

Meditating for the Planet: Effects of a Mindfulness-Based Intervention on Sustainable Consumption Behaviors

Environment and Behavior
2020, Vol. 52(9) 1012–1042

© The Author(s) 2019

Article reuse guidelines:

sagepub.com/journals-permissions

DOI: 10.1177/0013916519880897

journals.sagepub.com/home/eab



Sonja M. Geiger¹ , Daniel Fischer² ,
Ulf Schrader¹, and Paul Grossman³

Abstract

Recent research suggests that mindfulness may foster sustainable consumption behavior through the reduction of the so-called attitude–behavior gap, or by weakening material values while increasing subjective well-being. The current controlled longitudinal study tested these propositions by employing a sustainability-adapted mindfulness-based intervention (sMBI) to two different samples ($n = 60$ university students; $n = 71$ employees). Although the intervention successfully enhanced mindful experiences in both samples, we found no evidence for neither direct effects on sustainable consumption behavior or related attitudes, nor for the reduction of the attitude–behavior gap. However, the intervention led to greater well-being in the student sample and suggested a decline of materialistic value orientations in both samples. The results blunt previous claims about potential causal effects of mindfulness practice on sustainable consumption behavior. Nevertheless, they indicate that the sMBI affects behavior-distal variables, such as material

¹Technische Universität Berlin, Germany

²Leuphana University of Lüneburg, Germany

³European Center for Mindfulness, Freiburg, Germany

Corresponding Author:

Sonja M. Geiger, Institute for Vocational Education and Work Studies, Technische Universität Berlin, Marchstraße 23, 10587 Berlin, Germany.

Email: sonja.m.geiger@tu-berlin.de

values and well-being, which in turn could influence consumption behavior in the long run.

Keywords

mindfulness, sustainable consumption, pro-environmental behavior, attitude–behavior gap, material values, well-being, intervention study

Introduction

Various scientific papers have recently explored ways in which mindfulness may be related to attitudes and behaviors within the context of pro-environmental and sustainable consumption. A recent systematic literature review summarized and analyzed the few existing empirical studies on the topic (Fischer, Stanzsus, Geiger, Grossman, & Schrader, 2017). Most of the studies found positive, albeit very modest, relationships between different aspects of mindfulness and different types of self-reported sustainable consumption behavior (SCB). As these studies are mainly cross sectional in nature and use diverse operationalizations of both concepts, the often claimed causal effect of mindfulness on SCB remains far from proven. The primary aim of this exploratory study was to examine whether increased mindfulness might elicit effects upon attitudes toward or actual changes in SCB. The study employed a sustainability-adapted mindfulness-based intervention (sMBI) with a randomized controlled trial design and examined two potential indirect effects of mindfulness on SCB reported in the literature: (a) a reduction of the attitude–behavior gap (Chatzisarantis & Hagger, 2007) in regard to self-reported SCB, and (b) a reduction of material values associated with improved subjective well-being (Dittmar, Bond, Hurst, & Kasser, 2014; Ericson, Kjøenstad, & Barstad, 2014).

Mindfulness and SCB

Mindfulness has become a buzzword in the popular media, and research interest in the topic has soared over the last decade (Fischer et al., 2017). In the process of popularization, the original meaning of the Buddhist concept *sati* (Analayo, 2007) has been blurred in many Western adaptations of mindfulness (Grossman, 2011; Hyland, 2017). A common denominator of definitions within the context of Western clinical psychology (Bishop, 2004; Grossman, 2015; Kabat-Zinn, 1991) comprises two main aspects of mindfulness: (a) sustained attention to and awareness of whatever arises in the

present moment, and (b) a particular benevolent attitude toward subjective experience during these periods of awareness, often, perhaps somewhat misleadingly, labeled as “nonjudgmental” (e.g., Kabat-Zinn, 1991). Elaborating upon these constitutive components and based on original semantic interpretations of *sati* (Grossman, 2015), we define mindfulness for this study as “the unbiased awareness that emerges through intentionally and continuously paying attention to subjective momentary experience with an open, accepting, benevolent and compassionate attitude” (Böhme, Geiger, Grossman, Stanzus, & Schrader, 2016, p. 6). This definition reflects the multifaceted nature of mindfulness encompassing various facets of awareness (e.g., paying close attention to inner and outer stimuli, or acting with awareness in everyday life) as well as a wide range of attitudinal facets (e.g., acceptance, equanimity, and a sense of relativity of experiences; Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006; Bergomi, Tschacher, & Kupper, 2013). The practice of mindfulness is believed to cultivate both sustained awareness of experience and a benevolent orientation (Grossman, 2015), with supporting evidence for the effects reviewed by Eberth and Sedlmeier (2012). Further positive effects of mindfulness practice are reported with regard to neurocognitive functions (Malinowski, 2013; Tang, Hölzel, & Posner, 2015), attention restoration (Kaplan, 2001; Lymeus, Lindberg, & Hartig, 2018), physical and mental well-being (Grossman, Niemann, Schmidt, & Walach, 2004), and pro-social behaviors and compassion (Condon, 2017).

This study focused on how cultivating mindfulness might alter the ways people consume, particularly if reported consumption behaviors took greater account of the needs of other people and the planet—features commonly attributed to the idea of sustainability. Taking the basic concept of consumer behavior as satisfaction of needs and desires (Solomon, 2006) and placing it into the context of sustainable development (World Commission on Environment and Development, 1987), Geiger, Fischer, and Schrader (2017) have defined SCB as

individual acts of satisfying needs in different areas of life by acquiring, using and disposing goods and services that do not compromise the ecological and socioeconomic conditions of all people (currently living or in the future) to satisfy their own needs. (p. 3)

A cube model illustrating this definition comprises three core dimensions of consumption: (a) consumption *phases*, (b) consumption *areas*, and (c) *sustainability spheres*. First, consumption does not merely imply purchase decisions (acquisition phase, for example, buying an electric car) but also comprises the ways in which people make use of those goods and services

(usage phase, for example, the mileage driven) and how they finally dispose of them (disposal phase, for example, scrapping or selling it on secondhand market). Second, consumption is taking place in very diverse areas of human needs such as housing, food, mobility, clothing, or entertainment, with the first three considered to be most relevant with regard to their environmental impacts (European Environment Agency [EEA], 2013). Third, consumption behaviors do lead to consequences not only in an environmental but also in a socioeconomic sphere—for example, through influencing the working conditions or pay for people involved in production and service industries (Leach, Raworth, & Rockström, 2013). However, socially responsible consumption behaviors have hitherto only rarely been taken into account in environmental psychological research.

A cross-cutting fourth dimension concerns the relevance of impacts of each behavior and allows distinguishing more environmentally and socioeconomically relevant behaviors from the relevant ones (see, for example, the concept of peanuts vs. big points by Bilharz & Schmitt, 2011). With this conception, we turn away from a mere intent-based definition of environmentally or socially responsible behavior that is confined to the positive intention to avert harm to people and the environment, but does not consider actual impact (e.g., Kaiser & Wilson, 2004). Our impact-based definition requires focusing on those consumption behaviors (across different stages and areas) that have the greatest impact on either environmental or socioeconomic systems.

Rosenberg (2004) was among the first to discuss how cultivating mindfulness might counteract mindless, habit-formed consumption behavior. She sees the core quality of mindfulness in the ability to step out of automated thought processing modes (see also Bishop, 2004) and therefore as a valuable resource for overcoming habitualized, unsustainable consumption patterns. Fischer et al. (2017) outline this and three more indirect potential mechanisms, in which mindfulness could promote SCB. Our study focuses upon two of those: (a) mindfulness may help individuals to achieve greater concordance between attitudes and behaviors regarding sustainable consumption (closing the so-called attitude–behavior gap, see the moderation model in Figure 1a), and (b) mindfulness may reduce materialistic value orientations and increase well-being at the same time (see the mediation model in Figure 1b).

The first potential effect of mindfulness is the reduction of the attitude–behavior gap (Ajzen, 1991) or the intention–behavior gap (Sheeran & Webb, 2016). These terms describe the discrepancy between attitudes (or intentions) toward sustainable consumption and the actual consumption behaviors. Although in many surveys a majority of respondents tend to report favorable attitudes toward the environment and sustainable consumption options (e.g.,

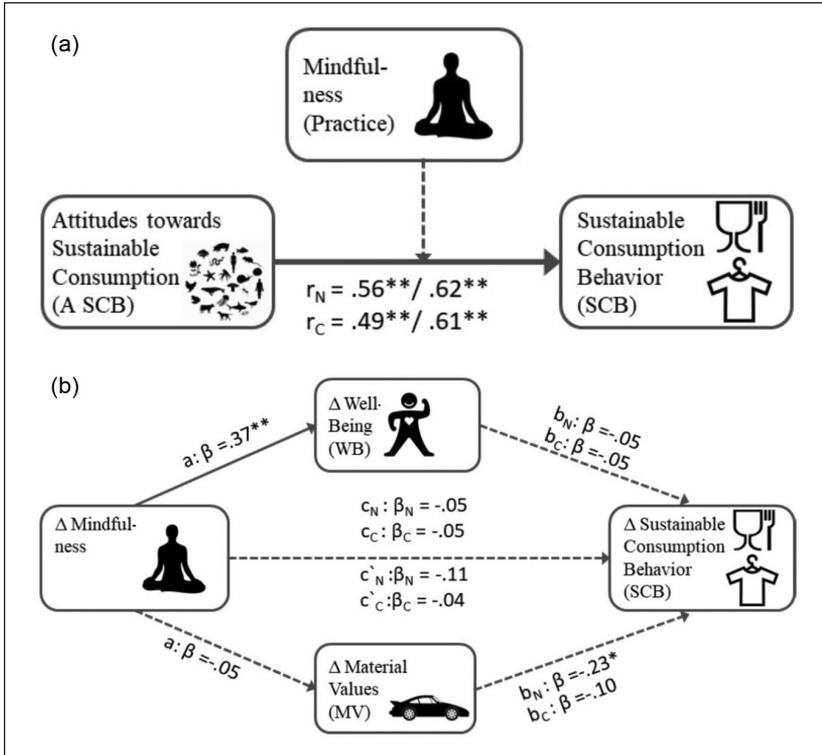


Figure 1. Potential mechanisms of mindfulness on SCB: (a) Moderation model—reduction of the attitude–behavior gap. (b) Mediation model—influence mediated through well-being and material values, adapted from Ericson, Kjønstad, and Barstad (2014).

