

# Improving stress mindset through education and imagery

Williams, Sarah; Ginty, Annie

DOI:

[10.1080/10615806.2023.2279663](https://doi.org/10.1080/10615806.2023.2279663)

License:

Creative Commons: Attribution-NonCommercial-NoDerivs (CC BY-NC-ND)

*Document Version*

Publisher's PDF, also known as Version of record

*Citation for published version (Harvard):*

Williams, S & Ginty, A 2023, 'Improving stress mindset through education and imagery', *Anxiety, Stress and Coping*. <https://doi.org/10.1080/10615806.2023.2279663>

[Link to publication on Research at Birmingham portal](#)

## General rights

Unless a licence is specified above, all rights (including copyright and moral rights) in this document are retained by the authors and/or the copyright holders. The express permission of the copyright holder must be obtained for any use of this material other than for purposes permitted by law.

- Users may freely distribute the URL that is used to identify this publication.
- Users may download and/or print one copy of the publication from the University of Birmingham research portal for the purpose of private study or non-commercial research.
- User may use extracts from the document in line with the concept of 'fair dealing' under the Copyright, Designs and Patents Act 1988 (?)
- Users may not further distribute the material nor use it for the purposes of commercial gain.

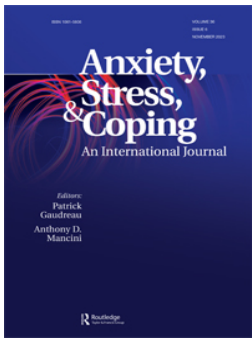
Where a licence is displayed above, please note the terms and conditions of the licence govern your use of this document.

When citing, please reference the published version.

## Take down policy

While the University of Birmingham exercises care and attention in making items available there are rare occasions when an item has been uploaded in error or has been deemed to be commercially or otherwise sensitive.

If you believe that this is the case for this document, please contact [UBIRA@lists.bham.ac.uk](mailto:UBIRA@lists.bham.ac.uk) providing details and we will remove access to the work immediately and investigate.



# Anxiety, Stress, & Coping

## An International Journal

ISSN: (Print) (Online) Journal homepage: <https://www.tandfonline.com/loi/gasc20>

# Improving stress mindset through education and imagery

Sarah E. Williams & Annie T. Ginty

**To cite this article:** Sarah E. Williams & Annie T. Ginty (12 Nov 2023): Improving stress mindset through education and imagery, *Anxiety, Stress, & Coping*, DOI: [10.1080/10615806.2023.2279663](https://doi.org/10.1080/10615806.2023.2279663)

**To link to this article:** <https://doi.org/10.1080/10615806.2023.2279663>



© 2023 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group



[View supplementary material](#)



Published online: 12 Nov 2023.



[Submit your article to this journal](#)





[View related articles](#)



[View Crossmark data](#)

# Improving stress mindset through education and imagery

Sarah E. Williams <sup>a</sup> and Annie T. Ginty <sup>b</sup>

<sup>a</sup>School of Sport, Exercise, and Rehabilitation Sciences, University of Birmingham, Birmingham, UK; <sup>b</sup>Baylor Psychology and Neuroscience Department, Baylor University, Waco, TX, USA

## ABSTRACT

**Background:** Research suggests interventions such as education and imagery can elicit a greater stress-is-enhancing mindset. The present study examined the individual and combined effect of stress-is-enhancing education and/or imagery delivered virtually in altering stress mindset. Three 3-minute online video interventions: (1) education, (2) imagery, (3) education with imagery were compared to each other and a control comparison.

**Design and Methods:** Participants ( $N = 164$ ; 103 = female;  $M_{age} = 20.03$ ,  $SD = 1.39$  years) completed the Stress Mindset Measure (SMM) before being randomly assigned to a group to watch a three-minute video and completing the SMM again.

**Results:** The 2-time  $\times$  4-group ANOVA showed a significant time effect,  $F(1, 158) = 50.45$ ,  $p < .001$ ,  $\eta_p^2 = .242$ , no group effect,  $F(3, 158) = 0.89$ ,  $p = .449$ ,  $\eta_p^2 = .017$ , and a significant time  $\times$  group interaction,  $F(3, 158) = 4.48$ ,  $p = .005$ ,  $\eta_p^2 = .078$ . All three experimental groups reported greater stress-is-enhancing mindset post-intervention compared to pre-intervention. At post-intervention the education with imagery group had a significantly more stress-is-enhancing mindset compared to the control group.

