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Key Topics in Behavioral Sciences

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Foreword

The Springer Behavioral and Health Sciences Books team is proud to introduce our new series, *Key Topics in Behavioral Sciences*. This collection features cutting-edge research from across our Behavioral Sciences journals program. Each volume features the top-cited and downloaded material from our research portfolio.

With science moving at the speed of light, research findings are produced at a rate never seen before. Keeping up with the flow of information is one of the major challenges for researchers and professionals alike. In this new series, Springer offers a more direct route to important research for readers.

Curating articles from a variety of journals, these volumes are organized along topical lines, reflecting key issues that impact the behavioral science field. In the process we are providing exposure that exceeds the bounds of individual specialty publications that can enhance interdisciplinary inquiry. The series offers ground-breaking investigations representing material that has garnered substantial scientific attention.

The high profile subjects cover a range of topics that span the entire field, chosen for their relevance and timeliness. It is hoped that making key issues more accessible in an organized framework will provide a rich resource in a fast-moving scientific environment.

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Emotional Eating and Weight in Adults: a Review

Mallory Frayn¹ · Bärbel Knäuper¹

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Abstract Emotional eating is the tendency to overeat in response to negative emotions and has shown to be associated with weight outcomes, both in respect to weight gain over time and difficulties with weight loss and weight loss maintenance. It is thus important to develop treatments to improve weight loss outcomes in emotional eaters. The purpose of this review is to explore adults' relationship between emotional eating and weight by: (1) describing self-report measures used to assess emotional eating such as the Dutch Eating Behavior Questionnaire (DEBQ), the Three Factor Eating Questionnaire (TFEQ), and the Emotional Eating Scale (EES), (2) exploring the relationship between emotional eating and weight outcomes, namely examining weight gain in longitudinal studies and difficulties with weight loss and weight loss maintenance in intervention studies, and (3) reviewing current interventions that target emotional eating, using techniques such as mindfulness, Acceptance and Commitment Therapy (ACT), Cognitive Behavior Therapy (CBT), and Dialectical Behavior Therapy (DBT). A better understanding of adults' emotional eating and its impact on weight is important to develop interventions that effectively target weight loss struggles unique to emotional eaters and improve weight outcomes for this population.

Keywords Emotional eating · Weight · Weight loss · Review

✉ Mallory Frayn
mallory.frayn@mail.mcgill.ca

Bärbel Knäuper
barbel.knauper@mcgill.ca

¹ Department of Psychology, McGill University, Stewart Biology Building, 1205 Dr. Penfield Avenue, Montreal, Quebec H3A 1B1, Canada

Introduction

Emotional eating is defined as the “tendency to overeat in response to negative emotions, such as anxiety or irritability” (van Strien et al. 2007, p. 106). It is a highly prevalent concern for those who struggle with their weight; it is suggested that 60% or more of individuals who are overweight or obese are also emotional eaters (Ganley 1989). Emotional eaters are particularly likely to consume foods high in fat, sugar, and calories in response to negative emotions (Elfhag and Rossner 2005). These eating habits in combination with increased body weight place emotional eaters at higher risk for developing diabetes and heart disease (e.g., Melanson 2007; Wang et al. 2010). This population also struggles with weight loss; emotional eaters are half as likely as non-emotional eaters to achieve the 10% weight loss goal of standard behavioral weight loss treatment (López-Guimerà et al. 2014). Emotional eating is important to study because of its negative effects on weight and overall health. Thus far very few interventions have incorporated the treatment of emotional eating into weight loss interventions.

The purpose of this paper is to review the relationship between emotional eating and body weight in adults and to explore the current treatment options used to address these concerns. To our knowledge, no such review exists. Other reviews have outlined theoretical perspectives on emotional eating (e.g., Canetti et al. 2002), have examined the prevalence of emotional eating in a variety of samples (e.g., Gibson 2012), and have reviewed studies using a certain treatment approach, namely mindfulness interventions, for emotional eating (e.g., Katterman et al. 2014; O'Reilly et al. 2014). However, none of these reviews have attempted to explicate the relationship between emotional eating and weight, nor have they thoroughly evaluated treatment options for overweight or obese emotional eaters. This review seeks to fill these gaps in the existing

literature to help establish better treatment protocols for emotional eating.

Currently, research in this area is still burgeoning and there is significant heterogeneity in the measures and methodologies used to study the effects of emotional eating on weight and treatment efficacy. For these reasons, we did not conduct a systematic review or meta-analysis; this review is instead a comprehensive narrative that describes the key findings that together help to elucidate the relationship between emotional eating and weight in adults in order to obtain possible solutions for effective treatments of emotional eating.

Studies included in this review are those that have examined the relationship between emotional eating and weight in a variety of contexts, including longitudinal studies in naturalistic settings (examining normal weight, overweight, and obese individuals) and behavioral weight loss interventions (examining overweight and obese individuals). In reviewing the literature we searched the PsycINFO database using the key words “emotional eating”, “emotional eaters”, “weight”, “weight gain”, “weight loss”, “weight loss intervention”, “weight maintenance”, “BMI”, and “longitudinal.” We also thoroughly examined the references cited in the studies found through the database to ensure we completed an exhaustive search of the literature. We included studies that: (1) used a self-report measure to quantitatively assess emotional eating, (2) included weight as a primary outcome variable, and (3) examined emotional eating in overweight and/or obese individuals. Studies were excluded from this review if they did not adhere to all three criteria listed above. Thus the studies described in this review highlight this relationship between emotional eating and weight. Gaining a better understanding of emotional eating has implications for the treatment of overweight and obesity, as it will allow for the refinement of behavioral weight loss programs to target emotional eating.

Studies in laboratory settings have explored the relationship between emotions and eating behavior by inducing negative moods and measuring subsequent food consumption (e.g., van Strien et al. 2013; Werthmann et al. 2014). These studies have been done in normal weight university student populations (e.g., van Strien et al. 2013; Wallis and Hetherington 2009; Werthmann et al. 2014). Of the mood induction laboratory studies that have been conducted with overweight and obese individuals, they have focused on binge eating, rather than emotional eating (e.g., Chua et al. 2004; Laessle and Schulz 2009). A recent meta-analysis found that the induction of a negative food state increases food consumption in binge eaters (Cardi et al. 2015). However, the results of these studies on binge eating are not directly applicable to emotional eating in the context of behavioral weight loss interventions targeted towards overweight and obese populations such as those we will be reviewing. Laboratory studies

are also not included in this review because they examine emotional eating at a single time point, making it difficult to determine the long term relationship between emotional eating, food consumption, and weight. This review will instead focus on studies in natural settings to examine the relationship between emotional eating and weight in overweight and obese individuals, namely examining weight gain and difficulties with weight loss over time.

Conceptualizations for eating in response to positive emotions will not be reviewed because there is evidence that it is a different construct than eating in response to negative emotions. For example, eating in response to positive emotions has shown to be negatively correlated with eating in response to negative emotions (e.g., Nolan et al. 2010; van Strien et al. 2016). There is also currently no conclusive evidence that eating in response to positive emotions is associated with being overweight or obese (e.g., van Strien et al. 2016; van Strien et al. 2013), whereas eating in response to negative emotions is negatively associated with weight outcomes (e.g., Delahanty et al. 2013; Koenders and van Strien 2011; Teixeira et al. 2010). Additionally, it has been observed that eating in response to positive emotions is associated with partaking in social situations (Patel and Schlundt 2001). Because food is often consumed socially in positive emotional contexts such as celebrations, it is difficult to determine whether emotional eating truly occurs in response to internal positive emotions or if increased consumption is more attributable to the external social context. This review therefore focuses on eating in response to negative emotions and the impact it has on weight outcomes.

This review is structured along three aims. First, we will describe the various ways in which emotional eating is assessed in research concerned with weight outcomes. Second, we will review the literature to see how emotional eating is related to weight and to weight loss success in intervention contexts. Using this information, the third aim is to explore and discuss ideal methods for targeting and treating emotional eating in weight loss interventions.

Aim 1: Self-Report Measures of Emotional Eating

Several self-report measures exist to assess emotional eating and the related construct of internal disinhibition, as introduced below. The Dutch Eating Behavior Questionnaire (DEBQ; van Strien et al. 1986), the Three Factor Eating Questionnaire (TFEQ; Stunkard and Messick 1985), and the Emotional Eating Scale (EES) are the three most frequently used, based on a cited reference search conducted using the Scopus database. The measures have been cited 1248, 2418, and 287 times, respectively. Other measures of emotional eating are outlined in Table 1.

Table 1 Other self-report measures of emotional eating

Name	Authors & year	Number of times cited	Number of items	Emotions assessed (-/+)	Contributions	Limitations
-	Blair et al. 1990	94	10	(-)	Assesses actual frequency of emotional eating episodes	Assesses only 5 categories of emotions
Canetti's emotional eating scale (EE)	Canetti et al. 2009	55	7	(-)	Brief and succinct measure of emotional eating	Assesses only 7 emotions
Emotional appetite questionnaire (EMAQ)	Geliebter and Aversa 2003; Nolan et al. 2010	128	22	(-/+)	Assesses eating in response to both positive and negative emotions and emotional situations	Difficult to differentiate between eating in response to an emotional situation vs. an actual emotion
Emotional overeating questionnaire (EOQ)	Masheb and Grilo 2006	115	6	(-/+)	Assesses frequency and specifies emotional "overeating" episodes	Assesses a limited scope of emotions, 5 negative and only 1 positive
The eating and appraisal due to emotions and stress (EADES) questionnaire	Ozier et al. 2007	33	54	(-/+)	Assesses both emotional eating and one's appraisal of their ability to cope with emotions and stress	Long and time-consuming to complete, requires personal insight to assess one's coping abilities

The Dutch Eating Behavior Questionnaire (DEBQ)

The Dutch Eating Behavior Questionnaire (DEBQ; van Strien et al. 1986) is a 33-item self-report measure that assesses different aspects of eating behavior on three subscales: (1) restrained eating, (2) emotional eating, and (3) external eating. In completing the DEBQ, participants are asked to rate their responses on a 5-point ordered rating scale from never (1) to very often (5). Responses are then summed separately for each subscale and divided by the total number of items on that subscale to derive a mean subscale score. Based on van Strien et al.'s (1986) initial validation study, the mean emotional eating subscale score averaged across normal weight and obese individuals was 1.92 ($SD = 0.68$). For obese individuals, this mean was slightly higher, $M = 2.11$ ($SD = 0.73$) than for their normal-weight counterparts, $M = 1.89$ ($SD = 0.67$). The DEBQ has been shown to have high internal consistency and factorial validity (e.g., Barrada et al. 2016; van Strien 2015; van Strien et al. 1986).

DEBQ emotional eating assesses an individual's desire to eat under negative emotional conditions like stress, anxiety, and depression. The DEBQ thus focuses on eating in response to negative, but not positive emotions. Examples of items on the emotional eating subscale include item 18, "Do you have a desire to eat when you are anxious, worried, or tense?" and item 23, "Do you have a desire to eat when you are bored or restless?" Van Strien et al. initially derived the emotional eating subscale items from the Eating Patterns Questionnaire (EPQ; Wollersheim 1970) based on face validity (van Strien et al. 1986). However, in validating the DEBQ, van Strien et al. revised and created new emotional eating subscale items as well as restrained and external eating subscale items to

ensure good dimensional validity for each of the three subscales (van Strien et al. 1986).

A cut-off score of 3.25 on the DEBQ emotional eating subscale is often used to classify emotional eaters in research contexts. The cut-off score is based on normative data from a Dutch sample (van Strien et al. 2012a). The score represents scores in the 80th percentile for this Dutch sample (van Strien et al. 2012a). Scores above the 80th percentile have also been used as the cut-off for categorizing emotional eaters in other studies (e.g., Bohon et al. 2009). In Aim 2, we review studies that examine emotional eating in overweight and/or obese individuals with weight as a primary outcome variable. Applying this criterion, all remaining studies examined emotional eating on a continuum rather than using a specific cut-off (e.g., Dohle et al. 2014; Koenders and van Strien 2011; Sung et al. 2009; van Strien et al. 2012b).

The Three Factor Eating Questionnaire (TFEQ)

Emotional eating can also be conceptualized as a form of disinhibition, where individuals feel compelled to eat in response to emotional cues and lack control over inhibiting this (Stunkard and Messick 1985). This disinhibition concept has been operationalized by Stunkard and Messick (1985) in their Three-Factor Eating Questionnaire (TFEQ). The authors later referred to the TFEQ as the "Eating Inventory" (EI; Stunkard and Messick 1988) and the publisher Pearson Education distributes it under this name. For consistency, we will refer to it as the TFEQ as is most commonly done in the literature. Similar to the DEBQ, the TFEQ is comprised of three subscales: (1) restraint, (2) disinhibition, and (3) hunger. The TFEQ was developed to expand upon Herman and

colleagues' restraint theory and its corresponding Restraint Scale (1975, 1980). Because the TFEQ was developed with a focus on restrained eating, the two remaining subscales are comprised of items that did not load onto the restraint factor. The disinhibition scale reflects loss of control over eating behaviors in response to either internal or external cues (Stunkard and Messick 1985).

Since the initial development of the TFEQ, studies have re-examined the factor structure of the measure, specifically in relation to the disinhibition scale. Many have found that disinhibition is comprised of an emotional component. Notably, Bond et al. (2001) found that disinhibition could be further reduced to emotional disinhibition, which was comprised of three TFEQ items (eating when lonely, blue, or anxious). Emotional disinhibition was found to have good test-retest reliability ($r = .70$).

More recent research administering the TFEQ has utilized factor analysis to introduce the construct of "internal disinhibition", which is more all encompassing than either emotional eating or emotional disinhibition (Niemeier et al. 2007). It has broadened the definition of disinhibition to include eating in response to internal cues other than emotions such as thoughts or cognitions. For example, the internal disinhibition subscale includes TFEQ items such as item 45, "Do you eat sensibly in front of others and splurge alone?" and item 49, "Do you go on eating binges even though you are not hungry?" both of which appear to target eating in response to internal states other than emotions such as impulsivity or hunger. More research is required to determine the differences in how internal disinhibition or emotional eating/disinhibition contribute to eating behaviors.

It is important to emphasize that the TFEQ measures the construct of internal disinhibition and that this is not the same construct as emotional eating. We are including it in this review because, as will be seen in Aims 2 and 3, some researchers have used the TFEQ internal disinhibition measure inadequately as a measure of emotional eating. This has been done frequently enough that neglecting to review the TFEQ would exclude potentially useful information and empirical evidence about the relationship between internal disinhibition (and its related partner, emotional eating) and weight outcomes.

The Emotional Eating Scale (EES)

Another measure of emotional eating is the Emotional Eating Scale (EES; Arnow et al. 1995), which asks participants to identify the extent to which 25 emotions stimulate a desire to eat from no desire (1), to an overwhelming urge (5). Emotions listed include irritation, fury, worry, uneasiness, sadness, helplessness, and others. Item scores are grouped into three emotional eating subscales: anger/frustration, anxiety, and depression. Arnow et al. (1995) argued that the DEBQ

considers too narrow a range of negative emotions, excluding many that may trigger emotional eating. Because of this, the EES examines 25 negative emotions, almost double the number of items on the DEBQ emotional eating subscale. The EES was initially validated using a population of obese females undergoing treatment for binge eating and weight loss. It has shown good construct, criterion, and discriminant validity in this population (Arnow et al. 1995). Waller and Osman (1998) found that the EES also has high internal consistency and overall good validity in normal weight women who have no eating disorders.

Aim 1 Conclusions

Several measures exist to assess self-reported emotional eating and the related constructs of emotional and internal disinhibition, three of the most frequently cited being the DEBQ, TFEQ, and the EES. Emotional eating, as assessed by the measures described in Aim 1, has shown to have good construct validity. For example, eating in response to negative emotions as assessed by the Emotional Appetite Questionnaire (EAQ; see Table 1 for a description of the measure) has been shown to have good convergent validity with the DEBQ emotional eating subscale, whereas eating in response to EAQ positive emotions has been shown to have divergent validity with DEBQ emotional eating (e.g., Nolan et al. 2010). This suggests that overeating in response to negative emotions, as defined by van Strien et al. (2007), is a separate construct from eating in response to positive emotions. The assessment of emotional eating has also been shown to have convergent validity with disordered eating behaviors such as binge eating (e.g., Arnow et al. 1995; Duarte and Pinto-Gouveia 2015) while displaying divergent validity with other constructs such as cognitive restraint and mindfulness (e.g., Arnow et al. 1995; Duarte and Pinto-Gouveia 2015). To our knowledge, convergent validity between emotional eating and internal disinhibition has not been examined. However, Hyland et al. (1989) compared the factor structures of the TFEQ and DEBQ and found that the three TFEQ items assessing eating when anxious, blue, or lonely were highly correlated with the DEBQ emotional eating subscale. It would be beneficial to analyze whether or not there is convergent validity between emotional eating and internal disinhibition given that they are often used interchangeably in studies targeting weight loss for those who struggle with eating in response to negative emotions.

Aim 2: Emotional Eating and Weight

Recently there has been an increased interest in examining the relationship between emotional eating and weight outcomes such as weight gain, weight loss, and weight loss

maintenance. Research in this area can be divided into two categories: (1) longitudinal studies in which the DEBQ was administered to look at changes in weight, specifically weight gain over time, and (2) weight loss intervention studies in which mainly the TFEQ was administered to examine the effect of internal disinhibition on weight loss and weight loss maintenance.

Longitudinal Studies

Emotional Eating and Weight Gain Several longitudinal studies have assessed associations between DEBQ emotional eating, BMI, and weight gain. Koenders and van Strien (2011) studied a large sample of employees over two years. Approximately half of the sample gained weight while the other half either lost or maintained weight. Higher levels of emotional eating predicted greater weight gain ($B = 0.18$, $SE = 0.06$). Other lifestyle factors including smoking, dietary habits, or alcohol consumption were not significantly associated with weight gain, suggesting that emotional eating may have an independent effect on weight gain.

Van Strien et al. (2012b) conducted a prospective 2-year follow-up study of individuals identified as being highly susceptible to weight gain based on their overeating. They found that emotional eating was positively correlated with both change in BMI over two years ($r = .11$) and overeating ($r = .29$). Emotional eating was also found to moderate the relationship between overeating and weight gain over time ($B = 0.48$, $SE = 0.17$) such that overeating combined with emotional eating was related to weight gain.

Dohle et al. (2014) studied a Swiss sample of participants enrolled in an eating and activity behavior survey and found that emotional eating was linked to heightened BMI over one year ($\beta = .28$). They also found that increased levels of physical activity helped to reduce the negative impact of emotional eating on BMI, such that higher levels of emotional eating and physical activity were associated with lower BMI than higher levels of emotional eating and lower physical activity ($\beta = -.07$). Higher emotional eating and physical activity was also associated with more fruit and vegetable consumption than higher emotional eating and lower physical activity ($\beta = .06$). Higher levels of emotional eating were linked to increased consumption of high fat, high sugar foods ($\beta = .06$) but there were no differences between high active and low active individuals in their consumption of these foods. This suggests that highly active emotional eaters may still consume “unhealthy” foods when emotional but this may be offset by physical activity and heightened consumption of “healthier” foods such as fruits and vegetables.

Longitudinal studies that used the DEBQ to examine eating behaviors have consistently found that emotional eating contributes to weight outcomes more so than external eating. van Strien et al. (2009) found that both restraint and emotional

eating moderated the relationship between overconsumption of food and being overweight. The presence of emotional but not external eating increased the likelihood that overeating led to being overweight ($B = 0.08$, $SE = 0.03$). Similarly, the Healthy Twin Study in Korea found that over time emotional eating but not external eating was positively associated with both weight gain ($B = 0.83$, $SE = 0.28$) and current BMI ($B = 0.35$, $SE = 0.10$) (Sung et al. 2009). These results suggest that internal cues such as anxiety or stress may be more detrimental in eliciting the desire to eat than external cues, such as exposure to highly palatable food in one’s environment, thus increasing food consumption and leading to weight gain.

Intervention Studies

Internal Disinhibition and Weight Loss Internal disinhibition as measured by the TFEQ has also been examined in the context of weight loss interventions. Niemeier et al. (2007) conducted a yearlong behavioral weight loss trial and found that higher baseline internal disinhibition significantly predicted less weight loss at 6 months ($B = 0.59$, $SE = 0.27$). External disinhibition was not related to weight loss. These findings suggest that internal disinhibition is an important factor to address in short-term weight loss.

Similarly, Butryn et al. (2009) found that internal disinhibition was related to weight loss outcomes in their intervention; reductions during the first three months were associated with greater weight loss from months 4 through 12 ($r = .36$). External disinhibition was not associated with weight outcomes ($r = .04$, ns).

More recently Braden et al. (2016) administered the TFEQ and examined the effect of emotional eating as assessed by the three items that measure eating when anxious, sad or blue, and lonely on weight loss. Decreased emotional eating was associated with increased weight loss success (7% decrease in initial body weight or higher) at both 6 months ($B = 0.30$) and 12 months ($B = 0.53$) post-intervention.

Emotional Eating and Weight Loss Teixeira et al. (2010) administered the DEBQ in the context of a weight loss intervention. Weight loss was assessed upon completion of the intervention at 12 months and weight maintenance was measured at the 24-month follow-up. Lower DEBQ emotional eating was associated with increased weight loss at 12 months ($r = .35$), but not 24 months ($r = .08$). At 24 months, higher exercise self-efficacy and exercise motivation were more predictive of successful weight loss than emotional eating.

Researchers have also used other measures than the DEBQ and TFEQ to assess the impact of emotional eating on weight in intervention settings. These studies have found that higher levels of emotional eating are predictive of less weight loss. For example, Canetti et al. (2009) examined psychosocial predictors of weight loss following bariatric surgery and a weight

loss program and found that higher levels of emotional eating (as assessed by the 7-item measure developed by Canetti called “Emotional Eating” or “EE” described in Table 1) were negatively correlated with weight loss ($r = -.42$ for surgery group and $r = -.46$ for weight loss program group).

