Keep Calm and Carry On: The Short- vs. Long-Run Effects of Mindfulness Meditation on (Academic) Performance

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Keep Calm and Carry On: The Short- vs. Long-Run Effects of Mindfulness Meditation on (Academic) Performance

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Abstract

Mindfulness-based meditation practices are becoming increasingly popular in Western societies, including in the business world and in education. While the scientific literature has largely documented the benefits of mindfulness meditation for mental health, little is still known about potential spillovers of these practices on other important life outcomes, such as performance. We address this question through a field experiment in an educational setting. We study the causal impact of mindfulness meditation on academic performance through a randomized evaluation of a well-known 8-week mindfulness meditation training delivered to university students on campus. As expected, the intervention improves students' mental health and non-cognitive skills. However, it takes time before students' performance can benefit from mindfulness meditation: we find that, if anything, the intervention marginally decreases average grades in the short run, i.e., during the exam period right after the end of the intervention, whereas it significantly increases academic performance, by about 0.4 standard deviations, in the long run (ca. 6 months after the end of intervention). We investigate the underlying mechanisms and discuss the implications of our results.

Keywords: performance, mental health, education, meditation, field experiment
JEL Codes: I21, C93, I12, I31

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1 Introduction

Mindfulness-based meditation practices are becoming increasingly popular in the Western world, including in private and public organizations.[1] According to Lyddy et al. (2021), more than half of all large companies offer their employees some form of mindfulness training as of 2021. These include Aetna, Black Rock, Deloitte, Deutsche Telekom, Ford, General Mills, Goldman Sachs, Google, HBO, McKinsey & Company, Nike, Procter & Gamble and SAP, among others. In addition to firms, public sector and international organizations such as the United Nations, the Australian government and the United States Postal Service offer similar programs to their employees. Mindfulness meditation is even part of the agenda of the World Economic Forum. Similarly, more and more educational institutions offer free mindfulness-based meditation courses to their students or consider integrating them into their teaching curriculum. For instance, the British government announced in February 2019 that in up to 370 English schools, students will begin to practice mindfulness as part of a study to improve youth mental health.[2] 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.[3] Top universities, such as Cambridge, Harvard, LSE, MIT, Oxford, Stanford, and Yale, are among those offering free mindfulness meditation programs to their students.[4]

[1] Even though consensus on an unequivocal definition of mindfulness is lacking so far, one of the most commonly cited definitions was formulated by Jon Kabat-Zinn, who defined it as "a moment to moment awareness that is cultivated by purposefully paying attention to the present-moment experience, with a non-judgmental attitude" (Kabat-Zinn, 1994).

[2] www.gov.uk/government/news/one-of-the-largest-mental-health-trials-launches-in-schools, www.nytimes.com/2019/02/04/world/europe/uk-mindfulness-children-school.html

[3] According to the American College Health Association Fall 2017 National College Health Assessment (ACHA, 2018), 57% of college students in the US reported experiencing high levels of stress in the past year. Moreover, 63% felt overwhelming anxiety and 41% felt so depressed that they found it difficult to function. Note that these data are likely to underestimate the current problem of poor mental health among college students. According to recent studies, the pandemic sharply increased the risk of clinical depression among young US adults (Giuntella et al., 2021), and these effects persist even after easing of the pandemic (Barbieri et al., 2021).

[4] Some of the top US business schools, such as HBS, NYU Stern, MIT, and the Rady School of Management, have also begun offering MBA and business courses on topics related to "mindful

Extensive literature provides evidence on the effectiveness of mindfulness meditation practices in achieving their main goals, namely, in reducing stress, anxiety and depression (see, for instance, Khoury, 2015, for a review). However, little is known about the potential spillovers of mindfulness meditation on other important life outcomes, such as performance. This paper helps fill this gap by investigating the causal impact of a mindfulness meditation program on students' academic performance in higher education.

Mindfulness meditation 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). As an example, among undergraduate university students from the US, those with higher self-reported anxiety and depression levels achieve poorer grades on examinations (Chapell et al., 2005; Hysenbegasi et al., 2005).[5] Mindfulness practice may also improve academic performance by increasing self-control and focus (Tang et al., 2015), which positively influence learning. Hence, there are good reasons to believe that mindfulness meditation not only improves mental health but may also help improve performance, which is arguably one of the reasons why it has become so popular in education and business companies.[6]

However, other arguments point to the potential limitations or even negative effects of mindfulness meditation training on academic performance. One argument concerns stress, whose relationship to performance is less straightforward than it is for anxiety and depression. While excessive levels of stress are likely to impair learning and memory, some level of stress could facilitate them (Vogel and Schwabe,

leadership".

[5]The worldwide economic costs of mental disorders, of which depression and anxiety are the most common, are estimated to be US $2.5 trillion, due mostly to lost productivity. Mental disorders thus account for higher economic costs than chronic somatic diseases such as cancer and diabetes (Trautmann et al., 2016).

[6]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).

2016).[7] In this case, the reduction in stress caused by mindfulness meditation could possibly reduce academic performance. Furthermore, mindfulness meditation training may reduce students' motivation to study by shifting attention away from future states and academic goals towards the present moment and acceptance of the status quo. In other words, mindfulness meditation could hinder goal-achievement processes (Hafenbrack and Vohs, 2018). Finally, learning a new (mindfulness meditation) practice and adopting a new (mindfulness meditation) routine may divert resources (in terms of cognitive effort and time) from studying.[8] However, in this last case, the negative effect of the training should be short-lived, because as the students repeat actions, the meditation practice is learned and habits are formed, thereby requiring minimal decision-making and minimal regulatory control (and probably less time) in the long run.

Taken together, these arguments suggest that there are potential countervailing effects of mindfulness meditation on academic performance. Furthermore, the importance of each of these effects may be changing over time. With the above dynamics and mechanisms potentially in play, it is difficult to predict how mindfulness meditation ultimately affects academic achievement. 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 meditation training on short- and long-term academic performance.

In collaboration with one of the largest German health insurance providers, we offered a free 8-week mindfulness meditation course to students at the University of Cologne.[9] Interested students could apply to the course by registering and com-

[7] 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.

[8] When initiating and implementing a new behaviour, people typically decide what to do and how to do it in order to achieve certain outcomes and avoid others (Wood and Rünger, 2016). However, making conscious decisions and exerting willpower are cognitively demanding and require the expenditure of some inner, limited resources that are depleted afterward (Muraven and Baumeister, 2021). This would imply that learning a new practice and adopting new meditation habits could reduce the amount of resources available to studying in the short term.

[9] 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

pleting an online questionnaire. Applicants were then randomly assigned to the treatment or the control group, and students in the treatment group were offered a place in the course. We then measured the effects of this intervention on the short- and long-run grades of the students assigned to the treatment group relative to students assigned to the control group, who did not have access to the course. The program was based on the well-established "mindfulness-based stress reduction" (MBSR) course, developed by Jon Kabat-Zinn (1994) in the US in the 1970s. The MBSR training has two great advantages: it is secular, and it is highly standardized. Thanks to these characteristics, the training has been subject to many scientific studies (see our literature review in Section 2) and is now used worldwide not only in education but also in health care and in companies and organizations.

The program consisted of eight weekly group sessions with an experienced and certified MBSR teacher and daily individual exercises. To determine the impact of the training on our primary outcome of interest – students' academic performance – we use grade information from the university's administrative records. We have access to all grades obtained in the semesters before the intervention, soon after it ended, and up to six months after it. These grades allow us to investigate and compare the intervention's short- and long-term effects on academic performance. In addition, we measured students' mental health, non-cognitive and cognitive skills, study behavior, and health (self-care) behavior. These data were collected before the intervention started and soon after it ended. They allow us to test whether our intervention achieved its goals in terms of improving mental health and to investigate channels through which it may affect grades in the short run.

Our main findings can be summarized as follows. Consistent with previous evidence, the mindfulness meditation program significantly improved students' self-reported mental health (stress, anxiety, and depression). It also significantly improved self-reported non-cognitive skills (self-control, conscientiousness, and neu-

that the proportion of 18- to 25-year-old adults diagnosed with one of these mental disorders rose by 38% between 2005 and 2016.

roticism) and very marginally increased cognitive skills (measured by performance in an incentivized Stroop task). However, we find that, if anything, the intervention marginally decreased students' short-term academic performance. In a "value-added specification" (VA) controlling for prior performance and program and study-year fixed effects, the intervention reduced grades by 0.26 sd ($p = 0.055$). When using a "first-differences specification" (FD), the effect is still negative but smaller and no longer significant.

We only observe robust positive effects of the intervention on academic performance in the long term. Specifically, the mindfulness training significantly improved long-term academic performance by, on average, 0.386 ($p = 0.017$) sd in a VA specification and by 0.446 sd ($p = 0.010$) in a FD specification. No effect was found on the number of exams – more precisely, on the number of credit points – taken in each semester, suggesting that the long-term improvement (short-term reduction) in grades did not come at the expense (advantage) of taking fewer (more) exams. These results survive additional robustness checks.

When exploring the underlying mechanisms behind our findings – and, in particular, behind our marginally negative effect in the short run – our data indicate that the intervention led to an increase in daily healthy routine and self-care practices, such as sleeping more and relaxing more consciously, both of which were found to be the best predictors of changes in short-term grades among all our pre-registered potential channels (i.e., mental heath, cognitive and non-cognitive skills, and study and health behavior). So overall, our evidence is consistent with the argument above according to which adopting a new meditation practice and related healthy habits reduces the amount of resources available for studying in the short (but not the long) term. We also find that the long-term positive effect of the intervention on academic performance 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, ultimately, mindfulness meditation can have substantial positive spillover effects on academic performance but that it may take time before students can reap these additional benefits.

The paper proceeds as follows. The next section 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. Section 6 reports the main findings and robustness checks. Section 7 explores potential channels that may help explain our results. Section 8 discusses the external validity and generalizability of our results. Section 9 concludes.

2 Related Non-economic Literature

2.1 Literature in Economics

Our study contributes to different strands of literature in economics. First, we contribute to the economics literature on the determinants of academic achievement. A large body of literature examines the role of monetary and non-monetary incentives in improving student 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).[10] 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. More closely related to our study, Cappelen et al. (2017) investigate the effects of physical exercise on academic performance in a field experiment. They 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 compared with a control group. Whereas their paper investigates positive spillover effects of

[10]For a review of the experimental literature, see Schildberg-Hörisch and Wagner (2020).

physical exercise on academic performance, we examine spillovers of mindfulness meditation on academic performance.

Second, our paper relates to an emerging 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, 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. (2022) 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. Oswald et al. (2015) is among the first economic studies to address this question. They provide evidence from a series of laboratory experiments for a positive causal link between human well-being and performance. More recently, Bellet et al. (2019) and Coviello et al. (2021) investigate this question in the field, with mixed results. While Bellet et al. (2019) find a positive effect of positive mood on workers' sales performance, Coviello et al. (2021) 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 exams' performance these channels are switched off. Thus, in a way, our intervention provides the hardest test of the hypothesis that well-being increases performance. Second, compared with these previous studies, which mainly rely on short-lived shocks (like weather changes) that manipulate 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 "fundamental" and persistent 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 not only mental health but also 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), focus on adults. These papers show that such skills may be malleable at a later age. While their studies concentrate on developing countries, our paper provides further evidence of such malleability in young adults in a developed country.[11]

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 in people experiencing mental or physical illness (Goyal et al., 2014), the practice has similar benefits in healthy people. Several studies review evidence about mindfulness-based techniques in nonclinical populations. Chiesa and Serretti (2009) analyze 10 studies on MBSR and conclude that it had 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) had a significant effect on the reduction of stress levels. In addition, they found that it reduces anxiety and increases psychological well-being.

[11] This is relevant because research in psychology has shown that in affluent 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 countries' differences, one may reasonably conjecture personality traits to be less malleable in developed than in developing countries.

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.

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.

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. More similar to our study, Hall (1999) and Mrazek et al. (2013) implement longer interventions and focus on academic performance. Hall (1999) randomly assigned 56 undergraduates to two study groups, one of which included meditation. Each study group met one hour twice a week for the duration of the academic semester. In the treatment group, students were instructed in natural breathing, relaxation and attention-focusing techniques. The meditation process was practiced 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. In Mrazek et al. (2013), 48 undergraduate students were randomly assigned to either a mindfulness class or a nutrition class. Classes met for 45

minutes four times a week for two weeks. They found that the mindfulness training improved GRE reading comprehension scores. Compared with these studies, our sample size is four times as large and, importantly, is balanced not only along past performance but also along all the channels through which the mindfulness training may affect performance, namely, mental health, cognitive and non-cognitive skills, and studying and health behavior at the baseline. Hence, to the best of our knowledge, our study is the first pre-registered and relatively large randomized controlled trial to investigate the causal effect of a mindfulness meditation training on short- and long-term academic performance.

3 The Experiment

In collaboration with a major German health insurance provider, we offered a free eight-week mindfulness meditation course to students at the University of Cologne. Interested students could apply for the course by registering and completing an online questionnaire. Eligible applicants were then randomly assigned to the treatment or the control group, and students in the treatment group were offered a place in the course.[12] We describe the design of the experiment in more detail below. The experiment was pre-registered (AEARCTR-0004197) and received ethics approval from the university's institutional review board.

3.1 Recruitment

In the summer semester of 2019, a mindfulness meditation course was offered to students at the Faculty of Management, Economics and Social Sciences of the University of Cologne. The course was advertised beginning on April 8, 2019, via the

[12]Given that we randomly assigned students who applied to the mindfulness training to either a treatment or a control group, for obvious reasons the latter were not offered any other course in substitution. This design feature also has one disadvantage: having a passive control group makes it harder to disentangle different mechanisms underlying a potential treatment effect of the meditation training (e.g., the effect of the course's content vs. time spent in the course). We try to address this issue in section 7 where we investigate channels possibly explaining our results.

mailing list, newsletters, and social media accounts of the same faculty (see Figure D.1 in Appendix D for an English translation of the announcement text).