Note. Results in the upper line are for nutrition behaviors N, in the lower line for clothing consumption C, correlation coefficients are reported for the control/intervention groups after intervention, differences of correlation coefficients are not significant, and Δ denotes the changes values for each variable, for example, Δ mindfulness = CHIMEpost – CHIMEpre. SCB= sustainable consumption behavior; CHIME = Comprehensive Inventory of Mindfulness Experiences.

BMUB UBA, 2017; Eurobarometer, 2014), sustainability indicators of collective behaviors (e.g., greenhouse gas emissions) maintain on unsustainable levels (United Nations, 2018). Evidence from mindfulness research in health promotion suggests that this gap can be reduced. Chatzisarantis and Hagger (2007) as well as Ruffault, Bernier, Juge, and Fournier (2016) found a moderating effect of trait mindfulness on the relationship between

intrinsic motivation or a behavioral intention, and the actual execution of this behavior, for physical exercise (both studies) and combined it with binge drinking (Chatzisarantis & Hagger, 2007). The authors conclude that trait mindfulness plays a role in reducing the intention–behavior gap, although both studies find only small moderation effects (β weights between .14 and .18), employ a reductionist operationalization of the mindfulness concept (for a discussion on the Mindful Attention Awareness Scale [MAAS] scale see Brown & Ryan, 2003; Grossman, 2011), and are correlational in nature, which prevents conclusions about causality.

In general, a moderation effect may also imply that the behavior is adjusted downward to a low-developed or adverse attitude (or a low intrinsic motivation in the example of physical exercise), for example, by alleviating feelings of guilt (see Schindler, Pfattheicher, & Reinhard, 2019 for according evidence). As our main concern is the role of mindfulness in the overall congruence between attitudes toward SCB and corresponding behavior (see moderation model Figure 1a), and as attitudes on environmental issues are reportedly very positive, we expect positive adjustments of behaviors to outweigh negative adjustments.

The second potential effect relates to the role mindfulness may play in supporting sustainable behavior through stimulating subjective well-being while weakening the importance of material values (see mediation model, Figure 1b). Regarding well-being, it has been repeatedly shown that mindfulness practice is instrumental in achieving subjective well-being (e.g., Brown & Ryan, 2003; Carmody & Baer, 2008; Grossman et al., 2004; Howell, Digdon, Buro, & Sheptycki, 2008). Subjective well-being and happiness in turn have been discussed as helpful psychological resources to facilitate environmental behavior and/or as a positive consequence of environmental engagement (Corral Verdugo, 2012; Kasser, 2017). Concerning materialism, Brown and Kasser (2005) and Brown, Kasser, Ryan, Linley, and Orzech (2009) found—also in cross-sectional studies—that dispositional mindfulness is positively associated with intrinsic values such as personal growth and friendship, and negatively with extrinsic, materialistic values, such as image concerns or financial success. Materialism in turn is likewise negatively correlated with self-reported pro-environmental concerns and behaviors (Hurst, Dittmar, Bond, & Kasser, 2013; Kilbourne & Pickett, 2008), including frugal behaviors (Pepper, Jackson, & Uzzell, 2009).

A substantial body of evidence indicates that well-being and materialism are intertwined (Dittmar et al., 2014; Kasser et al., 2014). Brown et al. (2009) go so far as to propose that “happy people live in more ecologically responsible ways *because* [emphasize added] such individuals hold intrinsically oriented values” (p. 360). Ericson et al. (2014) propose that taken together,

mindfulness, mediated by well-being and nonmaterial values, may slow down the rate by which people adapt to increasing material welfare (the so-called “hedonic treadmill effect”; Diener, Lucas, & Scollon, 2006) and reduce the need to seek fulfillment by means of consumption. This state of nonmaterialistic well-being has also been coined “sustainable happiness” (O’Brien, 2008), as it reduces the negative environmental and social consequences caused by conventional consumption goods and services.

To summarize, almost all the published mindfulness-sustainability research has used cross-sectional designs, obtaining purely correlational data about trait mindfulness as a dispositional, individual difference variable (Rau & Williams, 2016). These designs preclude inferences of a causal effect of mindfulness practice on SCB which appears to be implied in some of the aforementioned works (Davidson & Kaszniak, 2015; Spencer, Zanna, & Fong, 2005). To test this causal proposition, we conducted an experimental study that examined whether participation in mindfulness training may induce changes in SCB, reduce the attitude–behavior gap, and cause changes in related mediating variables. We tested these effects in the field of nutrition and clothing, where daily behaviors might be conceivably changed in the course of an 8-week intervention.

Research Aims and Hypotheses

In our study, we were interested in long-lasting, trait-like changes evoked through regular mindfulness practice (Davidson & Kaszniak, 2015; Rau & Williams, 2016), as opposed to immediate effects on momentary mental states. By employing an sMBI and a well validated dispositional scale of mindfulness experiences, this study examines potential changes in questionnaire indices of mindfulness as a result of mindfulness training alongside with changes in measures related to SCB. Our main aim is to address the issue of causality of direct effects of mindfulness training on SCB by employing a controlled intervention study with randomized allocation of participants. Furthermore, we investigated a moderation effect, namely, the reduction of the attitude–behavior gap. Last, we examined further effects of the sMBI on two potential mediating variables to SCB: materialism and well-being. The four resulting research aims and related hypotheses are as follows:

Research Aim 1: To design an sMBI that is effective to cultivate mindfulness in participants.

Hypothesis 1: The sMBI increases mindful experiences of participants.

Research Aim 2: To test direct effects of the sMBI on SCB prospectively.

Hypothesis 2a: The sMBI increases SCB of participants in the field of nutrition.

Hypothesis 2b: The sMBI increases SCB of participants in the field of clothing.

Research Aim 3: To test a moderation effect of the sMBI on SCB, that is, the reduction of the attitude–behavior gap in SCB.

Hypothesis 3a: The sMBI moderates (i.e., strengthens) the attitude–behavior relationship in sustainable nutrition.

Hypothesis 3b: The sMBI moderates (i.e., strengthens) the attitude–behavior relationship in sustainable clothing consumption.

Research Aim 4: To test the mediated effects of the sMBI on SCB through two potential mediators: material values and well-being.

Hypothesis 4a: The sMBI increases subjective well-being of participants.

Hypothesis 4b: The sMBI decreases endorsement of material values of participants.

Hypothesis 4c: The effects of changes in mindfulness on changes in SCB are mediated by changes in subjective well-being and material values.

Method

Participants

The sMBI was evaluated among two different adult populations at varying stages of life to examine generalizability of effects of our intervention. These included (a) university students, as well as (b) employees from two small-to-medium private firms and one public service employer, all in Germany. All participants were offered free participation in a mindfulness-based intervention (MBI) focused on stress reduction, in exchange for participating in the data collection (surveys and interviews), whereas the sustainable consumption focus of the study was not revealed.

Seventy-nine university students were recruited via the open enrollment Internet platform of the university's sports program. The participants were randomly assigned either to the intervention group (IG) or the waitlist control group (WG) with a random shuffle function employed to subject ID. Three students dropped out of the IG before the training started, leaving a starting *student sample* of $n = 76$ (IG/WG: $n = 37/n = 39$).

Seventy-eight employees from the three participating employers were recruited through the respective human resource manager. The employees were likewise randomly assigned to one of the two groups, with no dropouts before the start of the intervention. One person failed to complete the pre-intervention questionnaire, leaving a starting *employee sample* of $n = 77$ (IG/WG: $n = 37/n = 40$).

Of the resulting total starting sample of 153, nine participants did not attend the required minimum of five out of nine sessions to enter the analysis and were treated as intervention dropouts. In addition, seven participants attended a minimum of five sessions, but failed to complete the postintervention questionnaire, yielding a data set of 137. The dropout rate in the IG was thus 17.6%, 13 out of 74, and in the WG was 3.8%, three out of 79. Analyses of the 16 dropouts revealed that they were slightly younger, $M = 32$ years vs. $M = 37$ years, $t(151) = 1.89$, $p = .06$, and of similar gender distribution (50% vs. 37.2% men, $\chi^2 = 0.99$, $p = .32$) compared with the 137 completers. There were also no differences in terms of monthly net income, $t(151) = -1.13$, $p = .26$, scores in subjective well-being, $t(151) = -0.78$, $p = .44$, or mindfulness measures, $t(151) = 0.86$, $p = .39$.

