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*Lea Cassar, Mira Fischer, Vanessa Valero*

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Poschingerstr. 5, 81679 Munich, Germany

Telephone +49 (0)89 2180-2740, Telefax +49 (0)89 2180-17845, email [office@cesifo.de](mailto:office@cesifo.de)

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# Keep Calm and Carry On: Immediate- vs. Six-Month Effects of Mindfulness Training on Academic Performance

## Abstract

Mindfulness practices are gaining popularity in private and public organizations. In a randomized controlled trial, we examine whether mindfulness training improves the academic performance of university students. The intervention improves mental health and non-cognitive skills. However, it takes time before students' performance can benefit from the training: we find that, if anything, the intervention marginally decreases average grades right after the end of the intervention, whereas it significantly increases academic performance, by about 0.4 standard deviations, six months after.

JEL-Codes: I210, C930, I120, I310.

Keywords: performance, mental health, education, mindfulness training, field experiment.

*Lea Cassar*  
*University of Regensburg / Germany*  
*lea.cassar@ur.de*

*Mira Fischer*  
*WZB Berlin Social Science Center / Germany*  
*mira.fischer@wzb.eu*

*Vanessa Valero*  
*University of Leicester / United Kingdom*  
*vanessa.valero@leicester.ac.uk*

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# 1 Introduction

Mindfulness practices are becoming increasingly popular in the Western world, including in private and public organizations. According to Lyddy et al. (2021), more than half of all large companies offer their employees some form of mindfulness training as of 2021. International organizations, including the United Nations, and public entities like the Australian government and the United States Postal Service offer similar programs to their employees. Mindfulness training is even part of the agenda of the World Economic Forum. Similarly, more and more educational institutions offer free mindfulness courses to their students or consider integrating them into their teaching curriculum. For instance, the British government launched a project in 2019, introducing mindfulness practices in up to 370 English schools to improve youth mental health.<sup>1</sup> Mindfulness programs are also offered at universities where a large share of students report experiencing stress and common mental health problems, such as anxiety and depression (American College Health Association, 2017). Top universities, such as Cambridge, Harvard, MIT, Oxford, Stanford, and Yale, are among those offering free mindfulness programs to their students.

An extensive literature provides evidence on the effectiveness of mindfulness practices for improving mental health, namely by reducing stress, anxiety and depression (see, for instance, Khoury, 2015, for a review). However, little is known about the potential spillovers of mindfulness training on other important life outcomes, such as performance. Understanding these additional effects is crucial for assessing the overall impact and desirability of these trainings. The very few existing studies addressing this question measure performance through cognitive laboratory tasks, finding null or very marginal and selective positive effects of the training (Hafenbrack and Vohs, 2018; Charness et al., 2024; Shreekumar and Vautrey, 2022), or have a small sample size (below thirty subjects per treatment), making it very hard to draw any evidence-based conclusion (Hall, 1999). Hence, to the best of our knowledge, our study is the first pre-registered and relatively large randomized controlled trial to investigate the causal effects of a mindfulness training on academic performance, measured right after the program and six months after it ended.

On the one hand, mindfulness training may help improve academic performance by reducing anxiety and depression (Owens et al., 2012), which are often associated with lower academic performance (see Bernal-Morales et al., 2015, and Pascoe et al., 2020, for a detailed literature review). Furthermore, mindfulness practice may also improve academic performance by increasing self-control and focus (Tang et al., 2015), which positively influence learning (Duckworth et al., 2019). Finally, mindfulness practices increase present-moment awareness and reduce mind-wandering, the latter of which has been found to negatively affect exam performance and the ability to remember newly acquired information (e.g., Risko et al., 2012; Mrazek et al., 2013; Schacter and Szpunar, 2015; Wammes et al., 2016). Hence, there are good reasons to believe that mindfulness training not only improves mental health but may also help to improve performance,

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<sup>1</sup>[www.gov.uk/government/news/one-of-the-largest-mental-health-trials-launches-in-schools](http://www.gov.uk/government/news/one-of-the-largest-mental-health-trials-launches-in-schools)

which is arguably one of the reasons why it has become so popular in education and businesses.<sup>2</sup>

On the other hand, some arguments point to the potential limitations or even negative effects of mindfulness training on academic performance. One argument concerns stress, whose impact on performance is less straightforward than it is for anxiety and depression. While excessive stress can hinder learning and memory, some stress may facilitate them (Vogel and Schwabe, 2016).<sup>3</sup> Therefore, mindfulness practices, by reducing stress, could potentially reduce academic performance. Moreover, mindfulness training may reduce students' motivation to study by shifting attention away from future goals towards the present moment and acceptance of the status quo (Hafenbrack and Vohs, 2018). Lastly, successful mindfulness training requires learning a new skill and adopting a new daily routine, which may initially divert resources (e.g., time and cognitive effort) away from studying and thus negatively affect academic performance in the short run.<sup>4</sup> Akin to other human capital investments, the positive returns to mindfulness training might become more evident only in the long run, namely, once the practice is integrated into everyday life and becomes an ingrained habit, such that the benefits outweigh the initial costs.

Due to these potential countervailing effects of mindfulness practices on academic performance, we adopt an exploratory approach and refrain from formulating directional hypotheses.

In collaboration with one of the largest German health insurance providers, we offered a standardized 8-week mindfulness course free of charge to students at the University of Cologne.<sup>5</sup> Interested students could apply to the course by registering and completing an online questionnaire. Applicants were then randomly assigned to the treatment (102 subjects) or the control group (122 subjects), and students in the treatment group were offered a place in the course. Randomization was stratified along students' (planned) exams and we used re-randomization to ensure all relevant baseline measures were balanced. To determine the impact of the training on academic performance, we had access to grade information from the university's administrative records for the semesters before, at the time of, and up to six months after the intervention. In addition, we collected data

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<sup>2</sup>For instance, the University of Cambridge explicitly advertises its mindfulness training as a tool to support students to "study and thrive". <https://www.cambridgestudents.cam.ac.uk/welfare-and-wellbeing/mindfulness-cam>. In his best sellers book, David Gelles argues that for companies, a more mindful workforce is more productive (Gelles, 2015).

<sup>3</sup>This inverted U-shaped relationship between arousal and performance is known as the Yerkes-Dodson law (Yerkes and Dodson, 1908). See Teigen (1994) for a discussion.

<sup>4</sup>Research in the psychology of habit formation argues that learning a new behavior requires conscious decision making and the exertion of willpower (Wood and R unger, 2016) which are cognitively demanding and deplete mental resources otherwise available for other tasks and domains (Muraven and Baumeister, 2021). Consistent with this argument, previous research in Economics shows that focusing attention on a specific decision domain enhances decision-making within that domain but may lead to negative cognitive spillovers affecting choices in other domains (Altmann et al., 2022). Applied to our context, this would imply that learning a new meditation practice and making it a daily habit could reduce the amount of resources available to studying in the short term.

<sup>5</sup>A pre-pandemic study by Grobe et al. (2018) reveals that in Germany about one in six university students (almost half a million) experiences depression, anxiety, or panic attacks and that the share of 18- to 25-year-old adults diagnosed with one of these mental disorders rose by 38% between 2005 and 2016.

on students' mental health (stress, anxiety and depression), mindfulness, non-cognitive skills (self-control, conscientiousness and neuroticism), concentration on a cognitive laboratory task (Stroop, 1935), study behavior, and health (self-care) behavior before the intervention started and soon after it ended.

Our main findings can be summarized as follows. Consistent with previous evidence, the mindfulness program significantly improved students' self-reported mental health, mindfulness and non-cognitive skills, and very marginally increased performance on the cognitive laboratory task. However, we find that, if anything, the intervention marginally decreased students' immediate academic performance by a around 0.26 standard deviations.

We only observe robust positive effects of the intervention on academic performance six months after the program ended. Specifically, the mindfulness training significantly improved six-month academic performance by around 0.39 standard deviations. All our results also survive several robustness checks (including sample restriction, inverse probability weighting, and imputation of missings under very conservative assumptions) to address attrition concerns.

When exploring the behavioral mechanisms underlying our results we find that the intervention led to an improvement in daily health behavior and self-care practices, such as sleeping more and relaxing more consciously, both of which are found to be the best predictors of the negative changes in immediate grades among all our pre-registered potential channels. This is consistent with the argument above, according to which adopting a new meditation practice and related healthy habits reduce the amount of resources available for studying in the immediate (but not the longer) term. From the longer-term perspective, we find that an increase in mindfulness (measured at the end of the intervention) is the best predictor of the six-month positive change in grades. Furthermore, the latter effect is driven by those students who practiced on their own in addition to the course's instructions and requirements – and thus most likely continued practicing after the end of the intervention.

Taken together, these findings reveal that mindfulness practices can have substantial positive spillover effects on academic performance. However, akin to other human capital investments, it may require time before students can reap these additional benefits. Hence, with adequate time, mindfulness training can serve as a powerful tool not only for enhancing well-being but also for boosting (academic) performance.

The paper proceeds as follows. Section 2 outlines our contribution to the related literature in economics and briefly reviews related work in other fields. Sections 3 and 4 describe the experimental design and the intervention, respectively. Section 5 presents our empirical strategy. Sections 6 and 7 report the main findings and robustness checks, respectively. Section 8 explores potential channels that may help explain our results. Section 9 discusses the external validity and generalizability of our results. Section 10 concludes.

## 2 Related Literature

### 2.1 Literature in Economics

Our study contributes to different strands of literature in economics. First, we contribute to the economics literature investigating the role of student effort and motivation for academic achievement. A large body of literature focuses on monetary and non-monetary incentives to raise student effort and achievement (see, e.g., Angrist et al., 2009; Leuven et al., 2010; Levitt et al., 2016; Hvidman and Sievertsen, 2019; Lindo et al., 2010; Burgess et al., 2021).<sup>6</sup> Compared with effect sizes of about 0.2–0.4 standard deviations commonly found in this literature, the effects of our mindfulness intervention are sizeable. Moreover, a growing literature building on results in behavioral economics and psychology demonstrates the benefits of helping students to overcome procrastination and develop good habits. For example, Himmler et al. (2019) show that while a pure reminder has no significant effects, combining it with a non-binding agreement to facilitate self-commitment is highly effective and induces an incoming cohort of business administration majors at a German university to sign up for and pass significantly more exams with effect sizes of about 0.25 standard deviations. More closely related to our study, Cappelen et al. (2017) encourage a cohort of Norwegian college students to engage in more physical activities by providing them free gym memberships and find that their intervention increases gym attendance and academic performance by 0.15 standard deviations and improves their self-reported health behavior and self-control. Similarly, Fricke et al. (2018) use financial incentives to encourage students' participation in on-campus sports and exercise in two cohorts of college freshmen in Switzerland. Incentives increased participation frequency by 47% and improved grades by 0.14 standard deviations in the first cohort but were less effective in promoting participation and did not improve grades in the second cohort. The incentives did not raise the overall amount of physical activity but led to a substitution of on-campus activity for off-campus activity, did not affect health and wellbeing but allowed students to spend more time in class. Whereas Himmler et al. (2019) examine the effect of self-commitment and Cappelen et al. (2017) and Fricke et al. (2018) investigate spillover effects of physical exercise on academic performance, we examine spillovers of mindfulness training on academic performance.<sup>7</sup>

Second, our paper relates to a recent but fast-expanding literature in economics that evaluates the impact of meditation interventions on mental health, economic behavior, and cognitive performance. Di Bartolomeo and Papa (2016) find that subjects practicing meditation shortly before playing an investment game exhibit more trust and pro-social behavior. Alem et al. (2021) study the impact of an online MBSR program on stress and risk and time preferences among students in the UK. Consistent with our findings,

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<sup>6</sup>For a review of the experimental literature on incentives in education, see Schildberg-Hörisch and Wagner (2020).

<sup>7</sup>For reviews of the literature on behavioral interventions in education see Koch et al. (2015) and Lavecchia et al. (2016).

they find strong evidence that mindfulness training reduces perceived stress, measured using the Perceived Stress Scale. However, they only find suggestive evidence that such programs can affect attitudes towards risk and time. Closely related to our paper are the studies by Charness et al. (2024) and Shreekumar and Vautrey (2022). The former investigates the effect of a three-month training program based on principles of mindfulness and positive psychology in three large firms on trainees' cognitive performance in incentivized decision-making tasks and psychological questionnaires. The authors find strong evidence of a reduction in self-reported stress (which persists 3 months after the end of the training) but only marginal and selective positive effects of the training on the incentivized tasks. Shreekumar and Vautrey (2022) conducted a four-week experiment in which a large sample of US adults received free access to a popular mindfulness meditation app. They find a reduction in symptoms of stress, anxiety, and depression, and a 1.9% earnings increase on a proofreading task conducted two weeks after the start of the intervention. They do not find, however, an effect on the Stroop task. Our study contributes to this literature by investigating the effect of a mindfulness training on performance in a different, but equally important, context (education), and, crucially, it is unique in that it evaluates the effects of mindfulness training on a very important high-stakes outcome (academic performance) in addition to its effects on self-reported health measures and an incentivized "laboratory" task, thereby offering greater external validity.

More broadly, our paper also contributes to an emerging literature in economics investigating how well-being affects performance. The paper by Oswald et al. (2015) is among the first economic studies to address this question. The authors provide evidence from a series of laboratory experiments for a positive causal link between human well-being and performance. More recently, Bellet et al. (2024) and Coviello et al. (2022) investigate this question in the field, with mixed results. While Bellet et al. (2024) find a positive effect of positive mood on workers' sales performance, Coviello et al. (2022) mainly find a negative effect. Our paper differs from – and thus complements – these field studies in two crucial ways. First, while in the context of sales activities an important determinant of performance comes from soft and social skills, in the context of exam performance these channels are switched off. Thus, in a way, our intervention provides the hardest test of the hypothesis that well-being is positively associated with performance. Second, compared with these previous studies, which mainly rely on short-lived shocks (like weather changes) that affect people's mood, our MBSR training introduced participants to well-being-enhancing practices that they can apply any day for the rest of their lives. So in our intervention, participants' well-being is likely to have been influenced in a more sustainable way than in these previous studies.

Our paper is also related to the literature in economics evaluating the impact of psychological interventions on important life outcomes. Heller et al. (2017) find that interventions based on cognitive behavioral therapy (CBT) reduce delinquency and increase school engagement and graduation. Blattman et al. (2017) also find positive effects of CBT on reducing crime, and Baranov et al. (2020) find that it improves postpartum depression

and parental decision-making. John and Orkin (2022) find that simple psychological interventions can increase preventive health behavior. We contribute to this literature by showing that mindfulness training can affect both mental health and important economic outcomes, such as (academic) performance.

Finally, our paper contributes to the economic literature on the malleability of non-cognitive skills. Existing studies usually concentrate on the ability to improve non-cognitive skills of children (e.g., Heckman and Kautz, 2012; Alan et al., 2019). A few exceptions, such as Blattman et al. (2017) and Heller et al. (2017), focus on adults and investigate whether such skills may be malleable at a later age. While these studies focus on economically disadvantaged and criminally-involved young men (and, in the case of Heller et al. (2017), on a developing country), our paper provides further evidence of such malleability in non-disadvantaged young adults in a developed country.<sup>8</sup>

## 2.2 Literature from Other Fields

In this section we briefly review closely related papers in the non-economic literature. First, we discuss the literature on the effects of MBSR on variables that may be relevant for academic achievement, and further evidence that these variables are, indeed, related to academic performance. We then review the few existing studies on the causal effects of meditation on task performance and academic achievement.

While there is great interest in the application of MBSR to people experiencing mental or physical illness (Goyal et al., 2014), the practice has similar benefits in healthy people. Several studies review evidence on effects of mindfulness-based techniques in nonclinical populations. Chiesa and Serretti (2009) analyze 10 studies on MBSR and conclude that it has a significant effect on the reduction of stress levels in healthy people. Eberth and Sedlmeier (2012) review evidence for mindfulness meditation on various psychological variables. Analyzing 39 randomized controlled trials with meditators in non-clinical settings, they conclude that mindfulness meditation (including MBSR) has a significant effect on the reduction of stress levels. In addition, they find that it reduces anxiety and increases psychological well-being. Khoury et al. (2015) review 29 studies and confirm previous findings for stress and anxiety. In addition, they conclude that MBSR is effective in reducing depression. Seppälä et al. (2020) focus on university students. Contrary to the previous literature, they do not find that mindfulness meditation improves depression, anxiety or stress. However, with only 47 students in the control group and 34 in the MBSR group, this study might be under-powered. Using a larger sample of university students (i.e, 616 students), Galante et al. (2018) show that adding a mindfulness-based intervention to a mental health support improves students' resilience to stress. More recently, the

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<sup>8</sup>This is relevant because research in psychology has shown that in better-off families, IQ and personality traits are to a larger extent determined by genes and are less likely to be influenced by the environment than in poorer families (see review by Almlund et al. (2011)). Extending this argument to between-country differences, one may reasonably conjecture personality traits to be less malleable in developed than in developing countries.

large study by Kuyken et al. (2022) with about 18,000 teenagers concludes that school-based mindfulness training (SBMT) did not effectively promote student mental health in secondary schools: the majority of students found the practice boring and therefore did not derive any benefit from it. However, the authors also found that the students who actively engaged with the meditation practice saw an improvement in their wellbeing, which may suggest that the effects are heterogeneous and may depend on students' intrinsic motivation to practice and on the school environment.<sup>9</sup>

Eberth and Sedlmeier (2012) identify a multitude of other positive effects of mindfulness training on cognitive (e.g., attention, memory) and non-cognitive (e.g., neuroticism) skills. Tang et al. (2015) review the literature investigating the effects of MBSR on self-regulation and find emerging evidence that it may positively affect the functioning of brain regions involved in the regulation of attention, emotion, and self-awareness. By being more aware and mindful, students could better identify and address any negative patterns that may interfere with their academic performance.

