Can reading about stress benefits improve stress mindsets and mental well-being? And does internal locus of control have a mediating function here?

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Abstract

Previous research demonstrates that it is possible to change negative into positive beliefs about stress and that it improves mental well-being. The aim of the present study was to test if by administering a small-scale induction in form of an informative text about the benefits of stress itself and a positive stress mindset; (1) previous stress mindset change and (2) the effect of improved mental well-being can be replicated; (3) it additionally has a positive effect on internal locus of control, and if; (4) internal locus of control has a mediating function in the effect of the stress mindset induction on mental well-being. The study followed a randomized controlled experimental design with N=90 participants from the general German population. Over a course of two weeks, the experimental (n=45) and control group (n=45) members received the assessment and respective induction material via e-mail; baseline assessment, induction and post-induction assessment, follow-up assessment. Results show that the stress mindset scores of the experimental group improved significantly immediately after the induction but were at the same level with the control group again at follow-up assessment. There was no change in mental well-being, or internal locus of control and, thus, no mediating function of internal locus of control. The study shows that an informative text about mental and physical benefits of stress can temporarily, but not sustainably improve a person's stress mindset and does not affect mental well-being or internal locus of control. Based on these results, important implications for future research are discussed.

Introduction

Stress is baneful. This statement is supported by prolonged manifold research on the stress-health relationship and also represents the image of stress in the general public (Schneiderman, Ironson & Siegel, 2005; Rice, 2012; Robinson, 2018). Though there is evidence for an enhancing form of stress, also known as eustress, the negative side, called distress, is better known and has more intensely been researched in the past (Cilliers & Flotman, 2016; Aschbacher, O'Donovan, Wolkowitz, Dhabhar, Su & Epel, 2013). Regarding the straining perception of stress, which does not only include chronic stress but also daily hassles, it is associated with, for instance, depression, lower life-satisfaction, and general decreased mood and mental well-being, as well as cardio-vascular diseases and a weakened immune system (DeLongis, Folkman & Lazarus, 1988; Andrews & Wilding, 2004; Slavich & Irwin, 2014). Supporting the influence and strength of such a stress perception, a study by Keller and colleagues (2012) showed that a negative image of stress leads people to identify more distressing events in their lives and think that stress has had negative effects on their physical and mental health in general. It was additionally reported that, looking at the American population in total, up to 43% of people who identified more distressing events and thought stress was likely to negatively affect their mental and physical health also experienced an increased death risk.

At the same time, participants demonstrating a more favourable interpretation of stress enjoyed the contrary consequences, or benefits, of stress. More precisely, the more positive and enabling stance towards stress can not only contribute to a person's mental well-being, physical health and life-satisfaction, but also to degrees of productivity and motivation, happiness, and can itself even create stress resilience (Weinberg & Cooper, 2007; Rothmann & Cooper, 2015). Looking at the wide reaching positive and negative consequences on mental and physical health, how we think about stress combined with the growing complexity and demands of today's society and accompanied increasing stress, this study will examine efficient ways to handle stress by adjusting individual stances towards this concept to increase their quality of life and health.

Concluding from this research, people tend to interpret stress as being either more positive and enabling, or more negative and disabling. While the more positive tendency is expressed by associating stress with increasing productivity, quality of work, motivation and health supporting attributes, the more negative tendency interprets the same attributes in a more disruptive and mentally and physically harmful way (Keller et al., 2012; Crum, Salovey & Achor, 2013). Moreover, these qualitatively varying interpretations of stress, or other

specific topics, can also be categorized as mindsets, here, stress mindsets. The mechanisms behind mindsets have been conceptualised and researched during the past 30 years and offer essential findings that need to be elicited at this point. The findings include that people innate mindsets, also called frameworks, about things, which are either more positive or negative (Dweck, Chiu & Hong, 1993, 1995, 1997; Schroder, Dawood, Yalch, Donnellan & Moser, 2014). Additionally, individuals also expressed different degrees of belief in the possibility that one may be able to change the way one interprets specific topics. However, interventions aiming to change those mindsets, or interpretation frameworks, did not only demonstrate that it is possible to change people's mindsets, but also show that people who were more open to change the way they think about specific things (e.g. intelligence, personality, attitude) did also increase in mental well-being, decrease their scores on mental disorder measures and improved their behaviour towards the concepts at focus on the long run (Romero, Master, Paunesku, Dweck & Gross, 2014; Schleider & Weisz, 2016, 2017).

Interestingly, research like the 2007 published study by Blackwell, Trzesniewski, and Dweck, Aronson, Fried and Good (2002), or Costa and Faria (2018) illustrated that by just presenting findings about, or motivating to believe in, the possibility that people are indeed able to change the way they think about certain concepts into more enabling and profiting interpretations did already succeed in changing participants' mindsets. This did not only result in long-term adjustments of their interpretations of those concepts towards the way it was presented to them, but simultaneously contributed to higher levels of well-being and life-satisfaction. These results were replicated in both the general as well as clinical population of severely anxious or depressed individuals and the effects maintained over longer periods of time (Schleider & Weisz, 2016, 2017; Schroder, Dawood, Yalch, Donnellan & Moser, 2014; Schroder, Yalch, Dawood, Callahan, Brent Donnellan & Moser, 2017). Further supporting the efficiency of mindset interventions, not only longer programs with multiple sessions were shown to be effective, also the ones that only included one-time online presentation of information about the desired addressed mindset, produced equally significant results.

This gives rise to the assumption that the way people think about stress, described as stress mindset, is equally able to be changed. Nevertheless, though various interventions have been conducted to change people's stress reappraisal and coping behaviour, studies on stress mindsets have just recently occurred (Jamieson, Crum, Goyer, Marotta & Akinola, 2018). In this vein, Crum, Salovey and Achor (2013), for instance, performed an experiment on changing people's stress mindsets towards seeing stress as either enhancing or debilitating. Regarding these expressions, an enhancing stress mindset illustrated the benefits of stress to a

person's productivity and motivation as well as contributions to an active and healthy life, while a debilitating stress mindset described the opposite. They demonstrated that it is possible to change participants' general perceptions of stress into a more beneficial interpretation (enhancing), which in turn led to improved scores on mental well-being.

