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“Mindfulset” – Harnessing or Unleashing Learning Potential through Mindfulness Mindset

Gábor Orosz^{1*}, Lilla Török^{1,2}, Zsafia K. Takacs³, Kristopher M. Evans⁴, Kata Sik⁵, Kévin Rigaud¹, Éva Gál⁶, Beáta Bóthe⁷

¹Université d’Artois, Unité de Recherche Pluridisciplinaire Sport Santé Société, Sherpas, Liévin, France

Gábor Orosz

E-mail: gabor.orosz@univ-artois.fr

Orcid: <https://orcid.org/0000-0001-5883-6861>

Kévin Rigaud

E-mail: kevin.rigaud@univ-artois.fr

²University of Physical Education, Department of Psychology and Sport Psychology, Budapest, Hungary

E-mail: torok@tf.hu

Orcid: <https://orcid.org/0000-0001-7566-1047>

³University of Edinburgh, School of Health in Social Science, Edinburgh, United Kingdom

E-mail: zgarait@ed.ac.uk

Orcid: <https://orcid.org/0000-0003-0190-0628>

⁴Stanford University, Department of Psychology, Stanford, CA, USA

E-mail: krise@alumni.stanford.edu

Orcid: <https://orcid.org/0000-0002-7302-8018>

⁵University of Vienna, Department of Occupational, Economic, and Social Psychology, Vienna, Austria

E-mail: kata.sik@univie.ac.at

Orcid: <https://orcid.org/0000-0002-0897-258X>

⁶Babes-Bolyai University, Department of Pedagogy and Applied Didactics, Cluj-Napoca, Romania

E-mail: ge.evagal@gmail.com

Orcid: <https://orcid.org/0000-0002-7515-7024>

⁷University of Montreal, Department of Psychology, Montreal, Canada

E-mail: beata.bothe@umontreal.ca

Orcid: <https://orcid.org/0000-0003-2718-4703>

Declaration

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The authors declare that they have no conflicts of interest.

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“Mindfulset” – Harnessing or Unleashing Learning Potential through Mindfulness Mindset

This research introduces the "Mindfulness Mindset Scale" a concise and reliable tool designed to measure beliefs about the malleability of mindfulness skills. Study 1 (N=285) revealed a single-factor structure through exploratory factor analysis, further validated in Study 2 (N=286) using confirmatory factor analysis. Studies 3a (N=266) and 3b (N=320) revealed associations between the Mindfulness Mindset Scale and other measures of mindset, trait mindfulness, and coping, showing reasonable convergent and divergent validity. Study 4 (N=470) showed the predictive validity of the mindfulness mindset, being correlated with behavioral persistence, effort, resilience, challenge-seeking, and academic grades. Study 5 (N=320) supported the academic correlates of malleable beliefs of mindfulness beyond the mental health factors from Study 3 in two countries. In Study 6 ($N_{\text{French}}=613$, $N_{\text{Hungarian}}=524$), we demonstrated that a well-established learning mindset intervention can lead to changes in mindfulness mindset in two national contexts. Finally, a brief mindfulness mindset intervention designed for Study 7 (N=208) also led to changes in malleability beliefs about mindfulness skills. These behavioral results suggest that beliefs about mindfulness being malleable are a novel construct distinct from trait mindfulness. Such beliefs are related to adaptive psychological mechanisms relevant in educational contexts, considering students' coping, mastery behavior and academic performance. Importantly, these beliefs can be modified by brief interventions.

Keywords: mindfulness beliefs; malleability; growth mindset; mental health; academic performance; trait mindfulness

Educational Impact and Implications Statement

This research underscores how beliefs about the malleability of mindfulness can influence educational outcomes. A brief, valid, and reliable measure can assess these beliefs. Besides grade point average, this survey can also predict mastery behaviors like resilience, effort, perseverance, challenge-seeking, and academic grades. The study also found that these beliefs can be changed through psychologically wise interventions focused on learning and mindfulness.

“Mindfulset” – Unleashing Learning Potential through Mindfulness Mindset

Extensive literature highlights the positive associations between trait mindfulness and various outcomes, such as mental health, performance, and well-being (Coffey et al., 2010; Grossman et al., 2004; Keng et al., 2011). Additionally, several evidence-based interventions have been developed to help individuals cultivate their mindfulness skills so they can reap the benefits of being aware of the present moment in a non-judgmental way (Cavanagh et al., 2014; Chen et al., 2012; Kuyken et al., 2008; Vøllestad et al., 2012). However, there is a limited understanding of how beliefs about mindfulness skills influence related outcomes. Specifically, the belief that these skills or abilities are malleable (vs. fixed). Insights from the mindset literature (e.g., Dweck & Yeager, 2019) suggest that the way individuals think about their abilities or attributes, as either having a changeable or a fixed nature (i.e., having more of a growth or a fixed mindset), influences how invested they are in improving or changing these qualities. The influence of mindsets was explored in domains such as intelligence (Dweck & Yeager, 2019), personality (Yeager & Dweck, 2012), emotions (Karnaze & Levine, 2020), self-regulation (A. J. Mrazek et al., 2018), and willpower (Miller et al., 2012). Given the broad applicability of the mindset framework, it is plausible that individuals form beliefs about the changeability of mindfulness. Believing mindfulness is malleable may shape individuals' motivation and investment to practice and improve their mindfulness skills. We assume that students who believe their mindfulness skills can be improved are more willing to learn, use, and master them. Since mindfulness skills are associated with positive outcomes across many domains (e.g., psychosocial, emotional, physiological, behavioral), improving mindfulness beliefs may have far-reaching effects on health, well-being, and performance. Thus, the present study aimed to explore a new mindfulness mindset construct and its impact on several mental health and performance-related variables in an educational context. These studies explore a new "mindfulness mindset" construct and examine its effects on mental health and performance in an educational setting.

Malleable intelligence beliefs are positively related to academic performance (see Dweck & Yeager, 2019). Similarly, in schools, fostering adaptable mindfulness beliefs could be helpful. Believing that attention, present moment awareness, and acceptance as skills can be improved may encourage skills and behaviors conducive to better learning outcomes. It is hard to learn without being able to focus or regulate cognitive and emotional processes. At any given moment, a student may hear sentences like “*Stay focused!*”, “*Where is your mind?*” or “*Calm down*”. The messages students receive at school or home can influence how they think about their mindfulness-related skills. The capacity to be mindful (in terms of attention, awareness, present-orientation, and acceptance, e.g., Feldman et al., 2007) can be interpreted as a characteristic that one cannot change (fixed) or more like a skill that is similar to a tree that can grow (malleable). If students think that they cannot develop these mindfulness-related skills, they will be less inclined to make an effort to improve how much they focus and be present and non-judgmental. We propose that such a fixed mindfulness belief can prevent them from optimal learning, growth, and unleashing their potential in the academic context in the long run.

The Potential Benefits of Mindfulness in Education

Increasing evidence supports the advantages of dispositional mindfulness and its interventions in educational settings (Emerson et al., 2020; Takacs & Kassai, 2019; Weare, 2019). Mindfulness is associated with students’ psycho-social health, well-being, learning, cognitive development, and academic performance (Lyons & DeLange, 2016; Weare, 2019). Although dispositional mindfulness can be distinguished from mindfulness skills cultivated by mindfulness training and intervention, the two are interconnected. Former studies showed that through mindfulness training, the level of dispositional mindfulness could be elevated (Quaglia et al., 2016).

Previous studies showed that dispositional mindfulness is related to better physical and psychological health, and, more importantly, mindfulness-based interventions can also improve these outcomes (Bergin & Pakenham, 2016; Sala et al., 2020). In cross-sectional studies, students with higher

levels of dispositional mindfulness reported lower levels of anxiety, stress, depression, and burnout and higher levels of life satisfaction, subjective and psychological well-being (Bergin & Pakenham, 2016; K. Brown & Kasser, 2005; Palmer & Rodger, 2009; Song, 2011; Zúñiga et al., 2022). Moreover, dispositional mindfulness was also found to mitigate the impact of perceived stress on students' psychological adjustment (Bergin & Pakenham, 2016). Correspondingly, improving students' mindfulness skills reduced stress, anxiety, depression, and burnout (Daya & Hearn, 2018; Song & Lindquist, 2015) and improved their mood and self-efficacy (McConville et al., 2017).

Beyond its salutary impact on students' mental health, dispositional mindfulness and mindfulness-based interventions may benefit learning-related skills and behaviors. This positive effect on learning can be explained by the idea that being mindful activates top-down self-regulatory processes, known as executive functions, which are necessary to self-regulate emotions, thoughts, and behaviors (Lindsay & Creswell, 2017; Thierry et al., 2016). Focusing attention on the present moment and regulating attention when the mind wanders require inhibitory control (i.e., resisting urges and temptations), working memory (i.e., holding information in mind), and cognitive flexibility (i.e., adjusting to change). These skills are core executive functions or self-regulatory processes (Diamond, 2014) essential during learning and academic activities (Raver & Blair, 2016; Schooler et al., 2014).

Similarly, studies have also found that mindfulness increases self-regulation (Tang et al., 2019) by increasing the activation of brain regions (i.e., prefrontal cortex) responsible for the regulation of emotions, thoughts, and behaviors (Creswell et al., 2007). In concordance, dispositional mindfulness was positively associated with students' attention, working memory, and effective coping strategies (Li et al., 2021). Furthermore, dispositional mindfulness also positively correlates with academic performance (Lin & Mai, 2018; Shao & Skarlicki, 2009; Vorontsova-Wenger et al., 2021). Moreover, a comparative meta-analysis found that mindfulness-based interventions are the most promising avenue to foster children's executive function skills, especially working memory and inhibitory control skills,

among all different intervention approaches (Takacs & Kassai, 2019). Even a brief mindfulness-based intervention in school settings reduced off-task behavior and increased academically engaged behavior (Felver et al., 2014). These studies show that dispositional mindfulness and mindfulness-based interventions are related to improvement in various cognitive, emotional, and behavioral benefits that contribute to learning and academic performance.

Potential Benefits of Adaptive Beliefs About Mindfulness

Our understanding of the benefits of adaptive beliefs and metacognitions about mindfulness remains limited (Langdon et al., 2011). Furthermore, to our knowledge, scientific evidence is unavailable on how students can capitalize on metacognition regarding the malleability of their mindfulness. As far as we know, only one study has focused on assessing beliefs regarding the malleable nature of mindfulness (Kong & Jolly, 2019). In this study, the authors examined the role of such beliefs in an organizational context and focused on its two aspects: attention and awareness. The measure had impeccable psychometric properties, and it predicted more adaptive and less maladaptive (e.g., deviance) workplace behaviors (e.g., unconditional in-role behavior) above and beyond dispositional mindfulness. This study used the business context to demonstrate the first steps of implementing mindsets theory in mindfulness. However, in this seminal study, only a limited number of aspects of mindfulness were considered; the authors did not implement real-world behavioral outcomes, and their experimental results may not translate to educational practices. Therefore, based on the promising results of Kong and Jolly (2019), we designed a measure considering a broader set of mindset aspects about mindfulness and examined its relationship with students' mental health and behavioral and educational outcomes. In contrast to the organizational context, no prior studies examined the beneficial role of having a growth mindfulness mindset in educational settings.

Mindfulness Mindset Among Similar Mindset Constructs in the Field of Education

Earlier research has delved into beliefs about similar constructs, such as beliefs about willpower, self-regulation, anxiety, emotions, or even mind wandering (Job et al., 2010; Karnaze & Levine, 2020; Plaks et al., 2009; Reffi et al., 2020; Zedelius & Schooler, 2017). For example, non-limited willpower beliefs were associated with better self-regulation and higher grades (Job et al., 2015), while growth self-regulation and controllable mind-wandering mindsets were related to longer perseverance, resistance to everyday temptations, less intrusive thoughts, and less mind-wandering (Zedelius et al., 2021). We expect similar relations with positive outcomes in education, but we also assume that the mindfulness mindset is different from willpower (Job et al., 2010), self-regulation (Mrazek et al., 2018), and mind wandering (Zedelius et al., 2021) mindsets. From another perspective, recent studies examined mindsets about concepts relevant to mindfulness. The malleability of attention (Zhang et al., 2021) is relevant to the attention part of the mindfulness concept, while the malleability of rumination (Bessette et al., 2020) can be connected to the present focus aspects. The malleability of attention or rumination can grasp specific features of mindfulness but cannot reflect on its multifaceted nature. In the present study, we aim to use a more integrative concept of mindfulness, including attention, awareness, present-orientation, and a non-judgmental stance.

