The Influence of Age on the Change in Stress-Mindset:

Results from a Randomized Controlled Trial

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Abstract

Background: Research shows that mindsets can affect our well-being and it is more beneficial to hold a stress-is-enhancing-mindset than a stress-is-debilitating-mindset. This study examined whether reading about positive aspects of stress can alter a person's stress-mindset and if age has a moderating effect on this relationship. This is important to examine, so that future interventions can be tailored according to the age group, if age has a moderating effect.

Methods: This study features a randomized controlled trial (RCT) with two groups and three timepoints. The online survey took place at baseline, post-test (one week after baseline), and follow-up (two weeks after baseline). Participants were randomly assigned to either the intervention or the control group. In total, 88 participants completed the baseline and post-test (mean age = 36 years, 61% female, 44 in intervention group, 44 in control group), and 78 participants completed the follow-up (42 in intervention group, 36 in control group).

Results: The independent t-test showed a significantly larger shift towards a stress-is-enhancing-mindset in the intervention group compared to the control group at post-test. At follow-up, this difference between the groups disappeared. The moderation analysis showed no significant moderation effect of age on the relationship between condition and shift in stress-mindset, neither for the post-test nor for the follow-up.

Limitations: The sample was limited to Germans and did not include any unemployed people, thus diminishing generalizability of the results. The study's effectiveness was decreased by carrying out the intervention only at one point in time. Moreover, skipping or skimming through the intervention texts made the intervention ineffective for some participants.

Conclusion: Stress-mindsets can be changed directly after the intervention, while age does not moderate this change. Future research should be dedicated to investigating how to yield long-term change in stress-mindset and which variables moderate this change. Psychologists should be educated about current findings about stress-mindset to know where research is needed and what can be done so far to influence people's stress-mindsets positively.

Introduction

Stress is often illustrated as being negative, for example in the media, at work or in health classes (Crum, Salovey, & Achor, 2013). Stress is defined as "the experience of encountering or anticipating adversity in one's goal-related efforts" (Carver & Connor-Smith, 2010, p. 684). Distress specifically is defined as "a feeling of extreme worry, sadness, or pain" (Cambridge Dictionary, 2019). Thus, stress is generally related to some sort of difficulty and being negative. Stress has been associated with the six main reasons of death, which are heart disease, liver disease, lung ailments, cancer, accidents, and suicide (Crum et al., 2013). Hence, negative impacts on physical health up to increasing risk of death have been shown to be a result of stress. Furthermore, stress can operate as a mediator for decreased physical health, as in the study of Boyle and Fearon (2018), where it was shown that stress functions as a mediator between stigma application and physical health. In addition to that, stress has a negative impact on cognition, for example learning while being under stress shows to diminish memory (Schwabe & Wolf, 2010). The risk for mental illnesses is increased through experiences of stress. As the study of Wang (2005) showed, stress at work is a risk factor for evolving major depressive episodes. Stress can also cause depression or more precisely can cause brain dysfunctions that are considered to be responsible for depression (Praag, 2005). Furthermore, stress can impact relationships negatively. Thus, there is a link between experiencing stress and verbal aggression and/or anger in an intimate relationship (Bodenmann, Meuwly, Bradbury, Gmelch, & Ledermann, 2010).

However, there is also evidence for enhancing aspects of stress. The term "eustress" means "good stress" (Fevre, Matheny, & Kolt, 2003) or as Cambridge Dictionary (2019) defines it "stress that is not too extreme and is good for someone", which indicates that stress can be positive as well. For example, when difficulties arise, physiological activation is increased and attention is tightened, so that the individual can focus on accomplishing the assignment (Crum et al., 2013). Additionally, stressors at work are positively associated with

personal initiative taking which means in the study of Fay and Sonnentag (2002) that the employees became active in gaining the expertise to manage the tasks they had to do at work. Another study suggested that better memory and increased performance on intellectual assignments can be achieved through the release of stress hormones (Cahill, Gorski, & Le, 2003). Epel, McEwen, and Ickovics (1998) proposed that the stress response system gets more resilient after the person was exposed to stressors that were manageable which makes the person less vulnerable to negative effects of stress in the future. Accordingly, stress can have negative as well as positive effects. The study by Crum et al. (2013) showed that how a person views stress, i.e. which mindset the person holds about stress and its nature (good or bad) and consequences, has a major effect on the person's well-being. Hence, negative effects of stress can be diminished and stress itself can become beneficial when a person has a positive mindset about stress.

Stress-Mindset

Mindset can be defined as "a mental frame or lens that selectively organizes and encodes information" (Crum et al., 2013, p. 717) which then leads the person to gain a particular understanding of an event and directs the person to certain actions and responses. Mindsets influence a person's life and health by affecting behavioural, physiological, and psychological events (Crum et al., 2013). An example of how accepting a certain mindset has consequences for the person's health is the study by Levy and Myers (2004) that showed that participants who had more positive self-perceptions of aging were to a greater extent inclined to engage in more preventive health behaviours.

People can have different mindsets about stress. Crum et al. (2013) defines the stress-is-enhancing-mindset as "the belief that stress has enhancing consequences for various stress-related outcomes such as performance and productivity, health and wellbeing, and learning and growth" (Crum et al., 2013, p. 716) and the stress-is-debilitating-mindset as "the belief

that stress has debilitating consequences for those outcomes" (Crum et al., 2013, p. 716). This study focuses on whether a person has a rather "stress-is-enhancing-mindset" or a more "stress-is-debilitating-mindset".