**Conclusions:** Results suggest that online stress mindset videos may be effective with a combined stress education and imagery intervention being most effective.

## ARTICLE HISTORY

Received 3 April 2023

Revised 25 October 2023

Accepted 31 October 2023


## KEYWORDS

coping; imagery; online interventions; resilience; stress optimization

## Introduction

While stress can have negative effects on health and wellbeing (e.g., Cohen et al., 2007; Epel et al., 2018; McFarlane, 2010; Steptoe & Kivimaki, 2012), some research demonstrates stress can also lead to adaptive physiological and psychological functioning (e.g., Epel et al., 1998; Linley & Joseph, 2004). Stress mindset is the extent to which an individual believes stress to have positive benefits or negative benefits on outcomes such as performance and productivity, learning and growth, and health and vitality (Crum et al., 2013). A more stress-is-enhancing mindset is associated with more adaptive responses to stress (Crum et al., 2013). For example, research has demonstrated a more stress-is-enhancing mindset is associated with better performance during stress, greater positive affect, lower levels of perceived stress, lower anxiety and depressive symptoms, and higher levels of tolerance of uncertainty (Casper et al., 2017; Crum et al., 2013; Crum et al., 2017; Huebschmann & Sheets, 2020; Jiang et al., 2019; Keech et al., 2018; Keech et al., 2020).

**CONTACT** Sarah E. Williams  s.e.williams@bham.ac.uk   <https://www.linkedin.com/in/sarah-williams-47846012a/>  @DrSarahWilliams

 Supplemental data for this article can be accessed online at <https://doi.org/10.1080/10615806.2023.2279663>.

© 2023 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group

This is an Open Access article distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivatives License (<http://creativecommons.org/licenses/by-nc-nd/4.0/>), which permits non-commercial re-use, distribution, and reproduction in any medium, provided the original work is properly cited, and is not altered, transformed, or built upon in any way. The terms on which this article has been published allow the posting of the Accepted Manuscript in a repository by the author(s) or with their consent.

Importantly, stress mindset can be altered through interventions. One common intervention technique is the use of short (~3-minute) videos to educate individuals on either the positive (stress-is-enhancing mindset videos) or adverse (stress-is-debilitating mindset videos) effects of stress. Experimental studies have demonstrated that a stress-is-enhancing video intervention successfully elicits a more stress-is-enhancing mindset compared to control (Crum et al., 2013) and stress-is-debilitating videos (Baynard-Montague & James, 2023; Crum et al., 2013; Crum et al., 2017).

Recently, Keech et al. (2021) examined the effectiveness of combining a stress education intervention (i.e., educating about the negative and positive consequences of stress) with an imagery intervention. Briefly, participants engaged in the education piece and a brief practice imagery part where they imagined a “tangy lemon.” Then participants were asked to think about the potential positive consequences of the stress in their life, and imagine things they can do to experience these positive consequences. Keech et al. (2021) explained that imagery’s stimulation of neural networks related to what is being imagined may make them salient and accessible when the individual is in a similar situation.

Keech et al. (2021) demonstrated the stress education and imagery combined intervention elicited a more stress-is-enhancing mindset from baseline to post-intervention compared to the control condition. However, it is unclear whether the change in stress mindset was a result of the combined effect of stress education and imagery interventions or whether this was driven by the education about stress or the imagery of succeeding during stress. It may be possible that combining the techniques of educating participants about stress (similar to the videos employed by Crum et al., 2013, 2017) and implementing imagery scripts reinforcing the positive consequences of stress (similar to those employed by Williams et al., 2010, 2017) is more effective in eliciting a more effective stress mindset than use of one technique alone. Indeed, previous research examining how stress mindset may influence outcomes suggested that stress mindset interventions that additionally address proactive coping may be more beneficial (Keech et al., 2018). Brief imagery scripts of confidence, more positive anxiety, and adaptive psychophysiological responses to stress have been effective in eliciting more positive appraisals of and responses to stress (Cumming et al., 2007; Williams et al., 2010; Williams et al., 2017). This may be because imagery allows an individual to rehearse how they could respond to a future event such as a stressful situation which may in turn influence behavior as well as how they perceive these events (Conroy & Hagger, 2018; Pham & Taylor, 1999; Williams et al., 2017). Furthermore, Bioinformational theory proposes that when an individual includes response propositions (i.e., the physiological responses of the actual situation) into an image they will experience an actual physiological response which is thought to be the mechanism through which behaviors can be modified (Lang, 1979). By combining mental imagery with a stress-mindset education intervention, the individual has the opportunity to apply the newly learned information to an image of a stressful scenario and experience proactively coping to reinforce this behavior.