In addition to this, a later experimental study by Crum, Akinola, Martin and Fath (2017), in which participants were confronted with artificial stressful situations and information about either the enhancing or debilitating effects of stress, produced similar results regarding the beneficial impact of a positive stress mindset and success of such stress mindset changing interventions. Here, it was documented that subjects in the stress is enhancing condition adjusted their interpretation of stress on the one side, but also focused more strongly on stimuli in stressful situations that positively affected their mood on the other side, while the debilitating stress mindset group expressed the opposite. Despite the perennial scientific interest in the stress-health relationship, the promising results of these studies and small cost and time expense of the interventions themselves (i.e. informative texts about respective mindsets, or 3-minute videos), research on explicitly changing the way people think about the phenomenon stress itself is still scarce.

Though such mindset interventions depicted a supportive effect on mental and physical well-being and stress interpretation, potentially contributing variables in this process have not been incorporated in those studies yet. One possible contributor, which will be focused on in this study, is locus of control (LoC) (Rotter, 1966; Levenson, 1973). This describes if someone believes to be able to influence what is happening in one's life (internal locus of control) or is more likely to assume that one's life is controlled by unexpected events or other people (external locus of control). Furthrmore, research has shown that people expressing an internal locus of control also positively correlate with mental well-being (Burger, 1984; Glass, McKnight & Valdimarsdottir, 1993; Kelley & Stack, 2000; Gore, Griffin & McNierney, 2016). Now, looking at the relation between locus of control and stress perception, a study by Anderson (1977) illustrated that participants who scored high on internal LoC had also lower scores on the intensity and frequency of perceived stress, though they did not differ in other characteristics such as age, working hours, or gender, compared to individuals with high external LoC scores.

This can be related to aforementioned findings by Keller and colleagues (2012), which also support the independency between the literal number of stressful events in life and perceived number of distressing encounters. Regarding mindset interventions though, the role of and influences on LoC has seldom been studied by now. Though Schleider & Weisz (2016,

2017) inspected if participants' perceived control over stressful situations changes after a mindset intervention and found a simultaneous improvement in mental health and increased perception of control over distressing events, neither the nature of this relationship has been analysed, nor if participants' overall perception of control has changed. Thus, it could also be possible that the act of adjusting a person's mindset itself towards a more enabling perspective indirectly increases the feeling of being able to influence life events which in turn improves their mental health.

Based on previous research in this field, this study will, therefore, examine if the positive effects of former stress mindset interventions with multiple presentations of 3-minute videos or texts about an enhancing stress mindset can be replicated on a smaller scale. This will be done by once applying a small-scale experimental induction in form of an informative text about the mental and physical benefits of stress (enhancing stress mindset). Since this can be categorized neither as an intervention or a programme, the once presented informative text will be referred to as induction. Thus, it will be tested if an informative text about mental and physical benefits of stress will (1) shift the participants' stress mindsets towards an enabling mindset, (2) will improve mental well-being and (3) increase their internal locus of control. Additionally, it will also be analysed if (4) the induction's effect on mental well-being is mediated by changes in internal locus of control.

Method

Design

The research employed a randomised controlled experimental design. Participants were randomly allocated over an experimental and control condition (randomization ratio 1:1). Both groups were assessed online at three assessment points over a period of two weeks: at baseline (T0), directly after the experimental induction (T1) (i.e. 1 week after baseline) and at follow-up (T2) (i.e. 1 week after post experimental induction). The research was approved by the ethical committee of the University of Twente (Registration no. 190218).

Participants

From the general German population, researchers approached potential participants via convenient sampling from their private social environment either personally, via e-mail, or by other means of messaging services. Individuals had to be older than 18 and able to understand and speak German fluently to be eligible to participate and had to give online informed consent to enter the study. From initially 111 enrolled respondents, 21 were excluded from further analysis since they did not enter the second round of assessment and could, therefore,

not be allocated to any condition (Figure 1). This resulted into a final sample size of *n*=90, comprised of dominantly female and higher educated participants (60% female; M_{age}= 35.8 years; *SD*= 17.2) (Table 1). At baseline, there were no significant differences between the experimental and control group regarding the primary outcome measure of mental well-being (MHC-SF) or the secondary outcomes of stress mindset (SMM) and internal locus of control (LoCS). The majority of respondents indicated a moderate level of mental well-being, there was about an equal proportion of people who had an enhancing or debilitating stress mindset and both groups did show similar degrees of internal locus of control. Regarding the participants flow, both groups experienced small dropouts along the study, culminating to 43 and 37 participants completing all three assessment sessions in the experimental and control condition respectively (Figure 1). However, for statistical analysis, the missing data were imputed by applying the expected maximization (EM) algorithm by Dempster et al. (1977).

Table 1

Demographics and baseline characteristics of participants in experimental, sham condition and total and means and standard deviations of baseline independent sample t-tests and chi-square

	SM (*n*= 45)	SC (*n*= 45)	Total (*n*= 90)	*p*
Gender, *n* (%)				
Female	28 (62.2)	26 (57.8)	54 (60)	
Male	17 (37.8)	19 (42.2)	36 (40)	0.667[1]
Age, *M* (*SD*)	37.5 (18.3)	34.2 (16.1)	35.8 (17.2)	0.364[2]
Education, *n* (%)				
Low-Middle	10 (9)	6 (5.4)	16 (14.4)	
High	35 (31.5)	39 (35.1)	74 (66.6)	0.271[1]
MHC-SF, *M* (*SD*)	29.07 (12.09)	30.13 (11.29)	29.6 (11.64)	0.669[2]
SMM, *n* (%)				
Enabling	22 (48.9)	20 (44.4)	42 (46.7)	
Debilitating	23 (51.1)	25 (55.6)	48 (53.3)	0.667[1]
LoC, *M* (*SD*)				
Internal	2.2 (.7)	2.4 (.9)	2.3 (.8)	0.245[1]