Holding a stress-is-enhancing-mindset has clear advantages over holding a stress-is-debilitating-mindset. Thus, Crum et al. (2013) concluded that the stress-mindset affects how stress is psychologically encountered (e.g. cortisol release) and how stress is behaviourally addressed (e.g. wanting to receive feedback). The "fight or flight" response – a defensive mechanism present in stressful situations – is activated through the secretion of cortisol. In the study of Crum et al. (2013), an association between the stress-is-enhancing-mindset and a reduced cortisol release in high cortisol responders and an enhanced cortisol release in low cortisol responders was found, so that an appropriate or balanced level of arousal could be achieved. This is in line with the notion that performance is at its peak when a moderate level of arousal is attained. Furthermore, believing that stress is enhancing leads to behaviours that help to accomplish the stress-inducing task, by for example asking for feedback, whereas people holding a stress-is-debilitating-mindset avoid asking for feedback, hence making it more difficult to accomplish the task in a desired way (Crum et al., 2013). Similarly, Epel et al. (1998) indicated that cognitive and psychosocial factors, e.g. how stress is seen, can lead to positive or negative outcomes on the psychological and physical state of the person facing stress. For example, seeing the event as a challenge rather than a threat leads to salutary neuroendocrine responses which promotes physical thriving instead of a catabolic state that impedes development and curative functioning, thereby enhancing disease (Epel et al., 1998). Likewise, Crum and Lyddy (2014) showed that whether stress has positive or negative consequences is largely dependent on how the person views stress, that is whether the person has a stress-is-debilitating or a stress-is-enhancing-mindset. In summary, it can be said that how stress is perceived influences our well-being. Now the question arises: Can people even change their mindsets or are some born with the beneficial stress-mindset, whereas others

have to live with their misfortune of a negative stress-mindset? This question shall be discussed in the following.

Malleability of Mindsets

Research showed that indeed mindsets are malleable. Aronson, Fried, and Good (2002) conducted an intervention with college students, trying to change their intelligence mindset from an "intelligence-is-fixed" to an "intelligence-is-malleable-mindset". Already after three sessions of promoting the possibility to alter one's intelligence, the intervention showed effects in the expected direction, i.e. towards an "intelligence-is-malleable-mindset". Hence, the short-term effects were that a significant change from an "intelligence-is-fixed" to an "intelligence-is-malleable-mindset" occurred, however, in the long-term it appeared that only African American students were convinced that intelligence is expandable whereas white students' mindset-change did not endure (Aronson et al., 2002).

In an earlier study, participants' mindsets about personality and character were altered. Short articles supporting one of both views – namely that personality is rather fixed (entity article) or that personality can be developed (incremental article) – were presented to and read by the participants. The results showed that participants tended to agree to the view presented to them (Chiu, Hong, & Dweck, 1997). This supports the idea that by reading a manipulation text, readers' mindsets can be altered in the direction the text aims at.

Crum et al. (2013) conducted a study about the malleability of stress-mindsets and found evidence that after an intervention that consisted of showing three short videos that demonstrated either the enhancing or the debilitating nature of stress, participants seemed to change their stress-mindset into the direction predicted by the videos in both conditions. Moreover, participants in the stress-is-enhancing condition showed positive changes in their self-reported psychological symptoms and job performance, supporting the view that the

stress-is-enhancing-mindset holds benefits over the stress-is-debilitating-mindset (Crum et al., 2013). Thus, this study showed that among others the stress-mindset can be changed as well.

Influence of Age on Malleability of Mindsets

A study by Dues et al. (2016) showed that resistance to various stresses declines as a result of aging. Hence age can be an important factor in how stress is perceived and should be taken into account when trying to change how a person perceives stress, i.e. which stress-mindset a person has. In order to assess the relationship between people's age and their willingness to change their mindset, it might be useful to look at their openness or susceptibility to change. A study by Krosnick and Alwin (1989) indicated that people are most prone to change their political attitude in their early adult years and that up to the age of 30, this proneness to change declines. However, they did not find that after the age of 33, attitude became more stable. Yet, in a later study, Alwin and Krosnick (1991) found that there is an increase in attitude stability with age, and that there is no clear proof that attitude stability diminishes in old age. Similarly, to the results of their study in 1989, they found that for the youngest adults, attitude stability was the lowest. Another study by Khoshtaria (2017) showed that in Georgia younger people are more open to change than older people. Tulviste, Kall, and Rämmer (2016) found comparable results for other countries as well and concluded that these differences in generations is a general pattern that shows that openness to change is more important to younger people than it is to older people.

To conclude, previous research suggests that young people are most open to change and least stable in their attitude, and that attitude stability increases with age. Accordingly, this study aims at testing whether age influences the shift in stress-mindset – more specifically, whether younger participants are more likely to change from a rather stress-is-debilitating to a more stress-is-enhancing-mindset as compared to older participants. It is important to analyse the effect of age towards the likelihood of changing one's stress-mindset

because these findings can help to tailor future interventions, that aim at altering people's stress-mindset, according to the participants' age – if age has a moderating effect.

The Current Study

The aim of this study is to examine whether a person's stress-mindset can be changed through an intervention consisting of reading a text about the enhancing aspects of stress, thereby focusing on whether there is an immediate effect and whether there is an effect one week after the intervention took place. It is expected that a positive shift in stress-mindset occurs and is maintained up to one-week follow-up. Hence, the first hypothesis is: There is a significantly larger shift from a rather stress-is-debilitating to a more stress-is-enhancing-mindset in the intervention group compared to the control group directly after the intervention took place and at one-week follow-up.