Emotional eating has also been found to be associated with less weight loss in the Diabetes Prevention Program (DPP), a large-scale, manualized behavioral weight loss intervention (Delahanty et al. 2013). Participants who reported less frequent baseline emotional eating (measured by the Blair et al. questionnaire in Table 1) were more likely to achieve 7% weight loss at six months than those who reported more frequent emotional eating (odds ratio = 0.88). However, similar to the findings of Teixeira et al. (2010), baseline emotional eating was not predictive of weight loss upon completion of the intervention. The DPP encourages a low-fat diet and addresses barriers to achieving this diet, which may have helped mitigate the effect of emotional eating on consuming high fat, high calorie foods.

Aim 2 Conclusions

Emotional eating and internal disinhibition have been found to negatively impact weight outcomes in longitudinal and intervention contexts. Not only are they associated with weight gain over time (e.g., Koenders and van Strien 2011; Sung et al. 2009; van Strien et al. 2012b), they are also associated with less weight loss (e.g., Butryn et al. 2009; Canetti et al. 2009; Delahanty et al. 2013; Niemeier et al. 2007; Teixeira et al. 2010). Despite impacting initial weight loss, emotional eating appears to be less related to weight loss maintenance. Other factors such as exercise more strongly predict weight maintenance (e.g., Delahanty et al. 2013; Teixeira et al. 2010). This finding has implications for developing interventions to target emotional eating: To maximize long term weight change, it may be useful to test if targeting emotional eating helps with initial weight loss while encouraging exercising later on might promote weight maintenance.

There is great heterogeneity in the effect sizes and regression coefficients in studies examining the relationship between emotional eating and weight. This is an indication that this research is still in the incipient stages and consistent methodology has not yet been established. It is worth noting that studies that have administered the DEBQ and TFEQ use and report results for all of the subscales on these measures. This reduces potential publication bias because it helps ensuring that emotional eating and internal disinhibition results are reported even if they are not significant. However, it does not eliminate the possibility of publication bias altogether. It could be that only the studies that find significant or mostly significant effects for these subscales are published. Overall the connections between emotions, eating, and weight warrant further investigation to establish adequate treatment protocols

to mitigate this relationship and help promote weight loss and weight maintenance.

Aim 3: Interventions to Target Emotional Eating and Weight Loss

Traditional forms of intervention, such as behavioral weight loss programs, have shown little efficacy in reducing emotional eating and internal disinhibition (e.g., Butryn et al. 2009; Delahanty et al. 2013; Niemeier et al. 2007). This is likely because they do not address weight loss challenges specific to emotional eaters, namely using food for emotion regulation. Several approaches have been proposed to address emotional eating and thus encourage weight loss. These include: mindfulness, Acceptance and Commitment Therapy (ACT), Cognitive Behavior Therapy (CBT), and Dialectical Behavior Therapy (DBT).

Mindfulness Interventions for Emotional Eating

Mindfulness is a technique that has been employed to target weight loss for emotional eaters and is defined as the act of paying attention to the present moment purposefully and non-judgmentally (Bishop et al. 2004). This includes attending to internal experiences such as emotions. Learning to nonjudgmentally focus one’s awareness on emotions may help emotional eaters to come to tolerate and accept their internal experiences, rather than feeling compelled to act on them by eating.

One of the most prevalent mindfulness-based eating interventions is the Mindfulness-Based Eating Awareness Training (MB-EAT) originally developed by Kristeller and Hallett to treat binge eating (Kristeller and Hallett 1999). MB-EAT is a group intervention that involves cultivating mindfulness, mindful eating, emotional balance, and self-acceptance (Kristeller and Wolever 2011). When delivered as an RCT MB-EAT was found to improve binge eating and other outcomes, such as weight loss, depression, and TFEQ disinhibition (Kristeller et al. 2014). Although emotional eating was not examined, many of the sessions in the MB-EAT program are relevant to emotional eaters (e.g., recognizing what triggers binge eating, learning hunger, taste satiety, and fullness cues, etc.). Future research could apply this program to emotional eaters.

A 2014 literature review by O’Reilly et al. found mindfulness-based interventions to be effective in reducing eating behaviors associated with obesity such as binge eating, external eating, and emotional eating. Of the studies reviewed, 63% were found to reduce emotional eating. The average weight loss in studies that reported this outcome was 4.5 kg. The effect sizes for changes in weight were small (Cohen’s $d = 0.12$ to 0.26). Similarly, Katterman et al. (2014) did a

systematic review of the literature on mindfulness meditation to treat binge eating, emotional eating, and weight loss. They found that although mindfulness produced reductions in emotional eating and binge eating, it did not consistently lead to weight loss post-intervention (Cohen's $d = -0.17$ to 0.04). Weight loss was greatest in interventions that focused on weight as a primary outcome; namely those that combined mindfulness with behavioral weight loss components like nutrition and exercise education, goal setting, and problem solving (Cohen's $d = -3.29$). This finding suggests that although mindfulness may help to reduce emotional eating, pairing it with a behavioral weight loss program may improve weight loss more.

Treating Emotional Eating with ACT

ACT has recently been proposed to reduce emotional eating, subsequently promoting weight loss and weight maintenance. ACT encourages tolerance of internal cues such as emotions and external cues such as food. Forman and Butryn (2014) proposed a theoretical basis for applying ACT strategies to help address weight loss challenges for emotional eaters. They argue that there are three psychological skills necessary for successful weight control: values clarification, mindfulness, and distress tolerance. It should be noted that mindfulness is a component of ACT. However, it is not the exclusive component, and this differentiates ACT interventions from the mindfulness interventions described above.

ACT and Weight Loss Interventions for Emotional Eaters

ACT has been integrated into several weight loss programs in recent years. The “Mind Your Health” Project was a recent RCT comparing ACT to standard behavioral treatment (SBT) that examined weight loss in 128 overweight and obese individuals (Forman et al. 2013). The acceptance strategies used in the ACT group targeted commitment to weight loss and values, distress tolerance, and mindless eating. Post hoc analyses found that emotional eaters in the ACT group ($n = 41$) lost over 4% more weight than emotional eaters in the SBT group ($n = 26$), both at the post-treatment (12.68% vs. 8.21%) and 6-month follow-up (10.51% vs. 6%) time points. Emotional eaters benefited more from ACT than non-emotional eaters. One limitation of this intervention is that timing of the follow-up (6 months) does not inform about weight loss maintenance in the long term. The 40-week program was also unusually long compared to other behavioral weight loss programs, so it may not be feasible to achieve such significant weight losses outside of a structured research setting, in fewer sessions.

ACT interventions have also been shown to reduce internal disinhibition as measured by the TFEQ (e.g., Lillis et al. 2015; Niemeier et al. 2012). Emotional eating has not been

examined in these interventions. It is therefore unclear whether reductions in weight are related to acceptance strategies that target emotional eating specifically or internal disinhibition more broadly. In order to determine this, it is important to administer a measure that exclusively examines emotional eating, and currently only a few studies have done so, using the EES to assess emotional eating (e.g., Forman et al. 2013; Hill et al. 2015).

CBT and DBT for Emotional Eating

Most of the research investigating the use of CBT and DBT to address eating behaviors has been with eating disorders, such as BED, anorexia nervosa, and bulimia nervosa (e.g., Lenz et al. 2014; Safer et al. 2010; Turner et al. 2016). More recently, both CBT and DBT have been proposed to target and reduce emotional eating (e.g., Glisenti and Strodl 2012). According to CBT, emotional eating and other problematic eating behaviors are maintained through maladaptive behavioral factors and maladaptive cognitions (Cooper et al. 2003). Both behaviors and cognitions must be targeted to alter the emotions that lead to eating. DBT, which was originally developed to treat borderline personality disorder (Linehan 1993a, 1993b), is also applicable to emotional eating because of the emphasis it places on affect regulation. Emotional eaters use food as a way to regulate negative emotions that they experience. DBT may work to mitigate this by encouraging alternative emotion regulation skills that do not involve eating.

Glisenti and Strodl (2012) performed case studies comparing CBT and DBT for treating obese emotional eaters. Two of the cases received 22 sessions of CBT while the other two received 22 sessions of DBT. The CBT intervention involved elements such as addressing barriers to weight loss, addressing goals, and providing information on healthy eating and increasing physical activity. The DBT intervention included emotion regulation and distress tolerance skills to help acknowledge and manage negative emotions that lead to eating. While the emotional eaters who received CBT lost less than 1% of their initial body weight and displayed no reductions in emotional eating at 8-weeks, the emotional eaters who received DBT did display significant improvements in both areas, losing between 7 and 10% of their initial body weight. These results suggest that DBT may be more effective than CBT in reducing emotional eating and improving weight loss for emotional eaters, likely because it actively focuses on emotion regulation. However, RCTs are required to test this possibility.

Roosen et al. (2012) also conducted a pilot study adapting group DBT for emotional eaters. They recruited 35 obese male and female emotional eaters and had them participate in 20 group sessions designed to target their emotional eating and promote weight loss. Sessions focused on teaching emotion regulation skills through mindfulness, emotion regulation (decreasing susceptibility to negative emotions and increasing

positive emotions), and distress tolerance, similar to the mindfulness and ACT interventions described above. Upon completion of the intervention and at the 6-month follow-up, significant reductions were found in both emotional eating scores and weight. However, the effect sizes were small. Participants lost an average 1.7% initial body weight post-treatment and 2.4% at 6 months, suggesting that DBT may assist more with weight maintenance. Another strength is that the intervention had a very low attrition rate; only 1/35 participants dropped out.

Aim 3 Conclusions

Overall, several approaches have shown promising results in reducing emotional eating and facilitating weight loss, including mindfulness, ACT, CBT, and DBT interventions. More standardized RCTs are needed to test the effect of these treatments on weight loss and weight maintenance in emotional eaters. Moving forward, it would be useful to administer both the DEBQ or EES and the TFEQ in the context of a weight loss intervention. This would allow for the comparison of the predictive validity of emotional eating and internal disinhibition in relation to weight outcomes to see which construct has a greater effect on weight loss and weight loss maintenance.

Conclusions

Despite emotional eating's significant, negative association with weight loss and weight loss maintenance and its popularity as an anecdotally reported social construct, this is the first review that outlines the relationship between emotional eating and weight outcomes. The purpose of this review was to: (1) review common self-report questionnaires of emotional eating, (2) evaluate its impact on weight in various contexts, and (3) importantly, examine ways in which this knowledge can be used to treat emotional eating to improve weight loss outcomes.

As reviewed in Aim 3, there are various perspectives on how to treat emotional eating. To our knowledge, there is currently a lack of research comparing various treatment methods for emotional eating; rather treatments are compared to standard behavioral weight loss treatments. More research is needed to determine which methods are most appropriate for specific individuals and contexts. It may also be beneficial to combine treatment methods such as CBT and mindfulness in order to teach both behavior modification and acceptance strategies to reduce emotional eating (e.g., Corsica et al. 2014; Goldbacher et al. 2016). Gaining this insight will help to tailor interventions such that they are best suited to the individual situations of emotional eaters and maximize their effectiveness in reducing emotional eating and improving weight loss.

As seen in Aims 2 and 3, studies employ a variety of measures to assess emotional eating, from the DEBQ to assess emotional eating to the TFEQ to assess internal disinhibition.

Future research could draw comparisons between the DEBQ and TFEQ to determine whether emotional eating or internal disinhibition is better at predicting weight outcomes. These distinctions influence treatment strategies, as researchers are required to choose whether to target emotional eating or internal disinhibition, rather than viewing them as synonymous.

This example reflects a larger concern that emotional eating is not a well-defined construct. Although van Strien et al.'s (2007) definition is frequently used, the definition itself is somewhat open to interpretation. For example, it is contingent on "overeating" in response to negative emotions but this term itself is not defined. When examining the DEBQ itself, questions only ask how often one experiences the desire to eat in response to a variety of negative emotions. It does not assess how much people eat when they experience this desire, so it is difficult to assess whether or not overeating is experienced. Even in questionnaires that assess emotional "overeating" (e.g., Masheb and Grilo 2006), "overeating" is not formally defined. The EOQ asks respondents to endorse how often they have eaten an "unusually large amount of food, given the circumstances" in response to various emotions in the past 28 days, but what this means in terms of concrete consumption is open to individual interpretation. The lack of clarity makes it difficult to pinpoint what constitutes emotional eating and determine the extent to which specific emotional eating behaviors are problematic for weight outcomes. The ultimate implication of this ambiguity is that it makes it more difficult to design interventions to target emotional eating and help improve weight loss outcomes.

A large proportion of the population is overweight or obese, and a significant subset of these individuals eats in response to negative emotions. Thus emotional eating cannot be ignored in the development of weight loss programs. Yet current standard behavioral treatment fails to target the specific needs of emotional eaters and is thus rendered ineffective for this population. Implementing mindfulness and ACT techniques are two promising interventions used to teach emotional eaters to cope with negative emotions without eating. They have shown efficacy in reducing emotional eating as well as promoting weight loss in preliminary studies. Further research is necessary, in the form of large-scale RCTs, to develop programs that effectively and efficiently target weight loss for emotional eaters. Combining this research with broad dissemination of the findings will aid in promoting effective weight loss for those who struggle with emotional eating.

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The Effects of Exposure to Catcalling on Women's State Self-Objectification and Body Image

Sophie Fisher¹ · Danielle Lindner¹ · Christopher J. Ferguson¹

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Abstract Previous research has shown that sexual harassment has potential influence on women's well-being and body image. This study evaluated the effects of exposure to catcalling, which is the specific instance of sexual harassment on the street by strangers, on women's state body image and state self-objectification. The participants were randomized into experimental and control groups and were pre-tested to determine their state body image and self-objectification. The participants then watched one of two videos. The experimental video included four women being catcalled by a man while they walked down the street. The control video was set up on the exact same street, with the exact same women, but without the catcalling. Finally, participants completed a post-test questionnaire to measure their state body image and self-objectification as well as their trait body image and self-objectification. Results showed that there were no significant differences between the control and experimental groups regarding either body image or self-objectification. Bayes factor analyses confirmed the results as null.

Keywords Sexual harassment · Catcalling · Sexual objectification · Self-objectification · Body image

✉ Danielle Lindner
dlindner@stetson.edu

Sophie Fisher
sfisher@stetson.edu

Christopher J. Ferguson
cjfergus@stetson.edu

¹ Department of Psychology, Stetson University, 421 N. Woodland Blvd., Unit 8281, DeLand, FL 32723, USA

The sexual harassment of women was recognized both as a criminal issue and a social problem beginning in the 1970's in the United States (Shechory Bitton and Shaul 2013). Most existing studies on the topic focus on the sexual harassment of women in the workplace (e.g., Collinsworth et al. 2009; Koskela and Tani 2005; Wiener et al. 2013). Sexual harassment in the workplace is an important issue because it can lead to a hostile work environment where women report feeling unsafe. However, all forms of sexual harassment, whether in the workplace or not, can and do have consequences for victims such as body image disturbance, reduced empowerment, self-esteem issues, and more (Koss et al. 1994; Pina and Gannon 2012; Thompson et al. 1999). Little research to date has examined a specific form of sexual harassment called catcalling, or street/stranger harassment occurring in public spaces. The current study seeks to examine the effects of exposure to catcalling using an experimental protocol.

Catcalling

Oxford Dictionaries (n.d.) defines a catcall as “a loud whistle or comment of a sexual nature made by a man to a passing woman.” Catcalling is a form of sexual harassment, or unwanted verbal or nonverbal sexual attention, also aptly described as stranger harassment because the victim and the perpetrator do not know each other (Fairchild and Rudman 2008). Catcalling may be accompanied by whistles, winks, or grabs (Bowman 1993). It involves brief, one-sided interactions in public places (e.g., streets, public transit, shopping malls), and unlike quid pro quo harassment that might occur in the workplace or educational settings, catcalling has no clear purpose other than to call attention to a woman's body or sexuality (Fairchild and Rudman 2008; Saunders et al. 2016).

Of the more than 12,000 women who participated in the Canadian Violence Against Women Survey (VAWS; Johnson and Sacco 1995), 85% indicated that they had experienced stranger harassment at some time in their lives, making it far more common than quid pro quo harassment, which was reported by only 5% of women. Looking more closely at women's day-to-day experiences, data from two samples of women recruited on college campuses and one sample of women recruited via the Internet suggest that 28 to 47% of women experience unwanted sexual remarks or attention at least once every few days (Fairchild 2010; Fairchild and Rudman 2008; Saunders et al. 2016). Eighty percent of women in one of those samples reported that they experienced unwanted sexual remarks or attention at least once per month. Taken together, these findings highlight the frequency with which women experience sexual harassment.

Several studies have documented the negative effects of stranger harassment. Stranger harassment, which in some studies includes catcalling and other forms of sexual harassment perpetrated by strangers such as being followed or receiving an obscene phone call, is associated with a number of negative psychological outcomes, including poor body image, symptoms of anxiety and depression, and lower levels of perceived safety, and increased fear of rape (e.g., Davidson et al. 2016, 2015; Fairchild and Rudman 2008; MacMillan et al. 2000; McCarty et al. 2014; Schneider et al. 1997). In addition, stranger harassment may lead women to make behavioral changes including changing routes or transportation means, avoiding particular geographic locations, avoiding going out at night, or avoiding specific people (Livingston 2015). Despite the fact that stranger harassment generally only includes a brief contact between perpetrator and victim, some literature suggests that victims may perceive stranger harassment as more severe than harassment by persons known to them (MacMillan et al. 2000; McCarty et al. 2014).

Understandably, studies examining the effects of sexual harassment frequently report on negative consequences for victims of such harassment. However, given that catcalling is inherently a public event, the effects of catcalling may be felt by observers. Hitlan et al. (2006) found that 69% of their sample of college women in the United States reported observing sexual harassment and experiencing a negative emotional response. In an experimental study, Chaudoir and Quinn (2010) found that asking participants to watch a video and imagine themselves as a bystander to an instance of sexual harassment did not induce negative affect, but did lead to more negative emotions toward men. These findings suggest that some of the effects of sexual harassment may still be felt by observers, even if they are not the targets of such harassment.

While many are likely to be impacted negatively by catcalling and other forms of street harassment, researchers have argued that under some circumstances, people may not perceive catcalling negatively and may even perceive it

positively. In a popular press piece, Grossman (2008) argued that some women may interpret instances of catcalling in a positive light, perceiving unsolicited remarks about appearance as compliments. Liss et al. (2011) noted that some women may perceive sexual objectification or other forms of sexualization positively because cultural messages teach girls and women that beauty and attractiveness are important if one wants to be successful or happy. From this perspective, catcalling serves to let a woman know that she is living up to cultural ideals about appearance. However, while Liss and colleagues found that some women do enjoy sexualization, they described this enjoyment of sexualization as a form of false empowerment, given that it was ultimately still linked to negative body image and disordered eating. Thus, while some women may, on the surface, appear to respond positively to catcalling, the net effects of this type of sexual objectification still seem to be negative.

Understanding Catcalling Through the Lens of Objectification Theory

Objectification theory serves as a useful framework for understanding the effects of catcalling and other forms of sexual harassment on victims and bystanders. Objectification theory, first proposed by Fredrickson and Roberts in 1997, was designed to explain the effects of living in a culture where women are consistently sexually objectified, or reduced to bodies to be used and/or evaluated by others rather than being seen as full persons. Objectification theory argues that repeated experiences of or exposure to sexual objectification leads women to internalize an objectified view of their own bodies, termed self-objectification.

Within the objectification theory framework, catcalling can be viewed as a form of interpersonal sexual objectification. Interpersonal sexual objectification is most commonly assessed via self-report using the Interpersonal Sexual Objectification Scale (ISOS; Kozee et al. 2007), which asks respondents to report the frequency which they have experienced any kind of sexually objectifying gaze or unwanted sexual advance (including catcalling) in the last year. Sexual objectification in these forms is associated with increased self-objectification, body shame, and psychological distress (e.g., Fuller-Tyszkiewicz et al. 2012; Kozee et al. 2007; Szymanski and Feltman 2014).

While some may perceive self-objectification in and of itself to be fairly benign, the body of literature regarding the consequences of self-objectification suggests that this act of taking on an observer's perspective toward the body and equating oneself with the body is anything but. In both experimental and correlational studies, self-objectification has been linked to body shame and body dissatisfaction (e.g., Fredrickson et al. 1998; Lindner et al. 2012; Miner-Rubino et al. 2002;

Noll and Fredrickson 1998; Strelan and Hargreaves 2005). These adverse body image states also serve to mediate the relationships between self-objectification and several negative mental health consequences, including symptoms of eating disorders, depression, and sexual dysfunction (e.g., Calogero 2009; Calogero and Thompson 2009; Lindner et al. 2012; Noll and Fredrickson 1998; Tiggemann and Kuring 2004). Additional research links self-objectification to decreased flow experiences and poorer cognitive performance, indicating that the consequences of self-objectification extend beyond mental health (e.g., Fredrickson et al. 1998; Quinn et al. 2006; Tiggemann and Kuring 2004). Taken together, extant research shows that self-objectification is not harmless; thus, it is important to study the antecedents of self-objectification in order to learn more about appropriate targets for preventing it.

The Present Study

Existing literature regarding the effects of catcalling indicates that it has negative consequences for women's psychological well-being; however, most of the current studies are correlational in nature and involve self-report of catcalling or other interpersonal sexual objectification experiences. The current study investigated the effects of catcalling within the objectification theory framework. We sought to determine whether exposure to catcalling, as with other forms of sexual objectification, has the potential to influence women's self-objectification and body dissatisfaction. We chose to use a proxy design to examine the impact of women's viewing catcalling scenarios on their self-objectification and body dissatisfaction. Although this is obviously less salient than real-life exposure, as mentioned above, simply observing sexual harassment can have negative effects (e.g., Chaudoir and Quinn 2010; Hitlan et al. 2006). This study advances our understanding of the effects of sexual objectification or harassment by specifically isolating catcalling from other forms of sexual objectification or harassment, as was done by Chaudoir and Quinn (2010), and by examining the effects of experimentally manipulated exposure to catcalling on women's self-objectification, body shame, and body dissatisfaction as opposed to more general constructs not specifically related to objectification theory (e.g., negative affect).

