



How does mindfulness relate to sustainable attitude and behavior? The role of possible mediators

Petra Jansen¹ · Martina Rahe² · Fabian Wolff²

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Abstract

The study's primary goal is to investigate the relationship between different aspects of mindfulness which were carved out by a systematic literature review on sustainability through possible mediators. The relationship between different aspects of mindfulness (acceptance, acting with awareness, decentering, inner awareness, outer awareness, insight) and sustainable attitudes and behavior under the consideration of mediating variables (congruence of attitudes and behavior, values, well-being, connectedness to nature, disruption of routines, pro-socialness) was investigated in 337 participants. The results showed the diverse relation of mindfulness to sustainable attitude and behavior. In a mediation model, sustainable attitude and sustainable behavior were positively predicted by outer awareness and insight via connectedness to nature. Moreover, sustainable attitude and behavior were positively predicted by inner awareness, outer awareness, and insight via pro-socialness. There were no direct effects from any other aspect of mindfulness on sustainable attitude or behavior. Our study hints that connectedness to nature and pro-socialness are the relevant mediators between mindfulness (awareness and insight) and sustainable attitude and behavior. However, further intervention studies should test whether these mindfulness aspects are the most important for changing sustainable attitudes and behaviors.

Keywords Mindfulness · Sustainable attitudes · And behavior · Well-being · Pro-socialness · Connectedness to nature

Introduction

The progressing ecological crisis emphasizes the issue of sustainability, the use of resources in a way that the earth's capacity is not exceeded (European Commission - Environment, 2016). Recently it has been acknowledged that an inner transformation, is relevant to reaching a transition towards more sustainability, towards an outer transformation (Woiwode et al., 2021). Mindfulness is discussed as one crucial factor of inner transformation by which a more sustainable consumption behavior can be achieved (Wamsler et al., 2018). This paper's primary goal is to study the relationship between different mechanism of dispositional mindfulness on the one hand and sustainable attitudes and behaviors on the other through six potential mediators identified

from a literature review of publications in mindfulness and sustainability.

The role of mindfulness

In the Western view, mindfulness does not have a uniform definition; in a rough classification, mindfulness can be understood as a specific (meditation) practice or an essential attitude towards certain things, called dispositional mindfulness. Dispositional mindfulness can be described as the ability of a person to be aware of the present moment nonjudgmentally (Kabat-Zinn, 2003; Karl & Fischer, 2022). However, because there is no broad agreement on the different aspects of dispositional mindfulness, no single definition of dispositional mindfulness exists (Van Dam et al., 2018) and due to this, several measurements of mindfulness (e.g., FFMQ, Baer et al., 2008; FMI, Walach et al., 2006) exist, which investigate different aspects of dispositional mindfulness.

In this study, the Comprehensive Inventory of Mindfulness Experience (CHIME, Bergomi et al., 2014) was used because it integrates eight different facets of mindfulness

✉ Petra Jansen
Petra.Jansen@ur.de

¹ Faculty of Human Science, University of Regensburg, Universitätsstraße 31, 93053 Regensburg, Germany

² Faculty of Educational Sciences, University of Koblenz, Universitätsstraße 1, 56070 Koblenz, Germany

(Bergomi et al., 2013). The CHIME measures the aspects of acceptance, acting with awareness, decentering/non-reactive, openness, the relativity of thoughts, inner awareness, outer awareness, and insight. The subscale acceptance means being open to things as they occur in the present without having the intention to change them. Acting with awareness is described as conscious behavior and presence. Decentering/non-reactive is the ability to perceive the own emotion without immediately directing. Openness means an open, non-avoidant attitude, and relativity of thoughts is an awareness that all thoughts come and go. Inner awareness implies the awareness of internal, bodily-based processes; outer awareness describes the awareness of the situation outside of the own person. The distinction between inner and outer awareness was made for the first time in a mindfulness questionnaire and is justified by different correlation patterns with various other measurements. Insight means an insightful understanding (Bergomi et al., 2014).

The conceptualization of sustainable behavior

Besides the difficulties in defining dispositional mindfulness, a lack of consensus on the definition of “sustainable consumption” exists. Geiger et al. (2018a, b, p.3) refer to sustainable consumption as “individual acts of satisfying needs in different areas of life by acquiring, using, and disposing of goods and services that do not compromise the ecological and socio-economic conditions of all people (currently living or in the future) to satisfy their own needs.” From this sustainable consumption behavior, the attitudes toward sustainability must be differentiated. Even if consumers might have positive attitudes toward sustainable products, they do not always purchase them (Park & Lin, 2020; Schäufole & Janssen, 2021), a phenomenon that is described in the so-called attitude-behavior gap. And beside this, even explicit and implicit attitudes toward sustainable behavior differ (Jansen et al., 2021; Siebertz et al., 2022). To investigate sustainable attitudes and behavior in this study, we used the five-factor sustainability scale (Haan et al., 2018), which measures both aspects.

The relation between mindfulness and sustainable behavior

Regarding the relation between mindfulness practice and sustainable attitude and behavior, possible intervention studies are rare. For example, Geiger et al. (2020) found no evidence that mindfulness had a direct effect on sustainable consumption behavior and attitudes. The mindfulness training in their study lasted eight weeks and was based on the MBSR curriculum. Loving-kindness meditations and some exercises from a collection of practices for sustainable consumption were included. Another study showed that

either an eight-week mindfulness-based stress reduction or an active control group predicted increases in pro-environmental behavior (Riordan et al., 2022).