Moreover, this study investigates if age has a moderating effect on the relationship between condition and shift in a person's stress-mindset. It is expected that younger participants show a greater shift from a stress-is-debilitating to a stress-is-enhancing-mindset as compared to older participants. The second hypothesis is: Age has a significant moderation effect on the relationship between the condition and the shift in stress-mindset. The older a person gets, the less likely that person will change his/her stress-mindset. This moderation effect is depicted in Figure 1.

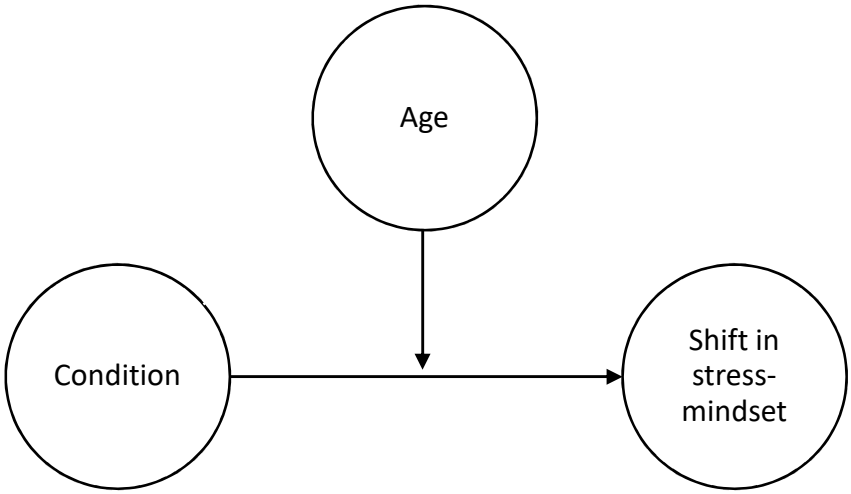

Figure 1. Model of the expected moderation effect of age on the relationship between condition and shift in stress-mindset.

Method

This study is approved by the ethical committee of the University of Twente (no. 190218). All participants voluntarily took part in this study and signed an online informed consent. The informed consent can be found in appendix 1.

Design

This study features a randomized controlled trial (RCT) with two groups and three timepoints. For the first hypothesis, the variables are a) condition with two levels, namely either being in the group that receives information that stress can be good (intervention group) or being in the group that receives neutral information (control group), and b) difference in stress-mindset with a continuous scale.

For the second hypothesis, the variables are a) age, b) condition (intervention vs. control group), and c) difference in stress-mindset with a continuous scale.

Participants and Procedure

The researchers of the study started to recruit the participants around two weeks before the first survey was conducted, resulting in a convenience sample. The inclusion criteria were that the participant had to be 18 years old or older, had a valid e-mail address and sufficient internet connection, and that he/she must have a sufficient level in German. The survey was online on Qualtrics and all participants received a link to that website via e-mail. A reminder e-mail was sent to the participants who, after two days, did not complete the survey yet.

The duration of the study was 2 weeks, starting with the baseline survey on the 3rd of April 2019. After the participants agreed to the informed consent – which stated confidentiality with their data, voluntary participation and the option of withdrawal for the participants – they were asked to answer questions about their demographics (including age, gender, educational level, and job status) and the Stress Mindset Measure (SMM). The instructions and complete informed consent can be found in appendix 1. In total, 90 participants filled in the baseline survey.

On the 8th of April, participants were randomly assigned by an independent researcher using random numbers from randomizer.org, to either the intervention group or the control group (allocation ratio 1:1) and received the post-test survey on the 10th of April. Both groups had the same procedure and differed only in the manipulation text they read. After reading either the text about stress or personality, the participants were asked to fill in the SMM a second time. In each condition, 45 participants completed the post-test survey, however, in both conditions one participant reported to not having read the manipulation text and thus had to be excluded, resulting in 44 valid participants for each condition.

The study ended with the follow-up survey, sent on the 16th of April, which contained the SMM and a debriefing document, that thanked the participant for cooperation and explained the set up and the aim of the study. The debriefing document can be found in appendix 2. The follow-up survey was completed by 42 participants of the intervention condition and by 36 participants of the control condition. The flow chart of participants is depicted in Figure 2.

Conditions

Intervention group.

The text containing information about stress was 1/3 of a page and first stated that stress is generally seen as negative. This was followed by stating positive aspects of stress (e.g. higher energy level and life satisfaction, fewer symptoms of depression and anxiety). The reader was rhetorically asked about his/her interpretation of a stressful situation before emphasizing the advantages of a positive mindset about stress (e.g. better performance and health, personal growth). The text can be found in appendix 3.

Control group.

The text about personality was about half a page. The "Big Five" were shortly mentioned and explained (e.g. "Openness to experience: curious, broad range of interests, try new things"). It was clarified that biological and environmental influences shape personality and that these five core traits are relatively stable in adulthood. In the end, the text mentioned that most people score more or less moderately on each of the five core traits. The text can be found in appendix 4.