Given previous research on sexual harassment and sexual and self-objectification, we hypothesized that participants would experience increases in self-objectification and body dissatisfaction. This effect was expected to hold while controlling for trait self-objectification, trait body image, and previous sexual objectification experiences. We also hypothesized that enjoyment of sexualization would moderate the relationship between exposure to catcalling and negative consequences (i.e., self-objectification and body dissatisfaction).

Method

Participants

A total of 92 female college students from a small liberal arts university participated in the study. They ranged in age from 18 to 22 years ($M = 19.02$, $SD = 1.22$). Over half were Caucasian ($n = 54$, 58.7%), with the rest identifying as Hispanic/Latino ($n = 17$, 18.5%), African American ($n = 14$, 15.2%), Native American ($n = 2$, 2.2%), Asian/Pacific Islander ($n = 3$, 3.3%), and other ($n = 2$, 2.2%).

Materials

Videos The video for the experimental condition was created by the first author to show a scenario of a man catcalling random women on a public street. The video depicted one man catcalling four women (two women individually and one pair of women) as they walked past him. The female actors were instructed not to look at the camera or show any reaction to the catcalling in order to prevent their behavior from affecting the participants' responses. The video focused on the man's catcalling behavior. The video for the control condition was filmed on the same public street with the same actors as the experimental video. In the control video the actors did not interact with one another; the female actors simply walked down the street to their destination, without provocation by the male actor.

Measures

Demographics Questionnaire Participants were asked to report their age, ethnicity/race, school year, school major, weight and height.

Body Image States Scale (BISS) (Cash et al. 2002). This scale was used to measure women's state body image before and after exposure to the video. The BISS consists of 6 items that measure the following domains of current body experience: (1) dissatisfaction–satisfaction with one's overall physical appearance; (2) dissatisfaction–satisfaction with one's body size and shape; (3) dissatisfaction–satisfaction with one's weight; (4) feelings of physical attractiveness–unattractiveness; (5) current feelings about one's looks relative to how one usually feels; and (6) evaluation of one's appearance relative to how the average person looks. For all items, the responses were based upon a 9-point rating scale, with anchors that varied depending on item content and higher scores reflecting more negative body image (i.e., more body dissatisfaction or body shame). In initial psychometric evaluations, the BISS had high internal consistency and was correlated with measures of other aspects of body image (Cash et al. 2002). For this particular study, the internal consistency of the BISS was .87 at pre-test and .93 at post-test.

Twenty Statements Test (TST; Kuhn and McPartland 1954) Consistent with the work of Fredrickson, Noll, Roberts, Quinn, and Twenge (1998), the Twenty Statements Test was used to measure state-level changes in self-objectification from pre-test to post-test. This test asks participants to write twenty answers to the question “Who am I?” on blank lines. The first author coded responses while blind to condition using the coding scheme adopted by Fredrickson et al. (1998), such that each participant’s total score was the percentage of appearance-related responses they wrote in response to the prompt.

The Interpersonal Sexual Objectification Scale (ISOS; Kozee et al. 2007) The ISOS includes 15 items that assess prior sexual objectification experiences involving body evaluation and physical invasion over the last year. There are 11 items to measure body evaluation and 4 items to measure physical invasion. The participants selected a response from 1 (never) to 5 (almost always) for each question. There is evidence for the scale’s reliability and validity in a sample of college women (Kozee et al. 2007). Prior sexual objectification experiences were treated as a covariate in this study, and the ISOS showed an internal consistency reliably of .94.

Multidimensional Body-Self Relations Questionnaire Appearance Evaluation Scale (MBSRQ-AE; Cash 2000) This scale measures trait body satisfaction, which was treated as a covariate in this study. Participants were given 7 statements that they must rate on a scale of 1 to 5, with 1 being definitely disagree, 3 being neither agree nor disagree, and 5 being definitely agree. Several studies provide evidence for the scale’s internal consistency, test-retest reliability, and validity (Cash 2000). The MBSRQ-AE had a Cronbach’s alpha of .90 for this sample.

Objectified Body Consciousness Body Surveillance Scale (OBC-Surveillance; McKinley and Hyde 1996) OBC-Surveillance was used as an index of women’s trait self-objectification, which was treated as a covariate in this study. This scale consists of 8 statements rated on a scale of 1 to 7, where 1 = strongly disagree, 4 is neither agree nor disagree, and 7 is strongly agree, and NA is not applicable. There was evidence for the construct validity, internal consistency, and test-retest reliability of the measure in initial validation studies (McKinley and Hyde 1996). Cronbach’s alpha was .79 for OBC-Surveillance in the present study.

Enjoyment of Sexualization Scale (ESS; Liss et al. 2011) This 9-item scale measures how much women enjoy the attention that men give them in a sexual and aesthetic way. Enjoyment of sexualization was treated as a moderator in this study. Participants rated their level of agreement with each

statement on a 6-point scale (1 = disagree strongly to 6 = agree strongly). A series of studies by Liss et al. (2011) provided evidence for the scale’s reliability and validity. The scale’s internal consistency was .80 in the present study.

Means and standard deviations for all scales are presented in Table 1.

Procedure

All study procedures received Institutional Review Board approval. Participants were recruited through a flyer posted in buildings on campus advertising the study with a signup sheet. Students were provided with course credit at the discretion of their instructor. Participants were randomly assigned to conditions by flipping a coin prior to their arrival. There were 46 participants in each group. Participants took part in the study in individual sessions. After providing informed consent, participants completed a pre-test questionnaire consisting of the TST and the BISS to measure their state self-objectification and body image. The participants then watched the catcalling video or the control video. After viewing the video, they completed the TST and the BISS to again measure state self-objectification and body image. They also completed measures of trait self-objectification, trait body image, previous objectification experiences, and their enjoyment of sexualization. The post-test questionnaire also included demographic questions. Lastly, participants were debriefed about the experiment.

Table 1 Means and standard deviations for study variables

Scale	Mean	Standard deviation	η_p^2/r^2 difference
Twenty statements test (pre)	.073	.080	.005
	.062	.077	
Twenty statements test (post)	.098	.082	.001
	.125	.154	
BISS (pre)	5.20	1.27	.015
	5.51	1.19	
BISS (post)	5.13	1.57	.033
	5.46	1.27	
MBSRQ	3.31	0.88	.000
	3.29	0.82	
ISOS	2.73	0.81	.071
	2.30	0.74	
OBSC (surveillance)	4.77	1.12	.006
	4.60	1.01	
ESS	3.12	0.68	.009
	3.30	0.70	

For each variable, the experimental group is presented on top, with the control group below. Effect sizes of difference calculated from t-score analyses other than for main study DVs

Results

All analyses were conducted in SPSS version 19. Examination of kurtosis and skewness values, Shapiro-Wilk Test of Normality, and Normal Q-Q plots supported that the assumption of normality was not violated. Examination of *z*-scores indicated there were no outliers. Box's Test found no violations of the assumption of homogeneity of covariance matrices ($p = .002$).

Main Analyses

Our main hypothesis predicted that participants would experience a decrease in body satisfaction and an increase in state self-objectification after being exposed to catcalling scenario videos relative to the control condition. The effect was hypothesized to hold while controlling for trait self-objectification, trait body image, previous sexual objectification experiences, and pretest dependent variable (i.e., state body image or self-objectification) scores. ANCOVA analyses were performed with body satisfaction and state self-objectification as outcomes. Trait self-objectification, trait body image, previous objectification experiences and pretest dependent variable scores were included as covariates.

Results found that there was no significant condition effect for posttest state body image, $F(1, 83) = 0.056$, $p = .814$, $\eta_p^2 = .001$. Pretest state body image $F(1, 83) = 67.568$, $p < .001$, $\eta_p^2 = .449$ and trait body satisfaction $F(1, 83) = 11.004$, $p = .001$, $\eta_p^2 = .117$ were significant predictors of posttest state body image. Regarding state self-objectification, no significant effect of condition was found $F(1, 84) = 2.839$, $p = .096$, $\eta_p^2 = .033$. Only state self-objectification prescore, $F(1, 84) = 29.694$, $p < .001$, $\eta_p^2 = .261$ was significant in the model.

Because null results can be hard to interpret through traditional null-hypothesis testing, the main outcome scores were further examined using Bayes Factors. For the results related to state body image, Bayes Factors results were equivalent to 2.977, in favor of the null hypothesis. For results related to state self-objectification, Bayes Factors results were equivalent to 2.930, in favor of the null hypothesis. In both cases, these outcomes lend further support to the null hypothesis as the most likely true outcome as opposed to Type II error.

Moderator Effects

It appeared possible that the impact of exposure to catcalling experiences could vary depending upon women's experience with sexualisation. Some women may find some degree of sexualization to be flattering, whereas others may be offended. Therefore we conducted moderator analyses using PROCESS. PROCESS is a regression-based model that allows for testing of specific direct and moderator effects

between multiple variables (Hayes 2013). Using PROCESS Model 1, experimental condition was entered as the independent variable and post-test state body satisfaction and self-objectification were used as dependent variables. Trait self-objectification, trait body image, previous objectification experiences and dependent variable pretest score were included as covariates.

Results for state body satisfaction did not reveal the presence of any moderator effects. As with the main analyses, experimental condition did not relate to state body satisfaction ($t = 0.27$, $p = .787$) nor was the moderating relationship with experiences of sexualization significant ($t = 0.28$, $p = .780$). Similar results were found for state self-objectification. Experimental condition did not relate to state self-objectification ($t = -0.58$, $p = .566$) nor was the moderating relationship with experiences of sexualisation significant ($t = 0.84$, $p = .404$). Thus, there was little evidence for a particular group of women influenced either positively or negatively by the catcalling exposures.

Discussion

Sexual harassment of women in public spaces remains an issue of pressing social concern. Although there is a growing body of literature about the effects of sexual harassment more generally, little existing research has examined women's experiences with public sexual harassment or "catcalling" specifically and the impact such behavior may have on women. This study examined the effects of exposure to catcalling on women's state body image and state self-objectification. Surprisingly, our results indicated no difference between participants exposed to a catcalling video and those exposed to a similar video without catcalling. Women did not experience changes in state body image or self-objectification after seeing a video of a man objectifying other women. Analysis of Bayes Factors confirmed the null results are unlikely to be explained as a product of Type II error.

There are several possible explanations for our findings. First, women in our experiment were not directly exposed to catcalling. Objectification theory (Fredrickson and Roberts 1997) is based on the premise that living in a culture in which women are constantly sexually objectified socializes women to internalize an observer's perspective on their own body and, as a result, experience more body image dysfunction and mental health consequences. This theory also holds that exposure to sexual objectification can occur in interpersonal interactions or via things like media messages. Thus, theory would suggest that witnessing objectification of other women could lead to more negative body image and increased self-objectification for the observer, but it is nonetheless possible that women are resistant to effects when witnessing objectification of another women, but might still experience effects if harassed directly.

We chose proxy exposure to minimize ethical concerns associated with directly exposing participants to catcalling given that Chaudoir and Quinn (2010) used a similar paradigm in the past.

The other, more optimistic explanation is that women are more resilient in the face of societal pressures than has often been previously thought. Rather than being easily molded by societal influences, many women may not experience significant negative effects, even when exposed to noxious and harassing stimuli, at least related to self-image (though women may still find harassment threatening or intimidating). This observation is consistent with evidence from other realms, such as media effects, which suggests that media depictions of beauty may not have the pronounced effects for most women as was once thought (Ferguson 2013; Hayes and Tantleff-Dunn 2010). Further, some scholars have argued that the notion that women are easily influenced by societal pressures is itself a patronizing perspective (Gill 2012).

As with most realms of research, only further study will explicate our finding and place it into context with other research results. However, we find our research to be consistent with increasing evidence for general resiliency in the face of societal influences which may argue for a new paradigm when considering societal influences on behaviour (Lang 2013).

Implications & Further Research

As with all studies, ours had limitations that are worth noting. First, as we acknowledge, it is likely that watching videos of catcalling may not have the same impact as in-person exposure. Second, our sample is relatively modest in size, and it would be good to replicate our findings with larger samples and those outside of university settings. Third, we administered self-report measures of covariates and moderators following exposure to the videos. We made this decision to minimize priming, but we also acknowledge that as a result of this choice, covariate scores may have been impacted by the experimental manipulation. However, as reflected in Table 1, mean scores on covariates were consistent across study groups, so this is not likely.

Our study also had two particular strengths relative to the existing literature on this topic. First, many existing studies on sexual harassment have utilized correlational designs (e.g., Fairchild and Rudman 2008; MacMillan et al. 2000; McCarty et al. 2014), whereas we used an experimental design. Second, we studied catcalling as distinct from other forms of sexual harassment, while much of the existing literature considers catcalling and other forms of sexual harassment together in calculating indices of sexual objectification (e.g., Kozee et al. 2007).

Future directions for research could include examining the frequency and effects of catcalling using ecological momentary assessment techniques, which would not present the same kinds of ethical problems as exposing participants to sexual objectification in a lab setting. It would also be worthwhile to examine whether different types of sexual harassment have differential effects, rather than considering catcalling in conjunction with other forms of sexual harassment that may or may not have the same kind of impact. The issue of sexual harassment of women in public spaces is an important one for researchers to consider. We hope that our study has advanced the science in this area.

Compliance with Ethical Standards

Conflict of Interest Sophie Fisher declares that she has no conflicts of interest. Danielle Lindner declares that she has no conflicts of interest. Christopher J. Ferguson declares that he has no conflicts of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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Work, Nonwork, and Sleep (WNS): a Review and Conceptual Framework

Tori L. Crain¹ · Rebecca M. Brossoit¹ · Gwenith G. Fisher¹

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Abstract

The current paper expands on traditional views of the work-nonwork interface to incorporate the critical component of sleep. We integrate past theoretical and empirical work from the sleep and organizational science literatures to inform a novel framework that will facilitate research evaluating associations among work, nonwork, and sleep, the three major areas of life. We propose that attitudes, behaviors, and states emerging in work and nonwork domains cannot be fully understood without taking into account upstream and downstream sleep quantity and quality effects. Rather, periods of sleep bookend engagement in work and nonwork roles. Thus, we propose the work, nonwork, and sleep (WNS) conceptual framework and, in doing so, identify specific, underlying resource mechanisms (i.e., human energy and time) operating both intra-individually and inter-individually. We also discuss contextual factors that act as predictors and moderators of these relationships. We suggest that a unifying framework explaining connections and underlying processes among work, nonwork, and sleep is necessary for applied psychology and management disciplines to significantly contribute to future research, intervention development and dissemination, and ultimately policy change. We provide a number of avenues for future investigation, including relevant special populations and methodological approaches. Although a plethora of work-nonwork theoretical frameworks exist, none have incorporated the third major area of life: sleep. We call for the expansion and acknowledgement of sleep, an important source of variance in everyday attitudes, behaviors, and states, and ultimately in long-term organizational, family, and individual health and well-being.

Keywords Work-nonwork interface · Work-family interface · Sleep · Resources · Theory

The intersection of work and sleep has become an increasingly important topic of investigation in the management and organizational psychology literature (e.g., Barnes, 2012; Basner, Spaeth, & Dinges, 2014). The Centers for Disease Control and Prevention estimate that approximately 83.6 million US adults

maintain less than 7 h of sleep per night (Liu et al., 2016). The federal government listed sleep health as a priority objective of their *Healthy People 2020* initiative and set a goal of increasing the proportion of adults who get sufficient sleep (i.e., at least 8 h for 18–21 year-olds and at least 7 h for individuals 22 and older) from 69.6 to 70.8%, a small improvement likely to result in large-scale implications. Adequate sleep is necessary for optimal day-to-day performance and functioning, in addition to the prevention of long-term chronic illness, mental health issues, and early mortality (Watson et al., 2015), outcomes that considerably affect our nation's workplaces, families, and overall well-being. Notably, organizational scholars have emphasized the need for public policy reform around sleep health (Barnes & Drake, 2015), future research to examine how workplace factors and sleep are ultimately bidirectionally related (e.g., Barnes, 2012; Crain et al., 2014; Mullins, Cortina, Drake, & Dalal, 2014), and future intervention work targeting upstream antecedents of sleep (e.g., Barnes, 2012; Crain et al., 2014).

One particularly promising area of investigation involves associations among work, nonwork, and sleep. A number of studies have consistently found relationships between work-family experiences and sleep outcomes (e.g., Barnes, Wagner,

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✉ Tori L. Crain
Tori.Crain@colostate.edu

Rebecca M. Brossoit
Rebecca.Brossoit@colostate.edu

Gwenith G. Fisher
Gwen.Fisher@colostate.edu

¹ Department of Psychology, Colorado State University, Fort Collins, CO 80523-1876, USA

& Ghumman, 2012; Crain et al., 2014), in addition to work-nonwork experiences, more broadly, and sleep outcomes (e.g., Sonnentag, Binnewies, & Mojza, 2008). Indeed, work and nonwork (including family) are often prioritized over sleep, by both individuals and organizations alike (Barnes, Jiang, & Lepak, 2016). Although consensus recommendations indicate that a minimum of 7 h of sleep per night will result in optimal health and well-being (Watson et al., 2015), society tends to relegate sleep to a less important role when trying to balance work and nonwork demands (Barnes et al., 2012), which has deleterious short- and long-term consequences (e.g., Watson et al., 2015). However, it is important to clarify what we mean when we refer to *sleep*. We define sleep as having a two-part definition, in line with Barnes (2012). *Sleep quantity* represents the duration, or amount of time, an individual remains asleep, whereas *sleep quality* refers to how well one sleeps regardless of sleep duration. Sleep quality is typically measured by evaluating difficulty initiating sleep, maintaining a sleeping state throughout the night, and may also refer to the presence of wakefulness during the sleeping period (Barnes, 2012; Cappuccio, D'Elia, Strazzullo, & Miller, 2010; Harvey, Stinson, Whitaker, Moskowitz, & Virk, 2008; Olson et al., 2015).

The primary objective of this paper is to review and integrate the sleep and work-nonwork literatures in order to develop a more holistic understanding of processes connecting the three major areas of life. Despite the plethora of work-nonwork theories (e.g., Edwards & Rothbard, 2000; ten Brummelhuis & Bakker, 2012) and the extensive work-

nonwork literature (e.g., Allen & Martin, 2017), very little of this research considered the role of sleep quality and quantity. A unifying framework explaining connections and underlying processes among work, nonwork, and sleep is necessary to significantly contribute to future research, intervention development and dissemination, and ultimately policy change to improve worker well-being. Thus, we propose the comprehensive work, nonwork, and sleep (WNS) framework (see Fig. 1) to address this gap. We suggest that sleep quality and quantity influence work and nonwork, which then influence subsequent sleep quality and quantity via energy and time resources.

Novel Contributions of the WNS Framework

Periods of sleep act as bookends to work and nonwork domains. Work experiences, nonwork experiences, and interactions among the two areas of life are affected by prior sleep and subsequently affect future sleep (e.g., Barnes et al., 2012; Jacobsen et al., 2014; Williams, Franche, Ibrahim, Mustard, & Layton, 2006). However, this serial dependency among the three areas of life has rarely been conceptualized or evaluated within work-nonwork research. The majority of existing studies have investigated conflict or enrichment of the work and nonwork domains in isolation rather than in an integrated framework (c.f., Byron, 2005; McNall, Nicklin, & Masuda, 2010). Previous work-nonwork research has been ignoring

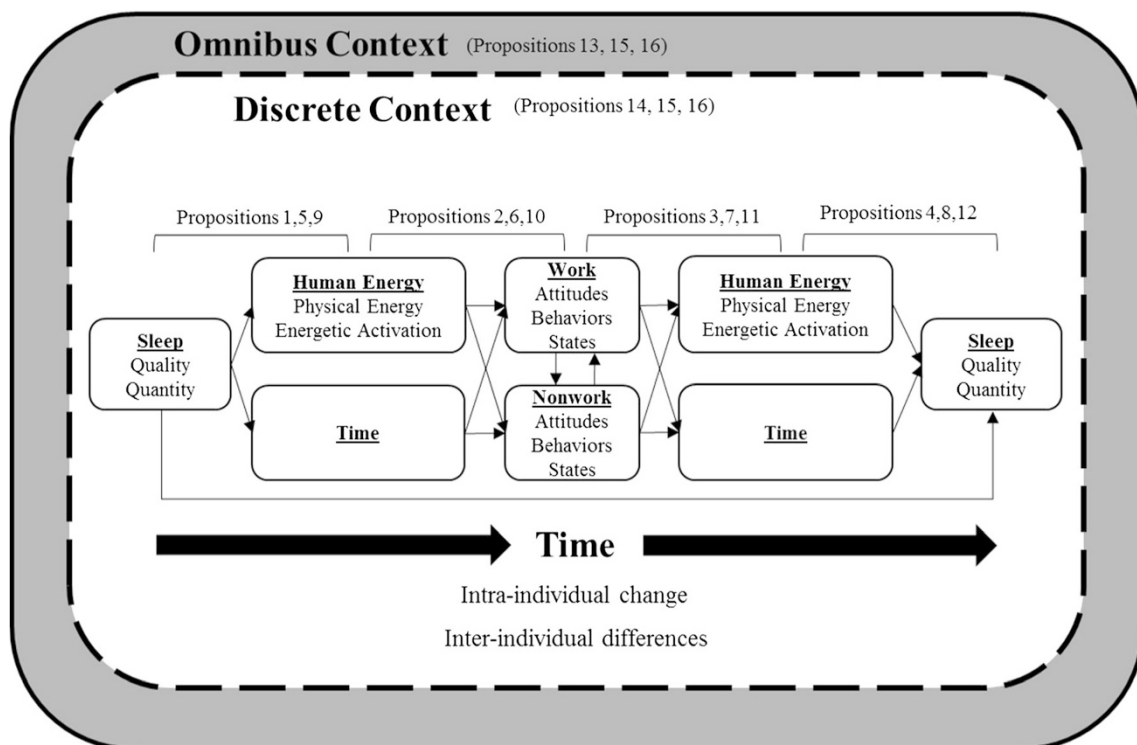


Fig. 1 Conceptual model of the work, nonwork, and sleep (WNS) framework

sleep as a significant source of variance in individuals' behavior in both the work and nonwork domains, while also failing to account for subsequent downstream effects on later sleep, an important determinant of optimal functioning, health, and well-being. We refer the reader at this point to Fig. 1. Conceptually, the majority of work-nonwork research to date has focused on relationships and processes within the limited middle portion of this figure, or how work and nonwork attitudes, behaviors, and states are connected. Thus, we expand on our understanding of these phenomena by incorporating upstream and downstream sleep quality and quantity, while also considering specific resources that link sleep to the work-nonwork nexus.