Next to the influence of mindfulness practice on sustainable attitude and behavior, the primary (mindfulness) attitudes, dispositional mindfulness, towards sustainable attitude and behavior are discussed: In two systematic literature reviews on how mindfulness can relate to sustainable behavior, the following five mediators were suggested (Fischer et al., 2017; Geiger et al., 2019): (1) well-being, (2) disruption of routines, (3) prosocial behavior/connectedness to nature and others, (4) congruence of attitude and behavior, and (5) non-material values. Partly following the differentiation of Geiger et al. (2019), Thiermann and Sheate (2021) distilled six key arguments for the relationship between mindfulness and sustainability on the individual level: greater openness to new experiences, stronger intrinsic values, improved personal health and subjective well-being, higher levels of connectedness with nature, increased awareness, and stronger prosocial tendencies. The factor “increased awareness” in the differentiation of Thiermann and Sheate (2021) is like Geiger et al.’s (2019) factor “disruption of routines.” Moreover, Geiger et al. (2019) described the aspects of “connectedness to nature” and “prosocial behavior” as one factor, whereas Thiermann and Sheate (2021) differentiated both aspects into separate elements. In the following, the possible relation between the different aspects of dispositional mindfulness and different mediators following the approach of Geiger et al. (2019) are explained.

The first possible mediating factor related to sustainability is well-being (Geiger et al., 2019). This assumption is due to the understanding that personal and planetary well-being are intrinsically interlinked (Wamsler, 2018) and resonates with the mindfulness principle that all human beings are connected (Bai, 2013). Well-being is a complex construct. It can be described as positive emotion, engagement, relationships, meaning, and accomplishment (Seligman, 2010). On the one hand, many studies showed positive effects of mindfulness on peoples’ well-being (Birtwell et al., 2019; Eberth & Sedlmeier, 2012). On the other hand, there seemed to be interdependencies between sustainable behavior and well-being (Kasser, 2017). Because the mindfulness facet of acceptance is related to well-being (Simione et al., 2021) and well-being to sustainable behavior, we expect relations between acceptance, well-being, and sustainable behavior. Because well-being is subjective and individualistic, we assume that the mindfulness aspects of inner awareness and insight are related to the mediating role of well-being to sustainable attitude and behavior.

The second possible mediating factor is the disruption of routines. For the disruption of routines, awareness as one aspect of mindfulness is necessary to be aware of the

actual behavior and to have the possibility to regulate the attention towards the disruption of routines. Unconscious habits of buying products that are not needed at all could then be limited and replaced by more environmentally friendly behavior. Empirically, it has been shown that an intervention towards sustainable behavior was more effective in those recently relocated participants who had disrupted their routines (Verplanken & Roy, 2016). This result emphasized the role of habits that moderate the relationship between intention and sustainable behavior change formulated in the comprehensive action determination model (Klöckner, 2013).

One other relevant mediating factor is the factor of connectedness, which can be differentiated in the connectedness to others, prosocial behavior, and connectedness to nature (Fischer et al., 2017; Geiger et al., 2019). Prosocial behavior can be defined as "...behavior that is costly to the individual and benefits others at the individual or group-level" (Böckler et al., 2018, p. 2). Inner awareness and insight might be related to the shift in perspective as one mechanism of mindfulness (Hölzel et al., 2011) and one theoretical explanation for why mindfulness could enhance compassionate responding and prosocial behavior (Condon et al., 2013; Lim et al., 2015). However, to act prosocial regarding others also, outer awareness is necessary. Connectedness to nature is defined as "a stable state of consciousness comprising symbiotic cognitive, affective, and experiential traits that reflect, through consistent attitudes and behaviors, a sustained awareness of the interrelatedness between oneself and the rest of nature" (Zylstra et al., 2014, p.126). To be aware of the interrelatedness between oneself and the rest of nature inner awareness, insight, and outer awareness are essential. The relationship between the general factor of dispositional mindfulness and connectedness to nature has already been proven (Schutte & Malouff, 2018). Besides this, Richter and Hunecke (2022) demonstrated that the relation of mindfulness to pro-environmental behavior is mediated by connectedness to nature and personal ecological norms.

Regarding the other two mediating factors, no clear relationships could be shown until now regarding different aspects of mindfulness and sustainable behavior. One might assume that mindfulness leads to a higher consciousness characterized by awareness and clarity, which could moderate the congruence of attitude and behavior (Chatzisarantis & Hagger, 2007) and thereby strengthen this relationship. Attitudes play an important role to explain behavior change towards sustainability, for example in the framework of the stage model of self-regulated behavior change (Bamberg, 2013), which has developed from the model of action phases (Heckhausen & Gollwitzer, 1987). In this model, different stages (pre-decisional, pre-actional, actional, and post-actional) with various tasks are crucial for self-regulated behavioral change.