Why Mindfulness Mindset Might be Related to Better Mental Health and Academic Performance?

Applying the growth mindset framework to mindfulness assumes that difficulties with staying in the present moment and adopting a non-judgmental attitude are improvable skills (e.g., “*If I try hard, I can stay focused*” or “*I can learn to let negative feelings go*”). Such individual differences in mindset may differentiate between students who try to adopt a more helpful attitude and those who persist in situations that require mindfulness skills. This might translate into better outcomes regarding being more mindful in academic settings and, possibly, better mental health and academic performance. For

example, it might be possible that despite their hardships, they would try to maintain extended focus on difficult tasks if they considered mindful attention a malleable skill. Also, they could disengage from distracting thoughts and feelings and reorient their attention to classroom activities. Alternatively, they could try to stay in the present moment with a non-judgmental attitude in situations with an intense emotional charge, such as facing difficulties, challenges, and failures during class. Moreover, if students believe they can improve their mindfulness skills, their approach toward challenging or adverse academic situations might change. Moreover, if students believe they can improve their mindfulness skills, their approach toward challenging or adverse academic situations might differ. Malleable mindfulness beliefs might incline students to change their automatic overt and covert mindfulness-related behaviors towards a more non-judgmental and non-reactive stance.

The Present Study

This series of studies seeks to develop a measure to assess students' beliefs about the malleability of mindfulness within higher education. In the first two studies, we evaluated its core psychometric properties through exploratory and confirmatory factor analysis as internal consistency. Then, we examined its convergent validity using mindset, coping, depression, anxiety, and social desirability (Studies 3a, b). Next, we were interested in its predictive validity regarding mastery behaviors and academic performance (grade point average from official academic records, Study 4). Studies 1, 2, 3a, and 4 were conducted within the Hungarian context. However, in Studies 3b and 5, we investigated the association between malleable beliefs of mindfulness and academic performance after controlling for other relevant mindset-related measures in a different national context (French), and we also explored its mental health-related correlates. Studies 3b and 5, conducted within a French context, examined the relationship between adaptable mindfulness beliefs and academic performance, accounting for other pertinent mindset measures, and delved into its associations with mental health. Lastly, using both French and Hungarian samples, we assessed the changeability of these beliefs through an established

learning mindset intervention (Study 6) and a targeted mindfulness mindset intervention (Study 7).

Table 1 provides an overview of the studies discussed in this paper.

1 **Table 1. Brief Summary of the Present Work**

Number of studies	Goal of the study
Study 1 Study 2	<i>Scale Development:</i> Exploratory and Confirmatory Factor Analyses on separate samples and Item Response Theory
Study 3a Study 3b	<i>Self-reported Validity:</i> Measurement invariance, convergent and discriminant validity with mindset-, mindfulness-, and coping-relevant self-reported measures and social desirability correlates
Study 4 Study 5	<i>Behavioral Validity:</i> Prediction of mastery behaviors and grade point average
Study 6 Study 7	<i>Changeability:</i> domain-general and domain-specific intervention studies in two countries

Study 1: Exploratory Factor Analysis

Study 1 aimed to develop a reliable and valid instrument to measure the lay theories people form about the malleability of their mindfulness capacities. We expected that beliefs about the changeability of the four components of mindfulness (attention, awareness, present orientation, and acceptance) would be strongly related, and they would load onto a single factor.

Methods

Item Construction

We used a deductive approach developing the Mindfulness Mindset Scale. Item creation drew inspiration from the Theory of Intelligence Scale (Dweck et al., 1995) and the content of the items of the Cognitive and Affective Mindfulness Scale (Feldman et al., 2007). Based on prior studies (Dweck et al., 1995), we used only items with reversed wording as responses are expected to be closer to normal distribution. Consequently, we formulated eight items using fixed-mindset phrasing (refer to Table 2). We aimed to construct concise, easy-to-understand items that belong to a single dimension, not double-barreled, and are not suggestive. Two items were constructed for each dimension: *Attention*, *Awareness*, *Present-orientation*, and *Self-acceptance*. These eight items were pre-tested with university students and further refined. A higher score indicated an individual's stronger tendency to endorse fixed beliefs about mindfulness.

Participants

Responses from 571 university students, spanning diverse majors from a credit course, were randomly split for the exploratory (Study 1) and confirmatory (Study 2) factor analyses. For the first exploratory factor analysis, we used the responses of 285 students (79.6% female, aged between 17 and 67 years, 8.8% over their twenties, $M_{age}=22.32$; $SD_{age}=5.47$, 3.2% ethnic minority, 31.2% from the capital, 48.7% from towns, and 20% from villages, 45.3% without a parent who has tertiary education degree). We chose this sample size for exploratory and confirmatory factor analysis in unidimensional scale development 200-300 respondents can offer adequate statistical power (DeVellis, 2017; Hoe, 2008; Singh et al., 2016).¹

¹In the following studies, our data was mainly based on college student samples, and in tertiary education the proportion of ethnic minorities is relatively small. For example, only one-third of the Roma students (Hungary

Procedure and Measures

Participants rated items were rated on a five-point Likert scale (1=*Strongly disagree*; 5=*Strongly agree*). The scale exhibited robust reliability ($\alpha=0.90$). The first part of the questionnaire included questions regarding demographic data, such as gender, age, and the highest level of education. This online study and subsequent ones were conducted under the Declaration of Helsinki and approved by the related university's ethical board with the participants' informed consent.

Transparency and Openness

These studies were not preregistered. Data for all studies are publicly available in the OSF repository, accessible at https://osf.io/e6nrg/?view_only=c1d074f14d55485c924ab3896b811247. Furthermore, the analysis codes for Studies 3b-7 are at the same link. Analyses for Studies 1-3a were conducted in SPSS, so there are no available code sets for these studies. However, the analyses can be replicated using the data from the provided link. Data were analyzed using R, version 4.1.0 (R Core Team, 2021), the packages mirt (Chalmers, 2012), lavaan (Rosseel, 2012), and SPSS, version 24.

Analytic Strategy

We conducted an exploratory factor analysis using SPSS version 24. Principal axis factoring extraction was chosen with Promax rotation ($Kappa=4$) because oblique rotations allow a better understanding of the relationships between the factors and provide a sound basis for further

and Europe's largest minority population, European Commission, 2011) attend the kind of high school that would allow them to enter higher education (in contrast to the three-fourth of the majority students, Kertesi-Kézdi, 2008). Based on the small proportion (less than 10%) of minority people (including Roma) in the Hungarian population and the low percentage of them (~15%) earning a college/university degree (KSH, 2016), minority students' presence in higher education and especially at prestigious universities was expected to be very low.

confirmatory factor analysis (T. A. Brown, 2006).² Additionally, the Kaiser-Guttman criterion (Guttman, 1954; Kaiser, 1960) and the scree plot (Cattell, 1966) were used to determine the adequate number of factors. Based on (Tabachnick & Fidell, 2001), the minimum loading of an item was 0.32, and cross-loading occurred when an item loaded at least 0.32 on two or more factors. Internal consistencies were also assessed by Cronbach's alpha, which was acceptable if the values were at least 0.70 (Nunnally, 1978). Based on Kline (2011), the normality thresholds for skewness and kurtosis were between -1 and +1.

To validate the scale's psychometric properties we used Item Response Theory (IRT) framework using the R package *mirt* (Chalmers, 2012). IRT allows for a comprehensive examination of item characteristics and provides valuable insights into the scale's measurement properties. Fit indices, including the Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR), were computed to assess the overall fit of the model. These fit indices explain how well the model reproduces the observed response patterns. A CFI and TLI value close to or above 0.95 indicates a good fit, while a RMSEA and SRMR value below 0.08 suggests an adequate fit (Brown, 2015). Category Characteristic Curves (CCC) were plotted to evaluate the individual items' performance. CCC illustrates the relationship between item responses and latent trait levels, providing information on the items' discriminating power across the trait continuum. Item Information Curves (IIC) were also examined to assess measurement precision at various trait levels. The IIC provides information on the items' information content and identifies regions of the latent trait where measurement is most precise. Furthermore, Scale Information Curves

²In the exploratory factor analysis, we were interested in how many factors appear with using the eight items. We choose oblique rotations as we expected that despite there are four underlying dimensions deriving from CAMS (attention, acceptance, awareness, and present-orientation); they belong to a single factor. Oblique rotation aims to allow potential factors to be correlated, which means that they can be associated more realistically in reality. Using oblique rotation, the extracted factors are rotated in space to maximize the correlation between the factors. This allows complex relationships between variables to be better represented and results in factors that are easier to interpret. Finally, oblique rotation can allow more precise predictions regarding future CFA analyses (Brown, 2015).

(SIC) were generated to evaluate the overall precision of the scale across the latent trait continuum. The SIC summarizes the information provided by all items on the scale and identifies areas of high precision. Discrimination parameters were estimated to evaluate the ability of the items to discriminate between individuals with different levels of the latent trait. Higher discrimination parameters indicate better item performance. Lastly, conditional reliability was calculated to assess the scale's internal consistency. This reliability estimate accounts for measurement error and indexes the scale's consistency across different latent trait levels. By employing these analytic strategies, we aimed to comprehensively evaluate the psychometric properties of the psychology scale, including fit to the IRT model, item characteristics, scale precision, discrimination parameters, and internal consistency.

Results and Discussion

Table 2 includes the main results of Study 1. One factor was extracted as there was only one with an eigenvalue greater than one, which was in line with the scree test results (see Supplemental Materials, Figure SM1). The factor accounted for 58.19% of the total variance. The overall KMO was equal to 0.92 (Bartlett’s Test of Sphericity: $p < 0.001$). No item had a smaller factor loading than 0.54, and the scale showed strong internal consistency.

2 Table 2. Exploratory factor analysis of the Mindfulness Mindset Scale

Scale Items	Mindfulness Mindset Scale
The extent to which one can live in the present moment is a characteristic that can’t really be changed. (PO)	0.78
Some people are more aware of their feelings than others, and this is a characteristic that can’t really be changed. (AW)	0.77
No matter what you do, you can’t change how much you accept your thoughts and feelings. (SA)	0.77
The extent one is aware of their thoughts and feelings is an ability that can’t really be changed. (AW)	0.76
Being able to live in the here and now is an ability that can’t be changed. (PO)	0.74
Some people can accept their feelings and thoughts, others cannot, and this is something that can’t be changed a lot. (SA)	0.73
Everybody has a certain amount of attentional span that fundamentally can’t be improved. (AT)	0.67

No matter what you do, you can't change how much your attention wanders when you are doing boring things. (AT)	0.54
Mean (standard deviation)	2.46 (0.84)
Eigenvalues	4.66
Variance explained (%)	52.48
Skewness (SE)	0.12 (0.15)
Kurtosis (SE)	-0.47 (0.29)
Measured range	1-5
Cronbach alpha	0.90

Notes. PO=Present orientation; AW=Awareness; SA=Self-acceptance; AT=Attention.

All eight items are loaded on a single factor. The skewness and kurtosis values were between -1 and 1, indicating that the responses' distribution was close to normal (Kline, 2011). Furthermore, the scale appeared to be reliable in terms of its internal consistency (Table 2). In the following step, we intend to examine the explored factor structure with confirmatory factor analysis (CFA).

Item Response Theory

The Item Response Theory (IRT) analysis was conducted to assess the psychometric properties of the newly validated Mindfulness Mindset scale. The confirmatory factor analysis yielded good fit indices, with a Comparative Fit Index (CFI) of 0.977 and a Tucker-Lewis Index (TLI) of 0.967, indicating a satisfactory model fit. The Root Mean Square Error of Approximation (RMSEA) was 0.094 (90% CI [0.069, 0.118]), indicating a reasonable fit. The Standardized Root Mean Square Residual (SRMR) was 0.063, suggesting a good fit (values based on Hu & Bentler, 1999).

Item-level analyses revealed that all items had satisfactory RMSEA fit indices, ranging from 0.004 to 0.041, indicating that they fit well with the underlying latent trait. The item-based IRT parameter estimates were higher than 1 and revealed adequate discrimination parameters, ranging from 1.286 to 3.271, suggesting that the items effectively differentiated individuals across the latent trait continuum.

Factor analysis results indicated a unidimensional structure, with factor loadings ranging from 0.603 to 0.887, supporting the scale's internal structure. The conditional reliability estimate was high, 0.912, indicating good internal consistency.

See the plots of the Category Characteristic Curves (Figure SM1), Item Information Curves (Figure SM2), and Scale Information Curve (Figure SM3) for visual representations of the scale's performance. These plots demonstrated orderly category response patterns, indicating that the response options functioned as expected. Despite the overall supportive results, it appears that the mindfulness mindset measure can assess more precisely the fixed side of the mindset spectrum.