Interested students could apply for a place in the course until April 24, 2019, by registering and completing a baseline survey on a website implemented with the survey software Qualtrics.[13] On the registration page, students were provided some basic information about the origins and potential benefits of mindfulness meditation and were asked to indicate which time slots would fit their schedule and which exams they were planning to take at the end of the summer semester. They also gave their consent to access and use the data on their grades and to link it to their questionnaire answers. The baseline questionnaire included questions eliciting students' mental health, cognitive and non-cognitive skills, and study and health-related behavior.

Students were informed that the course was financed by a large German health insurance provider and would be free to them, but that places were limited and thus not everyone could participate. We also informed students that the available slots would be allocated through a lottery, taking into account their time availability and the lectures they were planning to take. We highlighted that their answers to the baseline questionnaire would not affect their chance of getting a place. Finally, applicants were asked to agree to answer a follow-up questionnaire, independently of whether they would be placed in the course or not (see Figures D.2 in Appendix D for an English translation of the registration page). They were paid 10 euros for completing the survey.

[13]Initially, the deadline was April 15, and the advertisement only targeted bachelor's-level students of the Faculty of Management, Economics and Social Sciences of the University of Cologne. However, because by that time we had not attracted sufficient applicants, we extended the deadline to April 24 and decided to advertise the course to master's-level students of the same faculty as well.

3.2 Timeline

Table 1 provides an overview of the relevant dates and events of the study. The recruitment of students started one week after the beginning of the summer semester and lasted for two weeks, until April 24. 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, with 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, on July 12. Most exams of the summer semester are written in the three weeks surrounding the end of the lecture period (see Figure B.1 in the Appendix for the timing of exams). Thus, our main analysis on the short-term 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 from July 6 until July 27.[14] Consistent with this definition, our analysis on the long-term effects of the intervention on academic performance focuses on grades of the exams written during the main exam period of the winter semester, namely January 25 through February 19: i.e., about half a year after the end of the intervention. As shown in Figure B.1 in the Appendix, there are 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 and the midterm exams of the winter semester, respectively. These can be used to measure intermediate-term effects of our intervention. However, since the sample size is quite restricted, they are not the main focus of our analysis, although

[14] As shown in Figure B.1, some exams are written in the middle of the summer semester, with a peak around May 15: i.e., around the beginning of the meditation course. These exams are for programs in which some lectures only last for the first half of the semester's lecture period. As they take place before the beginning of the meditation course, we do not expect any effects of the course on grades in those lectures. Also note that midterm exams are usually organized not centrally by the faculty but by the responsible lecturers and that they have some discretion in choosing around the middle of the lecture period instead of sticking to the dates they registered in the system, which is why some of the exams are not properly dated and appear spread out during the lecture period.

we still report results for them in additional analyses.

Table 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 key dates of the field phase of the experiment.

3.3 Outcome Measures

We accessed students' pre- and post-intervention grade information from the university's administrative records. Information on prior grades allows us to test whether the treatments are balanced across academic performance prior to the intervention. 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 3.2. 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.

Mental health (stress, anxiety, and depression), non-cognitive skills (self-control, conscientiousness, and neuroticism), and study and health behavior are self-reported variables, whereas attention is measured with an incentivized Stroop task (all measured before and after the intervention) that we use to investigate the channels. All variables were pre-registered. We chose these variables because we know from the literature that they (i) are influenced by meditation, and (ii) are relevant for academic outcomes (see our literature review in Section 2). All items from the baseline and follow-up questionnaires are listed in Table D.3 in Appendix D.

Stress is measured using the well-known Perceived Stress Scale (PSS; Cohen et al., 1983). The PSS includes 10 items, each rated on a scale from 0 to 4, expressing how often, in the last two weeks, the participant felt as described by the statement (0=never, 4=very often). Our measure of stress is the sum of these 10 items, with a higher value corresponding to greater stress.

We measure anxiety using the well-known seven-item Generalized Anxiety Disorder questionnaire (GAD-7; Spitzer et al., 2006). The test includes seven items, each rated on a scale from 0 to 3, expressing how often, in the last two weeks, the participant has been bothered by the problem described by the statement (0=not at all, 3=nearly every day). The variable anxiety is then constructed by taking the sum of these seven items, with a higher value corresponding to being more anxious.

Similarly, we measure students' depression using the standard clinical screen for depression, the nine-item Patient Health Questionnaire (PHQ-9; Kroenke et al., 2001). The test contains nine items, each rated on a scale from 0 to 3, expressing how often, in the last two weeks, the participant has been bothered by the problem described by the statement (0=not at all, 3=nearly every day). The variable

depression is then constructed by taking the sum of these nine items, with a higher value corresponding to being more depressed.

We measure students' self-control using the Brief Self-Control Scale (BSCS; Tangney et al., 2004). This test contains 13 items, each rated on a scale from 1 to 5, expressing the extent to which the statement reflects how the participant typically is (1=not at all, 5=very much). Our self-control variable is the sum of these 13 questions, with a higher index corresponding to greater self-control.

To measure students' attention, we use 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 most correct answers. As for all the other survey items, the task was easily implemented using the survey software Qualtrics.

We elicit students' conscientiousness and neuroticism using a selected number of questions from the Big Five Inventory (BFI; John et al., 1991). More specifically, our questionnaire included nine items to elicit conscientiousness and seven items to elicit neuroticism. Each item was rated on a scale from 1 to 5 expressing the extent to which the participant agreed with the statement (1=disagree, 5=agree). Our conscientiousness and neuroticism variables are then constructed by taking the sum of these nine and seven items, respectively, with higher values corresponding to a higher level of conscientiousness and neuroticism, respectively.

The questionnaire also included 15 questions related to study behavior, in particular to elicit concentration while studying (5 questions), learning strategies (4 questions), studying self-concept (3 questions) and exam behavior (3 questions). Each question was answered on a scale from 1 to 5 expressing the extent to which the participant agreed with the statement (1=disagree, 5=agree). Each of our study

behavior indexes is based on the sum of the respective variables, with a higher index corresponding to better study concentration, strategies, self-concept and exam behavior, respectively.

Finally, the questionnaire included seven questions related to health behavior and self-care practices. Given that there is no natural or obvious categorization of such questions – unlike for the study behavior variables – we present the results both by using each statement separately and by aggregating them in a single index based on the sum of the seven variables, with a higher index corresponding to healthier behavior.

In addition to the above-mentioned pre-registered variables, we collected a measure of participants' mindfulness and of participants' motivation to apply for the training. Our mindfulness scale was adapted from the German Socio-Economic Panel Study Innovation Sample (SOEP-IS). The index contains eight questions, each answered on a scale from 1 to 6, expressing how often, in the last two weeks, the participant experienced the situation described by the statement (1=almost never, 6=almost always). The index is the sum of these eight questions, with a higher index corresponding to greater mindfulness. To elicit students' motivation for applying to the course, they were asked the following question: "What motivation is most important to your desire to learn mindfulness meditation? Please choose an option: - I am curious; - I want to improve my concentration; - I want to learn to relax better; - I want to learn to better deal with my emotions; - I want to lose weight; - I want to be more productive."

3.4 Sample Size and Randomization

The sample size of our experiment was determined by the number of applicants and by the budget available to the health insurance provider, as follows. By April 24, 2019, we had received applications (completed surveys) from 282 candidates. From this group, we excluded 58 because (i) they did not plan to write any exams

in the summer semester, (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. Eligible applicants were randomly assigned to the treatment or to the control group at the individual level. Applicants who were only planning to write less "popular" exams (i.e., exams that few other applicants would also write) were randomized stratified along these exams such that, wherever possible, for each student in the treatment group who is writing an exam, there is a student in the control group writing the same exam. Finally, 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). Hence, based on this restriction and on the randomization procedure described, we allocated 102 applicants to the treatment group and 122 to the control group. Our sample size is thus 224 observations.

4 The Intervention

Students allocated to the treatment were offered a place in a mindfulness meditation course based on the renowned "mindfulness-based stress reduction" (MBSR) program. The MBSR program was developed by Jon Kabat-Zinn (1994) in the US in the 1970s and is now used successfully worldwide in health care, psychotherapy, and education, at companies and organizations, and for many people experiencing stress. 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). It thus involves practicing a skill (focusing attention on a chosen object) and adopting a particular attitude (equanimity). As suggested by its title, the main goal of the MBSR program is to reduce stress and improve mental

health more generally. Since its development 50 years ago, numerous international studies have proved MBSR's health-promoting, stress-reducing, and quality-of-life-enhancing effects (see the literature review in Section 2).

A standard MBSR course comprises eight weekly 150-minute group sessions and one full-day retreat. Furthermore, participants in a standard course are asked to use an audio recording to practice 45 minutes, six days a week. We designed our intervention to adhere as closely as possible (given the funding and university setting) to the standard MBSR course. More specifically, our course comprised eight weekly 60-minute group sessions, which participants could attend in a room centrally located on the university campus, in a building of the Faculty of Management, Economics and Social Sciences, on Wednesday or Friday afternoons, depending on their group assignment. The room was chosen to minimize the time students would need to reach it, and most students' lectures take place in the same or adjacent buildings.[15] Each group included 17 participants, and there were six groups in total, three meeting on Wednesdays and three on Fridays. Similar to the standard MBSR program, our participants also received audio recordings and handouts and were asked to practice a 12-minute "body scan" or mindful movement exercise or a 30-minute sitting meditation alternating once a day. Furthermore, they were asked to take a "time out" for three minutes and to reflect on their thoughts and feelings in the present moment three times a day. Also in terms of content, our course was closely oriented towards a standard MBSR course. Participants were taught formal sitting mindfulness meditation, body awareness, and mindful movement exercises and participated in group discussions of experiences. During the mindfulness exercises, they were asked to focus on sensory objects of awareness, such as sounds and smells; breathing awareness; body sensations such as pressure, pain, itches, and tensions; and thoughts and emotions. The course was designed and taught by two experienced, certified MBSR teachers, who were selected and paid by the health

[15]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.

insurance provider.[16] Each group session was always taught by the same teacher. Before the start of the intervention, the two teachers worked closely together to design the course structure and the materials and content of each of the eight sessions, so that each weekly session was as homogeneous as possible across the six groups. For a detailed description of the structure and content of each of the eight weekly sessions, see Table D.4 in Appendix D. Note that although the teachers and participants knew that we would evaluate the program, they were not aware of the main goal of the study.

On average, students who were randomly assigned a place in the course attended just over half of the eight classes (4.5, sd: 2.6). Overall, 57% of assigned students were present at their course during any week, but Figure B.2 shows that mean attendance steadily decreased, from 81% in the first week to 35% in the final week. Fifty-six percent of students attended more than half (≥ 5) the sessions.[17] Moreover, 59% of respondents of the post-intervention survey who were assigned to the treatment group reported having done the exercises at least once a day at least every other day during the first four weeks of the course, while 50% reported having done so during the latter four weeks of the course, and 63% reported continuing to practice at least some of the exercises at the time the survey was running (the first and second week after the intervention ended). When asked whether they liked the course, 89% of respondents reported that the course was "very good" or "good". Finally, 78% of respondents reported that they had learned "very much" or "much" during the course, while 88% said that they would "definitely" or "probably" recommend the course to other students.

[16]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).

[17]See Figure B.3 for the distribution of participation by student. We exploit this variation when analyzing the role of treatment intensity.

5 Empirical Strategy

The main goal of MBSR trainings is to improve mental health. Furthermore, previous studies have shown that this training can also benefit cognitive and non-cognitive skills. Hence, we first test whether our training achieved its goals. We begin by analyzing the effects of the training on short-term mental health (stress, anxiety, depression), cognitive skills (focus) and non-cognitive skills (self-control, conscientiousness, neuroticism). Second, we test whether our intervention had any spillover effects on students' academic performance, which was registered as our primary outcome variable. Our data on students' grades allows us to distinguish between the effects of the intervention on short- vs. long-term performance.

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, as they constitute a simple comparison between treatment and control groups of mean outcomes measured after the intervention, and to models that control for the baseline measure of the respective outcome as well as baseline-performance, study-program, and study-year fixed effects as "value-added" (VA) specifications.[18] VA specifications take the following form:

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

where α 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 which, in the case of the secondary outcomes, takes the form of an index

[18]The "value-added" terminology is borrowed from the literature estimating "educational production functions", which goes back to Ben-Porath (1967) and Hanushek (1979). The idea is that a student's human capital accumulation up to time period t-1 can be measured, so that the value added to it by inputs invested during period t can be estimated (Koedel and Rockoff, 2015). Since in our study the treatment was randomized and none of the outcome measures were significantly unbalanced at baseline, EL estimates can be interpreted as causal. The inclusion of control variables in the VA models is merely intended to improve the precision of the estimates and serves as a robustness check.

over the questions used to elicit that specific outcome. All scales are standardized over the whole sample to have a mean of 0 and a standard deviation of 1.

In the case of our primary outcome, y_{it} is equal to $\overline{grade_{i,t}}$ – as defined by equation 3.3 – 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 in the short and in the long run. Because in the German grading system, smaller grades are better grades, to avoid confusion we invert the grades such that larger grades are better. To measure performance in comparable ways across study programs, we standardize grades to a mean of 0 and a standard deviation of 1 at the program level.[19]

y_{it-1} is the baseline measure of the respective outcome. In the case of the secondary outcomes, y_{it-1} is equal to the baseline scale elicited in the first questionnaire; 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. 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, β can be interpreted as the average treatment effect.