The completer data ($n = 137$) was checked for outliers and previous meditation experience. Four data sets were excluded because of extreme delta values in one of the five main variables ($|z| > 4$) and two more data sets because of extensive meditation experience (regular practice for more than a year). All further statistical analyses are based on this sample ($n = 131$) with sociodemographic characteristics presented in Table 1. As this study is a first approach to explore effects of an sMBI on SCB-related measures, we did not employ an intention-to-treat approach, in which all randomized participants are considered in analyses (see also Davidson & Kaszniak, 2015), but concentrated on potential effects of the intervention when fully received (i.e., completer or per-protocol analysis).

Procedure and Design

Intervention. The curriculum of the program was based on the well-established MBSR (mindfulness-based stress reduction) program developed by Jon Kabat-Zinn (1991). It was complemented by a few exercises from a collection of exercises for sustainable consumption (Fischer, 2017), which were adapted accordingly by mindfulness trainers to suit the mindfulness course (for a detailed account of the intervention design, see Stanzus et al., 2017). Like the original MBSR program, the sMBI comprises eight weekly group sessions, one additional half-day session after Week 6 (“day of mindfulness”), and individual daily practice. In addition to three basic mindfulness meditation practices (body scan, breathing, and metta-meditation), the sMBI includes a variety of elements, among them group discussions, inquiry and reflections, as well as yoga exercises. Adaptations in our program were made with regard to the duration of the different elements (e.g., a reduced length of the weekly sessions to 90 min and of daily practice to 20 min due to practical constraints in the partnering institutions), as well as the content of the curriculum. The first 4 weeks of the sMBI focused directly upon cultivating mindfulness, by

Table 1. Sociodemographic Characteristics of the Final Sample ($n = 131$).

	Students		Employees		Combined		Total
	IG	WG	IG	WG	IG	WG	
N	26	34	32	39	58	73	131
Female %	73.1	76.5	46.8	59.0	59.3	67.1%	63.4%
Age	29.2	28.7	40.9	39.6	35.9	34.5	35.2
SSES	5.96	6.09	6.06	6.03	6.02	6.05	6.04
n (Med exp)	6	5	2	1	8	6	14
int (Med exp)	0.15	0.09	0.09	0.03	0.12	0.05	0.08

Note. IG = intervention group; WG = waitlist control group; SSES = subjective socioeconomic status on a 0 to 10 scale; n (Med exp) = number of participants who claimed to have had prior experience with (mindfulness) meditation; int (Med exp) = intensity of meditation experience: product of years \times hours of weekly practice.

means of practicing body scan and breathing meditation, as well as confronting obstacles and challenges during the practice. Another topic covered in this phase was the relationship between mindfulness and dealing with one's emotions, positive and negative. An initial modification in this course phase included a more detailed look at feelings of (dis)satisfaction. As consumption behavior is geared to satisfying needs in different areas of life (e.g., Engel, Blackwell, & Miniard, 1990; Geiger et al., 2017), mindful dealing with one's own feelings of dissatisfaction has an immediate relevance to consumption behavior. During Weeks 5 to 8, ongoing mindfulness practice was supplemented by loving kindness metta-meditation, discussion of themes such as needs and desires, compassion and kindness, and mindfulness practice as an antidote to basic human inclinations of greed and aversion (see Grossman, 2015). In the course of these weeks, topics of mindful consumption were gradually introduced. The curriculum thus reflects and maintains characteristics of an MBSR course, while increasingly applying these basic characteristics to consumption-related topics in the final weeks of the course.

Experimental pre/post/follow-up design. Each participant was randomly assigned either to the IG that received the training immediately or a WG that received the training after the end of the first intervention wave. There were three time-points of assessment: (a) within a week before starting the training (pre), (b) within a week after the training was completed (post), and (c) 7 months after completion of the training (follow-up). Announcements and two reminders for each time-point of measurement were sent via e-mail. As all participants received the intervention at some point (the WG after the main

IG was finished), there was no control group for the follow-up measurement. The analyses of the follow-up data include participants of both IG and WG and thus represent uncontrolled, observational findings.

Measures

Mindfulness. Aspects related to mindfulness were assessed using the Comprehensive Inventory of Mindfulness Experiences (CHIME; Bergomi et al., 2013; Bergomi, Tschacher, & Kupper, 2014). The scale comprises 37 items (Cronbach's α pre/post = .88/.91) and eight facets called *acceptance* (α = .83/.87, for example, "I see my mistakes and difficulties without judging myself"), *inner awareness* (α = .68/.76, for example, "When I am sitting or lying, I perceive the sensation in my body"), *outer awareness* (α = .86/.87, for example, "I notice the sounds in my environment, such as birds chirping or cars passing"), *acting with awareness* (α = .64/.72, for example, "In everyday life, I get distracted by memories, images or reveries," reverse), *decentering* (α = .80/.83, for example, "When I experience distressing thoughts or images, I am able to just notice them without having to react immediately"), *openness* (α = .60/.62, for example, "I try to distract myself, when I feel unpleasant emotions," reverse), *relativity* (α = .74/.76, for example, "In everyday life, I am aware that my view on things is subjective and does not necessarily correspond to facts"), and (benevolent) *insight* (α = .73/.76, for example, "When I have needlessly given myself a hard time, I can see it with a bit of humor"). All items were assessed on a 7-point frequency scale, in which only the two extremes were labeled with *almost never* (0) and *almost always* (6).

SCB. SCB was assessed with self-reports on behaviors in two different areas, nutrition (SCB_{nutrition}: 17 items, α = .73/.79) and clothing (SCB_{clothing}: 16 items α = .74 / .74). The scale is based on the cube model of SCB (Geiger et al., 2017) and spans, accordingly, all three consumption phases, as well as both environmental and socioeconomic impacts of nutritional and clothing consumption behaviors (e.g., acquisition—environmental: "I buy organically grown produce"; usage—environmental: "I cook in energy saving ways"; acquisition—socioeconomic: "I buy fairly produced clothes"; and disposal—socioeconomic: "I give away or swap clothes I do not wear anymore"). Items were assessed on a 7-point frequency scale that had every second option labeled with *never* (0), *sometimes* (2), *often* (4), and *always* (6). Answer options for daily behaviors (e.g., preferred main food courses) were labeled with *never* (0), *once a week* (3), and *daily* (6). All items are reported in Appendix A in Supplementary Material.

Attitude toward SCB (A-SCB). An attitudinal scale was constructed for each consumption area, based on recommendations for measurements of attitudes by Ajzen (1991). Each scale reflected the main consumption aspects covered by the respective SCB-scales (A-SCB_{nutrition}: $n = 8$, $\alpha = .61/.68$, for example, “I find it important to be able to buy food from everywhere in the world at any time,” reverse; A-SCB_{clothing}: $n = 6$, $\alpha = .69/.73$, for example, “Clothes should be produced under fair working conditions”). Items were assessed on a 7-point Likert-type scale that had every second option labeled with *completely disagree* (0), *rather disagree* (2), *rather agree* (4), and *completely agree* (6). All items are reported in Appendix A in Supplementary Material.

Well-being. Subjective well-being was measured using the core module taken from the guidelines on how to assess well-being by the Organisation for Economic Co-operation and Development (OECD) (2013). The five items ($\alpha = .87/.89$) encompass a eudemonic sense of life and emotional aspects of hedonic well-being. We changed the original wording for the time frame from “yesterday” (OECD scale) to “last four weeks” to reflect a longer duration of sense of well-being (e.g., “How happy have you felt over the last four weeks?”). Items were assessed on the original OECD 11-point scale ranging from *not at all* (0) to *completely* (10).

Material values. The extent to which participants endorse materialistic values was assessed with a 15-item German version (Müller et al., 2013; $\alpha = .83/.87$) of the original material values scale by Richins and Dawson (1992; Richins, 2004). Items (e.g., “My life would be better if I owned certain things that I don’t have”) were assessed on the same Likert-type scale as attitudes (see above).

Subjective evaluation of the course. To capture how the participants perceived the success of the intervention, we asked them one question at the end of the sMBI (“How successful was the course participation for you regarding your personal expectations and goals?”) on an 11-point scale, ranging from *not at all* (0) to *total success* (10).

Data Analysis

All analyses were calculated with SPSS version 23.1. Cronbach’s α s were calculated to test the internal consistency of each scale with SPSS’ scaling function. Pre- to postintervention difference scores (Deltas Δ) were used to test the direct effects of the intervention on all dependent measures (Hypotheses 1, 2a, and 2b, as well as 4a and 4b) and the mediation analysis

(Hypothesis 4c). Two-factorial analyses of covariance (ANCOVAs) were computed for each measure, with preintervention level as covariate. The two factors were *experimental condition* (IG vs. WG) and *sample* (students vs. employees). Corrected Cohen's d effect sizes (d_{corr}) were calculated based on the differences of effect sizes between groups, as suggested by Klauer (2001).

