	30	
Apprenticeship	1 (50.0)	1 (50.0)	2	
Retired	2 (40.0)	3 (60.0)	5	
Self-employed	6 (75.0)	2 (25.0)	8	
Full-time (+38h)	11 (47.8)	12 (52.2)	23	
Part-time	13 (61.9)	8 (38.1)	21	
Unemployed	-	2 (100)	2	
Trait anxiety, *M (SD)*	2.01 (0.43)	1.95 (0.33)	1.98 (0.38)	.787
Baseline assessment	2.73 (0.81)	3.01 (0.56)	2.87 (1.37)	.023

Note. Education: "low" consists of secondary school level, college of higher education and general qualification for university entrance, "intermediate" consists of college of higher education, general qualification for university entrance and apprenticeship, "high" consists of Bachelor, Master and Phd. *p*- Values were calculated using Chi- Square tests for gender, education and employment and Mann-Whitney Test for age.

Descriptive Statistics

Means and Standard deviations of all variables for the experimental condition and control condition are presented in Table 3. The mean score for the control group was higher than for the experimental group, indicating that the control group had a higher level of stress mindset at baseline. After the intervention, mean scores increased during posttest and follow-up, with the experimental group scoring higher than the experimental group.

Table 3

Means and standard deviations (in parentheses) of stress mindset per condition

Condition	N=100	Baseline (T0)	Posttest (T1)	Follow-up (T2)
Control Group	49	3.01 (0.56)	3.16 (0.59)	3.11 (0.6)
Experimental Group	51	2.73 (0.81)	3.54 (0.76)	3.2 (0.79)

Repeated-measures analysis

Results revealed a large and statistically significant effect of time in stress mindset across both conditions (Wilks' Lambda= 0.6, F (2, 97) =32.0, $p<.001$, $n^2=.4$), indicating that watching the videos positively influenced the stress mindset of the participants.

Time*group effect showed that the change in mindset over time was large and significantly different for both groups, indicating the intervention effectively changed participant's stress mindset into a "stress is enhancing mindset" in the experimental condition compared to the control condition (Wilk's Lambda=0.77, F (2, 97) =14.61, $p<.001$, $n^2=.23$). This change is graphically illustrated below in *Figure 1*. Follow up comparisons indicated that each pairwise difference for the effect of time was significant, p<.001.
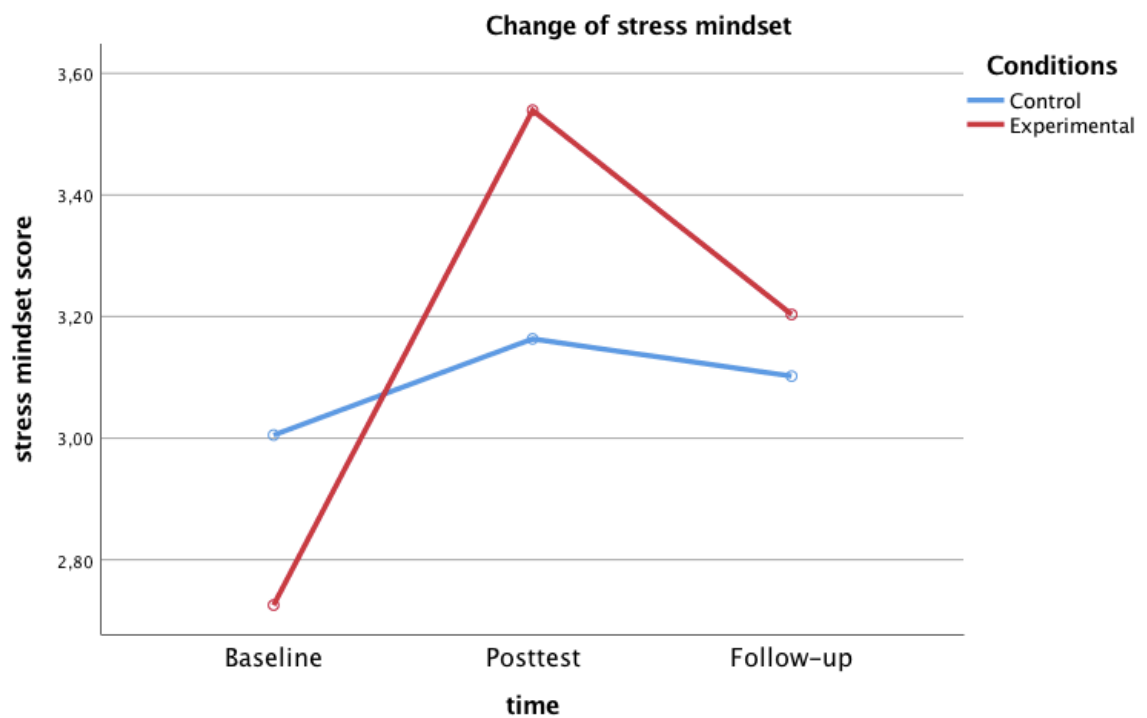
Figure 3. Mean stress mindset scores per condition at each time point