The important role of non-material values is in line with the value belief norm model (Stern et al., 1999) that emphasizes the factors of values (biospheric, altruistic, and egoistic), beliefs, and personal norms relevant to pro-environmental behavior. When mindfulness is understood as an act of embodied ethic, altruistic factors are taught, which is related to ethical values towards the self and others and all animate and inanimate objects (Grossman, 2015). Empirically it has been shown that mindfulness in general is correlated with intrinsic, socially oriented values and environmental behavior (Brown & Kasser, 2005), suitable to enhance the ability to recognize ways to act according to one's values (Christie et al., 2017) and positively related to living by one's values (Smout et al., 2014). However, which facets of dispositional mindfulness are important for the possible mediating role of values on sustainable attitudes and behavior needs to be clarified.

The main goal of this study

The main goal of this study is to investigate in depth the relationship between facets of inner and outer transformation, meaning between different aspects of dispositional mindfulness and possible mediating factors (Fischer et al., 2017; Geiger et al., 2019; Thiermann & Sheate, 2021) and attitude and behavior toward sustainability. For this, different aspects of dispositional mindfulness were related to the various possible mediators and sustainable attitude and behavior. The relation of acceptance on sustainable attitude (H1a) and behavior (H1b) should be mediated by well-being. The relation of acting with awareness of sustainable attitude (H2a) and behavior (H2b) should be mediated by disruptions of routines. Inner awareness is assumed to be related to sustainable attitude (H3a) and behavior (H3b) by the mediating role of well-being and higher pro-socialness. The relation of insight on sustainable attitude (H4a) and behavior (H4b) should be mediated by well-being and pro-socialness. Outer awareness is assumed to be related to sustainable attitude (H5a) and behavior (H5b) by the mediating role of connectedness to nature and higher pro-socialness. In an exploratory manner, we will also investigate which other aspects of mindfulness are related to possible mediators, especially the mediator congruence of attitude and behavior and values, which might, in turn, be related to sustainable attitude and behavior.

Methods

Participants

The sample consisted of $N=337$ participants (207 women, 125 men, 5 diverse) between 17 and 52 years ($M=23.08$, $SD=4.08$). Of these, 322 participants had the highest school leaving examination (Abitur). Originally, $N=347$ participants

took part in the study. However, $n = 10$ participants were excluded from the analyses due to short response times in the online questionnaire. A power analysis conducted by a Monte Carlo simulation analysis in MPlus suggested that the study had sufficient power. The likelihood of detecting the expected and statistically significant effects was usually above 0.90. Only the power to detect the effects of inner awareness of well-being (0.73) and disruption of routines on behavior (0.69) was lower.

Procedure

The online questionnaire was implemented using SoSci Survey (Leiner, 2019) and made available to the participants at two faculties (human science and education science) at two different universities in Germany. An email with the study's link was sent out, and they were informed through the newsletter of their participation in the study. If wished, they received study credit for their participation. First, all participants gave informed consent and reported their gender and age. Afterward, they answered the Comprehensive Inventory of Mindfulness Experience (Bergomi et al., 2014), the Creature of Habit Scale (Ersche et al., 2017), the Valued Living Questionnaire (Wilson et al., 2010), the Prosocialness Scale for Adults (Caprara et al., 2005), the Connectedness to Nature Scale (Pasca et al., 2017), the Values Questionnaire (subscale Progress, Smout et al., 2014), the Brief Inventory of Thriving (Su et al., 2014, German version: Hausler et al., 2017), and the Five-Factor Sustainability Scale (Haan et al., 2018).

The study was conducted according to the ethical guidelines of the Helsinki declaration and approved by the Ethic Research Board of the University of Regensburg (no. 22-3059-101). The study was preregistered at OSF https://osf.io/z249b/?view_only=5b28a5dcbc1a40e7bd11baceba5fedb4

Material

Mindfulness

Comprehensive Inventory of Mindfulness Experience (CHIME, Bergomi et al., 2014) This questionnaire has been validated for the German language (Bergomi et al., 2014). Eight aspects of mindfulness were measured with 37 items, which were answered on a 6-point Likert scale ranging from *almost never* (1) to *almost always* (6). Subscales and example items were: *acceptance* (Even when I make a big mistake, I treat myself with understanding), *acting with awareness* (In everyday life, I get distracted by memories, images, or reverie (reverse score)), *decentering/nonreactive* (When I experience distressing thoughts or images, I am able just to notice them without having

to react immediately), *openness* (I try to distract myself when I feel unpleasant emotions (reverse score)), the *relativity of thoughts* (It is clear to me that my evaluations of situations and people can easily change), *inner awareness* (I clearly notice changes in my body, such as quicker or slower breathing), *outer awareness* (I notice sounds in my environment, such as birds chirping or cars passing), *insight* (I need to smile when I notice how I sometimes see things as more difficult than they actually are). For each scale, the mean score was calculated.