Additionally, for each outcome, we also report results of running alternative

[19]See Section 3.3 for more details on how we compute the outcome.

OLS regressions of the following form:

$$\Delta y_i = \alpha + \beta \; Treatment_i + \varepsilon \tag{2}$$

where Δy_i is the difference between the endline and baseline (y_{it} - y_{it-1}) outcomes. In this model, β can be interpreted as the average difference-in-differences between the treatment and control groups.[20] 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 neither the VA nor the FD models are clearly superior in our case.[21]

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

[20] 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 $y_i = \alpha + \beta \; TreatGroup_i + \gamma \; Time_i + \delta \; (TreatGroup_i * Time_i) + \varepsilon$.

[21] The FD model 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 short-term grade and 0.58 for the baseline and long-term grade.

show all specifications throughout.[22]

6 Results

6.1 Balance Checks, Attrition, and Representativeness

We begin this section by investigating whether the treatment and control groups were balanced at baseline. Table A.1 in Appendix A presents mean values of the (pre-registered) variables and demographics elicited in the baseline survey and the baseline performance from the university's registry, separately for the treatment and control groups, using the overall sample. The scales, grades, and demographics were all balanced for the overall sample. 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 main examination period of the summer semester, immediately after the end of the program. These grades constitute our short-term performance outcomes. Table A.2 shows also that this reduced sample was balanced at baseline, although the p-value for the prior grade becomes rather small at 0.205, indicating that the grade is not as well balanced as it is for the overall sample. Of the 224 students in our overall sample, 124 (56 (55%) in the treatment group and 68 (56%) in the control group) took at least one exam in the main examination period of the winter semester, half a year after the end of the program. These grades constitute our long-term performance outcomes. Table A.3 shows that this reduced sample was also balanced at baseline.

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. Despite this difference, we find no bias in

[22]Note that because we only have a 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 same meditation group. Importantly, however, group assignment was independent of exams taken.

attrition. Table A.4 shows that the treatment and control groups in this reduced sample were balanced at baseline, except for the dummy indicating that a student was in their 4th or higher year of study, where the proportion is somewhat larger in the treatment group, significant at the 10% level.

All students of the Faculty of Management, Economics and Social Sciences of the University of Cologne were eligible to apply for a place in the meditation course. Table 2 compares our experimental sample with the overall student body of the faculty in order to shed light on whether certain students were more likely to select into the experiment. As the table shows, our sample, at 24 years of age on average, is the same age as the average student of the faculty. In our sample, the proportion of women, at 54%, tends to be 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 matriculating into 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%).

Furthermore, we find that students in our sample are moderately stressed, with an average score on the PSS of 21 (over a range of 0 to 40). The latter compares very well with the average level of stress of the German student population: in a representative sample of 18,000 university students in Germany in 2016, Herbst et al. (2016) find an average score of 20 on the PSS. We also find that our sample of students experience mild depression and mild to moderate anxiety – scoring on average 8.5 on the PHQ-9 and 9.5 on the GAD-7.[23]

[23]We could not find a study reporting the average depression and anxiety for a representative sample of the German student population. However, according to the representative sample of 7,500 German university students surveyed by (Kroenke et al., 2009) in 2017, 16% and 17% of students are categorized as experiencing depression (using the GAD-2) and anxiety (using the PHQ-2) respectively. This is consistent with our study, where 15% of students experience severe anxiety (using the GAD-7) and 17%, moderately severe depression (using the PhQ-9).

Table 2: Sample Comparison - Demographics

	Faculty			Our Sample		
Program	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 Busines 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.

Overall, this section shows that while not all students in our sample answered the endline questionnaire and that there are many for whom we do not observe a grade for a specific exam period, this attrition does not seem to follow any systematic pattern, and the sample remains balanced. Furthermore, our sample's characteristics closely match those of the faculty's student body, indicating that the meditation program attracted students of different genders, ages, and programs of study almost equally, speaking to the generalizability of our results for students of this social science faculty, one of the largest of its kind in Germany. We also find that our sample compares well with the German student population in terms of mental health speaking also in favor of the generalizability of our results for students in Germany more generally.

6.2 Effects of Mindfulness Meditation on Secondary Outcomes

6.2.1 Effects on mental health

We first examine whether our mindfulness meditation training improves mental health, the original intent of such programs. Table 3 presents OLS regressions

with stress, anxiety, and depression as dependent variables. All models include the binary treatment variable, *Treat*, taking the value of 1 if a student was assigned to the treatment group and 0 if the student was assigned to the control group. Stress, anxiety, and depression are reduced between 0.4 and 0.7 standard deviations (sd). All results are significant at the 1% level and very similar across the value-added and the first-difference specifications.[24] Columns 1-3 in Table C.1 show that models without control variables and merely comparing the endline scores give very similar results. Overall, these results show that, consistent with previous studies, the mindfulness training improves students' mental health and thus offer a validation of the effectiveness of our intervention.

Table 3: Mental Health Outcomes

	(1) Stress (VA)	(2) Stress (FD)	(3) Anxiety (VA)	(4) Anxiety (FD)	(5) Depression (VA)	(6) Depression (FD)
Treat	-0.663***	-0.704***	-0.439***	-0.448***	-0.602***	-0.592***
	(0.124)	(0.144)	(0.119)	(0.132)	(0.114)	(0.126)
Stress (BL)	0.481***					
	(0.070)					
Anxiety (BL)			0.605***			
			(0.065)			
Depression (BL)					0.579***	
					(0.065)	
Prior Grade	-0.055		0.054		0.010	
	(0.072)		(0.070)		(0.064)	
Prior ECTS Credits	-0.002		-0.002		-0.002	
	(0.002)		(0.002)		(0.002)	
Constant	0.224	0.293***	0.411	0.188*	0.521	0.270***
	(0.346)	(0.104)	(0.329)	(0.100)	(0.330)	(0.084)
Study Program FE	Yes	No	Yes	No	Yes	No
Study Year FE	Yes	No	Yes	No	Yes	No
R^2	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. * $p < .1$, ** $p < .05$, *** $p < .01$

[24]The results remain highly significant even after correcting for multiple hypotheses testing.

6.2.2 Effects on non-cognitive skills

Table 4 reports coefficient estimates of OLS regressions of non-cognitive skills on the treatment dummy. Self-control and conscientiousness are both improved by about 0.5 sd, whereas neuroticism is reduced by 0.4 sd. All results are significant at the 1% level, and results are very similar across the value-added and the first-difference specifications.[25] Columns 4-6 in Table C.1 show that models without control variables and just comparing the endline scores give very similar results.

Table 4: Non-Cognitive Skills Outcomes

	(1) Self-Control (VA)	(2) Self-Control (FD)	(3) Conscient. (VA)	(4) Conscient. (FD)	(5) Neuroticism (VA)	(6) Neuroticism (FD)
Treat	0.517***	0.490***	0.522***	0.470***	-0.353***	-0.403***
	(0.086)	(0.089)	(0.095)	(0.101)	(0.112)	(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		0.075		-0.068	
	(0.049)		(0.054)		(0.062)	
Prior ECTS Credits	0.003*		0.002*		-0.001	
	(0.001)		(0.001)		(0.002)	
Constant	-0.345	-0.210***	-0.680***	-0.208***	0.179	0.150*
	(0.252)	(0.061)	(0.254)	(0.070)	(0.244)	(0.079)
Study Program FE	Yes	No	Yes	No	Yes	No
Study Year FE	Yes	No	Yes	No	Yes	No
R^2	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. * $p < .1$, ** $p < .05$, *** $p < .01$

6.2.3 Effects on concentration

Table 5 reports coefficient estimates of OLS regressions of the incentivized Stroop task, our measure of concentration. The treatment improves performance in the Stroop task by about 0.2 standard deviations. This effect is not significant in the value-added specification but is marginally significant in the first-difference specification. Column 7 in Table C.1 shows that models without control variables and just comparing the endline scores show a very small and insignificant effect,

[25] The results remain highly significant even after correcting for multiple hypotheses testing.

suggesting that with respect to this outcome, controlling for imbalances at baseline and comparing changes rather than endline scores yields different results.

Table 5: Stroop Task

	(1) Stroop Task (VA)	(2) Stroop Task (FD)
Treat	0.174	0.228*
	(0.120)	(0.136)
Stroop Task (BL)	0.546***	
	(0.077)	
Prior Grade	0.058	
	(0.077)	
Prior ECTS Credits	-0.001	
	(0.002)	
Constant	-0.712**	-0.157
	(0.289)	(0.101)
Study Program FE	Yes	No
Study Year FE	Yes	No
R^2	0.405	0.015
N	182	187

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

6.3 Effects of Mindfulness Meditation on Short-Term Academic Performance

Table 6 presents results from OLS regressions of students' grades 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 detects 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).[26] While all three models suggest that the effect of the meditation program on short-term academic performance was negative, controlling for imbalances in prior performance with 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' short-term performance.

6.4 Effects of Mindfulness Meditation on Long-Term Academic Performance

We next investigate the effects of the intervention on long-term academic performance. Table 7 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 long-term 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).[27]

[26] 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 -0.102 on the treatment dummy in Model (3) is a real null effect.

[27] Ex-post power calculations on the specifications without controls reveal that Models (1) and (3) reach a power of 47% and 78%, respectively.

Table 6: Grade (short term)

	(1) Grade (E)	(2) Grade (VA)	(3) Grade (FD)
Treat	-0.308**	-0.260*	-0.102
	(0.145)	(0.135)	(0.148)
Prior Grade		0.458***	
		(0.080)	
Prior ECTS Credits		0.005*	
		(0.002)	
Constant	0.143	0.003	0.044
	(0.095)	(0.683)	(0.094)
Study Program FE	No	Yes	No
Study Year FE	No	Yes	No
R^2	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. * $p < .1$, ** $p < .05$, *** $p < .01$

We interpret these findings as robust evidence that the program positively affected students' long-term performance.

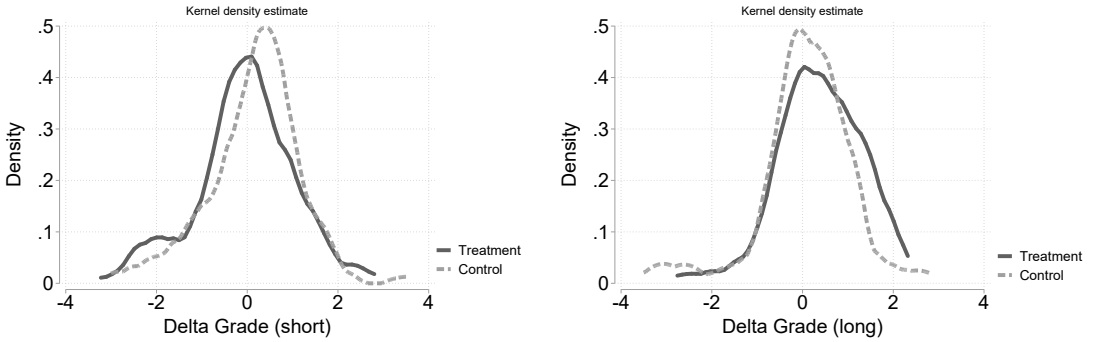
Finally, similar results emerge when looking at the distributions of changes in short-term and long-term grades compared with the baseline (see Figure 1). The exact p-value for the combined Kolmogorov-Smirnov (KS) test for the left-hand panel (delta grade short) of Figure 1 is 0.148. The exact p-value for the combined KS test for the right-hand panel (delta grade long) is 0.097.

Table 7: Grade (long-term)

	(1) Grade (E)	(2) Grade (VA)	(3) Grade (FD)
Treat	0.284*	0.386**	0.446***
	(0.171)	(0.159)	(0.170)
Prior Grade		0.515***	
		(0.105)	
Prior ECTS Credits		0.003	
		(0.002)	
Constant	-0.128	-0.152	-0.159
	(0.121)	(0.644)	(0.122)
Study Program FE	No	Yes	No
Study Year FE	No	Yes	No
R^2	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. * $p < .1$, ** $p < .05$, *** $p < .01$

Figure 1: Distributions of changes in short-term and long-term grade



Notes: The left-hand panel shows changes in the the short-term and the right-hand panel shows changes in the long-term grade by treatment group. Grades are non-standardized.

6.5 Effects on other performance measures: Medium-run grades and ECTS study points

Besides the two main exam periods which constitute our performance outcomes of primary interest, some students took exams after the 2019 summer break and as mid-term exams of the 2019/20 winter semester before the Christmas break. The former are either exams that students voluntarily moved 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 91 and 41 students, respectively, whose grades are not well balanced. As shown in Table C.2, value-added (columns 2 and 5) and first-difference (columns 3 and 6) models give positive effect sizes between 0.21 and 0.38 sd. When all medium-term grades of the two exam periods are combined in a first-difference model (column 9), we get a positive effect size of 0.34 sd, significant at the 5% level. This finding is consistent with the results we find for the long-term grade outcomes, which give us very similar effect sizes. It suggests that the positive effect

of the meditation intervention on performance already exists several weeks after the end of the intervention.

Next, we check whether the intervention had any effect on the "quantity" of exams taken, measured as the number of ECTS study points taken by a student during each exam period. ECTS study points 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 C.3 shows that the number of ECTS points is not affected by the treatment, in either the short or the long run. Thus, the observed quality changes in performance were not accompanied by quantity changes: the long-term improvement (short-term reduction) in average grades did not come at the expense (advantage) of completing fewer (more) ECTS points.

Finally, when combining the short-, medium-, and long-term grades, we find that they cancel each other out, giving an overall effect that is not significantly different from zero (see columns 7-9 in Table C.4).