Study 2: Confirmatory Factor Analysis

The purpose of the second study was to examine whether the single-factor structure of the Mindfulness Mindset Scale demonstrated in Study 1 shows an acceptable model fit by using confirmatory factor analysis.

Methods

Participants, Procedure, and Measures

For the confirmatory factor analysis, we used the responses of the other half of the sample: 286 students (81.5% female, aged between 18 and 47 years, 11.2% over their twenties, $M_{age}=22.34$; $SD_{age}=5.73$, 33.9% from the capital, 47.2% from towns, and 18.9% from villages, 42.7% without a parent who has tertiary education degree). The data collection for Study 2 was conducted at the same time and way as for Study 1.

Analytic Strategy

Confirmatory factor analyses (CFA) were conducted using AMOS 17.0. CFA analyses were conducted on covariance matrices, and the solutions were generated based on maximum-likelihood

estimation. Following the guidelines of Brown (2006) and Schreiber et al. (2006), several different indices of the goodness of fit were taken into consideration, including the chi-square degree of freedom ratio (χ^2/df), the root-mean-square error of approximation (RMSEA) and its 90% confidence interval, the comparative fit index (CFI), the Tucker–Lewis index (TLI), the Akaike Information Criterion (AIC) and the Browne-Cudeck criterion (BCC). Guided by the suggestions of Hu and Bentler (1999), the following criteria defined acceptable model fit: RMSEA (≤ 0.06), CFI (≥ 0.95), and TLI (≥ 0.95).

Results and Discussion

In order to confirm the factor structure of this new measure, CFA was performed based on the results of Study 1. The *first-order model* used maximum likelihood estimation with one error covariance. The fit indices indicated good fit [$\chi^2(20, N=286)=60.95, p<0.001$; CFI=0.962; TLI=0.932; RMSEA=0.085, 90%CI 0.061-0.110). The standardized factor loadings (β) were consistently strong, ranging from 0.55 to 0.81. However, the RMSEA score was higher than expected. According to Kenny et al. (2015), higher RMSEA scores can be expected if the degree of freedom and the sample size are relatively small.

Study 3: Convergent and Discriminant Validity

This study aimed to assess the convergent and discriminant validity of the Mindfulness Mindset Scale. We also tested the invariance of the measure between the French and Hungarian versions.

Study 3a: Hungarian Convergent and Discriminant Validity Results

This study aimed to test the relationship between the Mindfulness Mindset Scale and mindset measures across other domains: grit, coping, and mental health. First, intelligence and failure mindset measures were assessed. We expected that malleability beliefs in one domain would be associated with malleability beliefs in other domains (e.g., Spinath et al., 2003). Second, we presumed that grit would negatively relate to fixed beliefs about mindfulness (Tang et al., 2019). Third, the Depression, Anxiety,

and Stress Scale were assessed (Lovibond & Lovibond, 1995), as we expected that these mental health problems would be positively associated with the endorsement of fixed beliefs about mindfulness (e.g., Bohlmeijer et al., 2010; Schleider & Weisz, 2018). As the core of these items was related to mindfulness's cognitive and affective aspects, we were interested in whether the mindfulness mindset is related to cognitive and emotional regulation. Based on Kneeland et al. (2016) work on emotion mindsets' effect on emotion regulation, we expected that maladaptive forms of emotion regulation would be positively associated with fixed beliefs about mindfulness. We selected these variables since former studies convincingly demonstrated that mindfulness is related to various mental health and well-being factors (e.g., Coffey et al., 2010; Tang et al., 2019). Finally, we used the Marlowe-Crowne social desirability scale to ensure that this new measure is not related to socially desirable responses.

Methods

Participants and Procedure

University students ($N=266$, 76% female, age between 18 and 64, 40.5% over their twenties, $M_{age}=29.93$, $SD_{age}=10.16$, 0.7% ethnic minority, 3.4% from the capital, 63.6% from towns, and 33.1% from villages, 84.2% without a parent who has tertiary education degree) receiving partial course credit were invited to participate in an online survey. In these convergent and divergent validity studies (Study 3a and 3b), we aimed to identify weak correlations (between $r=0.15$ and $r=0.20$), and for this purpose, the suggested sample size ranged between $194 < N < 347$ respondents.

Measures

Beliefs about fixed mindfulness. In order to assess its convergent validity, this newly created measurement (Mindfulness Mindset Scale) was administered. The psychometric properties of the scale were described above in detail. In the present study—similar to Studies 1 and 2—Cronbach's alpha

value was adequate ($\alpha=0.84$). The average of the eight items was calculated with higher scores, suggesting an endorsement of fixed beliefs about mindfulness.

Fixed mindset of intelligence. Two items assessed fixed mindset (e.g., “*You have a certain amount of intelligence, and you really can’t do much to change it*”; 1=*Strongly disagree*, 6=*Strongly agree*; Dweck et al., 1995; Orosz et al., 2017). Higher values correspond to more fixed intelligence mindsets ($r=0.65$, $p<0.001$).

Failure-is-debilitating mindset. We adopted the four-item failure is debilitating mindset scale with two positively and two negatively worded items from Haimovitz and Dweck (2016), e.g., “*Experiencing failure improves performance and productivity*” (1=*Strongly disagree*; 6=*Strongly agree*). Higher values correspond to a more failure-is-debilitating mindset ($\alpha=0.65$).

Grit. Eight items assessed grit (e.g., “*Setbacks don’t discourage me. I don’t give up easily*”; 1=*Very much like me*, 5=*Not like me at all*; Duckworth & Quinn, 2009; Grit-S). Higher values indicate higher levels of grit ($\alpha=0.80$).

Depression, Anxiety, and Stress Scale (DASS). With 21 items, we assessed the severity of core symptoms of *depression* (e.g., “*I felt down-hearted and blue*”, $\alpha=0.89$), *anxiety* (e.g., “*I was aware of dryness of my mouth*”, $\alpha=0.82$), and *stress* (e.g., “*I tended to over-react to situations*”, 0=*Never*; 3=*Almost always*; $\alpha=0.87$; Lovibond & Lovibond, 1995). Higher values indicate higher levels of symptoms in the past two weeks.

Cognitive Emotion Regulation Questionnaire (CERQ). The questionnaire includes 36 items, making nine conceptually different factors. We assessed conscious cognitive components of emotion regulations when facing difficulty (Garnefski et al., 2001). Among these factors, *Acceptance* refers to having thoughts of acceptance regarding what the person has experienced (e.g., “*I think that I have to accept that this has happened*”, $\alpha=0.66$). *Positive refocusing* is related to having positive, happy, and

pleasant thoughts instead of thinking about threatening and stressful events (e.g., “*I think of nicer things than what I have experienced*”, $\alpha=0.87$). *Refocus on planning* is related to having thoughts about what to do and how to handle the experience one has had (e.g., “*I think of what I can do best*”, $\alpha=0.80$). *Positive reappraisal* focuses on giving positive meaning to the adverse events in terms of personal growth (e.g., “*I think I can learn something from the situation*”, $\alpha=0.84$). *Putting into perspective* is related to having thoughts that relativize the adverse event compared to other events (e.g., “*I think that it all could have been much worse*”, $\alpha=0.82$). *Self-blame* refers to having thoughts that blame oneself for what one has experienced (e.g., “*I feel that I am the one to blame for it*”, $\alpha=0.77$). *Rumination* refers to having recurrent thoughts about the feelings and thoughts associated with negative events (e.g., “*I often think about how I feel about what I have experienced*”, $\alpha=0.66$). *Catastrophizing* refers to having thoughts that exaggerate the negativity of the experience (e.g., “*I continually think how horrible the situation has been*”, $\alpha=0.89$). Finally, *Blaming others* refers to having thoughts that blame others for what one has experienced (e.g., “*I feel that others are to blame for it*”, $\alpha=0.75$).

Social Desirability. Inclination to desirable responding was assessed by the short Form C of the Marlowe-Crowne Social Desirability Scale (e.g., “*I’m always willing to admit it when I make a mistake*”, 1=*True*, 0=*False*, Reynolds, 1982). The scale consists of 13 items, including 4 reverse-coded items (*KR-21 coefficient*=0.65). Higher scores suggest higher levels of socially desirable responses.

Analytic Strategy

In order to demonstrate the convergent validity of this newly created measure, we probed the associations between variables. The statistical analyses were performed with SPSS version 24. Associations were evaluated by the Pearson correlation coefficient (see Table 3).

Results

According to the present results, fixed beliefs about mindfulness showed a significant positive association with fixed intelligence beliefs and a marginally significant positive relationship with fixed failure mindset but no relationship with grit. From the variables tapping on mental health, it had a small, positive relationship with depression and blaming others. Finally, it showed a marginally significant negative relationship with positive reappraisal and a marginally significant positive relationship with anxiety. Based on the thorough data probing, no other notable interactions or effects emerged in the subsequent studies (see Supplemental Materials for more details).

Discussion

The main goal of the present study was to demonstrate the construct validity of the Mindfulness Mindset Scale. Our results showed that fixed beliefs about mindfulness are positively associated with fixed intelligence beliefs, depression, and blaming others. This pattern partly supports our hypotheses regarding the relationship of the mindfulness mindset with other fixed mindset beliefs and adaptive functioning regarding arousal regulation and coping.

3 **Table 3.** *Convergent and Divergent Validity Results*

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.
1. Fixed mindfulness mindset	1															
2. Fixed intelligence mindset	0.27**	1														
3. Failure-is-debilitating mindset	0.12	0.11	1													
4. Grit	-0.06	-0.21**	-0.34***	1												
5. DASS: Anxiety	0.15 [†]	0.12	0.35***	-0.43***	1											
6. DASS: Depression	0.16*	0.18*	0.36***	-0.52***	0.72***	1										
7. DASS: Stress	0.06	0.17*	0.41***	-0.35***	0.71***	0.77***	1									
8. CERQ: Self-blame	-0.02	0.04	0.12	-0.30***	0.23**	0.35***	0.27**	1								
9. CERQ: Acceptance	-0.05	0.04	-0.08	-0.10	-0.03	0.01	0.00	0.30***	1							
10. CERQ: Positive refocusing	-0.02	0.04	-0.10	0.19*	-0.14 [†]	-0.25**	-0.16 [†]	-0.14 [†]	0.11	1						
11. CERQ: Catastrophizing	0.07	0.00	0.14 [†]	0.05	0.17*	0.12	0.18*	0.03	0.05	0.03	1					
12. CERQ: Putting into perspective	-0.08	0.02	-0.15 [†]	0.10	-0.10	-0.20	-0.10	0.02	0.31***	0.41***	0.19*	1				
13. CERQ: Refocus on planning	-0.08	-0.15 [†]	-0.32***	0.22**	-0.10	-0.19	-0.12	0.15 [†]	0.22**	0.42***	-0.05	0.37***	1			
14. CERQ: Positive reappraisal	-0.14 [†]	-0.19*	-0.41***	0.27**	-0.16*	-0.26**	-0.27**	0.03	0.19*	0.50***	-0.02	0.54***	0.69***	1		
15. CERQ: Blaming others	0.17*	0.07	0.13	-0.10	0.34***	0.25**	0.27**	-0.03	-0.08	0.21**	0.03	-0.01	0.05	0.03	1	
16. CERQ: Rumination	-0.00	0.03	0.08	-0.23**	0.27**	0.32***	0.34***	0.44***	0.18*	0.08	0.08	0.16*	0.34***	0.19*	0.10	1
17. MC Social Desirability Scale	0.04	0.01	-0.02	0.46***	-0.20*	-0.28***	-0.20*	-0.20*	0.00	0.17*	0.05	0.15 [†]	0.20*	0.29***	-0.11	-0.14 [†]

Notes. DASS=Depression, Anxiety, and Stress Scale; CERQ=Cognitive Emotion Regulation Questionnaire; MC=Marlowe Crowne.

[†] $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Study 3b: French Convergent and Discriminant Validity Results

Study 3 examined the associations between mindfulness mindset and dispositional mindfulness (Feldman et al., 2007) and the mindset meaning system constructs (Dweck & Yeager, 2019) in the French context.

Methods

Participants and Procedure

Participants were first-year French university students from a low-prestige college in a low-income region of the country ($N=320$, 54.4% female, age between 18 and 43, 0.3% over their twenties, $M_{age}=18.78$, $SD_{age}=1.89$, 74.2% perceived ethnic majority, 19.3% was not sure about their ethnic minority status, 6.5% perceived ethnic minority, 5.9% from the capital, 70.1% from towns and 24% from villages, 80.7% without a parent who has tertiary education degree). The current data was gathered through a larger data collection procedure (see also Study 5). The data provided information about the convergent, discriminant (reported in Study 3b), and predictive validity (reported in Study 5). Participation in this study was voluntary without compensation.