Bergomi et al. (2014) reported acceptable reliability and validity of the questionnaire. However, in the present study, openness and relativity of thoughts were eliminated from further analyses because of low internal consistencies (Cronbach's $\alpha < 0.7$). Moreover, two items aimed to measure acting with awareness ("I break or spill things out of carelessness or because I'm thinking of other things." (inverted)) and insight ("I notice in everyday life when a certain situation becomes difficult only because of my negative attitude towards it.") had to be excluded from achieving internal consistencies above Cronbach's $\alpha > 0.7$. In the end, the six remaining scales had the following satisfactory internal consistencies: acceptance (Cronbach's $\alpha = 0.850$, McDonald's $\omega_1 = 0.855$), acting with awareness (Cronbach's $\alpha = 0.701$, McDonald's $\omega_1 = 0.706$), decentering (Cronbach's $\alpha = 0.807$, McDonald's $\omega_1 = 0.806$), inner awareness (Cronbach's $\alpha = 0.717$, McDonald's $\omega_1 = 0.721$), outer awareness (Cronbach's $\alpha = 0.728$, McDonald's $\omega_1 = 0.736$), insight (Cronbach's $\alpha = 0.705$, McDonald's $\omega_1 = 0.735$).

Congruence of attitude and behavior (Congruence)

The valued living questionnaire (Wilson et al., 2010) The scale measures the importance of ten living domains and how consistent participants have lived according to their valued behavior. Participants expressed their opinion on the ten domains on a 10-point Likert scale ranging from *not at all important* (1) to *extremely important* (10). Consistencies between valued behavior and actual behavior were expressed on a 10-point Likert scale ranging from *not at all consistent* (1) to *highly consistent* (10). Example domains were family relations, recreation, spirituality, and physical well-being. The reliability (Cronbach's $\alpha = 0.77$ for importance, Cronbach's $\alpha = 0.75$ for congruence) and validity of the scales have been proven by Wilson et al. (2010). For the German version, the domains were forward and backward translated. A mean score was calculated for the ten items of the congruence scale. The present study revealed an internal consistency of Cronbach's $\alpha = 0.772$ and McDonald's $\omega_1 = 0.708$ for congruence.

Non-material values (Values)

Value questionnaire (VQ, subscale progress, Smout et al., 2014) Participants' values were measured with five items, answered on a 7-point Likert scale ranging from not at all true (1) to completely true (6). An example item is "I continued to get better at being the kind of person I want to be". For the German version, the questionnaire was forward and backward translated. A mean score was calculated for the five items of the value questionnaire. The present study revealed a good internal consistency (Cronbach's $\alpha=0.801$, McDonald's $\omega_1=0.819$).

Well-being

Brief Inventory of Thriving (BIT, Su et al., 2014, German-version: Hausler et al., 2017) Well-being was assessed by ten items which had to be answered on a 5-point Likert Scale from *strongly disagree* (1) to *5 strongly agree* (5). An example item is: "I am optimistic about my future." The internal consistency for the present study was good (Cronbach's $\alpha=0.871$, McDonald's $\omega_1=0.876$). The brief inventory of thriving was chosen as a comprehensive inventory that includes the components that are relevant components in various theories on eudaimonic well-being. The scale was validated for a German-speaking population (Hausler et al., 2017). A mean score was calculated for the ten items of the value questionnaire.

Connectedness to nature

Connectedness to Nature Scale (CNS, Pasca et al., 2017) Connectedness to nature was measured with thirteen items, which were answered on a 5-point Likert scale ranging from *strongly disagree* (1) to *strongly agree* (5). An example item is "Like a tree can be part of a forest, I feel embedded within the broader natural world." In the present study, two items were eliminated because of low corrected item-total correlations (<0.30). The internal consistency for the remaining scale with eleven items was good (Cronbach's $\alpha=0.857$, McDonald's $\omega_1=0.861$). For the German version, the questionnaire was forward and backward-translated. A mean score was calculated for the eleven items of the connectedness to nature scale.

Disruption of routines

Creature of Habit Scale (COHS, Ersche et al., 2017) Disruption of routines was measured with the creature of habitual routines. In this questionnaire, a high value indicates a high disruption of routines. Habitual routines were measured with 27 items which were answered on a 5-point Likert scale ranging from *disagree strongly* (1) to *agree strongly*

(5). An example item is "I tend to like a routine" (inverted). For the German version, the questionnaire was forward and backward translated. A mean score was calculated for the 27 items of the creature of habit scale. The present study revealed good internal consistency (Cronbach's $\alpha=0.829$, McDonald's $\omega_1=0.809$).

Pro-socialness

Prosocialness Scale for Adults (Caprara et al., 2005) Prosocial behavior was measured by 16 items on a 5-point Likert scale ranging from *never/almost never true* (1) to *almost always/always true* (5). An example item was "I try to console those who are sad." The questionnaire was based on item response theory (IRT). For the German version, the questionnaire was forward and backward-translated. A mean score was calculated for the 16 items of the prosocialness scale for adults. The present study revealed a good internal consistency (Cronbach's $\alpha=0.849$, McDonald's $\omega_1=0.846$).