6.6 Robustness Checks, Heterogeneity Analyses and Role of Treatment Intensity

As described in section 6.1, the sample sizes of students used in our short-run vs. long-run analyses do not coincide. Some students finished their studies in the summer semester and thus took no exams in the following winter semester. Hence, there are 70 students whose grades we observe in the short run but not in the long run. Furthermore, a few students did not take any exam during the summer semester but only later, in the winter semester. Hence, there are 13 students whose grades we observe in the winter but not in the summer semester. To test whether our results are influenced by this difference in samples, we run again our short-term and long-term analyses described in sections 6.3 and 6.4, but this time we restrict

the sample to those students for whom we observe both a short-term grade and a long-term grade. Results are reported in Table C.5. As can be seen, all the results remain unchanged.

One might wonder whether our effect might be caused by students in the treatment group taking different exams than the ones originally planned and which we used for our randomization strategy (see section 3.4). For example, 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, it is reassuring to know that we find 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: that is, the number of planned exams minus the number of exams actually taken ($p = 0.35$). In both the treatment and the control groups, students took on average about 1 exam less than planned, namely about 1.3 exams instead of 2.4. 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 move them around.

Next, we investigate whether there were any heterogeneous effects of the intervention on short-term and long-term grades by baseline scales or baseline grades – keeping in mind the limited sample size. Tables C.6 and C.7 report the results. As can be seen, when performing a median split of the sample, we identify no significant effects by baseline mental health, concentration (Stroop task), or grade. We merely find that the negative effect of the intervention on short-term performance is concentrated on people with below-median conscientiousness in our sample.

Table C.8 investigates heterogeneities in the effect on the scales. We find no significant heterogeneities for non-cognitive skills, concentration, or health behavior. However, we find that the intervention has a significantly more beneficial effect on people with worse mental health at baseline. Students with above-median stress

levels at baseline experience a stress reduction more than three times the size of the stress reduction experienced by less stressed students (-1.13 sd vs. -0.29 sd, column 1). Students with above-median levels of depression experience a reduction in depression twice the size of the reduction in depression experienced by less depressed students (-0.84 vs. -0.42, column 3). Results indicate similar heterogeneities for anxiety, but the latter are not significant.

Next, we test whether the effects may differ based on the motivation for applying to the meditation course. When we ask whether students who applied for a place in the meditation course because they wanted to improve their performance experienced different effects than students who applied because they wanted to improve their mental and physical health, we find, again, no significant heterogeneities for either grades or mental health (see Table C.9). We also do not find any significant heterogeneities by gender (see Table C.10).

Finally, we compare the effect sizes for people who attended the meditation course more often (i.e., attendance rate above the median) with those for people who attended the meditation course less often (attendance rate below the median) – keeping in mind that this is not a clean measure of intensity, as it is also determined by endogenous factors such as students' motivation and other obligations. As shown in Table C.11, we do find some significant differences: the short-term negative effect on the grade tended to be stronger for students who attended more often, while we find no significant differences for the long-term positive effect. The improvements of mental health, health behavior, non-cognitive skills and concentration also all tended to be concentrated on students who attended the meditation course more often.

7 Channels

We have shown that mindfulness meditation training significantly increased short-term mental health and non-cognitive skills and marginally increased cognitive skills as measured by performance in the Stroop task. As explained in the introduction, aside from stress, all of these variables are unequivocally expected to be, if anything, positive determinants of academic performance. And, in fact, consistent with these expectations, we find positive and significant correlations between baseline grades and self-control, conscientiousness, performance in the Stroop task and a negative and significant correlation between baseline grades and depression at baseline (Table C.12). However, if anything, the intervention marginally decreased short-term performance. How to reconcile these results?

As argued in the introduction, there could be three (non-mutually) exclusive explanations for the observed negative short-term effect of the intervention on the grades. First, it could be 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 speak against this explanation. As shown in Table C.12, we find no correlation between stress and grades at baseline. Consistent with this evidence, we also find that the short-term variation in grades is not associated with the short-term variation in stress (Table 10). Second, it could be that the intervention changed students' study behaviour by reducing their motivation to study and perform well academically. Third, it could be that the intervention, by requiring students to initially invest time and effort in learning a new self-care practice and creating new healthy habits, took resources away from studying in the short run – even though the students remained equally motivated to perform well academically. We use pre-registered variables to investigate these two additional potential channels in the sub-sections below. For both channels, we report the coefficients of the treatment dummies from VA regressions containing

the full set of control variables and robust standard errors.[28]

7.1 Study Behavior

The questionnaire included 15 questions related to study behavior. Each question was answered on a scale from 1 to 5 expressing the extent to which the participant agreed with the statement (1=disagree, 5=agree). These questions were meant to elicit concentration while studying (5 questions), learning strategies (4 questions), study self-concept, such as enjoyment and confidence when studying (3 questions) and exam behavior (3 questions). Following this natural categorization, we created four indexes of study behavior, each based on the sum of the respective variables, with a higher index corresponding to better study concentration, strategies, self-concept, and exam behavior.

Table 8 reports the results. As can be seen, the intervention significantly improved students' overall concentration, learning strategies and study self-concept by 0.34, 0.23 and 0.18 standard deviations respectively ($p < 0.01$). However, we find no significant effects for exam behavior.[29]

Taken together, these results show that, if anything, the intervention positively affected study behavior suggesting that the reduction in motivation to study and to perform well academically is probably not the channel for our short-term negative effects. Furthermore, there is also no reason why such a negative effect, if it was due to students' change in motivation, should disappear in the long run. We thus turn to our third and last candidate channel in explaining our findings.

7.2 Health Behavior and Self-Care Practices

The questionnaire included seven questions related to health behavior and self-care practices. Given that there is no natural or obvious categorization for these

[28]The results do not change when using the first-difference specification. The latter are available upon request.

[29]Note that we did not elicit exam behavior at baseline.

Table 8: Study Behaviors

	(1) Concentration	(2) Learning Strategies	(3) Study Self-Concept	(4) Exam Behavior
Treat	0.335***	0.232***	0.184***	0.158
	(0.071)	(0.073)	(0.068)	(0.117)
Prior Grade	0.015	0.017	0.071*	0.187***
	(0.039)	(0.038)	(0.042)	(0.067)
Prior ECTS Credits	0.002	0.003**	0.002**	0.003
	(0.002)	(0.001)	(0.001)	(0.002)
Concentration (BL)	0.477***			
	(0.056)			
Learning strategies (BL)		0.655***		
		(0.051)		
Study self-concept (BL)			0.667***	
			(0.062)	
Constant	0.106	0.090	-0.137	-0.126
	(0.222)	(0.240)	(0.271)	(0.180)
Study Program FE	Yes	Yes	Yes	Yes
Study Year FE	Yes	Yes	Yes	Yes
R^2	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. * $p < .1$, ** $p < .05$, *** $p < .01$

questions, we first present the results using each statement separately and then aggregate them in a single index based on the sum of the scores for each of the questions, with a higher index corresponding to a healthier behavior and/or to taking more care of oneself. Table 9 reports the results. Columns 1 to 7 show that alcohol consumption, smoking, taking medication and rising at the same time each day are not significantly affected by the intervention. However, students in the treatment group report drinking less coffee or tea to stay awake (β: -0.20, $p = 0.031$), seeking significantly more conscious relaxation (β: 0.51, $p = 0.000$) and being significantly less likely go to bed late and be tired the next day than students in the control group (β: -0.44, $p = 0.001$). Column 8 shows that aggregating all the items into a single index yields similar results. The intervention improved students' overall health behavior and self-care practices as measured by an increase in the index (β: 0.42, $p < 0.01$).

As already argued in previous sections, establishing new healthy habits and

Table 9: Health Behaviors

	(1) Coffee/Tea	(2) Alcohol	(3) Smoking	(4) Medication	(5) Getting Up	(6) Sleeping Late	(7) Relaxation	(8) Health Index
Treat	-0.203**	-0.062	-0.034	-0.102	0.104	-0.435***	0.505***	0.423***
	(0.093)	(0.120)	(0.085)	(0.152)	(0.127)	(0.130)	(0.126)	(0.114)
Prior Grade	-0.045	-0.114*	-0.023	0.018	-0.001	-0.051	-0.034	0.064
	(0.054)	(0.067)	(0.042)	(0.071)	(0.067)	(0.068)	(0.064)	(0.059)
Prior ECTS Credits	0.001	-0.001	-0.001	0.001	-0.003	-0.003*	0.001	-0.001
	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
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)
Constant	0.425	0.263	0.130	0.266	0.021	0.694**	0.127	-0.427*
	(0.356)	(0.315)	(0.110)	(0.468)	(0.268)	(0.337)	(0.379)	(0.257)
Study Program FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Study Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	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 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. * $p < .1$, ** $p < .05$, *** $p < .01$

learning new self-care practices takes resources (such as time and cognitive effort) away from studying, which could explain why grades marginally decreased in the short term despite the improvement in mental health, cognitive and non-cognitive skills, and study behavior.[30] Consistent with this argument, column 12 of Table C.11 further shows that the increase in the health behavior index is driven by students who attended the course more often (β=0.569, $p < 0.01$). As we have seen, these are also the students whose grades marginally decreased in the short term (see columns 1 and 2). Students who rarely attended the training did not improve their health behavior and did not see any reduction in their short-term grades.

To shed further light on the validity of this explanation, we also look at the correlations between changes in short-term grades and changes in all other relevant (pre-registered) variables in our study. Consistent with our conjecture, columns 1 and 2 in Table 10 show, respectively, that among all pre-registered variables, variation in short-term grades is *only* (negatively) associated with variation in the health behavior index (β=-0.140, $p = 0.098$) – and in particular, with the variables affected by the intervention, namely, with relaxing more consciously (β=-0.235, $p = 0.010$) and with being less likely to go to bed late (β=0.144, $p = 0.050$).[31]

Thus, overall, the analysis in this sub-section shows that while the intervention may have improved study behavior, which – if anything – should increase performance, it also required learning new self-care (meditation) practices and adopting a healthier routine, both of which may be competing with studying. In particular, the tendency to relax more, to drink less tea or coffee to stay awake, and to go

[30]For instance, instead of spending time relaxing or sleeping, students could be studying. Furthermore, even just the act of making conscious decisions and exerting willpower in establishing this new routine demands some cognitive effort and, in turn, the expenditure of some inner limited resources that may become depleted and thus not available for studying. (Muraven and Baumeister, 2021).

[31]An exception is conscientiousness. We find that variation in conscientiousness is negatively associated with variation in short-term grades (significant in column 2, β=-0.249 and $p = 0.031$, but not in column 1, β=-0.161 and $p = 0.110$ i). However, we can think of no reasonable argument for why an increase in conscientiousness should reduce performance.

Table 10: Channels

	(1) Δ Grade (short)	(2) Δ Grade (short)
Δ Stress	-0.096	-0.081
	(0.103)	(0.107)
Δ Anxiety	0.065	-0.019
	(0.113)	(0.127)
Δ Depression	0.102	0.126
	(0.109)	(0.119)
Δ Conscientiousness	-0.161	-0.249**
	(0.100)	(0.114)
Δ Neuroticism	-0.011	-0.004
	(0.125)	(0.123)
Δ Stroop Task	-0.027	0.032
	(0.085)	(0.089)
Δ Study Behavior (Overall)	0.028	
	(0.129)	
Δ Health Behavior (Overall)	-0.140*	
	(0.084)	
Δ Study Behavior (Concentration)		0.026
		(0.085)
Δ Study Behavior (Strategy)		0.178
		(0.112)
Δ Study Behavior (Self Concept)		-0.010
		(0.135)
Δ Health Behavior (Coffee/Tea)		-0.148
		(0.103)
Δ Health Behavior (Alcohol)		0.029
		(0.086)
Δ Health Behavior (Smoking)		-0.029
		(0.106)
Δ Health Behavior (Medication)		0.014
		(0.065)
Δ Health Behavior (Getting Up)		0.043
		(0.069)
Δ Health Behavior (Sleeping Late)		0.144*
		(0.073)
Δ Health Behavior (Relaxation)		-0.235***
		(0.090)
Constant	-0.017	-0.018
	(0.075)	(0.076)
R^2	0.043	0.108
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, neutroticism, and performances in the Stroop task. 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.
* $p < .1$, ** $p < .05$, *** $p < .01$

to bed earlier at night may have reduced the time and effort left for studying and thereby may have contributed to decreasing academic performance in the short run. However, as already mentioned in previous sections, most of these negative effects should be short-lived, because as people repeat actions, the meditation practice is learned and habits are formed, thereby requiring minimal decision making and minimal regulatory control (and probably less time) in the long run (Evans and Stanovich, 2013). This is consistent with our long-term results.

7.3 Channels for the Long-Term Effect

We now try to dig deeper into the potential channels that led to the long-term positive effect of the intervention on students' grades. The most important channel we want to rule out is that the observed long-run positive effect is just a student's compensatory response for the reduction in grades in the short run compared to their average grades at baseline. That is, we want to rule our that students in our treatment group studied harder in the long run in order to make up for the short-run reduction in grades compared to their average baseline grades. If this were the case, the positive treatment effect on long-run grades should be concentrated on students who experienced a reduction in grades in the short run compared to baseline. To test for this possibility, we look at the effect of the treatment on long-term grades separately for students whose average short-run grades were higher than at baseline and for students whose average short-run grades were lower than at baseline. The results are reported in Table C.13. As can be seen, the opposite is true: The positive long-run treatment effect is much larger and only significant for students who already experienced an increase in grades in the short run compared to baseline. The students who experienced a reduction in grades in the short run do not experience a significant increase in grades in the long run (although the coefficient remains positive).