Few studies investigate the causal impact of meditation directly on performance. Hafenbrack and Vohs (2018) report the results from a series of laboratory and online experiments examining the effects of a 15-minute mindfulness training on task motivation and task performance. Together, their findings suggest that while mindfulness meditation may impair participants' motivation to complete cognitive and performance tasks, it does not ultimately affect performance on those tasks. According to the study, the demotivation effect of the intervention is mediated by a reduction in future focus and arousal. However, the authors also find that mindfulness meditation enables people to detach from stressors, which improves task focus and may explain why, overall, mindfulness does not alter performance. Furthermore, Mrazek et al. (2013) found that a 2-week mindfulness-training course, by reducing mind wandering, improved the working memory capacity and reading comprehension scores of 26 students (compared to 22 students who were offered a training on nutrition) in a 20-minute laboratory task modeled after the GRE test. More similar to our study, Hall (1999) focuses on academic performance. This study randomly assigned 56 undergraduates to two groups, one of which included meditation. Each group met one hour twice a week for the duration of the academic semester for study time. In the treatment group, students were instructed in meditation techniques for 10 minutes each at the start and conclusion of the study session. At the end of the semester, the treatment group achieved a significantly higher grade point average (GPA) than the control group. However, participants were told that the experiment investigates the effect of focused study groups on academic performance and their participation served to fulfil a psychology course requirement delivered by the author of the study. It might thus be the case that students in the treatment group studied harder during study time than those in the control group to help confirm their professor's hypothesis, then obtaining better grades. Compared with this study, our sample size is four times as large and, importantly,

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<sup>9</sup><https://www.theguardian.com/society/2022/jul/12/mindfulness-schools-does-not-improve-mental-health-study>

is free from potential experimenter demand effects as we did not reveal to participants the objective of the study contrary to Hall (1999). Hence, to the best of our knowledge, our study is the first pre-registered and relatively large randomized controlled trial free from experimenter demand effect to investigate the causal effect of a mindfulness meditation training on academic performance. Furthermore, we investigate the impact of such training on grades right after and six months after the training ended.

## 3 The Experiment

### 3.1 Timeline

The course was advertised via the mailing list, newsletters, and social media accounts of the Faculty of Management, Economics and Social Sciences of the University of Cologne (see Appendix Figure E.1 for the announcement and Figure E.2 for the registration page). At the beginning of May, students were informed about whether they had received a place in the course or not. The meditation course started on May 15 and lasted for nine weeks, including a break of one week in the middle of June for the spring break holidays. The course was timed such that it ended together with the official lecture period of the summer semester. Most exams of the summer semester are written in the three weeks surrounding the end of the lecture period (see Appendix Figure B.1 for the timing of exams). Thus, our main analysis on the immediate effects of the intervention on academic performance uses all the grades of the exams written during the main exam period of the summer semester, namely between July 6 and July 27.

Consistent with this definition, our analysis on the six-month effects of the intervention on academic performance focuses on grades of the exams written during the main exam period of the winter semester (lasting from January 25 to February 19), i.e., about half a year after the end of the intervention. As shown in Appendix Figure B.1, there are also two secondary exam periods, in the second half of September and in the end of November / beginning of December, in which fewer exams are written. These consist of the retakes and voluntarily delayed exams of the summer semester (94 student observations) and the midterm exams of the winter semester (41 student observations), respectively. Due to the limited sample size, these results are not the primary focus of our analysis, but we report them in further analyses.

Appendix Table C.1 provides an overview of the relevant dates and events of the study.

### 3.2 Outcome Measures

We accessed students' pre- and post-intervention grade information from the university's administrative records. Grades at German universities vary from 1 to 6 following a descending order: i.e., 1 represents the best possible grade and 6 the worst possible grade. Grades lower than or equal to 4 are passing grades. For the sake of clarity, we invert the grades so that higher grades correspond to better academic performance.

Our primary pre-registered outcome, the grade average, is derived from computing the weighted arithmetic mean of the grades obtained by a student within the different exam periods as defined in section 3.1. Each grade is multiplied by the study points a student received for it and then divided by the sum of the study points the student earned for the whole period:

$$\overline{grade}_{i,t} = \frac{\sum_{k=1}^n (module\ grade_{i,t,k} \times module\ points_k)}{\sum_{k=1}^n module\ points_{i,t,k}}$$

where  $i$  denotes the student,  $t$  denotes the exam period, and  $k$  denotes the module. This is the same formula the university uses to compute a student’s average grade. Furthermore, as the means and standard deviations of grades differ significantly across the 10 study programs our participants follow (e.g., the mean passing grade is 1.8 (sd 0.48) for the MSc in Political Science and 2.6 (sd 0.78) for the BSc in Economics), we standardize the grades to a mean of 0 and a standard deviation of 1 at the program level to make performance comparable across the programs. This also makes our effect sizes easily comparable with those found in other studies.

Our selection of secondary outcomes was based on the previous literature showing that they are (i) influenced by mindfulness training, and (ii) relevant for academic outcomes. Stress, anxiety and depression were measured using the well-known ten-item Perceived Stress Scale (PSS; Cohen et al., 1983), the seven-item Generalized Anxiety Disorder questionnaire (GAD-7; Spitzer et al., 2006) and the nine-item Patient Health Questionnaire (PHQ-9; Kroenke et al., 2001), respectively. Mindfulness is measured using a selected number (eight) of questions from the Mindful Attention Awareness Scale (MAAS), (Brown and Ryan, 2003). Self-control was elicited using the Brief Self-Control Scale (BSCS; Tangney et al., 2004), while we elicited students’ conscientiousness and neuroticism using the relevant questions (nine and seven questions, respectively) from the Big Five Inventory (BFI; John et al., 1991). For each of these self-reported variables, we created an index by summing up the answers to the respective questions. Finally, in order to measure students’ cognitive skills and, in particular, concentration on a task, we used an incentivized Stroop task (Stroop, 1935), which requires participants to identify the color of a printed word when the word’s meaning and color may be incongruent. The individual score is computed by dividing the number of correct answers (of a total of 20) by the time a participant needs to answer all tasks. We incentivized the task by paying 20 euros each to those participants who were the three fastest among those with the greatest number of correct answers. All variables were pre-registered and measured before and after the intervention. All items from the baseline and follow-up questionnaires are listed in Appendix Table E.3. To increase comparability, we standardize each of these variables to a mean of 0 and a standard deviation of 1 over the whole sample.

### 3.3 The data

#### 3.3.1 The sample

By April 24, 2019, we received 282 applications (completed surveys). From this group, we excluded 58 students because (i) they did not plan to write any exams in the summer semester, and/or (ii) they did not plan to take any exam that at least one other applicant indicated they would write in the summer semester, and/or (iii) they did not indicate any availability for any of the time slots offered for the meditation course. Thus, we were left with 224 eligible candidates, whom we randomly assigned to either the treatment or control group at the individual level, with stratification along planned exams. The budget provided by the health insurance provider could cover the costs of the course for a maximum of 102 participants (6 meditation groups of 17 participants each). Therefore, 102 applicants were allocated to the treatment group, and 122 to the control group, resulting in a total of 224 observations in our overall sample. Nevertheless, since not every student participated in at least one exam during every exam period, our sample experiences attrition. Table C.3 provides a comprehensive breakdown of how these 224 observations are dispersed across various exam periods. Despite this, attrition is orthogonal to treatment assignment (see subsection 7.1 for more details). Additionally, as elaborated later, we conducted multiple robustness checks to further mitigate concerns regarding attrition. All of our findings are robust to all supplementary tests.

#### 3.3.2 Balance checks

Appendix Table A.1 displays the mean values of the outcome variables at baseline, along with some demographics, separately for the treatment and control groups, using the overall sample. We used a rerandomization approach based on Morgan and Rubin (2012) to ensure that both groups were balanced along baseline characteristics. However, we obtained the grade information from the university’s administrative records only after the completion of the intervention, which is why we could not use it for rerandomization. Of the 224 students on our overall sample, 181 (84 (82%) in the treatment group and 97 (80%) in the control group) took at least one exam in the summer semester, immediately after our intervention. Attrition is balanced between the treatments ( $p=0.592$ ). Additionally, Appendix Table A.2 shows that this reduced sample is balanced along baseline characteristics, although the p-value for prior grade decreases to 0.205, suggesting slightly reduced balance compared to the overall sample. Furthermore, 124 students from the overall sample (56 (55%) in the treatment group and 68 (56%) in the control group) took at least one exam in the winter semester, six months after our intervention. Once again, attrition is balanced between the treatment groups ( $p=0.900$ ). Appendix Table A.3 shows that this reduced sample remains balanced at baseline along the observable characteristics.

The follow-up questionnaire was answered by 94 students in the treatment group

(92%) and 93 students in the control group (76%) after a maximum of four personalized reminders were sent by email. Attrition in the questionnaire is not balanced between the treatments ( $p=0.001$ ). Despite this difference, we do not find it to affect balance between the treatments on any outcome variable at baseline except stress, which is slightly higher at baseline ( $p=0.045$ ) in the control group students than the treatment group students who fill in the follow-up questionnaire (see Appendix Table A.4).

### 3.3.3 Representativeness

We compare our experimental sample with the overall student body of the faculty to examine if certain students were more inclined to participate in the experiment. As shown in Appendix Table C.2, our sample is representative in terms of age, while the proportion of women, at 54%, is slightly higher than for the faculty overall (45%). The proportion of students pursuing different education programs matches approximately the distribution of students across the different programs at the overall faculty. Only the proportion of students following the BSc in Social Sciences program tends to be somewhat higher in our sample than for the faculty overall (19% vs. 13%), while the proportion of students in the BSc in Business Administration tends to be somewhat lower in our sample than at the overall faculty (21% vs. 31%). Thus, overall, our sample's characteristics closely resemble those of the faculty's student body. This suggests that the meditation program attracted students of different genders, ages, and study programs almost equally. Hence, our findings are likely to be generalizable to students within this social science faculty, which happens to be one of the largest in Germany.

Furthermore, our sample of students showed moderate levels of stress, with an average PSS score of 21 (out of 40). This is very similar to the average stress level observed in a representative sample of 18,000 German university students, as reported by Herbst et al. (2016), where the average PSS score was 20. The similarity of our sample to the overall student body of the faculty in terms of demographics and to German university students in terms of prior stress levels suggests that our sample is representative in relevant dimensions and does not consist of a specially selected group of students, which speaks towards a high external validity of our results.

## 4 The Intervention

Our intervention is based on the well-known “mindfulness-based stress reduction” (MBSR) program developed by Jon Kabat-Zinn (1994) in the 1970s in the US. This program has significant advantages as it is secular and highly standardized, making it a subject of extensive scientific research and widely adopted globally, not only in education but also in health care, companies and public organizations. Mindfulness is a broad term that encompasses different meditation techniques, cognitive skills, and attitudes and is commonly defined as “paying attention in a particular way: on purpose, in the present moment, and

non-judgmentally” (Kabat-Zinn, 1994, p. 4).

Our intervention closely followed the standard MBSR course, with few necessary adjustments due to funding and university constraints. The course comprised eight weekly 60-minute group sessions held on the university campus on Wednesday or Friday, with six groups in total, each including 17 participants.<sup>10</sup> Participants were provided with audio recordings and handouts and were asked to do mindfulness exercises daily. These exercises included a 12-minute ”body scan” or mindful movement, or a 30-minute sitting meditation, along with three-minute ”time out” reflections on thoughts and feelings three times a day. The course content covered formal sitting mindfulness meditation, body awareness, mindful movements, and group discussions of experiences. Two skilled and certified MBSR teachers, appointed and compensated by the health insurance provider we worked with, designed and taught the course.<sup>11</sup> The same teacher led each group session, and before the intervention began, the two teachers worked closely together to ensure consistency and uniformity across all eight sessions in the six groups. For a detailed description of the structure and content of each session, see Appendix Table E.4. Note that although the teachers and participants were aware that the program would be evaluated, they were not informed about the study’s main goal.

## 5 Empirical Strategy

For each outcome, we report results of OLS regressions with and without control variables. We refer to models that contain only a treatment dummy and no control variable as ”endline” (EL) specifications. ”Value-added” (VA) specifications include control variables such as the baseline measure of the outcome, baseline-performance, study-program, and study-year fixed effects. VA specifications take the following form:

$$y_{it} = \alpha + \beta Treatment_i + \gamma y_{it-1} + X_i \delta + \varepsilon \quad (1)$$

where  $\alpha$  is a common intercept;  $Treatment_i$  is a binary variable equal to 1 if student  $i$  was assigned to the treatment group, and 0 otherwise; and  $y_{it}$  is the dependent variable. In the case of our primary outcome,  $y_{it}$  is equal to  $\overline{grade_{i,t}}$  – as defined by equation 3.2 – namely, the post-intervention performance of student  $i$  measured by the weighted arithmetic mean of the grades obtained either (i) in the main exam period of the 2019 summer semester right after the intervention, or (ii) in the main exam period of the following winter semester, about half a year after the end of the intervention. These two variables represent, respectively, students’ performance right after the program ended and six months after. In the case of the secondary outcomes,  $y_{it}$  takes the form of an index over the questions used to elicit that specific outcome in the endline questionnaire.

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<sup>10</sup>For the sake of external validity, note that most weekly trainings offered by the top universities listed in the introduction also last between 1 and 2 hours.

<sup>11</sup>Note that in Germany the individual cost of attending a standard MBSR program outside of the university is about 400 euros, which is equivalent to about \$450 (as of the time of the experiment).

$y_{it-1}$  is the baseline measure of the respective outcome. In the case of the primary outcome,  $y_{it-1}$  is equal to the student’s prior grade: i.e., the weighted average grade over all modules completed in the current program before the semester in which the intervention took place. In the case of the secondary outcomes,  $y_{it-1}$  is equal to the baseline scale elicited in the first questionnaire. Finally,  $X_i$  denotes a row vector of control variables, consisting of the following: prior ECTS credits (sum of study points over all modules completed in the current program before the semester in which the intervention took place), study-program dummies (10 categories; see Table 2), and study-year dummies (4 categories: “1st year”, “2nd year”, “3rd year”, “4th or higher year”). In this model,  $\beta$  can be interpreted as the average treatment effect.

Additionally, for each outcome, we also report results of running alternative OLS regressions of the following form:

$$\Delta y_i = \alpha + \beta \textit{Treatment}_i + \varepsilon \quad (2)$$

where  $\Delta y_i$  is the difference between the endline and baseline ( $y_{it} - y_{it-1}$ ) outcomes. In this model,  $\beta$  can be interpreted as the average difference-in-differences between the treatment and control groups.<sup>12</sup> We refer to this model as a “first-difference specification” (FD). It is an individual-level fixed-effects model that only uses variation at the level of the individual and is intended to eliminate bias from unobserved, time-invariant variables. We show these results as a robustness check, acknowledging that the VA specification may be superior to the FD specification in our case.<sup>13</sup>

Our empirical strategy can be interpreted as follows. The univariate regression of the endline score on the treatment dummy (i.e., equation 1 without controls) does not control for any possible imbalances at baseline and simply compares outcomes. The multivariate regression of the endline score on the treatment dummy and the baseline score, as well as baseline performance and study-program and study-year fixed effects (i.e., equation 1), identifies effects from differences between treatment and control groups within the cells resulting from the control variables. And, finally, the univariate regression of the first difference on the treatment dummy (i.e., equation 2) identifies the treatment effect from changes within individuals. Thus, these models control for possible imbalances at baseline with increasing strictness. Note, however, that none of our baseline measures are significantly unbalanced. We show all specifications throughout.<sup>14</sup>

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<sup>12</sup>The first-difference specification produces exactly the same coefficient and standard error for the treatment dummy as a difference-in-differences model with standard errors clustered on the individual level (using the “cluster” option in Stata that is based on Liang and Zeger (1986)) of the form  $y_i = \alpha + \beta \textit{TreatGroup}_i + \gamma \textit{Time}_i + \delta (\textit{TreatGroup}_i * \textit{Time}_i) + \varepsilon$ .