Measures

Beliefs about fixed mindfulness. Same as in Study 1, Study 2, and Study 3a. The scale showed good reliability in this sample ($\alpha=0.90$).

Fixed mindset of intelligence. Same as in Study 3a. The scale showed good reliability in this sample ($r=0.61$, $p<0.001$).

Dispositional Mindfulness. The Cognitive and Affective Mindfulness Scale (CAMS; Feldman et al., 2007) was used to determine dispositional mindfulness. This 12-item measure aims to assess the subjective ability to regulate attention, maintain an awareness of present-moment

experience, and maintain an accepting or non-judgmental attitude toward present-moment experience. Respondents indicated the degree to which statements like “*I am able to accept the thoughts and feelings I have*” apply to them ($\alpha=0.63$). Items were rated on a four-point Likert scale from *rarely/not at all* (1) to *almost always* (4). Higher scores mean higher levels of dispositional mindfulness.

Mindset Meaning System. The way mindsets orient individuals’ thinking was measured using five items following the National Learning Mindset intervention (Dweck & Yeager, 2019; Yeager et al., 2019). We measured effort beliefs with one item (“*When you have to try really hard in a subject in school, it means you can’t be good at that subject*”, 1: *completely disagree*, 6: *completely agree*). Performance-avoidance goals were also assessed with a single item (“*One of my main goals for the rest of the school year is to avoid looking dumb in my classes*”, 1: *completely disagree*, 6: *completely agree*). Learning goals were assessed with one item in which students chose between two options (1: *easy problems that will not teach anything new but will give a high score* vs. 2: *harder problems that might provide a lower score but give more knowledge*). We also assessed helpless and resilient responses to academic challenges with one item each (helpless: “*How likely would you think after getting a bad grade that “it means you are probably not very smart at this subject at math?”*”; resilient: “*How likely would you think after a bad grade that you can get a higher score next time if you find a better way to study?*”, 1: *not at all likely to think about it*, 5: *very likely to think about it*).

Analytic Strategy

The statistical analyses were performed by the SPSS version 24. Correlations were estimated by the Pearson coefficient r (see Table 4). As learning goals were a dichotomous variable, we performed an independent samples t-test to test the difference in terms of fixed beliefs of mindfulness between participants willing to learn from working on challenging problems and those who would prefer easy problems.

To test structural invariance between countries and languages, several multigroup confirmatory factor analyses were carried out (Meredith, 1993; Vandenberg & Lance, 2000) using R Statistical Software (version 4.1.0; R Core Team, 2021) package lavaan (Rosseel, 2012). First, the models were estimated freely for both the Hungarian and French samples. Second, four single-factor, first-order models with increasingly constrained parameters were estimated: (1) factor loadings and thresholds were freely estimated (configural invariance), (2) factor loadings were set to be equal (metric invariance), (3) factor loadings and thresholds were set to be equal (scalar invariance), and (4) factor loadings, thresholds, and residual variances were constrained to be equal (strict invariance).

Results

The present results showed that fixed beliefs about mindfulness showed a small, positive relationship with a fixed intelligence mindset, the endorsement of performance-avoidance goals, and helpless responses to challenges. Moreover, it was negatively associated with dispositional mindfulness and resilient responses to challenges.

4 **Table 4.** *Descriptive Statistics, Convergent and Divergent Validity Results*

	<i>Mea</i> <i>n</i>	<i>SD</i>	1.	2.	3.	4.	5.	6.
1. Fixed mindfulness mindset	2.55	0.72	1					
2. Fixed intelligence mindset	2.65	1.16	0.16**	1				
3. Dispositional mindfulness	2.55	0.37	-0.12*	-0.17**	1			
4. MMS: Effort beliefs	4.30	2.57	0.09	0.18**	-0.05	1		
5. MMS: Performance-avoidance goals	3.24	1.60	0.21***	0.19**	-0.05	0.06	1	
6. MMS: Resilient responses to challenges	4.16	0.98	-0.14*	-0.14*	0.17**	-0.16**	-0.01	1
7. MMS: Helpless responses to challenges	3.14	1.13	0.18*	0.13*	-0.32***	0.03	0.20***	-0.25***

Note. MMS=Mindset Meaning System; * $p<0.05$; ** $p<0.01$; *** $p<0.001$.

Independent samples *t*-test showed that participants willing to choose harder but more instructive problems to solve scored higher on the scale measuring fixed mindfulness mindset

($M=2.39$; $SD=0.71$) than those opting for easily solvable problems ($M=2.65$; $SD=0.71$), $t(270)=2.98$, $p=0.003$, $d=0.37$.

Measurement Invariance

To ensure that comparisons of the results across the two countries and languages are meaningful, measurement invariance was employed to examine the scale's factor structure across the two countries and languages. In step zero, the baseline models were estimated for the Hungarian and French samples, showing a good fit (see Table 5). Then, parameters were gradually constrained, and changes in fit indices were observed. In the configural model, all parameters were freely estimated, and the fit indices were within the range of acceptability (CFI=0.949, TLI=0.929, RMSEA=0.088 [90% CI 0.07-0.01]). In the metric model, factor loadings were constrained to be equal, resulting in negligible differences in fit indices ($\Delta CFI=0.000$; $\Delta TLI=0.011$; $\Delta RMSEA=-0.003$). In the scalar invariance model, factor loadings and thresholds were set to be equal in both groups, again showing adequacy in terms of fit index changes ($\Delta CFI=-0.003$; $\Delta TLI=0.004$; $\Delta RMSEA=-0.003$). In the last step, the residual or strict invariance model, residual variances were constrained to be equal, and there was a significant deterioration of fit indices compared to the preceding model ($\Delta CFI=-0.110$; $\Delta TLI=-0.092$; $\Delta RMSEA=0.049$).

Table 5. *Invariance Between French and English Versions of the Mindfulness Mindset Scale*

Hungarian vs. French Invariance										
Model	χ^2 (df)	CFI	TLI	RMSEA	90% CI	Comparison	$\Delta\chi^2$ (df)	ΔCFI	ΔTLI	$\Delta RMSEA$
French	61.530* (20)	0.954	0.936	0.091	0.066-0.117	-	-	-	-	-
Hungarian	47.019* (20)	0.938	0.913	0.085	0.054-0.117	-	-	-	-	-
Configural (C)	108.548* (40)	0.949	0.929	0.088	0.069-0.109	-	-	-	-	-
Metric (M)	115.238* (47)	0.949	0.940	0.081	0.063-0.100	M-C	6.6899 (7)	0.000	0.011	-0.007
Scalar (Sc)	126.864* (54)	0.946	0.944	0.078	0.061-0.096	Sc-M	11.626 (7)	-0.003	0.004	-0.003
Strict (St)	283.459*	0.836	0.852	0.128	0.113-0.143	St-Sc	115.59*	-0.110	-0.092	0.049

χ^2 =Chi-square, df=Degrees of Freedom, CFI=Comparative Fit Index, TLI=Tucker-Lewis Index, RMSEA=Root-Main-Square Error of Approximation, 90% CI=90% Confidence Interval of the RMSEA, $\Delta\chi^2$ =Chi-square Difference Test, Δ CFI=Change in CFI value compared to the preceding model, Δ TLI=Change in the TLI value compared to the preceding model, Δ RMSEA=Change in the RMSEA value compared to the preceding model.

* $p < 0.001$.

Discussion

People with more malleable beliefs indicated higher scores on the dispositional mindfulness measure. However, it appears that the correlation was relatively small. Therefore, the overlap between the two concepts appears relatively small, confirming divergent validity; malleability belief about mindfulness skills is a fundamentally distinct construct from trait mindfulness. At the same time, the small correlation seems to suggest a complex relationship between mindfulness malleability beliefs and trait mindfulness. For instance, many people might be low on trait mindfulness but believe that mindfulness skills can be trained. In addition, people with a regular mindfulness practice are likely to score high on the malleability of mindfulness, and, at the same time, they might be very aware of their lack of mindfulness in their everyday lives, and thus, they might underestimate their trait mindfulness. These might explain the small correlation found. Future research should entangle this complex relationship.

A fixed mindfulness mindset was positively related to performance-avoidance goals and helpless response to a challenge, while negatively related to resilient responses. The correlation pattern between the mindset meaning system items and the mindfulness mindset was very similar to those found in the fixed intelligence mindset (and also in prior large-scale studies, Dweck & Yeager, 2019). It appears that the two mindset domains (intelligence and mindfulness) can contribute similarly to the mindset meaning system dimensions (see also in Study 5) without a substantial overlap between them (as the result of the weak correlation between the two; $r = 0.16$ - 0.37 , on average: $r = 0.27$ with 7% of common variance). The scale appears to be invariant across Hungarian and French students and languages, and we found significant differences only at the

strict level, which means that at least one item's residual variance was different between the two groups (Putnick & Bornstein, 2016). However, the residual invariance is inconsequential to interpreting latent mean, loading, and intercept differences (Vandenberg & Lance, 2000). Despite the residual invariance differences, students from Hungary and students from France filled in the Mindfulness Mindset Scale in a very similar manner.

What are the practical implications of invariance testing? Simply put, the measure had an acceptable configural invariance, which means that the underlying structure or relationship pattern between the items and the factor is similar for Hungarian or French students. It is like they have the exact blueprint for the house; however, the colors and decorations differ. It means that the two groups hold the same underlying patterns of mindfulness mindset (e.g., which questions are related to each other). It also showed a good metric invariance, like having the same ruler to measure the mindfulness mindset in the two groups. It means the items or metrics have the same meaning and measurement units for French and Hungarian students. The measure demonstrated a good scalar invariance, similar to having a zero point on a thermometer mean the same for different groups. Therefore, the way it assesses mindfulness mindset is consistent (metric invariance), and the items have the same measurement units (e.g., the same level of fixed mindfulness mindset) across the two groups. Strict invariance ensures that the measurement scales, the item characteristics, and the meaning of the measurements are consistent across all groups being compared. Our new scale had an inadequate strict invariance, meaning respondents do not necessarily mean the same on (at least one) given statement.

Study 4: Predictive Validity for Mastery Behaviors and Associations with Academic Grades

With this study, we aimed to demonstrate the predictive validity of the Mindfulness Mindset Scale and examine whether it is correlated with mastery behaviors. Furthermore, we investigated the links between students' academic achievement and the Mindfulness Mindset Scale. Therefore,

the primary goal was to demonstrate that mindfulness mindset relates to mastery behaviors and real-world academic achievement.

Methods

Participants

To examine the predictive validity, we used the responses of 470 Hungarian university students (84% female, aged between 18 and 52 years, 3.2% over their twenties, $M_{age}=21.7$; $SD_{age}=4.08$, 3.2% ethnic minority, 46.4% from the capital, 37.5% from towns, and 15.5% from villages, 34.5% without a parent who has tertiary education degree). Participation in this study was voluntary. In the validation study of PERC, the link between the intelligence mindset and PERC overall score was $r=0.14$ (Porter et al., 2020); we expected a similarly weak correlation between the mindfulness mindset and mastery behaviors. For this reason, the expected sample size was $N=398$. We aimed to recruit more students as we were unsure about the potential attrition during the relatively tedious PERC task.

Procedure

Participants were invited to participate in an online investigation about the relationship between individual differences and visual problem-solving. After completing self-report questionnaires and reporting their GPA, they performed the PERC task that enabled us to collect behavioral data related to mastery orientation. Students completed the PERC task and self-report questionnaires in a single session. Participants received partial course credit for their participation.