The vast sleep literature indicates that the amount and quality of sleep we obtain fundamentally influences our everyday behavior and experiences. For example, prior research has clearly established links exist between lack of sleep and negative emotion (e.g., van der Helm & Walker, 2009), perceptions of stress (e.g., Minkel et al., 2012), and decreased functioning on a variety of cognitive tasks, including attention, vigilance, and working memory (e.g., Lim & Dinges, 2010). Thus, at a basic level, effects of inadequate and insufficient sleep permeate behavioral processes, regardless of whether one is working or not, interacting with others, or operating in isolation. Our everyday experiences in turn also impact our ability to obtain quality sleep in optimal amounts. For example, strain from work and home have both been linked with detrimental sleep outcomes (e.g., Cropley, Dijk, & Stanley, 2006; Naseri-moaddeli, Sekine, Hamanishi, & Kagamimori, 2002; Troxel, Robles, Hall, & Buysse, 2007), whereas time spent working and engaging in leisure activities are also reciprocally related to time spent sleeping (Basner et al., 2014).

Among the studies that have investigated sleep in relation to work or nonwork, few have considered specific, underlying mechanisms by which sleep affects other nonwork domains or is affected by the nonwork domains. Based on Quinn, Spreitzer, and Lam (2012) discussion of human energy as a resource within organizations, we posit that work, nonwork, and sleep are ultimately connected via fluctuations in two specific types of human energy: physical energy and energetic activation. Furthermore, time has often been noted as an important resource in both general stress theories and work-family theories (e.g., Halbesleben, Neveu, Paustian-Underdahl, & Westman, 2014; ten Brummelhuis & Bakker, 2012) and work time is the primary life activity exchanged for sleep time (Basner et al., 2007, 2014). As such, we suggest that finite time resources that could be allocated to work or nonwork are lost when sleeping and this loss should affect work and life attitudes, behaviors, and states. We then make specific predictions regarding the relationships between work, nonwork, and

sleep both within and between people (i.e., both inter-individually and intra-individually). Specifying the nature of such processes is necessary for the development of future research and consequently the refinement of theory that fully explains the interconnectedness among work, nonwork, and sleep. From a practical standpoint, future research that finds empirical support for such mechanisms will be critical for intervention research. Understanding intervention targets and downstream processes is necessary for accurate design and evaluation of effective programs and policies (Kosseck, Hammer, Kelly, & Moen, 2014).

Work, Nonwork, and Sleep Constructs: Prior Research

Among the potential mechanisms that can influence sleep outcomes, we emphasize social and environmental factors in the WNS framework. Prior research in the sleep, neuroscience, and chronobiology literatures has demonstrated an endogenous two-process model of sleep regulation, in which homeostatic and circadian processes interact to predict sleep. The homeostatic process, also known as “sleep drive,” describes that the propensity to sleep increases throughout the day and decreases during periods of sleep, whereas the circadian process relies on diurnal circadian rhythms (i.e., the “biological clock”) that influence the propensity to sleep depending on the time of day (e.g., Borbély, Daan, Wirz-Justice, & Deboer, 2016). We expand on this basic physiological and biological understanding of sleep by considering exogenous social and environmental factors in the WNS framework. For instance, although the need for sleep is foundational to human physiology, individuals often intentionally restrict sleep in order to accommodate other life demands, namely work and nonwork activities.

A number of studies have begun to investigate associations among work, nonwork, and sleep quality and quantity. Below, we review the literature and classify past research into three categories: (a) studies that have taken a *negative* perspective by incorporating work-nonwork variables that encompass the conflict or spillover between domains in relation to sleep outcomes, (b) studies that have taken a *positive* perspective by incorporating work-nonwork variables that encompass the enrichment or spillover between domains in relation to sleep outcomes, and (c) studies that have evaluated the relations between separate work variables, nonwork variables, and sleep variables, rather than work-nonwork measures (i.e., work-family conflict and spillover) that assume connectedness between domains. This last category represents those studies that are most in line with the propositions of the WNS framework.

Negative Work-Nonwork and Sleep Perspective

The majority of work-nonwork research to date that has incorporated sleep has focused on work-family conflict, a form of interrole tension that arises when the demands of work and family life are incompatible (Greenhaus & Beutell, 1985). Work-family conflict is bidirectional, and previous theory suggested that conflict can be time-, strain-, or behavior-based (Edwards & Rothbard, 2000). Additionally, a few studies evaluated negative spillover, or the transferring of mood, skills, behavior, and values from the family domain to work domain or vice versa (Edwards & Rothbard, 2000). This work-family conflict and negative spillover research has primarily conceptualized sleep quality and quantity as outcome variables.

Work-Family Conflict and Sleep Quality Work-to-family and family-to-work conflict have been negatively and concurrently associated with self-reported sleep quality (Nylén, Melin, & Laflamme, 2007; Sekine, Chandola, Martikainen, Marmot, & Kagamimori, 2006) and sleep complaints (Lallukka, Rahkonen, Lahelma, & Arber, 2010). A study by Crain et al. (2014) similarly indicated positive associations among measures of work-family conflict and self-reported sleep insufficiency and insomnia symptoms. Building from this cross-sectional work, Jacobsen et al. (2014) found both a positive association between work-to-family conflict and sleep insufficiency cross-sectionally as well as longitudinally over a 2-year time lag. Further, negative work-to-family and family-to-work spillover predicts insomnia longitudinally over 2 years (Vedaa et al., 2016). Other longitudinal research indicated that work-to-family and family-to-work conflict predicts women's use of sleep medication 5 years later (Lallukka et al., 2013). In a unique mediation study, Mäkelä, Bergbom, Tanskanen, and Kinnunen (2014) found that baseline work-family conflict acted as a mediator of the relationship between baseline business travel and sleep problems at a one-year follow-up. In comparison to these cross-sectional and longitudinal studies, Van Hooff, Geurts, Kompier, and Taris (2006) found that global work-family conflict is positively related to daily sleep complaints inter-individually.

Work-Family Conflict and Sleep Quantity In addition to sleep quality, sleep quantity has also been investigated in relation to work-family conflict, albeit less frequently. For example, prior research has found cross-sectional associations between work-family conflict and self-reported measures of sleep duration (Crain et al., 2014; Jacobsen et al., 2014), in addition to objective actigraphic measures of total sleep time (Crain et al., 2014). Moreover, Berkman et al. (2015) reported that family-to-work conflict is negatively associated with objective actigraphic total sleep time, whereas work-to-family conflict is positively associated with total sleep time. In contrast, Britt and Dawson (2005) conceptualized self-reported sleep

duration as an antecedent of work-family conflict, yet found a negative cross-sectional association with work-to-family conflict.

Positive Work-Nonwork and Sleep Perspective

In comparison to the negative work-nonwork research, very few studies have examined a work-nonwork positive spillover perspective, or the beneficial transfer of mood, skills, behavior, and values from family to work or work to family (Edwards & Rothbard, 2000), in relation to sleep. Williams and colleagues (Williams et al., 2006) found a positive association between positive family-to-work spillover and self-reported sleep quality. In contrast, Vedaa et al. (2016) found that positive work-to-family spillover predicted fewer self-reported symptoms of insomnia over a 2-year period. Thus, our understanding of sleep in relation to positive work-nonwork experiences is limited.

Work, Nonwork, and Sleep Perspective

Fewer studies to date have investigated separate work, nonwork, and sleep constructs in relation to one another. In one of the few studies to utilize such a conceptualization, Barnes et al. (2012) evaluated associations among work, family, and sleep time. Inter-individual results showed a negative, nonlinear relationship between work time and sleep time, and between family time and sleep time, such that stronger relationships were seen at high levels of work time rather than low levels of work time. The negative, nonlinear relationship between work time and sleep time was also replicated intra-individually. Furthermore, inter-individual and intra-individual results indicated a significant interaction between family time and work time on sleep time, such that the lowest levels of sleep time were found under conditions of high work and family time. Other research conducted by Geiger-Brown, Trinkoff, and Rogers (2011) found that adverse work schedules (i.e., shiftwork, night shiftwork, quick returns to work, mandatory overtime or on-call work, long work hours, weekend work) are negatively associated with sleep duration and quality and that this association does not change when accounting for home demands (i.e., caregiving roles, hours per week spent on housework, childcare, or chores).

Summary Taken together, these studies have demonstrated that work, nonwork, and sleep are interrelated. Although the majority of research has utilized work-family conflict or spillover measures, some research has examined sleep in relation to work variables or family variables separately (e.g., Kurumatani et al., 1994). In line with this last set of studies, we separate work, nonwork, and sleep as distinct but interrelated constructs, rather than using conflict or spillover. Taking this approach will further allow for the identification of the

specific mechanisms that connect work, nonwork, and sleep, and better explicate the processes involved.

Work, Nonwork, and Sleep Framework

Theoretical Background

Work-nonwork scholars have used a number of different theoretical perspectives to explain previously hypothesized associations among work, nonwork, and sleep constructs. These have included Hobfoll's (1989) conservation of resources theory (e.g., Crain et al., 2014; Jacobsen et al., 2014), Edwards and Rothbard's (2000) scarcity theory, and George's (2005) conceptualization of slack resources (e.g., Barnes et al., 2012), in addition to Meijman and Mulder's (1998) effort recovery model (e.g., Vedaa et al., 2016; Williams et al., 2006). Other work has specifically drawn upon Karasek's (1979) job demand-control model and Johnson and Hall's (1988) job demand-control-support model or Demerouti, Bakker, de Jonge, Janssen, and Schaufeli (2001) job demands-resources model (e.g., Mäkelä et al., 2014; Sekine et al., 2006), proposing a relationship among work characteristics, work-family conflict, and sleep.

Thus, theoretical perspectives represented in the sleep, nonwork, and work literature are numerous and diverse, with different, fairly broad theories being used to argue for the same relationships. Furthermore, none of these different theories explicitly address sleep as either an antecedent or outcome, but rather make general predictions regarding stressor-strain relationships or fluctuations in broadly-defined resources. As such, scholars interested in work, nonwork, and sleep relationships have been loosely applying theories or piecing together separate theories in an attempt to provide a theoretical rationale for their proposed relationships. We, like others (e.g., Ganster & Rosen, 2013), posit that such general theoretical application results in a limited ability to falsify a theory, and as such, a very general understanding of phenomena, rather than a thorough, detailed understanding of phenomena. In order to advance theory and empirical research regarding work, nonwork, and sleep, an overarching framework that explains how the specific areas of work, nonwork, and sleep interact to affect workers' behavior and outcomes is warranted.

Other theoretical work in the organizational sciences has investigated sleep, but has yet to explicitly and sufficiently include the role of the nonwork domain (e.g., Barnes, 2012; Mullins et al., 2014). Again, as a result, theory is often roughly applied, and thus specific predictions are difficult to accurately generate from the theoretical rationales ignoring the nonwork domain, resulting in work, nonwork, and sleep research potentially taking on more of an exploratory or inductive approach. Given that foundational relationships among these

variables have now been established, there is a strong need for a framework that specifically addresses associations among these constructs and the mechanisms involved with these processes.

The Central Role of Human Energy and Time Resources

Despite the numerous distinct theories used in previous work-nonwork-sleep research, there is one commonality: resources play a central role in linking these three areas of life. Resources broadly can be thought of as "anything that allows an actor to enact a schema" (Feldman & Worline, 2011, pp. 630), and Quinn et al. (2012, pp. 345) define schema as "a cognitive framework that people use to organize their understanding of a situation." A resource (i.e., sleep) can generate additional resources (i.e., energy and time). However, a common criticism of prominent resource theories, such as COR theory, is that definitions of resources tend to be broad and vague, such that almost anything may be considered a resource (e.g., Ganster & Rosen, 2013; Halbesleben et al., 2014). We address this limitation of the past literature by focusing on two types of specific resources, namely human energy and time, which are most relevant to work, nonwork, and sleep interactions.

Various lists, categories, and taxonomies of resources have been proposed by a number of stress theorists (e.g., Halbesleben et al., 2014; ten Brummelhuis & Bakker, 2012; Hobfoll, 1989). As previously mentioned, this leaves researchers with an all-inclusive and generic understanding of what could be considered a resource. Because our framework is specifically focused on resources that are generated by sleep, there is a need to identify and put forward specific resources that fluctuate in response to varying levels of sleep quality and quantity. Moreover, we are interested in resources that result fairly quickly and are necessarily proximal to sleep.

As we reviewed the numerous resources proposed by stress scholars, we first engaged in a process of elimination to determine which proposed resources *do not* theoretically vary in direct response to sleep. These primarily fell into the categories of macro resources (e.g., culture, policies), objects (e.g., owning a home), conditions (e.g., employment status, marital status), personal resources (e.g., experience, self-efficacy), and contextual constructive resources (e.g., rewards, autonomy, social support). Now, it is important to note that sleep may influence subsequent processes that in turn result in these resources more distally. Additionally, these resources may have an influence associations among work, nonwork, and sleep as higher-level contextual resources, which we discuss later in this paper. However, in trying to identify only those resources that directly result from sleep (i.e., mechanisms connecting sleep with work and nonwork), we were then left with the resource category that has generally been referred to as

“energies.” Theorists have defined this category as resources that are proximate to the self and somewhat fleeting (e.g., ten Brummelhuis & Bakker, 2012). These energies can be additionally thought of as resources that once used, cannot be used at a later point in time or for other purposes.

Of those energies that have been proposed, including for example, mood, physical energy, cognitive energy, time, and recovery experiences (e.g., Halbesleben et al., 2014; ten Brummelhuis & Bakker, 2012), we see physical and cognitive energy, mood, and time as being those relevant and foundational resources that should fluctuate in response to sleep, while also affecting later sleep. These energies have been more recently considered by Quinn et al. (2012) as subsumed under the umbrella category of *human energy resources*.

Human Energy Resources We conceptualize human energy as a specific type of resource that uniquely affects and is affected by sleep. Thus, we borrow from Quinn et al.’s (2012) hierarchical taxonomy of energy resource constructs to inform our model. Quinn et al. synthesize existing energy literatures and determine that there are two primary types of human energy, including physical energy and energetic activation. We propose that sleep quality and sleep quantity can be characterized as resources that generate the subsequent resources of human energy and energetic activation. Although Quinn et al.’s taxonomy of energy resource constructs helps to inform our framework, their larger proposed model, which is largely based on motivational principles and explains the micro-dynamics of resource fluctuation in organizational members, is less relevant to our framework. Our framework is broader, providing propositions for resource fluctuation across the areas of work, nonwork, and sleep. However, we suggest that such micro-processes of resource fluctuation proposed by Quinn et al. could be incorporated into future work in this area (see Table 1).

Thus, we describe next how Quinn et al.’s taxonomy informs the present framework. The first type of human energy is *physical energy*, which refers to “the capacity to do work,” with work representing the process by which an object changes position as a result of force being applied. Physical energy can be utilized through volitional acts (e.g., conscious thought or movement) or through the non-volitional functioning of bodily systems (e.g., breathing) and unconscious or automatic responses to environmental stimuli. Physical energy can be further classified as either potential energy (i.e., energy stored as glucose or adenosine triphosphate in the body for future use) or kinetic energy (i.e., energy possessed by an object in motion). Yet, as Quinn et al. pointed out, physical energy can generally be measured using self-report means in the organizational sciences. Within the sleep literature, a lack of physical energy is referred to as fatigue, or “a physiological state of reduced mental or physical performance capability” and can

result from a lack of sleep (Gander et al., 2017, p. 698). Regarding the temporal nature of the construct, Ricci, Chee, Lorandean, and Berger (2007) characterized fatigue as occurring along a continuum, as it can arise acutely in response to specific situations or can occur more pervasively and last over longer periods of time. Thus, we argue that physical energy (or its antithesis, fatigue) can vary *intra-individually* (i.e., variability within-people over time) and *inter-individually* (i.e., differences between people). For example, individuals may experience intra-individual change with low physical energy in the evening occurring from a particularly long work shift (i.e., within-person effect), whereas inter-individual variability may occur when some people have less physical energy on average than others (i.e., between-person effect).

The second type of human energy, *energetic activation*, represents feelings of “vitality, vigor, or enthusiasm” (Quinn et al., 2012, p. 342). In contrast to physical energy, energetic activation is not a physiological state related to human performance capability, but instead one’s perception that they are energized. Quinn et al. explained that energetic activation may take on multiple affective forms, including emotions that are fairly brief and have a particular target like a person or experience, moods that are longer-lasting and more diffuse, or dispositions that are more stable over time and represent individual’s typical energetic tendencies. Similarly, Barsade and Gibson (2007) distinguished between feeling states (i.e., discrete emotions and moods) and feeling traits (i.e., dispositional affect), which can be represented with an affective circumplex graph. Within this circular figure, there exists an x-axis, moving from low pleasantness to high pleasantness, and a y-axis, ranging from low energy to high energy. Moods can be captured with the pleasantness dimension, and dispositional affect can be assessed with either trait pleasantness or as positive affectivity and negative affectivity, a combination of pleasantness and energy dimensions (Watson, Clark, & Tellegen, 1988). Discrete emotions can be measured with a number of primary emotional constructs (e.g., joy, anger, fear) and are placed around the circumplex according to their characteristic pleasantness and energy. Drawing on the affective literature, we propose that variability in emotions can be measured intra-individually (i.e., within-day or day-to-day), whereas moods can be measured either intra-individually (i.e., day-to-day or week-to-week) or inter-individually, and dispositions inter-individually.

Time Resources Time has often been noted as an important resource in both general stress theories and work-family theories (e.g., Greenhaus & Beutell, 1985; Halbesleben et al., 2014; ten Brummelhuis & Bakker, 2012). Furthermore, work-family scholars have identified time-based conflict to be one of the three primary dimensions of work-family conflict, aside from strain-based and behavior-based conflict (e.g., Carlson, Kacmar, Wayne, & Grzywacz, 2006; Netemeyer,

Boles, & McMurrian, 1996). Robinson and Godbey (2010) defined time as being finite and having a zero-sum property, meaning that time spent sleeping cannot then be allocated to work or nonwork, and similarly, time spent doing work or nonwork activities, cannot then be spent sleeping. Intra-individually, 24 h in any given day is divided among the three areas of work, nonwork, and sleep. Inter-individually, time on average is also divided among work, nonwork, and sleep over the course of weeks, months, and even years. Given past research indicating that time is borrowed from sleep to accommodate work and family both intra-individually and inter-individually (e.g., Barnes et al., 2012), in addition to findings from nationally representative samples indicating that work time is the primary life activity exchanged for sleep time (e.g., Basner et al., 2007, 2014), we propose that time is a major resource that should be considered when evaluating the interplay among work, nonwork, and sleep.

Assumptions Underlying the WNS Framework

Now that we have defined human energy and time and before specifying our propositions, it is important to orient the reader to the framework and note a couple assumptions (see Fig. 1). We suggest sleep affects attitudes, behaviors, and states at work and nonwork, while work and nonwork attitudes, behaviors, and states affect sleep, through resource mechanisms. We define *attitudes* as an evaluation of a psychological object (e.g., person, event, etc.) based on beliefs, feelings, or past behavior (Byrne, 2015); *behaviors* as the volitional actions someone takes (e.g., performance); and *states* as psychological conditions someone experiences at a given time (e.g., motivation, burnout).

The Role of Time The first important underlying assumption of the WNS framework is that relationships among work, nonwork, and sleep unfold over time. Sleep is captured as both an antecedent and an outcome in Fig. 1 because work, nonwork, and sleep represent periods of activity through which individuals move over the course of their day and across days, months, and years. We use single-headed arrows in Fig. 1 and employ causal language throughout the remainder of the article to indicate the temporal nature of our propositions. Thus, our framework is not meant to represent correlational relationships or co-occurrences among constructs, but rather true causal processes that develop and unfold over time.

A key defining feature of the WNS framework is its applicability to studying both inter-individual differences and intra-individual change (for a review see Bolger, Davis, & Rafaeli, 2003). Inter-individual investigations influenced by the WNS framework might include, for example, researching whether people who have higher sleep quality on average also experience increases in physical energy and subsequently more work motivation. Inter-individual designs in this context

require time lags of weeks, months, or years. In contrast, intra-individual investigations, for example, might include whether individuals experience more physical energy on days following nights of good sleep quality, and subsequently, increased motivation that day. Intra-individual designs then require repeated sampling within day or over the course of days.

When designing studies to test the WNS framework, researchers should consider the appropriate time frame and whether the constructs of interest are best modeled at the inter-individual level, intra-individual level, or both. Although the framework, constructs, and relationships are generally applicable to both levels, two primary caveats exist. Regarding resource mechanisms, energetic activation can exist at both levels, but we argue that dispositions are most relevant to inter-individual research questions given their fairly stable existence, whereas moods may be relevant to either inter-individual or intra-individual research questions, and emotions are mostly relevant to intra-individual research questions, given they are brief and have a particular target. For a more thorough discussion of these affective constructs and their appropriateness at each level, see Ashkanasy and Dorris (2017). Second, work and nonwork attitudes, behaviors, and states can be relevant to either inter-individual or intra-individual research questions, but attitudes in most cases are likely most appropriate to be considered within an inter-individual framework, given that they tend to be more enduring, are characteristic of a disposition towards a person, situation, or object, and thus less subject to variation from day-to-day (Schleicher, Hansen, & Fox, 2011). However, we acknowledge that some studies have examined intra-individual variability in attitudes like job satisfaction. See Judge, Weiss, Kammeyer-Mueller, and Hulin (2017) for a thorough review.