Analyses to test Hypotheses 3a and 3b were performed on two levels: first, to test changes in the attitude–behavior relationship between participants, we computed bivariate correlation coefficients between attitude and behavioral measures for IG and WG separately at each measurement point in time, and then tested for differences using Fisher's z -transformations as recommended by Eid, Gollwitzer, and Schmitt (2017). Higher correlation coefficients post-intervention for the IG would indicate a positive moderation effect. A second analysis looked at the individual attitude–behavior discrepancy (ABD) within participants, computed as the difference score ($\text{ABD} = \text{A-SCB} - \text{SCB}$). Although absolute values of this measure cannot be interpreted, relative changes over time ($\Delta\text{ABD} = \text{ABD}_{\text{post}} - \text{ABD}_{\text{pre}}$) can be tested between groups, which was done in a 2×2 ANCOVA, again with *experimental condition* and *sample* as factors and prelevel ABD as a covariate.

The mediation analyses for Hypothesis 4c was conducted on change values ($\Delta = \text{post}_{\text{values}} - \text{pre}_{\text{values}}$) of all involved variables, using a bootstrapping method ($k = 5,000$ iterations) applied to Model 4 of the PROCESS macro by Hayes (2012, 2013). The significance of the indirect effect $a \times b$ is indicated by the according confidence interval excluding the value 0.

The sample size of the study was mainly determined by available funding for the mindfulness training, so statistical power was analyzed post hoc. For a medium effect size ($f = 0.25$) and $\alpha = .05$, our sample yielded a test power $(1 - \beta) = .83$ for each individual ANCOVA (two groups, one covariate). Because of the explorative nature of our study, we also report multiple results on different variables. To account for α -error inflation, we adjusted $\alpha = .01$ for multiple testing, which in turn diminished the power to find an effect in each of the tests, to $(1 - \beta) = .62$. Despite these apparent disadvantages, we proceeded with multiple testing to explore the various postulated effects and identify promising areas for future research.

Results

Preintervention, cross-sectional relationships between study variables. To establish comparability of our study with former cross-sectional studies, we first present first-order correlations of all main measures at the preintervention point in time (see Table 2). Most notably, the CHIME measure was weakly, positively related to the SCB measures. These weak relationships were based

Table 2. Zero-Order Correlations, Reliability Information, and Descriptive Results of All Main Study Variables at Preintervention (Cronbach's α Pre/Post are shown in italics in the Diagonal).

	1.	2.	3.	4.	5.	6.	7.	M	SD
1. CHIME	<i>.88/.91</i>							3.12	0.65
2. A-SCB Nutrition	.04	<i>.61/.68</i>						4.69	0.62
3. A-SCB Clothing	.13	.54**	<i>.69/.73</i>					5.02	0.79
4. SCB Nutrition	.18*	.63**	.43**	<i>.73/.79</i>				3.33	0.61
5. SCB Clothing	.25**	.50**	.67**	.64**	<i>.74/.74</i>			2.90	0.70
6. Material values	-.17*	-.18*	-.25**	-.25**	-.38**	<i>.83/.87</i>		2.03	0.82
7. Well-being	.39**	-.19*	-.08	-.09	-.06	-.19*	<i>.87/.89</i>	5.50	1.90

Note. All scales were measured on a 0- to 6-point scale, except for well-being that was measured on a 0- to 10-point scale. CHIME = Comprehensive Inventory of Mindfulness Experiences; A-SCB = attitudes toward sustainable consumption behavior; SCB = sustainable consumption behavior.
* $p < .05$. ** $p < .01$.

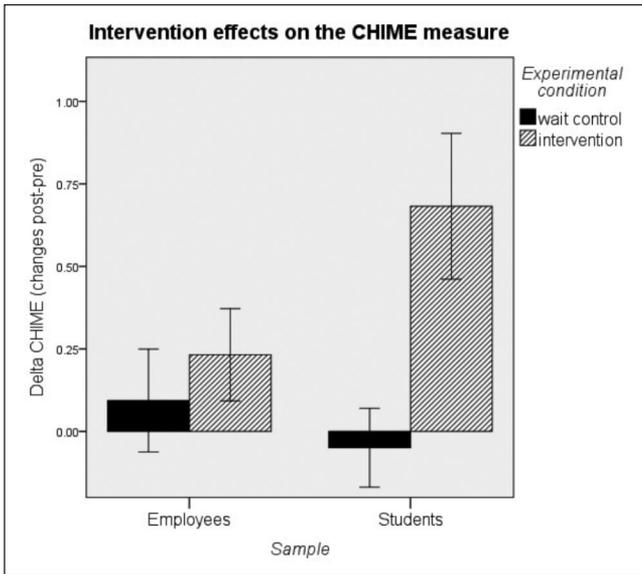


Figure 2. Training effects on the mindfulness measure (CHIME scale mean). Note. The error-bars represent the 95% confidence interval of the mean. CHIME = Comprehensive Inventory of Mindfulness Experiences.

on only few positive correlations on the facet level (see Supplementary Material, Appendix B): sustainable nutrition behavior was positively correlated with outer awareness ($r = .30, p = .001$), whereas sustainable clothing consumption was positively related to both outer awareness ($r = .31, p < .001$) and relativity ($r = .25, p = .004$). Moreover, the CHIME measure was positively related to well-being and negatively related to material values. Material values showed negative relationships with all study variables, including well-being, attitudes toward consumption behaviors, and self-reported SCB.

Direct effects of the sMBI on mindful experiences (Research Aim 1). Regarding the efficacy of the intervention to effect changes in mindfulness experiences themselves (as measured by CHIME), a two-factorial ANCOVA on the overall Δ CHIME score revealed a significant main effect for *experimental condition*, $F(1, 126) = 32.0, p < .001, \eta_p^2 = .203$ and a significant interaction effect for *Experimental Condition \times Sample* $F(1, 126) = 11.9, p = .001, \eta_p^2 = .087$ (see Figure 2). Post hoc *t*-tests on the pre-post changes in the IGs revealed that although intervention effects were bigger in the student sample, $t(25) = 6.36, p < .001, d = .98$, they were still present in the employee

sample, $t(32) = 3.40, p = .002, d = .39$, supporting Hypothesis 1. Noteworthy is that the change values in the IG ranged from -0.73 to $+2.03$, indicating strongly varying effects between participants. The mean effects stayed stable over time for the 44 persons who responded to the 7 months follow-up questionnaire—dependent t -test comparing post with follow-up data, $t(43) = 0.35, p = .73$.

Differential effects of the intervention upon individual facets of mindfulness experience were assessed by performing the same analyses upon each of the eight different CHIME subscales. Mindfulness practice caused changes in all facets except for outer awareness and insight (see Table 3). For three of the eight facets of mindfulness experience, an Experimental Condition \times Sample interaction also emerged. Post hoc t -tests revealed that for two of the facets (acceptance and decentering) the training effects were only weaker for the employee compared with the student sample, whereas they were completely absent in the employee sample for the facet acting with awareness, indicating differential intervention effects. The students also rated their own subjective success with the training more highly in comparison with the employee sample, $t(59) = 2.65, p = .01, d = .74$. As expected, none of the main effects for *sample* were significant.

In addition, participants with lower baseline scores improved most in all aspects (see right-most column in Table 2). Partial η^2 of the covariate effects ranged from .11 to .35, meaning that between 11% and 35% of changes in facets of mindfulness were predicted by the corresponding preintervention level.

Direct effects of the sMBI on SCB (Research Aim 2). To test direct effects of the sMBI on SCB, we calculated two independent ANCOVAs on $\Delta\text{SCB}_{\text{nutrition}}$ and $\Delta\text{SCB}_{\text{clothing}}$. For nutrition, there was neither a main effect of *experimental condition*, $F(1, 126) = 1.8, p = .179, \eta_p^2 = .014$, nor interaction of Experimental Condition \times Sample, $F(1, 126) = 2.59, p = .110, \eta_p^2 = .020$, indicating that the intervention did not increase sustainable nutrition behavior in any of the samples, refuting Hypothesis 2a. The preintervention levels of sustainable nutrition behavior did not have an effect on changes over time, either, $F(1, 126) = 1.51, p = .221, \eta_p^2 = .012$.

The intervention also failed to show a direct effect on sustainable clothing behavior, $F(1, 126) = 1.89, p = .172, \eta_p^2 = .015$, refuting Hypothesis 2b. For this consumption area, a small interaction effect of Experimental Condition \times Sample emerged, $F(1, 126) = 7.83, p = .006, \eta_p^2 = .059$, reflecting a counterintuitive rise of $\text{SCB}_{\text{clothing}}$ in the student control group. Here, preintervention levels had a significant effect on changes, $F(1, 126) = 16.4, p < .001, \eta_p^2 = .115$, indicating that people with lower baseline levels tended to change more ($r = -.30, p < .001$).