<sup>13</sup>The first-difference specification assumes very high predictive power of the baseline for the endline measure. However, if the baseline is based on different measures than the endline and thus is a noisy control variable, the VA model might be preferred. For a discussion, see McKenzie (2012). In our case, the grades are based on different exams in the pre- and post-intervention periods, and correlations are rather low: 0.49 for the baseline and immediate grade and 0.58 for the baseline and six-month grade.

<sup>14</sup>Note that because we have few clusters in the treatment group and no clusters in the control group, these specifications do not take into account potential dependencies between observations belonging to the

## 6 Results

### 6.1 Immediate Effects on mental health and other skills

Before turning to our main research question we test whether the MBSR training was successful in achieving its inherent goal of improving mental health, and whether, consistent with previous evidence, it also affects non-cognitive skills, mindfulness and concentration measured by performance in a laboratory task. This serves mainly as a validity check for our intervention.

We observe that stress, anxiety, and depression are reduced by between 0.4 and 0.7 standard deviations (sd) (see Appendix Table C.4). Similarly, self-control and conscientiousness are both improved by about 0.5 sd, whereas neuroticism is reduced by 0.4 sd (see Appendix Table C.5). All results are significant at the 1% level. Appendix Table C.6 shows that the score in the stroop task increased by about 0.2 standard deviations, with this effect being marginally significant in the first-difference specification, though not significant in the value-added specification. This table also shows that the treatment improves mindfulness by about 0.6 standard deviations. This effect is significant at the 1% level.<sup>15</sup>

Appendix Table C.7 shows that models without control variables and just comparing the endline scores find very similar results to all the ones described above. We conclude that, consistent with previous evidence, our mindfulness intervention strongly improved students' mental health, non-cognitive skills, mindfulness and very marginally increased performance in a cognitive laboratory task.

### 6.2 Immediate Effects on Grades

Table 1 presents results from OLS regressions of grades students obtained during the main exam period for the 2019 summer semester immediately after the intervention. Model (1) has the endline grade as dependent variable and includes the binary treatment variable, *Treat*. Model (2) repeats this analysis but additionally controls for prior performance, as well as study-program and study-year fixed effects, making this a value-added model. Model (3) has the first-differenced grade (endline grade – baseline grade) as dependent variable and includes the binary treatment variable, making this an individual-level fixed-effects model that only picks up changes within individuals. While Model (1) gives a treatment effect of -0.31 sd ( $p=0.035$ ), Model (2) gives a treatment effect of -0.26 sd ( $p=0.055$ ), and Model (3) gives an insignificant treatment effect of -0.10 sd ( $p=0.491$ ).<sup>16</sup> While all three models suggest that the effect of the meditation program on immediate academic performance was negative, controlling for imbalances in prior performance with same meditation group. Importantly, however, meditation group assignment was independent of exams taken.

<sup>15</sup>All results remain highly significant even after correcting for multiple hypotheses testing.

<sup>16</sup>Ex-post power calculations on the specifications without controls reveal that Models (1) and (3) reach a power of 66% and 17%, respectively. We are thus underpowered to determine whether the insignificant coefficient of -0.10 on the treatment dummy in Model (3) is a real null effect.

increasing strictness reduces the treatment effect size to the degree that the null hypothesis of no effect can no longer be rejected. We interpret these findings as evidence that, if anything, the program harmed students' immediate performance.

Table 1: Grade (Immediate)

	(1) Grade (E)	(2) Grade (VA)	(3) Grade (FD)
Treat	-0.308** (0.145)	-0.260* (0.135)	-0.102 (0.148)
Prior Grade		0.458*** (0.080)	
Prior ECTS Credits		0.005* (0.002)	
Study Program FE	No	Yes	No
Study Year FE	No	Yes	No
R <sup>2</sup>	0.025	0.294	0.003
N	181	177	177

Note: This table shows OLS regressions of the mean grade of the main summer-semester exam period on the treatment dummy. Model (1) does not include any control variables. Model (2) uses summer-semester grade as dependent variable and controls for prior mean grade, prior total ECTS credits, study-program fixed effects (9 dummies), and study-year fixed effects (3 dummies). Model (3) uses the change in grade (summer-semester grade – baseline grade) as dependent variable and does not include any control variables. All models include a constant. Heteroskedasticity robust standard errors are in parentheses. \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

### 6.3 Six-Month Effects on Grades

Table 2 presents results from OLS regressions of students' grades obtained during the main exam period of the 2019/20 winter semester, half a year after the intervention. The table, again, shows results for a model with the endline grade as dependent variable and without any control variables, a value-added model additionally controlling for prior performance and study-year and study-program fixed effects, and a model with the first-differenced grade as the dependent variable and no further control variables. All three models show that the meditation intervention had a significantly positive effect on six-month academic performance. While Model (1) gives a treatment effect of 0.28 sd ( $p=0.099$ ), Model (2) gives a treatment effect of 0.39 sd ( $p=0.017$ ), and Model (3) gives a treatment effect of 0.45 sd ( $p=0.010$ ).<sup>17</sup> We interpret these findings as robust evidence that the program positively affected students' six-month performance.

Finally, similar results emerge when looking at the distributions of changes in immediate and six-month grades compared with the baseline (see Figure 1). The exact p-value for the combined Kolmogorov-Smirnov (KS) test for the left-hand panel (delta immediate

<sup>17</sup>Ex-post power calculations on the specifications without controls reveal that Models (1) and (3) reach a power of 47% and 78%, respectively.

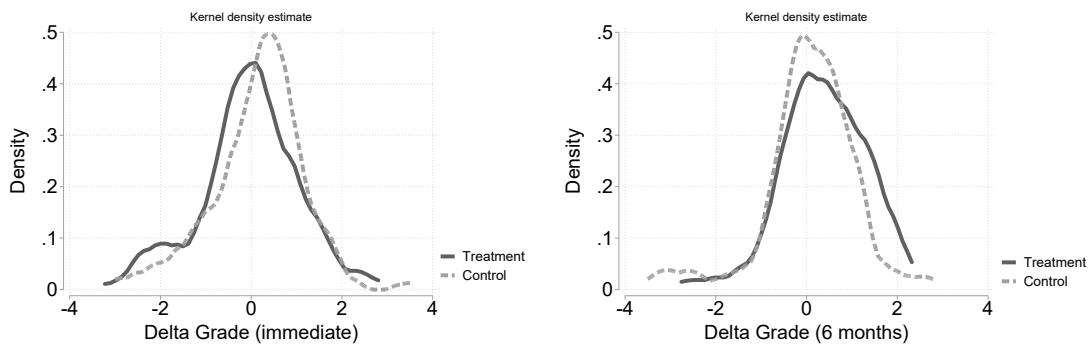
Table 2: Grade (Six Months)

	(1) Grade (E)	(2) Grade (VA)	(3) Grade (FD)
Treat	0.284* (0.171)	0.386** (0.159)	0.446*** (0.170)
Prior Grade		0.515*** (0.105)	
Prior ECTS Credits		0.003 (0.002)	
Study Program FE	No	Yes	No
Study Year FE	No	Yes	No
R <sup>2</sup>	0.022	0.318	0.053
N	124	121	121

Note: This table shows OLS regressions of the mean grade of the main winter-semester exam period on the treatment dummy. Model (1) does not include any control variables. Model (2) uses the winter-semester grade as dependent variable and controls for prior mean grade, prior total ECTS credits, study-program fixed effects (9 dummies), and study-year fixed effects (3 dummies). Model (3) uses the change in grade (winter-semester grade – baseline grade) as dependent variable and does not include any control variables. All models include a constant. Heteroskedasticity robust standard errors are in parentheses. \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

grade) of Figure 1 is 0.148. The exact p-value for the combined KS test for the right-hand panel (delta six-month grade) is 0.097.

Figure 1: Distributions of Changes in Immediate and Six-Month Grades



Notes: The left-hand panel shows changes in the immediate grades and the right-hand panel shows changes in the six-month grades by treatment group. Grades are non-standardized.

## 6.4 Effects on Grades including other Exam Periods

Besides the two main exam periods which constitute our performance outcomes of primary interest, some students took exams at the end of September after the break of the 2019 summer semester and as mid-term exams of the 2019/20 winter semester before

the Christmas break. The former are either exams that students voluntarily allocated to the secondary exam session of the summer semester so as to spread the burden of exam writing across a longer period, which is possible for some of the larger exams written in the faculty, or retaken exams that students had previously failed. The latter are exams written in some classes that last only half a semester. In both cases, we only observe small samples of 94 and 43 students, respectively.

Table 3 shows treatment effects on grades when including grades from those secondary exam periods in our analysis. Models (1) - (3) show that the treatment effect over both summer semester exam periods (main + after-break) becomes close to zero and remains insignificant, while Models (4) - (6) show that the effect over both winter semester exam periods (main + mid-term) is similar in magnitude to the effect for the primary exam period of the winter semester alone and remains significant. Hence, including these additional exam periods to our analysis does not fundamentally change our main results.<sup>18</sup>

Table 3: Grade (both exam periods in the summer and winter semesters)

	summer			winter		
	(1) Grade (E)	(2) Grade (VA)	(3) Grade (FD)	(4) Grade (E)	(5) Grade (VA)	(6) Grade (FD)
Treat	-0.230 (0.141)	-0.144 (0.129)	-0.005 (0.138)	0.228 (0.165)	0.335** (0.152)	0.380** (0.162)
Prior Grade (stand.)		0.476*** (0.075)			0.515*** (0.091)	
Prior ECTS Credits		0.005** (0.002)			0.005** (0.002)	
Constant	0.105 (0.091)	-0.134 (0.396)	-0.018 (0.088)	-0.100 (0.119)	-0.526 (0.611)	-0.108 (0.112)
Study Program FE	No	Yes	No	No	Yes	No
Study Year FE	No	Yes	No	No	Yes	No
R <sup>2</sup>	0.014	0.326	0.000	0.014	0.345	0.040
N	194	190	190	132	129	129

Note: Note: This table shows OLS regressions of the mean grade over the main and retake exam periods of the summer (Models 1 - 3) and the mid-term and main exam periods of the winter semester (Models 4 - 6) on the treatment dummy. Models (1) and (4) use the post-intervention outcome as dependent variable and do not include any control variables. Models (2) and (5) use the post-intervention outcome as dependent variable and control for prior mean grade, prior total ECTS credits, study-program fixed effects (9 dummies), and study-year fixed effects (3 dummies). Models (3) and (6) use the change in mean grade (mean grade outcome – baseline grade) as dependent variable and do not include any control variables. All models include a constant. Heteroskedasticity robust standard errors are in parentheses. \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

<sup>18</sup>For the sake of completeness we report the effects of the mindfulness training on the grades obtained during the after-break and mid-term exams periods alone in Table C.8. As can be seen, the positive effects of the training seem to start emerging already several weeks after the end of the intervention and can thus be captured by the exams written after the summer break.

## 6.5 Effects on Number of Exams and ECTS Study Points

We check whether the intervention had any effect on the “quantity” of exams taken. Mann-Whitney U tests indicate no treatment difference in (i) the number of planned exams ( $p = 0.76$ ), (ii) the number of actual exams taken ( $p = 0.54$ ), or (iii) the number of exams not taken, i.e., the number of planned exams minus the number of exams actually taken ( $p = 0.35$ ). Furthermore, note that most courses are mandatory and are only offered once a year during a specific semester. Therefore, students do not have a lot of freedom to postpone them.

Finally, one might worry that students in the treatment group decided to switch their planned exams towards more difficult ones in the summer semester and to easier ones in the winter semester. While we cannot directly test for this conjecture, we may look at the number of ECTS study points, which indicate the workload of a module in which a student is writing an exam and determines its weight in the student’s overall grade. Thus, the higher the total number of ECTS study points completed during an exam period, the higher the overall workload completed. Table 4 shows that the number of ECTS points is not affected by the treatment, either right after or six months after our intervention ended. Thus, the observed quality changes in performance were not accompanied by quantity changes: the six-month improvement (immediate reduction) in average grades did not come at the expense (advantage) of completing fewer (more) ECTS points. This result remains unchanged when we consider both the main and re-take exam periods of the summer and the mid-term and main exam periods of the winter, respectively (See Appendix Table C.9).

Table 4: ECTS Credits

	(1) Credits (im., E)	(2) Credits (im., VA)	(3) Credits (6 m., E)	(4) Credits (6 m., VA)
Treat	-0.714 (1.100)	-0.472 (1.041)	-0.080 (1.041)	-0.127 (0.943)
Prior Grade (stand.)		1.227** (0.553)		0.820 (0.550)
Prior ECTS Credits		0.019 (0.021)		-0.008 (0.014)
Study Program FE	No	Yes	No	Yes
Study Year FE	No	Yes	No	Yes
R <sup>2</sup>	0.002	0.224	0.000	0.247
N	224	219	224	219

Note: This table shows OLS regressions of the total ECTS credits acquired during a given exam period on the treatment dummy. Models (1) and (2) show regressions for the total ECTS credits acquired during the main summer semester exam period. Models (3) and (4) show regression for the total ECTS credits acquired during the main winter semester exam period. Models (1) and (3) use the ECTS credits acquired during the given exam period as dependent variable and do not contain any control variables. Models (2) and (4) use the ECTS credits acquired during the given exam period as dependent variable and control for prior mean grade, prior total ECTS credits, study program fixed effects (9 dummies), and study year fixed effects (3 dummies). All models contain a constant. Heteroskedasticity robust standard errors are in parentheses. \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

## 7 Attrition Concerns

As described in Section 3.3, the samples used for our immediate and six-month analyses are not identical. More specifically, there are 70 students for whom we observe grades immediately but not six months later. Additionally, a few students took exams only in the winter semester and not in the summer semester, resulting in 13 students whose grades we observed six months but not immediately after the end of the intervention. This raises concerns that (selective) attrition might influence our results. However, the following observations and robustness checks strongly mitigate this concern.

### 7.1 Accounting for Attrition

Reassuringly, there is no significant difference by treatment in missing immediate- ( $p = 0.59$ ) and six-month ( $p = 0.90$ ) grades or grades from summer semester retakes ( $p = 0.45$ ) or winter semester midterms ( $p = 0.84$ ).<sup>19</sup> Further tests strongly suggest that treatment assignment did not affect re-taking or postponing exams: First, treatment group students are not more likely to have failed any exams in the main summer exam period ( $p = 0.90$ ). Second, conditional on having any grade in the summer, treatment group students are also not more likely to have a missing grade in the main summer exam period ( $p = 0.28$ ). Third, conditional on having failed an exam in the main summer exam period, treatment group students do not acquire any more ECTS study points in the summer retake exam period than control group students ( $p = 0.81$ ). Furthermore, we do not find that students' grades in the summer semester affected their probability of dropping out of the sample in the winter semester: Students who had a reduction in their grade over the two summer semester exam periods compared to baseline are not more likely to have a missing grade in the winter semester exam periods than students who experienced an improvement or no change in their grade ( $p = 0.48$ ).

Rather, missingness is explained by some student demographics, such as whether someone is a bachelor or master student and how advanced one is in one's program: We find that 8.6% of bachelor and 26.2% of master students have both a missing grade for the main and retake exam period of the summer ( $p = 0.00$ ). Furthermore, 33.7% of bachelor and 62.3% of master students have a missing grade for both exam periods of the winter ( $p = 0.00$ ). These differences may be explained by master students writing fewer exams and following shorter programs than bachelor students. Bachelor students in study year 3 are significantly more likely to have a missing grade for both summer semester exam periods than those in study year 1, and bachelor students in study year 2 are more likely to have a missing grade for both winter semester exam periods than those in study year 1, which may be explained by students writing more exams in the beginning of their bachelor's programs than towards the end. For master students we do not find these differences to be significant, which may be explained by an already high

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<sup>19</sup>All p-values in this section are from Mann-Whitney U tests unless stated otherwise.

baseline of 24.2% missing summer semester and 54.5% of winter semester exam grades even of master students in their first study year.

Similarly, the more ECTS study points students have already acquired the more likely they are to have a missing grade in both summer semester ( $p = 0.01$ ) and both winter semester exam periods ( $p = 0.06$ ). However, prior grade performance does not explain a missing grade either in the summer semester exam periods ( $p = 0.44$ ) or the winter semester exam periods ( $p = 0.26$ ) and neither does gender ( $p = 0.42$  and  $p = 0.30$ , respectively). While some baseline scales marginally predict missingness of either grades in the summer or winter semester, only the health behavior index still marginally predicts missingness in the winter semester exam periods after correcting for multiple hypothesis testing.<sup>20</sup>

## 7.2 Inverse Probability Weighting

Although we have seen in the last section that treatment assignment does not predict missingness, some baseline variables (weakly) predict missingness and may thus be used to correct for attrition by inverse probability weighting (IPW). We run OLS regressions again but with observations weighted by the inverse probability of treatment group assignment conditional on having a non-missing outcome of interest estimated using a probit model. The probit model regresses the treatment dummy on all variables we observe at baseline (prior mean grade, prior total ECTS credits, study-program fixed effects (9 dummies), and study-year fixed effects (3 dummies), gender, stress, anxiety, depression, Stroop task, self-control, conscientiousness, neuroticism, mindfulness, study behavior, health behavior). We find that estimates for the effect of the meditation program on grades remain unchanged by IPW as shown in Table 5 below.<sup>21</sup>

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<sup>20</sup>p-values for non-binary explanatory variables are from univariate linear regressions with heteroskedasticity robust standard errors of the respective variable on a missing grade indicator.