Flexible and Permeable Boundaries The second important underlying assumption of the WNS framework is related to changes in the nature of work. Given increases in flexible scheduling, telework, and technology, we suggest that most individuals do not travel through these the three areas of life in a perfectly linear fashion (i.e., from sleep to nonwork to work to nonwork and back to sleep again) within a 24-h period. Consistent with the boundary management literature (e.g., Ashforth, Kreiner, & Fugate, 2000), we suggest that work, nonwork, and sleep boundaries can be *flexible* in that individual activities in each area do not necessarily have to be tied to a specific time or place (e.g., sleep only at home, work only at the office). Furthermore, work, nonwork, and sleep boundaries can also be *permeable* such that a given area can be interrupted by people and activities from other areas (e.g., an unexpected nonwork call at work, an intentional nap taken during a work break). Because this sequencing of work, nonwork, and sleep may be variable depending on the individual, their family situation, occupation, organizational culture, and other factors.

Sleep Quantity Versus Sleep Quality As previously mentioned, we also consider sleep quality separately from sleep quantity. Prior research suggests that sleep quality and quantity are empirically distinct constructs, with bivariate correlations among different measures of sleep quality and sleep quantity ranging in size from ± 0.07 – 0.18 (Barnes, Schaubroeck, Huth, & Ghumman, 2011; Crain et al., 2014). Barnes (2012) theorized that sleep quality and sleep quantity, although distinct, have similar effects on outcomes that are additive in nature. We also suggest that it is important for sleep research within the organizational sciences to use measures of *both* constructs because different antecedents are theoretically likely to influence quality and quantity to varying degrees. For example, although time spent at work and leisure activities has often been investigated as an antecedent of quantity (Basner et al., 2014), stress, rumination, and emotional reactivity have often been investigated in relation to quality (e.g., Baglioni, Spiegelhalder, Lombardo, & Riemann, 2010; Zoccola, Dickerson, & Lam, 2009). Thus, mechanisms influencing sleep outcomes are likely unique depending on the sleep construct of interest.

We argue that both sleep quantity and quality are critical to resource mechanisms. For example, although it is necessary to obtain sufficient amounts of sleep, if a 7- to 9-h period of sleep is interrupted by frequent awakenings, this should inhibit the generation of human energy resources the following day. On the other hand, if someone has high quality sleep, but only slept for 3 h in a 24-h period, this should also prevent sufficient resource generation. The importance of both sleep quantity and sleep quality has been demonstrated in Uehli et al.'s (2014) meta-analysis, which provided evidence that both sleep quantity and quality influence the rate of work injuries. As Barnes et al. (2011) and others have pointed out, most prior research in this area has seldom included both sleep quantity and sleep quality simultaneously in studies, which makes it challenging to disentangle which construct is more essential. Although prior work has emphasized sleep quality over sleep quantity, we recommend studying both sleep quantity and sleep quality to fully understand their relevance to physical energy and energetic activation resources, and under which conditions one construct has stronger effects than the other.

Human Energy and Time as Resource Mechanisms Connecting Work, Nonwork, and Sleep

Human Energy In the following sections, we provide a rationale for the role of two types of human energy—physical energy and energetic activation—within the WNS framework.

Physical Energy Resource Mechanism As seen in Fig. 1, we propose that sleep influences physical energy inter-individually and intra-individually. Both theory and basic empirical research about sleep provide evidence for the role of

sleep in conserving and promoting physical energy. Past sleep literature (e.g., Berger & Phillips, 1995; Jung et al., 2011) suggested that sleep serves to limit the energy resources utilized over the course of a 24-h period, whereas more recent theorists have significantly extended these ideas with the notion that limited energy resources are also allocated to important biological functions during sleep, such as development or growth, maintenance of physiological systems, and reproduction (e.g., Schmidt, 2014) and wake, such as regulation of endocrine and immune responses (e.g., Banks & Dinges, 2007). However, our review focuses less on these biological consequences and instead on attitudes, behaviors, and states in the work and nonwork domains.

Individuals who obtain sufficient and adequate sleep quantity and quality are more likely to possess enough physical energy for waking physical and cognitive activities, which could take place in either the work or nonwork domains. Regarding the influence of physical energy on work and nonwork attitudes, Myles' (1985) study found that sleep-deprived individuals engaging in bouts of exercise perceived greater exercise intensity than individuals who were rested, suggesting that sleepy individuals are more likely to perceive their work or nonwork (e.g., exercise, housework) activities to be more physically demanding and less enjoyable. Concerning work and nonwork behaviors, other studies with athletes indicate that sleep is positively associated with athletic performance both intra-individually and inter-individually (Fullagar et al., 2015; Mah, Mah, Kezirian, & Dement, 2011; Reilly & Edwards, 2007; Skein, Duffield, Edge, Short, & Münder, 2011). We suggest that these results can be generalized to individuals engaging in physical jobs (e.g., construction workers, firefighters, nurses) and physical nonwork activities (e.g., sports, caregiving). Additional performance studies indicate that individuals with insufficient sleep are more likely to engage in presenteeism and absenteeism, as well (e.g., Swanson et al., 2011), which can be explained by a lack of physical energy. Basic research studies that have found effects of sleep deprivation and sleep restriction on decrements in simple attention, complex attention, processing speed, working memory, and short-term memory inter-individually and intra-individually (e.g., Banks & Dinges, 2007; Lim & Dinges, 2010) are in line with organizational studies and theory linking sleep restriction with job performance and productivity (e.g., Barnes & Hollenbeck, 2009; Kuppermann et al., 1995; Rosekind et al., 2010). Further, a large literature exists providing evidence for increased work and nonwork accidents and injuries under conditions of less sleep (e.g., Leger et al., 2014; Watson et al., 2015). Lastly, consistent with Quinn et al. (2012), we propose that sleep loss could be linked with states like burnout and/or engagement at work or at home through a physical energy mechanism, given that

conceptualizations of burnout have included a physical fatigue component (e.g., Shirom, 2011), and engagement conceptualizations have included a vigor component (e.g., Schaufeli, Salanova, González-Romá, & Bakker, 2002).

Proposition 1: Sleep quality and quantity positively influence physical energy.

Proposition 2: Physical energy positively influences work and nonwork attitudes, behaviors, and states.

We also propose that work and nonwork attitudes, behaviors, and states can lead to increases or decreases in physical energy resources that can, in turn, impact sleep quality and quantity (see Fig. 1). Our review of the literature indicates that this mechanism of physical energy is rather complex and depends on whether individuals are (a) engaging in behaviors at work or home that lead to physiological arousal that could impair sleep or (b) engaging in physical activity specifically that could either impair or promote sleep.

Regarding the first situation, sleep scholars have theorized that cognitive hyperarousal facilitates the presence of disturbances during sleep and difficulty initiating sleep (e.g., Baglioni et al., 2010). We borrow from Watkins' (2008) discussion and definition of constructive and unconstructive repetitive thought, or the positive or negative thinking about oneself, their experiences, and/or the larger environment both attentively and repeatedly over time. We propose that work and nonwork attitudes, behaviors, and states can influence constructive and unconstructive repetitive thought, which in turn should negatively affect sleep quality and quantity if this cognitive process is engaged in close to bedtime. Some workplace research has found a link between work-related rumination and problem-solving pondering and sleep inter-individually (e.g., Querstret & Cropley, 2012). Further, Syrek, Weigelt, Peifer, and Antoni (2017) found that affective rumination mediates the link between unfinished work tasks and sleep impairment, both inter-individually and intra-individually.

Physiological arousal may also result from engaging with technology close to bedtime, given the harmful exposure to bright light that can delay circadian rhythms, in addition to the potentially physically arousing nature of technology use (e.g., Cain & Gradisar, 2010). In general, previous studies found a link between work and nonwork-related technology use, telepressure, and impaired sleep (e.g., Barber & Santuzzi, 2015; Schieman & Young, 2013), whereas recent research by Gradisar et al. (2013) found a more specific relationship between interactive technology (e.g., using computers) that is not found with more passive types of technology (e.g., television viewing). What is notable is that the majority of these studies related to technology use in the organizational literature

have been focused on inter-individual differences rather than intra-individual change.

Concerning the second scenario we mention above related to physical activity rather than physiological arousal, some research has found a relationship between physical demands at work and short sleep inter-individually (e.g., Trinkoff, Storr, & Lipscomb, 2001), and research with professional and Olympic athletes suggests that they experience poorer sleep quality compared to control individuals (e.g., Leeder, Glaister, Pizzoferrero, Dawson, & Pedlar, 2012). This seems to be in line with conclusions from Driver and Taylor (2000) that moderate exercise can be beneficial for sleep, while exhaustive exercise can be detrimental for sleep. We suggest that these results likely generalize to high intensity physically demanding jobs and home lives.

Proposition 3: Work and nonwork attitudes, behaviors, and states positively influence physical energy.

Proposition 4: Physical energy in turn influences sleep quality and quantity.

In summary, given propositions 1–4, we argue that physical energy acts as a mediator through which sleep affects work and nonwork attitudes, behaviors, and states, as sleep serves to generate physical energy that can then be put towards activities and efforts in both the work and nonwork domains. Furthermore, physical energy acts as a mediator through which work and nonwork attitudes behaviors, and states affect subsequent sleep. Engagement in work and nonwork roles depletes physical energy that promotes one's need for sleep, but this relationship may be rather complex with intense physical efforts potentially disrupting sleep. Additionally, engagement in work and nonwork roles may also facilitate physiological arousal that impairs subsequent sleep. We turn now to a discussion of the second human energy resource mechanism, energetic activation.

Energetic Activation Resource Mechanism As seen in Fig. 1, we propose that sleep influences energetic activation inter-individually (i.e., dispositions, moods) and intra-individually (i.e., moods, emotions). Past research supports the role of sleep in generating positive affective resources (Baglioni et al., 2010; Barnes, 2012; Mullins et al., 2014), and organizational scholars have theorized that sleep influences workplace outcomes through an affective mechanism (Barnes, 2012; Mullins et al., 2014). For example, sleep loss has been found to predict heightened emotional reactions to disruptive work events the following day (Zohar, Tzischinsky, Epstein, & Lavie, 2005). Our review of the literature indicates that job satisfaction is the primary work attitude that has been evaluated in relation to sleep quality and quantity at the inter-individual level, although affect has rarely been investigated as a mechanism (e.g., Karagozoglu & Bingöl, 2008; Yoon, Kook, Lee, Shin, & Kim, 1999). Other relevant workplace

behaviors that should be influenced by the generation of sleep-related positive affective resources include performance, creativity, helping behaviors, and fewer withdrawal behaviors (e.g., Brief & Weiss, 2002). A series of studies has begun to examine inter-individual and intra-individual associations between lack of sleep and unethical behavior that has been theorized to be linked through an affective mechanism (Barber & Budnick, 2016; Barber & Budnick, 2015; Barnes et al., 2011; Christian & Ellis, 2011). Relevant work states include goal orientation and motivation, as well as engagement (Barber, Grawitch, & Munz, 2012).

In addition to workplace behaviors, sleep quality and quantity have been shown to be related to a number of nonwork attitudes, behaviors, and states that should also be influenced through an affective mechanism. These include intra-individual life satisfaction (e.g., Paunio et al., 2009) and relationship satisfaction (Insana, Costello, & Montgomery-Downs, 2011). Friedman et al. (2005) also find that individuals with poorer sleep experience fewer positive interactions with others in general on average, while other studies find that, within couples, sleep is associated with relationship functioning (Hasler & Troxel, 2010).

Proposition 5: Sleep quality and quantity positively influence energetic activation.

Proposition 6: Energetic activation positively influences work and nonwork attitudes, behaviors, and states.

Energetic activation can also result from work and nonwork attitudes, behaviors, and states, as they can serve as a signal to individuals about their current state, thereby eliciting an affective reaction. Previous theory and research has made a case for the link between work and home attitudes, behaviors, states, and resulting affect. For example, Judge, Thoresen, Bono, and Patton (2001) theorized that job satisfaction predicts subsequent positive mood and Judge and Ilies (2004) relatedly found that daily job satisfaction influences subsequent positive mood at home. Similarly, Lyubomirsky, King, and Diener (2005) note that although there is substantial evidence for positive emotions leading to successful behavioral outcomes at both work and home (e.g., task performance, helping behaviors, communication), the traditional conceptualization has been that individuals who are more successful at work and outside of work in turn experience more positive emotions. Other research from the sleep field acknowledges the bidirectional nature between sleep disturbance and emotional outcomes (e.g., Baglioni et al., 2010), thereby indicating that work and nonwork attitudes, behaviors, and states that result in positive or negative affect can influence sleep quality and quantity.

Proposition 7: Work and nonwork attitudes, behaviors, and states positively influence energetic activation.

Proposition 8: Energetic activation positively influences sleep quality and quantity.

Given propositions 5–8, we conclude that energetic activation acts as a mediator through which sleep affects work and nonwork attitudes, behaviors, and states, as sleep serves to promote affective perceptions of energy, which in turn influence work and nonwork attitudes, behaviors, and states. Energetic activation also acts as a mediator through which work and nonwork attitudes behaviors, and states affect subsequent sleep. Positive attitudes, behaviors, and states in the work and nonwork domains can generate affective perceptions of feeling energized, which can either disrupt sleep or promote sleep. In the next section, we discuss the second primary resource mechanism of time.

Time Resource Mechanism In Fig. 1, we include time as a major resource mechanism affected by and affecting sleep. We suggest that time is most relevant to sleep quantity, rather than sleep quality. Finite time resources that could be allocated to work or nonwork are lost when engaging in the sleep domain and this loss should negatively affect work and nonwork attitudes, behaviors, and states. Conversely, however, obtaining adequate sleep quality and quantity is related to a host of positive neurobehavioral outcomes (e.g., Banks & Dinges, 2007), and so allocating time to sleep can result in increases in efficiency, productivity, and performance even if less time is allocated to actual work and nonwork activities. Thus, the relationship between sleep and time is complex. Regarding specific work attitudes, for example, individuals who spend more time sleeping may experience greater time pressure at work, and time pressure has been negatively related to job satisfaction (e.g., Linzer et al., 2000). However, time pressure and urgency at work are considered to be challenge stressors, which generally have positive effects on performance through decreased strains and increased motivation (e.g., LePine, Podsakoff, & LePine, 2005). Similarly, daily time pressure has been associated with increased work engagement, under conditions of high job control (Kühnel, Sonnentag, & Bledow, 2012), suggesting that more positive work states are also likely to be experienced when time is lost, under the right conditions.

We also propose that sleep affects nonwork attitudes through a time-based resource loss mechanism. For example, having leisure time (i.e., free time) has been noted as a strategy for increasing happiness (e.g., Tkach & Lyubomirsky, 2006). Zabriskie and McCormick (2003) found that leisure time spent with family members is the strongest predictor of family satisfaction for parents. Further, one of the most commonly reported barriers to physical activity is perceived lack of time (e.g., Brownson, Baker, Housemann, Brennan, & Bacak, 2001).

Proposition 9: Sleep quantity influences time.

Proposition 10: Time influences work and nonwork attitudes, behaviors, and states.

When sleep is considered an outcome, we propose that job attitudes, behaviors, and states that result in a prioritization of work time will lead to decreased sleep quantity. Previous studies have shown a positive relationship between job involvement and work interfering with family at the intra-individual level (e.g., Byron, 2005), and we suggest that job involvement should lead to work time similarly interfering with sleep. Other work has shown that individuals sacrifice sleep in exchange for work and family time, both inter-individually and intra-individually (Barnes et al., 2012), and inter-individual time use data suggests that work time is the primary activity exchanged for sleep time (e.g., Basner et al., 2007).

Allocating time resources to nonwork rather than sleep will likely also decrease sleep duration. For example, we would expect commitment to one's social relationships in the form of time spent with those individuals, in addition to commitment to exercise or other leisure activities, to decrease sleep time. Caregiving for children and/or an aging adult has also been associated with decreased sleep quantity inter-individually and intra-individually (e.g., Berkman et al., 2015; Castro et al., 2009; Kang, Matsumoto, Shinkoda, Mishima, & Seo, 2002). Other research indicated that time spent socializing, relaxing, engaging in leisure activities, and watching television is associated with less sleep inter-individually (e.g., Basner et al., 2007).

Proposition 11: *Work and nonwork attitudes, behaviors, and states influence time.*

Proposition 12: *Time influences sleep quantity.*

Given propositions 9–12, we conclude that time acts as a mediator through which sleep quantity affects work and nonwork attitudes, behaviors, and states, as sleep quantity both depletes the amount of time available for work and nonwork activities, while simultaneously improving human performance that could result in increased efficiency and/or increased time pressure. We also suggest that time acts as a mediator through which work and nonwork attitudes, behaviors, and states affect sleep quantity. Individuals who prioritize work and nonwork domains as a result of attitudes, behaviors, and states, are less likely to have adequate time for sleep.

The Role of Context

Building off of the detailed propositions 1–12, we acknowledge that the proposed effects among work, nonwork, and sleep do not occur within a vacuum, but rather are heavily influenced by contextual factors. We draw on Johns' (2006) discussion of the importance of context in the organizational sciences to motivate an additional set of propositions. Johns (2006, p. 386) describes context as “situational opportunities and constraints that affect the occurrence and meaning of organizational behavior as well as functional relationships

between variables.” Furthermore, Johns (2006) describes two specific levels of analysis, including the overarching *omnibus context*, in addition to the *discrete context* that is nested within the omnibus context.

The omnibus context refers to high level factors including (a) *who* is being studied in terms of demographic indicators or occupational characteristics, (b) *where* the study is taking place, as factors like national culture or economic climate can influence results, (c) *when* the study is being conducted, as indicators of time—like phase of organizational change or episode during the progression of a societal trend—can be powerful, and (d) *why* data are being collected, given that the reason may influence participant feelings of accountability in responding. Variables at the discrete level include (a) task variables, such as job demands, job autonomy, role ambiguity, and work schedule; (b) social variables, such as leadership, especially leadership related to sleep or work-life balance, workplace norms around the importance of sleep or recovery, and coworker support that could allow for more flexible shifts; and (c) physical variables, such as temperature, light, and work spaces that allow for napping.

In addition, context can also be understood within Watson et al.' (2015) biopsychosocial model of sleep duration drivers. Although this model is specific to sleep quantity, we believe it is a useful larger sleep-specific framework to understand the multitude biological, psychological, and social factors—at the societal, social, and individual level—that influence sleep. Societal (e.g., public policy) and social (e.g., family responsibilities) factors map onto Johns' omnibus and discrete contexts, respectively. Additionally, this model incorporates the role of the individual (e.g., genetics, health). However, we argue that individual differences play a less critical role than the human energy and time resources in the proposed framework. This is evidenced in prior studies that have controlled for a host of related variables. One example is Kessler et al.' (2011) study, which identified a work performance decrement equivalent to \$2280 annually for every employee with insomnia, even after controlling for 26 comorbid health conditions, age, gender, and years of education. Further, Berkman, Buxton, Ertel, and Okechukwu (2010) found that employees with managers that encouraged work-family balance slept nearly 29 min longer per day than those who did not receive this type of support from their managers, an effect that was found after controlling for age, gender, hourly wage, educational attainment, race/ethnicity, work site, hours worked per week, and night work. Therefore, we contend that human energy resources and time should meaningfully contribute to and be influenced by sleep above and beyond many individual factors that are known to influence sleep.

Drawing on Johns's (2006) and Watson et al.'s (2015) work, we include in Fig. 1 the omnibus and discrete contexts encapsulating lower level processes that occur between work,

nonwork, and sleep. Because there are numerous constructs that can be considered as elements of the omnibus and discrete contexts, we are not able to address all possible elements exhaustively or provide specific propositions regarding certain

constructs. Instead, we provide examples below for each of our propositions, and point the reader to Table 1, which provides a list of possible constructs for future studies testing the WNS framework.

Table 1 Relevant context constructs for testing the WNS framework

Construct	Variable
Omnibus context	
Who constructs	Demographics Race/ethnicity, gender, age, marital/partner status, caregiver status Income level Health status Access to healthcare Individual differences Genetics Personality Occupational characteristics Job title Supervisor status Tenure Commute time and method
Where constructs	Location Public policy Cultural indicators Economic indicators
When constructs	Phase of organizational change Episode during progression of societal trend (e.g., beginning of recession) Recent major life events (e.g., new parent)
Why constructs	Research study conducted by individuals internal to company Research study conducted by individuals external to company Union endorsement of study
Discrete context	
Task constructs	Work Job demands Job autonomy Role ambiguity Work schedule Schedule control Nonwork Nonwork demands Role ambiguity
Social constructs	Work Norms, culture, climate Policies, procedures Leadership, sleep leadership Family/nonwork-supportive organizational perceptions General supervisor support, oworker support Family/nonwork-supportive supervisor behaviors, coworker behaviors Aggression Nonwork General social support Family/spouse/partner/child support Aggression
Physical constructs	Work Temperature Lighting Nap areas Nonwork Temperature Lighting Bedroom environment

First, we propose that elements of the omnibus context can act as predictors of constructs included in the WNS framework (i.e., sleep, resource mechanisms, work/nonwork attitudes, behaviors, and states). For instance, research indicates that Mexican-born immigrants living in the USA tend to have better sleep habits than US-born Americans, likely due to a cultural emphasis on the importance of sleep and siestas, or naps (e.g., Seicean, Neuhauser, Strohl, & Redline, 2011).

Proposition 13: *The omnibus context influences sleep quality and quantity, resource mechanisms, and work/nonwork attitudes, behaviors, and states.*

Second, we propose that elements of the discrete context can act as predictors of constructs included in the WNS framework. For example, job demands have been associated with decreased sleep quality and quantity (e.g., Åkerstedt et al., 2002; de Lange et al., 2009).