SM= Stress mindset condition; SC= Sham condition; MHC-SF= Mental health continuum short form; SMM= Stress mindset measure; LoC= Locus of control scale; [1]= computed with Chi-square; [2]= computed with independent sample *t*-test

Note: No significant differences between groups using a significance level of .05

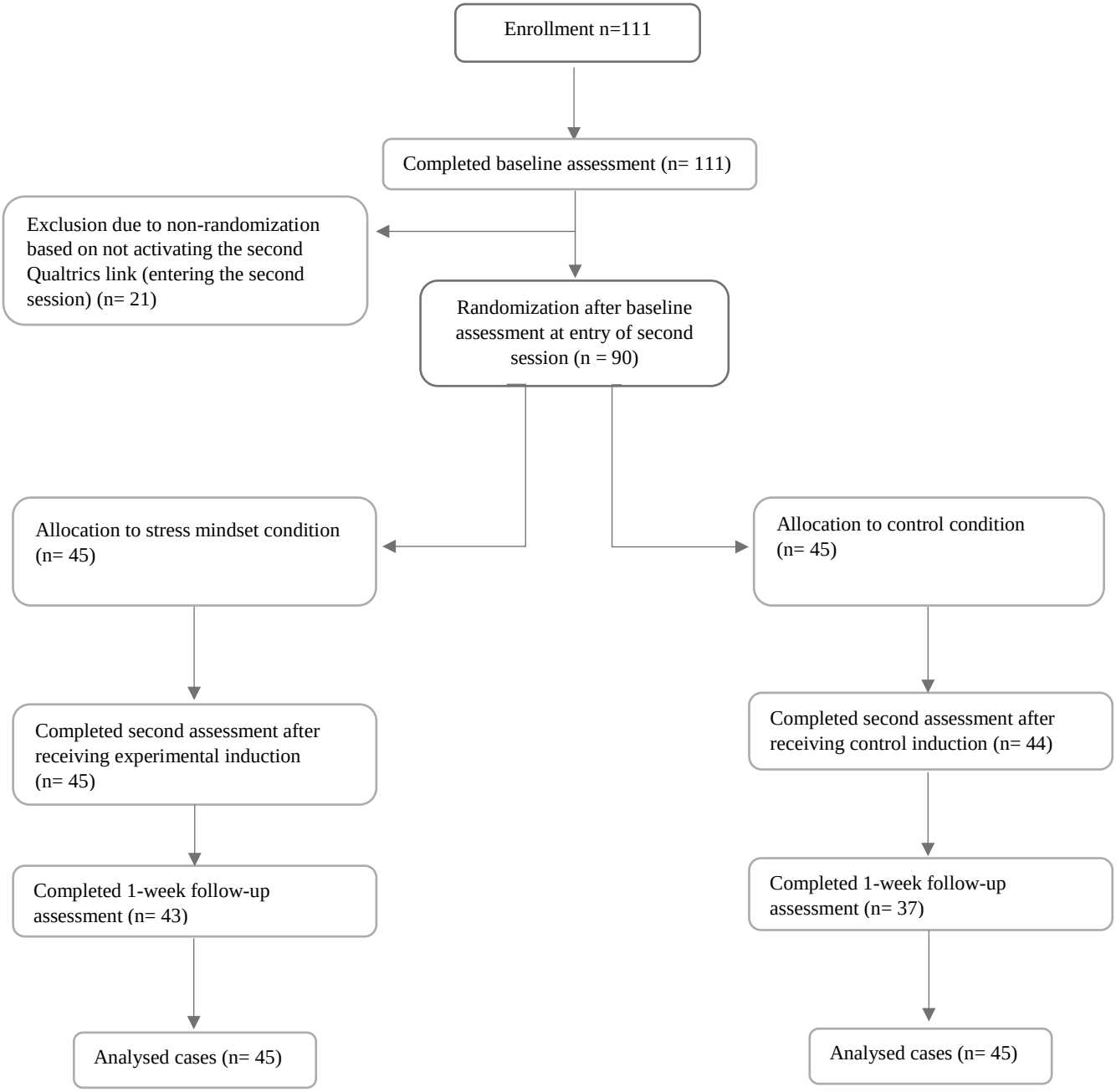

Figure 1. Flowchart of experimental induction participants and dropouts.

Procedure

Respondents were contacted via e-mail three times over a time span of two weeks during April 2019 (April 3rd, April 10th, April 16th). The e-mails contained links to gain access to the questionnaires and texts, designed with the survey tool Qualtrics. Moreover, the respondents participated in this study via reading the informative material and completing the respective

surveys with the help of the technical devices with internet access of their choice (e.g. laptop, tablet, or mobile phone) in their private environment. In the first e-mail, participants were informed about their rights, that every of the in total 3 sessions would take them between 10 to 15 minutes to complete, the structure (Table 2) and purpose of the research and had to sign the informed consent before they could start taking part in the study. Additionally, they were informed that after receiving the e-mail notifications for each session they had to finish those within the next 3 consecutive days.To avoid subject biases, a cover story about the study purpose was introduced. Respondents were told the current research was about how people process unspecified new information.

During the first (T0) and last (T2) session, participants received questionnaires about stress mindset (SMM), mental well-being (MHC-SF) and internal locus of control. This was supposed to take approximately 10 to 15 minutes every time. The second (T1) session included a text that was either about research that shows the enhancing qualities of stress (experimental condition), or a text with general information about the Big Five personality traits (control condition). After reading the text, respondents were asked to shortly summarize what they have learned from the previously presented text and to complete the SMM and MHC-SF. The random allocation of praticipants to the experimental or control condition took place after signing the informed consent in T0 and was computer-generated. Demographic data were collected at T0 and each questionnaire was introduced with a brief instruction about how to answer the questions and use the scales. For debriefing purpose, the study ended with informing about the true purpose of the research and participants were given the choice to examine the text from the contrary condition (Appendix A). Furthermore, researchers contact details were given in case respondents were interested in the end results of the study.