Table 3. Effect Sizes of Change, Main, Interaction, and Preintervention Level Effects of the Adapted Mindfulness Training on Changes in Eight Mindfulness Facets.

dV: Changes in mindful experiences and its facets	Effect sizes of change, d_{korr}	Experimental condition (intervention vs. control)				Interaction: Experimental Condition \times Sample				Covariate: preintervention levels				
		F	p	η_p^2	F	p	η_p^2	F	p	η_p^2	F	p	η_p^2	r
		Δ CHIME	E: 0.21 S: 1.10	.000	.203	32.0	.001	.087	11.9	.001	.087	12.9	.000	.109
1. Δ Acceptance	E: 0.20 S: 1.01	.000	.138	20.2	.007	.057	7.6	.007	.057	14.8	.000	.106	-.38**	
2. Δ Decentering	E: 0.09 S: 0.93	.000	.144	17.9	.009	.054	7.1	.009	.054	19.8	.000	.144	-.40**	
3. Δ Acting with awareness	E: -.07 S: 0.67	.000	.079	10.9	.009	.053	7.0	.009	.053	19.1	.000	.131	-.40**	
4. Δ Inner awareness	E: 0.27 S: 0.68	.002	.072	9.7	.085	.023	3.0	.085	.023	20.2	.000	.138	-.40**	
5. Δ Outer awareness	E: 0.27 S: 0.25	.033	.036	4.7	.600	.002	<1	.600	.002	33.2	.000	.208	-.46**	
6. Δ Openness	E: 0.29 S: 0.67	.001	.084	11.6	.242	.011	1.38	.242	.011	52.0	.000	.292	-.52**	
7. Δ Relativity	E: 0.20 S: 0.62	.005	.060	8.1	.160	.016	2.0	.160	.016	45.0	.000	.263	-.52**	
8. Δ Insight	E: -.01 S: 0.71	.038	.034	4.4	.017	.044	5.8	.017	.044	51.7	.000	.288	-.53**	

Note. Effect sizes d_{korr} following Klauer (2001) for mean changes over time between groups are given separately for each sample. CHIME = Comprehensive Inventory of Mindfulness Experiences; E = employees, S = students. Significant effects ($p < .01$) are printed in bold. * $p < .05$. ** $p < .01$.

Table 4. Comparison of Correlation Coefficients Between Attitudes and Corresponding Behaviors by Condition and Measurement Points in Time.

	Nutrition		Clothing consumption	
	Pre	Post	Pre	Post
Control group ($n = 73$)	.56**	.56**	.67**	.49**
Intervention group ($n = 58$)	.72**	.62**	.68**	.61**
Fisher's z	1.53	.51	.10	.96
p	.064	.304	.459	.169

For the follow-up data of the remaining participants ($n = 44$), a trend in both consumption areas emerged, reflecting a slight increase of SCB in both consumption fields, nutrition: $t(43) = 2.46, p = .018, d = .18$; clothing: $t(43) = 2.64, p = .012, d = .19$.

Moderation effects of the sMBI: reduction of the attitude–behavior gap (Research Aim 3). As a first step before approaching the attitude–behavior gap, we checked for changes in attitudes. Just as the behavioral measures, overall attitude measures did not change in either consumption fields (all F -values < 1), whereas descriptive results reflect very strong positive attitudes from the outset (see Table 2, $m = 4.69/5.02$ on a possible maximum of 6).

To test the moderation hypothesis across participants, correlation coefficients reflecting the congruence of attitude and corresponding behavior between participants were compared using Fisher's z . As can be seen in Table 4, there were no significant differences between the two groups, at any point in time. Correlations coefficients of both groups did not differ after intervention, neither in the area of nutrition ($z = .51, p = .30$), refuting Hypothesis 3a, nor in the area of sustainable clothing ($z = .96, p = .17$), refuting Hypothesis 3b. If changed at all, correlation coefficients declined in the IG in both cases. To check changes in *intraindividual* discrepancy between attitudes and behavior, a new *intraindividual* “discrepancy measure” ($ABD = A\text{-SCB} - \text{SCB}$) was computed as the difference between attitudes and behaviors. A 2×2 ANCOVA on the delta values of this measure ($\Delta ABD = ABD_{\text{post}} - ABD_{\text{pre}}$) revealed no significant reduction for the nutrition related attitude–behavior gap, as neither a significant effect for *experimental condition* ($F < 1$) nor an interaction *Experimental Condition* \times *Sample* ($F < 1$) occurred. For the clothing-related attitude–behavior-gap, the main effect of *experimental condition*, $F(1, 126) = 3.33, p = .07, \eta_p^2 = .026$, failed to reach significance, so did the interaction effect *Experimental Condition* \times *Sample*, $F(1, 126) = 4.41, p = .04, \eta_p^2 = .034$.

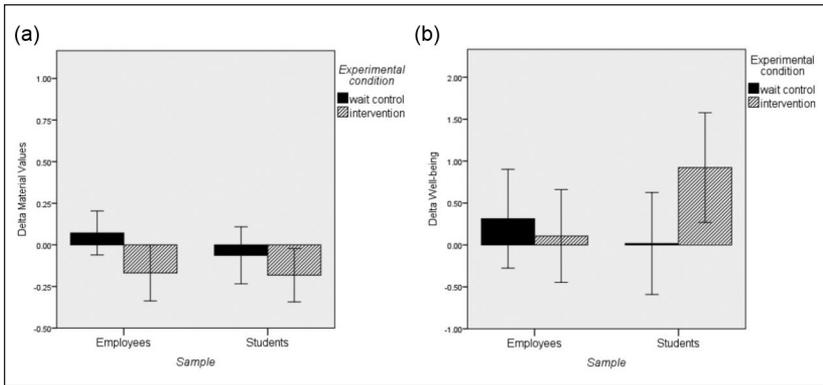


Figure 3. Training effects on materialism and well-being: (a) intervention effects on material values and (b) intervention effects on well-being.

Note. Well-being was measured on an 11-point scale as opposed to a 7-point scale of all other measurements, the error-bars represent the 95% confidence interval of the mean.

Effects of the sMBI on two potential mediators: well-being and material values (Research Aim 4). To test for effects of the training on subjective well-being, an ANCOVA on ΔWB was run. The main effect of *experimental condition*, $F(1, 126) = 3.13, p = .08, \eta_p^2 = .024$, failed to reach significance, accompanied by an interaction effect of *Experimental Condition* \times *Sample*, $F(1, 126) = 6.16, p = .014, \eta_p^2 = .047$. Post hoc *t*-tests comparing pre- to postmeasurement levels within the respective IGs only, revealed that well-being only increased for the student sample, $t(26) = 2.90, p = .008, d = .48$, but not for the employee sample— $t(32) = 0.39, p = .70, d = .06$; see Figure 3b—only partially supporting Hypothesis 4a. The preintervention level of well-being had a strong effect on the changes over the course of the training, $F(1, 126) = 25.28, p < .0001, \eta_p^2 = .167$, again showing that people with a relative low subjective well-being at baseline increased more at second measurement ($r = -.38, p < .001$).

For material values, the main effect of *experimental condition* just failed to reach statistical significance, $F(1, 126) = 5.78, p = .018, \eta_p^2 = .044$. The absence of an interaction effect ($F < 1$) indicates that the tendency for a decline in material values was comparably small across samples ($d = .22$ for employees and $d = .21$ for students, see Figure 3a), only tentatively suggesting support for Hypothesis 4b. *Preintervention levels* of material values, $F(1, 126) = 8.23, p < .005, \eta_p^2 = .061$, had an additional effect, reflecting that participants with stronger materialistic values changed most over time ($r = -.24, p < .005$).

As not all participants seem to have benefited equally from the intervention (see the large range of changes in mindful experiences), we ran an additional analysis to test the particular effects of increases in mindful experience rather than looking at the intervention in general. Two mediation analyses on changes in each SCB with changes in mindful experiences as the predictor, and changes in well-being and material values as parallel mediators were conducted, using delta values of all five variables. Results of the regressions are depicted in Figure 1b. Neither of the two indirect effects for either outcome (sustainable nutrition or clothing consumption) were significant, as the confidence interval for the indirect effect for sustainable nutrition via well-being included the 0 ($a \times b = .056$, $LLCI_{2.5\%} = -.007$, $ULCI_{97.5\%} = .146$) and so did the confidence interval of the material values effect ($a \times b = .011$, $LLCI_{2.5\%} = -.025$, $ULCI_{97.5\%} = .066$). The picture for sustainable clothing consumption was similar: the indirect effect of well-being was not significant ($a \times b = -.018$, $LLCI_{2.5\%} = -.066$, $ULCI_{97.5\%} = .034$), and neither was the indirect effect of material values ($a \times b = .005$, $LLCI_{2.5\%} = -.009$, $ULCI_{97.5\%} = .053$).

Discussion

The baseline cross-sectional findings of our study are fully in line with previous research revealing small, positive relationships between measures of mindfulness and SCB in the fields of nutrition and clothing. In agreement with recent studies (Barbaro & Pickett, 2015; Geiger, Otto, & Schrader, 2018; Hunecke & Richter, 2018), these relationships hinge mainly upon the mindfulness facets of inner and outer awareness and relativity of perception (see Appendix B). Unlike studies using the MAAS (Brown & Kasser, 2005; Panno et al., 2017), our cross-sectional analysis did not reveal a positive relationship with perceived attentiveness in everyday life and SCB, neither did the subscale acceptance correlate with either SCB measures. These cross-sectional findings suggest that only particular characteristics of mindfulness are positively related to SCBs, a conclusion also stressed by Hunecke and Richter (2018) and Geiger, Grossman, and Schrader (2018). In accordance with former research, the cross-sectional data also evidenced negative relationships of material values with all other study variables. We found small negative relationships with mindful experiences (as e.g., Brown & Kasser, 2005), subjective well-being (as e.g., Dittmar et al., 2014), and both SCBs (as e.g., Hurst et al., 2013; Pepper et al., 2009).