Proposition 14: *The discrete context influences sleep quality and quantity, resource mechanisms, and work/nonwork attitudes, behaviors, and states.*

Third, we propose that elements of the omnibus context can influence elements of the discrete context, which can in turn influence constructs in the WNS framework. For example, the type of job someone has can predict whether they can have a flexible work schedule (e.g., Hale, 2014), which can in turn influence sleep (e.g., Tucker, Bejerot, Kecklund, Aronsson, & Åkerstedt, 2015).

Proposition 15: *The omnibus context indirectly influences sleep quality and quantity, resource mechanisms, and work/nonwork attitudes, behaviors, and states through the discrete context.*

Lastly, we suggest that elements of the omnibus or discrete context can act as moderators of the relationships proposed by the WNS framework. For example, the positive effect of sleep on human energy resources could be moderated by age, such that the relationship is stronger for younger adults compared to older adults, due to age-related changes in sleep quality and quantity (e.g., Pace-Schott & Spencer, 2011).

Proposition 16: *The omnibus context and discrete context moderate relationships among sleep quality and quantity, resource mechanisms, and work/nonwork attitudes, behaviors.*

Discussion

In summary, we propose the WNS framework as a holistic model that integrates the sleep and organizational literatures in order to stimulate future research that extends beyond the work-nonwork interface to incorporate sleep. Although the framework offers specific predictions related to the role of resource mechanisms, context is accounted for more broadly.

Future Directions

In the following section, we address a number of important directions for this area of research, while also providing a summary in Table 2. We highlight future research questions specific to theoretical processes, resources, context, methodology, and interventions.

Theoretical Process Questions The proposed framework is markedly serial in nature, with a specific focus on how sleep quality and quantity generate a chain of reactions in work and nonwork domains, which ultimately impact downstream sleep quality and quantity. However, it is important to point out that sleep, work, and nonwork may operate simultaneously to produce a given outcome, in a much more complex fashion. For example, Barnes et al. (2012) found that negative, nonlinear relationships between work time and sleep time are strengthened under conditions of high family time demands. We propose that other interactions among the three domains are likely, as well. For example, work attitudes, behaviors, and states may interact with nonwork attitudes, behaviors, and states to influence sleep outcomes. Additionally, human energy and time resources may interact to influence subsequent effects on work, nonwork, or sleep. Although we felt that such complexity was beyond the scope of this paper given the numerous interactions that could occur among the three areas of life and the resources that are generated by them, we urge researchers to further explicate these processes in future theoretical and empirical work.

Resource Questions In line with Barnes (2012), we ultimately believe that the constructs of sleep quantity and sleep quality should be studied in tandem. We propose that both sleep quantity and quality are necessary for human energy resources, and suggest that the resource mechanism of time primarily affects and is affected by sleep quantity, rather than sleep quality, although sleep quality may also be affected through alternative mechanisms or more complex processes involving multiple mechanisms. Sleep quantity and sleep quality may also interact as some researchers have considered moderating effects between these measures of sleep (e.g., Barber, Munz, Bagsby, & Powell, 2009; Barnes, Lucianetti, Bhave, & Christian, 2015). Future research should attempt to disentangle which specific resources and processes influence and are influenced by the distinct, yet related, constructs of sleep

Table 2 Summary of recommendations for future research

Research questions	Selected relevant references	Level of analysis
Theoretical process questions		
How do work, nonwork, and sleep simultaneously influence subsequent outcomes?	Barnes et al. (2012)	Inter-individual Intra-individual
Do interactions occur between two areas (e.g., sleep and work) to influence outcomes in the third area (e.g., nonwork)?		
Resource questions		
Does sleep quality have stronger effects on energetic activation resources than sleep quantity?	Barnes (2012); Sonnentag and Zijlstra (2006)	Inter-individual Intra-individual
Does sleep quantity have stronger effects on time resources than sleep quality?		
In what directions do physical energy resources influence sleep quality and quantity? Are nonlinear effects present?	Leeder et al. (2012); Barnes et al. (2012); Basner et al. (2007, 2014); Grondin (2010); Robinson & Godbey (2010); Strathman & Joireman (2005)	Inter-individual Intra-individual
In what directions do time resources affect work, nonwork, and sleep?		
How are shifts in human energy resources related to work attitudes, behaviors, and states, as well as sleep quality and quantity?	Bledow et al. (2011); Quinn et al. (2012)	Inter-individual Intra-individual
How do individuals consciously allocate resources and/or engage in certain actions to conserve, gain, or lose resources?	Vroom (1964); Quinn et al. (2012)	Inter-individual Intra-individual
What additional resource mechanisms besides human energy and time might exist? What is the strength of their influence in comparison to human energy and time?	Halbesleben et al. (2014); ten Brummelhuis and Bakker (2012)	Inter-individual Intra-individual
Context questions		
Which work-related variables affect sleep quality and quantity? For example, within the omnibus context, what are the work-tasks and social environment variables most strongly related to sleep quality and quantity?		Inter-individual
In the omnibus context, what HR policies are most effective for promoting sleep quality and quantity?		Inter-individual Intra-individual
Which sub-populations of workers (based on industry, occupation, or worker characteristics) are at higher risk for negative outcomes related to sleep? Samples for initial investigation include the following:		
• Shiftworkers	Drake and Wright (2017); Short, Agostini, Lushington, and Dorrian (2015); Smith et al. (2011)	Inter-individual
• Workers exposed to safety hazards	Gander et al. (2017); Weinger and Ancoli-Israel (2002)	
• Workers with specific work-family demands (e.g., young children, sandwiched generation, eldercare)	Allen and Finkelstein (2014); Fisher et al. (2016); Neal and Hammer (2017)	
• Workers with psychological disorders that may affect or be affected by sleep	Alvaro, Roberts, and Harris (2013); Peterson and Benca (2017); Ramsawh, Stein, and Mellman (2017)	
• Workers with chronic health conditions that may affect or be affected by sleep	Ancoli-Israel, Moore, and Jones (2001); Menefee et al. (2000)	
• Workers with certain genetic dispositions	Curtis et al. (2016); Shi et al. (2017)	
• Workers with certain personality dispositions	Hintsanen et al. (2014); Saksvik et al. (2011)	
Which sub-populations of workers may benefit from napping?	Ficca et al. (2010); Milner and Cote (2009)	
Methodological questions		
Are identical results found with objective and self-report measures of sleep quality and quantity?	Barnes (2012); Sadeh (2011)	Inter-individual Intra-individual
How do intra-individual results differ from inter-individual results across WNS propositions?	Bolger et al. (2003)	Inter-individual Intra-individual
Over what time period or study duration do we observe the strongest effects for the propositions presented in this article?	Ford et al. (2014)	Inter-individual Intra-individual
Intervention questions		
What Total Worker Health® interventions are most effective for improving sleep quality and quantity?	Schill & Chosewood (2013)	Inter-individual Intra-individual
What types of intervention components lead to sustainable effects over longer time lags?		

quantity and sleep quality. We also encourage organizational scholars to consider both short (< 7 h) and long (> 9 h) sleep durations as maladaptive, given some existing, yet inconclusive, sleep literature on this topic (e.g., Watson et al., 2015).

We have provided 16 testable propositions related to energy and time mechanisms connecting work, nonwork, and sleep, based on past theory and research. However, for five propositions, we were not able to make specific, directional hypotheses as multiple outcomes are likely to exist. First, proposition 4 states that physical energy influences sleep quality and quantity. Past findings from the exercise literature (e.g., Driver & Taylor, 2000) suggest that some nonlinear effects may be present whereby work behavior that requires moderate, but not low or high, physical depletion of resources is most ideal for maintaining adequate sleep quality and quantity. These associations may also depend on occupation type and job tasks, as regular physical energy depletion may lead to different outcomes if experienced less frequently, but more intensely.

Propositions 9–12 regarding time as a mechanism connecting work, nonwork, and sleep are also general and not directional. We suggest that directionality may depend on the participants' cognitive appraisal of time and how time is measured by the researchers. For example, reports of time spent engaging in an activity may have a different effect on work performance than subjective perceptions of time pressure experienced while doing the activity. Moreover, objective reports of time use can differ from subjective reports of time use (e.g., Robinson & Godbey, 2010). As such, future studies should utilize multiple constructs related to time, such as time use, time pressure, and time urgency, with both subjective and objective methods whenever appropriate. Future work in this area should draw on the sociology literature around time use (e.g., Robinson & Godbey, 2010), in addition to the social and cognitive psychology literature around perceptions of time (e.g., Grondin, 2010; Strathman & Joireman, 2005).

Although we discuss each of the human energy and time resource mechanisms in isolation, it is also likely the case that different resources are being gained and lost simultaneously within work, nonwork, or sleep areas and thus exert distinct influences on the subsequent area. These shifts in human energy resources may result in different outcomes depending on which resources individuals value and utilize most in a given setting. When testing the WNS framework, we urge investigators to measure multiple types of human energy and time resources and determine their relative effects on outcomes. It may also be the case that outcomes are dependent on the dynamic interplay among multiple shifting resources. For example, Bledow, Schmitt, Frese, and Kühnel (2011) affective shift model suggests that work engagement results from negative affect being followed by an upregulation of positive affect. Thus, shifts in resources should also be evaluated in connection to one another.

The WNS framework does not explicitly discuss the process by which individuals choose to consciously conserve, gain, or lose resources while residing within work, nonwork, or sleep areas. We see potential for integration with expectancy theory (Vroom, 1964), and its basic propositions that individuals are motivated when they perceive a connection between effort expended and resulting performance, when that performance should lead to a given outcome, and when that outcome should in turn result in some valued reward. The value placed on sleep is likely the result of individuals' perceptions of whether sleep results in human energy and time resources that in turn influence performance in the work or nonwork area and subsequently whether that performance leads to outcomes and rewards.

Lastly, although we believe that human energy and time are the resources most directly and proximally related to sleep and are thus the most appropriate resource mechanisms for consideration in this framework, there is potential for other resources mechanisms to play a role. We encourage researchers to test additional resources and pit them against human energy and time to further develop this framework and establish the role of these resource mechanisms. Additionally, we encourage researchers to use a variety of self-report and objective methods and measures when conceptualizing resources. For example, physical energy might be measured with objective neurobehavioral tests, such as the well-validated psychomotor vigilance task (e.g., Basner & Dinges, 2011) or self-reported measures of general fatigue or even work-related fatigue (e.g., Frone & Tidwell, 2015).

Context Questions Although the WNS framework was developed to explain interconnections among work, nonwork, and sleep for all working individuals, we also describe a few specific high-risk populations. We argue that researchers should collectively cast a broad net in terms of identifying samples for studies when testing WNS, by both evaluating WNS processes across occupations and samples (i.e., establishing generalizability), while also delineating for what groups or occupational samples WNS is particularly relevant and where certain aspects of WNS should be emphasized and/or revised depending on the sample. This level of understanding and theoretical clarification is necessary for future applied work in organizations where WNS propositions are used to design interventions or policies. Below, we specify those groups that should be prioritized in future research testing the WNS framework.

As global trends move towards a “24-hour society”—in which goods and services can be produced and consumed at any hour of the day—organizations have adapted to meet these demands by modifying work schedules to include all hours of the day (e.g., Moore-Ede, 1994). Although the use of shiftwork schedules, which deviate from the traditional 9:00 a.m. to 5:00 p.m. Monday to Friday workweek (e.g., Smith, Folkard, Tucker, & Evans, 2011), helps organizations

meet the needs of a round-the-clock market, meta-analytic evidence suggests that shiftwork has detrimental effects on sleep length (Pilcher, Lambert, & Huffcutt, 2000). In turn, shiftworkers are at a heightened risk for accidents and injuries on the job (Folkard, Lombardi, & Tucker, 2005), burnout (Wisetborisut, Angkurawaranon, Jiraporncharoen, Uaphanthasath, & Wiwatanadate, 2014), work-family conflict (e.g., Jansen, Kant, Kristensen, & Nijhuis, 2003), lower family satisfaction (e.g., Grosswald, 2004), lower overall marital quality (e.g., White & Keith, 1990), and experiences of “social marginalization” due to family and friend gatherings happening opposite of shiftworkers’ schedules (e.g., Costa, 2003; Harrington, 2001).

Additionally, individuals who work in occupations where workers, or others they serve, have a high safety risk warrant special consideration. Sleep and fatigue issues are especially germane to workers in operational settings like the airline industry (e.g., Gander et al., 2015), nuclear power plants (e.g., Paim et al., 2008), long-haul trucking (e.g., Mitler, Miller, Lipsitz, Walsh, & Wylie, 1997), railway (Härmä, Sallinen, Ranta, Mutanen, & Müller, 2002), and healthcare (e.g., Weinger & Ancoli-Israel, 2002). Workers in these settings are likely to experience resource loss across the three mechanisms, with decreases in physical energy resources likely being especially important, given previous robust findings of sleep restriction affecting elements of neurobehavioral functioning, such as lapses in attention and decreased working memory (e.g., Banks & Dinges, 2007). Furthermore, higher-level contextual influences should be taken into account when conducting research with these individuals. For example, despite current duty hour limits for medical residents in the USA (i.e., 80 h maximum weekly limit, with first year residents not able to exceed 16 h continuous shifts and more experienced residents not able to exceed 24 h continuous shifts; Accreditation Council for Graduate Medical Education (ACGME, 2011), guidelines are often not followed and residents intentionally misreport their hours due to the general opinion that duty hour limitations are detrimental for training, in addition to the noted culture in healthcare focused on unwavering commitment to patients (e.g., Fargen & Rosen, 2013; Philibert, Miller, Heard, & Holt, 2009).

Work-family research is predicated upon the notion that many workers have caregiving roles in the nonwork domain and that these family roles may conflict with, as well as enhance, work experiences. Such family roles may involve caring for children, parents or grandparents, spouses/partners, or other relatives. Nonwork demands and work-family conflict are particularly high for parents of young children (e.g., Allen & Finkelstein, 2014), and one of the hallmarks associated with caring for infants or young children is difficulty with obtaining sufficient sleep quantity and quality, regardless of one’s work status (e.g., Medina, Lederhos, & Lillis, 2009). This is especially pertinent for caregivers around a child’s birth, or for new

parents, as these transitional times are particularly disruptive to sleep (e.g., Gay, Lee, & Lee, 2004). Qualitative studies have revealed that first-time mothers not only experience disturbed sleep, but often feel underprepared with how to manage their sleep after their first baby is born (e.g., Barnes et al., 2008; Kennedy, Gardiner, Gay, & Lee, 2007). Further, the labor force participation rate of mothers with children under age 6 is 64.2%, and mothers of infants under age 1 is 58.1%. In other words, more than half of mothers of infants in the USA return to work before their baby is 1 year old. This trend related to sleepy mothers has significant implications for productivity, performance, and safety in the workplace (Rosekind et al., 2010). Additionally, having children is an antecedent to work-family conflict (e.g., Byron, 2005) and influences employees’ ability to achieve work-family balance and obtain healthy sleep. Caregivers also frequently report strains that are associated with resource depletion (emotional, physical, and time-based resources; e.g., Schulz & Beach, 1999; Ybema, Kuijer, Hagedoorn, & Buunk, 2002), which in turn should affect sleep.

According to the CDC, half of adults in the USA report having at least one chronic health condition and one in four adults report having multiple chronic health conditions (Ward, Schiller, & Goodman, 2014). The incidence of chronic health conditions also increases with age such that workers have an increased risk of developing health conditions as they get older (Grosch & Pransky, 2009). The National Alliance on Mental Illness (NAMI) reports that one in five adults in the USA experience mental illness (excluding substance abuse disorders) in a given year (NAMI, 2016). Relatedly, clinical sleep disorders (e.g., insomnia, sleep apnea) should also be considered. These disorders are also common in the USA; for example, one in three people report having symptoms of insomnia, and one in ten people meet the diagnostic criteria for clinical insomnia (Vaughn & D’Cruz, 2017). Poor sleep can be a symptom of a developing physical/mental illness or sleep disorder, an outcome of an illness, and can worsen the symptoms of physical/mental health problems (e.g., Colten & Altevogt, 2006; NAMI, 2016). We recommend that organizational scientists collaborate with clinicians from the medical field to conduct studies with these types of samples.

Although we contend that individual demographic differences (e.g., gender) are not central to the proposed framework, people with certain genetic and personality predispositions could be considered high-risk populations. For instance, there is evidence for a genetic basis of sleep-wake patterns, including timing, duration, and the development of sleep disorders (e.g., Dauvilliers, Maret, & Tafti, 2005; Shi, Wu, Ptáček, & Fu, 2017). Relatedly, there is emerging research that suggests that people with a genetic mutation (hDEC2-P385R) may require less sleep—between 4 and 6 h—to feel well-rested in the morning and have typical daytime functioning He et al., 2009). However, population prevalence estimates of the occurrence of this mutation are unknown, and previous studies

have established that individuals generally tend to underestimate their own sleep-related impairment (e.g., Curtis, Williams, Jones, & Anderson, 2016; Van Dongen, Maislin, Mullington, & Dinges, 2003). As such, although there may be genetic differences in how much sleep someone needs and the types of sleep-related impairments they are predisposed to, most healthy adults require 7–9 h of sleep (Watson et al., 2015).

Personality has also been linked with sleep-related outcomes; people low in extraversion, agreeableness, and conscientiousness, and high in neuroticism, tend to report having poorer sleep (e.g., Hintsanen et al., 2014). There are also individual differences in whether someone is tolerant to shiftwork. For example, people who prefer mornings, are introverted, and have low flexibility are often less tolerant to shiftwork (see Saksvik, Bjorvatn, Hetland, Sandal, & Pallesen, 2011 for a comprehensive review).

Some researchers argue that napping can help to mitigate the negative effects of a poor night's sleep (e.g., Milner & Cote, 2009). Therefore, napping is one strategy that could be effective for some of the high-risk populations previously discussed. Prior work has shown that naps can be particularly effective for improving performance, vigilance, and reducing fatigue in shiftworkers and those that are employed in safety-sensitive industries (e.g., Ficca, Axelsson, Mollicone, Muto, & Vitiello, 2010; Sallinen, Härmä, Åkerstedt, Rosa, & Lillqvist, 1998; Smith, Kilby, Jorgensen, & Douglas, 2007). However, people often experience sleep inertia—an immediate feeling upon awakening of disorientation, grogginess, and decreased performance—so there should be a delay between the end of a nap and the start of a worker's shift (e.g., Milner & Cote, 2009; Tassi & Muzet, 2000). Other work has shown that naps are effective at reducing frustration and impulsivity (e.g., Goldschmied et al., 2015). However, workers with physical/mental health problems or sleep disorders (i.e., individuals for which it is typically harder to fall and stay asleep) may have adverse outcomes from napping, as naps have also been shown to disrupt nocturnal sleep and increase daytime sleepiness (e.g., Owens et al., 2010; Sharma & Andrade, 2012). In general, the literature regarding the benefits and drawbacks of naps is mixed (e.g., Dhand & Sohal, 2006; Irish, Kline, Gunn, Buysse, & Hall, 2015). Although naps may be beneficial for some people, there is limited evidence to provide general recommendations regarding naps, given that the effectiveness of napping depends on a host of factors (e.g., occupation, health status, individual differences).

These findings suggest that shiftworkers, workers in high-risk occupations, caregivers, people impacted by chronic illness, psychological disorders, and/or clinical sleep disorders, and individuals with certain predispositions (i.e., genetics or personality) have nuanced experiences pertaining to sleep, work, and nonwork. Relatedly, some of these high-risk populations may benefit from napping, whereas others may not. In

particular, we recommend a future focus on identifying the human energy and time resource mechanisms that link sleep with work and nonwork domains for these individuals. In addition, we encourage researchers to consider the influence of higher-level contextual resources that are critical to facilitating positive change for these groups.

Methodology Questions In testing the WNS framework, we encourage the use of both self-report and objective measures of sleep, mechanisms, and behavior in order to triangulate results. Organizational research has made less use of objective measures (e.g., Ganster & Rosen, 2013; Hurrell, Nelson & Simmons, 1998), and we believe that borrowing rigorous objective techniques would serve to better validate the WNS framework. For example, psychomotor vigilance testing often utilized in the sleep and fatigue science fields (see Van Dongen & Dinges, 2005) would be helpful for assessing cognitive energy resources. Additionally, some organizational researchers have begun to use actigraphy (e.g., Crain et al., 2014) and polysomnography (Barnes, Ghumman, & Scott, 2013) as objective measures of sleep quality and quantity (see Barnes, 2012 for a brief review). Finally, because slow wave sleep represents the key marker of sleep need, and core body temperature and melatonin are markers of the sleep-wake cycle (e.g., Borbély et al., 2016), advanced techniques (e.g., polysomnography, neuroimaging) are necessary for studying internal sleep processes; therefore, we also encourage organizational researchers to collaborate with scholars from sleep, cognitive science, and neuroscience disciplines.

We have developed the WNS framework to explain both intra-individual change (i.e., within-person processes that may fluctuate over time) and processes that occur between individuals over time. There is potential for researchers to collect parallel intra-individual and inter-individual data using different methods in order to determine whether results differ within individuals, across individuals, or both.

Both intra- and inter-individual designs can be employed to study changes over various time lags. For example, to capture events that occur within each day or across a series of days or weeks, daily diary or experience sampling methodology may be quite useful. These methods involve requesting that participants provide multiple self-reports on consecutive days during their typical daily experiences, thereby “capturing life as it is lived” (Bolger et al., 2003, p. 580). This method allows researchers to capture within-person processes using multiple observations over relatively short timeframes. Other research can examine intra-individual changes over longer periods of time, such as how sleep patterns vary over months or years.

Practical Implications

The WNS framework has important implications for organizations and individuals. At the organizational level,

acknowledgement of the interplay among work, nonwork, and sleep by top leadership should affect resultant policies and practices that influence performance, productivity, absenteeism, presenteeism, and healthcare costs. Furthermore, an understanding of the energy and time resources that are gained and lost by engaging in work, nonwork, and sleep, in addition to a consideration of contextual influences, could lead to the development of integrated Total Worker Health® initiatives that target the protection and promotion of worker well-being at multiple levels (Schill & Chosewood, 2013). For example, an organization could implement individual-focused time management training with an organizational-focused program that allows for scheduling of shifts to be more predictable. For individuals on the other hand, an appreciation of how work, nonwork, and sleep interact via resource mechanisms is likely to influence behavior change related to the investment, management, and preservation of resources deemed to be valuable for optimally engaging in both work and non-work roles.