Table 2

Assessment points of measurements

	Baseline (T0)	Post (T1)	Follow-up (T2)
MHC-SF	X	X	X
SMM	X	X	X
LoCS	X		X

Note. MHC-SF= Mental health continuum – short form; SMM= Stress mindset measure; LoCS= Locus of control scale

Measurements

Outcome variables. In this study, results from baseline (T0), post-induction (T1) and 1-week follow-up (T2) of the Mental Health Continuum Short Form (MHC-SF) and Stress Mindset Measure (SMM) were used for assessment.

The Mental Health Continuum Short Form (MHC-SF) is a 14-item questionnaire and designed to measure a person's emotional, psychological, and social well-being during the course of their last month (Lamers, Westerhof, Bohlmeijer, ten Klooster & Keyes, 2010). Each item is a question about experiences out of one of the three categories. Giving an example for each of them, emotional well-being (items 1-3) includes items like; "During the past month, how often did you feel happy?", social well-being (items 4-8); "During the past month, how often did you feel that you belonged to a community (like social group or your neighbourhood)?", or psychological well-being (items 9-14); "During the past month, how often did you feel that your life has a sense of direction or meaning to it?". Participants can answer the questions by indicating that they "never" felt like this, "once or twice", "about once a week", "about 2 or 3 times a week", "almost every day", or "every day". Each answer is scored with 0 to 5 points respectively and a total score ranging from 0-70 can be calculated for each participant. The Cronbach's alpha for the sub- and total scale(-s) were above .90 for all three points of administration.

Designed by Crum, Salovey and Achor (2013) the Stress Mindset Measure (SMM) assesses if people innate a stress is enhancing, or stress is debilitating mindset. The SMM consists of eight items which can be measured on a 5-point Likert scale, ranging from 0 = strongly disagree to 4 = strongly agree. The measure assesses people's general perception of stress (e.g. "The effects of stress are negative and should be avoided.") as well as their opinion on how stress is related to health, productivity and growth (e.g. "Experiencing stress improves my health and vitality."). After reversed scoring of the odd numbered items, an average score is calculated for each participant, with average scores ≥ 2 demonstrating a stress is enhancing mindset and scores < 2 showing a stress is debilitating mindset (Crum, Akinola, Martin & Fath, 2017). Cronbach's alpha was ranging from .84 to .92.

Mediator. Baseline (T0) and 1-week follow-up (T2) measures of the Brief Version of Levenson's (1974) Locus of Control Scale (LoCS) were used for analysis.

The LoCS is a shortened version of the Levenson's (1974) Locus of Control Scale, containing 9 items, created by S. G. Sapp and W. J. Harrod (1993). The items are statements about an individual's degree of perceived internal control (e.g. "My life is determined by my own actions."), control by chance (e.g. "To a great extent, my life is controlled by accidental

happenings."), or by powerful others (e.g. "I feel like what happens in my life is mostly determined by powerful people."), regarding events in their lives. On a 7-point Likert scale, ranging from 1=strongly agree to 7= strongly disagree, participants of the brief LoCS indicate for each item how strongly they agree or disagree. Thus, the lower the mean scores for each dimension, the stronger the person's tendency towards the construct. For the purpose of this study, only the internal locus of control dimension was used. Cronbach's alpha was ranging from .57 (T0) to .86 (T2).

Conditions.

Just before entering T1, both groups received the experimental induction in form of two different informative texts.

Experimental condition. Participants allocated in the experimental condition received an informative text about the positive consequences of stress. The text was based on research results about the benefits of stress itself as well as the belief in positive aspects about stress, such as increased productivity, improved heath and focus. More precisely, participants were informed that research has shown, compared to people with a negative attitude, people with a positive attitude towards stress enjoy better physical health, have a higher energy level, are more productive and satisfied with their lives and express decreased levels of symptoms for anxiety and depression (Weinberg & Cooper, 2007; Keller, et al., 2012; Crum, Salovey & Achor, 2013; Rothmann & Cooper, 2015). Furthermore, they were told that stress sets the brain into the optimal state to absorb new information and stay focused, and increases the hormone production to support the immunesystem. If they were interested to read more about the benefits of stress, a link was included, guiding them to a newsarticle in which Stefanie Maek (2017) explaines the topic comprehensively and more extensively. For comprehension purpose, the text was formulated in a non-scientific manner and the word count was 184 words.

Control condition. Participants in the control condition received an informative text about personality. Based on scientific literature about personality traits, the participants were educated about the Big Five personality traits of openness, conscienscousness, extraversion, agreeableness and neuroticism and their main characteristics (Goldberg, 1990). Additionally they were told that science has shown not only genetical factors are contributing to a person's personality, but also environmental factors and that personality is becoming more stable and less open for change with increasing age (Specht, Egloff, & Schmukle, 2011). This text included 199 words and was written in a non-scientific style.

Statistical analysis

The data analysis was conducted with IBM SPSS Statistics 24, conform the CONSORT guidelines for reporting parallel group randomized trials (Moher et al., 2010). The dataset was screened for completion and missing data of total scores for post-induction (T1) and follow-up (T2) assessments were imputed using the expected maximization (EM) algorithm (Little's MCAR test: χ^2 (12) = 11.949, p = 0.450) (Dempster et al., 1977). Complete datasets for baseline, post-induction and follow-up measures were accessible of 100, 98.9 and 88.9 % of participants respectively. Data analysis resulted into similar outcomes before and after missing variable replacement, thus, outcomes from the imputed dataset are reported.