The present study aimed to extend previous work by examining the individual and additive effect of stress-is-enhancing education and/or imagery delivered virtually in altering stress mindset. More specifically, the present study examined effectiveness of three brief (3-minute) online stress mindset video interventions: (1) education, (2) imagery, (3) education with imagery, in eliciting a more stress-is-enhancing mindset. These interventions were compared to a control comparison video. It was hypothesized that while all three intervention conditions would be effective in eliciting a stress-is-enhancing mindset from pre- to post-intervention, the increases in stress-is-enhancing mindset would be greatest for the education with imagery condition.

## Methods

### Participants

*A priori* power analyses using a power set at 0.80 and  $\alpha = .05$  suggested a sample of 128 participants was needed to detect a small to moderate effect ( $f = .15$ ). To account for potential

missing data, a total of 164 participants (male = 57, female = 103, non-binary = 1, cisgender = 1, gender fluid = 1, prefer not to say = 1) between the ages of 18 and 28 (Mean = 20.03 years, Standard Deviation = 1.39) years took part in the study. Participants were university students recruited from universities throughout the United Kingdom (U.K.). Inclusion criteria included being proficient in English and not experiencing a medically diagnosed mental health condition at the time of testing. The research was approved by the university's Institutional Review Board of the first author (ERN\_21-1177) and all participants provided informed consent before taking part in the study.

## **Procedures**

Participants were recruited from a variety of university sports teams, and societies throughout the U.K. by emailing "contact us" email addresses, social media posts, and word of mouth. Data collection ran from November 2021 to May 2022. Participants completed the study via Qualtrics, a secure online platform which contained the questionnaires and access to the video interventions. Participants accessed the study through an online link which took participants to an information page about the study. All participants provided informed consent. After consent was obtained, participants moved to the next page in which the study commenced. First, participants completed surveys measuring demographic information and baseline stress mindset. Participants were then randomly assigned to one of the 4 intervention groups using Qualtrics' randomization process; (1) education ( $n = 38$ ; female = 23, male = 12, gender fluid = 1, cassgender = 1, prefer not to say = 1), (2) imagery ( $n = 41$ ; female = 27, male = 14), (3) education with imagery ( $n = 42$ ; female = 23, male = 18, non-binary = 1), and (4) control ( $n = 43$ ; female = 30, male = 13). Participants then watched the intervention video they were assigned to before completing some post-intervention manipulation checks and were reassessed in their stress mindset. Overall study completion took 15–20 min and as a thank you for taking part, participants had the option of being entered into a prize draw to win up to £100 worth of Amazon gift cards. Please see the supplementary materials for a description of the open science practices employed and how the data can be accessed.

## **Measures**

### **Stress mindset**

Stress mindset was assessed using the Stress Mindset Measure (SMM; Crum et al., 2013). The SMM consists of 8-items (e.g., "The effects of stress are positive and should be utilized") that assess the extent to which individuals believe stress is either debilitating or enhancing. Responses to all items are made on a 5-point Likert-type scale (0 = strongly disagree to 4 = strongly agree). Negatively worded items (e.g., "Experiencing stress depletes my health and vitality") are reverse scored and all items are averaged with a higher score indicating a more stress-is-enhancing mindset. The SMM has been a valid and reliable measure of stress mindset (Crum et al., 2013). In the present study, the SMM had good internal reliability both pre- ( $\alpha = .81$ ) and post-intervention ( $\alpha = .83$ ).

### **Post-intervention manipulation checks**

A single item measured intervention engagement (e.g., "when watching the video, how much of the time were you engaged in the content?") with responses made on a 7-point Likert scale ranging from 1 (none of the time) to 7 (all of the time) so a higher score reflected better engagement. In the two intervention groups containing imagery, a second item assessed how easy or hard it was for participants to imagine the scenario described to them. Responses were made on a 7-point Likert scale ranging from 1 (very hard to image) to 7 (very easy to image) so a higher score reflected better imagery ability.