Post-hoc analysis

Post-hoc analysis showed that differences between the experimental and control group were intermediate and statistically significant at posttest with higher level of positive stress mindset in the experimental condition (F (1,104) = 10.41, MSE= 5.05, p=.002, d=.63). This indicated that the intervention was effective in changing the participants stress mindset into a "stress-is-enhancing mindset" compared to the control condition. At the follow-up test the results did no longer differ significantly between the groups (F (1,106) = 0.199, MSE= 0.1, p=.657, d=.09). This result illustrates that the growth difference after the posttest was not maintained up to follow-up.

Moderation analysis

The results showed that the effectiveness of the intervention was not moderated by levels of trait anxiety as no statistically significant results were found ($ß$= -.14, *s.e* =.29, p= .535, 95% CI [-.62; .54]).Therefore, levels of trait anxiety in this study did not moderate whether participants did change their mindset or not. In *Figure 2* it can be seen that all slopes

indicate that trait anxiety did not moderate the effectiveness of the intervention. Table 4 confirms the main effect of the intervention but not the moderation of trait anxiety.

Moderation of trait anxiety

Figure 4. Moderation effects per condition. *SD=* standard deviation.

Table 4

Linear model of predictors of stress mindset (trait anxiety)

	β	t	95%CI	p
Constant	.24	5.46	.85; 1.81	.000
Condition	.01	5.45	.37; .79	.000
Trait anxiety	.24	-0.86	-.67; .54	.39
Interaction	.29	-0.14	-.62; .54	.535

Note. $R^2 = .0001$, $F(4, 101) = 22.29$

Discussion

The purpose of the present study was to investigate if a stress mindset can be positively changed by watching a video of the enhancing effects of stress and if the effectiveness of the intervention was moderated by levels of trait anxiety of the participants. The results of the study confirmed that participants in the experimental condition significantly

changed their stress mindset towards a "stress-is-enhancing" mindset compared to the control condition. Furthermore, results showed that the effectiveness of the intervention was not moderated by levels of trait anxiety of the participants.

With regard to the effectiveness of the intervention, the first result is in line with previous research, for example by Crum et al. (2013) and Crum et al. (2017). These studies reported also a significant increase in stress mindset in response to the stress-is-enhancing videos. While the current study involved participants that were predominantly students, previous studies of Crum et al. (2013) examined participants that were employees. Therefore, the current research provides further support for the possibility of changing stress mindsets in another participant population.

Furthermore, the current study makes several contributions to the literature about stress mindset. Considering that the concept of mindset is usually investigated in the domain of personality or intelligence, for example, the current research yields important insights into a less investigated domain of mindset combined with an intervention to change it. Knowing how to change people's stress mindset can help people to deal with stress and reduce their negative consequences. Therefore, the present study can have implications for the individual as well as society.

Although the intervention was effective in changing participant's stress mindset, the growth difference between both conditions after the posttest was not maintained until the follow-up assessment. It can be assumed that short online videos administered in one week might not be sufficient to change a stress mindset on a long-lasting level. In line with this, Crum et al. (2013) argued that short video manipulations cannot assure a lasting effect on a change in stress mindset. Most mindset interventions included active engagement in form of extra courses and materials about certain types of mindsets (e.g. growth, attitude, personality, intelligence mindset) to maintain the change in mindset (Aronson, Fried & Good, 2002; Costa & Faria, 2018; Rhew, Piro, Goolkasian & Cosentino, 2018). Furthermore, other studies included additional components such as personal lectures or teaching of practical skills over a longer period of time and achieved a more stable shift in their mindsets (Graham, Mancher, Miller Wolman, Greenfield & Steinberg, 2011; S in & Lyubomirsky, 2009).