Reversed scoring of single items of the stress mindset and locus of control questionnaires was performed as well as new variables created for the subcategories of the SMM (debilitating vs. enabling). To check for randomization and characteristics of both groups (experimental and control) at T0, descriptive statistics of demographic data and baseline outcome measure scores were calculated using χ^2-tests and independent *t*-test (Table 2). Additionally, a χ^2-test of SMM total scores at T1 and an independent sample *t*-test of change scores of total scores (T1-T0) were conducted as a manipulation check to see if the experimental induction led to immediate different proportions of stress mindsets between the groups, or if there were different degrees of changes in stress mindsets within the groups respectively.

To test the hypothesized positive effects of the experimental condition on mental well-being, stress mindset and internal locus of control scores (dependent variables), compared to the control condition, a time x group repeated measures ANOVA was conducted for each dependent variable. Additionally, independent *t*-tests with change scores between every assessment point for each outcome variable were performed to assess differing degrees of scoring changes. Followed by the mediation analysis to examine whether the effect of the experimental induction relative to the control induction on well-being was mediated through changes in locus of control. Here, multiple linear regressions were conducted using the 3rd version of the PROCESS plug-in tool, written by Andrew F. Hayes (2017). The internal locus of control baseline to follow-up difference score was used as the mediating variable (M), the condition (exp= 1, ctr= 0) as independent variable X, and follow-up scores of mental well-being as dependent variable Y. Applying the regression-based analysis proposed by Preacher and Hayes (2004) to assess the relationships between the mediator, dependent and independent variables, a regression model was fitted. Starting with the regression of the

condition (X) on change scores of internal locus of control (M) (path *a*), followed by the prediction of mental well-being change scores between T0 and T2 (Y) by change scores of internal locus of control (M) while controlling for the condition (X) (path *b*), finishing with a regression of condition (X) on change scores between T0 and T2 of mental well-being (Y) (path c). All tests were two-tailed and used a significance level of < .05.

Results

Manipulation checks

Post-induction SMM measures did not reveal significant differences in proportions of enabling and disabling stress-mindsets between the groups ($\chi^2(1)= 0.19$, $p=0.667$) (Table 1). However, though there were similar proportions of stress-mindsets between the groups at T0 and T1, participants from the experimental group experienced a larger increase in total scores and, thus, change towards an, or growth of their enabling stress-mindset than the ones in the control group. The total score differences between baseline and post-induction scores yielded a significant difference between the conditions ($t(88)= 2.15$, $p= 0.034$).

Effects on primary and secondary outcome variables

There were no significant interaction effects found between time and group for neither of the dependent variables mental well-being, stress mindset, or internal locus of control (Table 3). From baseline, through post-induction until follow up, participants in both conditions expressed similar scoring patterns. Regarding the MHC-SF, there were small continuous increases in scores over time, but this was independent from the experimental condition and visible in both groups ($F(1,88)= 0.64$; $p= 0.801$). The same was shown in SMM and internal LoCS scores. Though, looking at the change score of SMM between baseline and post-induction assessment, participants from the experimental condition experienced a significantly bigger shift towards an enabling stress mindset, this growth difference was not maintained until the follow-up assessment ($t(88)= 1.598$; $p=0.114$). In the same vein, scores on the internal LoCS were also independent from the experimental condition ($F(1,88)= 1.967$; $p= 0.164$) and the groups did not differ in their scoring patterns comparing baseline and follow-up measures ($t(88)= -0.576$; $p= 0.566$). Overall, the experimental condition did not induces significantly different changes in the respondents' scores on any dependent variable (Table 3). However, there was a significant effect of time regarding the individuals' scores on MHC-SF ($F(1,88)= 8.01$; $p= 0.006$) and SMM ($F(1,88)= 16.607$; $p< 0.001$) across the three points of assessment, independent from the condition.

Table 3

Means and standard deviations for well-being, stress-mindset and internal locus of control and repeated measures ANOVA outcomes for between-groups effects

	SM (n= 45) M (SD)	SC (n= 45) M (SD)	F^a	p
MHC-SF				
Baseline	29.07 (12.09)	30.13 (11.29)		
Post-test	30.84 (12.68)	31.52 (12.78)	0.64	0.801
1-week follow-up	31.47 (11.6)	33.08 (12.75)		
SMM				
Baseline	1.81 (0.74)	1.86 (0.67)		
Post-test	2.24 (0.75)	2.04 (0.64)	0.48	0.49
1-week follow-up	2.13 (0.86)	2 (0.8)		
internal LoCS				
Baseline	2.24 (0.65)	2.42 (0.88)		
1-week follow-up	2.16 (0.71)	2.41 (1.14)	1.967	0.164

SM= Stress-mindset condition; SC= Sham condition; CI= Confidence interval; MHC-SF= Mental health continuum short form; SMM= Stress mindset measure; internal LoCS= internal Locus of control scale

^{a} = Between-groups effect (time × group).

Mediation effect

Figure 2 shows that there was neither a significant direct effect of the intervention on mental well-being changes found (c= -1.1302, p= 0.386, 95% CI [-3.7099, 1.4495]) nor a significant indirect effect via the mediator internal locus of control (ab = -0.1294, 95% CI [-0.6912, 0.4648]). Furthermore, there was also no significant relation found between participants' group allocation and their internal locus of control scores (a= 0.0936, p= 0.566, 95% CI [-0.2293, 0.4165]) Thus, it is demonstrated again that the intervention neither created significant changes on the mental well-being nor on changes in internal locus of control.