### ***Stress mindset interventions***

All videos were created and recorded in PowerPoint before being uploaded to YouTube as a video file. They were based on the early work of Crum et al. (2013) but also incorporated the more recent work of Keech et al. (2021) advocating that “interventions aimed at encouraging more adaptive stress mindsets should present that stress ‘can be’ rather than ‘is’ enhancing” (p. 124). The videos were then embedded into the Qualtrics survey for the participants to watch depending on their assigned group. All videos were approximately 3 min in length and were matched in terms of number of slides, number of images, color scheme, and background music, and were matched as closely as possible regarding the amount of information presented on each slide. Thus, the difference between the interventions was the content of the text participants were presented with. Participants were unable to move onto the post-intervention questions until the videos had concluded. Links to all videos can be accessed in the supplementary materials.

### ***Education video***

The education video was based on the 3-minute video interventions used by Crum et al. (2013) and were designed to educate participants that stress can be beneficial. Statements such as “it is often peak pressure which acts as fuel for peak performance” were included to try to highlight that stress can enhance performance, and participants told that both physical and psychological responses to stress are normal responses and should be embraced through statements such as “don’t fear stress ... embrace it and achieve success.” The video also provided real-world examples of when performance can be enhanced by conditions of stress such as elite athletes, politicians, and surgeons who can all perform their best under the most stressful or pressurized situations.

### ***Imagery video***

The imagery video contained a short imagery script based on those employed by Williams et al. (2010, 2017) which has been effective in altering perceptions of stress and the experienced responses. The video encouraged individuals to imagine themselves experiencing stress but performing well with the aim of exposing the participants to the possibility that stress could be beneficial. Participants were asked to think about a previously stressful situation where they managed to cope or perform well such as a job interview. They were asked to imagine feelings and physical responses while also being successful to demonstrate how stress can elicit responses to help people perform better and be more likely to succeed. Participants were also asked to imagine possible future stressful situations they may encounter and “imagine rising to the occasion and performing incredibly well, showing what you are truly capable of.”

### ***Education with imagery video***

The imagery group video was a combination of content from both the education and imagery videos to educate participants on the benefit of stress and get them to imagine experiencing stress while experiencing a positive outcome. Consequently, some of the slides used in the education video were combined with some of the slides used in the imagery video. This combined video consisted of the same number of slides as each of the education and imagery videos.

### ***Control video***

The control group video educated participants about The Big Five personality constructs of neuroticism, agreeableness, extraversion, conscientiousness and openness. This was in an attempt to avoid any mention of stress mindset but still expose participants to an educational type of video. Examples of characteristics thought to be reflective of each personality trait were provided (e.g., openness examples: being curious, having a broad range of interests, and trying new things). The video purposefully avoided any mention of stress, stress mindset, or the ability to cope with stress.

## Data analysis strategy

Data were downloaded from Qualtrics and all statistical analysis was performed using SPSS (Version 28). Individuals ( $n = 84$ ; not included in the participant's section above) who partially completed the questionnaire pack were assumed to have withdrawn from the study part way through and thus their data was excluded and destroyed. Data from the 164 participants included in the study were retained and inspected for missing values. Missing values were identified for the following variables: ease of imaging ( $n = 9$ ), pre-stress mindset ( $n = 1$ ), post-stress mindset ( $n = 1$ ) and video engagement ( $n = 14$ ). Little's MCAR test suggested that data was completely missing at random,  $\chi(96) = 84.94, p = .783$ . For a more a more detailed exploration of the missing data please see Supplementary Table 1 in the supplementary materials. Participants with missing data were excluded from the analysis containing that particular data which is reflected in the variations in degrees of freedom.