Regarding the moderation of trait anxiety, the second result was not in line with expectations. It could have been expected that participants with low levels of trait anxiety hold a more stress-is-enhancing mindset than participants with higher levels of trait anxiety. In the current research, trait anxiety did not moderate the change in mindset. This result could be explained by the fact that no strong evidence was found in the literature for the potentially

moderating role of anxiety and served to investigate the research gap. Because the effectiveness of the intervention was not moderated by trait anxiety, this means that the intervention does not need to be tailored to the level of anxiety of the participants and is equally effective for the participants. Practically, this can be advantageous when developing interventions.

Strengths and Limitations

To start with the strengths, the randomized controlled experiment was a powerful study design. Also, the randomization process was performed by an independent researcher who was not involved in the recruitment or in the analysis, therefore selection and analysis bias were reduced. Furthermore, the used questionnaires in the study were validated in prior studies to ensure the high reliability of the measurements. All tests proved to have good to excellent reliability in the present study. Finally, the video used in the present study was also shown to be effective in changing people's stress mindsets in the study of Crum et al. 2013, which makes the current findings stronger. All of the points result in a reduction of bias in the study outcome.

Several limitations emerged during the research process. First, the sample was homogenous in that most participants were students. It could be assumed that a more heterogeneous sample including more employees, for example, could be more representative fort the population. Second, several participants did not complete all questionnaires. Non-completion of questionnaires could lead to a misrepresentation of certain population characteristics because parts of a population with certain characteristics might be less inclined to complete questionnaires (Boynton, 2004; Dallosso, Matthews, McGrother, Clarke, Perry, Shaw, & Jagger, 2003). Based on this, one study showed that the deletion of participants leads to a decrease in statistical power (Raaijmakers, 1999). Furthermore, the study was slightly underpowered because it aimed for 80% power and ended up with 70% power. Further, the short video manipulations did not account for a prolonged change in the stress mindset. This could be explained by the fact that the video manipulation was shown to the participants at only one time over a short period of time whereas participants in the study of Crum et al. (2013) received the experiment several times over a longer period of time. It can be predicted that repeated application of the experiment over a longer period could maintain the change towards a "stress-is-enhancing" mindset.

Future research

In order to address the limitations of the current study, future research should investigate how an enduring change in stress mindset can be achieved by an intervention. Therefore, it can be investigated how different forms of interventions in terms of educational texts, videos and audios work because a powerful intervention might consist of different methods to reach a wide range of individuals. The present experiment can also be extended with a stress-management program for example to maintain a stable change in stress mindset. Because stress mindset is a rather unexplored construct, future studies can examine its changeability more extensively. More research on stress mindset can yield practical implications in how to deal with stress in the general public as well as the clinical practice.

A further suggestion for future research is to include an additional condition to the experimental- and control condition. As done by Crum et al. 2013, a condition like a "stress-is debilitating" can be included to investigate whether people are equally vulnerable to negative manipulation as to a positive one.

Finally, more research can investigate concepts that might moderate the effectiveness of the intervention to explore the need for tailored interventions in the future. In this way, more suitable interventions for a specific population can be developed.

Conclusion

The current research confirmed that it is possible to temporarily change people's mindset in a positive direction. It underlined that a stress mindset is not a stable construct and can be changed through an intervention. Future studies should explore how to induce a sustained change in stress mindset. To achieve an enduring change in stress-mindset, the intervention could be extended with additional materials or programs. Trait anxiety did not moderate the effectiveness of the intervention, meaning that one experiment can be used for all participants. Future studies need to explore other potential moderating concepts on the impact of the intervention to identify how the intervention can be developed more powerful.

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Appendices

Appendix A

Stress Mindset Measure
German Version

Bitte geben Sie an, inwieweit Sie den folgenden Aussagen zustimmen oder nicht zustimmen.