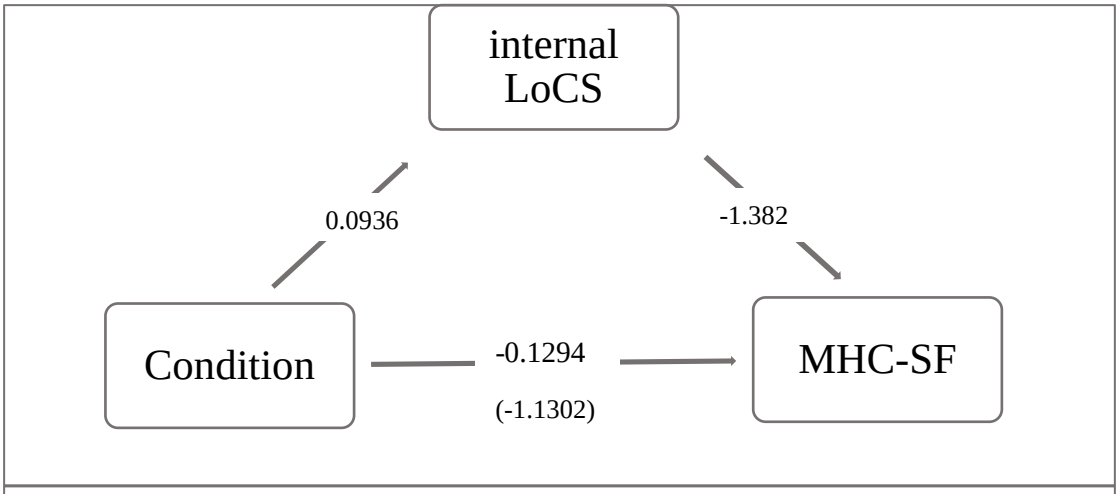

Figure 2. Outcomes of mediation model determining the indirect effect of the mediator on changes in well-being compared to the sham condition. Total effect (c-path) is given in parentheses.

Discussion

This study deployed a short experimental induction in form of a one-time delivered text about the benefits of stress to test if the positive impact of stress mindset interventions on stress mindset and mental well-being found in previous research could be replicated. Additionally, it was also examined if an informative text aiming to change a person's stress mindset also has an effect on internal locus of control and if it has a mediating function regarding the effect of the induction on mental well-being. Furthermore, contrarily to former studies in this field, for which data from participants from educational environments were taken (i.e. high-schools, or universities), the current study recruited participants from the general German population.

Though the results did not show a significant difference in absolute proportions of participants categorized with an enhancing or debilitating stress mindset between the experimental and control group, looking at the scoring differences before and after the induction, the experimental group demonstrated a significantly larger shift towards higher scores, thus, towards an enhancing stress mindset, or strengthened it. Nevertheless, this positive trend was not maintained until the follow-up assessment one week later. However, the other outcomes of the present study also show that the small scale enhancing stress mindset induction, compared to the short text about personality traits of the control condition, did not lead to significant difference in mental well-being, or internal locus of control. Moreover, any changes in the latter measurement scores turned out to be independent of the induction, but due to chance. Consequently, the proposed mediation effect of changes in internal locus of control on the influence of the condition on changes in participants' mental well-being scores was not supported.

On the other hand, findings of previous studies in this area demonstrate the possibility to cause sustainable change in people's mindsets (e.g. personality, or intelligence) (Aronson, Fried & Good, 2002; Blackwell, Trzesniewski & Dweck, 2007; Yeager, Trzesniewski & Dweck, 2013) and to explicitly affect people's stress perceptions and improve mental well-being (Crum, Salovey & Achor, 2013; Crum, Akinola, Martin & Fath, 2017; Jamieson, Crum, Goyer, Marotta & Akinola, 2018). Here, participants not only expressed a significant shift towards an enhancing interpretation of stress, but also improved their mental well-being scores after receiving the interventions.

Noteworthy to say, here, is that well-being was assessed differently in the previous studies, which could also be a reason for the different outcomes. While Crum, Salovey and Achor (2013) used the Mood and Anxiety Symptom Questionnaire (MASQ; Watson et al., 1995) and, thus, assessed changes in symptoms of anxiety and depression, participants in the study of Crum, Akinola, Martin and Fath (2017) received the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988), which indicated their current positive or negative emotional states at different points in time. Thus, these studies showed that improvements in stress mindset correlated with increased emotional and psychological well-being and gave no information about changes in social well-being, which was additionally assessed in the MHC-SF used in the present study. Therefore, it is possible that changes in stress mindset may lead to improved emotional states (PANAS) and decrease anxiety and depressive symptoms (MASQ), but may be less effective in increasing social well-being.

Looking at the differing procedures comparing the present study with previous ones, multiple possible reasons for the deviating results can be concluded. First, the current experimental induction was less time intensive than those interventions and programmes performed before and used a different format to present the informational material. In past stress mindset studies participants were confronted with videos of approximately 3 minutes of length to induce either an enabling or debilitating stress mindset and also received the materials multiple times (Crum, Salovey & Achor, 2013; Crum et al., 2017; Jamieson et al., 2018). By delivering the intervention via a video format, former studies transferred the information by stimulating multiple sensational pathways, nambely, auditive and visual. The participants were confronted with video material that included topic specific visual and text material as well as atmospheric background music aiming to evoke either a positive (i.e. enhancing stress condition), or a negative mood (i.e. debilitating stress condition) (Crum, Akinola, Martin & Fath, 2017; Jamieson, Crum, Goyer, Marotta & Akinola, 2018). Thus, not only does this include the advantage that visual information is easier processed than written

text, but also that the information was delivered via multiple pathways and, therefore, had a bigger chance to be memorized than bare texts (Chen & Wu, 2015; Dewan, 2015).

Additionally, in past research, participants were aware of the purpose and mindset change or stress theme, which could have further buffered the effect of the intervention. Neither the repeated exposure to the stimulus nor the respondents' awareness of the purpose of the study were the case in the present research, though the latter is a strength of this study, enabling to filter the effect of the induction instead of the priming briefing about the study's purpose. Furthermore, regarding mindset interventions in general, most programs, which yielded significant changes in participants' mindsets towards the aimed expression and were able to maintain those, demanded active engagement with the topic for several weeks as in form of incorporated adjustments of students curricula, or extra courses and materials about certain types of mindsets (e.g. growth, attitude, personality, intelligence mindset) (Aronson, Fried & Good, 2002; Blackwell, Trzesniewski & Dweck, 2007; Yeager, Trzesniewski & Dweck, 2013; Costa & Faria, 2018; Rhew, Piro, Goolkasian & Cosentino, 2018). In contrast, the current study applied an informative text to enhance the participants stress mindest, which was presented once, thus, the information was not as frequently actively induced as in the previous research.