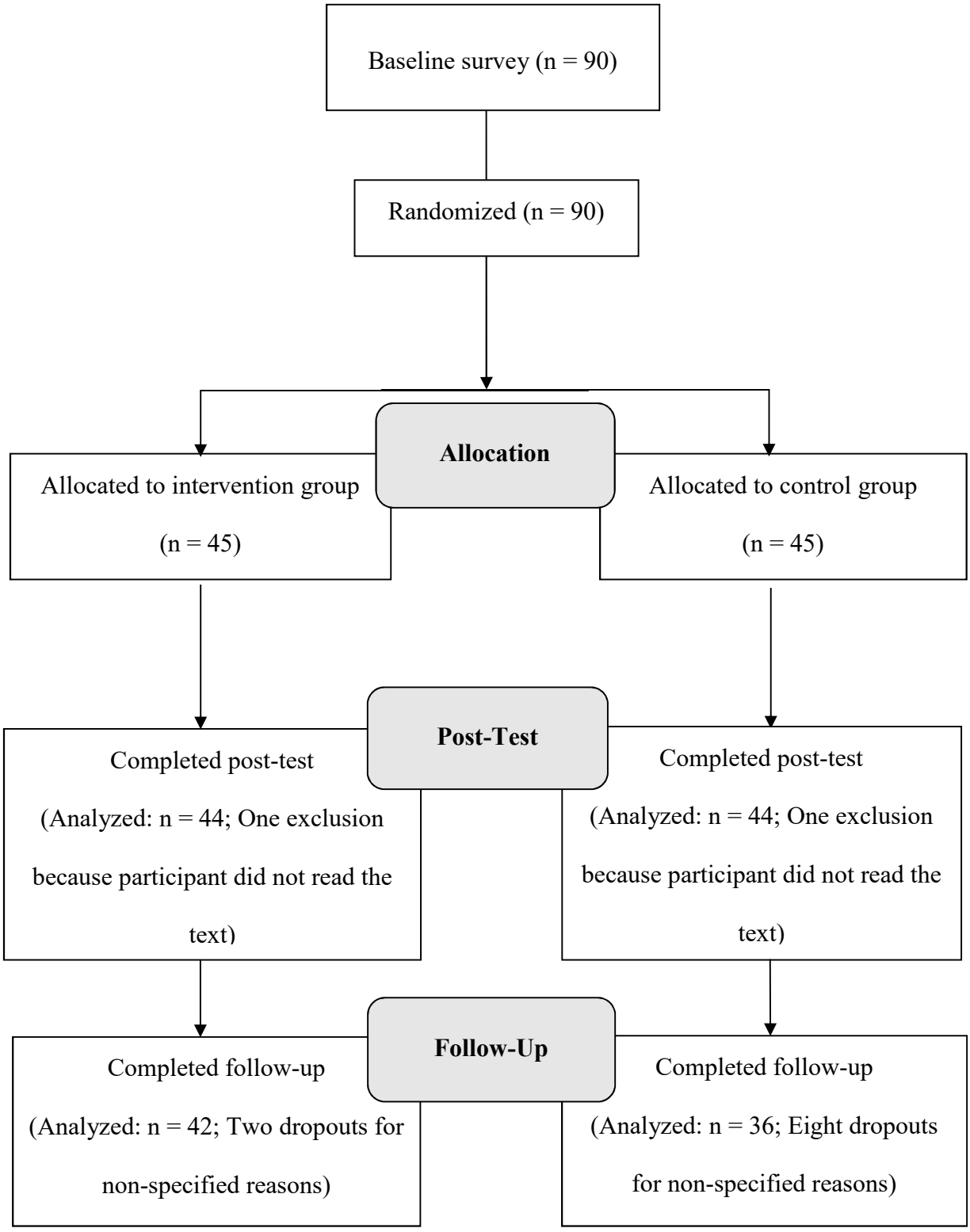

Figure 2. Flow chart of participants.

Measures

Stress Mindset Measure.

In order to measure the participant's stress mindset, the Stress Mindset Measure (SMM) with 8 items was used, developed by Crum et al. (2013). These items are statements about the nature of stress (e.g. *"The effects of stress are negative and should be avoided."*) and the consequences of experiencing stress concerning learning and growth, health and vitality, and performance and productivity (e.g. *"Experiencing stress facilitates my learning and growth."*). The participant can answer these items on a five-point Likert scale, ranging from: strongly disagree (0) to strongly agree (4). Scoring low on the Stress Mindset Measure means that one has a rather debilitating stress-mindset while scoring high means having a rather enhancing stress-mindset. The psychometric properties were good, with a high internal consistency for the English version (Cronbach's alpha is .86) when sampling 388 employees of an international financial institution in the northeast region of the United States (Crum et al., 2013). For this study, the survey was translated into German and had a high internal consistency with Cronbach's alpha being .88. All items can be found in appendix 5.

Age.

Age was assessed at baseline as well. Age operates as a continuous variable and therefore, no age groups were formed.

Statistical Analyses

To analyse the data, IBM SPSS Statistics 24 was used while following the Consolidated Standards of Reporting Trials (CONSORT) (Moher et al., 2010). Baseline characteristics of participants were calculated and can be found in Table 1 under results.

To examine whether the participant's stress-mindset has changed, the difference in the stress-mindset scores between baseline and post-test ($t_1 - t_0$) and baseline and follow-up ($t_2 - t_0$) was calculated. An independent two tailed t-test was performed with the difference in

stress-mindset scores as the dependent variable, while condition (intervention vs. control group) was entered as the independent variable with a significance level of $p < 0.05$.

To test the moderation effect of age, i.e. whether younger people experience a greater shift towards the stress-is-enhancing-mindset as compared to older people, the PROCESS tool by Hayes (2012) was used. The difference in stress-mindset scores was entered in the regression analysis as dependent variable, condition as independent variable, and age as moderating variable. To see if a moderation effect occurred, the *p*-value for the interaction in the PROCESS output is crucial. If it is below .05, there is a significant moderation effect; if the *p*-value is .05 or higher, there is no significant moderation effect.