<sup>21</sup>IPW identifies the average treatment effect for the whole population under the assumption that missingness depends only on variables used for re-weighting that are correlated with treatment assignment for non-missing observations. However, the stability of our estimates after re-weighting with a large number of variables makes it unlikely that missingness is strongly associated with variables that we do not observe.

Table 5: Grades (Estimated with Inverse Probability Weighting)

	(1)	(2)
	Grade (immediate)	Grade (6 months)
ATE	-0.261** (0.123)	0.398*** (0.135)
POmean Control	0.141 (0.091)	-0.179 (0.112)
N	177	121

Note: This table shows the average treatment effect (ATE) and the potential-outcome means for the control group (POmean Control) for grade outcomes estimated by a linear model using weighted regression coefficients to account for attrition. The linear model controls for prior mean grade, prior total ECTS credits, study-program fixed effects (9 dummies), and study-year fixed effects (3 dummies) (coefficients not shown). The weights are the inverse probability of treatment group assignment conditional on having a non-missing grade in the short run (model 1), or long rung (model 2), respectively, estimated using a probit model. The probit model regresses the treatment dummy on all variables we observe at baseline (in addition to those in the linear model, these are: gender, stress, anxiety, depression, Stroop task, self-control, conscientiousness, neuroticism, mindfulness, study behavior, health behavior). Heteroskedasticity robust standard errors are in parentheses. \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

### 7.3 Sample Restriction

As described above, we do not observe exactly the same sample of students in the immediate term and six months later. To investigate whether our results are driven by sample selection (on variables we do not observe) we re-run our immediate and six-month analyses described in sections 6.2 and 6.3, limiting the sample to students for whom we observe both immediate and six-month grades.<sup>22</sup> Results, again, remain unchanged as can be seen in Table 6 below.

<sup>22</sup>Note that the effects emerging from this type of analysis must be interpreted as estimates for the respondents only rather than for the entire population of students, namely, for the subsample of students who take summer and winter exams and who do not graduate.

Table 6: Grades (Estimated with Matching Samples)

	Grade (immediate)			Grade (six months)		
	(1)	(2)	(3)	(4)	(5)	(6)
	E	VA	FD	E	VA	FD
Treat	-0.378** (0.181)	-0.339* (0.177)	-0.228 (0.188)	0.167 (0.180)	0.304** (0.153)	0.332** (0.165)
Prior Grade		0.527*** (0.095)			0.593*** (0.097)	
Prior ECTS Credits		0.001 (0.003)			0.005 (0.003)	
Study Program FE	No	Yes	No	No	Yes	No
Study Year FE	No	Yes	No	No	Yes	No
R <sup>2</sup>	0.039	0.329	0.014	0.008	0.428	0.037
N	111	108	108	111	108	108

Note: This table shows OLS regressions of the mean grade on the treatment dummy. Models (1) - (3) show regressions for the mean grade over the main summer-semester exam period, given that a grade for the main winter-semester exam period is observed for the student. Models (4) - (6) show regressions for the mean grade over the main winter-semester exam period, given that a grade for the main summer-semester exam period is observed for the student. Models (1) and (4) use the post-intervention outcome as dependent variable and do not include control variables. Models (2) and (5) use the post-intervention outcome as dependent variable and control for prior mean grade, prior total ECTS credits, study-program fixed effects (9 dummies), and study-year fixed effects (3 dummies). Models (3) and (6) use the change in mean grade (intermediate grade [i.e., main exam period summer or winter] – baseline grade) as dependent variable and do not include control variables. All models include a constant. Heteroskedasticity robust standard errors are in parentheses. \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

## 7.4 Imputation of Missings

Finally, we investigate whether our results are robust to simulations involving the imputation of missings. In doing so, we take a conservative approach. For observations with a baseline grade but no immediate (six-month) grade, we assume a zero treatment effect and re-run the value added models shown in Table 1 and Table 2. In the first imputation exercise we assume that both concerned treatment and control group students underwent the same grade change that the control group with observed immediate (six-month) grades experienced on average. As can be seen in columns (1) and (4) of Table 7, this reduces the size of the immediate- and six-month effects on grades. However, the coefficients remain significant. In the second imputation exercise we assume that students with missing immediate- and six-month grades, respectively, underwent the same grade change as students in the control group with observed immediate (six-month) grades *who are in*

the same study program underwent on average. This gives very similar treatment effect estimates, which also remain significant (models (2) and (5) in Table 7). In the third imputation exercise we assume that students with missing immediate- and six-month grades, respectively, underwent the same grade change as students in the control group with observed immediate (six-month) grades *whose baseline standardized grade is in the same decile of the grade distribution*, underwent on average. This gives slightly larger treatment effect estimates, which are again significant (models (3) and (6) in Table 7).

The results from these robustness checks, along with the fact that missingness is not systematically related to treatment assignment, provide strong evidence that our main findings are not biased by attrition and, indeed, capture a causal effect of the meditation program on grades.<sup>23</sup>

Table 7: Grades (Estimated with Imputed Missings)

	Grade (immediate)			Grade (six months)		
	(1)	(2)	(3)	(4)	(5)	(6)
Imput. using $\Delta$ control:	overall	by program	by decile	overall	by program	by decile
Treat	-0.190*	-0.197*	-0.249**	0.221**	0.218**	0.271***
	(0.111)	(0.111)	(0.111)	(0.088)	(0.089)	(0.088)
Prior Grade (stand.)	0.559***	0.572***	0.425***	0.734***	0.768***	0.518***
	(0.065)	(0.067)	(0.064)	(0.054)	(0.055)	(0.049)
Prior ECTS Credits	0.004**	0.004**	0.003*	0.001	0.001	0.001
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
Study Program FE	Yes	Yes	Yes	Yes	Yes	Yes
Study Year FE	Yes	Yes	Yes	Yes	Yes	Yes
R <sup>2</sup>	0.408	0.418	0.288	0.583	0.603	0.430
N	219	219	219	219	219	219

Note: This table shows OLS regressions for grade outcomes imputing missing immediate and six-month grades. For those observations for which we have a baseline grade but do not observe a grade immediately or six months after the end of the meditation course, we impute the respective grade assuming the average grade change of those in the control group (models 1 and 4), or the average grade change of those in the control group who are in the same study program (models 2 and 5), or the average grade change of those in the control group whose standardized baseline grade is in the same decile (models 3 and 6). All models control for prior mean grade, prior total ECTS credits, study-program fixed effects (9 dummies), and study-year fixed effects (3 dummies). All models contain a constant. Heteroskedasticity robust standard errors are in parentheses. \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

<sup>23</sup>We tested the robustness of our results for mental health and other skills subjecting them the same procedures for inverse probability weighting described in Section 7.2 and the imputation of missings described Section 7.4 and find all of them to be robust as well.

## 8 Potential Channels

### 8.1 Immediate Effects

As argued in the introduction, there are three possible (non-mutually exclusive) explanations for the observed negative immediate effect of the intervention on the grades.

First, it could be the case that the relationship between stress and performance is positive in our sample and therefore by reducing the former, the meditation course also reduced the latter. However, our data do not support this explanation as we find neither a correlation (Appendix Table C.10) nor a non-linear relationship between stress and grades at baseline. Moreover, the immediate change in grades is not associated with the immediate change in stress (Appendix Table C.13).

Second, it is conceivable that the intervention reduced students' academic motivation and thus negatively affected their study and exam behavior. The questionnaire included 15 questions, including concentration while studying (5), learning strategies (4), study self-concept and engagement (3), and exam behavior (3) (see Appendix Table E.3). Four indexes were created based on the sum of the respective variables, with a higher index indicating higher values in each area. As shown in Appendix Table C.11, the intervention significantly improved all indexes ( $p < 0.01$ ) except for exam behavior for which no treatment differences were found. Thus, our evidence contradicts the second explanation.

A third explanation could be that the intervention, by requiring students to initially invest time and effort in learning new self-care practices and healthy habits, took resources away from studying in the immediate term – even though the students remained equally motivated to perform well academically. We thus examine whether the intervention influenced students' self-care practices and habits and how these changes correlate with grade outcomes.

The questionnaire included seven questions related to health behavior and self-care practices. We first present the results for each statement separately and then aggregate them into a single index, with a higher index corresponding to a healthier behavior or greater self-care. As shown in Appendix Table C.12, students in the treatment group report drinking less coffee or tea to stay awake ( $\beta$ : -0.20,  $p = 0.031$ ), seeking significantly more conscious relaxation ( $\beta$ : 0.51,  $p = 0.000$ ) and being significantly less likely to go to bed late and be tired the next day than students in the control group ( $\beta$ : -0.44,  $p = 0.001$ ). When combined into a single index, the intervention significantly improved students' overall health behavior and self-care practices ( $\beta$ : 0.42,  $p < 0.01$ ).

Examining the correlations between changes in immediate grades and other relevant pre-registered variables, we find that a change in grades in the immediate term is mainly (negatively) associated with a change in the health behavior index ( $\beta$ =-0.164,  $p = 0.07$ ) – and in particular, with the variables affected by the intervention, namely, with relaxing more consciously ( $\beta$ =-0.238,  $p = 0.010$ ) and with being less likely to go to bed late ( $\beta$ =0.149,  $p = 0.04$ ) (see Appendix Table C.13). With the exception of conscientious-

ness, where the negative association is less clear, our findings speak towards this third explanation.

## 8.2 Six-Month Effects

First, we want to rule out the possibility that the observed six-month positive effect is merely a compensatory response from students in the treatment group trying to make up for the initial reduction in immediate grades compared to their average baseline grades. To do this, we investigate whether the treatment effect on six-month grades differs based on whether students' immediate grades were higher or lower than their baseline grades. The results, as shown in Appendix Table D.1, reveal that the positive six-month treatment effect is much larger and only significant for students who already experienced an increase in immediate grades compared to baseline. The students who experienced a reduction in immediate grades do not experience a significant increase in six-month grades (although the coefficient remains positive). Hence, we do not believe this explanation to be relevant.

Next, we investigate which pre-registered variable(s) best explain(s) the six-month increase in performance. However, as the ex-post questionnaire was only administered immediately after the intervention, we lack direct observations of the secondary outcomes six months later. Despite this limitation, we analyze how changes in the immediate term might predict changes in grades after six months. Examining the correlations between changes in grades (from baseline to six months) and changes in each of the pre-registered channels (from baseline to immediately after the intervention), we find that the change in six-month grades is only positively associated with the change in mindfulness ( $\beta=0.208$ ,  $p = 0.08$  and  $\beta=0.227$ ,  $p = 0.08$  in Appendix Table C.14).

Finally, we investigate whether students who are more likely to continue practicing mindfulness after the course experienced higher long-term benefits in terms of academic performance. Since we cannot directly observe who continues practicing mindfulness after the intervention, we use the item "Own Practice" from the post-intervention questionnaire that asks students how often they have meditated on their own in the last two months (specifying "beyond or independent of the course exercises" in the treatment group) which is our best proxy for their motivation or likelihood to continue these practices. We binarize this variable by coding those who indicate a higher value than the mean value in their treatment group as Own Practice==1 (and the rest as Own Practice==0), which results in 45.1% of students of the control group and 40.4% of students of the treatment group being coded as Own Practice==1. Interacting this variable with the treatment dummy, we find that the treatment effect for students who did not practice on their own is small and not significant. However for those who did, the treatment effect is much larger and highly significant (see F-tests in Appendix Table D.2). This suggests that the long-term positive effect of the intervention on academic performance is driven by students who practiced (and likely continued practicing) on their own beyond the course's instructions after having been taught an effective method in the training.

## 9 Discussion

In this section, we assess the external validity of our findings according to the SANS conditions outlined by List (2020) and discuss the limitations of our study.

### 9.1 External validity

The SANS conditions outlined by List (2020) include: Selection, Attrition, Naturalness, and Scalability. In terms of selection, we have shown that our student sample compares well with the overall student body of the Faculty of Management, Economics and Social Sciences of the University of Cologne (one of the largest faculties of its kind in Germany) in terms of age, gender, and programs of study. We also found that our sample of students is comparable to a representative sample of the German student population in terms of their prior stress level, speaking in favor of the representativeness of our sample in one most important dimensions when one intends to evaluate the effects of a Mindfulness Based Stress Reduction (MBSR) intervention. Regarding attrition, we did not find that it was related to treatment status and the samples for which we observe grade and questionnaire outcomes remain balanced in terms of all relevant baseline variables as shown in Section 7.1. Considering the naturalness of our setting, our intervention mirrors the type of meditation courses students are offered at many universities (e.g., Cambridge, LSE, MIT or Yale). Carrying out our field experiment at a university allows us to have a setting that is natural to students. In addition, students only knew that the meditation course would be evaluated but were not aware of the study’s aims. Furthermore, the stakes of performing well academically are so high that students are unlikely to adapt their academic behaviour to what they might believe the researchers want them to do. Hence, we have good reasons to believe that our finding, that mindfulness meditation can have substantial positive spillover effects on academic performance but that it may take time for students to reap these benefits, is likely to be replicable for and generalizeable to other student populations. The last consideration for external validity from List’s SANS conditions concerns scalability. Scaling our intervention to large numbers of students should be quite straightforward. The MBSR training is highly standardized, can be done in a class setting and could be made available as part of the curriculum in any typical university. One important consideration for the implementation of such programs is the costs. For our experiment, we collaborated with a health insurance company that hired two certified MBSR teachers who received approximately 5,000 euros each for teaching eight 60-minute group sessions to three groups each (they also prepared audio recordings and handouts). This amounts to a price per meditation group of roughly 1,700 euros and a per-student cost of about 100 euros.<sup>24</sup> As the mechanism through which our intervention affects academic performance is likely individual behavior change due to learning and

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<sup>24</sup>Note that universities in some countries might also approach health insurance providers to pay for the course, similarly to what we have done. Alternatively, they may train some of their own employees with prior experience in meditation to enable them teach the course to their students.

applying a new skill individually, no equilibrium effects that might reduce effectiveness when large populations are treated are to be expected.

Although we offer evidence from a university, our research design can be adapted to firms. MBSR trainings are offered worldwide not only in education but also in companies and organizations (e.g., Deloitte, Ford, Google and Nike, to name a few). We expect that the impact of such a training on performance in the work context depends on what drives this performance. Performance in firms does not only depend on individual ability but cooperative behavior and likely has a different production function than individual academic performance. We know, however, that collective performance can be raised by improving social skills (Weidmann and Deming, 2021) which in turn can be promoted by mindfulness meditation (Jones, 2018). This suggests that mindfulness meditation programs could improve teamwork besides individual skills and thus enhance work performance in the longer term to a larger extent than we observe in an academic setting. Indeed, measuring individual academic performance is likely to capture a lower bound effect of mindfulness meditation training on performance in many settings. While there are, of course, other effects (including negative) likely to influence the impact of such programs on performance in firms, a full account of such effects is beyond the scope of this paper. We hope that our research design will be replicated in other universities and in firms around the world to shed light on where mindfulness meditation can be beneficial not only for mental health but also for performance.

## 9.2 Limitations

While our statistically significant results show that the mindfulness intervention improved six-month exam grades, it is not sufficiently powered to differentiate between a weakly negative and a true null effect of the intervention on immediate grades. Our sample size was limited by the number of groups the health insurance was prepared to pay for, the maximum group size the meditation teachers deemed feasible for this kind of course and the number of course applicants who qualified to be included in the randomization.

Moreover, the absence of a placebo condition limits our ability to pinpoint any mechanism and our analyses can provide suggestive evidence only. It also prevents us from excluding various alternative mechanisms. While certain elements of our intervention besides the mindfulness training per se may contribute to positive effects on the treatment group (e.g., a friendly support group and a dedicated weekly time window that students could use for self-care), others may contribute negatively (e.g., participants in the treatment group having less time to study). Although implementing a placebo control design control could effectively address these concerns,<sup>25</sup> we consciously opted against this design. Our decision stemmed from the desire to assess the genuine impact of mindfulness programs as they are commonly offered at universities and other organizations, encom-

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<sup>25</sup>Not without entailing serious practical and theoretical issues for the study's implementation and interpretation given that we cannot force students to attend a different course from the one they applied to.

passing all associated aspects. While a placebo control design could have allowed for further exclusion of alternative mechanisms, our chosen approach succeeds in providing insights into the real-world effects of mindfulness training on high-stakes outcomes.

Despite these limitations, our study remains the first to examine the real-world effects of a widely applied mindfulness training on a relatively large sample in a high-stakes educational setting, hence contributing meaningful insights into the training’s potential benefits on a socially and individually important outcome and providing a foundation for further exploration and refinement of these findings in future research.