When conducting sleep-related experiments in the workplace, we suggest organizational researchers carefully consider ethical issues that may arise with this work, in line with recommendations from Barber (in press). More specifically, we encourage organizational researchers to implement what Barber calls “positive sleep interventions approaches” whereby the study design involves the promotion of sleep, rather than “negative sleep intervention approaches,” whereby participants are restricted or even deprived of sleep. Barber provides five key ethical areas that should be taken into account by researchers and scrutinized by journal and grant reviewers, including participant vulnerability, informed consent, debriefing, managing risk in field designs, and minimizing risks/maximizing benefits.

Conclusion

The current paper extends traditional views of the work-nonwork interface that do not incorporate sleep. We call for the expansion and acknowledgement of sleep, an important source of variance in everyday attitudes, behaviors, and states to advance our understanding of work and nonwork experiences. In light of the burgeoning literature on sleep within the organizational sciences, it is an opportune time for the development of a comprehensive conceptual model elucidating the connections among the three major areas of life. We hope that the WNS framework will facilitate momentum in this area of research and help steer us closer towards a comprehensive understanding of individual, family, and organizational well-being.

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Associations between Mindfulness, Self-Compassion, Difficulties in Emotion Regulation, and Emotional Eating among Adolescents with Overweight/Obesity

M. J. Gouveia¹ · M. C. Canavarro¹ · H. Moreira¹

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Abstract

This study explores whether the associations between mindfulness and self-compassion skills and emotional eating are mediated by difficulties in emotion regulation in adolescents with overweight/obesity, and whether the direct and indirect effects vary according to nutritional treatment and weight status. The sample included 245 adolescents (12–18 years old) with overweight ($85^{\text{th}} \leq \text{Body Mass Index (BMI)} < 97^{\text{th}}$ percentile) and obesity ($\text{BMI} \geq 97^{\text{th}}$ percentile; WHO 2006) undergoing or not nutritional treatment. Participants completed self-reported measures of mindfulness, self-compassion, difficulties in emotion regulation and emotional eating. Regardless of undergoing or not nutritional treatment and of weight status, difficulties in emotion regulation mediated the associations between mindfulness and emotional eating, and between self-compassion and emotional eating. Specifically, higher levels of mindfulness and self-compassion skills were associated with less difficulties in emotion regulation, which, in turn, were associated with less emotional eating (mindfulness: point estimate = -0.14 , $SE = 0.06$, $95\%CI = -0.26/-0.05$; self-compassion: point estimate = -1.76 , $SE = 0.67$, $95\%CI = -3.20/-0.58$). Moreover, whereas mindfulness skills were directly associated with emotional eating, self-compassion was only indirectly associated with emotional eating, suggesting that self-compassion skills are related to emotional eating only because these skills enable more adaptive emotion regulation. Mindfulness and self-compassion may help adolescents with overweight/obesity develop more adaptive responses to emotional distress, which consequently may help them develop healthier eating behaviors. Future research should be developed on the adequacy of mindfulness and compassion-based approaches for adolescents with overweight/obesity.

Keywords Mindfulness · Self-compassion · Difficulties in emotion regulation · Emotional eating · Adolescents with overweight/obesity

According to the World Health Organization, pediatric obesity is one of the most serious public health challenges of the 21st century (WHO 2017). In a recent prevalence study in Portugal, there were 18.3% adolescents with overweight (Body Mass Index (BMI) $> 85^{\text{th}}$ percentile), and 9.2% with obesity (BMI $> 97^{\text{th}}$ percentile; Viveiro et al.

2016). The consequences of pediatric obesity are not limited to physical health complications (e.g., type 2 diabetes, hypertension, cardiovascular disease; Vivier and Tompkins 2008) but extend to the psychological and social contexts (e.g., lower quality of life, more internalizing and externalizing problems, social exclusion; Gouveia et al. 2014; Zeller and Modi 2008). Moreover, adolescents with overweight/obesity who are seeking treatment to lose weight frequently have higher BMI, more comorbid health problems, and poorer psychosocial outcomes compared with community samples of adolescents with overweight/obesity, placing them at an increased risk for poor psychological adaptation (Buttitta et al. 2014; Tsiros et al. 2009).

Disordered eating behaviors, such as emotional eating, have been identified as developmental pathways to obesity (Braet et al. 2008; Eichen et al. 2017). Emotional eating has

✉ M. J. Gouveia
maria.gouveia@student.fpce.uc.pt

¹ Center for Research in Neuropsychology and Cognitive-Behavioral Intervention, Faculty of Psychology and Educational Sciences of the University of Coimbra, Coimbra, Portugal

been defined as eating in response to an emotional state rather than hunger (Braet and van Strien 1997), eating as a form of emotional relief (D'Arrigo 2007), or eating when negative emotions are regulated in unhealthy ways (Evers et al. 2010). Emotional eating is often related to the consumption of more energy-dense foods in response to negative emotions (Oliver et al. 2000) and, therefore, it is a behavior that can contribute to obesity, not only among adults but also among adolescents (Aparicio et al. 2016; Harrist et al. 2013).

Some predictors and correlates of emotional eating have already been identified (e.g., unbalanced diet, excess body weight, negative emotions; Graziano et al. 2010; Zeman et al. 2006). The identification of psychological and emotional correlates of emotional eating is important because it allows prevention and intervention programs, particularly programs for adolescents with overweight/obesity, to be informed about specific emotional processes or skills that can be targeted to help adolescents develop an adaptive psychological functioning and, consequently, healthy eating behaviors and weight (Kemp et al. 2013). Emotional (dys) regulation is a possible emotional correlate of emotional eating that has recently gained much interest in the context of pediatric obesity, due to its documented association with disordered eating behaviors (Evers et al. 2010; Harrist et al. 2013) and with poorer treatment outcomes (i.e., less weight loss; Wildes et al. 2010), both in children and in adolescents.

Emotion regulation is a multidimensional construct that can be broadly defined as an individual's ability to identify, understand, and accept emotional experiences; control impulsive behaviors when distressed; and flexibly modulate emotional responses as situationally appropriate (Gratz and Roemer 2004). Adolescents with such abilities have a greater repertoire of adaptive and socially acceptable responses, which contributes to healthy psychological functioning. In contrast, in the absence or deficit of one or more of these abilities, adolescents may experience difficulties in regulating their emotions (Gratz and Roemer 2004). An emotionally dysregulated adolescent has an increased risk and a predisposing vulnerability to developing psychopathology (e.g., internalizing and externalizing problems; eating disorders; Hofmann et al. 2012; Kaufman et al. 2015), which makes the difficulties in emotion regulation an important transdiagnostic indicator of psychopathology risk.

Emotional eating has been considered an indicator of a disturbed emotional regulation system (Evers et al. 2010; Micanti et al. 2017). For instance, to manage internal states and emotions, especially negative and stressful ones, adolescents may use more accessible maladaptive coping mechanisms, such as emotional eating (Kemp et al. 2013; O'Reilly et al. 2014). The inability to self-regulate eating

behavior has been explained with different theoretical models, including escape theory (i.e., the eating behavior to escape from negative self-awareness or self-assessments; Heatherton and Baumeister 1991), affect regulation models (i.e., the eating behavior to down-regulate or compensate the lack of appropriate reinforcing experiences; Wedig and Nock 2010), dysregulation models (i.e., the eating behavior as a result of poor recognition of physical hunger and satiety cues; Dalen et al. 2010), and psychosomatic theory (i.e., the eating behavior due to the inability to differentiate between physical hunger cues and emotional arousal; O'Reilly et al. 2014). These different theories seem to emphasize the importance of common psychological individual resources that may explain the engagement in this eating behavior. Moreover, in a study with female university students, it has been suggested that it is not the experience of negative emotions itself but the lack of adaptive emotion regulation strategies to address those emotions that leads to emotional eating (Evers et al. 2010). In turn, emotional eating might generate negative emotions among youth (e.g., Braet and van Strien 1997), reinforcing the inadequacy of this learned behavior as strategy for emotion regulation.

Previous studies have identified the need to examine how emotion regulation is related to the development of psychopathology among adolescents (Neumann et al. 2010). In fact, the frequency and variability of negative emotions may increase during adolescence compared with childhood, driven by heightened sensitivity to the social context and increased self-conscious awareness (Zeman et al. 2006). From a neurologic point of view, adolescence is when most neurobiological mechanisms relevant to psychological dysregulation develop (e.g., response inhibition, reward/risk processing; Luna et al. 2004). In addition, adolescence has been identified as a critical risk period for the development of symptoms of eating disorders because of biological (e.g., physical and hormonal changes) and psychosocial factors (e.g., increased concerns with body shape and appearance; decrease self-esteem; Klump 2013). Some authors have argued that emotional eating may be less frequent in young children since they may not yet consider that someone might eat when they feel upset (van Strien and Oosterveld 2008), but it may increase in frequency with the onset of puberty (Pearson et al. 2012; Wardle et al. 1992). Since emotion regulation is particularly malleable in adolescence and given the increased frequency and variability of negative emotions on this developmental phase, it is important to target emotional eating during this period.

Two internal psychological resources that may contribute to an adaptive emotion regulation are mindfulness and self-compassion (Gregorio and Pinto-Gouveia 2013; Neff 2003). Dispositional mindfulness has been conceptualized as an inner capacity for cultivating awareness of present-moment experiences with a non-judging attitude (Brown et al. 2007).

Self-compassion is intrinsically associated with mindfulness, and has been generally defined as an adaptive way of relating intrapersonally (Gilbert and Procter 2006). According to Neff (2009, 2012), self-compassion involves an attitude of kindness and acceptance towards difficult experiences and negative aspects of oneself, reducing levels of self-judgment, isolation and over-identification.

Both mindfulness and self-compassion skills contribute to positive psychological outcomes (e.g., psychological resilience, fewer psychological problems; Muris et al. 2016), adaptive emotional regulation (e.g., Black 2015; Brown et al. 2007) and improved executive functioning (i.e., which includes psychological processes that manage emotional regulation and planning, being responsible for the goal-directed behavior, and which can also influence mindfulness and self-compassion skills; Shin et al. 2016) among adolescents from different ages. Bringing mindful awareness and non-judgmental acceptance to the present moment may enable individuals to change their relationship with their emotions, thoughts and other inner experiences by improving their awareness of emotional and sensory cues and therefore facilitating more flexible and adaptive responses (Brown et al. 2007). Such emotional regulation capacity will allow the individual to respond in accordance with their own values, goals and needs (Leary et al. 2006) instead of over-identifying with internal states and responding in an automatic, overlearned or impulsive way (Bishop et al. 2004; Gratz and Gunderson 2006), as frequently occurs in individuals with disordered eating behaviors (Dalen et al. 2010).

The study of mindfulness in the pediatric obesity field is taking the first steps. Recently, mindfulness practice has been suggested to promote healthy behaviors in college students (e.g., physical activity, fruit and vegetable intake; Gilbert and Waltz 2010) and some mindfulness-based interventions proved to be promising approaches in promoting weight loss (Daly 2013; Sperry et al. 2014) and improving weight-related behaviors (Barnes et al. 2016; Turner and Hingle 2017) among adolescents. Contrarily, a recent study with low-income adolescents failed to find a significant association between mindful eating and weight loss (Goodwin et al. 2017). However, O'Reilly and Black (2015), in a conceptual review, suggested that mindfulness-based interventions could be particularly useful for youths with overweight/obesity given the many positive psychological outcomes of these interventions among children/adolescents and the evidence from obesity-related eating behavior studies in adults.

This study aims to advance knowledge in the field of emotion regulation among adolescents with overweight/obesity by exploring the associations among mindfulness, self-compassion, difficulties in emotion regulation, and emotional eating in a sample of adolescents with

overweight/obesity. The main goal of this study is to explore whether the associations between two psychological resources (mindfulness and self-compassion) and emotional eating are mediated by the difficulties in emotion regulation in a clinical and community sample of adolescents with overweight/obesity. In addition, because adolescents with overweight/obesity who are seeking treatment for weight loss and adolescents with overweight/obesity from the community that are not receiving treatment may differ in their psychological adjustment (Buttitta et al. 2014; Tsiros et al. 2009), and because adolescents with obesity may present a more compromised psychological functioning than adolescents with overweight (e.g., Williams et al. 2005), the moderating role of undergoing nutritional treatment (in treatment for weight loss vs. not in treatment for weight loss) and of weight status (overweight vs. obesity) in the proposed mediation model are also explored. Based on the literature, we hypothesize that higher levels of mindfulness and self-compassion skills will be associated with less difficulty in regulating emotional states, which in turn will be associated with lower levels of emotional eating. Moreover, we hypothesize the proposed associations to be stronger for adolescents with obesity and for those seeking nutritional treatment.

Method

Participants

The sample included 245 adolescents (51% were seeking nutritional treatment and 49% were adolescents from the community recruited from school settings) between 12 and 18 years of age ($M = 14.49$, $SD = 1.71$). Of these, 136 adolescents had overweight ($85^{\text{th}} \leq \text{BMI} < 97^{\text{th}}$ percentile) and 109 were obese ($\text{BMI} \geq 97^{\text{th}}$ percentile; WHO 2006), according to the WHO Child Growth Standards. The following inclusion criteria were considered: (1) age between 12 and 18 years; (2) overweight or obesity; (3) able to understand and answer the questionnaires; (4) no developmental delay or diagnosis of an eating disorder; and (5) no genetic syndromes for which obesity is a comorbidity. The main sociodemographic and clinical characteristics of the sample are presented in Table 1.

Procedure

The sample of adolescents seeking treatment for their obesity was collected from pediatric hospitals, and the community sample of adolescents was recruited from schools. Authorization for the sample collection was obtained from the Portuguese Data Protection Authority, the Ethics Committee of the Faculty of Psychology and Educational

Table 1 Sociodemographic and clinical characteristics of the sample

	Overweight/obese adolescents not undergoing nutritional treatment (<i>n</i> = 120)	Overweight/obese adolescents undergoing nutritional treatment (<i>n</i> = 125)	Group differences	
			<i>F/χ²</i>	<i>η_p²/Φ</i>
Age (years) <i>M</i> (<i>SD</i>); range	14.18 (1.81); 12–18	14.78 (1.55); 12–18	28.01***	.103
Gender <i>n</i> (%)				
Male	62 (51.7)	62 (49.6)	.11	.021
Female	58 (48.3)	63 (50.4)		
Weight category <i>n</i> (%)				
Overweight	88 (73.3)	48 (38.4)	30.25***	.351
Obese	32 (26.7)	77 (61.6)		
zBMI <i>M</i> (<i>SD</i>); range	1.72 (0.63); 1.01–4.78	2.16 (0.65); 1.05–4.04	28.01***	.103
Presence of comorbid health conditions <i>n</i> (%)				
Yes	26 (21.7)	83 (66.4)	49.61***	.450
No	94 (78.3)	42 (33.6)		
Comorbid health conditions <i>n</i> (%)				
Respiratory diseases	15 (12.5)	25 (20.0)	15.30	.375
Metabolic diseases	2 (1.7)	7 (5.6)		
Neurologic diseases	3 (2.5)	8 (6.4)		
Heart diseases	0 (0.0)	7 (5.6)		
Mental diseases	4 (3.3)	23 (18.4)		
Dermatologic diseases	0 (0.0)	6 (4.8)		
Digestive system diseases	0 (0.0)	1 (0.8)		
Genetic diseases	0 (0.0)	2 (1.6)		
Kidney diseases	0 (0.0)	1 (0.8)		
Spinal diseases	0 (0.0)	2 (1.6)		
Oncologic Diseases	1 (0.8)	0 (0.0)		
Others	1 (0.8)	1 (0.8)		

BMI z-scores were calculated according to the recommended WHO Child Growth Standards (2006), using the software WHO Anthro provided by the WHO (2010)

p* < .05; *p* < .01; ****p* < .001

Sciences of the University of Coimbra, the Board of Directors of each school unit, and the Ethics Committee and the Board of Directors of each hospital.

The adolescents from school settings were recruited from two Portuguese public school units between February and April 2016. In total, 43 classes from the two units were selected and invited to participate in the study. All the classes were visited twice by a research assistant. On the first visit, the study aims were presented to the adolescents, and each one received an envelope containing a letter explaining the study and the parent or legal representative's informed consent form. On the second visit, one week later, those adolescents whose parents provided informed consent completed the questionnaires during class. All the adolescents completed the measures regardless of their weight status. They were informed of the voluntary nature of the study and the confidentiality and anonymity of their answers and their assent to participate was requested. The

research assistant was present to monitor and to assist the adolescents whenever necessary.

The adolescents from hospital settings were recruited from the nutrition outpatient services of two public pediatric hospitals in the central region of Portugal between June 2015 and November 2016. The nutrition treatment consisted of a non-structured individual weight management program in which the nutritionist provided nutrition, physical activity, and behavior modification recommendations and prescribed diet and exercise plans tailored to the specific needs of each adolescent. A research assistant approached adolescents with overweight/obesity and their parents before or after the nutrition consultation, presented the study and requested their participation. The duration of the nutritional treatment was not considered an inclusion criterion. Therefore, the participants included adolescents who were beginning treatment and adolescents who had been undergoing treatment for months (*M* = 15.91; *DP* =

17.12; range: 0–95 months). All the adolescents were informed of the voluntary nature of the study and the confidentiality and anonymity of their answers. Those who agreed to participate and were able to understand the study questionnaires provided informed consent and completed the questionnaires in the presence of the research assistant in a consultation office provided for this purpose. If the participants were not available to complete the questionnaires at that moment, a pre-addressed and stamped envelope was provided to allow the participant to complete the questionnaire at home and return it by mail whenever possible. After two weeks of non-delivery, a written message was sent to the participant's parent or legal representative to remind them to return the questionnaires.

In total, 1094 adolescents were contacted; of these, 882 participated in the study, with 660 recruited from the school settings and 222 from the hospitals (response rate: 80.62%). Given the objectives of this study, several cases were excluded from the analysis. Specifically, 507 participants recruited from the schools and 11 participants recruited from the hospitals were eliminated because they had low weight ($n = 13$), normal weight ($n = 480$), or missing weight/height information ($n = 25$). In addition, 110 adolescents were excluded because they did not answer one or more of the study questionnaires; 6 adolescents recruited from the hospitals were excluded for not meeting the inclusion criteria (3 had an eating disorder, and 3 were excluded for not being able to fully understand and answer the questionnaires). Finally, 3 cases were excluded due to invalid responses on the study questionnaires.

Measures

Sociodemographic and clinical information

Sociodemographic information (i.e., age, gender) was self-reported by the adolescents. Clinical information (i.e., weight, height, presence of comorbid health conditions) was self-reported by the adolescents recruited from the school settings and was objectively measured and reported by the nutritionist for the adolescents with overweight/obesity recruited from the hospital settings. BMI was calculated for each participant using weight (kg) and height (m) values, according to the following formula: $\text{weight}/[\text{height}]^2$.

Mindfulness

Mindfulness skills (i.e., adolescents' present-moment awareness and their nonjudgmental, nonavoidant responses to their thoughts and feelings) were assessed using the Portuguese version of the Child and Adolescent Mindfulness Measure (CAMM; Cunha et al. 2013; Greco et al. 2011). This instrument was developed for children over the age of 9 years

and has adequate evidence for the reliability and validity of its scores (Greco et al. 2011). It contains 10 items (e.g., "I keep myself busy so I don't notice my thoughts or feelings") answered using a 5-point response scale (0 = *Never true* to 4 = *Always true*). Higher scores reflect higher levels of mindfulness. In this study, the Cronbach's α was .83.

Self-compassion

The Portuguese version of the Self-Compassion Scale-Short Form (SCS-SF; Castilho et al. 2015; Raes et al. 2011) was used to assess the adolescents' levels of self-compassion (i.e., the ability to hold one's feelings of suffering with a sense of warmth, connection and concern). This is a reliable instrument to measure self-compassion in adolescents samples with good psychometric proprieties (e.g., Cunha et al. 2016). The instrument contains 12 items (e.g., "When something upsets me, I try to keep my emotions in balance") rated on a 5-point response scale (1 = *Almost never* to 5 = *Almost always*), with higher scores indicating higher levels of self-compassion. This study used only the total score, which had a Cronbach's α of .70.

Difficulties in emotion regulation

The Portuguese version of the Difficulties in Emotion Regulation Scale - Short Form (DERS-SF; Kaufman et al. 2015; Moreira and Canavarro 2016) was used to assess the adolescents' different difficulties in regulating emotions during times of stress. This instrument revealed excellent psychometric proprieties both in adult and adolescent samples (Kaufman et al. 2015) and contains 18 items (e.g., "I pay attention to how I feel") answered on a 5-point response scale (1 = *Almost never* to 5 = *Almost always*). Higher scores indicate more difficulties in emotion regulation. The Cronbach's α for the total score was .89.

Emotional eating

Adolescents' emotional eating (i.e., the desire to eat under different emotional states, such as irritated, depressed, lonely, frightened, and disappointed) was assessed using the Portuguese version of the Emotional Eating subscale of the Dutch Eating Behavior Questionnaire (DEBQ; van Strien et al. 1986; Viana and Sinde 2003). The DEBQ has demonstrated internal consistency among 7 to 18 years old youths (e.g., Cronbach's alpha for overweight and normal-weight subjects between .91 and .93; Braet et al. 2008). This subscale contains 13 items ("Do you have a desire to eat when feeling lonely?") answered using a 5-point response scale (0 = *Never* to 4 = *Very often*). Higher scores reflect higher levels of emotional eating. In this study, the Cronbach's α was .94.