Having ruled out that our positive long-term treatment effect is caused by stu-

dents' compensatory responses to the short-run negative changes, we want to test whether it is indeed the students who continued practicing mindfulness meditation after the end of the course who got the highest benefits in terms of higher grades in the long run. Our problem in investigating this question is that the ex-post questionnaire was only administered immediately after the intervention ended. Hence, we do not directly observe our secondary outcomes in the long run. To address this issue, the best we could do is to look for a variable in our ex-post questionnaire that might indicate how motivated, or how likely, a student is to continue performing the meditation practice in the long run, i.e., six months after the end of the intervention. The following item seemed the most reasonable to us. Students were asked: "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]." Students could answer by choosing one of the following options: 1- (Almost) every day; 2- (Almost) every week; 3- Sometimes; 4-Never.[32]

We conjecture that students who practiced meditation beyond the training requirements are more likely to have continued practicing in the long run and thus to have benefited from the practice's effects on their performance. To test this conjecture, we divide subjects into those who reported practicing on their own at least sometimes (71.0%) and those who reported never practicing on their own (29.0%). We then look at how the interaction between the treatment and having practiced on one's own affected grades in the long run. As shown in column 3 in Table C.14, the treatment effect for those who did not practice on their own is -0.269 (p=0.517) whereas the treatment effect for those who did practice on their own is 0.624 (-0.269+0.893). A joint F-test for coefficient of the treatment dummy and

[32]Note that a plausible conjecture would also be that the students who experienced a reduction in their short-run grades compared with their baseline decided to stop their practice whereas students who experienced an increase in their short-run grades compared with their baseline decided to continue practicing and, thereby, benefited the most from the practice in the long run. To directly test for this conjecture, however, we would need a measure of "own practice" that was elicited *after* the students received the information of their short-run grades rather than before.

the coefficient of the interaction of the treatment dummy with the own practice dummy gives a p-value of 0.000. In column 4, the effect for those who did not practice on their own is -0.310 (p=0.422) whereas for those who did practice, it is 0.659 (-0.310+0.969, joint F-test: p=0.000). This shows that the long-term positive effect of the intervention on academic performance is driven by those students who practiced (and most likely continued practicing) on their own, beyond the course's instructions.

Finally, columns 1-2 and 5-12 of Table C.14 also report effects by own practice on short-term grades and on our (short-term) secondary outcomes, respectively. As can be seen, the interaction term is never significant, suggesting that exercising on one's own while also attending the meditation course and doing the course exercises does not produce any additional benefit. This suggests that having (likely) continued practicing on one's own *after* the end of the intervention rather than having practiced on one's own *during* the intervention likely drives our long-term results.

8 Discussion of External Validity

In this section, we evaluate the external validity of the results of our field experiment by discussing the SANS conditions (selection, attrition, naturalness, and scalability) outlined by List (2020). 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 universities 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 mental health, speaking in favor of the representativeness of our sample. 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

discussed in Section 6.1. Considering the naturalness of the setting, our intervention mirrors the type of meditation courses students are offered at some 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, the stakes of performing well academically are so high for students that they are unlikely to adapt their academic behaviour to what they might believe the researchers want them to do. Hence, 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 replicate and generalize 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 class of roughly 1,700 euros and a per-student cost of about 100 euros.[33] As the mechanism through which our intervention affects academic performance is likely individual behavior change due to learning and 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

[33]Note that universities in some countries might also approach health insurance providers to pay for the course, similarly to what we have done.

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 long 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) susceptible 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 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 meditation course on academic achievement in higher education. We advertised the course to all students of the social science faculty in a German university. Among the students who applied to the program, we randomly assigned 102 to the treatment group, who were offered a place in the course, and 122 to the control group, who were not. We also investigated channels through which our intervention affects grades.

Consistent with previous studies, the intervention improved students' mental health by reducing their stress, anxiety and depression levels, and raised students' non-cognitive skills, such as self-control, conscientiousness and neuroticism. We

also find a marginal positive effect on cognitive skills measured by performance in the incentivized Stroop task. However, our main result reveals that it takes time for the students to benefit from the positive spillovers of the meditation course on their performance. Our analysis shows that, if anything, the intervention worsened students' academic performance in the short run. We only observe robust significant positive effects of the intervention on academic performance in the long run, i.e., six months after the end of the intervention. In exploring channels for these results, we show that the intervention significantly improved daily health behavior and self-care practices (such as relaxing more often and avoiding going to bed late), both of which may take resources away from studying in the short run.

Taken together, these findings reveal that, ultimately, mindfulness meditation can have substantial positive spillover effects on academic performance but that it may take time for students to reap these benefits. As with any other type of investment, in which costs are borne in the short run in order to gain positive returns in the long run, a mindfulness meditation training may be initially costly in terms of performance because it requires students to put time and effort into learning a new (self-care) practice and creating new (healthy) habits but in later stages, if one continues practicing, the positive effects of the training are likely to emerge.

Finally, our findings also suggest that the relationship between mental health and (academic) performance is more complex than typically assumed: mental health and performance do not necessarily move in parallel, and, in fact, an improvement in mental health may even be associated with a worsening in performance in the short run.

The implications of these findings are relevant for all those educational institutions and organizations that offer – or consider offering – mindfulness meditation training to their students and employees, and in particular to all those organizations that do so with the dual objective of increasing not only well-being but also

performance. More generally, the findings are informative to the policy debate on whether mindfulness training should become part of the curriculum in schools and universities. In this respect, the message of this paper is clear: mental health and performance should be considered separate goals of education that are possibly not aligned in the short run.

References

ACHA (2018). "National college health assessment ii: Undergraduate student reference group data deport fall 2017." Report, American College Health Association, ACHA, Hanover, MD.

Alan, S., Boneva, T., and Ertac, S. (2019). "Ever failed, try again, succeed better: Results from a randomized educational intervention on grit." *The Quarterly Journal of Economics*, *134*(3), 1121–1162.

Alem, Y., Behrendt, H., Belot, M., and Bíró, A. (2021). "Mind training, stress and behaviour—a randomised experiment." *PloS one*, *16*(11), e0258172.

Almlund, M., LeeDuckworth, A., Heckman, J., and Kautz, T. (2011). "Personality psychology and economics." *Handbook of the Economics of Education*, *4*, 1–181.

Angrist, J., Lang, D., and Oreopoulos, P. (2009). "Incentives and services for college achievement: Evidence from a randomized trial." *American Economic Journal: Applied Economics*, *1*(1), 136–163.

Baranov, V., Bhalotra, S., Biroli, P., and Maselko, J. (2020). "Maternal depression, women's empowerment, and parental investment: evidence from a randomized controlled trial." *American Economic Review*, *110*(3), 824–59.

Barbieri, P. N., Giuntella, O., and Saccardo, S. (2021). "Lifestyle and mental health 1 year into covid-19." *Scientific Report*, *11*(1), 1–6.

Bellet, C., De Neve, J.-E., and Ward, G. (2019). "Does employee happiness have an impact on productivity?" Working paper 2019-13, Saïd Business School.

Ben-Porath, Y. (1967). "The production of human capital and the life cycle of earnings." *Journal of Political Economy*, *75*(4, Part 1), 352–365.

Bernal-Morales, B., Rodríguez-Landa, J. F., and Pulido-Criollo, F. (2015). "Impact of anxiety and depression symptoms on scholar performance in high school and university students." In F. Durbano (Ed.), *A Fresh Look at Anxiety Disorders*, vol. 225, chap. 11, IntechOpen.

Blattman, C., Jamison, J. C., and Margaret, S. (2017). "Reducing crime and violence: Experimental evidence from cognitive behavioral therapy in liberia." *American Economic Review*, *107*(4), 1165–1206.

Burgess, S., Metcalfe, R., and Sadoff, S. (2021). "Understanding the response to financial and non-financial incentives in education: Field experimental evidence using high-stakes assessments." *Economics of Education Review*, *85*, 102195.

Cappelen, A. W., Charness, G., Ekström, M., Gneezy, U., and Tungodden, B. (2017). "Exercise improves academic performance." Working Paper 1180, Research Institute of Industrial Economics IFN.

Chapell, M. S., Blanding, Z. B., Silverstein, M. E., Takahashi, M., Newman, B., Gubi, A., and McCann, N. (2005). "Test anxiety and academic performance in undergraduate and graduate students." *Journal of Educational Psychology*, *97*(2), 268–274.

Charness, G., Le Bihan, Y., and Villeval, M. C. (2022). "Mindfulness training, cognitive performance and stress." *Working paper*.

Chiesa, A., and Serretti, A. (2009). "Mindfulness-based stress reduction for stress management in healthy people: a review and meta-analysis." *Journal of Alternative and Complementary Medicine*, *15*(5), 593–600.

Cohen, S., Kamarck, T., and Mermelstein, R. (1983). "A global measure of perceived stress." *Journal of Health and Social Behavior*, *24*(4), 385–396.

Coviello, D., Deserranno, E., Persico, N., and Sapienza, P. (2021). "Effect of mood and worker incentives on workplace productivity." *Working paper*.

Di Bartolomeo, G., and Papa, S. (2016). "Does collective meditation foster trust and trustworthiness in an investment game?" *International Review of Economics*, *63*(4), 379–392.

Eberth, J., and Sedlmeier, P. (2012). "The effects of mindfulness meditation: A meta-analysis." *Mindfulness*, *3*(3), 174–189.

Evans, J. S. B., and Stanovich, K. E. (2013). "Dual-process theories of higher

cognition: Advancing the debate." *Perspectives on Psychological Science*, *8*(3), 223–241.

Gelles, D. (2015). *Mindful work: How meditation is changing business from the inside out*. Houghton Mifflin Harcourt.

Giuntella, O., Hyde, K., Saccardo, S., and Sadoff, S. (2021). "Lifestyle and mental health disruptions during covid-19." *Proceedings of the National Academy of Sciences*, *118*(9).

Goyal, M., Singh, S., Sibinga, E. M., Gould, N. F., Rowland-Seymour, A., Sharma, R., Berger, Z., Sleicher, D., Maron, D. D., Shihab, H. M., Ranasinghe, P. D., Linn, S., Saha, S., Bass, E. B., and Haythornthwaite, J. A. (2014). "Meditation programs for psychological stress and well-being: a systematic review and meta-analysis." *JAMA internal medicine*, *174*(3), 357–368.

Grobe, T. G., Steinmann, S., and Szecsenyi, J. (2018). "Barmer medical report." Tech. rep., Berlin: Barmer.

Hafenbrack, A. C., and Vohs, K. D. (2018). "Mindfulness meditation impairs task motivation but not performance." *Organizational Behavior and Human Decision Processes*, *147*, 1–15.

Hall, P. D. (1999). "The effect of meditation on the academic performance of african american college students." *Journal of Black Studies*, *29*(3), 408–415.

Hanushek, E. A. (1979). "Conceptual and empirical issues in the estimation of educational production functions." *Journal of Human Resources*, 351–388.

Heckman, J. J., and Kautz, T. (2012). "Hard evidence on soft skills." *Labour Economics*, *19*(4), 451–464.

Heller, S. B., Shah, A. K., Guryan, J., Ludwig, J., Mullainathan, S., and Pollack, H. A. (2017). "Thinking, fast and slow? some field experiments to reduce crime and dropout in chicago." *The Quarterly Journal of Economics*, *132*(1), 1–54.

Herbst, U., Voeth, M., Eidhoff, A. T., Müller, M., and Stief, S. (2016). "Studierendenstress in deutschland–eine empirische untersuchung." Tech. rep., Berlin:

AOK-Bundesverband.

Hvidman, U., and Sievertsen, H. H. (2019). "High-stakes grades and student behavior." *Journal of Human Resources*, *56*(3), 821–849.

Hysenbegasi, A., Hass, S. L., and Rowland, C. R. (2005). "The impact of depression on the academic productivity of university students." *Journal of Mental Health Policy and Economics*, *8*(3), 145–151.

John, A., and Orkin, K. (2022). "Can simple psychological interventions increase preventive health investment?" *Journal of the European Economic Association*, *20*(3), 1001–1047.

John, O. P., Donahue, E. M., and Kentle, R. L. (1991). "The big five inventory–versions 4a and 54." *University of California, Berkeley, Institute of Personality and Social Research*.

Jones, T. M. (2018). "The effects of mindfulness meditation on emotion regulation, cognition and social skills." *European Scientific Journal*, *14*(14), 18–32.

Kabat-Zinn, J. (1994). *Wherever you go, there you are: Mindfulness meditation in everyday life*. Hyperion.

Khoury, B., Sharma, M., Rush, S. E., and Fournier, C. (2015). "Mindfulness-based stress reduction for healthy individuals: A meta-analysis." *Journal of Psychosomatic Research*, *78*(6), 519–528.

Koedel, C., and Rockoff, J. E. (2015). "Value-added modeling: A review." *Economics of Education Review*, *47*, 180–195.

Kroenke, K., Spitzer, R. L., Williams, J. B., and Löwe, B. (2009). "An ultra-brief screening scale for anxiety and depression: the phq–4." *Psychosomatics*, *50*(6), 613–621.

Kroenke, K., Spitzer, R. L., and Williams, J. B. W. (2001). "The phq-9: Validity of a brief depression severity measure." *Journal of General Internal Medicine*, *16*(9), 606–613.

Leuven, E., Oosterbeek, H., and van der Klaauw, B. (2010). "The effect of financial

rewards on students' achievement: evidence from a randomized experiment." *Journal of the European Economic Association*, *8*(6), 1243–1265.

Levitt, S., List, J., and Sadoff, S. (2016). "The effect of performance-based incentives on educational achievement: Evidence from a randomized experiment." Working Paper 22107, National Bureau of Economic Research.

Liang, K.-Y., and Zeger, S. L. (1986). "Longitudinal data analysis using generalized linear models." *Biometrika*, *73*(1), 13–22.