First a chi-square and one-way ANOVA were run to determine any group differences in gender allocation across groups and any gender differences in baseline stress mindset. To investigate any differences in video engagement (all groups) or ease of imaging (two groups who received imagery), separate one-way ANOVAs were conducted. For the main analysis, a 2-time (pre-intervention, post-intervention)  $\times$  4-video (education, imagery, education and imagery, personality) ANOVA examined whether there were any changes in stress mindset from pre- to post-intervention and whether any interventions were more effective than the others. For all analysis, the critical alpha level was set to .05, partial eta squared was reported as the effect size, and any significant differences were followed up using Bonferroni post-hoc pairwise comparisons. Although not part of the study aims, some post hoc exploratory analyses were conducted to examine whether demographic characteristics such as gender and age as well as video engagement influenced intervention effectiveness. Details regarding this additional post-hoc analysis and results (which are largely unchanged from the main analysis) are reported in the supplementary materials.

## Results

### Group differences and post-intervention manipulation checks

A chi-square analysis showed no statistically significant differences in gender breakdown across the four groups ( $\chi[15] = 14.87, p = .461$ ) and a one-way ANOVA showed no statistically significant differences in baseline stress mindset between males ( $M = 2.20; SD = 0.61$ ) and females ( $M = 2.20; SD = 0.67$ ),  $F(1, 157) = 0.01, p = .945, \eta_p^2 < .001$ . Consequently, remaining data analysis collapsed gender. Means and standard deviations of video engagement and ease of imaging for the different groups are reported in Table 1. Average engagement scores were between 5 and 6, suggesting all intervention videos were relatively engaging and well received by participants. The one-way ANOVA found no statistically significant differences in video engagement between all groups,  $F(3, 146) = 2.58, p = .056, \eta_p^2 = .050$ . Mean ease of imagery scores in both imagery groups was between 5 and 6, suggesting they found the intervention relatively easy to image. A one-way ANOVA indicated no statistically significant group differences between interventions,  $F(1, 72) = 2.54, p = .116, \eta_p^2 = .034$ .

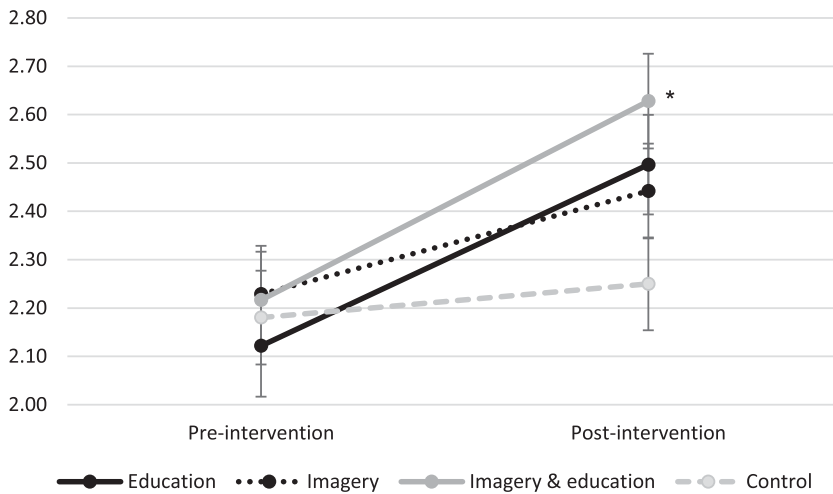
### Stress mindset

Means and standard errors of stress mindset for all four groups at pre- and post-intervention are reported in Figure 1. The 2-time  $\times$  4-group mixed ANOVA showed a significant main effect of

**Table 1.** Means and standard deviations of video engagement and ease of imaging for each intervention group.

	Control group	Education group	Imagery group	Education with Imagery group
Video engagement	5.32 (1.07)	5.65 (1.32)	5.24 (1.14)	5.89 (0.96)
Ease of imaging	–	–	5.25 (1.34)	5.68 (0.88)





**Figure 1.** Group means and standard errors of stress mindset at pre-intervention and post-intervention.

Note: \* significantly higher than control at post-intervention.