Regarding our prospective study, we found that our sMBI elicited increases in almost all facets of mindfulness with the exception of “outer awareness” and “insight,” both aspects that are cross-sectionally related to SCBs. As the

main mindfulness meditation exercises (breathing, body scan) in the training were focused on inner awareness, outer awareness might be an indirect consequence not directly triggered by those exercises and the sMBI. Likewise, the insight facet, operationalized as an equanimous, self-compassionate attitude toward one's own slips and failures, can be seen as an effect that may only very gradually develop at a later point in time, once core facets such as "acceptance" and "decentering from one's own experiences" have been cultivated.

Although the intervention was, in general, effective at enhancing mindfulness experiences, the sMBI did not show any direct effects on either attitudes or self-reported behaviors in either of the two consumption areas. These results cast substantial doubt regarding causal inferences drawn from earlier cross-sectional findings, but point to a common third set of factors. In the field of mindfulness and SCB, one such factor might be the inclination to lead a less materialistic lifestyle, which may go hand in hand both with a propensity to meditate and to act more sustainably.

As neither self-reported behavior nor attitude changed overall, it comes as no surprise that the mindfulness training did not lead to a greater concordance between sustainable consumption-related attitudes and self-reported behaviors. A reduction of the attitude-behavior gap was neither found across participants, which would have been expressed as a stronger cross-sectional relationship between attitude and behavior at the end of the intervention, nor within participants, expressed as a reduced *intraindividual* discrepancy score.

In line with recent applications of Campbell's probabilistic paradigm in attitude research (Kaiser, Byrka, & Hartig, 2010), mean values of attitude measures were substantially higher than mean values of behavioral measures at both measurements points in time. According to Campbell's paradigm, a certain item assessing attitude is simply easier to endorse than the enactment of the corresponding behavior. Given this assumption, attempting to reduce the attitude-behavior gap is a futile endeavor. However, this may not apply to behavioral *intentions*, as Chatzisarantis and Hagger (2007) and Ruffault et al. (2016) evidenced moderation effects of trait mindfulness on the intention-behavior relationship. Unlike the latter (nonexperimental) studies, we did not recruit participants that had formed an explicit intention to change the behavior in question (SCB in our case), and our samples participated in the course for other reasons (for stress reduction, or to increase general awareness). As intentions have been found to be a central predictor of behavior change in other domains (e.g., health; Schwarzer, 2008), it remains an open question to what extent we would have found effects if we had specifically chosen participants who explicitly expressed intentions to live more sustainably in the future.

Another possible explanation for the lack of effects of the sMBI on SCB is that the intervention may have been too brief or the changes in the relevant mindfulness facets too insubstantial to evoke detectable behavioral change. Considering how long it takes to form consumption habits, it might be overly optimistic to assume they can be changed within a 2-month time frame. The follow-up observational results, which did suggest slight increases in SCBs 7 months after completion of the training, provide some very preliminary support for a more gradual influence of mindfulness.

However, a potentially promising finding of this study is that the intervention triggered small changes in the behavior-distal variable of material values, although this effect narrowly missed statistical significance criterion of $p < .01$. Given the exploratory and pioneering nature of this study, this finding seems worthy of cautious consideration. As these changes were unrelated to changes in the mindfulness measure (see mediation results Figure 1b), they are likely to have been evoked by other characteristics of the course, for example, the reflections on needs and desires.

Changes in well-being, however, were substantially related to changes in the mindfulness measure (see Figure 1b), in agreement with numerous studies on the positive effects of mindfulness programs on subjective well-being (Brown & Ryan, 2003; Eberth & Sedlmeier, 2012; Grossman et al., 2004). Taken together, our results only partially corroborate Ericson et al.'s (2014) mediation model. Whereas mindfulness practice and respective changes in mindful experiences were directly related to increased well-being, and the sustainability adaptations in the course may have triggered a re-evaluation of material values, these effects did not translate into detectable behavior change, despite all the correlational evidence from numerous cross-sectional relations. This could indicate a lack of causality of reported relationships, intervention and evaluation times that were too short in our study to cause SCB changes, or the nature of our dependent variables that may be less affected by material values and well-being than other behaviors, such as for example, conspicuous or compensatory consumption related to status symbols.

In general, effects tended to be stronger among the student sample compared with the employee group. Various factors may account for those differences: Besides the obvious age differences, the recruitment procedure, study setting, and mindfulness trainers also differed between samples. Students actively responded to program announcements and had to enroll themselves in the course with no further incentive other than a free course participation, ensuring a certain level of intrinsic motivation. In addition, students were not familiar with the other participants or the facilities before participating. The employees were recruited by the human resources staff of the partner companies of the study and took part in the training with already known colleagues.

Also, the training took place in a familiar company room, perhaps missing the feeling of “being away from it all,” shown to be beneficial for restoration effects (Kaplan, 2001). A certain sense of obligation toward the company cannot be ruled out as an influencing factor either. In addition, the mindfulness trainer of the employee groups reported that it was difficult to guarantee absolute confidentiality with regard to personal matters and that employees may have been more reserved as a result. Importantly, these differences between student and employee samples point to the challenges of offering and evaluating MBIs among differing populations within varying real life contexts.

Limitations of the Current Study and Future Recommendations

One drawback of our study is the questionable external validity of self-reported questionnaire data on SCB. Even if social desirability might not be too much of an issue in sustainability-related surveys (see Milfont, 2009), it appears to be difficult for people to accurately assess frequencies of their own behavior. For example, market shares of sustainable products often do not correspond to survey data on self-reported behavior (for the case of sustainable fashion, see Geiger & Keller, 2017). Future studies using experience sampling or online shopping histories would offer significant methodological improvement. Further insights regarding our own study are expected from the 25 qualitative in-depth interviews that were conducted with a subsample of our study participants; these will be reported elsewhere.

Another limitation of our investigation is the issue of multiple testing that we employed due to the exploratory nature of our study. In light of multiple tests, only highly significant results ($p < .01$) should be interpreted as solid evidence. Borderline significant results (e.g., the changes in material values or cross-sectional correlations) may be cautiously taken as preliminary evidence to indicate potential for future research. Also, measurement scales should assure an appropriate time frame for detecting change. In the case of the well-being measure, the time frame of 4 weeks used in the instruction (in alignment with a European wide survey, Statistische Ämter des Bundes und der Länder, 2018) might have been too long to detect the true effect size of changes in well-being.

Another limiting factor concerns the specificity of our different samples that have participated under particular circumstances potentially affecting the outcome, which makes it difficult to draw solid conclusions about the differential efficacy of MBIs in our different groups. For further studies, we recommend limiting the target population to one specific group (and setting) and expanding the sample size to allow for greater power and more elaborate (e.g., latent) statistical analytical procedures.

In light of the absence of an effect of the sMBI upon SCB and its inability to reduce the attitude–behavior gap, we recommend that future studies investigating mindfulness and aspects of sustainability venture more strongly beyond the self-referentially focused aspects of MBSR and deliberately address the ethical foundations of mindfulness practice. One such approach, which addresses behavior change in line with personal values and could thus inspire an explicitly sustainability-related mindfulness training, is acceptance and commitment therapy (Hayes, 2016). Furthermore, in the future, it may be worthwhile to consider other outcome variables that closely relate to material values (e.g., quantitative levels of consumer goods, conspicuous or compensatory consumption associated with status symbols).

Based on the findings and limitations of this study, we recommend that future sustainability-adapted MBIs take into account the following design principles:

- Promote the intention of developing more sustainable lifestyles;
- Provide a stronger focus on awareness of aspects beyond one’s own personal interests, that is, cultivation of an awareness of the environment, other people and animals that is infused by values of kindness and nonharm (e.g., through intensified mindfulness exercises on sensory experience or social interaction);
- Integrate the ethical dimensions related to cultivating mindfulness more prominently;
- Employ natural settings or objects of contemplation directly relevant to sustainability (see Lymeus et al., 2018);
- Deliver the longer, standard MBSR length of 2.5 hr for individual sessions;
- Introduce additional training sessions to yield an overall course length of 10 to 12 weeks (see Kok & Singer, 2016);
- Provide more guidance in the postintervention phase as to how participants may expand their mindfulness practice into everyday life.

Conclusion

This exploratory, prospective investigation of a sustainability-adapted MBI provides some initial indications that the cultivation of mindfulness may influence variables distally related to SCB. Overall, however, our study could not evidence direct behavior changes in SCB as a result of participation in mindfulness training. The small and mixed effects on material values and well-being suggest indirect benefits of mindfulness for changing individual lifestyles toward greater sustainability, which we believe are sufficient to

justify further efforts to develop, refine, and test the efficacy of sMBI for SCB. This study was a first, maybe too ambitious attempt. Future efforts may do well to place greater emphasis on the inherent relationships between mindfulness and ethical values of benevolent and on nonavaricious relationships to others and to the natural world. Also, subsequent studies could examine effects of mindfulness trainings that span a substantially longer period of time and evaluation than the present investigation. Finally, changes in values are possibly a promising way toward creating a more sustainable world in a lasting and profound manner, and development of mindfulness, proposed as one possible antidote to greed, aversion, and delusion, may provide a plausible vehicle toward that purpose.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This research was funded under social ecological research scheme (SÖF) of the German Federal Ministry for Education and Research, research grant number 014UT1416.

ORCID iDs

Sonja M. Geiger  <https://orcid.org/0000-0003-4821-5214>

Daniel Fischer  <https://orcid.org/0000-0001-5691-0087>

Supplemental Material

Supplemental material for this article is available online.