1. Die Effekte von Stress sind negativ und sollten vermieden werden.
2. Stress zu erleben, fördert mein Lernen und meine Entwicklung.
3. Stress zu erleben, verschlechtert meine Gesundheit und meine Vitalität.
4. Stress zu erleben, fördert meine Leistungsfähigkeit und meine Produktivität.
5. Stress zu erleben, verhindert mein Lernen und meine Entwicklung.
6. Stress zu erleben, verbessert meine Gesundheit und meine Vitalität.
7. Stress zu erleben, verringert meine Leistungsfähigkeit und meine Produktivität.
8. Die Effekte von Stress sind positiv und sollte genutzt werden.

1= Stimme absolut nicht zu

2= Stimme nicht zu

3= Stimme weder zu noch dagegen

4=Stimme absolut zu

Appendix B

State-Trait Anxiety Inventory (trait scale)

English Version

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you generally feel. There are no right or wrong answers.

Do not spend too much time on any one statement but give the answer which seems to describe how you generally feel.

1. I feel pleasant.
2. I feel nervous and restless.

3. I feel satisfied with myself.

4. I wish I could be as happy as others seem to be.

5. I feel like a failure.

6. I feel rested.

7. I am „calm, cool, and collected ".

8. I feel that difficulties are piling up so that I cannot overcome them.

9. I worry too much over something that really doesn't matter.

10. I am happy.

11. I have disturbing thoughts.

12. I lack self-confidence.

13. I feel secure.

14. I make decisions easily.

15. I feel inadequate.

16. I am content.

17. Some unimportant thought runs through my mind and bothers me.

18. I take disappointments so keenly that I can't put them out of my mind.

19. I am a steady person.

20. I get in a state of tension or turmoil as I think over my recent concerns and interests.

1. Almost never

2. Sometimes

3. often

4. Almost always

State-Trait Anxiety Inventory (trait scale)

German Version

Im folgenden Fragebogen finden Sie eine Reihe von Feststellungen, mit denen man sich selbst beschreiben kann. Bitte lesen Sie jede Feststellung durch und wählen sie aus den vier Antworten, diejenige aus, die angibt, wie Sie sich im Allgemeinen fühlen.
Kreuzen Sie bitte bei jeder Feststellung die Zahl unter der von Ihnen gewählten Antwort an.

Überlegen Sie bitte nicht lange und denken Sie daran, diejenige Antwort auszuwählen, die am besten beschreibt, wie Sie sich im Allgemeinen fühlen.

1. Ich bin vergnügt.
2. Ich werde schnell müde.
3. Mir ist zum Weinen zumute
4. Ich glaube, mir geht es schlechter als anderen Leuten.
5. Ich verpasse günstige Gelegenheiten, weil ich mich nicht schnell genug entscheiden kann.
6. Ich fühle mich ausgeruht.
7. Ich bin ruhig und gelassen.
8. Ich glaube, dass mir meine Schwierigkeiten über den Kopf wachsen.
9. Ich mache mir zuviel Gedanken über unwichtige Dinge.
10. Ich bin glücklich.
11. Ich neige dazu, alles schwer zu nehmen.
12. Mir fehlt es an Selbstvertrauen.
13. Ich fühle mich geborgen.
14. Ich mache mir Sorgen über mögliches Missgeschick.
15. Ich fühle mich niedergeschlagen.
16. Ich bin zufrieden.
17. Unwichtige Gedanken gehen mir durch den Kopf und bedrücken mich.
18. Enttäuschungen nehme ich so schwer, dass ich sie nicht vergessen kann.
19. Ich bin ausgeglichen.
20. Ich werde nervös und unruhig, wenn ich an meine derzeitigen Angelegenheiten denke.

1= Überhaupt nicht

2= Ein wenig

3=Ziemlich

4= Sehr

Appendix C

Informed Consent

English Version

Welcome to the study!

The purpose of this study is to investigate how people perceive new information. This study consists of **four** parts. The first part starts after you have read and agreed to this informed consent. If you agree with the conditions to participate in this study, you will be automatically redirected to the first survey. This first survey will take approximately 20 minutes. Please complete this survey at least on **October 28th,** to be able to participate in this study.