Measures

Mastery Behaviors. After piloting the original task version (Porter et al., 2020), we constructed the Hungarian college student version of the Persistence, Effort, Resilience, and Challenge-Seeking (PERC) Task to assess mastery behaviors. This measure is based on Mueller and

Dweck's Laboratory Task (1998). In the PERC, participants completed different sets of Raven's intelligence matrices. The task was set up to measure *challenge-seeking*, *effort*, *persistence*, and *resilience*. After participants completed a set of easy puzzles as a baseline exercise, they needed to choose whether to continue with similarly easy vs. more difficult tasks (*challenge seeking*). Despite their choice, participants solved a mix of medium-difficulty tasks. After each task, they had the chance to review the solutions of each task, and *effort* was measured in terms of time spent viewing these solutions. Subsequently, students received a set of challenging puzzles, and *persistence* was measured in terms of time spent on these difficult puzzles. Lastly, participants had the chance to solve a final set of easier items after this challenging set of tasks. *Resilience* was assessed regarding accuracy on these tasks, which represented resilience after solving the previous complex block ("post-failure performance", Porter et al., 2020, p. 7). These dimensions were aggregated to a general indicator of mastery behaviors. The measure was initially developed for high school students. However, our pilot study found it necessary to increase the task's difficulty level for college students. For example, we found a floor effect in resilience using the high school version with almost zero variance. Therefore, we adapted the PERC task to have an appropriately difficult level for the university population. For this purpose, we selected Raven items used in our previous study (Nagy et al., 2022), accounting for the difficulty levels (% of successful completion rate) for each block determined by the original PERC study (Porter et al., 2020). Our primary outcome was the aggregate indicator of mastery behavior; we used the separate scores of the four dimensions: challenge-seeking, resilience, persistence, and effort as secondary outcomes.

Beliefs about fixed mindfulness. Same as in Study 3. The scale showed good reliability in this sample ($\alpha=0.86$).

Grade point average (GPA). As an additional behavioral measure, the university provided participants' official GPA earned in their previous academic term, which is rated on a five-point scale (1=worst grade (fail) ~E/F in the US grading system, 5=best grade ~A in the US grading system where 2=passing) in the Hungarian higher educational system.

Statistical analyses were performed using R Statistical Software (version 4.1.0; R Core Team, 2021). First, we performed a zero-order correlational analysis, including all variables.

Results

Zero-order correlation showed that a fixed mindfulness mindset had a negative association with behavioral measures of mastery-related factors: persistence, effort, resilience, and challenge-seeking, as well as academic achievement, as shown in Table 6.

5 **Table 6.** Correlations Between the Measured Variables

	1.	2.	3.	4.	5.	6.	7.
1. Fixed mindfulness mindset	1						
2. PERC: Aggregated score	-0.18***	1					
3. PERC: Persistence	-0.17***	0.73***	1				
4. PERC: Effort	-0.18***	0.52***	0.78***	1			
5. PERC: Resilience	-0.14**	0.77***	0.65***	0.50***	1		
6. PERC: Challenge-seeking	-0.11*	0.79***	0.39***	0.25***	0.31***	1	
7. GPA	-0.18***	0.00	-0.02	0.07	0.05	-0.05	1

Notes. PERC=Persistence, Effort, Resilience, and Challenge-Seeking. The table represents Pearson correlations (*r*) for all variables. PERC (*N*=470), GPA (*N*=403).

p*<0.05; *p*<0.01; ****p*<0.001.

Discussion

These results suggest that a fixed mindfulness mindset is negatively related to mastery behaviors such as effort, persistence, resilience, and challenge-seeking. The negative relationship was genuine for this novel measure of mastery behaviors, and in the fixed mindfulness mindset was also negatively correlated with academic performance.

Study 5: Predictive Validity for Academic Performance in a Different National Context

The present study aimed to examine the predictive validity of the Mindfulness Mindset Scale in terms of academic grades in a new country context. Furthermore, considering intelligence mindsets and dispositional mindfulness, we were interested in whether these links still stand. This study also allowed us to reproduce prior findings (Dweck & Yeager, 2019) about mindset beliefs, mindset meaning system elements, and academic performance. Therefore, it aimed to provide further evidence for the potential academic benefits of a growth mindfulness mindset beyond the previously demonstrated (Study 3a) positive mental health outcomes.

Methods

Participants and Procedure

Statistical analyses were performed on the same sample as in Study 3b; however, we were mainly interested in predictive validity regarding academic achievement in the present case. We aimed to identify a weak correlation (between $r=0.15$ and $r=0.20$) between GPA and mindfulness mindset. For this strength of correlation, the suggested sample size ranged between $194 < N < 347$ respondents; thus, the sample size of $N=320$ (see Study 3a) appeared to be adequate.

Measures

Beliefs about fixed mindfulness. Same as in the previous studies. The scale showed good reliability in this sample ($\alpha=0.90$).

Fixed mindset of intelligence. Same as in Study 3a, b, and Study 4. The scale showed good reliability in this sample ($r=0.61$, $p<0.001$).

Mindset Meaning System. The same as in Study 3b.

Dispositional Mindfulness. The same as in Study 3b. The Cognitive Affective Mindfulness Scale showed good reliability in the current sample ($\alpha=0.63$).

Grade point average (GPA). University provided official grades in each of the courses of their last semester on a twenty-point scale (1=worst grade ~F in the US grading system, 20=best grade ~A in the US grading system, below 10, the course is failed). Since the present participants belonged to two different grading systems, we standardized the grades (by grading systems) to be comparable.

Failing records. The university provided data regarding participants' failing in each term (failed or did not fail). Fail means the end of studies due to not reaching the minimum overall grade.

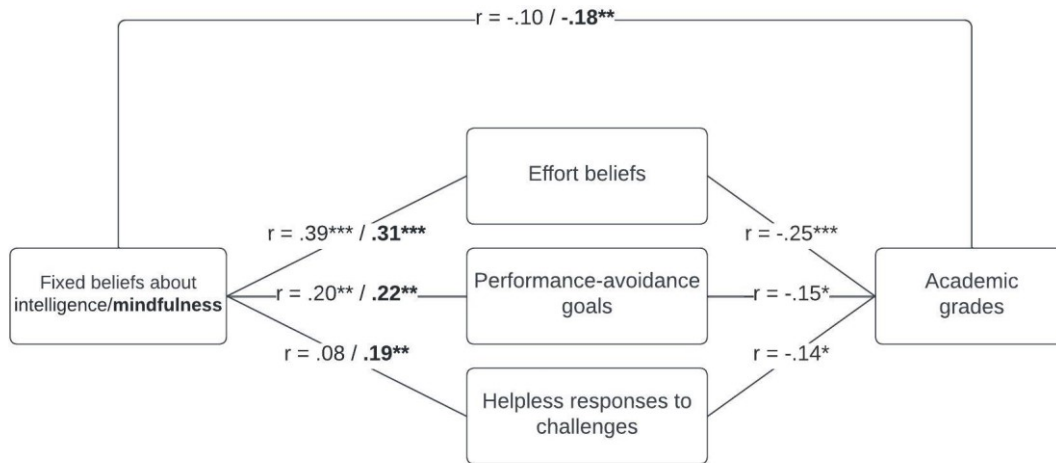
Analytic Strategy

Statistical analyses were performed using R Statistical Software (version 4.1.0; R Core Team, 2021). First, we reproduced Dweck and Yeager's theoretical model and analysis (2019) regarding the mindset meaning system items and intelligence mindset in a French higher educational sample. Subsequently, we reproduced this model by substituting the intelligence mindset with a mindfulness mindset. Finally, we used OLS and binomial regressions to test whether a fixed mindfulness mindset can predict academic outcomes above and beyond fixed intelligence beliefs and dispositional mindfulness.

Results

Zero-order correlation results showed that a fixed mindset about intelligence and a fixed mindset about mindfulness show similar patterns with the mindset meaning system elements and academic performance regarding grades (Figure 1). However, in the current sample, a fixed mindfulness mindset (vs. intelligence mindset) showed a significant negative association with academic grades and a positive association with helpless responses to challenges.

6 **Figure 1.** *The Connection Between the Fixed Beliefs About Intelligence and the Fixed Beliefs About Mindfulness with the Mindset-Related Meaning System Elements that Can Predict Academic Grades*



Notes. The paths represent *zero-order correlation* coefficients following Dweck and Yeager (2019). The first values correspond to intelligence mindset, the second and bold values correspond to fixed mindfulness mindset.

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

A multiple linear regression showed that among the measured variables, fixed mindfulness mindset, $b = -0.24$, $t(245) = -2.689$, $p = 0.008$, $d = 0.18$, was a significant negative predictor of the first-semester official grade point average after controlling for intelligence mindset, $b = -0.08$, $t(245) = -1.244$, $p = 0.21$, $d = 0.08$, and dispositional mindfulness, $b = 0.15$, $t(282) = 1.311$, $p = 0.19$, $d = 0.09$. At the same time, fixed mindfulness mindset, $b = -0.20$, $t(243) = -2.173$, $p = 0.03$, $d = 0.15$, also predicted the second-semester grade point average of the participants after keeping intelligence mindset, $b = -0.07$, $t(243) = -1.076$, $p = 0.28$, $d = 0.07$, and dispositional mindfulness, $b = 0.28$, $t(243) = 2.431$, $p = 0.02$, $d = 0.17$ constant.

Conducting a binary logistic regression, it was found that, holding the intelligence mindset and dispositional mindfulness constant, the odds of failing in the first semester increased by 35% (95% CI [0.48, 0.87]) for participants who scored one standard deviation higher on fixed mindfulness mindset ($p = 0.005$). However, in the second semester, this failing probability drops to 28% (95% CI [0.58, 1.03]) for those scoring one standard deviation higher on fixed mindfulness items ($p = 0.08$).

Discussion

According to the results, a fixed mindfulness mindset is negatively associated with grades from official academic records in a French higher education sample, above and beyond dispositional mindfulness and intelligence mindsets. Furthermore, it is in a similar relationship pattern with mindset meaning system and academic performance as intelligence mindset (Dweck & Yeager, 2019).

Study 6: Mindfulness Mindset Changes Across Countries as the Result of Learning Mindset Intervention

Several studies have demonstrated that carefully designed interventions can change mindsets about intelligence (Yeager et al., 2019), stress (Crum et al., 2013), or emotion reappraisal (see Jamieson et al., 2018); thus, we might assume that beliefs about the malleability of mindfulness and its components could also be changed. Since, currently, there are no established interventions aiming to change the mindfulness mindset, as a preliminary attempt to explore this new construct's changeability, we used an evidence-based and cross-nationally successful mindset intervention (i.e., learning mindset intervention; Yeager et al., 2019, see also Rege et al., 2021). As this learning mindset intervention refers to the plasticity of the brain, emphasizes the importance of efforts and strategy choices in learning, and uses the analogy that the brain is like a muscle, we assumed that it might bring about changes in beliefs about the changeability of learning-relevant mindfulness skill as well. Our rationale to explore the impact of a learning mindset intervention on the mindfulness mindset could be illustrated through emerging literature regarding the so-called "bifactor structure" of mindset beliefs and systems theory.

Mindset studies generally measure mindset in a domain-specific manner (e.g., intelligence, math ability, personality, morality, anxiety; Blackwell et al., 2007; Degol et al., 2018; Han et al., 2018; Ratchford et al., 2021; Schroder et al., 2017). However, some authors discussed the idea of an overarching, global mindset, which encompasses a general belief about growth (Lewis et al., 2021;

Petscher et al., 2017). Correspondingly, research results seem to confirm the presence of a global mindset factor by demonstrating the existence of a bifactor structure with a global mindset and domain-specific factor (Lewis et al., 2021). Similarly, our previous results (Study 3a) demonstrated that a fixed mindfulness mindset is positively related to a fixed intelligence mindset, which might also support the idea that there is a global mindset belief.

Suppose we assume the existence of a global mindset construct that incorporates all domain-specific mindset beliefs and transpose this idea to the systems theory framework that asserts that changing one element in the system may trigger changes in other elements or the whole system (von Bertalanffy & Sutherland, 1974). In that case, we might expect that change in a large and relatively overarching domain, such as the mindset of learning, could also set changes in other mindset domains in motion. If students encounter messages advocating the changeability or improvability of their abilities, they might also apply this new knowledge or way of thinking in other contexts less directly related to learning. Thus, this new change in one domain could be transferred to another. Overall, the current two studies could confer additional evidence that the mindfulness mindset behaves like other mindset beliefs; thus, it is also changeable through interventions.

Methods

Participants

For the present study, two sets of participants were recruited: French and Hungarian university students. To have enough statistical power to demonstrate a significant difference between the control and the intervention groups with an effect size between $d=0.20$ and $d=0.25$, with a power of 0.80, we needed 504-786 participants as in this case, the intervention focused on intelligence beliefs and not mindfulness beliefs.

The French sample consisted of 613 undergraduate college students ($N_{female}=345$), aged between 18 and 28 years (0% over their twenties, $M_{age}=18.69$, $SD_{age}=1.17$, 20.8% were not sure

about their (perceived) ethnic minority status, 6.2% belonged to a (perceived) ethnic minority group, 4.6% from the capital, 69.8% from towns, and 25.6% from villages, 79.4% without a parent who has tertiary education degree) who were randomly allocated into the intervention ($N=360$) and control ($N=369$) conditions. The Hungarian sample consisted of 524 Hungarian engineering undergraduate first-year students ($N_{female}=58$; 11.1%), aged between 18 and 39 years (1.3% over their twenties, $M_{age}=19.43$, $SD_{age}=2.46$, 2.9% ethnic minority, 37.6% from the capital, 45.4% from towns, and 17% from villages, 23.3% without a parent who has tertiary education degree), have participated and were randomized into the intervention ($N=259$) and control ($N=265$) conditions. Among the participants were numerous students who were also the first in their families to attend college ($N_{total}=100$, 19.1%).