Sustainable behavior and attitude

Five-Factor Sustainability Scale (FFSS, Haan et al., 2018) The sustainable attitude was measured by 31 items assigned to five subscales. Participants expressed their agreement on a 5-point Likert scale ranging from *strongly disagree* (1) to *strongly agree* (5). The five factors were labeled *sustainable spending* ("Understandably, sustainable living may cost a little extra"), *sustainable skepticism* ("Animal rights are blather"), *sustainable responsibility* ("Companies should be subsidized for being sustainable"), *sustainable support* ("I am in favor of installing as many solar panels as possible"), and *sustainable mobility* ("Fuel should become more expensive so that more people will travel by public transport"). Haan et al. (2018) have proven the scale's validity. In addition to the 31 attitudinal items, 39 behavioral items had to be answered on a 5-point Likert scale. Subscales were *general* ("I live sustainable as much as I could"), *household* ("I save energy by using as little water as possible"), *consumption* ("I eat as little meat as possible"), *mobility* ("I travel by bike or public transport because this is better for the environment"), and *nature* ("Whenever I buy eggs, I choose organic eggs"). For the German version, the questionnaire was forward and backward translated. Two mean scores were calculated, one for the 31 items of attitudinal items, and one for the 39 ones of the behavioral items. Internal consistencies for the present study were (very) good (attitude: Cronbach's $\alpha=0.892$, McDonald's $\omega_1=0.890$; behavior: Cronbach's $\alpha=0.907$, McDonald's $\omega_1=0.906$).

Data analyses

Due to the high number of variables and items, we conducted our analyses using manifest variables. We started to calculate the bivariate correlations between all scales to check that there was no multicollinearity (all VIF < 2.2). Subsequently, we estimated a path model in MPlus 7.4 (Muthén & Muthén, 2015). For model estimation, we used the MLR estimator, which is robust against violations of normality assumptions. We regressed sustainable attitude and behavior on the six facets of mindfulness as well congruence of attitude and behavior, non-material values, well-being, connectedness to nature, disruption of routines, and pro-socialness. Moreover, we regressed congruence, values, well-being, connectedness to nature, disruption of routines, and pro-socialness on the six facets of mindfulness, and we regressed sustainable behavior on sustainable attitude. We allowed correlations between all exogenous variables and between the residuals of the subscales of the mediator variable. We examined the indirect effects using the “Model Indirect” command implemented in MPlus. In addition to our model, we also studied these effects in a second model using bootstrapping (in this model, we used the ML estimator, as the MLR estimator cannot be combined with bootstrapping in MPlus). Since there were no differences in the significance of the indirect effects at the 5% alpha level between the two models, we reported the *p*-values for the indirect effects from the model using the MLR estimator (MPlus syntax can be found in the Supplemental Material).

Results

Table 1 shows the correlations between all study variables. Table 2 shows the beta coefficients and *p*-values of all examined direct effects. A table showing the total effects can be found in the supplemental material. Figure 1 only depicts the significant direct effects but also highlights the significant indirect effects.

Congruence was predicted by acting with awareness ($\beta = 0.164, p < 0.01$), values by acceptance ($\beta = 0.215, p < 0.01$), acting with awareness ($\beta = 0.238, p < 0.001$), and insight ($\beta = 0.125, p < 0.05$), and well-being by acceptance ($\beta = 0.230, p < 0.001$), acting with awareness ($\beta = 0.243, p < 0.001$), inner awareness ($\beta = 0.144, p < 0.05$), and insight ($\beta = 0.167, p < 0.01$). Connectedness to nature was predicted by outer awareness ($\beta = 0.365, p < 0.001$) and insight ($\beta = 0.156, p < 0.01$), disruption of routines by acting with awareness ($\beta = 0.183, p < 0.01$), and pro-socialness by inner awareness ($\beta = 0.220, p < 0.001$), outer awareness ($\beta = 0.191, p < 0.01$), and insight ($\beta = 0.245, p < 0.001$). Furthermore, sustainable attitude was predicted by connectedness to nature ($\beta = 0.334, p < 0.001$)

and pro-socialness ($\beta = 0.230, p < 0.001$) and sustainable behavior is predicted by connectedness to nature ($\beta = 0.216, p < 0.001$), disruption of routines ($\beta = -0.114, p < 0.01$), pro-socialness ($\beta = 0.128, p < 0.01$), and sustainable attitude ($\beta = 0.582, p < 0.001$).

In contrast to H1a and H1b, no significant indirect effects of acceptance via well-being on sustainable attitude ($\beta < 0.01, p = 0.98$) and behavior ($\beta = -0.01, p = 0.46$) were found. In contrast to H2a, no significant indirect effect was found from acting with awareness via disruption of routines on sustainable attitude ($\beta < 0.01, p = 0.87$). The indirect effect from acting with awareness via disruption of routine on sustainable behavior ($\beta = -0.01, p = 0.03$) was significant, which is in line with hypothesis 2b.

For inner awareness, in contrast with the first part of H3a and H3b, no significant indirect effects were found from inner awareness via well-being on sustainable attitude ($\beta = 0.00, p = 0.98$) and behavior ($\beta = -0.01, p = 0.44$). However, in line with the second part of H3a and H3b, significant indirect effects were found from inner awareness via pro-socialness on sustainable attitude ($\beta = 0.03, p < 0.05$) and behavior ($\beta = 0.02, p < 0.05$). Furthermore, there was a significant indirect effect from inner awareness via pro-socialness and attitude on behavior ($\beta = 0.02, p = 0.01$).

For insight, in contrast with the first part of H4a and H4b, no significant indirect effects were found from insight via well-being on sustainable attitude ($\beta = 0.00, p = 0.98$) and behavior ($\beta = -0.01, p = 0.46$). In line with the second part of H4a and H4b, significant indirect effects were found from insight via pro-socialness on sustainable attitude ($\beta = 0.03, p < 0.01$) and behavior ($\beta = 0.02, p < 0.05$). Furthermore, there was a significant indirect effect from insight via connectedness to nature on behavior ($\beta = 0.02, p < 0.05$). There were significant indirect effects from insight via connectedness to nature and attitude on behavior ($\beta = 0.02, p < 0.05$) and from insight via pro-socialness and attitude on behavior ($\beta = 0.02, p < 0.05$).