Lindo, J., Sanders, N., and Oreopoulos, P. (2010). "Ability, gender, and performance standards: Evidence from academic probation." *American Economic Journal: Applied Economics*, *2*(2), 95–117.

List, J. A. (2020). "Non est disputandum de generalizability? a glimpse into the external validity trial." Working Paper 27535, National Bureau of Economic Research.

Lyddy, C., Good, D. J., Bolino, M. C., Thompson, P. S., and Stephens, J. P. (2021). "Where mindfulness falls short." *Harvard Business Review*.

McKenzie, D. (2012). "Beyond baseline and follow-up: The case for more t in experiments." *Journal of development Economics*, *99*(2), 210–221.

Mrazek, M. D., Franklin, M. S., Phillips, D. T., Baird, B., and Schooler, J. W. (2013). "Mindfulness training improves working memory capacity and gre performance while reducing mind wandering." *Psychological Science*, *24*(5), 776–781.

Muraven, M., and Baumeister, R. (2021). "Self-regulation and depletion of limited resources:does self-control resemble a muscle?" *Psychological Bulletin*, *126*, 247–259.

Oswald, A. J., Proto, E., and Sgroi, D. (2015). "Happiness and productivity." *Journal of Labor Economics*, *33*(4), 789–822.

Owens, M., Stevenson, J., Hadwin, J. A., and Norgate, R. (2012). "Anxiety and depression in academic performance: An exploration of the mediating factors of worry and working memory." *School Psychology International*, *33*(4), 433–449.

Pascoe, M. C., Hetrick, S. E., and Parker, A. G. (2020). "The impact of stress on students in secondary school and higher education." *International Journal of Adolescence and Youth*, *25*(1), 104–112.

Schildberg-Hörisch, H., and Wagner, V. (2020). "Chapter 19 - Monetary and non-monetary incentives for educational attainment: Design and effectiveness." In S. Bradley, and C. Green (Eds.), *The Economics of Education (Second Edition)*, 249 – 268, Academic Press.

Shreekumar, A., and Vautrey, P. L. (2022). "Managing emotions: The effects of online mindfulness meditation on mental health and economic behavior." *Working Paper*.

Spitzer, R. L., Kroenke, K., Williams, J. B., and Löwe, B. (2006). "A brief measure for assessing generalized anxiety disorder: the gad-7." *Archives of Internal Medicine*, *166*(10), 1092–1097.

Stroop, J. R. (1935). "Studies of interference in serial verbal reactions." *Journal of Experimental Psychology*, *18*(6), 643–662.

Tang, Y. Y., Hölzel, B. K., and Posner, M. I. (2015). "The neuroscience of mindfulness meditation." *Nature Reviews Neuroscience*, *16*(4), 213–225.

Tangney, J. P., Baumeister, R. F., and Boone, A. L. (2004). "High self-control predicts good adjustment, less pathology, better grades, and interpersonal success." *Journal of Personality*, *72*(2), 271–324.

Teigen, K. H. (1994). "Yerkes-dodson: A law for all seasons." *Theory Psychology*, *4*(4), 525–547.

Trautmann, S., Rehm, J., and Wittchen, H.-U. (2016). "The economic costs of mental disorders: Do our societies react appropriately to the burden of mental disorders?" *EMBO Reports*, *17*(9), 1245–1249.

Vogel, S., and Schwabe, L. (2016). "Learning and memory under stress: implications for the classroom." *npj Science of Learning*, *1*(16011).

Weidmann, B., and Deming, D. J. (2021). "Team players: How social skills improve

team performance." *Econometrica*, *89*(6), 2637–2657.

Wood, W., and Rünger (2016). "Psychology of habit." *Annual review of psychology*, *67*(1), 289–314.

Yerkes, R. M., and Dodson, J. D. (1908). "The relation of strength of stimulus to rapidity of habit-formation." *Journal of Comparative Neu- rology Psychology*, *71*, 291–301.

Appendix

A Balance Checks

Table A.1: Balance Checks: Whole Sample

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

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

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

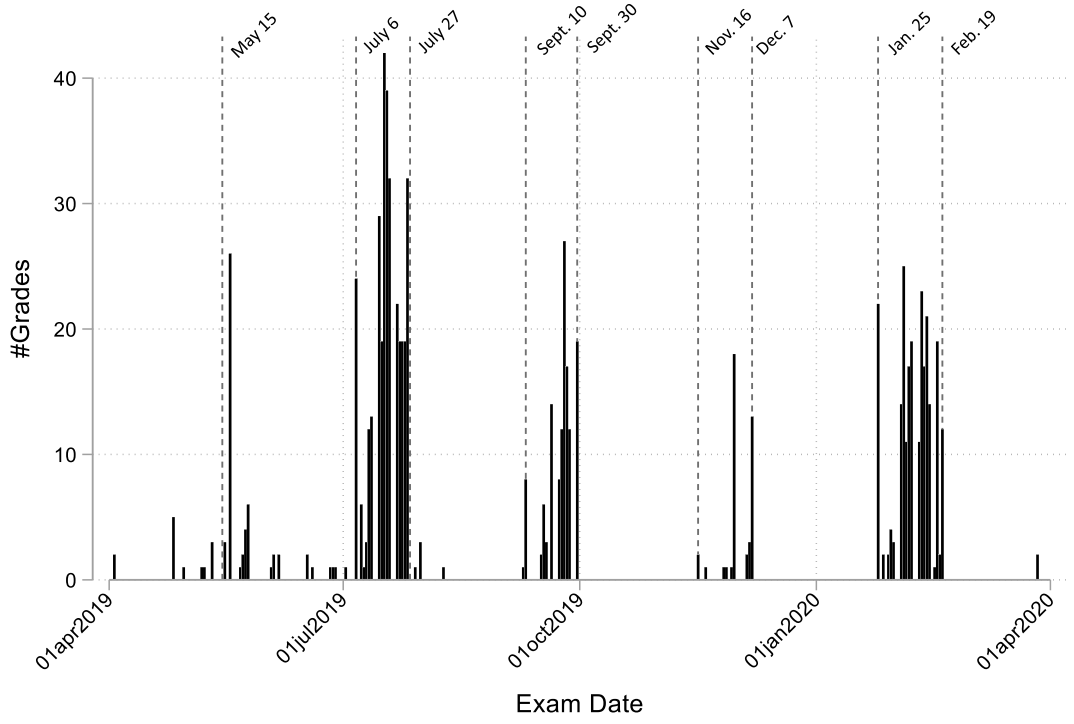
Table A.4: Balance Checks: Sample with Post-Intervention Questionnaire

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

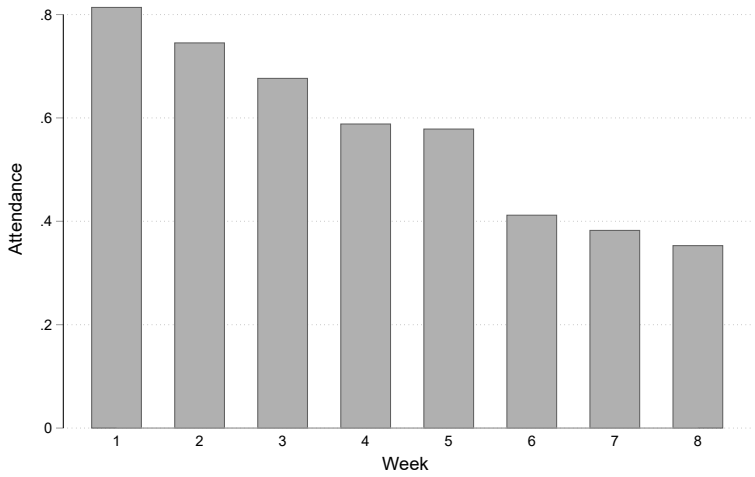
B Figures

Figure B.1: Grades by Date



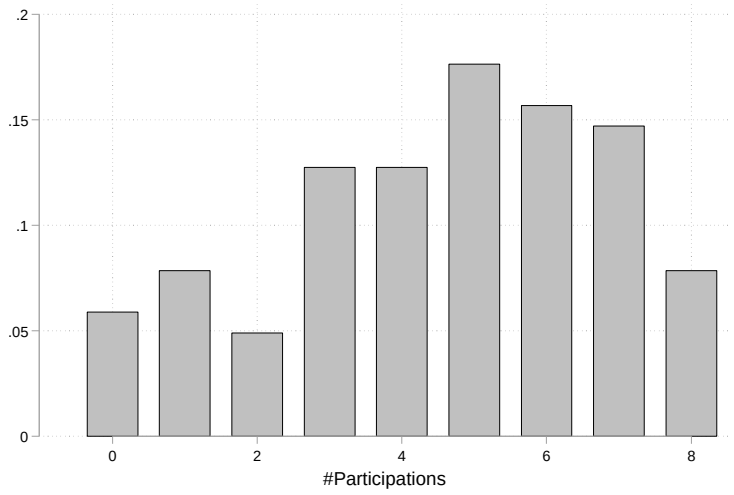
Note: This figure depicts the distribution of non-aggregated grade outcomes by official exam date. The x-axis shows the date. The y-axis shows the number of exams for which we observe an outcome written on a particular day.

Figure B.2: Attendance by Week



Note: This figure depicts the fraction of assigned students attending the meditation training in each week.

Figure B.3: Attendance by Student



Note: This figure depicts the distribution of participations by assigned student.

C Additional Tables

Table C.1: 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)
Treat	-0.656***	-0.522***	-0.661***	0.462***	0.437***	-0.352**	0.020
	(0.139)	(0.142)	(0.139)	(0.143)	(0.143)	(0.144)	(0.147)
Constant	0.330***	0.262**	0.332***	-0.232**	-0.220**	0.177	-0.010
	(0.113)	(0.116)	(0.110)	(0.100)	(0.105)	(0.108)	(0.106)
R^2	0.108	0.068	0.110	0.054	0.048	0.031	0.000
N	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.2: Grade (medium-term)

	Secondary period Summer			Mid-Term period Winter			Both		
	(1) Grade (E)	(2) Grade (VA)	(3) Grade (FD)	(4) Grade (E)	(5) Grade (VA)	(6) Grade (FD)	(7) Grade (E)	(8) Grade (VA)	(9) Grade (FD)
Treat	0.047	0.276	0.375*	-0.160	0.209	0.357	-0.025	0.232	0.343**
	(0.195)	(0.196)	(0.194)	(0.272)	(0.307)	(0.274)	(0.186)	(0.170)	(0.171)
Prior Grade		0.475***			0.571***			0.508***	
		(0.111)			(0.201)			(0.095)	
Prior ECTS Credits		0.005			0.001			0.005**	
		(0.003)			(0.007)			(0.002)	
Constant	-0.020	-0.918	-0.069	0.071	-0.211	0.006	0.010	-1.205	-0.042
	(0.140)	(0.881)	(0.150)	(0.201)	(0.637)	(0.199)	(0.122)	(0.818)	(0.118)
Study Program FE	No	Yes	No	No	Yes	No	No	Yes	No
Study Year FE	No	Yes	No	No	Yes	No	No	Yes	No
R^2	0.001	0.307	0.036	0.008	0.472	0.039	0.000	0.394	0.034
N	94	91	91	43	41	41	110	107	107

Note: This table shows OLS regressions of the mean grade of the medium term on the treatment dummy. Models (1) - (3) show regressions for the mean grade of the secondary exam period of the summer semester. Models (4) - (6) show regressions for the mean grade of the mid-term exam period of the winter semester. Models (7) - (9) show regressions for the mean grade over both the secondary exam period of the summer and the mid-term exam period of the winter semester. Models (1), (4), and (7) use the post-intervention outcome as dependent variable and do not include any control variables. Models (2), (5), and (8) 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), (6), and (9) use the change in mean grade (medium term grade [i.e., secondary summer, mid-term winter, or both] − 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.3: ECTS Credits

	(1) Credits (short, E)	(2) Credits (short, VA)	(3) Credits (long, E)	(4) Credits (long, VA)
Treat	-1.181	-1.053	0.235	0.075
	(1.129)	(1.098)	(1.268)	(1.103)
Prior Grade		1.640***		1.326*
		(0.592)		(0.682)
Prior ECTS Credits		0.017		0.010
		(0.021)		(0.017)
Constant	12.030***	8.285**	10.849***	2.427
	(0.787)	(3.394)	(0.882)	(3.037)
Study Program FE	No	Yes	No	Yes
Study Year FE	No	Yes	No	Yes
R^2	0.006	0.265	0.000	0.364
N	186	182	132	129

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. * $p < .1$, ** $p < .05$, *** $p < .01$

Table C.4: Grade (overall)

	all exams summer			all exams winter			all exams summer+winter		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Grade (E)	Grade (VA)	Grade (FD)	Grade (E)	Grade (VA)	Grade (FD)	Grade (E)	Grade (VA)	Grade (FD)
Treat	-0.249*	-0.169	-0.044	0.227	0.341**	0.390**	-0.089	-0.014	0.076
	(0.140)	(0.126)	(0.137)	(0.165)	(0.151)	(0.161)	(0.136)	(0.111)	(0.124)
Prior Grade		0.468***			0.532***			0.524***	
		(0.074)			(0.092)			(0.077)	
Prior ECTS Credits		0.006***			0.005**			0.007***	
		(0.002)			(0.002)			(0.002)	
Constant	0.114	-0.334	-0.012	-0.099	-0.587	-0.116	0.039	-0.445	-0.054
	(0.091)	(0.595)	(0.085)	(0.118)	(0.513)	(0.110)	(0.094)	(0.361)	(0.078)
Study Program FE	No	Yes	No	No	Yes	No	No	Yes	No
Study Year FE	No	Yes	No	No	Yes	No	No	Yes	No
R^2	0.016	0.334	0.001	0.014	0.349	0.043	0.002	0.424	0.002
N	197	193	193	133	130	130	206	202	202