Procedure

The present study implemented a well-established, self-administered, online intervention developed by Yeager et al. (2019) to improve students' growth mindset about their learning abilities and intellectual capacities. In a nutshell, the central message of this intervention is that working hard, choosing challenging work as well as adaptive strategies, and asking for help can improve their abilities (for a more detailed presentation of the intervention's content, see Yeager et al., 2016, 2019). This message is conveyed by presenting information about the brain's functioning, plasticity, and improvability through learning. Moreover, the idea of malleability and its internalization is further reinforced by self-reflective activities (identifying the benefits of having a stronger brain, like achieving one's goals), metaphors (brain like a muscle, which improves through challenging work), quotes from prominent scientists (source credibility), and messages from other students who participated in the intervention. Finally, saying-is-believing and self-persuasive activities were also included, which asked participants to advise a struggling peer and formulate how to use their stronger brain to achieve their goals.

Participants were invited to participate in the present study by their teachers. The same platform delivered the survey and intervention during course hours in a single session. First, participants completed the baseline survey and were automatically randomized into the intervention and control conditions by the survey platform. Participants in the intervention conditions were presented with the above-presented growth mindset intervention content. The control condition paralleled the growth mindset intervention regarding length, design, presentation, and content type (e.g., stories, scientific information, quotes) and provided general information about the brain. Participation was voluntary and completely anonymous; no rewards were offered to those participating.

Measures

Before and after the intervention, several measures were implemented. However, we will focus only on intelligence and mindfulness mindset measures in the present case. The other results will be published elsewhere.

Beliefs about fixed mindfulness. At the pre-test, we used four items from the newly developed Mindfulness Mindset Scale to measure beliefs about fixed mindfulness (one from each of the four dimensions), while in the post-test, we used all eight items. The scale was reliable on this sample ($\alpha_{pre, 4 \text{ items}}=0.67$; $\alpha_{post, 8 \text{ items}}=0.89$).

Fixed mindset of intelligence. We used the same measure as in Studies 3a,b, 4, and 5 to measure fixed intelligence mindset. The scale showed good reliability at the pre- ($\alpha=0.75$) and post-test ($\alpha=0.80$).

Analytic Strategy

Statistical analyses were performed using R Statistical Software (version 4.1.0; R Core Team, 2021). Ordinary least squares (OLS) regression analyses were carried out separately in each national subsample to explore the impact of the growth mindset intervention on intelligence and

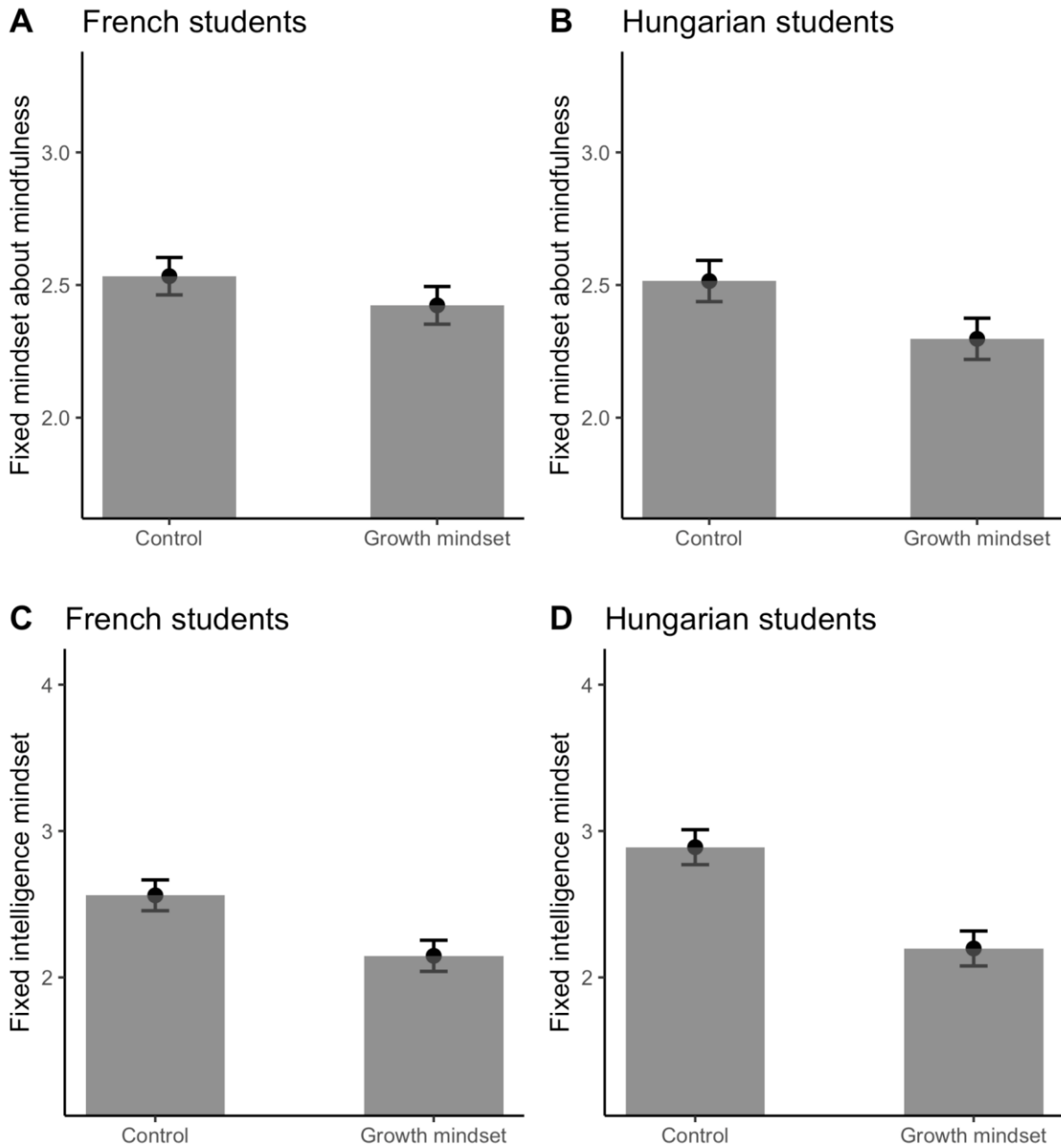
mindfulness mindset when controlling for initial intelligence or mindfulness mindsets, respectively, in each sample. In the analysis, only those participants who provided outcome data at post-test were included.

Results

Among the French university students, a simple linear regression indicated that the intervention reduced the fixed mindfulness mindset at the post-test when the initial level of fixed mindfulness mindset was controlled, $b=-0.110$, $t(612)=-2.153$, $p=0.032$, $d=0.147$. Those French students in the intervention group reported lower levels of fixed mindfulness mindset at the post-test with a 0.15 standard deviation. We found an even more substantial effect among Hungarian engineering students, $b=-0.219$, $t(511)=-3.899$, $p<0.001$, $d=0.263$. It means that Hungarian participants in the intervention group reported lower levels of fixed mindfulness mindset at the post-test with a 0.26 standard deviation.

In the case of fixed intelligence mindset, the intervention reduced the fixed intelligence mindset among French students at post-test when controlling for initial levels of fixed intelligence mindset, $b=-0.413$, $t(645)=-5.414$, $p<0.001$, $d=0.365$. Again, this effect was even stronger among Hungarian students, $b=-0.692$, $t(645)=-8.4021$, $p<0.001$, $d=0.549$. In sum, the intervention led to the expected intelligence mindset change (contrasting to the control) in both country contexts, and it also made students believe that their mindfulness-related skills can be changed. These differences between groups in mindfulness mindset and intelligence mindset post-test scores are also illustrated in Figure 2.

7 **Figure 2.** *Post-Test Intervention Mindset Scores Separately for the Growth Mindset Intervention and Control Groups Among French and Hungarian Students*



Notes. *A*, Post-intervention self-reported fixed mindfulness mindset scores (1-5) among French participants; *B*, Post-intervention self-reported fixed mindfulness mindset scores (1-5) among Hungarian participants; *C*, Post-intervention self-reported fixed intelligence mindset scores (1-6) among French participants; *D*, Post-intervention self-reported fixed intelligence mindset scores (1-6) among Hungarian participants.

The bar caps represent standard errors.

Discussion

The present study confers preliminary evidence for the changeability of the mindfulness mindset. Results indicate that a learning mindset intervention reduced the fixed intelligence and mindfulness mindsets.

Study 7: A Mindset about Mindfulness Intervention

In the prior study, we found that an intelligence growth mindset intervention can change beliefs about mindfulness. However, in the present study, we wanted to see whether similar changes can be seen in the case of an intervention focusing specifically on mindset about mindfulness. As prior studies (Studies 4 and 5) demonstrated that a growth mindfulness mindset is related to better academic achievements, in the present case, we mainly focused on the changeability of these beliefs and not the academic performance outcomes as a downstream consequence of the belief change.

Methods

Participants

As this intervention aimed to target specifically mindfulness mindset beliefs and not intelligence-related beliefs, we expected that a smaller sample size would be enough to demonstrate these effects compared to the prior intervention studies. Thus, to have enough statistical power to demonstrate a difference between the intervention and the control groups with an effect size ranging between $d=0.35$ and $d=0.40$, with a power of 0.80, we needed 198-258 participants. Altogether 208 Hungarian university students were randomly allocated to one of the two conditions (66.3% female, aged between 18 and 50 years, $M_{age}=22.29$; $SD_{age}=3.87$, 5.8% over their twenties, 2.4% ethnic minority, 59.6% from the capital, 32.7% from towns and 7.7% from villages, 31.3% without a parent who has tertiary education degree) and after filtering the duplicated entries 202 students ($n=102$ control, $n=100$ intervention) remained in the sample. From the control condition 3 (2.88%),

while from the intervention condition, 7 (6.73%) of the students did not finish either the intervention/control task or the post-intervention assessment and were thus excluded from analyses.

Procedure

Based on Walton and Wilson (2018), we developed a brief intervention to change beliefs about students' mindfulness skills. The main message of this intervention was that the components of mindfulness skills (attention, awareness, present-orientation, and acceptance) are malleable, and they can be improved by practicing them. We used student testimonials to demonstrate these malleability beliefs. After reading these testimonials as personal messages to other students, participants could work on a "saying-is-believing" exercise (Walton & Cohen, 2011). Participants were requested to advise a struggling peer and formulate how they would use their stronger mindfulness skills to achieve their goals. This indirect self-persuasive strategy (Aronson, 1999) was proven effective in prior lay belief interventions, leading to recursive processes and long-term change (see Walton & Wilson, 2018; e.g., Yeager et al., 2019).

See Figure 3 as an example of a sample testimonial that the students could read, see Figure 4 for the "saying-is-believing" exercise, and see Figure 5 for a letter one of the participating students wrote. The control condition had the same structure and type of interactive reflection task; however, its content was neutral regarding psychological processes and related to a healthy diet that can contribute to better academic performance. The control condition paralleled the treatment condition in terms of length, design, presentation, and content type (e.g., stories) except that it provided information about the importance of eating healthy (*response time* $Mdn_{Mindfulness\ Mindset}=1916.50$ s, *response time* $Mdn_{Control}=1825$ s, $p>0.05$; *number of characters* $Mdn_{Mindfulness\ Mindset}=330.50$, *number of characters* $Mdn_{Control}=379.50$, $p>0.05$). Following informed consent, the survey software accomplished random assignments automatically in real-time.

Participants were invited to participate in the study for a partial credit course. First, participants completed the pre-intervention survey, were automatically randomized into the

intervention and control conditions, and filled out the post-intervention tests. Participation was voluntary and completely anonymous; no rewards were offered to those participating.