In line with H5a, significant indirect effects were found from outer awareness via connectedness to nature ($\beta = 0.07, p < 0.001$) and pro-socialness ($\beta = 0.03, p < 0.05$) on sustainable attitude. In line with H5b, significant indirect effects were found from outer awareness via connectedness to nature ($\beta = 0.05, p < 0.001$) and pro-socialness ($\beta = 0.02, p < 0.05$) on sustainable behavior. There were significant indirect effects from outer awareness via connectedness to nature and attitude on behavior ($\beta = 0.05, p < 0.001$) and from outer awareness via pro-socialness and attitude on behavior ($\beta = 0.02, p < 0.05$).

All predictors in the model explained 55.5% of the variance of sustainable behavior, 17.7% of sustainable attitude, 11.7%, of congruence of attitude and behavior, 22.0% of non-material values, 32.0% of well-being, 23.2% of connectedness to nature, 10.6% of disruption of routines, and 20.2% of pro-socialness.

Table 1 Correlations between the study variables

	Acceptance	Acting with awareness	Decentering	Inner awareness	Outer awareness	Insight	Congruence	Values	Well-being	Connectedness to nature	Disruption of routines	Pro-Socialness	Sustainable attitude
Acting with Awareness	<i>r</i> .215** <i>p</i> < .001												
Decentering	<i>r</i> .593** <i>p</i> < .001	.279**											
Inner Awareness	<i>r</i> .245** <i>p</i> < .001	.233**	.301**										
Outer Awareness	<i>r</i> .269** <i>p</i> < .001	.039	.293**	.526**									
Insight	<i>r</i> .367** <i>p</i> < .001	.472	< .001	< .001	.272**								
Congruence	<i>r</i> .245** <i>p</i> < .001	.230**	.247**	.205**	.168**	.179**							
Values	<i>r</i> .358** <i>p</i> < .001	.321**	.307**	.243**	.179**	.266**	.432**						
Well-being	<i>r</i> .426** <i>p</i> < .001	.364**	.398**	.318**	.188**	.342**	.423**	.639**					
Connectedness to Nature	<i>r</i> .252** <i>p</i> < .001	.051	.272**	.246**	.430**	.298**	.151**	.212**	.204**				
Disruption of Routines	<i>r</i> .180** <i>p</i> < .001	.354	< .001	< .001	< .001	< .001	.005	< .001	< .001	.110*			
Pro-Socialness	<i>r</i> .078 <i>p</i> .151	.045	.094	.353**	.330**	.305**	.253**	.182**	.317**	.297**	.048		
Sustainable Attitude	<i>r</i> .032 <i>p</i> .778	.070	.070	.096	.192**	.114*	.123*	.095	.098	.445**	.151**	.335**	.691**
Sustainable Behavior	<i>r</i> .559 <i>p</i> < .001	.200	.201	.080	< .001	.036	.024	.083	.071	< .001	.006	< .001	< .001

* *p* < .05, ** *p* < .01

Table 2 Results of the path model

	Attitude		Behavior		Congruence		Values		Well-being		Connectedness to nature		Disruption of routines		Pro-socialness	
	β	<i>p</i>	β	<i>p</i>	β	<i>p</i>	β	<i>p</i>	β	<i>p</i>	β	<i>p</i>	β	<i>p</i>	β	<i>p</i>
Acceptance	-.013	.852	-.061	.192	.112	.128	.215	.001	.230	<.001	.058	.326	.041	.555	-.066	.283
Acting with Awareness	.070	.231	.021	.637	.164	.003	.238	<.001	.243	<.001	-.003	.948	.183	.001	.006	.911
Decentering	-.089	.214	.031	.520	.077	.238	.034	.623	.094	.110	.079	.225	.146	.054	-.088	.181
Inner Awareness	-.069	.329	-.055	.245	.061	.316	.071	.285	.144	.029	-.030	.652	.108	.105	.220	<.001
Outer Awareness	-.001	.990	.004	.940	.057	.361	.031	.614	-.033	.546	.365	<.001	-.021	.742	.191	.001
Insight	-.008	.906	-.028	.529	.062	.314	.125	.025	.167	.003	.156	.008	-.020	.747	.245	<.001
Congruence	-.015	.805	.037	.354												
Values	-.043	.527	.026	.629												
Well-Being	.002	.982	-.046	.448												
Connectedness to Nature	.334	<.001	.216	<.001												
Disruption of Routines	.009	.870	.114	.002												
Pro-Socialness	.230	<.001	.128	.005												
Attitude			.582	<.001												