Results

Baseline Characteristics

Table 1 includes all valid participants who filled in the baseline and post-test survey. In total, there were 88 participants with a mean age of 35.8 years (*SD* = 17.2). The majority was female (61.4%), middle educated (60.2%), and employed (62.5%). There were no significant differences between intervention and control group on all baseline characteristic measures.

Table 1

Baseline Characteristics of Participants in the Intervention and Control Group.

	Intervention Group (n = 44)	Control Group (n = 44)	*p*-value
Age, *M (SD)*	37.1 (18.3)	34.5 (16.2)	0.483
Gender, *n (%)*			0.661
Male	16 (36.4)	18 (40.1)	

Female	28 (63.6)	26 (59.9)	
Education, *n (%)*			0.357
Low	6 (13.6)	4 (9.1)	
Middle	29 (65.9)	24 (54.5)	
High	5 (11.4)	11 (25.0)	
Other	4 (9.1)	5 (11.4)	
Employment status, *n (%)*			
Paid employment	26 (59.1)	24 (54.5)	0.667
Unemployed or unable to work	0 (0)	0 (0)	
Retiree, student, or homemaker	18 (40.9)	20 (45.5)	

Dropouts

The mean age of the 10 participants who dropped out was 31.7 years (*SD* = 14.1), with the majority being male (60.0%), middle educated (70%), and being a retiree, student or homemaker (70.0%). There were no significant differences between participants who completed the study and those who dropped out on all baseline characteristic measures. However, there was a marginally significant difference in employment status between completers and dropouts ($p = 0.069$). Of those, who completed the study, 60.3% were employed and only 39.7% were a retiree, student, or homemaker; while of those, who dropped out, only 30% were employed, but 70% were a retiree, student, or homemaker. This tendency indicates that retirees, students, and/or homemakers were more likely to drop out, yet, the difference is only marginally significant and should be interpreted with caution.

Changeability of Stress-Mindset

The results of the independent t-test demonstrated that directly after reading the intervention or control text, the shift towards a stress-is-enhancing-mindset was significantly larger in the intervention group (M = 3.66, SD = 5.02) compared to the control group (M = 1.43, SD = 3.90); t (86) = 2.33, p = 0.022. However, at follow-up, the shift towards a stress-is-enhancing-mindset was not significantly larger in the intervention group (M = 2.64, SD = 4.59) compared to the control group (M = 1.42, SD = 3.89); t (76) = 1.26, p = 0.211. These results suggest that the intervention influenced the shift in people's stress-mindset directly after the intervention at post-test but that these effects did not maintain up to one-week follow-up. Hence, the first hypothesis is partly accepted and partly rejected.

Moderation Effect of Age

The results of the moderation analysis using the PROCESS tool by Hayes (2012) demonstrated that age did not have a moderating effect on the relationship between condition and change in stress-mindset at post-test (b = -0.008, 95% CI [-0.120, 0.105], t = -0.13, p = .894) and follow-up (b = 0.008, 95% CI [-0.105, 0.120], t = 0.14, p = .889). This finding indicates that younger people are no more likely to experience a shift in stress-mindset than do older people. Accordingly, the second hypothesis is rejected.

Discussion

This study aimed at investigating whether people shift from a rather stress-is-debilitating to a more stress-is-enhancing-mindset after receiving information about the enhancing aspects of stress. Furthermore, this study aimed at inspecting if there is a moderation effect of age on the relation between condition and shift in stress-mindset.

Changeability of Stress-Mindset

The results showed that a person's stress-mindset can be shifted from a rather stress-is-debilitating to a more stress-is-enhancing-mindset directly after a brief intervention where participants had to read a text. This is in line with previous studies. Crum et al. (2013) showed by implementing a different kind of intervention – namely showing three different videos – that stress-mindsets can be changed. Moreover, Chiu et al. (1997) demonstrated that an intervention consisting of reading a text with the aim of altering a person's mindset can be effective, yet, they focused on the mindset about personality traits.

However, in this study, the shift in stress-mindset disappeared at post-test. This indicates that only reading an article that briefly states positive aspects of stress is ineffective to change a person's stress-mindset that was built up over several years. A study by Aronson et al. (2002) also shows that even though an intervention that was aimed at changing a participant's mindset had a short-term effect, this change can cease in the long-term (Aronson et al., 2002). Hence, the results of the present study are in line with previous research.

Moderating Effect of Age

Furthermore, the results showed that age does not moderate the relationship between condition and shift in stress-mindset. This means that older people are neither less nor more likely to shift their stress-mindset after reading about the enhancing aspects of stress as compared to younger people. This stands in contrast to findings of previous research. Khoshtaria (2017) found that in Georgia, openness for change is higher in younger people than in older people. This finding was supported by Tulviste et al., (2016) for several countries with the conclusion that the tendency of younger people being more open to change compared to older people is a general pattern. Moreover, Krosnick and Alwin (1989) showed that the likelihood to change is highest in the early adult years and Alwin and Krosnick (1991) demonstrated that attitude stability increases with age.

There are various explanations for the difference in the findings of this study – namely that age does not have an effect on the shift in stress-mindset – and the findings from previous studies – that younger people are most open to change and that stability in attitude increases with age (Alwin & Krosnick, 1991; Khoshtaria, 2017; Krosnick & Alwin, 1989; Tulviste et al., 2016). One possible explanation is that the studies by Khoshtaria (2017) and Tulviste et al. (2016) only examined people's openness to change by asking in how far they find themselves similar to descriptions of people with certain values (such as openness to change) and inferred from this in how far the participants value openness to change. The current study, however, did not rely on self-reported openness to change, but on calculated change in stress-mindset. Therefore, it is crucial to make a distinction between the anticipated openness to attitude change on the one hand and the occurrence or calculation of attitude change on the other hand.