References

- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50, 179-211. doi:10.1016/0749-5978(91)90020-T
- Analayo. (2007). *Sati in den Pali Lehrreden* [Sati in the Pali lectures]. München, Germany: Buddhistische Gesellschaft München e.V.
- Baer, R. A., Smith, G. T., Hopkins, J., Krietemeyer, J., & Toney, L. (2006). Using self-report assessment methods to explore facets of mindfulness. *Assessment*, 13, 27-45. doi:10.1177/1073191105283504
- Barbaro, N., & Pickett, S. M. (2015). Mindfully green: Examining the effect of connectedness to nature on the relationship between mindfulness and engagement in pro-environmental behavior. *Personality and Individual Differences*, 93, 137-142. doi:10.1016/j.paid.2015.05.026

- Bergomi, C., Tschacher, W., & Kupper, Z. (2013). The Assessment of mindfulness with self-report measures: Existing scales and open issues. *Mindfulness, 4*, 191-202.
- Bergomi, C., Tschacher, W., & Kupper, Z. (2014). Konstruktion und erste Validierung eines Fragebogens zur umfassenden Erfassung von Achtsamkeit. [Construction and first validation of a scale for the comprehensive assessment of mindfulness]. *Diagnostica, 60*, 111-125. doi:10.1026/0012-1924/a000109
- Bilharz, M., & Schmitt, K. (2011). Going big with big matters. The key points approach to sustainable consumption. *Gaia, 20*, 232-235.
- Bishop, S. R. (2004). Mindfulness: A proposed operational definition. *Clinical Psychology: Science and Practice, 11*, 230-241. doi:10.1093/clipsy/bph077
- BMUB UBA (2017). *Umweltbewusstsein in Deutschland 2016* [Environmental awareness in Germany]. Retrieved from <https://www.umweltbundesamt.de/publikationen/umweltbewusstsein-in-deutschland-2016>
- Böhme, T., Geiger, S. M., Grossman, P., Stanzus, L., & Schrader, U. (2016). *Arbeitsdefinition von Achtsamkeit im Projekt BiNKA* [Working definition of mindfulness in the BiNKA project] (Technical paper). Berlin, Germany: Technische Universität.
- Brown, K. W., & Kasser, T. (2005). Are psychological and ecological well-being compatible? The role of values, mindfulness, and lifestyle. *Social Indicators Research, 74*, 349-368. doi:10.1007/s11205-004-8207-8
- Brown, K. W., Kasser, T., Ryan, R. M., Linley, A. P., & Orzech, K. (2009). When what one has is enough: Mindfulness, financial desire discrepancy, and subjective well-being. *Journal of Research in Personality, 43*, 727-736. doi:10.1016/j.jrp.2009.07.002
- Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: Mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology, 84*, 822-848. doi:10.1037/0022-3514.84.4.822
- Carmody, J., & Baer, R. A. (2008). Relationships between mindfulness practice and levels of mindfulness, medical and psychological symptoms and well-being in a mindfulness-based stress reduction program. *Journal of Behavioral Medicine, 31*, 23-33. doi:10.1007/s10865-007-9130-7
- Chatzisarantis, N., & Hagger, M. (2007). Mindfulness and the intention-behavior relationship within the theory of planned behavior. *Personality and Social Psychology Bulletin, 33*, 663-676. doi:10.1177/0146167206297401
- Condon, P. (2017). Mindfulness, compassion and pro-social behavior. In J. C. Karremans & E. K. Papies (Eds.), *Current issues in social psychology. Mindfulness in social psychology* (pp. 124-138). London, England: Routledge.
- Corral Verdugo, V. (2012). The positive psychology of sustainability. *Environment, Development and Sustainability, 14*, 651-666. doi:10.1007/s10668-012-9346-8
- Davidson, R. J., & Kaszniak, A. W. (2015). Conceptual and methodological issues in research on mindfulness and meditation. *The American Psychologist, 70*, 581-592. doi:10.1037/a0039512

- Diener, E., Lucas, R. E., & Scollon, C. N. (2006). Beyond the hedonic treadmill: Revising the adaptation theory of well-being. *The American Psychologist, 61*, 305-314. doi:10.1037/0003-066X.61.4.305
- Dittmar, H., Bond, R., Hurst, M., & Kasser, T. (2014). The relationship between materialism and personal well-being: A meta-analysis. *Journal of Personality and Social Psychology, 107*, 879-924. doi:10.1037/a0037409
- Eberth, J., & Sedlmeier, P. (2012). The effects of mindfulness meditation: A meta-analysis. *Mindfulness, 3*, 174-189. doi:10.1007/s12671-012-0101-x
- Eid, M., Gollwitzer, M., & Schmitt, M. (2017). *Statistik und Forschungsmethoden: Mit Online-Materialien* [Statistics and research methods]. Weinheim, Germany: Beltz.
- Engel, J. F., Blackwell, R. D., & Miniard, P. W. (1990). *Consumer behavior* (6th ed.). Chicago, IL: Dryden Press.
- European Environment Agency. (2013). *Environmental pressures from European consumption and production. A Study in Integrated Environmental and Economic Analysis* (Technical Report No. 2/2013). Copenhagen, Denmark: Author.
- Ericson, T., Kjønstad, B. G., & Barstad, A. (2014). Mindfulness and sustainability. *Ecological Economics, 104*, 73-79. doi:10.1016/j.ecolecon.2014.04.007
- Eurobarometer. (2014). *Attitudes of European citizens toward the environment*. European Commission, Directorate-General for the Environment. Retrieved from https://ec.europa.eu/commfrontoffice/publicopinion/archives/ebs/ebs_295_en.pdf
- Fischer, D. (2017). *Relevante konsumpädagogische Formate für die Entwicklung eines konsumspezifischen Achtsamkeitstrainings* [Relevant educational formats for sustainable consumption for the development of a consumption specific mindfulness training] (Technical Report). Berlin, Germany: Technische Universität. Retrieved from http://achtsamkeit-und-konsum.de/wp-content/uploads/2017/06/2016_Fischer_RelevanteKonsumformate.pdf
- Fischer, D., Stanzus, L., Geiger, S. M., Grossman, P., & Schrader, U. (2017). Mindfulness and sustainable consumption: A systematic literature review of research approaches and findings. *Journal of Cleaner Production, 162*, 544-558. doi:10.1016/j.jclepro.2017.06.007
- Geiger, S. M., Fischer, D., & Schrader, U. (2017). Measuring what matters in sustainable consumption: An integrative framework for the selection of relevant behaviors. *Sustainable Development, 26*, 18-33. doi:10.1002/sd.1688
- Geiger, S. M., Grossman, P., & Schrader, U. (2018). Mindfulness and sustainability: Correlation or Causation? *Current Opinion in Psychology, 28*, 23-27. doi:10.1016/j.copsyc.2018.09.010
- Geiger, S. M., & Keller, J. (2017). Shopping for clothes and sensitivity for the suffering of others: The role of compassion and values in sustainable fashion consumption. *Environment and Behavior, 50*, 1119-1144. doi:10.1177/0013916517732109
- Geiger, S. M., Otto, S., & Schrader, U. (2018). Mindfully green and healthy: An indirect path from mindfulness to ecological behavior. *Frontiers of Psychology: Environmental Psychology, 8*, Article 2306. doi:10.3389/fpsyg.2017.02306

- Grossman, P. (2011). Defining mindfulness by how poorly I think I pay attention during everyday awareness and other intractable problems for psychology's (re)invention of mindfulness: Comment on Brown et al. (2011). *Psychological Assessment, 23*, 1034-1040. doi:10.1037/a0022713
- Grossman, P. (2015). Mindfulness: Awareness informed by an embodied ethic. *Mindfulness, 6*, 17-22. doi:10.1007/s12671-014-0372-5
- Grossman, P., Niemann, L., Schmidt, S., & Walach, H. (2004). Mindfulness-based stress reduction and health benefits: A meta-analysis. *Journal of Psychosomatic Research, 57*, 35-43. doi:10.1016/S0022-3999(03)00573-7
- Hayes, A. F. (2012). *SPSS PROCESS documentation*. Retrieved from <http://www.afhayes.com>
- Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis*. New York, NY: Guilford Press.
- Hayes, S. C. (2016). Acceptance and commitment therapy, relational frame theory, and the third wave of behavioral and cognitive therapies [Republished Article]. *Behavior Therapy, 47*, 869-885. doi:10.1016/j.beth.2016.11.006
- Howell, A. J., Digidon, N. L., Buro, K., & Sheptycki, A. R. (2008). Relations among mindfulness, well-being, and sleep. *Personality and Individual Differences, 45*, 773-777. doi:10.1016/j.paid.2008.08.005
- Hunecke, M., & Richter, N. (2018). Mindfulness, construction of meaning, and sustainable food consumption. *Mindfulness, 111*, 1140. doi:10.1007/s12671-018-0986-0
- Hurst, M., Dittmar, H., Bond, R., & Kasser, T. (2013). The relationship between materialistic values and environmental attitudes and behaviors: A meta-analysis. *Journal of Environmental Psychology, 36*, 257-269. doi:10.1016/j.jenvp.2013.09.003
- Hyland, T. (2017). McDonaldizing spirituality: Mindfulness, education, and consumerism. *Journal of Transformative Education, 15*, 334-356. doi:10.1177/1541344617696972
- Kabat-Zinn, J. (1991). *Full catastrophe living: Using the wisdom of your body and mind to face stress, pain, and illness*. New York, NY: Dell Publishing.
- Kaiser, F. G., Byrka, K., & Hartig, T. (2010). Reviving Campbell's paradigm for attitude research. *Personality and Social Psychology Review, 14*, 351-367. doi:10.1177/1088868310366452
- Kaiser, F. G., & Wilson, M. (2004). Goal-directed conservation behavior: The specific composition of a general performance. *Personality and Individual Differences, 36*, 1531-1544. doi:10.1016/j.paid.2003.06.003
- Kaplan, S. (2001). Meditation, restoration, and the management of mental fatigue. *Environment and Behavior, 33*, 480-506. doi:10.1177/00139160121973106
- Kasser, T. (2017). Living both well and sustainably: A review of the literature, with some reflections on future research, interventions and policy. *Philosophical Transactions, Series A: Mathematical, Physical, and Engineering Sciences, 375*, 20160369. doi:10.1098/rsta.2016.0369
- Kasser, T., Rosenblum, K. L., Sameroff, A. J., Deci, E. L., Niemiec, C. P., Ryan, R. M., . . . Hawks, S. (2014). Changes in materialism, changes in psychological