Figure 3. *Sample Testimonial from the Mindfulness Mindset Intervention.*

Today I take criticism less to heart

"My mother often told me that I was someone who took things to heart. I used to ruminate quite a lot when I got criticism about my performance. Sometimes I would spend days turning over the feedback from one of my teachers. At one boxing practice, my coach once stopped me in the middle of a fight and said the following while I was gasping for breath. "If you're fixated on what you messed up, you can't pay attention to what's going on. You think the deeper you hurt yourself for a mistake you make, the more you learn from it? Well, you're wrong. While you're busy thinking gloomy thoughts, you can't learn from what's happening to you. That's when they knock you out in boxing and in life." I've found that I don't learn by dwelling on things, I learn by paying attention to what's happening to me in the here and now. Only I can change how much I take things to heart. Of course, I'm still listening to criticism, but today I'm deliberately not adding to the pointless ruminations that kept me tossing and turning at night."

Kitty, 20-year-old PE student

Notes. Translated by deepl.com.

Figure 4. The Instruction of the “Saying-is-Believing” Letter-Writing Exercise Aiming to Facilitate Self-Persuasion

Advice to improve concentration

Now think of a dear friend or relative who could benefit from these thoughts.

How would you explain to them that concentration can be improved and opens the way to strengthening the brain?

For example, you could write about

- **with practice it becomes easier to redirect your wandering attention back to learning,**
- **ruminating does not take you forward,** and with practice it becomes easier to reduce the amount of it,
- **you can learn to be more and more in the present** while studying.

Along the lines of the above thoughts, what do you suggest for when you find it difficult to pay attention when preparing for an exam or when you receive negative feedback from a teacher?

Below the text box you can see the stories you have read before.

Please let us know what your advice is!

At the end of the exercise, you can send them this advice.
We will also share your thoughts anonymously with future students.

"Improving concentration skills opens the way to develop my brain in a way that..."

Please describe in a few sentences!

Being **prosocial** with loved ones in need

Learning mindset: Everybody can learn these strategies with some effort

Encouraging them to **integrate the strategies** into their letter

Encouraging them to choose the best **personalized arguments**

Students are **capable** of providing a good advice

Letter-writing exercise allows **self-persuasion**

Notes. Translated by deepl.com.

Figure 5. Sample Letter Written by One of the Participants

“Developing concentration is very important in achieving our everyday goals. If all you think about is studying for a difficult exam, and you've been racking your brain for days before, you'll get tired, and your performance may be determined to a large extent by how much you've been chewing over what you haven't been able to learn, review or remember. For me, it helped me a lot to focus on the present, to let go of those factors and just think about what I could put down on paper then and there, in that moment. I didn't dwell on what ifs or what would have been ifs. So, I was able to get over the feeling of failure and show my true knowledge.”

Notes. Translated by deepl.com.

Measures

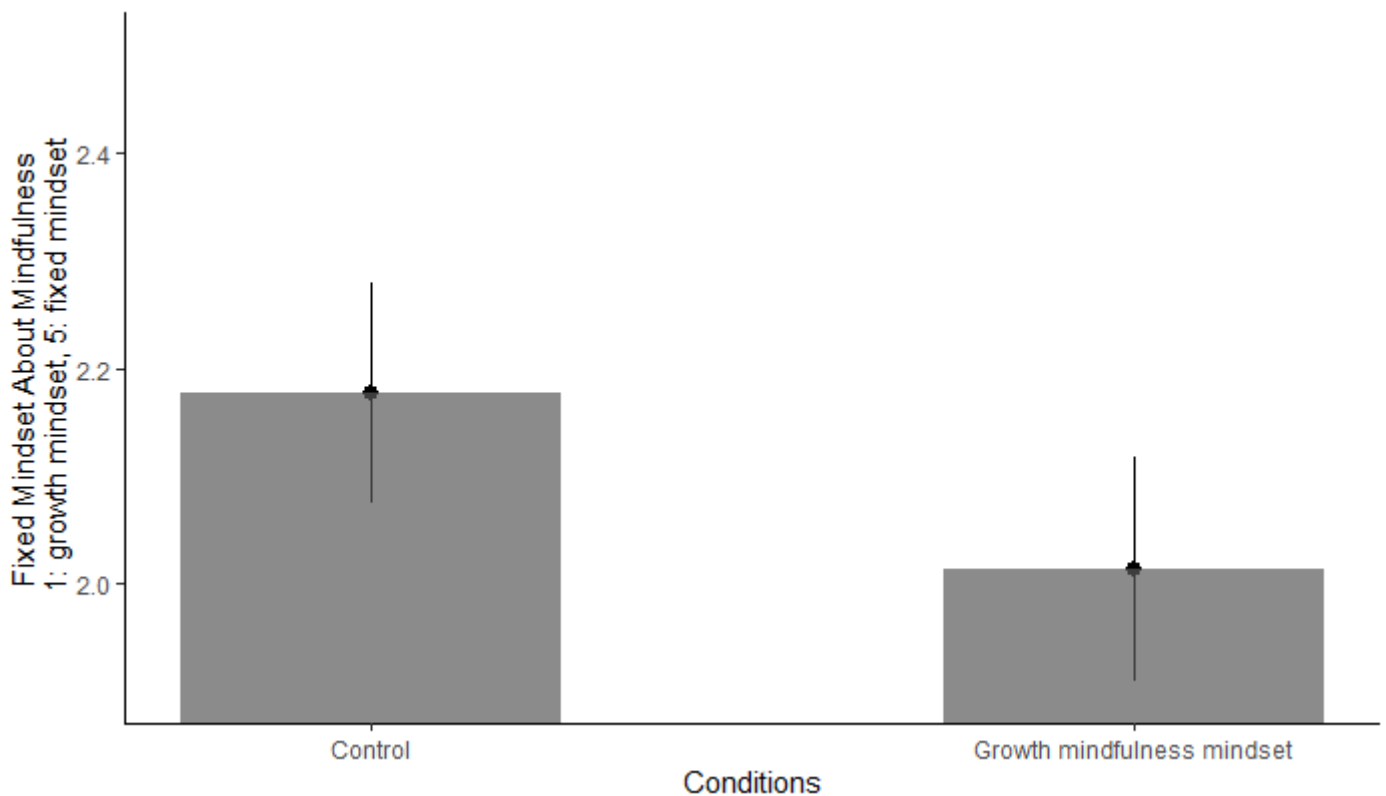
Beliefs about fixed mindfulness. Before and after the intervention, we used the Mindfulness Mindset Scale to measure beliefs about fixed mindfulness. The scale showed excellent reliability in this sample ($\alpha_{pre}=0.88$; $\alpha_{post}=0.93$).

Statistical analyses were performed using R Statistical Software (version 4.1.0; R Core Team, 2021). OLS regression analyses were conducted to measure the effect of the growth mindfulness mindset intervention on mindfulness mindset when controlling for initial mindfulness mindsets. In the analysis, only those participants who provided outcome data at the post-test were included.

Results

The results suggested that the intervention reduced the fixed mindfulness mindset at the post-test when the initial level of fixed mindfulness mindset was controlled, $b=-0.16$, $t(189)=-2.21$, $p=0.028$, $d=0.19$. This means that students in the intervention group reported lower levels of fixed mindfulness mindset in the post-test, with a 0.18 standard deviation compared to the pre-test.

8 **Figure 6.** Post-Test Intervention Predicted Mindfulness Mindset Scores while Controlling for Pre-Intervention Scores



Notes. Post-intervention self-reported fixed mindfulness mindset scores (1: Strongly disagree -5: Strongly agree) among participants randomly allocated to control or growth mindfulness mindset conditions. The Y axis depicts ~ 1 SD. Error bars represent standard errors.

Discussion

The present study confers preliminary evidence for the changeability of the mindfulness mindset. Results indicate that an intervention targeting the malleability of mindfulness skills reduced the fixed mindfulness mindset immediately after the intervention. They also suggest that this new measurement instrument is sensitive enough to measure change. Future studies might examine the long-term effects and the downstream consequences of changing this mindset.

General Discussion

One main conclusion of mindset research is that the ways people think about their skills fundamentally matter (Dweck & Yeager, 2019). The current research project, through seven studies, highlighted that this is also true for thinking about mindfulness-related skills. To our knowledge, no prior study examined the role of malleability beliefs of mindfulness in education, and only one systematic research investigated this topic in the organizational context (Kong & Jolly, 2019). The present study aimed to fill this gap by asking whether malleable mindfulness beliefs are associated with coping strategies and academic achievement among students. Furthermore, it should be noted that there is a lack of evidence regarding beliefs about mindfulness and the relationship between mindfulness and academic achievement and learning. Only a handful of studies demonstrate associations between academic performance and mindfulness-related constructs or interventions (Beauchemin et al., 2008; Lin & Mai, 2018; M. D. Mrazek et al., 2017; Nidich et al., 2011). Therefore, the present study, focusing on the malleability beliefs of mindfulness, aimed to contribute to the mindfulness literature with an aspect that might benefit academic performance in two different higher educational contexts in France and Hungary.

The Mindfulness Mindset Scale demonstrated excellent *psychometric properties* according to the exploratory and confirmatory factor analyses and the reliability analyses with language

invariance considering French and Hungarian respondents (Studies 1 and 2). Regarding *convergent validity*, fixed mindfulness mindset was positively associated with fixed intelligence beliefs, depression, and blaming others, with helpless responses to challenges and performance-avoidance goals, as well as devaluing efforts in learning, and it was negatively associated with dispositional mindfulness and resilient responses to challenges (Study 3a and 3b). *Discriminant validity* analyses demonstrated that this belief is distinct from other mindsets (intelligence, failure is debilitating) and trait mindfulness (Studies 3a and 3b). *Predictive validity* results suggest that fixed intelligence beliefs are negatively associated with mastery behaviors like challenge seeking, effort, persistence, and resilience after struggling with difficult problems and negatively predicted academic grades in two countries with fairly different educational systems (Studies 4 and 5). Finally, two randomized controlled trial field experiments demonstrated the *changeability* of mindfulness beliefs through a well-established growth intelligence mindset intervention adapted to a non-US cultural context (Yeager et al., 2019, Study 6) and a new mindfulness mindset-specific intervention (Study 7). Table 8 presents an overview of the studies.

9 **Table 8.** *The Brief Summary of the Results of the Studies.*

	Aims of the studies	Results
Study 1 Study 2	Factor Analyses: Scale development, exploratory and confirmatory factor analysis, reliability, and item response theory	Appropriate factor structure, internal reliability, and item response theory results
Study 3a Study 3b	Self-reported Validity: Measurement invariance, convergent and discriminant validity with mindset-, mindfulness-, and coping-relevant self-reported measures and social desirability correlates	Appropriate invariance, convergent validity with relevant mental health and coping, divergence from similar measures, unrelated to social desirability
Study 4 Study 5	Behavioral Validity: Prediction of mastery behaviors and grade point average	Predicting mastery behaviors and academic performance

Study 6 Study 7	<p>Changeability: Prior intelligence mindset intervention studies that can change mindfulness mindset in two countries</p> <p>Newly designed specific and targeted interventions can change the mindfulness mindset</p>	Both a classic intelligence mindset and a new mindfulness mindset intervention can lead to more malleable beliefs about mindfulness immediately after the intervention
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Notes.

Theoretical Contribution

Enhancing mindfulness mindsets may promote mindfulness-related skills and willingness to make efforts to develop those skills. It might predict compliance with interventions and willingness to maintain a mindfulness practice in the long run. Accordingly, it may be a moderator of intervention efficacy. Both research on implicit beliefs (see Burnette et al., 2022) and mindfulness (see Goldberg et al., 2022) are on the rise. However, attempts for integration of the two broad fields are relatively sparse. This research suggests that integrating these fields by enhancing beliefs about the malleability of mindfulness skills can positively impact mindfulness-related skills. Thus, promoting the understanding that mindfulness skills can be developed and improved through practice may offer a promising approach to enhancing mindfulness practices and may be built into mindfulness interventions.

The belief about the possibility of improving mindfulness skills does not appear in the scientific discourse systematically. Although there are some references to the malleability nature of mindfulness skills that “*requires practice to develop and become routine*” (Jankowski & Holas, 2014, p. 75) or Garland et al. (2009) posited that “*mindfulness is an innate psychological function that can be fostered by training*” (p. 38), and that is the basic idea behind mindfulness-based interventions, former studies did not put this aspect of participants’ metacognition in the focus of their research (except for a very few studies, e.g., Kong & Jolly, 2019). The present results demonstrate the importance of examining these beliefs, especially in education and academic performance.