Another explanation for the difference in findings is the limited generalizability of one concept for other concepts. The studies by Alwin and Krosnick (1991) and Krosnick and Alwin (1989) assessed stability of attitude concerning politics, which is a different concept than change in stress-mindset. Thus, a different mechanism may underlie a change in the concept 'political attitude' compared to the concept 'stress-mindset'. As a result, changeability in political attitude might not be generalizable to changeability concerning other attitudes/mindsets, like the stress-mindset.

A third possible explanation is that Alwin and Krosnick (1991) showed an increase in attitude stability with age, yet, this does not exclude change in attitude. A person might have a stable attitude but is open to change this attitude as soon as he/she sees good reasons to do so. With this comes another restraint to the conclusion of the studies by Krosnick and Alwin (1989) and Alwin and Krosnick (1991). Both times they did not give an incentive to change, that is, they did not present a reason why the people should change their political attitude. This is different from the present study, since participants read about the enhancing aspects of

stress and thus, had good reason to change their stress-mindset to a more stress-is-enhancing-mindset. If no incentive to change is given, it is important to take into account how often people in different age groups face experiences that cause change in attitude or mindset when drawing a conclusion about age-related openness to change.

Moreover, the findings of this study are supported by Tyler and Schuller (1991) who found that older people are as open to change as younger people and proposed that older people alter their attitudes when there is a sound rationale to support a change. This assumption is reinforced by the study of Tuokko, McGee, Gabriel, and Rhodes (2007), who examined older people about their openness to modify their style of driving. Their study showed that the majority of these participants were inclined to contemplate the prospect of altering their driving behaviour after attending a driver education program.

At first, the findings of the current study seem to stand in contrast to previous research, however, a closer look reveals that differences in evaluating openness to change, limited generalizability due to investigating a different concept, and discrepancies in manipulation might be the cause for the apparent disparity to earlier studies. Moreover, there is also previous literature supporting the findings of this study, which supports the reliability of the present study despite of the apparent differences to other former literature.

Strengths and Limitations

The strengths of this study include the representativeness of the sample, with a wide age range from 18 to 84 years and different educational levels ranging from low to high. Moreover, a strong design was used, namely a randomized controlled trial which yields the most reliable data on the effectiveness of interventions addressing health care (Moher et al., 2010). Another strong point is the use of an already verified stress-mindset-measure by Crum et al., (2013) to minimize measurement error. The chosen design as well as the verified SMM imply high validity and reliability of this study.

When interpreting the results, some limitations should be taken into account. One limitation lies within the sample: Only Germans were included, and the baseline characteristics show that no unemployed people participated in the study. This poses a constraint towards the generalizability of the results. To overcome this limitation, a greater sample with more nationalities and all job statuses – including unemployed persons – should be adopted for future research.

Furthermore, the intervention took place only at one point in time. This had negative consequences for the study's effectiveness. First, the impact of the intervention could be greater if the manipulation was more extended, that means if participants had to read different articles about the positive aspects of stress at more than one point in time. The study by Crum et al. (2013) supports this recommendation, since their intervention consisted of three different videos that the participants watched at an interval of 2-3 days and their study showed a change in stress-mindset 2-3 days after the last video was shown. Secondly, some participants reported that they skipped the text, however, it is unknown how many others did not read the text or just skimmed through it and thus, the intervention was not fully effective for them. This limitation could have been avoided by implementing the intervention at different points in time to increase the effect of the intervention even when the participant only skims through the manipulation text. An additional way to avoid this limitation is to give participants the possibility to go back to the text after they already pressed the "next" button. Another solution can possibly overcome all three limitations concerning the decreased effectiveness of the intervention, namely instead of letting the participants read a text, they could be shown a video about the enhancing aspects of stress. This would increase the effectiveness of the intervention, since information that is heard and seen can be better remembered than information that is only read by a person (Broadbent et al., 2018; Shams & Seitz, 2008). Furthermore, the participant would easily recognise that the manipulation text is not another form of an informed consent text – since some participants communicated to the

researchers that they skipped the text because they first thought it would be another informed consent. This would most likely lead to an increase in participants who actually received the intervention.

Moreover, the quality of the manipulation texts was not tested beforehand, which could have led to diminished effectiveness due to the style of writing, its structure and other criteria. To reduce this limitation, before composing a manipulation text, the investigators should look at previous research that analysed what makes a text persuasive. To further enhance the quality of the manipulation text, a pilot study could be implemented where the participants can rate the persuasiveness of the text and give recommendations on how to improve it.

Lastly, some participants dropped out because they forgot to fill in the follow-up survey despite the reminder e-mail. This led to a decreased sample size and loss of data. As a reason, some participants mentioned that they did not see the e-mail early enough because they do not check their e-mails every day. To avoid this problem a different channel of contacting the participants could be implemented. For example, every researcher could remind the participant she recruited via a personal text message to fill in the survey. Another solution is that the participant will be asked in the beginning how he/she would like to be contacted and if desired can give the phone number. Then the independent researcher would send a text message directly to the phone with the link for the survey. Hence, the study would be more adapted to the participant's needs, especially for those who do not check their e-mails on a daily basis, as well as adopt more contemporary methods of conducting research.