## 10 Conclusion

To the best of our knowledge, we conducted the first pre-registered and relatively large randomized controlled trial investigating potential spillovers of a mindfulness training on academic achievement in higher education. Furthermore, we are also the first to study academic performance six months after the intervention, providing valuable insights into the effects of mindfulness training on student outcomes in the longer term.

Consistent with previous studies, the intervention improves students’ mental health (stress, anxiety, and depression), mindfulness and non-cognitive skills (self-control, conscientiousness, and neuroticism). We also observe a marginal improvement in a cognitive laboratory task. However, our main results reveal that it takes time for students to benefit from the positive spillovers of the mindfulness training on their academic performance. Our analysis shows that, if anything, the intervention worsened students’ immediate academic performance. We only observe robust significant positive effects of the intervention on academic performance six months after the end of the intervention. When investigating the factors behind these results, we find that the intervention leads to a significant improvement in daily health behavior and self-care practices, like increased relaxation and better sleep habits, which may take resources away from studying in the immediate term. The driver for higher academic performance in the longer term likely is students’ continued mindfulness practice and enhanced awareness of their thoughts and emotions (mindfulness).

The study’s findings highlight the significant positive spillover effects of mindfulness meditation on academic performance but they also point towards the importance of allowing sufficient time for students to fully reap these additional benefits – besides the benefits for students’ mental health, which our study shows actualize already in the short term. Like any significant human capital investment, mindfulness training may initially require students to invest time and effort in learning new self-care practices and creating healthier habits, potentially hindering immediate performance. However, as students continue to practice mindfulness, the positive effects are beginning to emerge, leading to improved performance in the longer term. Our study thus emphasizes the importance of not only measuring short-term but also delayed outcomes of an intervention in order not to dismiss its potential benefits for a given domain prematurely and to enable practitioners to draw

better-informed conclusions from it.

The study's findings are crucial for educational institutions and organizations that offer or consider providing mindfulness training to students and employees aiming to enhance well-being and performance. The findings also provide valuable insights into the debate on integrating mindfulness training into educational curricula. It highlights that an improvement in mental health and in performance are separate goals that may not be aligned in the short but in the longer term. Recognizing the longer-term performance benefits of mindfulness trainings, it is important to allow sufficient time for their beneficiaries to fully realize these advantages. In other words: Keep calm and carry on.

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# Online Appendix

## A Balance Checks

Table A.1: Balance Checks: Whole Sample

	(1)	(2)	(3)	(4)
	Control	Treat	Overall	(1) vs. (2), p-value
Prior Grade (non-inv.), excl. failed	2.286 (0.052)	2.346 (0.062)	2.313 (0.040)	0.451
Prior Grade (non-inv.), incl. failed	2.665 (0.084)	2.757 (0.090)	2.706 (0.061)	0.457
Prior ECTS Credits	62.752 (3.669)	59.939 (4.200)	61.493 (2.759)	0.613
Female	0.541 (0.045)	0.529 (0.050)	0.536 (0.033)	0.863
Bachelor Student	0.746 (0.040)	0.706 (0.045)	0.728 (0.030)	0.505
BSc Business Administration	0.213 (0.037)	0.216 (0.041)	0.214 (0.027)	0.963
BSc Economics	0.115 (0.029)	0.108 (0.031)	0.112 (0.021)	0.871
BSc Economics w/ Social Sciences	0.082 (0.025)	0.049 (0.021)	0.067 (0.017)	0.328
BSc Social Sciences	0.180 (0.035)	0.196 (0.040)	0.188 (0.026)	0.765
BSc Health Economics	0.033 (0.016)	0.059 (0.023)	0.045 (0.014)	0.350
BSc Information Systems	0.123 (0.030)	0.078 (0.027)	0.103 (0.020)	0.276
MSc Business Administration	0.107 (0.028)	0.108 (0.031)	0.107 (0.021)	0.975
MSc Economics	0.082 (0.025)	0.069 (0.025)	0.076 (0.018)	0.709
MSc Political Science	0.033 (0.016)	0.049 (0.021)	0.040 (0.013)	0.540
MSc Other Program	0.033 (0.016)	0.069 (0.025)	0.049 (0.014)	0.218
1st Year Student	0.328 (0.043)	0.363 (0.048)	0.344 (0.032)	0.586
2nd Year Student	0.385 (0.044)	0.363 (0.048)	0.375 (0.032)	0.730
3rd Year Student	0.230 (0.038)	0.176 (0.038)	0.205 (0.027)	0.330
4th Year Student	0.057 (0.021)	0.098 (0.030)	0.076 (0.018)	0.254
Stress (BL)	21.328 (0.363)	20.578 (0.355)	20.987 (0.256)	0.145
Anxiety (BL)	9.197 (0.461)	8.784 (0.441)	9.009 (0.321)	0.524
Depression (BL)	9.492 (0.454)	9.480 (0.510)	9.487 (0.338)	0.987
Stroop Task (BL)	0.511 (0.016)	0.486 (0.018)	0.500 (0.012)	0.302
Self-Control (BL)	39.762 (0.781)	39.461 (0.868)	39.625 (0.580)	0.796
Conscientiousness (BL)	30.508 (0.524)	30.147 (0.540)	30.344 (0.376)	0.634
Neuroticism (BL)	21.828 (0.489)	21.902 (0.480)	21.862 (0.344)	0.915
Mindfulness (BL)	26.984 (0.426)	27.471 (0.502)	27.205 (0.325)	0.457
Study Behavior (BL)	46.893 (0.751)	46.951 (0.746)	46.920 (0.530)	0.957
Health Behavior (BL)	23.770 (0.301)	24.127 (0.332)	23.933 (0.223)	0.426
<i>N</i>	122	102	224	
Proportion	0.545	0.455	1.000	

Note: This table shows balance checks on pre-intervention outcomes for the whole sample included in the randomization. Column (1) shows the mean value of the respective variable in the control group. Column (2) shows the mean value of the respective variable in the treatment group. Column (3) shows the mean value of the respective variable over both groups. Column (4) shows the p-value from a t-test of the differences of the means of the respective variable across the treatment and control group. Standard errors are shown in parentheses.

Table A.2: Balance Checks: Sample with Immediate Grade Outcome

	(1)	(2)	(3)	(4)
	Control	Treat	Overall	(1) vs. (2), p-value
Prior Grade (non-inv.), excl. failed	2.303 (0.059)	2.401 (0.067)	2.348 (0.044)	0.273
Prior Grade (non-inv.), incl. failed	2.638 (0.089)	2.808 (0.101)	2.716 (0.067)	0.205
Prior ECTS Credits	63.938 (3.988)	63.148 (4.732)	63.576 (3.052)	0.898
Female	0.526 (0.051)	0.548 (0.055)	0.536 (0.037)	0.770
Bachelor Student	0.794 (0.041)	0.762 (0.047)	0.779 (0.031)	0.608
BSc Business Administration	0.227 (0.043)	0.250 (0.048)	0.238 (0.032)	0.716
BSc Economics	0.124 (0.034)	0.131 (0.037)	0.127 (0.025)	0.885
BSc Economics w/ Social Sciences	0.082 (0.028)	0.060 (0.026)	0.072 (0.019)	0.553
BSc Social Sciences	0.206 (0.041)	0.167 (0.041)	0.188 (0.029)	0.500
BSc Health Economics	0.041 (0.020)	0.060 (0.026)	0.050 (0.016)	0.575
BSc Information Systems	0.113 (0.032)	0.095 (0.032)	0.105 (0.023)	0.693
MSc Business Administration	0.093 (0.030)	0.095 (0.032)	0.094 (0.022)	0.955
MSc Economics	0.093 (0.030)	0.060 (0.026)	0.077 (0.020)	0.406
MSc Political Science	0.010 (0.010)	0.036 (0.020)	0.022 (0.011)	0.249
MSc Other Program	0.010 (0.010)	0.048 (0.023)	0.028 (0.012)	0.128
1st Year Student	0.299 (0.047)	0.345 (0.052)	0.320 (0.035)	0.509
2nd Year Student	0.423 (0.050)	0.369 (0.053)	0.398 (0.036)	0.465
3rd Year Student	0.227 (0.043)	0.179 (0.042)	0.204 (0.030)	0.425
4th Year Student	0.052 (0.023)	0.107 (0.034)	0.077 (0.020)	0.164
Stress (BL)	21.577 (0.412)	20.560 (0.408)	21.105 (0.292)	0.083
Anxiety (BL)	9.165 (0.516)	8.500 (0.469)	8.856 (0.352)	0.347
Depression (BL)	9.155 (0.500)	9.631 (0.552)	9.376 (0.370)	0.522
Stroop Task (BL)	0.509 (0.018)	0.489 (0.019)	0.500 (0.013)	0.456
Self-Control (BL)	40.557 (0.876)	38.869 (0.949)	39.773 (0.645)	0.193
Conscientiousness (BL)	30.701 (0.573)	29.845 (0.601)	30.304 (0.415)	0.305
Neuroticism (BL)	21.887 (0.556)	21.726 (0.526)	21.812 (0.384)	0.836
Mindfulness (BL)	27.454 (0.482)	27.167 (0.560)	27.320 (0.365)	0.697
Study Behavior (BL)	47.938 (0.820)	46.857 (0.805)	47.436 (0.577)	0.351
Health Behavior (BL)	23.732 (0.349)	24.155 (0.380)	23.928 (0.257)	0.413
<i>N</i>	97	84	181	
Proportion	0.536	0.464	1.000	

Note: This table shows balance checks on pre-intervention outcomes for the sub-sample for whom a grade outcome from the main exam period of the summer semester is observed. Column (1) shows the mean value of the respective variable in the control group. Column (2) shows the mean value of the respective variable in the treatment group. Column (3) shows the mean value of the respective variable over both groups. Column (4) shows the p-value from a t-test of the differences of the means of the respective variable across the treatment and control group. Standard errors are shown in parentheses.

Table A.3: Balance Checks: Sample with Six-Month Grade Outcome

	(1)	(2)	(3)	(4)
	Control	Treat	Overall	(1) vs. (2), p-value
Prior Grade (non-inv.), excl. failed	2.386 (0.069)	2.426 (0.085)	2.403 (0.053)	0.707
Prior Grade (non-inv.), incl. failed	2.774 (0.107)	2.853 (0.127)	2.808 (0.082)	0.634
Prior ECTS Credits	58.191 (5.054)	56.264 (5.498)	57.347 (3.710)	0.798
Female	0.559 (0.061)	0.536 (0.067)	0.548 (0.045)	0.799
Bachelor Student	0.853 (0.043)	0.821 (0.052)	0.839 (0.033)	0.638
BSc Business Administration	0.250 (0.053)	0.321 (0.063)	0.282 (0.041)	0.383
BSc Economics	0.132 (0.041)	0.143 (0.047)	0.137 (0.031)	0.867
BSc Economics w/ Social Sciences	0.074 (0.032)	0.054 (0.030)	0.065 (0.022)	0.656
BSc Social Sciences	0.235 (0.052)	0.161 (0.050)	0.202 (0.036)	0.307
BSc Health Economics	0.029 (0.021)	0.071 (0.035)	0.048 (0.019)	0.282
BSc Information Systems	0.132 (0.041)	0.071 (0.035)	0.105 (0.028)	0.274
MSc Business Administration	0.029 (0.021)	0.054 (0.030)	0.040 (0.018)	0.500
MSc Economics	0.059 (0.029)	0.018 (0.018)	0.040 (0.018)	0.252
MSc Political Science	0.029 (0.021)	0.036 (0.025)	0.032 (0.016)	0.845
MSc Other Program	0.029 (0.021)	0.071 (0.035)	0.048 (0.019)	0.282
1st Year Student	0.382 (0.059)	0.393 (0.066)	0.387 (0.044)	0.906
2nd Year Student	0.324 (0.057)	0.357 (0.065)	0.339 (0.043)	0.697
3rd Year Student	0.235 (0.052)	0.196 (0.054)	0.218 (0.037)	0.605
4th Year Student	0.059 (0.029)	0.054 (0.030)	0.056 (0.021)	0.901
Stress (BL)	21.515 (0.487)	20.714 (0.528)	21.153 (0.358)	0.268
Anxiety (BL)	9.662 (0.630)	8.875 (0.564)	9.306 (0.429)	0.363
Depression (BL)	10.059 (0.613)	10.107 (0.668)	10.081 (0.450)	0.958
Stroop Task (BL)	0.504 (0.022)	0.486 (0.021)	0.496 (0.015)	0.562
Self-Control (BL)	39.353 (1.013)	39.036 (1.206)	39.210 (0.775)	0.840
Conscientiousness (BL)	30.574 (0.761)	30.232 (0.772)	30.419 (0.542)	0.755
Neuroticism (BL)	21.324 (0.648)	21.964 (0.586)	21.613 (0.442)	0.473
Mindfulness (BL)	26.529 (0.579)	27.339 (0.697)	26.895 (0.447)	0.369
Study Behavior (BL)	46.544 (1.031)	46.732 (1.032)	46.629 (0.730)	0.899
Health Behavior (BL)	23.324 (0.409)	23.482 (0.459)	23.395 (0.304)	0.796
<i>N</i>	68	56	124	
Proportion	0.548	0.452	1.000	

Note: This table shows balance checks on pre-intervention outcomes for the sub-sample for whom a grade outcome from the main exam period of the winter semester is observed. Column 1 shows the mean value of the respective variable in the control group. Column 2 shows the mean value of the respective variable in the treatment group. Column 3 shows the mean value of the respective variable over both groups. Column 4 shows the p-value from a t-test of the differences of the means of the respective variable across the treatment and control group. Standard errors are shown in parentheses.

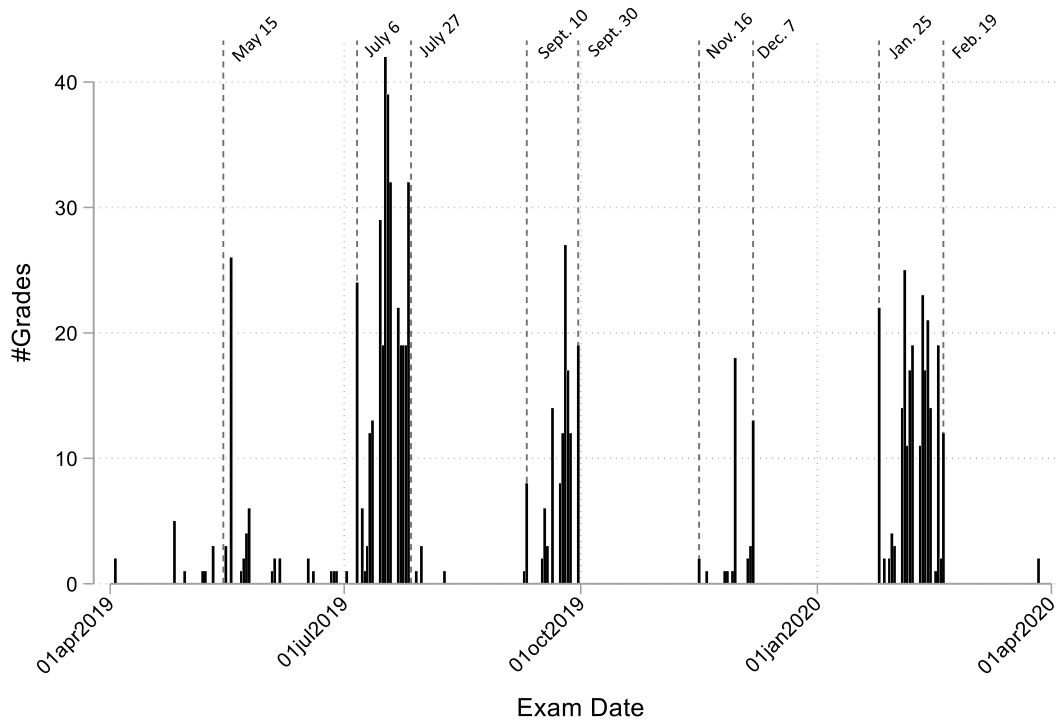
Table A.4: Balance Checks: Sample with Post-Intervention Questionnaire