time,  $F(1, 158) = 50.45$ ,  $p < .001$ ,  $\eta_p^2 = .242$ , but a non-statistically significant group effect,  $F(3, 158) = 0.89$ ,  $p = .449$ ,  $\eta_p^2 = .017$ . Additionally, there was a statistically significant time  $\times$  group interaction,  $F(3, 158) = 4.48$ ,  $p = .005$ ,  $\eta_p^2 = .078$ . Bonferroni pairwise comparison post-hoc analysis showed that while there were no statistically significant differences from pre- to post-intervention for the control group ( $p = .341$ ), the education ( $p < .001$ ), imagery ( $p = .005$ ), and education with imagery ( $p < .001$ ) groups all reported a greater stress-is-enhancing mindset post-intervention compared to pre-intervention. Additionally, there were no statistically significant group differences pre-intervention ( $p$ 's = 1.000), but post-intervention, the education with imagery group had a significantly more stress-is-enhancing mindset compared to the control group ( $p = .039$ ). There were no other statistically significant post-intervention group differences (control vs education  $p = .491$ , control vs imagery  $p = .978$ , education vs imagery  $p = 1.000$ , education vs education with imagery  $p = 1.000$ , imagery vs education with imagery  $p = 1.000$ ). Further details of the stress mindset data including all post hoc comparison differences are reported in the Supplementary Tables 2 and 3.<sup>1</sup>

## Discussion

The present study was the first to examine the individual and combined effect of a stress-is-enhancing education and/or imagery intervention delivered virtually in altering stress mindset. The three interventions (education, imagery, and education with imagery) were compared to a control comparison video. It was hypothesized that while all three interventions would effectively elicit a more stress is enhancing mindset from pre- to post-intervention, the education with imagery condition would elicit the greatest increase.

In support of the hypothesis all three video interventions elicited a more stress-is-enhancing mindset. Findings support existing work that suggests stress education interventions as brief as one 3-minute video can alter stress mindset (Baynard-Montague & James, 2023; Crum et al., 2017). Findings also add to the established intervention techniques capable of altering stress mindset in suggesting that imagery can be just as effective as stress education videos which have been previously used. Unlike Keech et al. (2021), the imagery intervention did not contain a stress education component, demonstrating that imagery similar to that used by Williams et al. (2010, 2017) can also increase a stress-is-enhancing mindset.



While all intervention techniques elicited a significant increase in a more stress-is-enhancing mindset, the stress education with imagery intervention group was the only intervention group at post-intervention to report a significantly more stress-is-enhancing mindset compared to the control group. Although both the education and imagery groups experienced an increase in stress-is-enhancing mindset, these groups were not statistically significantly different to the control group at post-test. While we can only speculate, there are some possible reasons that the education only intervention group did not statistically significantly differ from the control group: (1) there was only one dose of the education intervention and more doses may have elicited a greater increase which may have possibly resulted in post-test statistically significant differences compared to the control group, (2) the stress mindset pre-test scores in the present study were higher than in previous studies (present study: 2.12–2.23; Crum et al., 2013, 2017: 1.60–1.80). However, it is also important to note that while we did not obtain a significant difference at post-test between the education group and the control group, similar stress mindset work such as Crum et al. (2013) did not compare the education and control groups at pre- or at post-intervention as we have in the present study (instead they only examined the significant increase from pre- to post-intervention in the education only group similar to what we obtained in the present study). As such we cannot make any inferences with regards to whether or not our intervention was similarly effective.

Similar to Keech et al. (2021), the present study suggests educating people about stress and combining education with imagery is likely to be effective. Keech et al. (2021) explained that neural networks may become more salient and accessible through the use of imagery. Given that the present study's education with imagery intervention was the same duration as both the stress education and imagery interventions, findings suggest that the combination of educational content with the use of imagery is more effective than using these techniques in isolation. This is in line with the theory of Experiential Learning in which the imagery served as an experience (albeit imaginary) to help participants remember the newly acquired information that stress can be enhancing (Yardley et al., 2012).

When establishing effective intervention techniques to alter stress mindset, it is important to consider their potential of being rolled out in mass. While stress mindset education videos and imagery interventions have the potential to be effective, the majority of previous studies have been conducted in the laboratory with participants tested one-on-one with researchers (Crum et al., 2013, 2017). For interventions to be effective outside of the laboratory, it is essential that they can be administered in a quick and cost-effective way that can target the large audiences. The present study suggests that online videos are effective for both stress education and imagery interventions to alter stress mindset.