- well-being: Evidence from three longitudinal studies and an intervention experiment. *Motivation and Emotion*, 38(1), 1-22. doi:10.1007/s11031-013-9371-4
- Kilbourne, W., & Pickett, G. (2008). How materialism affects environmental beliefs, concern, and environmentally responsible behavior. *Journal of Business Research*, 61, 885-893. doi:10.1016/j.jbusres.2007.09.016
- Klauer, K. J. (2001). *Handbuch kognitives Training* [Handbook Cognitive Training]. Göttingen, Germany: Hogrefe.
- Kok, B. E., & Singer, T. (2016). Phenomenological fingerprints of four meditations: Differential state changes in affect, mind-wandering, meta-cognition, and interoception before and after daily practice across 9 months of training. *Mindfulness*, 8, 218-231. doi:10.1007/s12671-016-0594-9
- Leach, M. A., Raworth, K., & Rockström, J. (2013). Between social and planetary boundaries: Navigating pathways in the safe and just space for humanity. In International Social Science Council (ISSC) & United Nations Educational, Scientific and Cultural Organization (UNESCO) (Eds.), *World social science report 2013: Changing global environments* (pp. 84-89). Paris, France: OECD Publishing and UNESCO Publishing.
- Lymeus, F., Lindberg, P., & Hartig, T. (2018). Building mindfulness bottom-up: Meditation in natural settings supports open monitoring and attention restoration. *Consciousness and Cognition*, 59, 40-56. doi:10.1016/j.concog.2018.01.008
- Malinowski, P. (2013). Neural mechanisms of attentional control in mindfulness meditation. *Frontiers in Neuroscience*, 7, Article 8. doi:10.3389/fnins.2013.00008
- Milfont, T. L. (2009). The effects of social desirability on self-reported environmental attitudes and ecological behaviour. *The Environmentalist*, 29, 263-269. doi:10.1007/s10669-008-9192-2
- Müller, A., Smits, D. J. M., Claes, L., Gefeller, O., Hinz, A., & de Zwaan, M. (2013). The German version of the Material Values Scale. *Psycho-Social Medicine*, 10, 2-9. doi:10.3205/psm000095
- O'Brien, C. (2008). Sustainable happiness: How happiness studies can contribute to a more sustainable future. *Canadian Psychology/Psychologie Canadienne*, 49, 289-295. doi:10.1037/a0013235
- Organisation for Economic Co-operation and Development. (2013). *OECD guidelines on measuring subjective well-being*. Paris, France: OECD Publishing. Retrieved from <http://site.ebrary.com/lib/alltitles/docDetail.action?docID=10694083>
- Panno, A., Giacomantonio, M., Carrus, G., Maricchiolo, F., Pirchio, S., & Mannetti, L. (2017). Mindfulness, pro-environmental behavior, and belief in climate change: The mediating role of social dominance. *Environment and Behavior*, 50, 864-888. doi:10.1177/0013916517718887
- Pepper, M., Jackson, T., & Uzzell, D. (2009). An examination of the values that motivate socially conscious and frugal consumer behaviours. *International Journal of Consumer Studies*, 33, 126-136. doi:10.1111/j.1470-6431.2009.00753.x
- Rau, H. K., & Williams, P. G. (2016). Dispositional mindfulness: A critical review of construct validation research. *Personality and Individual Differences*, 93, 32-43. doi:10.1016/j.paid.2015.09.035

- Richins, M. L. (2004). The material values scale: Measurement properties and development of a short form. *Journal of Consumer Research*, *31*, 209-219. doi:10.1086/383436
- Richins, M. L., & Dawson, S. (1992). A consumer values orientation for materialism and its measurement: Scale development and validation. *Journal of Consumer Research*, *19*, 303. doi:10.1086/209304
- Rosenberg, E. L. (2004). Mindfulness and consumerism. In T. Kasser & A. D. Kanner (Eds.), *Psychology and consumer culture: The struggle for a good life in a materialistic world* (1st ed., pp. 107-125). Washington, DC: American Psychological Association.
- Ruffault, A., Bernier, M., Juge, N., & Fournier, J. F. (2016). Mindfulness may moderate the relationship between intrinsic motivation and physical activity: A cross-sectional study. *Mindfulness*, *7*, 445-452. doi:10.1007/s12671-015-0467-7
- Schindler, S., Pfattheicher, S., & Reinhard, M.-A. (2019). Potential negative consequences of mindfulness in the moral domain. *European Journal of Social Psychology*, *49*, 1055-1069. doi:10.1002/ejsp.2570
- Sheeran, P., & Webb, T. L. (2016). The Intention-Behavior Gap. *Social and Personality Psychology Compass*, *10*(9), 503-518. doi:10.1111/spc3.12265
- Schwarzer, R. (2008). Modeling health behavior change: How to predict and modify the adoption and maintenance of health behaviors. *Applied Psychology*, *57*(1), 1-29. doi:10.1111/j.1464-0597.2007.00325.x
- Solomon, M. R. (2006). *Consumer behaviour: A European perspective* (3rd ed.). Harlow, UK; New York, NY: Financial Times/Prentice Hall.
- Spencer, S. J., Zanna, M. P., & Fong, G. T. (2005). Establishing a causal chain: Why experiments are often more effective than mediational analyses in examining psychological processes. *Journal of Personality and Social Psychology*, *89*, 845-851. doi:10.1037/0022-3514.89.6.845
- Stanszus, L., Fischer, D., Böhme, T., Frank, P., Fritzsche, J., Geiger, S. M., . . . Schrader, U. (2017). Education for sustainable consumption through mindfulness training: Development of a consumption-specific intervention. *Journal of Teacher Education for Sustainability*, *19*, 5-21. doi:10.1515/jtes-2017-0001
- Statistische Ämter des Bundes und der Länder. (2018). *Leben in Europa 2018 Personenfragebogen* [Life in Europe 2018. Questionnaire]. Retrieved from https://www.statistik.sachsen.de/download/Erhebungsboegen/2A_EUSILC_PFB.pdf
- Tang, Y.-Y., Hölzel, B. K., & Posner, M. I. (2015). The neuroscience of mindfulness meditation. *Nature Reviews. Neuroscience*, *16*, 213-225. doi:10.1038/nrn3916
- United Nations. (2018). *The sustainable development goals report 2018*. New York, NY: Author. Retrieved from <https://unstats.un.org/sdgs/files/report/2018/TheSustainableDevelopmentGoalsReport2018-EN.pdf>
- World Commission on Environment and Development. (1987). *Our common future*. New York, NY: Oxford University Press.

Author Biographies

Sonja M. Geiger is an environmental psychologist working in research projects at the Technische Universität Berlin that look into the determinants of sustainable consumption behavior. Before returning to the scientific exploration of sustainability issues, she has worked for an international environmental association in Latin America. She is especially interested in the interplay between normative, cognitive, and emotional determinants of sustainable behavior.

Daniel Fischer is assistant professor at the School of Sustainability at Arizona State University in the United States and guest professor at Leuphana University Lueneburg in Germany. Trained in education science, his research examines how sustainable consumption can be promoted through communication and learning in ways that increase reflexivity in learners and – in an educational tradition – help them reshape their relations to the consumer societies that they have been born, encultured, and socialized into in the industrialized world.

Ulf Schrader holds the chair of Economic Education and Sustainable Consumption and has been serving as the director of the School of Education at Technische Universität Berlin from 2016 on. Besides his teaching, he has been leading numerous research projects in the fields of sustainable consumption, corporate social responsibility, consumer education and vocational orientation.

Paul Grossman is the Director of the European Center for Mindfulness, an institute dedicated to deepening an understanding of Buddhist psychology and mindfulness in Western culture, society and science, as well as training MBSR teachers. Educated as a research psychologist to explore convergences of psychological and physiological processes, Dr. Grossman is emeritus Research Director of the University Hospital Basel Department of Psychosomatic Medicine, Basel, Switzerland. There, over many years, he examined the benefits of mindfulness-based programs among patients with serious disease and investigated psychophysiological aspects of illness and health.