Future Research and Implications

This study holds promising results with an indication that stress-mindset can indeed be changed regardless of age. However, since stress-mindset is a relatively new topic, it is most important for now to focus on conducting further research about stress-mindset. It should be

investigated how long-term change in stress-mindset can be achieved – for example by exploring different channels like using applications or group interventions to see which one is more effective in the long-term. Additionally, other possible moderators should be analysed like education or job level. These can have an influence on the changeability of a person's stress-mindset since lower educated people might not fully understand the manipulation text and people with a low-status job experience increased stress (Lundberg, 1999). This can have an impact on how stress is perceived and how a positive change in stress-mindset can be achieved.

Nevertheless, psychologists should be educated about what is already known about stress-mindset, for example different types of stress-mindsets (enhancing versus debilitating), the consequences of holding a stress-is-enhancing as compared to a stress-is-debilitating-mindset, and the possibility of changing a person's stress-mindset through interventions regardless of age. This is beneficial so that psychologists know what still needs to be researched while simultaneously the current findings can be implemented in the psychologist's workplace to influence people's stress-mindsets positively.

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Appendix 1: Instructions for Participants and Informed Consent

Herzlich Willkommen!

Das Ziel unserer Studie ist zu untersuchen, wie Menschen neue Informationen wahrnehmen. Diese Studie besteht aus drei Teilen. Der erste Teil beginnt, nachdem Sie diese Einverständniserklärung gelesen und ihr zugestimmt haben. Wenn Sie zustimmen, teilzunehmen, werden Sie automatisch zu der Studie weitergeleitet. Der erste Fragebogen wird etwa 20 bis 30 Minuten dauern. Bitte füllen Sie diesen Fragebogen spätestens am 5. April aus, um an der Studie teilnehmen zu können.

Am Mittwoch, dem 10. April werden Sie eine E-Mail mit dem Link für den zweiten Fragebogen erhalten. Sie werden ebenfalls Informationen zum Lesen bekommen. Dieser Fragebogen (inklusive des Lesens) wird ungefähr 15 Minuten dauern. Am Ende, am Dienstag 16. April werden Sie eine E-Mail mit dem Link für den letzten Fragebogen erhalten, welcher ungefähr 10-15 Minuten dauern wird. Bitte füllen Sie jeden Fragebogen innerhalb von 3 Tagen aus. Jeder Fragebogen erhält einige Fragen über Ihre Persönlichkeit und Ihr Wohlergehen.

Ihre Daten werden ausschließlich online erfasst und vertraulich behandelt. Daher nutzen wir Ihren Namen und E-Mail Adresse nur, um Ihnen die drei personalisierten Fragebögen zu schicken. Alle Daten werden durch eine Teilnehmernummer identifiziert, nicht durch Ihren Namen. Während der Forschungsperiode werden Ihre Daten mit größter Vertraulichkeit behandelt und sind nur der Hauptforscherin Dr. Marijke Schotanus-Dijkstra zugänglich. Ihre Daten unterliegen in allen veröffentlichten und schriftlichen Formen dem Datenschutz. Die Teilnahme in dieser Studie ist freiwillig. Wenn Sie sich dazu entscheiden teilzunehmen, werden Sie gefragt, dieser Einverständniserklärung zuzustimmen. Danach haben Sie immer noch die Möglichkeit, jederzeit die Studie zu beenden, ohne einen Grund für die Beendigung zu nennen.

Wenn Sie Fragen oder Anmerkungen zu der Studie haben, kontaktieren Sie bitte Dr. Marijke Schotanus-Dijkstra (m.schotanus@utwente.nl). Forscher Natascha Berden, Morticia Boroch, Helen Brand, Pia Hülsmann, Miriam Kebernik, Carina Schreiber, Lara Watermann, Felizia Wellinger Unter der Leitung von Marijke Schotanus-Dijkstra University of Twente. Ich habe die oben genannte Information 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.

English version:

Welcome to the study!

The purpose of this study is to investigate how people perceive new information. This study consists of three 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 to 30 minutes. Please complete this survey before the 05.04. to be able to participate in this study.

On Wednesday - 10.04. - you will receive an email with a link to the second survey. You will also receive some information to read. This survey (including the reading) will take approximately 15 minutes. Finally, on Tuesday - 16.04. - you will receive an email with a link to the final survey which will take approximately 10-15 minutes. Please complete each survey within 3 days. Each survey contains some questions about your personality and wellbeing.

Your data will be collected entirely online and treated confidentially. Therefore, we use your name and email address only for sending you the three personalized surveys. 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 dr. Marijke Schotanus-Dijkstra (m.schotanus@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.

Appendix 2: Debriefing Document at the End of the Study

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 XX 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) mithilfe 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)

English version:

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, XX 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)

Appendix 3: Text Containing Information about Stress

Wussten Sie, dass Stress sehr vorteilhaft für Ihre Gesundheit und Ihr persönliches Wachstum sein kann? Auch wenn Stress in den Medien und von vielen unserer Mitmenschen als negativ dargestellt wird, hat er auch eine positive Seite. Zum Beispiel haben Menschen, die glauben, dass Stress positiv ist, ein höheres Energielevel sowie bessere Arbeitsleistungen, sind generell mehr mit ihrem Leben zufrieden und zeigen zudem weniger Depressions- oder Angstsymptome. Wie interpretieren Sie eine stressige Situation? Empfinden Sie die Situation als negativ oder positiv?