### ***Limitations and future research directions***

Despite the novelty of the findings, the present study is not without limitations. First, the study did not include any additional outcome variables. Previous research has shown changing stress mindset through use of videos can lead to changes in other variables such as positive affect, lower levels of perceived stress, lower anxiety and depressive symptoms (Crum et al., 2013; Keech et al., 2021). Future work should examine whether the online video intervention in the present study elicits similar changes in wellbeing alongside changes in stress mindset. Second, the present study contained no long-term follow-up. Keech et al. (2021) showed that participants still had a greater stress-is-enhancing mindset following their stress education and imagery intervention 2-weeks post intervention. However, this more enhancing mindset had decreased slightly from post-intervention to 2-weeks follow-up. This suggests that over time interventions to enhance stress mindset may need to be topped-up to maintain their maximum effect. Given how readily available access to online stress mindset video interventions could be, future research can examine the effectiveness of such interventions with intervention top-ups to see whether they can elicit more sustained

changes or even greater enhancements in a more stress-is-enhancing mindset. Finally, the present study suggests that different intervention techniques can be effective in eliciting a more positive stress mindset. However, the present study was designed to detect group differences and was not powered to examine if individual differences on a variety of variables (e.g., gender, age, socioeconomic status) influence the effectiveness of the types of interventions. It is important that future research examines and establishes which intervention techniques are most effective for which populations as well as other factors likely to influence intervention effectiveness by developing a priori hypotheses regarding individual differences and tests an appropriate number of participants to provide sufficient statistical power to detect individual differences.

## Conclusion

In conclusion, the present study aimed to investigate and compare the effectiveness of stress education, imagery, and stress education with imagery on stress mindset. Results from the present study demonstrated that while all three intervention techniques were effective in eliciting a more stress-is-enhancing mindset, the intervention consisting of education with imagery may be the most effective. However, future research should investigate the longevity of such interventions, whether certain interventions are more effective for certain individuals, and whether the alterations in stress mindset are accompanied by more adaptive responses to stress and greater wellbeing.

## Note

1. As part of the review process, a series of post-hoc analyses demonstrated that there was no statistically significant main effect for time after controlling for gender ( $p = .073$ ). Additionally, differences between control and intervention groups became statistically non-significant when controlling for age ( $p = .052$ ) and video engagement ( $p = .066$ ). However, it should be noted these post-hoc analyses were not part of our *a priori* aims and therefore were not accounted for when conducting our *a priori* power analyses to determine sample size. Therefore, these post-hoc analyses should be interpreted with caution and need to be replicated in studies appropriately powered to conduct such analyses.

## Acknowledgements

The authors would like to thank Donna Lundborg for her feedback and support during the drafting of the manuscript.

## Disclosure statement

No potential conflict of interest was reported by the author(s).

## Funding

This work received no funding.

## Data availability statement

The data file is available at the following link <https://doi.org/10.25500/edata.bham.00000968> and the syntax will be made available upon reasonable request.