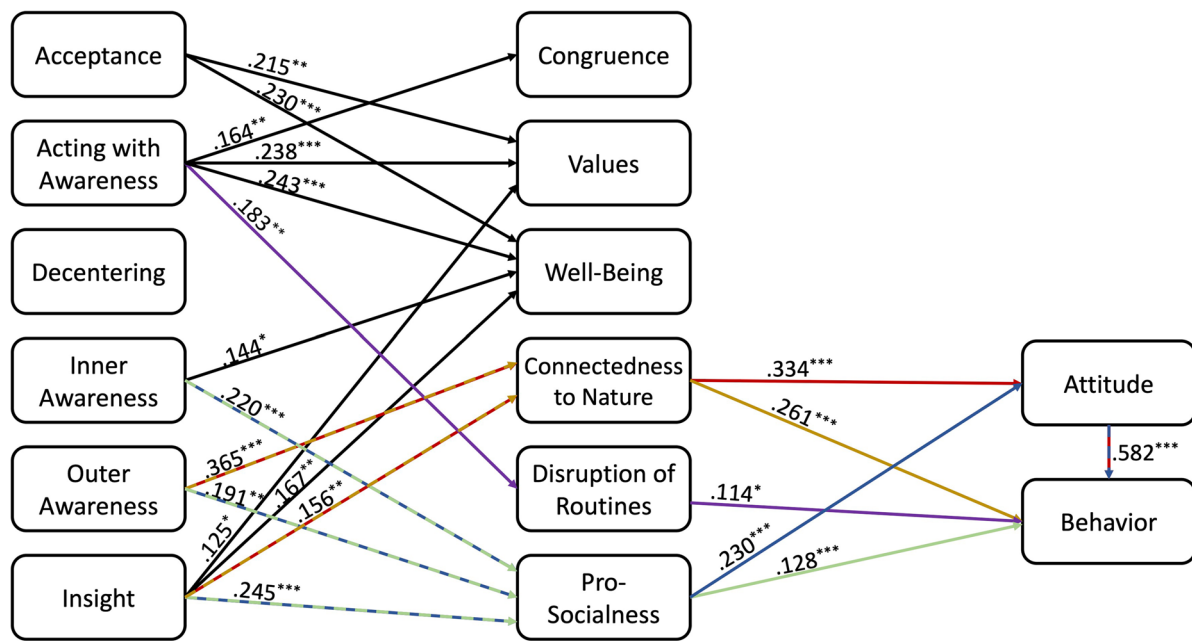


Fig. 1 Results of the path model with standardized beta coefficients. The figure only depicts statistically significant effects. Significant indirect effects are highlighted by specific colors. * $p < .05$, ** $p < .01$, *** $p < .001$

Discussion

This study provides preliminary evidence of the relationship between different factors of mindfulness and sustainable attitude and behavior and its possible mediators. It shows that the mindfulness facets of awareness and insight and the connectedness factors of connectedness to others (prosocial behavior) and connectedness to nature are highly relevant.

The role of inner awareness, outer awareness, and insight

The first significant result is that the mindfulness facets of inner awareness and insight are related to sustainable attitudes and behavior by pro-socialness (confirming partly hypotheses 3 and 4). This internal mindful process might alter the sense of the self, a non-attachment (Hölzel et al., 2011), which provides the opportunity to react to others more sensitively to develop an enhanced pro-socialness. The higher the inner awareness for the own processes, the higher the pro-socialness in the study presented here. Inner awareness is only related to pro-socialness but not to connectedness to nature. For this, the distinction of two different mediating factors proposed by Thiermann and Sheate (2020) is worth being considered in the future in more depth. The results of the relevance of insight, seen as an insightful understanding of pro-socialness, could be explained through the importance of nonjudgmental awareness. On the one hand, insight is highly correlated with nonjudgmental

awareness in the FFMQ (Bergomi et al., 2014); on the other hand, nonjudgmental awareness might foster prosocial behavior toward another’s suffering (Donald et al., 2019).

Besides the relation of inner awareness and insight by pro-socialness to sustainable attitude and behavior, our results demonstrate that outer awareness is related to pro-socialness and connectedness to nature, which is again related to sustainable attitudes and behavior, confirming hypothesis 5. Outer awareness describes the awareness of things surrounding us; this integrates people and nature. Therefore, it is one’s connectedness with people and the nature around one’s own with the focus not lying on oneself anymore. Although the relationship between the general factor of mindfulness and connectedness to nature has already been confirmed in a meta-analysis (Schutte & Malouff, 2018), this study provides deeper insight into that outer awareness and insight are the relevant aspects of mindfulness that are related to connectedness to nature.

The role of connectedness to nature and pro-socialness

The relation of connectedness to nature to pro-environmental behavior is in line with two meta-analyses (Mackay & Schmitt, 2019; Whitburn et al., 2019). Different explanations exist for the connection between connectedness to nature and sustainable behavior. One possible explanation is gratitude to nature: Gratitude to nature was the strongest predictor of various outcomes (environmental activism support, pro-environmental behavior, environmental donation) of

sustainable behavior. Manipulation of gratitude to nature had some effects on pro-environmental behavior, which was seen especially for intention and those persons with a weak trait of gratitude to nature (Tam, 2022). Next to connectedness to nature, pro-socialness was a significant mediator of the relations between mindfulness and sustainable attitude and behavior. This is in line with another study showing that compassion for other humans, as one aspect of pro-socialness, is related to pro-environmental values, pro-environmental intentions, and reported donations to nature or environmental organizations (Pfattheicher et al., 2016).