Secondly, the sample of the present study differed from those of previous ones. Whereas the current research applied an intervention on people with an age range of 18 up to 84, past studies dominantly examined participants who were either elementary school pupils, adolescents, or undergraduate students (Aronson, Fried & Good, 2002; Blackwell, Trzesniewski & Dweck, 2007; Crum, Salovey & Achor, 2013; Yeager, Trzesniewski & Dweck, 2013; Crum, Akinola, Martin & Fath, 2017; Costa & Faria, 2018; Jamieson, Crum, Goyer, Marotta & Akinola, 2018). Considering the decreasing potential of personality and attitude change with increasing age (Krosnick & Alwin, 1989; McCrae & Costa, 1994; Vaidya, Gray, Haig & Watson, 2002), it is up for speculation, if the currently applied induction would be more effective in a younger population. Furthermore, it should also be paid attention to the environment past research was conducted in. Mindset interventions applied to children or adolescents often took place in a group environment and/or educational institutions which naturally incorporate the emphasis to learn and acquire new knowledge and skills. Besides the increased duration of these interventions, this could have further increased the probability and speed of adoption of the delivered information.

Based on these arguments, it could, thus, be that the short induction of the present research would have yielded different results was it applied on a younger population and

incorporated in an educational environment. Hence, the method used here might itself be effective in changing people's stress mindsets, but not in an adult population.

Strengths and Limitations

The current study was, to the present knowledge of the researchers, the first one to apply a low-intensity method in form of delivering an informative text to increase people's enhancing perception of stress. Thus, findings of this study can be considered for future research designs and their choice of suitable intervention methods. Furthermore, another advantage is the RCT design of this study, which increased the potential for generalizability of research findings. Based on this it can be inferred, that a sample with similar characteristics will express similar results when receiving the present induction. This is additionally possible due to this study's use of measures with high test-retest reliability and construct validity demonstrated in past and the current research (Lamers, Westerhof, Bohlmeijer, ten Klooster & Keyes, 2010; Crum, Salovey & Achor, 2013; Sapp & Harrod, 1993).

Furthermore, since the study at present was conducted online without supervison, it cannot be guaranteed that participants absorbed the new information in an environment without disruptions that could significantly distort information processing. Related to this, exposure to the chosen induction was limited to only one time, whereas participants in past (stress) mindset studies were confronted several times over a longer period with more complex stimuli. Hence, it could also be that repeated application of a low-intensity induction would create a bigger shift towards an enabling stress mindset and also affect mental well-being and internal locus of contol.

Also, participants were confronted three times in a relatively short time span with mainly the same questionnaires. Participants could have recognized the items and tried to replicate their answering patterns to demonstrate a coherent personality, resulting into findings that are not representative for eventual changes in the subjects' development. Moreover, the mediating variable was not assessed directly after the induction at T1, thus, it is not clear if the induction had an immediate effect on participants' internal locus of control. However, regarding the internal locus of control measure it is important to point out the low Cronbach's alpha of 0.54 at baseline assessment. This puts the reliable measuring into question and leaves room for speculation if eventual changes between baseline and follow-up levels of internal locus of control were accurately measured.

Implications for future research

Considering the young age of stress mindset research and its still low variability in applied methods, this study did serve with important implications that need to be considered

during future research choices. It has been shown, that the applied form of short-term stress mindset induction does induce immediate improvement of stress mindset but does not create prolonged change of stress mindset. Adding this to the absence of significant differences in mental well-being, or internal locus of control, the present induction and procedure are inadvisable for repition in future studies aiming to sustainably change stress mindsets, mental well-being or locus of control, or should be adjusted. This could be done by increasing the number of exposures to the induction, thus, delivering the text more often. Likewise, the text format could be replaced by a video as it has been done previously, to stimulate multiple pathways of information processing, increase the likelihood of remembering the delivered content and simplify knowledge acquisition (Chen & Wu, 2015; Dewan, 2015).

Moreover, it is advised to increase the timespan between the assessment points to not create a familiarity effect of the questionnaires. This should prevent the increased need to demonstrate a coherent self-expression in the participants, which would bias the outcomes. Additionally, it could be controlled for a standardized environment to check for noise and additional measures could be incorporated to test if the participants have understood the presented information. These additional measures could take the form of a short survey with questions about the content of the text, which would test if the participants have read and understood the text and initiate deeper processing of the presented content.

Looking at the used measures of this study, a further consideration could be the choice of a different scale to measure locus of control. Here, only the 3-item subscale for internal locus of control from the brief locus of control scale (Sapp & Harrod, 1993) was used, which resulted into a low Cronbach's alpha of 0.54 at T0. Therefore, in future studies, a longer version of this measure would be advisable to increase the reliability of the scale. A suitable alternative would be the Levenson's (1973) multidimensional locus of control scale, including 8 items to test internal locus of control and resulting into a Cronbach's alpha of 0.74 (Kourmousi, Xythali, & Koutras, 2015). Furthermore, since past mindset research created promising outcomes and was dominantly performed on children or adolescence, further research could be conducted on varying potentials of mindset inductions or interventions across different ages. Thus, since the probability for personality and attitude changes is decreasing with age (Krosnick & Alwin, 1989; McCrae & Costa, 1994; Vaidya, Gray, Haig & Watson, 2002; Specht, Egloff, & Schmukle, 2011), it could be tested if different age groups demand different forms of inductions, programs, or interventions for stress mindset change.