## ORCID

Sarah E. Williams  <http://orcid.org/0000-0003-4142-0813>

Annie T. Ginty  <http://orcid.org/0000-0002-6817-4336>

## References

- Baynard-Montague, J., & James, L. E. (2023). A stress mindset manipulation can affect speakers' articulation rate. *Anxiety, Stress & Coping*. <https://doi.org/10.1080/10615806.2023.2179621>
- Casper, A., Sonnentag, S., & Tremmel, S. (2017). Mindset matters: The role of employees' stress mindset for day-specific reactions to workload anticipation. *European Journal of Work and Organizational Psychology*, 26(6), 798–810. <https://doi.org/10.1080/1359432x.2017.1374947>
- Cohen, S., Janicki-Deverts, D., & Miller, G. E. (2007). Psychological stress and disease. *The Journal of the American Medical Association*, 298(14), 1685–1687. <https://doi.org/10.1001/jama.298.14.1685>
- Conroy, D., & Hagger, M. S. (2018). Imagery interventions in health behavior: A meta-analysis. *Health Psychology*, 37(7), 668–679. <https://doi.org/10.1037/hea0000625>
- Crum, A. J., Akinola, M., Martin, A., & Fath, S. (2017). The role of stress mindset in shaping cognitive, emotional, and physiological responses to challenging and threatening stress. *Anxiety, Stress, & Coping*, 30(4), 379–395. <https://doi.org/10.1080/10615806.2016.1275585>
- Crum, A. J., Salovey, P., & Achor, S. (2013). Rethinking stress: The role of mindsets in determining the stress response. *Journal of Personality and Social Psychology*, 104(4), 716–733. <https://doi.org/10.1037/a0031201>
- Cumming, J., Olphin, T., & Law, M. (2007). Self-reported psychological states and physiological responses to different types of motivational general imagery. *Journal of Sport & Exercise Psychology*, 29(5), 629–644. <https://doi.org/10.1123/jsep.29.5.629>
- Epel, E. S., Crosswell, A. D., Mayer, S. E., Prather, A. A., Slavich, G. M., Puterman, E., & Berry Mendes, W. (2018). More than a feeling: A unified view of stress measurement for population science. *Frontiers in Neuroendocrinology*, 49, 146–169. <https://doi.org/10.1016/j.yfrne.2018.03.001>
- Epel, E. S., McEwen, B. S., & Ickovics, J. R. (1998). Embodying psychological thriving: Physical thriving in response to stress. *Journal of Social Issues*, 54(2), 301–322. <https://doi.org/10.1111/0022-4537.671998067>
- Huebschmann, N. A., & Sheets, E. S. (2020). The right mindset: Stress mindset moderates the association between perceived stress and depressive symptoms. *Anxiety, Stress, & Coping*, 33(3), 248–255. <http://doi.org/10.1080/10615806.2020.1736900>
- Jiang, Y., Zhang, J., Ming, H., Huang, S., & Lin, D. (2019). Stressful life events and well-being among rural-to-urban migrant adolescents: The moderating role of the stress mindset and differences between genders. *Journal of Adolescence*, 74(1), 24–32. <https://doi.org/10.1016/j.adolescence.2019.05.005>
- Keech, J. J., Cole, K. L., Hagger, M. S., & Hamilton, K. (2020). The association between stress mindset and physical and psychological wellbeing: Testing a stress beliefs model in police officers. *Psychology & Health*, 35(11), 1306–1325. <https://doi.org/10.31234/osf.io/3gbx8>
- Keech, J. J., Hagger, M. S., & Hamilton, K. (2021). Changing stress mindsets with a novel imagery intervention: A randomized controlled trial. *Emotion*, 21(1), 123–136. <https://doi.org/10.1037/emo0000678>
- Keech, J. J., Hagger, M. S., O'Callaghan, F. V., & Hamilton, K. (2018). The influence of university students' stress mindsets on health and performance outcomes. *Annals of Behavioral Medicine*, 52(12), 1046–1059. <https://doi.org/10.1093/abm/kay008>
- Lang, P. J. (1979). A bio-informational theory of emotional imagery. *Psychophysiology*, 16(6), 495–512. <https://doi.org/10.1111/j.1469-8986.1979.tb01511.x>
- Linley, P. A., & Joseph, S. (2004). Positive change following trauma and adversity: A review. *Journal of Traumatic Stress*, 17(1), 11–21. <https://doi.org/10.1023/b:jots.0000014671.27856.7e>
- McFarlane, A. C. (2010). The long-term costs of traumatic stress: Intertwined physical and psychological consequences. *World Psychiatry*, 9(1), 1–64. <https://doi.org/10.1002/j.2051-5545.2010.tb00254.x>
- Pham, L. B., & Taylor, S. E. (1999). From thought to action: Effects of process-versus outcome-based mental simulations on performance. *Personality and Social Psychology Bulletin*, 25(2), 250–260. <https://doi.org/10.1177/0146167299025002010>
- Steptoe, A., & Kivimaki, M. (2012). Stress and cardiovascular disease. *Nature Reviews Cardiology*, 9(6), 360–370. <https://doi.org/10.1038/nrcardio.2012.45>
- Williams, S. E., Cumming, J., & Balanos, G. M. (2010). The use of imagery to manipulate challenge and threat appraisal states in athletes. *Journal of Sport and Exercise Psychology*, 32(3), 339–358. <https://doi.org/10.1123/jsep.32.3.339>
- Williams, S. E., Veldhuijzen van Zanten, J., Trotman, G. P., Quinton, M. L., & Ginty, A. T. (2017). Challenge and threat imagery manipulates heart rate and anxiety responses to stress. *International Journal of Psychophysiology*, 117, 111–118. <https://doi.org/10.1016/j.ijpsycho.2017.04.011>
- Yardley, S., Tuenissen, P. W., & Dornan, T. (2012). Experiential learning: Transforming theory into practice. *Medical Teacher*, 32, 12. <https://doi.org/10.3109/0142159X.2012.643264>