Studien haben kürzlich herausgefunden, dass Stress den Körper und das Gehirn in einen optimalen Zustand setzt, um Leistung zu erbringen. Dabei wird die Aufmerksamkeit auf die zu erfüllende Aufgabe fokussiert und dadurch wird das Gedächtnis und die Leistungsfähigkeit gesteigert. Stress ist also ein wichtiger Bestandteil, um sowohl alltägliche Aufgaben als auch schwierige Herausforderungen zu meistern. Aus diesem Grund sind Menschen, die Stress als einen notwendigen und positiven Aspekt des Lebens betrachten, eher dazu veranlagt, erfolgreicher und glücklicher zu sein.

Insgesamt lässt sich sagen, dass der Glaube daran, dass Stress positiv ist, eine sehr vorteilhafte Wirkung auf Ihr persönliches Wachstum, Ihre Leistungsfähigkeit und Ihre Gesundheit haben kann.

English version:

Did you know that stress is beneficial for your health and personal growth? Although stress is being portrayed in a negative way in the media and by the people around us, there is also a positive side of experiencing stress. For example, people who believe that stress is positive have higher energy levels, show better workplace performance, are more satisfied with their life in general and have fewer symptoms of depression and anxiety. How do you interpret a stressful situation? Do you find stress negative or positive?

Recent scientific studies have shown that experiencing stress puts the body and the brain in an optimal condition to function in order to fulfill the demands and tasks asked for. Therefore, the attention is focused on the demands and this will boost memory and performance. Stress is an essential ingredient of being able to fulfill everyday tasks as well as more difficult challenges. Thus, individuals who perceive stress as a necessary and positive aspect of life are more likely to succeed and feel happy.

Taken together, if you believe that stress is positive, this can have a great beneficial impact on your personal growth, performance and your health.

Appendix 4: Text Containing Information about Personality

Wussten Sie, dass “the Big Five” nicht nur Tiere sind, sondern auch Ihre Persönlichkeit erklären? Während sich “the Big Five” in Afrika auf die fünf am schwierigsten zu jagenden Wildtiere bezieht - den Löwen, den Leoparden, das Nashorn, den Elefanten und den Büffel - benutzen Psychologen den Ausdruck “the Big Five”, um die fünf Kerneigenschaften Ihrer Persönlichkeit zu beschreiben:

Offenheit für Erfahrungen: Neugierde, weites Interessenspektrum und offen neue Dinge zu probieren

Gewissenhaftigkeit: Bedächtigkeit, Planung, Organisation und Aufmerksamkeit fürs Detail

Extraversion: kontaktfreudig, gesprächig, durchsetzungsfähig und selbstbewusst, aufgeschlossen und energiegeladen.

Verträglichkeit: treu, gütig, kooperativ, und sorgend um andere Leute

Neurotizismus: emotional instabil, Stimmungsschwankungen und Neigung zu negativen Verstimmungen Neueste wissenschaftliche Studien zeigen, dass sowohl biologische als auch umweltliche Einflüsse eine Rolle in der Persönlichkeitsentwicklung spielen. Außerdem sollen diese fünf großen Persönlichkeitszüge im Erwachsenenalter relativ stabil sein. Wichtig zu wissen ist, dass jeder dieser fünf Persönlichkeitsfaktoren einen Bereich zwischen zwei Extremen darstellt. Zum Beispiel starke Extraversion im Gegensatz zu starker Introversion, und Neurotizismus (emotionale Instabilität) im Gegensatz zu emotionaler Stabilität. In der Realität liegen die meisten Leute irgendwo zwischen den beiden Extremen jeder Persönlichkeitsdimension.

English version:

Did you know that ‘The Big Five’ are not only animals but also indicate your personality? While the big five animals in Africa refer to the five animals most difficult to hunt on foot - the lion, leopard, rhinoceros, elephant and cape buffalo - psychologists use the term to

describe the five core traits of your personality:

Openness to experience: curious, broad range of interests, try new things.

Conscientiousness: thoughtfulness and planning, organized, attention to detail.

Extraversion: sociable, talkative, assertive, outgoing and energized.

Agreeableness: trust, kindness, cooperative, care about other people.

Neuroticism: emotional unstable, mood swings, gets upset easily.

Recent scientific studies have shown that both biological and environmental influences play a role in shaping our personalities. Studies also suggest that these big five personality traits tend to be relatively stable over the course of adulthood. It is important to note that each of the five personality factors represents a range between two extremes. For example, extreme extraversion versus extreme introversion, and neuroticism (emotional instability) versus emotional stability. In the real world, most people lie somewhere in between the two polar ends of each dimension. Taken together, your personality can be categorized into five main personality traits which are relatively stable.

Appendix 5: Items and Instructions for the Stress Mindset Measure in German

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

Bitte benutzen Sie die angegebene Skala für alle 8 Aussagen.

0 = Stimme absolut nicht zu

1 = Stimme nicht zu

2 = Neutral (stimme weder zu noch dagegen)

3 = Stimme zu

4 = Stimme absolut zu

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, verbessert 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 sollten genutzt werden.

English version:

Rate the extent to which you agree or disagree with the following questions:

(scoring: use this scale for all 8)

0 = Strongly Disagree

1 = Disagree

2 = Neither Agree nor Disagree

3 = Agree

4 = Strongly Agree

1. *The effects of stress are negative and should be avoided.*
2. *Experiencing stress facilitates my learning and growth.*
3. *Experiencing stress depletes my health and vitality.*
4. *Experiencing stress enhances my performance and productivity.*
5. *Experiencing stress inhibits my learning and growth.*
6. *Experiencing stress improves my health and vitality.*
7. *Experiencing stress debilitates my performance and productivity.*
8. *The effects of stress are positive and should be utilized.*