Conclusion

This study adds to the, at this point, small number of researches on how to influence

people's stress mindsets. It demonstrated, that reading an informative text about the enhancing qualities of stress can temporarily improve but not lead to a prolonged shift of a person's stress mindset. Furthermore, it illustrated that the applied small-scale induction does not contribute to changes in mental well-being, like more extensive past intervention did, or affect internal locus of control. There is still a huge need to gather information about suitable methods and techniques to create those changes and investigate the mechanisms that are responsible for this. In this regard, the present study did serve with implications for further research in this field and can be taken as an inspiration for upcoming investigations.

One proposal would be that future research should employ interventions that run for a longer period than the present one and include multiple applications of different formats, such as written texts and videos, to compare their effectiveness across different age groups. Also important looking for are additional factors, such as individual characteristics, observable behaviour, physical health and performance, that are affected by stress mindset change, so a clearer picture about its benefits and use can be created. Overall, stress is an inevitable component of today's life and this study contributed to finding out about efficient techniques that help people to better handle it, enabling a more satisfied and healthier life.

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Appendix A

German version of the debriefing document, delivered to the participants

Liebe/r Teilnehmer/in,

In den letzten 2 Wochen haben Sie bei der Studie teilgenommen, die untersucht, wie Personen neue Informationen wahrnehmen. Wir danken Ihnen herzlich, dass Sie sich Zeit genommen haben, daran teilzunehmen. Wir sind sehr zufrieden mit der Art und Weise, wie sich jeder und jede beteiligt und Mühe gegeben hat, alle Fragebögen nach bestem Wissen auszufüllen. Mit den Daten dieser Studie können wir Antworten auf wichtige wissenschaftliche Fragen finden und hoffen, mehr darüber zu erfahren, wie Personen neue Informationen wahrnehmen und auf sie reagieren. Hiermit informieren wir Sie über den wahren Aufbau und Grund der Studie.

Aufbau der Studie

Insgesamt haben 158 Personen an der Studie teilgenommen. Diese wurden in 3 verschiedene, gleichgroße Gruppen eingeteilt, wobei jede Gruppe einen anderen Text vor der zweiten Umfrage gelesen hat. Wenn Sie Interesse haben, können Sie auf den folgenden Seiten diese Texte lesen (Sie können diese auch überspringen, wenn Sie auf den Pfeil klicken, der Sie zur nächsten Seite führt). Ein Text handelte davon, wie Menschen Stress empfinden, ein weiterer handelte davon, wie Personen das Leben wahrnehmen und ein Text behandelte das Thema ‚Persönlichkeit'. Der letzte Text diente als Kontrollkondition, hierbei erwarten wir keine Veränderung in Ihrer Wahrnehmung oder Meinung, nachdem Sie den Text gelesen haben. Jedoch erwarten wir, dass sich Ihre Denkweisen über Stress und über das Leben in eine positive Richtung verändern, nachdem Sie die beiden anderen Texte gelesen haben.

Ziel der Studie

Das Ziel der Studie war es zu untersuchen, ob bestimmte Denkweisen (über Stress beziehungsweise über das Leben) mit Hilfe geeigneter Informationen geändert werden können. Wir untersuchen ebenfalls, ob solche Informationen ihr mentales Wohlergehen positiv beeinflussen. Die Texte, die dafür verwendet wurden, entsprechen dabei dem aktuellen wissenschaftlichen Stand und wir sind gespannt, ob Personen anders wahrnehmen, denken oder handeln, nachdem sie über einige neuste Erkenntnisse in der Wissenschaft gelesen haben.

Um die Ergebnisse nicht zu verfälschen, wurde Ihnen das eigentliche Ziel der Studie am Anfang vorenthalten. Wir erwarten einige erste Ergebnisse in einigen Monaten, wobei eine wissenschaftliche Arbeit womöglich mehr als ein Jahr bis zur Veröffentlichung braucht. Wenn Sie mehr über die wissenschaftlichen Erkenntnisse erfahren möchten, die wir zum Schreiben der Texte über Stress und das Leben genommen haben, geben wir Ihnen ein paar Lesetipps weiter unten.

Nochmals möchten wir Ihnen herzlich für Ihre Zeit und Teilnahme an der Studie danken.

Lesetipps

https://www.tandfonline.com/doi/abs/10.1080/10615806.2016.1275585 (über Stress)

https://journals.sagepub.com/doi/abs/10.1177/1948550611401425 (über das Leben)

Translated version of the debriefing document

Dear participant,

In the past 2 weeks, you took part in the study investigating how people perceive new information. We sincerely thank you for your invested time to participate! We are very happy with the way in which everyone was involved and has done their best to complete all surveys. With the data from this study, we can find answers to important scientific questions and we hope to gain more insight in how people perceive and react to new information. We will now inform you about the real set-up of the study and its aim.

Set-up of the study

In total, 158 people participated in the study. They were divided into 3 different groups of equal size and every group received a different text to read before the second survey. If you are interested, you can read those texts on the following pages (or skip these by clicking on the arrow to go to the next page). One text was about how people perceive stress, one text was about how people perceive life and one text was about personality. The latter text was used as a control condition, we expected no change in your perceptions or beliefs after reading this text. However, we did expect that the so called 'stress mindset' or 'life-mindset' would change in a beneficial way, by reading the other two texts.

Aim of the study

The aim of this study was to analyse whether the different mindsets (about stress or about life) could be changed with appropriate information. We also test whether such information influences your mental well-being in a beneficial way. The used texts conform to current scientific knowledge and we were curious whether people perceive, believe or act differently after reading some latest insights from science.

In order to not bias or distort the results, we kept back the true aim of the study. We expect some first results in a few months, although a scientific paper about the results will probably take more than a year until publication. If you want to read more about the scientific insights we used as input for the texts about the stress or life mindset, we give you some reading tips below.

Again, we thank you very much for your invested time and participation!

Reading tips

https://www.tandfonline.com/doi/abs/10.1080/10615806.2016.1275585 (about stress)

https://journals.sagepub.com/doi/abs/10.1177/1948550611401425 (about life)