	(1)	(2)	(3)	(4)
	Control	Treat	Overall	(1) vs. (2), p-value
Prior Grade (non-inv.), excl. failed	2.275 (0.061)	2.292 (0.060)	2.283 (0.043)	0.846
Prior Grade (non-inv.), incl. failed	2.579 (0.090)	2.658 (0.085)	2.618 (0.062)	0.523
Prior ECTS Credits	66.489 (4.124)	62.467 (4.400)	64.500 (3.009)	0.505
Female	0.559 (0.052)	0.553 (0.052)	0.556 (0.036)	0.935
Bachelor Student	0.731 (0.046)	0.702 (0.047)	0.717 (0.033)	0.661
BSc Business Administration	0.204 (0.042)	0.213 (0.042)	0.209 (0.030)	0.887
BSc Economics	0.118 (0.034)	0.106 (0.032)	0.112 (0.023)	0.798
BSc Economics w/ Social Sciences	0.108 (0.032)	0.043 (0.021)	0.075 (0.019)	0.092
BSc Social Sciences	0.183 (0.040)	0.202 (0.042)	0.193 (0.029)	0.739
BSc Health Economics	0.032 (0.018)	0.064 (0.025)	0.048 (0.016)	0.316
BSc Information Systems	0.086 (0.029)	0.074 (0.027)	0.080 (0.020)	0.773
MSc Business Administration	0.118 (0.034)	0.106 (0.032)	0.112 (0.023)	0.798
MSc Economics	0.086 (0.029)	0.064 (0.025)	0.075 (0.019)	0.567
MSc Political Science	0.032 (0.018)	0.053 (0.023)	0.043 (0.015)	0.482
MSc Other Program	0.032 (0.018)	0.074 (0.027)	0.053 (0.016)	0.202
1st Year Student	0.333 (0.049)	0.351 (0.049)	0.342 (0.035)	0.800
2nd Year Student	0.376 (0.051)	0.383 (0.050)	0.380 (0.036)	0.926
3rd Year Student	0.258 (0.046)	0.170 (0.039)	0.214 (0.030)	0.145
4th Year Student	0.032 (0.018)	0.096 (0.031)	0.064 (0.018)	0.077
Stress (BL)	21.849 (0.405)	20.734 (0.375)	21.289 (0.278)	0.045
Anxiety (BL)	9.366 (0.521)	9.011 (0.465)	9.187 (0.348)	0.611
Depression (BL)	9.860 (0.538)	9.447 (0.539)	9.652 (0.380)	0.588
Stroop Task (BL)	0.526 (0.018)	0.489 (0.019)	0.508 (0.013)	0.154
Self-Control (BL)	39.430 (0.897)	39.191 (0.904)	39.310 (0.635)	0.852
Conscientiousness (BL)	30.280 (0.601)	30.096 (0.571)	30.187 (0.413)	0.825
Neuroticism (BL)	22.000 (0.559)	22.266 (0.492)	22.134 (0.371)	0.721
Mindfulness (BL)	26.742 (0.495)	27.255 (0.528)	27.000 (0.362)	0.479
Study Behavior (BL)	47.097 (0.886)	47.128 (0.789)	47.112 (0.591)	0.979
Health Behavior (BL)	23.871 (0.351)	24.043 (0.353)	23.957 (0.248)	0.731
<i>N</i>	93	94	187	
Proportion	0.497	0.503	1.000	

Note: This table shows balance checks on pre-intervention outcomes for the sub-sample who answered the post-intervention questionnaire. Column 1 shows the mean value of the respective variable in the control group. Column 2 shows the mean value of the respective variable in the treatment group. Column 3 shows the mean value of the respective variable over both groups. Column 4 shows the p-value from a t-test of the differences of the means of the respective variable across the treatment and control group. Standard errors are shown in parentheses.

## B Figures

Figure B.1: Grades by Date



Note: This figure depicts the distribution of non-aggregated exam outcomes by official exam date. The x-axis shows the date. The y-axis shows the number of grade outcomes for exams written on a particular day.

## C Additional Tables

Table C.1: Timeline

2019	April 1	Beginning of summer semester lecture period
	April 8 - 24	Recruitment of participants and baseline questionnaire
	April 25 - May 7	Applicants informed about treatment allocation
	May 15	Beginning of meditation course
	June 10 - 14	Pentecost holiday
	July 12	End of meditation course and of summer semester lecture period
	July 15 - 29	Follow-up questionnaire
	July 6 - 27	Exam period of summer semester
2020	Jan 25 - Feb 19	Exam period of winter semester

Note: This table shows important dates of the field phase of the experiment.

Table C.2: Sample Comparison - Demographics

Program	Faculty			Our Sample		
	Students (%)	Female (%)	Age	Students (%)	Female (%)	Age
BSc Business Administration	31.4	47.0	22.9	21.4	54.2	22.7
BSc Economics	13.3	32.3	23.2	11.2	40.0	23.4
BSc Economics w/ Social Sciences	2.7	44.0	22.4	6.7	33.3	22.3
BSc Social Sciences	12.9	53.0	23.8	18.8	59.5	23.3
BSc Health Economics	4.4	80.6	23.9	4.5	100	24
BSc Information Systems	6.7	19.9	23.4	10.3	34.8	24.1
MSc Business Administration	11.0	46.6	25.3	10.7	54.2	25.3
MSc Economics	5.8	32.9	25.8	7.6	64.7	25.8
MSc Political Science	3.8	50.2	26.6	4	77.8	28.2
MSc Other Program	8.2	52.2	26.6	4.9	45.5	26.6
Overall	100	45.1	24.0	100	53.6	24.0
N	8181			224		

Note: This table compares the proportion of students overall, the proportion of women, and the mean age in different fields of study in the experimental sample and the universe of students at the Social Science Faculty of the University of Cologne.

Table C.3: Our Sample

Label	Description: Students for whom we have data on...	# Obs.	
1	grades in main exam periods of SS and WS	111	
2	grades in main exam period of SS (but not WS)	70	
3	grades in main exam period of WS (but not SS)	13	
<b>1+2+3</b>	<b>grades in main exam periods of SS and/or WS</b>		<b>194</b>
4	grades in SS retakes and WS midterms (but not for 1-3)	2	
5	grades in SS retakes (but not WS midterms and not for 1-3)	5	
6	grades in WS midterms (but not SS retakes and not for 1-3)	2	
<b>4+5+6</b>	<b>grades in SS retakes and/or WS midterms (but not for 1-3)</b>		<b>9</b>
7	grades in SS and WS outside exam periods, incl. pre intervention (but not for 1-6)	2	
8	grades in SS outside exam periods, incl. pre interv. (but not WS outside exam periods and not for 1-6)	8	
9	grades in WS outside exam periods (but not SS outside exam periods and not for 1-6)	0	
<b>7+8+9</b>	<b>grades in SS and/or WS outside exam periods, incl. pre intervention (but not for 1-6)</b>		<b>10</b>
10	a non-grade course in SS and WS (but not for 1-9)	0	
11	a non-grade course in SS (but not in WS and not for 1-9)	3	
12	a non-grade course in WS (but not in SS and not for 1-9)	0	
<b>10+11+12</b>	<b>a non-grade course in SS and/or WS (but not for 1-9)</b>		<b>3</b>
13	grade and non-grade course before SS (but not for 1-12)	3	
14	grade before SS (but not a non-grade course pre intervention and not for 1-12)	4	
15	non-grade course before SS (but not a grade pre intervention and not for 1-12)	0	
<b>13+14+15</b>	<b>grade and/or non-grade course before SS (but not for 1-12)</b>		<b>7</b>
16	none of 1-15 (no grade or course data)	1	1
<b>1+...+16</b>	<b>Total (1-16)</b>	<b>224</b>	<b>224</b>
<b>Additional info not retrievable from above: Students for whom we have data on...</b>			
17	grades in main exam period and retake period of SS	81	
18	grades in main exam period of SS (but not SS retakes)	100	
19	grades in SS retakes (but not main exam period of the SS)	13	
<b>17+18+19</b>	<b>grades in main exam period and/or retake period of SS</b>		<b>194</b>
20	grades in midterm and main exam period of WS	36	
21	grades in main exam period of WS (but not WS midterms)	88	
22	grades in WS midterms (but not main exam period of WS)	8	
<b>20+21+22</b>	<b>grades in midterm and/or main exam period of WS</b>		<b>132</b>

Note: This table summarizes the number of student observations for whom we observe grade outcomes in the specified time periods of the summer semester (SS) and winter semester (WS).

Table C.4: Mental Health Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)
	Stress (VA)	Stress (FD)	Anxiety (VA)	Anxiety (FD)	Depression (VA)	Depression (FD)
Treat	-0.663*** (0.124)	-0.704*** (0.144)	-0.439*** (0.119)	-0.448*** (0.132)	-0.602*** (0.114)	-0.592*** (0.126)
Stress (BL)	0.481*** (0.070)					
Anxiety (BL)			0.605*** (0.065)			
Depression (BL)					0.579*** (0.065)	
Prior Grade	-0.055 (0.072)		0.054 (0.070)		0.010 (0.064)	
Prior ECTS Credits	-0.002 (0.002)		-0.002 (0.002)		-0.002 (0.002)	
Study Program FE	Yes	No	Yes	No	Yes	No
Study Year FE	Yes	No	Yes	No	Yes	No
R <sup>2</sup>	0.371	0.115	0.453	0.059	0.504	0.107
N	182	187	182	187	182	187

Note: This table shows OLS regressions on mental health outcomes elicited in the survey on the treatment dummy. Models (1), (3), and (5) use the post-intervention outcome as dependent variable and control for the baseline measure of the respective outcome, prior mean grade, prior total ECTS credits, study-program fixed effects (9 dummies), and study-year fixed effects (3 dummies). Models (2), (4), and (6) use the change in outcome (endline – baseline) as dependent variable and include no control variables. All models contain a constant. Heteroskedasticity robust standard errors are in parentheses. \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

Table C.5: Non-Cognitive Skills Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)
	Self-Control (VA)	Self-Control (FD)	Conscient. (VA)	Conscient. (FD)	Neurot. (VA)	Neurot. (FD)
Treat	0.517*** (0.086)	0.490*** (0.089)	0.522*** (0.095)	0.470*** (0.101)	-0.353*** (0.112)	-0.403*** (0.116)
Self-Control (BL)	0.758*** (0.043)					
Conscientiousness (BL)			0.711*** (0.047)			
Neuroticism (BL)					0.732*** (0.058)	
Prior Grade	-0.033 (0.049)		0.075 (0.054)		-0.068 (0.062)	
Prior ECTS Credits	0.003* (0.001)		0.002* (0.001)		-0.001 (0.002)	
Study Program FE	Yes	No	Yes	No	Yes	No
Study Year FE	Yes	No	Yes	No	Yes	No
R <sup>2</sup>	0.701	0.140	0.655	0.104	0.537	0.061
N	182	187	182	187	182	187

Note: This table shows OLS regressions of non-cognitive skills outcomes elicited in the survey on the treatment dummy. Models (1), (3), and (5) use the post-intervention outcome as dependent variable and control for the baseline measure of the respective outcome, prior mean grade, prior total ECTS credits, study-program fixed effects (9 dummies), and study-year fixed effects (3 dummies). Models (2), (4), and (6) use the change in outcome (endline – baseline) as dependent variable and include no control variables. All models include a constant. Heteroskedasticity robust standard errors are in parentheses. \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

Table C.6: Stroop Task and Mindfulness

	(1) Stroop Task (VA)	(2) Stroop Task (FD)	(3) Mindfulness (VA)	(4) Mindfulness (FD)
Treat	0.174 (0.120)	0.228* (0.136)	0.644*** (0.120)	0.622*** (0.136)
Stroop Task (BL)	0.546*** (0.077)			
Mindfulness (BL)			0.523*** (0.060)	
Prior Grade (stand.)	0.058 (0.077)		-0.039 (0.066)	
Prior ECTS Credits	-0.001 (0.002)		0.003 (0.002)	
Study Program FE	Yes	No	Yes	No
Study Year FE	Yes	No	Yes	No
R <sup>2</sup>	0.405	0.015	0.431	0.101
N	182	187	182	187

Note: This table shows OLS regressions of the incentivized Stroop task and the mindfulness scale elicited in the survey on the treatment dummy. Models (1) and (3) use the post-intervention outcome as dependent variable and control for the baseline measure of the respective outcome, prior mean grade, prior total ECTS credits, study-program fixed effects (9 dummies), and study-year fixed effects (3 dummies). Models (2) and (4) use the change in outcome (endline – baseline) as dependent variable and do not include control variables. All models include a constant. Heteroskedasticity robust standard errors are in parentheses. \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

Table C.7: Secondary Outcomes without Controls

	(1) Stress (E)	(2) Anxiety (E)	(3) Depression (E)	(4) Self-Control (E)	(5) Conscientiousness (E)	(6) Neuroticism (E)	(7) Stroop Task (E)	(8) Mindfulness (E)
Treat	-0.656*** (0.139)	-0.522*** (0.142)	-0.661*** (0.139)	0.462*** (0.143)	0.437*** (0.143)	-0.352** (0.144)	0.020 (0.147)	0.727*** (0.137)
Constant	0.330*** (0.113)	0.262** (0.116)	0.332*** (0.110)	-0.232** (0.100)	-0.220** (0.105)	0.177 (0.108)	-0.010 (0.106)	-0.365*** (0.099)
R <sup>2</sup>	0.108	0.068	0.110	0.054	0.048	0.031	0.000	0.133
N	187	187	187	187	187	187	187	187

Note: This table shows OLS regressions of the secondary outcomes on the treatment dummy without control variables. All models include a constant. Heteroskedasticity robust standard errors are in parentheses. \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

Table C.8: Grade (Secondary Exam Periods)

	after-break exam period summer			winter mid-term exam period		
	(1) Grade (E)	(2) Grade (VA)	(3) Grade (FD)	(4) Grade (E)	(5) Grade (VA)	(6) Grade (FD)
Treat	0.047 (0.195)	0.276 (0.196)	0.375* (0.194)	-0.160 (0.272)	0.209 (0.307)	0.357 (0.274)
Prior Grade (stand.)		0.475*** (0.111)			0.571*** (0.201)	
Prior ECTS Credits		0.005 (0.003)			0.001 (0.007)	
Constant	-0.020 (0.140)	-0.640 (0.671)	-0.069 (0.150)	0.071 (0.201)	-0.738 (1.669)	0.006 (0.199)
Study Program FE	No	Yes	No	No	Yes	No
Study Year FE	No	Yes	No	No	Yes	No
R <sup>2</sup>	0.001	0.307	0.036	0.008	0.472	0.039
N	94	91	91	43	41	41

Note: Note: This table shows OLS regressions of the mean grade during the secondary exam period of the summer (Models 1 - 3) and the mid-term exam period of the winter semester (Models 4 - 6) on the treatment dummy. Models (1) and (4) use the post-intervention outcome as dependent variable and do not include any control variables. Models (2) and (5) use the post-intervention outcome as dependent variable and control for prior mean grade, prior total ECTS credits, study-program fixed effects (9 dummies), and study-year fixed effects (3 dummies). Models (3) and (6) use the change in mean grade (mean grade outcome – baseline grade) as dependent variable and do not include any control variables. All models include a constant. Heteroskedasticity robust standard errors are in parentheses. \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

Table C.9: ECTS Credits (main and secondary exam periods)

	(1)	(2)	(3)	(4)
	Credits (summer, E)	Credits (summer, VA)	Credits (winter, E)	Credits (winter, VA)
Treat	-1.034 (1.208)	-0.550 (1.129)	0.204 (1.259)	0.048 (1.102)
Prior Grade (stand.)		1.369** (0.604)		0.670 (0.641)
Prior ECTS Credits		0.022 (0.023)		0.003 (0.021)
Constant	13.475*** (0.833)	20.126*** (3.145)	7.943*** (0.844)	17.019*** (3.966)
Study Program FE	No	Yes	No	Yes
Study Year FE	No	Yes	No	Yes
R <sup>2</sup>	0.003	0.263	0.000	0.261
N	224	219	224	219

Note: This table shows OLS regressions of the total ECTS credits acquired during the exam periods of a given semester on the treatment dummy. Models (1) and (2) show regressions for the total ECTS credits acquired during the main and retake summer semester exam periods. Models (3) and (4) show regression for the total ECTS credits acquired during the midterm and main winter semester exam periods. Models (1) and (3) use the ECTS credits acquired during the given exam period as dependent variable and do not contain any control variables. Models (2) and (4) use the ECTS credits acquired during the given exam period as dependent variable and control for prior mean grade, prior total ECTS credits, study program fixed effects (9 dummies), and study year fixed effects (3 dummies). All models contain a constant. Heteroskedasticity robust standard errors are in parentheses. \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

Table C.10: Correlations of Grades (non-inv.), Non-Cognitive Skills and Concentration at Baseline

	(1)								
	Prior Grade	Stress (BL)	Anxiety (BL)	Depr. (BL)	Self-C. (BL)	Consc. (BL)	Neurot. (BL)	Stroop T. (BL)	Mindf. (BL)
Prior Grade	1								
Stress (BL)	0.0952	1							
Anxiety (BL)	0.0308	0.694***	1						
Depr. (BL)	0.247***	0.583***	0.608***	1					
Self-C. (BL)	-0.268***	-0.234***	-0.119*	-0.347***	1				
Consc. (BL)	-0.238***	-0.215***	-0.149**	-0.336***	0.703***	1			
Neurot. (BL)	-0.0914	0.646***	0.710***	0.450***	-0.154**	-0.196***	1		
Stroop T. (BL)	-0.214***	-0.105	-0.102	-0.0556	-0.0988	-0.122*	-0.0239	1	
Mindf. (BL)	-0.126*	-0.415***	-0.481***	-0.429***	0.402***	0.341***	-0.386***	-0.0690	1