Note: This table shows OLS regressions of the mean grade by semester. Models (1) - (3) show regressions for the mean grade over the main and secondary summer-semester exam period. Models (4) - (6) show regressions for the mean grade over the mid-term and main winter-semester exam period. Models (7) - (9) show regressions for the mean grade over the whole time period. Models (1), (4), and (7) use the post-intervention outcome as dependent variable and do not include control variables. Models (2), (5), and (8) 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), (6), and (9) use the change in mean grade (medium term grade [i.e., all summer exams, all winter exams, or both] − baseline grade) as dependent variable and do not include control variables. All models contain a constant. Heteroskedasticity robust standard errors are in parentheses. * $p < .1$, ** $p < .05$, *** $p < .01$

Table C.5: Robustness checks with matching samples for short- and long-term grade outcomes

	(1)	(2)	(3)	(4)	(5)	(6)
	Grade (short, E)	Grade (short, VA)	Grade (short, FD)	Grade (long, E)	Grade (long, VA)	Grade (long, FD)
Treat	-0.378**	-0.339*	-0.228	0.167	0.304**	0.332**
	(0.181)	(0.177)	(0.188)	(0.180)	(0.153)	(0.165)
Prior Grade		0.527***			0.593***	
		(0.095)			(0.097)	
Prior ECTS Credits		0.001			0.005	
		(0.003)			(0.003)	
Constant	0.096	0.259	0.101	-0.035	-0.776	-0.030
	(0.121)	(0.439)	(0.122)	(0.127)	(0.783)	(0.110)
Study Program FE	No	Yes	No	No	Yes	No
Study Year FE	No	Yes	No	No	Yes	No
R^2	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 (medium term 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. * $p < .1$, ** $p < .05$, *** $p < .01$

Table C.6: Short-Term Grades by Baseline Grade and Scales

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Treat	-0.244	-0.214	-0.243	-0.244	-0.497**	-0.283	-0.088	-0.205	-0.312
	(0.174)	(0.189)	(0.183)	(0.205)	(0.196)	(0.176)	(0.193)	(0.203)	(0.192)
TreatXHigh Stress	-0.054								
	(0.282)								
High Stress	-0.029								
	(0.172)								
TreatXHigh Anxiety		-0.093							
		(0.288)							
High Anxiety		0.063							
		(0.173)							
TreatXHigh Depression			-0.015						
			(0.273)						
High Depression			-0.164						
			(0.169)						
TreatXHigh Self-control				-0.032					
				(0.274)					
High Self-control				0.025					
				(0.172)					
TreatXHigh Conscientiousness					0.495*				
					(0.260)				
High Conscientiousness					-0.287*				
					(0.162)				
TreatXHigh Neuroticism						0.054			
						(0.267)			
High Neuroticism						-0.201			
						(0.161)			
TreatXHigh Stroop Task							-0.338		
							(0.262)		
High Stroop task							0.308*		
							(0.185)		
TreatXHigh Prior Grade								-0.115	
								(0.295)	
High Prior Grade								-0.005	
								(0.260)	
TreatXHigh Heath Index									0.095
									(0.264)
High Health Index									0.026
									(0.175)
Prior Grade	0.455***	0.457***	0.445***	0.456***	0.463***	0.468***	0.440***	0.481***	0.458***
	(0.082)	(0.081)	(0.081)	(0.080)	(0.080)	(0.077)	(0.080)	(0.133)	(0.080)
Prior ECTS Credits	0.005*	0.005*	0.004*	0.005*	0.005**	0.004*	0.005**	0.005*	0.005*
	(0.002)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)
Constant	0.018	-0.052	0.125	-0.013	0.107	0.125	-0.219	-0.020	-0.046
	(0.681)	(0.426)	(0.706)	(0.711)	(0.417)	(0.699)	(0.427)	(0.448)	(0.406)
Study Program FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Study Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.295	0.295	0.301	0.294	0.310	0.302	0.306	0.295	0.296
N	177	177	177	177	177	177	177	177	177

Note: This table shows OLS regressions of the mean grade of the main exam period of the summer semester on the treatment dummy that control for prior mean grade, prior total ECTS credits, study-program fixed effects (9 dummies), and study-year fixed effects (3 dummies). Each model additionally contains a dummy equal to 1 for those students who scored above the sample median on the respective baseline variable (mental health outcomes, non-cognitive skills, Stroop task, prior grade, health behavior index) and an interaction term of the respective dummy and the treatment dummy. All models include a constant. Heteroskedasticity robust standard errors are in parentheses. * $p < .1$, ** $p < .05$, *** $p < .01$

Table C.7: Long-term grades by baseline and scales

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Treat	0.370*	0.367	0.213	0.402*	0.475**	0.210	0.391*	0.289	0.233
	(0.196)	(0.237)	(0.238)	(0.228)	(0.220)	(0.195)	(0.225)	(0.234)	(0.226)
TreatXHigh Stress	0.040								
	(0.323)								
High Stress	0.038								
	(0.238)								
TreatXHigh Anxiety		0.023							
		(0.317)							
High Anxiety		-0.074							
		(0.223)							
TreatXHigh Depression			0.302						
			(0.352)						
High Depression			-0.152						
			(0.257)						
TreatXHigh Self-control				-0.052					
				(0.338)					
High Self-control				0.350					
				(0.279)					
TreatXHigh Conscientiousness					-0.243				
					(0.314)				
High Conscientiousness					0.559**				
					(0.250)				
TreatXHigh Neuroticism						0.425			
						(0.330)			
High Neuroticism						-0.306			
						(0.251)			
TreatXHigh Stroop Task							-0.011		
							(0.311)		
High Stroop task							0.039		
							(0.233)		
TreatXHigh Prior Grade								0.221	
								(0.337)	
High Prior Grade								-0.128	
								(0.299)	
TreatXHigh Heath Index									0.288
									(0.320)
High Health Index									0.139
									(0.237)
Prior Grade	0.522***	0.516***	0.528***	0.486***	0.452***	0.516***	0.513***	0.528***	0.520***
	(0.109)	(0.106)	(0.111)	(0.109)	(0.109)	(0.106)	(0.110)	(0.170)	(0.104)
Prior ECTS Credits	0.003	0.003	0.003	0.001	0.001	0.003	0.003	0.003	0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Constant	-0.136	-0.084	0.029	-0.156	-0.122	0.036	-0.173	-0.092	0.002
	(0.656)	(0.691)	(0.708)	(0.605)	(0.722)	(0.673)	(0.669)	(0.653)	(0.634)
Study Program FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Study Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.319	0.319	0.323	0.338	0.361	0.332	0.318	0.321	0.339
N	121	121	121	121	121	121	121	121	121

Note: This table shows OLS regressions of the mean grade of the main exam period of the winter semester on the treatment dummy that control for prior mean grade, prior total ECTS credits, study-program fixed effects (9 dummies), and study-year fixed effects (3 dummies). Each model additionally contains a dummy equal to 1 for those students who scored above the sample median on the respective baseline variable (mental health outcomes, non-cognitive skills, Stroop task, prior grade, health behavior index) and an interaction term of the respective dummy and the treatment dummy. All models include a constant. Heteroskedasticity robust standard errors are in parentheses. * $p < .1$, ** $p < .05$, *** $p < .01$

Table C.8: Heterogeneity Analysis of Secondary Outcomes

	(1) Stress	(2) Anxiety	(3) Depression	(4) Self-Control	(5) Conscientiousness	(6) Neuroticism	(7) Stroop Task	(8) Health Index
Treat	-0.292*	-0.245	-0.417***	0.459***	0.512***	-0.212	0.298	2.045***
	(0.168)	(0.176)	(0.133)	(0.164)	(0.149)	(0.188)	(0.227)	(0.628)
TreatXHigh Stress	-0.842***							
	(0.278)							
High Stress	1.050***							
	(0.203)							
TreatXHigh Anxiety		-0.407						
		(0.263)						
High Anxiety		1.239***						
		(0.200)						
TreatXHigh Depression			-0.425*					
			(0.255)					
High Depression			1.184***					
			(0.202)					
TreatXHigh Self-control				0.082				
				(0.220)				
High Self-control				1.250***				
				(0.158)				
TreatXHigh Conscientiousness					-0.143			
					(0.216)			
High Conscientiousness					1.245***			
					(0.163)			
TreatXHigh Neuroticism						-0.300		
						(0.253)		
High Neuroticism						1.317***		
						(0.177)		
TreatXHigh Stroop Task							-0.292	
							(0.286)	
High Stroop task							0.899***	
							(0.213)	
TreatXHigh Heath Index								-1.065
								(0.913)
High Health Index								3.920***
								(0.668)
Prior Grade	-0.093	0.011	-0.051	0.014	0.166**	-0.128*	0.087	0.298
	(0.074)	(0.076)	(0.070)	(0.064)	(0.065)	(0.074)	(0.091)	(0.237)
Prior ECTS Credits	-0.004	-0.002	-0.001	0.002	0.002	0.001	-0.001	-0.003
	(0.003)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.007)
Constant	-0.097	-0.162	-0.213	-1.410***	-1.223***	-0.473	-1.165***	-3.284***
	(0.370)	(0.360)	(0.452)	(0.314)	(0.358)	(0.337)	(0.382)	(1.127)
Study Program FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Study Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.294	0.378	0.401	0.559	0.524	0.362	0.276	0.365
N	182	182	182	182	182	182	182	182

Note: This table shows OLS regressions of the secondary outcomes elicited in the post-intervention questionnaire on the treatment dummy that control for prior mean grade, prior total ECTS credits, study-program fixed effects (9 dummies), and study-year fixed effects (3 dummies). Each model additionally contains a dummy equal to 1 for those students who scored above the sample median on the respective baseline variable (mental health outcomes, non-cognitive skills, Stroop task, prior grade, health behavior index) and an interaction term of the respective dummy and the treatment dummy. All models include a constant. Heteroskedasticity robust standard errors are in parentheses. * $p < .1$, ** $p < .05$, *** $p < .01$

Table C.9: Outcomes by Motivation

	(1) Grade (s, VA)	(2) Grade(s, D)	(3) Grade (l, VA)	(4) Grade (l, D)	(5) Stress	(6) Anxiety	(7) Depression	(8) Self-Control	(9) Conscient.	(10) Neurot.	(11) Stroop	(12) Health B.
Treat	-0.262	-0.171	0.491**	0.390**	-0.681***	-0.416***	-0.562***	0.485***	0.587***	-0.328**	0.192	0.556***
	(0.165)	(0.174)	(0.208)	(0.194)	(0.165)	(0.147)	(0.144)	(0.117)	(0.124)	(0.136)	(0.157)	(0.151)
TreatXPerf-motivated	0.001	0.151	-0.222	0.106	0.083	-0.009	-0.109	0.088	-0.144	-0.025	-0.005	-0.341
	(0.282)	(0.232)	(0.316)	(0.234)	(0.272)	(0.264)	(0.244)	(0.171)	(0.193)	(0.249)	(0.252)	(0.225)
Perf-motivated	0.030		0.070		-0.140	-0.148	0.060	-0.049	-0.008	-0.100	-0.107	0.138
	(0.182)		(0.224)		(0.234)	(0.210)	(0.210)	(0.137)	(0.157)	(0.195)	(0.199)	(0.178)
Prior Grade	0.459***		0.507***		-0.065	0.040	0.011	-0.034	0.070	-0.077	0.047	0.064
	(0.081)		(0.107)		(0.074)	(0.069)	(0.066)	(0.049)	(0.054)	(0.063)	(0.077)	(0.060)
Prior ECTS Credits	0.005*		0.003		-0.002	-0.002	-0.002	0.003**	0.002*	-0.001	-0.001	-0.001
	(0.002)		(0.002)		(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
Stress (BL)					0.476***							
					(0.072)							
Anxiety (BL)						0.594***						
						(0.066)						
Depression (BL)							0.577***					
							(0.065)					
Self-Control (BL)								0.757***				
								(0.046)				
Conscient. (BL)									0.705***			
									(0.050)			
Neurot. (BL)										0.724***		
										(0.060)		
Stroop Task (BL)											0.553***	
											(0.077)	
Health B. (BL)												0.649***
												(0.051)
Constant	-0.022	0.044	-0.656	-0.159	0.269	0.456	0.501	-0.329	-0.682**	0.208	-0.312	-0.478*
	(0.692)	(0.095)	(0.647)	(0.123)	(0.348)	(0.319)	(0.341)	(0.262)	(0.268)	(0.246)	(0.238)	(0.256)
Study Program FE	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Study Year FE	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.295	0.006	0.321	0.054	0.373	0.457	0.505	0.702	0.657	0.540	0.407	0.537
N	177	177	121	121	182	182	182	182	182	182	182	182

Note: This table shows OLS regressions of the grades and secondary outcomes 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. Models (5) - (7) use the mental health scales, models (8) - (10) use the non-cognitive skills outcomes, model (11) uses the Stroop task and model (12) uses the health behavior index 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 "Perf-motivated" equal to 1 for those students who indicated that they applied for the meditation course because they wanted to improve their performance and an interaction term of this dummy and the treatment dummy. All models include a constant. Heteroskedasticity robust standard errors are in parentheses. * $p < .1$, ** $p < .05$, *** $p < .01$