On Wednesday, 30th of October - you will receive an email with a link to the second survey. You will also receive additional information. This survey (including the reading and watching a video) will take approximately 20 minutes.

You will receive the final two questionnaires on the following two dates:

Wednesday, 6th of November - duration: 15 minutes
Wednesday, 11th of December - duration: 20 minutes.

 Please complete each survey within 3 days. Each survey contains some questions about your wellbeing and attitude.

Your data will be collected entirely online and treated confidentially. Therefore, we use your name and email address only for sending you surveys. To ensure anonymity, all materials will be identified by an assigned participant number, not by your name. During the research period, your data will be treated with great confidentiality and only be accessible by the main researcher dr. Marijke Schotanus-Dijkstra. Your individual privacy will be maintained in all published and written data resulting from this study.

Participation in this study is voluntary. If you decide to participate, you will be asked to agree to the informed consent. After that, you are still free to withdraw at any time and without giving a reason for your withdrawal.

If you have any comments or questions regarding this study, please contact Jan-Niklas Girnth (j.girnth@student.utwente.nl).

I have read and I understand the provided information. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason. I voluntarily agree to take part in this study.

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Under supervision of dr. Marijke Schotanus-Dijkstra
University of Twente

Translated Version in German

Herzlich willkommen!

Das Ziel unserer Studie ist zu untersuchen, wie Menschen neue Informationen wahrnehmen. Diese Studie besteht aus vier Teilen. Der erste Teil beginnt, nachdem Sie diese Einverständniserklärung gelesen und ihr zugestimmt haben. Wenn Sie der Teilnahme zustimmen werden Sie automatisch zu der Studie weitergeleitet. Der erste Fragebogen wird etwa 20 Minuten dauern. Bitte füllen Sie diese Studie bis zum **28. Oktober 2019** aus, um an der Studie teilnehmen zu können.

Am Mittwoch, den 30. Oktober werden Sie eine E-Mail mit dem Link für den zweiten Fragebogen erhalten. Sie werden ebenfalls Informationen zum Lesen oder ein Videomaterial erhalten. Dieser Fragebogen (inklusive des Lesens) wird etwa 20 Minuten dauern.

Die letzten beiden Fragebögen erhalten sie an folgenden Tagen:

Mittwoch, 6. November - Dauer: etwa 15 Minuten
Mittwoch, 11. Dezember - Dauer: etwa 20 Minuten.

Bitte füllen Sie jeden Fragebogen innerhalb von 3 Tagen aus. Jeder Fragebogen enthält einige Fragen über Ihr Wohlergehen und Ihre Einstellung.

Ihre Daten werden ausschließlich online erfasst und vertraulich behandelt. **Ihr Name und Ihre E-Mail-Adresse werden lediglich zum Versenden der Fragebögen genutzt. Alle Ihre Daten werden durch eine Teilnehmernummer identifiziert, um Ihre Anonymität sicherzustellen.** Während der Forschungsperiode sind Ihre Daten ausschließlich der Hauptforscherin Dr. Marijke Schotanus-Dijkstra zugänglich. Ihre Daten unterliegen dem Datenschutzgesetz.

Die Teilnahme an dieser Studie ist freiwillig. Wenn Sie sich dazu entscheiden teilzunehmen, werden Sie gebeten, dieser Einverständniserklärung zuzustimmen. Auch danach steht Ihnen jederzeit die Möglichkeit offen, diese Studie ohne Angabe eines Grundes zu beenden. Wenn Sie Fragen oder Anmerkungen zu der Studie haben, kontaktieren Sie bitte Jan-Niklas Girnth (j.girnth@student.utwente.nl).

Ich habe die oben genannten Informationen gelesen und zur Kenntnis genommen. Ich weiß, dass meine Teilnahme freiwillig ist und dass ich die Studie jederzeit ohne die Angabe von Gründen beenden kann. Ich stimme freiwillig zu, an dieser Studie teilzunehmen.

Forscher
Marleen Jansen, Katharina Meyer, Sâre Danaci, Clemens Cholewa, Jan-Niklas Girnth, Nils Hatger
Unter der Leitung von Dr. Marijke Schotanus-Dijkstra
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