All variables are unstandardized. Prior grade is the non-inverted, unstandardized average grade before the intervention including marks from failed exams, i.e. larger grades indicate worse grades. \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

Table C.11: Study and Exam Behavior

	(1)	(2)	(3)	(4)
	Concentration	Learning Strategies	Self-Concept & Engagement	Exam Behavior
Treat	0.335*** (0.071)	0.232*** (0.073)	0.184*** (0.068)	0.158 (0.117)
Concentration (BL)	0.477*** (0.056)			
Learning strategies (BL)		0.655*** (0.051)		
Study self-concept (BL)			0.667*** (0.062)	
Prior Grade	0.015 (0.039)	0.017 (0.038)	0.071* (0.042)	0.187*** (0.067)
Prior ECTS Credits	0.002 (0.002)	0.003** (0.001)	0.002** (0.001)	0.003 (0.002)
Study Program FE	Yes	Yes	Yes	Yes
Study Year FE	Yes	Yes	Yes	Yes
R <sup>2</sup>	0.440	0.565	0.568	0.123
N	182	182	182	182

Note: This table shows OLS regressions of study behaviors elicited in the endline survey on the treatment dummy. All models use the post-intervention outcome as dependent variable and control for the baseline measure of the respective outcome, prior mean grade, prior total ECTS credits, study-program fixed effects (9 dummies), and study-year fixed effects (3 dummies). All models include a constant. Heteroskedasticity robust standard errors are in parentheses. \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

Table C.12: Health Behavior

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Coffee/Tea	Alcohol	Smoking	Medication	Getting Up	Sleeping Late	Relaxation	Health Index
Treat	-0.203** (0.093)	-0.062 (0.120)	-0.034 (0.085)	-0.102 (0.152)	0.104 (0.127)	-0.435*** (0.130)	0.505*** (0.126)	0.423*** (0.114)
Coffee/Tea (BL)	0.788*** (0.052)							
Alcohol (BL)		0.680*** (0.063)						
Smoking (BL)			0.832*** (0.047)					
Medication (BL)				0.387*** (0.140)				
Getting up (BL)					0.530*** (0.077)			
Sleeping late (BL)						0.504*** (0.067)		
Relaxation (BL)							0.495*** (0.070)	
Health index (BL)								0.656*** (0.050)
Prior Grade	-0.045 (0.054)	-0.114* (0.067)	-0.023 (0.042)	0.018 (0.071)	-0.001 (0.067)	-0.051 (0.068)	-0.034 (0.064)	0.064 (0.059)
Prior ECTS Credits	0.001 (0.002)	-0.001 (0.002)	-0.001 (0.001)	0.001 (0.002)	-0.003 (0.002)	-0.003* (0.002)	0.001 (0.002)	-0.001 (0.002)
Study Program FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Study Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R <sup>2</sup>	0.652	0.493	0.738	0.179	0.325	0.362	0.399	0.530
N	182	182	182	182	182	182	182	182

Note: This table shows OLS regressions of health behaviors elicited in the online survey on the treatment dummy. All models use the post-intervention outcome as dependent variable and control for the baseline measure of the respective outcome, prior mean grade, prior total ECTS credits, study-program fixed effects (9 dummies), and study-year fixed effects (3 dummies). All models include a constant. Heteroskedasticity robust standard errors are in parentheses. \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

Table C.13: Channels for the Immediate Grade

	(1)	(2)
	$\Delta$ Grade (immediate)	$\Delta$ Grade (immediate)
$\Delta$ Stress	-0.087 (0.107)	-0.070 (0.110)
$\Delta$ Anxiety	0.093 (0.118)	0.004 (0.132)
$\Delta$ Depression	0.104 (0.110)	0.122 (0.121)
$\Delta$ Conscientiousness	-0.202* (0.104)	-0.263** (0.116)
$\Delta$ Neuroticism	-0.004 (0.127)	0.002 (0.126)
$\Delta$ Stroop Task	-0.021 (0.085)	0.032 (0.088)
$\Delta$ Mindfulness	0.068 (0.090)	0.069 (0.093)
$\Delta$ Study Behavior (Overall)	0.148 (0.244)	
$\Delta$ Health Behavior (Overall)	-0.164* (0.089)	
$\Delta$ Study Behavior (Concentration)		0.022 (0.084)
$\Delta$ Study Behavior (Strategy)		0.171 (0.113)
$\Delta$ Study Behavior (Self Concept)		-0.010 (0.136)
$\Delta$ Health Behavior (Coffee/Tea)		-0.143 (0.104)
$\Delta$ Health Behavior (Alcohol)		0.028 (0.085)
$\Delta$ Health Behavior (Smoking)		-0.031 (0.109)
$\Delta$ Health Behavior (Medication)		0.018 (0.065)
$\Delta$ Health Behavior (Getting Up)		0.041 (0.070)
$\Delta$ Health Behavior (Sleeping Late)		0.149** (0.072)
$\Delta$ Health Behavior (Relaxation)		-0.238** (0.091)
Constant	-0.016 (0.074)	-0.020 (0.075)
$R^2$	0.049	0.112
N	149	149

Note: This table shows OLS regressions of the change in grade in the main summer semester exam period (summer semester grade – baseline grade) on the change in stress, anxiety, depression, conscientiousness, neuroticism, performance in the Stroop task, and mindfulness. Model (1) contains the change in the overall study behavior index and the overall health behavior index as additional regressors, while Model (2) contains the change in the disaggregated health and study behavior measures as additional regressors. All models include a constant. Heteroskedasticity robust standard errors are in parentheses. \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

Table C.14: Channels for the Six-Month Grade

	(1)	(2)
	$\Delta$ Grade (6 months)	$\Delta$ Grade (6 months)
$\Delta$ Stress	-0.111 (0.114)	-0.088 (0.122)
$\Delta$ Anxiety	-0.115 (0.185)	-0.137 (0.181)
$\Delta$ Depression	0.138 (0.149)	0.156 (0.153)
$\Delta$ Conscientiousness	0.170 (0.173)	0.111 (0.162)
$\Delta$ Neuroticism	0.238 (0.152)	0.194 (0.133)
$\Delta$ Stroop Task	0.062 (0.115)	0.052 (0.120)
$\Delta$ Mindfulness	0.208* (0.117)	0.227* (0.130)
$\Delta$ Study Behavior (Overall)	-0.251 (0.267)	
$\Delta$ Health Behavior (Overall)	0.019 (0.125)	
$\Delta$ Study Behavior (Concentration)		-0.032 (0.094)
$\Delta$ Study Behavior (Strategy)		-0.012 (0.189)
$\Delta$ Study Behavior (Self Concept)		-0.081 (0.140)
$\Delta$ Health Behavior (Coffee/Tea)		0.114 (0.143)
$\Delta$ Health Behavior (Alcohol)		-0.098 (0.125)
$\Delta$ Health Behavior (Smoking)		0.204 (0.158)
$\Delta$ Health Behavior (Medication)		0.087 (0.099)
$\Delta$ Health Behavior (Getting Up)		0.189* (0.099)
$\Delta$ Health Behavior (Sleeping Late)		-0.151 (0.102)
$\Delta$ Health Behavior (Relaxation)		-0.171 (0.110)
Constant	-0.000 (0.100)	-0.025 (0.101)
$R^2$	0.098	0.208
N	102	102

Note: This table shows OLS regressions of the change in grade in the main winter semester exam period (winter semester grade – baseline grade) on the change in stress, anxiety, depression, conscientiousness, neuroticism, performance in the Stroop task, and mindfulness. Model (1) contains the change in the overall study behavior index and the overall health behavior index as additional regressors, while Model (2) contains the change in the disaggregated health and study behavior measures as additional regressors. All models include a constant. Heteroskedasticity robust standard errors are in parentheses. \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

## D Heterogeneity Analyses

Table D.1: Six-Month Effects by Direction of Immediate Effects

	If immediate absolute change is positive			If immediate absolute change is negative		
	(1) Grade (6 months, VA)	(2) Grade (6 months, VA)	(3) Grade (6 months, FD)	(4) Grade (6 months, VA)	(5) Grade (6 months, VA)	(6) Grade (6 months, FD)
Treat	0.542** (0.199)	0.566*** (0.197)	0.761*** (0.214)	0.022 (0.296)	0.246 (0.278)	0.206 (0.226)
Prior Grade		0.249 (0.180)			0.777*** (0.152)	
Prior ECTS Credits		0.004 (0.003)			0.004 (0.005)	
Study Program FE	No	Yes	No	No	Yes	No
Study Year FE	No	Yes	No	No	Yes	No
R <sup>2</sup>	0.082	0.382	0.121	0.000	0.562	0.016
N	74	71	71	50	50	50

Note: This table shows OLS regressions of the mean grade of the main winter semester exam period on the treatment dummy. Models (1) - (3) focus on students whose immediate average grade was higher than at baseline while models (4) - (6) focus on students whose immediate average grade was lower than at baseline. Models (1) and (4) use the post-intervention outcome as dependent variable and do not include control variables. Models (2) and (5) use the post-intervention outcome as dependent variable and control for prior mean grade, prior total ECTS credits, study-program fixed effects (9 dummies), and study-year fixed effects (3 dummies). Models (3) and (6) use the change in mean grade (winter-semester grade – baseline grade) as dependent variable and do not include control variables. All models include a constant. Heteroskedasticity robust standard errors are in parentheses. \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

Table D.2: Effects by Independent Practice

	(1) Grade (immediate, VA)	(2) Grade (immediate, FD)	(3) Grade (6 months, VA)	(4) Grade (6 months, FD)
Treat	-0.334 (0.216)	-0.288 (0.219)	0.120 (0.258)	0.183 (0.279)
TreatXOwn Practice	0.139 (0.286)	0.249 (0.307)	0.520 (0.331)	0.440 (0.359)
Own Practice	0.008 (0.175)	-0.027 (0.192)	-0.330 (0.242)	-0.269 (0.261)
Prior Grade (stand.)	0.495*** (0.090)		0.528*** (0.128)	
Prior ECTS Credits	0.005** (0.002)		0.002 (0.003)	
Constant	-0.036 (0.444)	0.081 (0.150)	-0.811 (0.568)	-0.025 (0.226)
Study Program FE	Yes	No	Yes	No
Study Year FE	Yes	No	Yes	No
F-test	0.308	0.855	0.003	0.007
R <sup>2</sup>	0.313	0.017	0.329	0.045
N	149	149	102	102

Note: This table shows OLS regressions of the grades on the treatment dummy. Models (1) and (3) use the mean grade of the main summer- and winter-semester exam periods, respectively, as dependent variables. Models (2) and (4) use the change in grade (summer grade - baseline grade and winter grade - baseline grade, respectively) as dependent variables. All models except (2) and (4) control for prior mean grade, prior total ECTS credits, study-program fixed effects (9 dummies), and study-year fixed effects (3 dummies). All models additionally contain a dummy "Own practice" equal to 1 for those students who indicated in the endline questionnaire that they practiced meditation independently more often than the average student in their treatment group during the period of the meditation course and an interaction term of this dummy and the treatment dummy. All models include a constant. The row F-test shows p-values for F-tests of the linear combination of the coefficients of "Treat" and "TreatXOwn Practice" in the respective model. Heteroskedasticity robust standard errors are in parentheses. \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

## E Invitation, Registration, Questionnaires, and Session Content

Figure E.1: Invitation Text (translated from German)

*Subject:* Course "Fundamentals of Mindfulness Meditation" now open for bachelor's and master's students

Dear Students,

we are pleased to offer an 8-week course during the summer semester in which you can learn the basics of **mindfulness meditation**.

Please note: The course is now open to WiSo faculty **master's students** as well! The application deadline has been extended to April 24!

The course is based on the **Mindfulness Based Stress Reduction (MBSR)** program. This program has been successfully used worldwide in corporate, university, and healthcare settings, among others, to effectively reduce stress, promote mental and physical health, and enhance performance.

Participation in the course is **free of charge**, as the entire course is financed by Techniker Krankenkasse (regardless of which health insurance company someone is insured with).

The course will be given by two experienced meditation teachers and will take place **once a week** starting **May 15, 2019**. There will be 6 course groups that will meet for one hour each **Wednesday** or **Friday** at the following times in a seminar room in the SSC building:

- 2:00 pm-3:00 pm

- 3:15 pm-4:15 pm

- 4:30 pm-5:30 pm

The course consists of the weekly meeting, where meditation and relaxation techniques are learned, and **daily home exercises**, where the techniques are practiced and deepened independently.

Since the course is scientifically evaluated and very expensive, **regular attendance** and **high motivation** are essential for participation.

The number of places in the course is limited and only students of the WiSo faculty can apply for it. Places are allocated by lottery. More details on the application page.

The course will be scientifically evaluated by a team of researchers led by Jun.-Prof. Dr. Lea Cassar. For this reason, we rely on all students to participate in an online survey when applying for a course place, as well as **a survey at the end of the semester**. Please see the registration page for more information.

If you are interested in taking a course, we would appreciate it if you apply to participate by **April 24** at the following website:

[https://unikoinwiso.eu.qualtrics.com/jfe/form/SV\\_cGB9wExtZWMbl1b](https://unikoinwiso.eu.qualtrics.com/jfe/form/SV_cGB9wExtZWMbl1b)

Some browser plugins prevent the page from displaying properly. If this happens, please disable them temporarily.

Best regards,

Jun.-Prof. Dr. Lea Cassar

Figure E.2: Registration Page (Translated from German)

**Course description “Basics of Mindfulness Meditation”**

Mindfulness is a state of mind that involves being aware of the present moment as best we can. That means looking at things as they are right now, without judging them and without actively intervening.

This sounds relatively unspectacular, but in reality it is not that easy. Because most of the time our mind is very busy - we think about the past, we make plans, we worry and think about everything that still has to be done.

With mindfulness we get back in touch with ourselves and draw strength from the present moment. We can look at problems with more distance and gain clarity for new decision-making possibilities and actions. We develop a better feeling for physical and psychological signals, for our stress reactions and stress limits.

Mindfulness is a key competence for healthy living and one's own personal development, especially when it comes to coping with the diverse demands of everyday life at university and at work, while remaining productive and at the same time satisfied and healthy in the long term.

In this 8-week course, you will learn meditation and relaxation techniques that allow you to deal with stress and stressful situations in a more mindful way.

What will participants take away from the course?

- The basics of mindfulness meditation
- Learning formal mindfulness exercises and how to apply them in everyday life
- Improving body awareness and learning to consciously relax
- Improving understanding and regulation of emotions
- Better insight into stress-reinforcing thought patterns and the ability to gradually dissolve them

What are the positive effects of practicing mindfulness?

- Better concentration
- More clarity and objectivity even in difficult situations
- More calmness and composure in dealing with stress
- Increased effectiveness with less effort at the same time
- Higher well-being

The course is based on the concept of Mindfulness Based Stress Reduction (MBSR) according to Jon Kabat-Zinn. This program was developed in the 1970s in the USA and is now successfully used worldwide in organizations, educational institutions, in health care and in psychotherapy for many people suffering from stress. Meanwhile, numerous international studies prove the positive effects of MBSR on mental and physical health as well as effectiveness.

The course is scientifically evaluated by a research team led by Jun.-Prof. Dr. Lea Cassar. For this purpose, all course applicants fill out an online questionnaire once directly at the time of application as well as at the end of the summer semester. They should plan about 20 minutes for each of these.

**Course Schedule**

The course will take place from May 15 to July 12, 2019 in the SSC building and will consist of one hour per week. In addition, there will be daily exercises to do at home.

To help us plan, please click on all times that are compatible with your schedule and when you could attend the course:

Wednesdays	2:00 pm-3:00 pm <input type="checkbox"/>	Fridays	2:00 pm-3:00 pm <input type="checkbox"/>
	3:15 pm-4:15 pm <input type="checkbox"/>		3:15 pm-4:15 pm <input type="checkbox"/>
	4:30 pm-5:30 pm <input type="checkbox"/>		4:30 pm-5:30 pm <input type="checkbox"/>

Figure E.2: Registration Page (Translated from German, continued)

**Personal Information**

First Name:

Last Name:

Email Address:

Gender:

Year of birth:

Matriculation number:

Programm of study:

Semester of study:

In which courses do you plan to take an exam this summer semester?:

**Conditions of Participation**

1. Participation in the course is free of charge, but there is only a limited number of places available. These will be allocated among the applicants by lottery and taking into account the lectures taken and time availability in the summer semester 2019.
2. How course applicants answer the questionnaire has no influence on the allocation of places. However, only applicants who have completely filled out the questionnaire and the application can participate in the allocation of places.
3. All course applicants, regardless of whether or not they have been awarded a place, agree to take part in an online survey lasting approximately 20 minutes at the end of the summer semester. They will receive appropriate financial compensation for doing so.
4. Participation in the course is voluntary and at the participant's own responsibility. Withdrawal is possible at any time without giving reasons by sending an e-mail to [lcassar@uni-koeln.de](mailto:lcassar@uni-koeln.de).