Table C.10: Heterogeneous Effects by Gender

	(1) Grade (s, VA)	(2) Grade(s, D)	(3) Grade (l, VA)	(4) Grade (l, D)	(5) Stress	(6) Anxiety	(7) Depression	(8) Self-Control	(9) Conscient.	(10) Neurot.	(11) Stroop	(12) Health B.
Treat	-0.344*	-0.068	0.473**	0.451**	-0.585***	-0.455***	-0.548***	0.512***	0.557***	-0.320*	0.181	1.044
	(0.205)	(0.179)	(0.235)	(0.210)	(0.183)	(0.174)	(0.164)	(0.132)	(0.137)	(0.176)	(0.182)	(0.662)
TreatXFemale	0.155	-0.062	-0.142	-0.009	-0.135	0.027	-0.089	0.003	-0.068	-0.054	-0.013	0.830
	(0.275)	(0.226)	(0.306)	(0.237)	(0.255)	(0.236)	(0.214)	(0.180)	(0.178)	(0.230)	(0.250)	(0.802)
Female	-0.235		0.264		0.023	-0.019	0.166	-0.124	-0.140	0.095	-0.012	-0.676
	(0.171)		(0.234)		(0.203)	(0.189)	(0.167)	(0.120)	(0.126)	(0.160)	(0.186)	(0.547)
Stress (BL)					0.488***							
					(0.079)							
Anxiety (BL)						0.606***						
						(0.065)						
Depression (BL)							0.565***					
							(0.069)					
Self-Control (BL)								0.758***				
								(0.043)				
Conscient. (BL)									0.707***			
									(0.047)			
Neurot. (BL)										0.722***		
										(0.060)		
Stroop Task (BL)											0.546***	
											(0.078)	
Health B.												0.745***
												(0.056)
Prior Grade	0.458***		0.516***		-0.058	0.054	0.007	-0.035	0.070	-0.067	0.058	0.143
	(0.079)		(0.105)		(0.073)	(0.070)	(0.064)	(0.049)	(0.053)	(0.062)	(0.077)	(0.198)
Prior ECTS Credits	0.005**		0.003		-0.002	-0.002	-0.002	0.003**	0.003*	-0.001	-0.001	-0.001
	(0.002)		(0.002)		(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.005)
Constant	0.143	0.044	-0.272	-0.159	0.224	0.569	0.391	-0.636**	-0.719**	0.047	-0.704**	-0.864
	(0.442)	(0.095)	(0.666)	(0.123)	(0.373)	(0.367)	(0.351)	(0.298)	(0.330)	(0.337)	(0.326)	(0.798)
Study Program FE	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Study Year FE	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.302	0.003	0.328	0.053	0.373	0.453	0.508	0.705	0.661	0.538	0.405	0.483
N	177	177	121	121	182	182	182	182	182	182	182	182

Note: This table shows OLS regressions of the grades and secondary outcomes 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. Models (5) - (7) use the mental health scales, models (8) - (10) use the non-cognitive skills outcomes, model (11) uses the Stroop task and model (12) uses the health behavior index 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 equal to 1 for female students and an interaction term of this dummy and the treatment dummy. All models include a constant. Heteroskedasticity robust standard errors are in parentheses. * $p < .1$, ** $p < .05$, *** $p < .01$

Table C.11: Outcomes by Attendance

	(1) Grade (s, VA)	(2) Grade(s, D)	(3) Grade (l, VA)	(4) Grade (l, D)	(5) Stress	(6) Anxiety	(7) Depression	(8) Self-Control	(9) Conscient.	(10) Neurot.	(11) Stroop	(12) Health B.
TreatXAttended_often	-0.353*	-0.328*	0.464**	0.370*	-0.729***	-0.515***	-0.672***	0.566***	0.561***	-0.433***	0.305**	0.569***
	(0.183)	(0.195)	(0.185)	(0.191)	(0.146)	(0.131)	(0.138)	(0.104)	(0.103)	(0.128)	(0.139)	(0.106)
TreatXAttended_rarely	-0.161	0.129	0.276	0.545**	-0.561***	-0.319*	-0.491***	0.440***	0.461***	-0.230	-0.027	0.197
	(0.164)	(0.172)	(0.221)	(0.229)	(0.162)	(0.164)	(0.140)	(0.109)	(0.141)	(0.154)	(0.151)	(0.187)
Prior Grade	0.470***		0.500***		-0.044	0.066	0.023	-0.040	0.069	-0.055	0.034	0.040
	(0.083)		(0.108)		(0.074)	(0.073)	(0.066)	(0.050)	(0.055)	(0.064)	(0.078)	(0.061)
Prior ECTS Credits	0.005*		0.003		-0.002	-0.002	-0.002	0.003**	0.002*	-0.001	-0.001	-0.000
	(0.002)		(0.002)		(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
Stress (BL)					0.480***							
					(0.070)							
Anxiety (BL)						0.608***						
						(0.065)						
Depression (BL)							0.583***					
							(0.065)					
Self-Control (BL)								0.753***				
								(0.044)				
Conscient. (BL)									0.706***			
									(0.049)			
Neurot. (BL)										0.735***		
										(0.058)		
Stroop Task (BL)											0.561***	
											(0.078)	
Health B. (BL)												0.648***
												(0.050)
Constant	0.071	0.044	-0.166	-0.159	0.254	0.443	0.162	-0.369	-0.697***	0.214	-0.397	-0.493*
	(0.438)	(0.095)	(0.666)	(0.123)	(0.365)	(0.338)	(0.338)	(0.255)	(0.265)	(0.270)	(0.246)	(0.251)
Study Program FE	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Study Year FE	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.298	0.028	0.321	0.056	0.374	0.457	0.508	0.703	0.656	0.542	0.416	0.545
N	177	177	121	121	182	182	182	182	182	182	182	182

Note: This table shows OLS regressions of the grades and secondary outcomes on course attendance. 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. Models (5) - (7) use the mental health scales, models (8) - (10) use the non-cognitive skills outcomes, model (11) uses the Stroop task and model (12) uses the health behavior index 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 two interaction terms. "Treat*Attendend often" identifies the treatment effect – relative to the control group – for students whose course attendance was above the treatment-group mean. "Treat*Attendend rarely" identifies the treatment effect – relative to the control group – for students whose course attendance was below the treatment-group mean. All models include a constant. Heteroskedasticity robust standard errors are in parentheses. * $p < .1$, ** $p < .05$, *** $p < .01$

Table C.12: Correlations of Grades (non-inv.), Non-Cognitive and Cognitive Skills at Baseline

	Prior Grade	Stress (BL)	Anxiety (BL)	Depr. (BL)	Self-C. (BL)	Consc. (BL)	Neurot. (BL)	Stroop T. (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

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.13: Long-Term Effects by Short-Term Effects

	If short-term absolute change is positive			If short-term absolute change is negative		
	(1) Grade (long, VA)	(2) Grade (long, VA)	(3) Grade (long, D)	(4) Grade (long, VA)	(5) Grade (long, VA)	(6) Grade (long, D)
Treat	0.542**	0.566***	0.761***	0.022	0.246	0.206
	(0.199)	(0.197)	(0.214)	(0.296)	(0.278)	(0.226)
Prior Grade		0.249			0.777***	
		(0.180)			(0.152)	
Prior ECTS Credits		0.004			0.004	
		(0.003)			(0.005)	
Constant	-0.132	-1.487*	-0.124	-0.121	-2.366**	-0.231
	(0.144)	(0.785)	(0.167)	(0.230)	(1.027)	(0.148)
Study Program FE	No	Yes	No	No	Yes	No
Study Year FE	No	Yes	No	No	Yes	No
R^2	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 short-run average grade was higher than at baseline while models (4) - (6) focus on students whose short-run 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 C.14: Outcomes by Own Practice

	(1) Grade (s, VA)	(2) Grade(s, D)	(3) Grade (l, VA)	(4) Grade (l, D)	(5) Stress	(6) Anxiety	(7) Depression	(8) Self-Control	(9) Conscient.	(10) Neurot.	(11) Stroop	(12) Health B.
Treat	-0.401	-0.390	-0.269	-0.310	-0.307	-0.180	-0.314*	0.238	0.353**	-0.124	0.438**	0.383
	(0.306)	(0.327)	(0.413)	(0.385)	(0.242)	(0.197)	(0.177)	(0.177)	(0.178)	(0.208)	(0.174)	(0.238)
TreatXOwn practice	0.175	0.347	0.893**	0.969**	-0.458	-0.415	-0.364	0.265	0.135	-0.324	-0.399	0.093
	(0.355)	(0.371)	(0.445)	(0.420)	(0.296)	(0.269)	(0.240)	(0.203)	(0.204)	(0.257)	(0.263)	(0.295)
Own practice	-0.039	-0.062	-0.307	-0.252	0.060	0.221	0.035	0.158	0.149	0.101	0.172	-0.097
	(0.166)	(0.194)	(0.239)	(0.253)	(0.186)	(0.190)	(0.160)	(0.116)	(0.127)	(0.155)	(0.203)	(0.155)
Prior Grade	0.461***		0.543***		-0.066	0.049	0.002	-0.018	0.086	-0.074	0.052	0.063
	(0.079)		(0.108)		(0.072)	(0.071)	(0.064)	(0.047)	(0.053)	(0.063)	(0.076)	(0.058)
Prior ECTS Credits	0.005*		0.003		-0.002	-0.003	-0.002	0.002*	0.002	-0.001	-0.001	-0.000
	(0.002)		(0.002)		(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
Stress (BL)					0.485***							
					(0.070)							
Anxiety (BL)						0.602***						
						(0.064)						
Depression (BL)							0.585***					
							(0.065)					
Self-Control (BL)								0.751***				
								(0.043)				
Conscient. (BL)									0.699***			
									(0.048)			
Neurot. (BL)										0.732***		
										(0.058)		
Stroop Task (BL)											0.546***	
											(0.077)	
Health B. (BL)												0.655***
												(0.051)
Constant	0.006	0.081	-0.122	-0.025	0.247	0.518	0.546	-0.466*	-0.775***	0.165	-0.385	-0.386
	(0.691)	(0.150)	(0.641)	(0.225)	(0.362)	(0.381)	(0.341)	(0.249)	(0.256)	(0.262)	(0.237)	(0.281)
Study Program FE	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Study Year FE	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.296	0.008	0.346	0.090	0.381	0.461	0.511	0.716	0.662	0.542	0.411	0.531
N	177	177	121	121	182	182	182	182	182	182	182	182

Note: This table shows OLS regressions of the grades and secondary outcomes 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. Models (5) - (7) use the mental health scales, models (8) - (10) use the non-cognitive skills outcomes, model (11) uses the Stroop task and model (12) uses the health behavior index 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 on their own during the period of the meditation course and an interaction term of this dummy and the treatment dummy. All models include a constant. Heteroskedasticity robust standard errors are in parentheses. * $p < .1$, ** $p < .05$, *** $p < .01$

D Invitation, Registration, Questionnaires, and Session Content

Figure D.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://unikoelnwiso.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 D.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 ☐	Fridays	2:00 pm-3:00 pm ☐
	3:15 pm-4:15 pm ☐		3:15 pm-4:15 pm ☐
	4:30 pm-5:30 pm ☐		4:30 pm-5:30 pm ☐

Figure D.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.

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.

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).

Submit

Table D.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 D.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 D.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 a 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 D.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 D.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)
Excercises 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 D.4: Sessions of the Meditation Course

	Group session	Individual exercises
Week 1	- time out - introduction to the course, motivation to participate in the course, introduction of participants - topics of teacher's talk: mindfulness, focus on the body, present moment awareness - body scan - exchange of thoughts	- time out (3 times per day) - body scan (once a day)
Week 2	- time out - exchange of experiences in the last week - topics of teacher's talk: somatic markers, the body as a resource, listening to the body, dealing with unpleasant emotions and pain - body scan - exchange of thoughts	- time out (3 times per day) - body scan (once a day) - observing the body in everyday life – stopping to pay attention to sensations
Week 3	- time out - exchange of experiences in the last week - 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 - sitting meditation, observing the breath - exchange of thoughts	- time out (3 times per day) - body scan or sitting meditation (once a day, alternating) - observing judgments in stressful situations
Week 4	- time out - exchange of experiences in the last week - topics of teacher's talk: stress, triggers and responses, judgement, expectations towards ourselves, autopilot, creating a gap between triggers and responses, introduction to yoga - yoga (standing) - exchange of thoughts	- time out (3 times per day) - body scan or sitting meditation (once a day, alternating) - observing the arising of stress and stress-related thoughts in everyday life; stress diary
Week 5	- time out - exchange of experiences in the last week - topics of teacher's talk: judgements are thoughts, dealing with thoughts (not identifying with and observing thoughts) - sitting meditation - exchange of thoughts	- time out (3 times per day) - sitting meditation, yoga or body scan (once a day, alternating) - observing thoughts that trigger difficult emotions in every day life

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

	Group session	Individual exercises
Week 6	- time out - exchange of experiences in the last week - topics of teacher's talk: dealing with emotions (observing and not ignoring emotions, not identifying with emotions) - guided self-reflection using RAIN method (recognize, allow, investigate, nurture) by Tara Brach - sitting meditation, observing with compassion and kindness - exchange of thoughts	- time out (3 times per day) - sitting meditation, yoga or body scan (once a day, alternating) - observing (difficult) emotions in everyday life with kindness
Week 7	- time out - exchange of experiences in the last week - topics of teacher's talk: mindful communication - practice of mindful communication in pairs - exchange of thoughts	- time out (3 times per day) - sitting meditation, yoga or body scan (once a day, alternating) - integrating new skills into everyday life
Week 8	- time out - exchange of experiences in the last week - topics of teacher's talk: tips on integrating new skills into everyday life, cultivating gratitude and self-esteem - sitting meditation - exchange of experiences and thoughts with respect to the course	- time out (3 times per day) - sitting meditation, yoga or body scan (once a day, alternating) - integrating new skills into everyday life

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.