Previous studies tackled the malleability aspects of some mindfulness-related concepts. The malleability of attention (Zhang et al., 2021) is relevant for the attention segment of the mindfulness concept, while the malleability of rumination (Bessette et al., 2020) can be connected to the present-focus aspect of mindfulness. In contrast to these constructs, our focus on mindset regarding mindfulness was broader and included four already well-explored components (attention, awareness, present-orientation, and acceptance) constituting mindfulness. Our conceptualization of mindfulness mindset is aligned with the classic intelligence mindsets (Dweck & Yeager, 2019), where the *malleability (growth vs. fixed)* is in the focus instead of other aspects such as the good vs. bad (e.g., failure is debilitating mindset; Haimovitz & Dweck, 2016), the enhancing vs. debilitating (e.g., stress mindset; Crum et al., 2013), or limited vs. non-limited (e.g., willpower; Job et al., 2010) dimensions.

Applied and Practical Relevance

Mindfulness practices can be embedded into a more general framework when one imagines that meditation is a never-ending Sisyphean work without improvement in contrast to the image of gradual progress leading to the flourishing of the soul. Thus, malleability beliefs about mindfulness-related skills likely affect how much effort one puts into and how likely they are to keep up with mindfulness-related practices if one believes in developing these skills.

One can approach the present results from the perspective of students' learning. Students might often hear sentences like "pay attention!" or "be present" at school. The meaning of these messages that a student can get from a teacher or a parent is entirely different if one thinks of these mindfulness-related skills as something that can be improved compared to something set in stone. These beliefs about mindfulness skills can lead to different behavioral tendencies in the long term and induce recursive processes (a cascade of adaptive BEATs based on Dweck's (2017) model). For example, if a student believes that they can improve attention, present orientation, awareness, and self-acceptance, it is likely that they will set goals to improve these skills and will be motivated

to pay attention (and to be present, etc.) in different challenging and performance-oriented situations. In comparison, fixed mindfulness beliefs can lead to goals fueled by cognitive helplessness. From the fixed perspective, hearing the above-mentioned attention, awareness, and acceptance “advice” can lead to the following pejorative interpretations: “*I’m trying to pay more attention, but it does not depend on me, it is so boring*” or “*I’m simply not able to focus when the weather is so nice outside*”. These interpretations can induce recursive processes in which the frustration of the situation will lead to the avoidance of people and the situations where they can receive such feedback, including several classroom situations.

This approach differs from the classic view about the rarely identified link between dispositional (and also state) mindfulness characteristics and academic performance (Beauchemin et al., 2008; Lin & Mai, 2018; M. D. Mrazek et al., 2017; Nidich et al., 2011). Trait mindfulness may be less related to academic goals than beliefs about the developability of mindfulness skills. Trait mindfulness can be in parallel with intelligence as a capacity that can help students understand their homework, but neither can motivate them to learn and improve these critical capacities. Future research should discover whether targeting beliefs about mindfulness enhances the benefits of mindfulness interventions.

We found that the learning mindset intervention (Yeager et al., 2016, 2019) can change intelligence beliefs and, as a side effect, make the perception of mindfulness skills more malleable. Considering these non-specific intervention and predictive validity results, the present work opened the door towards domain-specific interventions focusing specifically on mindfulness's malleability and its effects on academic achievement. Future studies might examine how changing the above-mentioned internal monologues might lead to recursive processes and better capacities to pay attention, to be aware of the experiences, to be in the present moment, and to be more self-accepting in the face of challenging academic situations. The following section highlights five main points regarding applying the mindfulness mindset measure and the construct in various fields.

First, assessing a relatively intangible construct can become measurable and tangible. We

hope that one of the applied and practical relevance is initiating a discourse on the potential benefits of perceiving the malleability beliefs of mindfulness. Suppose future studies find evidence that these beliefs are related to academic outcomes in other institutions, countries, or cultural contexts. In that case, it can provide a potential to a new generation of wise social psychological interventions (see Walton & Wilson, 2018) that can focus on these beliefs and can help students unleash their learning capacities, maybe hand in hand with targeting other learning-related beliefs, such as intelligence (Yeager et al., 2019) or stress mindsets (Crum et al., 2023; Yeager et al., 2022). In these interventions, this measure, or a shortened version, can be used to verify whether this specific mindset changed.

Second, mindfulness training and interventions sometimes have traces that the mindfulness skills are developable or improvable with practice, but we had an impression that the malleability belief of mindfulness is not a very explicit part of most of these programs. The present work might draw the attention of mindfulness instructors to highlight the malleability of mindfulness skills. Furthermore, teachers who use mindfulness exercises in the classroom, or mindfulness instructors in general, might use this measure to assess students' beliefs about their mindful capabilities, which can provide them a hint or overview about the extent they might consider individual differences regarding this belief, and emphasize the malleability of mindfulness skills accordingly.

Furthermore, educators shape student mindsets and mindfulness scales through teaching and learning but also through their presence, feedback, and compassion. Additionally, mindfulness training for educators is associated with improved health, well-being, and performance. Training educators in mindfulness and mindsets may prove to be an effective way to intervene at the school environmental level to help produce a more sustained mindset (Walton & Yeager, 2020) and mindfulness changes.

Third, another practical relevance might be applying this measure in other fields where learning and performance might matter, and a mindfulness mindset might be relevant. For example, using the measure in sports or organizational contexts can be helpful.

Fourth, this construct might be tested as a moderator in future mindfulness intervention studies. It is possible that mindfulness interventions can be more effective among those with malleable beliefs regarding their mindfulness-related skills.

Fifth, we think that the primary relevance of this measure is pointing out a measurable aspect of mindfulness that appears to be relevant in academic performance. With this work, we wanted to open a discourse about the potential relevance of these beliefs among practitioners and applied and academic experts. These might not be the best items to assess the malleability of beliefs about mindfulness, and we think that while they will be used, future studies might contribute to their refinement and adjustment to various educational contexts. For example, one can imagine a simplified version for primary school students. However, without the discourse, we cannot initiate the refinement of the measure.

Limitations and Future Research

Although the present study has several strengths, such as comprehensive samples from two countries and behavioral measures, it is not without limitations. First, we did not measure the long-term temporal stability of the Mindfulness Mindset Scale. Second, a broad set of metacognitive dimensions can be investigated besides the malleability (such as limitedness, enhancing-debilitating nature, and controllability) and can be useful to investigate in future studies. Third, it should also be noted that, besides the mindset meaning system model in Study 3b and Study 5, we did not examine underlying psychological processes about how a mindfulness mindset can influence students' academic performance.

In considering the limitations of Study 4, it is vital to recognize the potential impact of cognitive fatigue on our findings regarding the behavioral measure of mastery behaviors (i.e., the PERC task). Although we tried to mitigate fatigue effects (following the guidelines of the original PERC measure), such as implementing a break before the final set of puzzles, some fatigue was probably inevitable given the demanding nature of the tasks. Future studies could consider this more directly and potentially consider ways to measure or control cognitive fatigue.

Another limitation that can be mentioned is related to the relatively weak effects that our first mindfulness mindset intervention attempt (Study 7) resulted in the fixed mindfulness mindset scores. This intervention attempt can be seen as the first step, and further adjustments, and developments are required to make it effective in changing these beliefs.

This is a very new measure that assesses malleability, and the intervention attempt we had in Study 7 is in a very early stage; it does not focus on improvement strategies in a sophisticated way. Understanding malleability is a stepping stone that can provide room for more specific improvement actions. Based on the intelligence mindset interventions (e.g., Yeager et al., 2016, 2019), we suppose that teachers might encourage students to make efforts to pay attention, providing them strategies that can reduce distracting elements and encouraging them to seek the advice of classmates who can more easily immerse themselves into learning activities.

Future studies might examine the weak link between mindfulness mindset and trait mindfulness. We believe that this might be due to a highly complex relationship. For instance, many people might have strong beliefs regarding the malleability of mindfulness skills, although they do not score high on trait mindfulness. Similarly, it is plausible that people with regular mindfulness practices are likely to have strong malleability beliefs while they are very aware of their lack of mindfulness and might underestimate their trait of mindfulness.

Another question pertains to the relationship between mindset and mindfulness mindsets. It appears that beliefs about intelligence and mindfulness are weak but associated with each other,

meaning they are distinct constructs. They may be at the same level without any sort of hierarchy between the two. Alternatively, it is also possible they are in a hierarchical relationship in which one (e.g., mindfulness mindset) can induce or provide room to the other (e.g., intelligence mindset). For the non-hierarchical structure, we can imagine it as eyeglasses in which the right lens sees intelligence as malleable, and the left sees mindfulness skills as malleable. The individual will process the information of both lenses with equal weight in which one does not depend on the other. For the hierarchical structure, we can use the analogy of driving a car with a strong engine representing potential intellectual capacities and a functioning windscreen wiper representing mindfulness skills. If students cannot learn when and how to switch the windscreen wiper, they are not able to navigate, and therefore, they cannot use the potential of the strong engine; they cannot learn how to drive their car as fast as they can because they cannot see what is going on in their environment. If they learn to use and master using their windscreen wipers, they can be in the present moment and see what is going on outside; they can be present and aware of what is happening that can open the door towards using the horsepower under the hood. Future research is needed to test the link between the two mindsets. A series of future studies are required to demonstrate whether intelligence and mindfulness mindsets are hierarchically or non-hierarchically related to each other.

Future research might also find it interesting to examine separately the effect of specific components of mindfulness we examined in the present study (present orientation, self-acceptance, awareness, attention). Malleable beliefs about cognition-based (attention-related or present-orientation-related) mindfulness elements may relate more closely to achievement-relevant outcomes than emotion-focused aspects (self-acceptance, awareness). However, malleable beliefs about emotion-based elements might connect more closely to well-being-relevant outcomes than cognition-focused aspects. Attention-monitoring skills are equally possible to be associated with achievement outcomes, while acceptance skills relate more closely to mental health (see Lindsay & Creswell, 2018). Future studies can also simplify the item set and make it even more concise to

implement it among younger students with limited literacy. Future interventions can build on the initial attempt we used in Study 1 to demonstrate the mediating role of a mindfulness mindset and academic performance benefits. In sum, despite being a relatively long paper, this multi-study project is only the first step to examining under what circumstances a mindfulness mindset can be related to academic performance. Based on the above debate on intelligence mindsets, examining the boundary conditions of these associations can be crucial in future studies.

Invariance testing provided the first evidence for cross-national robustness. Students from two institutions from two European countries responded similarly to the items. It does not mean that this measure is invariant in other cultural contexts. Nevertheless, future studies might examine whether mindfulness mindset functions are similar in other cultural or institutional contexts.

The present results suggest a robust but weak link between mindfulness mindset and academic performance. However, it is crucial to consider this new construct with a new measure, and careful examination is needed to establish the boundary conditions. Prior debate on the heterogeneity of the link between intelligence mindset and performance (e.g., Li & Bates, 2020; Sisk et al., 2018) as well as the effectiveness of the related interventions can provide guidelines for the present, mindfulness mindset research agenda (see the debate: Bryan et al., 2021; Burnette et al., 2023; Macnamara & Burgoyne, 2023; Sisk et al., 2018; Tipton et al., 2023). In the case of intelligence mindsets, we need to know whether and how this link is present in challenging situations. As beliefs about mindfulness skills is a sparsely investigated field, detailed future research is needed regarding how the mindfulness mindset construct fits into the large family of mindfulness-related constructs that are not always strongly related to relevant real-life outcomes above and beyond already examined personality variables (e.g., Altgassen et al., 2023).

Conclusion

In the present work, we demonstrated a reliable measure with convergent, divergent, and predictive validity. Furthermore, we demonstrated two ways of adaptively changing these beliefs.

The present paper highlighted the importance of beliefs about mindfulness-related skills, above and beyond trait mindfulness, and showed that the two are distinct constructs. The synergy between a growth mindset and mindfulness can be explored in multiple ways. One of these might be related to beliefs about mindfulness. Based on the present results, a growth mindfulness mindset is related to academic performance in two countries and relatively different educational contexts and appears to have positive links to mental health. This mindset is similar to other mindsets that can be changed through multiple wise social psychological interventions. However, future intervention studies focusing specifically on the malleability beliefs of mindfulness are needed to explore the long-term effects of changing mindfulness beliefs in an educational context.

Mindfulness practice develops the ability to notice and regulate thoughts and emotions. In the process, people can appreciate how their beliefs and levels of mindfulness impact their thinking, feelings, and responses to the world. While this is helpful, other unexplored beliefs about the malleability of mindfulness itself may contribute to one's ability and motivation to improve this capacity. Integrating these approaches may offer new insights into using mindsets and mindfulness better to improve students' health, well-being, and performance. This work also offers ripe questions to be explored. Yeager et al. (2022) demonstrated that mindset interventions may have synergistic effects. Do mindfulness malleability beliefs moderate the efficacy of mindfulness interventions? Might a mindfulness mindset offer unique enhancing effects beyond mindfulness or mindset interventions alone?

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