**Privacy Policy**

1. All course applicants, regardless of whether you have received a place or not, agree that their examination results from their current course of study from previous semesters as well as from the academic year 2019/2020 will be stored by Jun.-Prof. Dr. Lea Cassar in the IT network of the University of Cologne for research purposes until the end of the study. After that, the data will be deleted.
2. All course applicants, regardless of whether they have received a place or not, agree that Jun.-Prof. Dr. Lea Cassar will link the data from the registration and the two surveys with the applicants' examination data in the IT network of the University of Cologne and then process it in anonymized form with the other two researchers involved in the study (Dr. Mira Fischer, WZB Berlin, and Dr. Vanessa Valero, University of Zurich) for the purpose of scientific research.
3. Consent for data processing can be revoked at any time by emailing [lcassar@uni-koeln.de](mailto:lcassar@uni-koeln.de).

Last but not least: For the scientific evaluation it is important that participants attend the course until the end. All course applicants declare to intend to attend the complete course if they get a place.

- YES. I have read and agree to the course description, conditions of participation, and privacy policy. I hereby apply for a place on the course. (Continue to questionnaire.)
- NO. I do not agree and do not wish to apply for a place.

If you have any questions, please contact Jun.-Prof. Dr. Lea Cassar ([lcassar@uni-koeln.de](mailto:lcassar@uni-koeln.de)).

Submit

Table E.3: Questionnaire

Variable Name	Text	Categories	Pre	Post
First name	First name	[open field]	x	x
Last name	Last name	[open field]	x	x
Matriculation no.	Matriculation number	[open field]	x	x
Gender	Gender	1- Male; 2- Female; 3- Diverse	x	
Year of birth	In which year were you born?	[open field]	x	
Bachelor	Are you currently enrolled as a Bachelor's student at the WiSo faculty?	1- Yes; 2- No	x	
Bachelor program	In which Bachelor's program are you enrolled?	1- Business Administration; 2- Economics; 3- Economics Social Science; 4- Social Sciences; 5- Health Economics; 6- Information Systems; 7- other	x	
Master	Are you currently enrolled as a Master's student at the WiSo faculty?	1- Yes; 2- No	x	
Master program	In which Master's program are you enrolled?	1- M.Sc. International Management / CEMS MIM; 2- M.Sc. Business Administration; 3- M.Sc. Economics; 4- M.Sc. Health economics; 5- M.Sc. Information Systems; 6- M.A. Political Science; 7- M.Sc. Sociology and Social Research; 8- M.Ed. Business education	x	
Semester	In which semester are you? (in your current degree program)	1st; 2nd; 3rd; 4th; 5th; 6th; 7th; 8th (being 8th or higher)	x	
Mindfulness	Below are a number of statements about your everyday experiences. Please indicate on the scale below how often or rarely each experience has happened to you in the last 2 weeks. Your answers should reflect your true experiences, and not depend on your expectations of yourself. 1- I could experience an emotion and only realize it later. 2- I find it hard to focus on what is going on. 3- I tend not to notice feelings of physical tension or discomfort until they really grab my attention. 4- It seems like I'm functioning "automatically" without really being aware of what I am doing. 5- I rush through activities without paying attention to them. 6- I catch myself listening to others with one ear while doing something else at the same time. 7- I find myself absorbed in thoughts of the future or the past. 8- I nibble, not realizing that I am eating.	1- Almost never; 2- Very rarely, 3 - Rarely 4- Often; 5- Very often, 6 - Almost always	x	x

Table E.3: Questionnaire (continued)

Variable Name	Text	Categories	Pre	Post
Stress	The following questions are about how often you feel stressed during the last 2 weeks. 1- In the last two weeks, how often have you been upset because of something that happened unexpectedly? 2- In the last two weeks, how often have you felt that you were unable to control the important things in your life? 3- In the last two weeks, how often have you felt nervous and stressed? 4- In the last two weeks, how often have you felt confident about your ability to handle your personal problems? 5- In the last two weeks, how often have you felt that things were going your way? 6- In the last two weeks, how often have you found that you could not cope with all the things that you had to do? 7- In the last two weeks, how often have you been able to control irritations in your life? 8- In the last two weeks, how often have you felt that you were on top of things? 9- In the last two weeks, how often have you been angered because of things that happened that were outside of your control? 10- In the last two weeks, how often have you felt difficulties were piling up so high that you could not overcome them?	1- Never; 2- Almost never; 3- Sometimes; 4- Fairly often; 5- Very often	x	x
Anxiety	Over the last 2 weeks, how often have you been bothered by any of the following problems? 1- Feeling nervous, anxious or on edge. 2- Not being able to stop or control worrying. 3- Worrying too much about different things. 4- Trouble relaxing. 5- Being so restless that it is hard to sit still. 6- Becoming easily annoyed or irritable. 7- Feeling afraid as if something awful might happen.	1- Not at all; 2- Several days; 3- More than half the days; 4- Nearly everyday	x	x
Depression	Over the last 2 weeks, how often have you been bothered by any of the following problems? 1- Little interest or pleasure in doing things. 2- Feeling down, depressed, or hopeless. 3- Trouble falling or staying asleep, or sleeping too much. 4- Feeling tired or having little energy. 5- Poor appetite or overeating. 6- Feeling bad about yourself - or that you are a failure or have let yourself or your family down. 7- Trouble concentrating on things, such as reading the newspaper or watching television. 8- Moving or speaking so slowly that other people could have noticed. Or the opposite - being so fidgety or restless that you have been moving around a lot more than usual. 9- Thoughts that you would be better off dead or of hurting yourself in some way.	0- Not at all; 1- Several days; 2- More than half the days; 3- Nearly everyday	x	x

Table E.3: Questionnaire (continued)

Variable Name	Text	Categories	Pre	Post
Self-control	Please indicate how much each of the following statements reflects how you typically are. 1- I am good at resisting temptation. 2- I have a hard time breaking bad habit. 3- I am lazy. 4- I say inappropriate things. 5- I do certain things that are bad for me, if they are fun. 6- I refuse things that are bad for me. 7- I wish I had more self-discipline. 8- People would say that I have iron self-discipline. 9- Pleasure and fun sometimes keep me from getting work done. 10- I have trouble concentrating. 11- I am able to work effectively toward long-term goals. 12- Sometimes I can't stop myself from doing something, even if I know it is wrong. 13- I often act without thinking through all the alternatives.	1- Not at all; 2- Slightly; 3- Moderately; 4-?; 5- Very much	x	x
Conscientiousness	How true the following are about you. 1- Does a thorough job. 2- Can be somewhat careless. 3- Is reliable. 4- Tends to be disorganized. 5- Tends to be lazy. 6- Perseveres until the task is finished. 7- Does things efficiently. 8- Make plans and follows through with them. 9- Is easily distracted.	1-Disagree, 2- Rather Disagree; 3- Neutral; 4- Rather Agree 5- Agree	x	x
Neuroticism	How true the following are about you. 1- Is depressed, blue 2- Is relaxed, handles stress well. 3- Can be tense. 4- Worries a lot. 5- Is emotionally stable, not easily upset. 6- Remains calm in tense situations. 7- Gets nervous easily.	1-Disagree, 2- Rather Disagree; 3- Neutral; 4- Rather Agree 5- Agree	x	x
Study behavior	How exactly do these statements currently apply to you? 1- I usually rightfully estimate how much time I need to complete a task. 2- Every day, I know what things I have to do and how far I can handle them. 3- If I cannot keep up with my work, I often give up. 4- I always make the same mistakes. 5- I distribute my work and my learning evenly throughout the semester. 6- I often dig with thoughts while learning. 7- I consciously gather my concentration before I start learning. 8- I regularly check my messages on my smartphone while I'm learning. 9- I set up my learning place in a quiet place without distractions. 10- I usually start learning only when the pressure is very high. 11- It is easy for me to concentrate on learning for a long time. 12- I am sure that I can learn all the skills to be successful in my studies. 13- I like to study. 14- I am always attentive in lectures. 15- I am not a good student. 16- I am nervous before exams. 17- I find it easy to manage time well while writing an exam. 18- I panic easily when I can't solve an exam problem. (Statements 16-18 only contained in post-intervention questionnaire.)	1-Disagree, 2- Rather Disagree; 3- Neutral; 4- Rather Agree 5- Agree	x	x

Table E.3: Questionnaire (continued)

Variable Name	Text	Categories	Pre	Post
Health behavior	Please rate a few more statements about your current habits. 1- I get up at the same time every morning., 2- I consciously relax., 3- I drink alcohol. 4- I drink coffee or tea to stay awake. 5- I take medication to be more efficient. 6- I go to bed late in the evening and then get tired the next day. 7- I smoke.	1-Never; 2- Hardly ever; 3- Occasionally; 4- Rather Regularly; 5- Very Regularly	x	x
Stroop task	(20 items of the type: "Click on the answer that matches the color of the following word: Blue" on separate screens. Students were instructed that among the people with the greatest number of correct answers the three fastest would be paid 20 euros.)	(Correct answer involved clicking on the color in which the word (e.g. "Blue") was written, which could be any of black, blue, yellow, green, or red. )	x	x
Experience	Do you have experience with meditation?	1- No, no experience.; 2- Yes, I have meditated, but not regularly. I do not meditate at the moment.; 3- Yes, I meditated regularly, but I do not meditate at the moment.; 4- Yes, I meditate sometimes.; 5- Yes, I meditate (almost) every week.; 6- Yes, I meditate (almost) every day.	x	
Motivation	What motivation is most important to your desire to learn mindfulness meditation? Please choose an option.	1- I am curious.; 2- I want to improve my concentration.; 3- I want to learn to better relax.; 4- I want to learn to deal better with my emotions.; 5- I want to loose weight.; 6- I want to be more productive	x	
Father's education	Does your father have a university degree?	1- Yes; 2- No	x	
Mother's education	Does your mother have a university degree?	1- Yes; 2- No	x	
Future interest	Would you like to be informed by e-mail if another mindfulness course is offered at the University of Cologne?	1- Yes; 2- No		x
Liked course	How did you like the course "Fundamentals of Mindfulness Meditation"?	1- Very much; 2- Much; 3- Rather less; 4- Not at all; 5- I don't know		x (T)
Learned course	How much did you learn on the course?	1- Very much; 2- Much; 3- Rather less; 4- Nothing at all; 5- I don't know		x (T)

Table E.3: Questionnaire (continued)

Variable Name	Text	Categories	Pre	Post
Recommend course	Would you recommend participation in the course to other students?	1- Definitely; 2- Probably; 3- Probably not; 4- Definitely not; 5- I don't know		x (T)
Exercises first half	During the FIRST HALF of the course, how often did you do the exercises on your own?	1- (Almost) daily, about three times per day; 2- (Almost) daily, about once a day; 3- On at least half of the days, about three times per day; 4- On at least half of the days, about once a day; 5- Irregularly, about three times per day; 6- Irregularly, about once a day; 7- Rarely; 8- Never		x (T)
Exercises second half	During the SECOND HALF of the course, how often did you do the exercises on your own?	1- (Almost) daily, about three times per day; 2- (Almost) daily, about once a day; 3- On at least half of the days, about three times per day; 4- On at least half of the days, about once a day; 5- Irregularly, about three times per day; 6- Irregularly, about once a day; 7- Rarely; 8- Never		x (T)
Exercises now	Are you currently continuing to do the exercises?	1- Yes; 2- No		x (T)
Own practice	In the last two months, how often have you meditated on your own (i.e., beyond or independent of the course exercises)? [treatment group]; In the last two months, how often have you meditated on your own? [control group]	1- (Almost) every day; 2- (Almost) every week; 3- Sometimes; 4- Never		x
App	Are you currently using a meditation app?	1- Yes; 2- No		x
Friends	Are you friends with students who have taken the "Fundamentals of Mindfulness Meditation" course?	1- Yes; 2- No		x (C)
Course materials	Have any participants in the "Fundamentals of Mindfulness Meditation" course shared course materials with you?	1- Yes; 2- No		x (C)
Comments	Anything else you would like to tell us? - Otherwise, simply leave the field blank.	[open field]		x

Note: This table lists the items contained in the pre- and/or post-intervention questionnaire. The column "Variable name" contains the name used in the analysis. The column "Text" contains the item text shown to participants. The column "Categories" contains the answer categories available to participants. Columns "Pre" and "Post" indicate whether the variable was contained in the pre- and/or post-intervention questionnaire, respectively. T = only contained in treatment group questionnaire; C = only contained in control group questionnaire.

Table E.4: Sessions of the Meditation Course

	Group session	Individual exercises
Week 1	<ul style="list-style-type: none"> <li>- time out</li> <li>- introduction to the course, motivation to participate in the course, introduction of participants</li> <li>- topics of teacher's talk: mindfulness, focus on the body, present moment awareness</li> <li>- body scan</li> <li>- exchange of thoughts</li> </ul>	<ul style="list-style-type: none"> <li>- time out (3 times per day)</li> <li>- body scan (once a day)</li> </ul>
Week 2	<ul style="list-style-type: none"> <li>- time out</li> <li>- exchange of experiences in the last week</li> <li>- topics of teacher's talk: somatic markers, the body as a resource, listening to the body, dealing with unpleasant emotions and pain</li> <li>- body scan</li> <li>- exchange of thoughts</li> </ul>	<ul style="list-style-type: none"> <li>- time out (3 times per day)</li> <li>- body scan (once a day)</li> <li>- observing the body in everyday life – stopping to pay attention to sensations</li> </ul>
Week 3	<ul style="list-style-type: none"> <li>- time out</li> <li>- exchange of experiences in the last week</li> <li>- topics of teacher's talk: attitudes while practicing meditation (beginner's mind, non-intentionality, not judging, letting go, not grasping, trust, benevolence/compassion), sitting posture</li> <li>- sitting meditation, observing the breath</li> <li>- exchange of thoughts</li> </ul>	<ul style="list-style-type: none"> <li>- time out (3 times per day)</li> <li>- body scan or sitting meditation (once a day, alternating)</li> <li>- observing judgments in stressful situations</li> </ul>
Week 4	<ul style="list-style-type: none"> <li>- time out</li> <li>- exchange of experiences in the last week</li> <li>- topics of teacher's talk: stress, triggers and responses, judgement, expectations towards ourselves, autopilot, creating a gap between triggers and responses, introduction to yoga</li> <li>- yoga (standing)</li> <li>- exchange of thoughts</li> </ul>	<ul style="list-style-type: none"> <li>- time out (3 times per day)</li> <li>- body scan or sitting meditation (once a day, alternating)</li> <li>- observing the arising of stress and stress-related thoughts in everyday life; stress diary</li> </ul>
Week 5	<ul style="list-style-type: none"> <li>- time out</li> <li>- exchange of experiences in the last week</li> <li>- topics of teacher's talk: judgements are thoughts, dealing with thoughts (not identifying with and observing thoughts)</li> <li>- sitting meditation</li> <li>- exchange of thoughts</li> </ul>	<ul style="list-style-type: none"> <li>- time out (3 times per day)</li> <li>- sitting meditation, yoga or body scan (once a day, alternating)</li> <li>- observing thoughts that trigger difficult emotions in every day life</li> </ul>

Table E.4: Sessions of the Meditation Course (continued)

	Group session	Individual exercises
Week 6	<ul style="list-style-type: none"> <li>- time out</li> <li>- exchange of experiences in the last week</li> <li>- topics of teacher's talk: dealing with emotions (observing and not ignoring emotions, not identifying with emotions)</li> <li>- guided self-reflection using RAIN method (recognize, allow, investigate, nurture) by Tara Brach</li> <li>- sitting meditation, observing with compassion and kindness</li> <li>- exchange of thoughts</li> </ul>	<ul style="list-style-type: none"> <li>- time out (3 times per day)</li> <li>- sitting meditation, yoga or body scan (once a day, alternating)</li> <li>- observing (difficult) emotions in everyday life with kindness</li> </ul>
Week 7	<ul style="list-style-type: none"> <li>- time out</li> <li>- exchange of experiences in the last week</li> <li>- topics of teacher's talk: mindful communication</li> <li>- practice of mindful communication in pairs</li> <li>- exchange of thoughts</li> </ul>	<ul style="list-style-type: none"> <li>- time out (3 times per day)</li> <li>- sitting meditation, yoga or body scan (once a day, alternating)</li> <li>- integrating new skills into everyday life</li> </ul>
Week 8	<ul style="list-style-type: none"> <li>- time out</li> <li>- exchange of experiences in the last week</li> <li>- topics of teacher's talk: tips on integrating new skills into everyday life, cultivating gratitude and self-esteem</li> <li>- sitting meditation</li> <li>- exchange of experiences and thoughts with respect to the course</li> </ul>	<ul style="list-style-type: none"> <li>- time out (3 times per day)</li> <li>- sitting meditation, yoga or body scan (once a day, alternating)</li> <li>- integrating new skills into everyday life</li> </ul>

Note: This table lists the contents of the sessions of the meditation course that took place weekly and lasted 60 minutes, and the individual exercises that participants were asked to do daily and that were accompanied by written handouts and audio recordings to follow along.