Both mediators, connectedness to nature and pro-socialness, are related. For example, nature exposure can promote pro-socialness (Castelo et al., 2021). Furthermore, connectedness to nature and pro-socialness have already been considered as one single mediator, for example, in the model of Geiger et al. (2018a). One possible mechanism to explain the significant mediation effects might be that exposure to nature reduces self-focused thoughts like rumination (Bratman et al., 2015), and the capacity for other-focused thoughts might be increased. Consequently, interconnectiveness becomes more salient. Nevertheless, the relation of inner awareness and insight with pro-socialness and outer awareness and insight with connectedness to nature confirms our assumption to treat both mediating factors separately, as proposed by Thiermann and Sheate (2021).

The role of various mediators

In line with our hypothesis 2b, acting with awareness was also related to the disruption of routes related to sustainable behavior. Disruptions of routines might not be related to sustainable attitude because disruption of routines or habits often takes place implicitly, and attitudes towards sustainability were measured explicitly in this study. Switching off the autopilot mode diminishes implicit non-sustainable consumption choices (Fischer et al., 2017).

The other possible mediators were not related to sustainable attitude and behavior. Regarding well-being, the result contradicts a study by Brown and Kasser (2005), who have shown that individuals scoring higher in subjective well-being reported more ecologically responsible behavior (ERB). The contrary results could be attributed to different measurements of well-being. The brief inventory of thriving was chosen in this study because it provides a comprehensive investigation of well-being, including the components of subjective well-being as it is high life satisfaction, supportive relationships, meaning in life, engagement in daily activities, a sense of mastery, optimism, and feeling of autonomy (Su et al., 2014). Especially the components of supportive relationships, meaning in life, and engagement in daily activities could be assumed to be related to sustainable attitude and behavior. In line with this study, the role

of responsible production and consumption was negatively correlated with well-being (DeNeve & Sachs, 2020).

The study provides evidence that, together with disruptions of routines, pro-socialness and connectedness to nature are the strongest mediators between the awareness and insight aspects of mindfulness and sustainability. This result is in line with a framework of individual, collective, and systems level change provided by Wamsler et al. (2021). They also suppose that an increase in the transformative qualities of awareness, connection, and insight (besides purpose and agency), are relevant internal transformation qualities. In their framework, subjective well-being is conceptualized as an intermediary factor. It is also in line with the framework of the two-pathway model of pro-environmental behavior (Thiermann & Sheate, 2020).

Theoretical and practical implications

Due to the preliminary study with the small sample size and the non-representativeness, results should not be overinterpreted. Bearing this overinterpretation in mind, the results of this study hint from a theoretical point of view the importance of inner transformative qualities as a link between mindfulness and sustainable attitude and behavior. Especially the factor of connectedness to nature and others seemed to be important. One practical implication is that mindfulness programs can be taught in nature. One example is the restoration skills training (ReST), a nature-based mindfulness program. It is a five-week meditation-based course that takes place in a natural environment (Lymeus et al., 2019). ReST was developed with the aim of effortlessly building a meditative state based on restorative experiences supported by the environment and, over time, ReST should provide benefits at least comparable to those of conventional mindfulness training. The ReST approach to meditation is based on the exploration of sensations and related experiences in a pleasant and interesting environment characterized by vegetation, water and other natural features and processes.

Limitation

The study presented here has some limitation factors: It is a cross-sectional correlational study. Thus, it does not investigate causal relationships between different aspects of mindfulness, various mediators, and sustainable attitude and behavior. Also, it is important to note that this study did not include moderating variables, which could affect the relations between the investigated variables. Furthermore, it is possible that some important variables were missing, considering theories from environmental psychology, which claim that, for example, next to values and habits, the ascription of responsibility, awareness of consequences, personal and social norms, intentions, and perceived behavior control, described in the Comprehensive Action Determination Model (Klößner, 2013), might play an important role. This leads to the assumption that inner transformational qualities

are essential in describing sustainable attitudes and behaviors but that the normative path in explaining pro-environmental behaviors cannot be ignored. For this reason, the critical variables from the normative path in the model of Thiermann and Sheate (2020) should be included in further studies.

Furthermore, the participants were mostly university students, and mindfulness and body-mind activities (e.g., yoga) were not registered. To reduce complexity and due to the high correlation between the different scales of sustainable attitude and behavior, each aspect, sustainable attitude, and sustainable behavior has been analyzed one-dimensional. Nevertheless, the dimensionality of sustainable behavior must be discussed (Geiger et al., 2018a, b). However, there are also assumptions that consider ecological behavior unidimensional (e.g., Kaiser, 2006).

Conclusion

To conclude, from the proposed mediators between mindfulness and sustainable attitude and behavior, prosocial behavior, and connectedness to nature, together with disruptions of routines, are the most important. There was no direct path from mindfulness to sustainable behavior and attitude. However, all indirect effects are small and higher for sustainable attitudes than behavior. Due to the preliminary study with the small sample size and the non-representativeness, results should not be overinterpreted.

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Data availability The data can be retrieved from osf https://osf.io/z249b/?view_only=5b28a5dcbc1a40e7bd11baceba5fedb4.

Declarations

Ethical approval and consent to participate The study was approved by the ethical committee of the University of Regensburg (reference number: no. 22-3059-101) and has been conformed to the ethical standard laid down in the 1964 Declaration of Helsinki.

Conflict of interest None.

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