Data Analyses

Statistical analyses were conducted using the Statistical Package for the Social Sciences (SPSS, version 22.0; IBM SPSS, Armonk, NY) and the PROCESS computation tool (Hayes 2013). Missing data were handled through the SPSS Missing Values Analysis. Missing values varied between 0% and 0.8% and were infrequent and completely random [Little's MCAR test: $\chi^2(516) = 552.257$, $p = .131$ (Tabachnick and Fidell 2013)]. The Expectation-Maximization imputation procedure was used to estimate missing values to avoid losing cases in the analyses.

Cronbach's coefficient alpha was used as an indicator of the internal consistency of the instruments. Descriptive statistics and differences between groups (i.e., adolescents undergoing nutritional treatment and adolescents not undergoing nutritional treatment) were examined for sociodemographic (i.e., age, gender) and clinical variables (i.e., zBMI, presence of comorbid health conditions). Comparisons of study variables between groups (undergoing vs not undergoing nutritional treatment), controlling for sociodemographic and/or clinical variables that differed between groups, were assessed with ANCOVAs.

Pearson's bivariate correlations were computed between all study variables and between study variables and sociodemographic and clinical characteristics to identify potential covariates to be included in the model. Correlations coefficients $\geq .10$ were classified as small, $\geq .30$ were classified as medium, and $\geq .50$ were classified as large (Cohen 1988).

Regression-based path analyses were performed with PROCESS. Two moderated mediation models were estimated to examine the indirect effects of mindfulness and self-compassion [independent variables (IV)] on emotional eating [dependent variable (DV)] through the difficulties in emotion regulation [mediator (M)], and to examine whether the indirect and direct effects were moderated by the nutritional treatment (0 = without nutritional treatment; 1 = with nutritional treatment) and by the weight status (0 = overweight; 1 = obesity). Following the recommendations of Hayes (2013) for testing mediation models with more than one IV, first one IV was entered as the IV and the other was entered as a covariate, and then the reverse. Each moderator was hypothesized to affect all the paths in the model [Model 59 in Hayes (2013)]; therefore, in each moderated mediation model, five interactions were analyzed. Sociodemographic and clinical covariates were entered if they were significantly correlated with the DV. In the absence of one or more significant interactions, the model was re-estimated after the removal of the moderator from one or more paths (Hayes 2013). The index of moderated mediation was used as a formal test of the indirect effect of the moderator in the model. Indirect effects were tested using a bootstrapping procedure (10000 samples) that

generates 95% bias-corrected and accelerated confidence intervals (BCaCIs) and were significant if zero was not contained within the confidence interval (CI). The empirical power tables proposed by Fritz and Mackinnon (2007) for mediation models suggest that the sample size of this study is sufficient to find a mediated effect including small-to-medium a and b paths (.26) with a .80 power.

Results

Preliminary Analyses

The differences in sociodemographic (age, gender) and clinical variables (zBMI, presence of comorbid health conditions) between adolescents undergoing nutritional treatment and adolescents not undergoing nutritional treatment were analyzed. Significant differences were found for age, $F(1, 243) = 8.01$, $p = .005$, $\eta^2_p = .032$, zBMI, $F(1, 243) = 28.01$, $p < .001$, $\eta^2_p = .103$, and the presence of comorbid health conditions, $\chi^2(1) = 49.61$, $p < .001$, $\Phi = .450$; the adolescents undergoing nutritional treatment were older and had a higher zBMI and more comorbid health conditions than the adolescents who were not undergoing nutritional treatment. No significant differences were found for gender, $\chi^2(1) = 0.11$, $p = .799$, $\Phi = .021$. Regarding the study variables, and controlling for age, zBMI and presence of comorbid health conditions, no significant differences were found for mindfulness, $F(1, 240) = 0.87$, $p = .353$, $\eta^2_p = .004$, self-compassion, $F(1, 240) = 0.39$, $p = .535$, $\eta^2_p = .002$, difficulties in emotion regulation, $F(1, 240) = 1.17$, $p = .280$, $\eta^2_p = .005$, or emotional eating, $F(1, 240) = 0.58$, $p = .447$, $\eta^2_p = .002$. Because no significant differences were found in the study variables, the two groups were analyzed together in subsequent analyses.

Descriptive statistics and bivariate correlations between study variables are presented in Table 2. Medium to large correlations were found among all study variables and between some study variables and sociodemographic/clinical variables. Specifically, significant medium associations were found between mindfulness and age ($r = -.13$, $p = .039$); mindfulness and gender ($r = -.19$, $p = .003$); emotional eating and gender ($r = .16$, $p = .010$); and emotional eating and zBMI ($r = .15$, $p = .021$).

The Indirect Effects of Mindfulness and Self-Compassion on Emotional Eating Through Difficulties in Emotion Regulation

To examine whether mindfulness and self-compassion were indirectly associated with emotional eating through difficulties in emotion regulation and whether this effect was moderated by the nutritional treatment and by the weight

Table 2 Descriptive statistics and correlations between study, sociodemographic and clinical variables

Variables	<i>M</i>	<i>SD</i>	Range	1	2	3	Age	Gender	Presence of comorbid health conditions	zBMI	Group type
1. Mindfulness	26.99	6.97	3.00–40.00	—			-.13*	-.19**	-.04	.01	.02
2. Self-compassion	3.22	0.59	1.08–4.75	.38**	—		-.03	-.11	-.00	-.01	.02
3. Difficulties in emotional regulation	2.45	0.74	1.00–4.50	-.54**	-.56**	—	.02	.05	.06	-.04	-.04
4. Emotional eating	12.25	11.03	0.00–52.00	-.49**	-.38**	.46**	.11	.16*	.02	.15*	.03

Gender: 0 = boys; 1 = girls; Presence of comorbid health conditions: 0 = no; 1 = yes; Group type: 0 = adolescents not undergoing nutritional treatment; 1 = adolescents undergoing nutritional treatment

* $p < .05$; ** $p < .01$; *** $p < .001$

status, two moderated mediation models were estimated. In the first moderated mediation analysis, gender and zBMI were entered as covariates in the model because they were significantly correlated with emotional eating (see Table 2). The analysis revealed that no path in the model was moderated by nutritional treatment. Specifically, the interaction between mindfulness and nutritional treatment was not significant in the path linking mindfulness and difficulties in emotion regulation ($b = -0.00$, $p = .850$), as was the interaction between self-compassion and nutritional treatment in the path linking self-compassion and difficulties in emotion regulation ($b = 0.11$, $p = .427$). Likewise, the interaction between difficulties in emotion regulation and nutritional treatment in the path linking difficulties in emotion regulation and emotional eating was not significant ($b = -2.57$, $p = .172$). Finally, in terms of direct effects, the interaction between mindfulness and nutritional treatment was not significant ($b = 0.08$, $p = .675$), nor was the interaction between self-compassion and nutritional treatment ($b = 0.11$, $p = .961$). The moderation of the indirect effects was non-significant (index of moderated mediation $_{\text{mindfulness}} = 0.14$, $SE = 0.13$, 95%CI = $-0.10/0.40$; index of moderated mediation $_{\text{self-compassion}} = 2.39$, $SE = 1.62$, 95%CI = $-0.50/5.83$).

In the second moderated mediation analysis, only gender was entered as a covariate in the model because the weight group was the moderator. As in the first model, no path was moderated by the weight group. Specifically, with mindfulness as IV, in the path linking mindfulness and difficulties in emotion regulation the interaction between mindfulness and the weight group was not significant ($b = 0.01$, $p = .588$), as was the interaction between difficulties in emotion regulation and the weight group ($b = -2.14$, $p = .263$), and the interaction between mindfulness and the weight group ($b = -0.25$, $p = .221$) in the path linking difficulties in emotion regulation and emotional eating. With self-compassion as IV, in the path linking self-compassion and difficulties in emotion regulation the interaction between self-compassion and the weight group was not significant ($b = 0.10$, $p = .400$), as was the

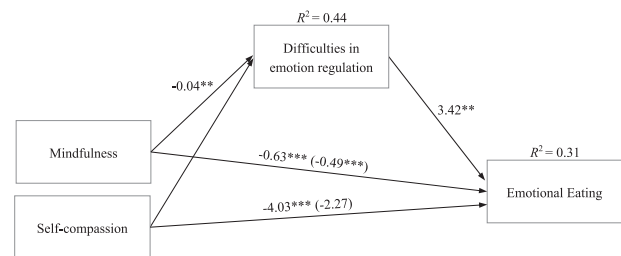


Fig. 1 Statistical diagram of the mediating model estimating the indirect effects of mindfulness and self-compassion on emotional eating, through the difficulties in emotion regulation. Path values represent unstandardized regression coefficients. The values outside the parentheses represent the total effects of mindfulness/self-compassion on emotional eating. The values in parentheses represent the direct effects, from the bootstrapping analysis, of mindfulness/self-compassion on emotional eating after the inclusion of the mediator. * $p < .05$; ** $p < .01$; *** $p < .001$

interaction between difficulties in emotion regulation and the weight group ($b = -1.51$, $p = .433$) and the interaction between self-compassion and the weight group ($b = -1.44$, $p = .550$) in the path linking difficulties in emotion regulation and emotional eating. Finally, the indexes of moderated mediation were non-significant for mindfulness and for self-compassion (index of moderated mediation $_{\text{mindfulness}} = 0.11$, $SE = 0.10$, 95%CI = $-0.08/0.30$; index of moderated mediation $_{\text{self-compassion}} = 1.08$, $SE = 1.23$, 95%CI = $-1.29/3.53$). Therefore, the model was re-estimated without using nutritional treatment and weight status as moderators [Model 4 in Hayes (2013)].

The effects of the IVs on the proposed M (path a), the effects of M on the DV partialling out the effect of the IVs (path b), the direct effects of the IVs on DV after controlling for M (path c'), and the total effect of IV on DV (path c) are depicted in Fig. 1. As presented in Fig. 1, although the total effects of mindfulness and self-compassion on emotional eating were both significant, only the direct effect of mindfulness on emotional eating was significant in a model explaining 31.2% of the emotional eating variance, $F(4, 240) = 27.21$, $p < .001$. A significant indirect effect of mindfulness on emotional eating through difficulties in

emotion regulation was found (point estimate = -0.14 , $SE = 0.06$, $95\%CI = -0.26/-0.05$), as was a significant indirect effect of self-compassion on emotional eating through difficulties in emotion regulation (point estimate = -1.76 , $SE = 0.67$, $95\%CI = -3.20/-0.58$).

An Alternative Model: The Indirect Effect of Difficulties in Emotion Regulation on Emotional Eating Through Mindfulness and Self-Compassion Skills

Given the cross-sectional design of this study, alternative models may be considered. To explore the possibility that difficulties in emotion regulation are associated with emotional eating through mindfulness and self-compassion skills, we tested a reversed double mediation model in which difficulties in emotion regulation was the independent variable, emotional eating was the dependent variable, mindfulness and self-compassion skills were the mediators, and nutritional treatment was the moderator. An identical model was tested with weight status as moderator. The same procedures were followed and, in addition to the variables introduced as covariates in the previous model, also adolescent's age was introduced as covariate since it was significantly correlated with mindfulness ($r = -.13$; $p = .038$).

The first moderated mediation analyses revealed that no path in the alternative model was moderated by nutritional treatment. Specifically, the interaction between difficulties in emotion regulation and nutritional treatment was not significant in the path linking difficulties in emotion regulation and mindfulness ($b = -1.51$, $p = .132$), and in the path linking difficulties in emotion regulation and self-compassion ($b = 0.04$, $p = .641$). Likewise, the interaction between mindfulness and nutritional treatment in the path linking mindfulness and emotional eating was not significant ($b = 0.08$, $p = .693$), as was the interaction between self-compassion and nutritional treatment in the path linking self-compassion and emotional eating ($b = -2.25$, $p = .916$), and the interaction between difficulties in emotion regulation and nutritional treatment in the path linking difficulties in emotion regulation and emotional eating ($b = -2.72$, $p = .200$). The moderation of the indirect effects was non-significant (index of moderated mediation_{mindfulness} = 0.03 , $SE = 1.14$, $95\%CI = -2.17/2.31$; index of moderated mediation_{self-compassion} = 0.35 , $SE = 1.19$, $95\%CI = -2.02/2.65$).

In the second moderated mediation analyses, no paths were moderated by the weight status. Specifically, the interaction between difficulties in emotion regulation and the weight group was not significant in the path linking difficulties in emotion regulation and mindfulness ($b = 0.22$, $p = .830$) and in the path linking difficulties in emotion regulation and self-compassion ($b = 0.09$, $p = .327$).

Moreover, the interaction between mindfulness and the weight group in the path linking mindfulness and emotional eating was non-significant ($b = -0.24$, $p = .233$), as was the interaction between self-compassion and the weight group in the path linking self-compassion and emotional eating ($b = -1.11$, $p = .648$), and the interaction between difficulties in emotion regulation and the weight group in the path linking difficulties in emotion regulation and emotional eating ($b = -2.61$, $p = .219$). Finally, the moderation of weight status was also non-significant (index of moderated mediation_{mindfulness} = 1.10 , $SE = 1.21$, $95\%CI = -1.12/3.70$; index of moderated mediation_{self-compassion} = 0.28 , $SE = 1.15$, $95\%CI = -1.87/2.72$). Therefore, the model was re-estimated without using nutritional treatment and weight status as moderators [Model 4 in Hayes (2013)].

In this mediation model, the total and the direct effects of difficulties in emotion regulation on emotional eating were significant (total effect: $b = 6.87$, $SE = 0.83$, $p < .001$, $95\%CI = 5.24/8.50$; direct effect: $b = 3.46$, $SE = 1.05$, $p = .001$, $95\%CI = 1.38/5.54$). With regard to the indirect effects, only the indirect effect of difficulties in emotion regulation on emotional eating through mindfulness was significant (point estimate = 2.40 , $SE = 0.61$, $95\%CI = 1.33/3.73$). The indirect effect of difficulties in emotion regulation on emotional eating through self-compassion was non-significant (point estimate = 1.01 , $SE = 0.57$, $95\%CI = -0.08/2.12$). This model explained 34.3% of the emotional eating variance, $F(6, 238) = 20.70$, $p < .001$.

Discussion

The results of this study showed that higher levels of mindfulness and self-compassion skills in adolescents with overweight/obesity were associated with lower levels of emotional eating by helping adolescents use more adaptive strategies for emotion regulation. In addition, mindfulness skills were also negatively associated with emotional eating, whereas self-compassion skills were not, which suggests that self-compassion skills were related to emotional eating only because these skills enable more adaptive strategies for emotion regulation.

Contrarily to our hypothesis, the associations among the variables in the model were independent of nutritional treatment and of weight status, which suggests that the relationship between mindfulness, self-compassion, emotion regulation and emotional eating in adolescents may occur regardless of whether the adolescent is undergoing treatment for weight loss or has overweight or obesity. We may speculate that, since these constructs are individual psychological skills and processes, they are inherent to the individual and the developmental context and might not depend on external sources, such as the nutritional

treatment. Nevertheless, we should be cautious when interpreting these results because nutritional treatment was only measured regarding the presence, or not, of nutritional consultations regardless of its duration and effect, and weight and height was self-reported in the sample collected in schools.

Negative significant associations were found between mindfulness and self-compassion skills and difficulties in emotion regulation. Although these links, to the best of our knowledge, have only been studied among adults, the results of our study suggest that they may also occur among adolescents. In fact, when individuals develop mindful awareness and non-judgmental acceptance of the present moment, they may modify their relationship with emotions (Brown et al. 2007), first by directing their attention towards the emotions and related thoughts and body sensations, and second, by letting the emotions, thoughts and sensations be as they are and accepting them as a part of the human condition. This alternative and flexible attitude may help the individual use more adaptive and rational responses instead of employing dysregulated strategies to address negative emotions, such as automatic eating behaviors (Brown et al. 2007). In contrast, by over-identifying with negative internal states, individuals may decrease their capacity to pay attention to the present moment and to accept it as it is and may in turn respond in automatic, overlearned or impulsive ways (Bishop et al. 2004; Gratz and Gunderson 2006). A possible way to address internal negative states and emotions is by engaging in disordered eating behaviors, such as emotional eating, which may occur for different reasons, such as to escape from negative self-awareness or self-assessments (Heatherton and Baumeister 1991) or to compensate for the absence of other reinforcing experiences (i.e., food as a self-reward; Wedig and Nock 2010) or because the individual has difficulties recognizing physical hunger and satiety cues (Dalen et al. 2010) or distinguishing between physical hunger cues and emotional arousal (O'Reilly et al. 2014). In all these situations, the common denominator might be the absence of a mindful awareness and non-judgmental acceptance of internal (and very often, painful) states. Similarly, neurological studies demonstrated that the regular practice of mindfulness changes the neural systems involved in executive functioning, such as decision-making, self-regulation and habitual reactions (Black 2015; Shin et al. 2016), thereby allowing more adaptive and balanced responses.

Although our study was intended to explore the associations between these constructs in a model mediated by difficulties in emotion regulation, given the cross-sectional design of this study, it is important to acknowledge that the inverse relationship is also possible (Maxwell and Cole 2007). Therefore, we tested whether difficulties in emotion regulation were indirectly associated with emotional eating

through mindfulness and self-compassion skills. In this model, a significant indirect effect of the difficulties in emotion regulation on emotional eating was only found through mindfulness. Self-compassion did not mediate this association. In addition, a significant direct effect between difficulties in emotion regulation and emotional eating was found. Therefore, it is also possible that adolescents with less difficulty in regulating their emotional states may have, in turn, higher levels of mindfulness skills. These results suggest that the association between mindfulness/self-compassion and emotion regulation may be bidirectional. Nevertheless, the directionality of these variables goes beyond the scope of this study and should be further explored in future longitudinal research.

The findings of our mediation model suggested that mindfulness skills were negatively associated with emotional eating in adolescents with overweight/obesity, not only directly but also because they may help these adolescents adopt more adaptive emotion regulation strategies. Specifically, developing a mindful awareness of the present moment and consequently, neither engaging in nor identifying with negative automatic thoughts may discourage adolescents with overweight/obesity from engaging in emotional eating. According to our study, this association may occur both because of the positive role of this psychological resource and because mindfulness may provide more adaptive ways of dealing with negative emotions and internal states.

Self-compassion was also found to be negatively associated with emotional eating through more adaptive emotion regulation strategies. This finding may suggest that by being more warm and compassionate toward themselves and accepting failures and sufferings as part of the human condition, adolescents with overweight/obesity may develop a protective shield that might give them better ways to deal with emotions and, as a result, reduce the need to engage in emotional eating. Additionally, the development of self-kindness and self-compassion was not enough to explain why adolescents with overweight/obesity eat emotionally; the way these adolescents regulated their emotions and inner states also explained the emotional eating. Therefore, our results support the idea that emotional eating may occur in response to maladaptive emotion regulation (e.g., Kemp et al. 2013; Micanti et al. 2017) that generates more accessible responses with the short-term objective of relieving the negative internal states (Evers et al. 2010) and not only because, for instance, of a self-critical and non-compassionate stance towards oneself. This is in accordance with previous studies suggesting that it is the lack of adaptive emotion regulation strategies for addressing negative emotions, and not the experience of negative emotions itself, that determines eating behaviors (Evers et al. 2010).

The positive association found between difficulties in emotion regulation and emotional eating is in accordance with previous studies demonstrating that the maladaptive regulation of internal states, especially difficult and stressful ones, can encourage engagement in disordered eating behaviors (e.g., Evers et al. 2010; Kemp et al. 2013), particularly among individuals with overweight/obesity (Eichen et al. 2017; Gorlach et al. 2016). The emotional eating contributes to weight gain and, therefore, to the development or maintenance of obesity or other eating disorders (Doyle et al. 2007). As a result, disordered eating behaviors have a multidimensional impact on psychosocial functioning (Gowey et al. 2016), placing the adolescent in a vulnerable psychological state that may be characterized by feelings of failure, inadequacy, shame, and isolation. This study provides additional support for the assumption that emotion dysregulation may be an important target for intervention in individuals with overweight/obesity that should be addressed during emerging adolescence, before long-term unhealthy eating habits are established and maintained into adulthood (Gowey et al. 2016).

Limitations and Future Research

This study has several limitations that must be noted. First, the cross-sectional design prevents the establishment of causal relationships and mechanisms, and therefore, alternative models may be considered. Therefore, we tested whether difficulties in emotion regulation were indirectly associated with emotional eating through mindfulness and self-compassion skills. Since the results suggested that this direction may also occur, future longitudinal studies are needed to ascertain the direction of these associations. Nevertheless, although the present study has a cross-sectional design, it emphasizes the beneficial role that both mindfulness and self-compassion may have as modifiable psychological skills that can be promoted in psychological interventions. If psychological interventions aimed at increasing mindfulness and self-compassion skills can in turn diminish adolescents' difficulties in emotion regulation, they may also potentiate more generalized benefits for the adolescent in addition to healthier eating behaviors, since emotion dysregulation is a vulnerability factor to several psychological problems. Nevertheless, these are tentative hypothesis that should be clarified in longitudinal studies. Second, the sample was only collected from two public schools and two hospitals of the central region of Portugal, which compromises the representativeness of the sample. Moreover, and although the majority of the participants were Caucasian, information on race and ethnicity was not collected. Third, two different procedures were used to obtain clinical information: for the adolescents recruited from the hospitals, weight and height were

measured by the nutritionist, whereas for the adolescents recruited from schools, this information was self-reported. This is an important issue as it has been demonstrated that youths may not be able to accurately self-report their weight and height (Brener et al. 2003; Tokmakidis et al. 2007). Additionally, comorbid health conditions (and the diagnosis of an eating disorder) were reported by the adolescents and the nutritionists, and were not diagnosed by a clinical psychologist, which is also a limitation of this study. Fourth, the adolescents recruited from the hospitals were invited to participate in the study at different stages of the nutrition treatment (i.e., on the first consultation or weeks/months after the beginning of the treatment). Although the duration of the nutrition treatment was not considered an inclusion criterion, it would have been ideal for all the participants to have been assessed at the same stage of the treatment. Fifth, only self-report instruments were used; this can compromise the validity of the results if participants were influenced by social desirability and did not reliably report their inner states.

Nevertheless, this study provides innovative knowledge in the field of emotion regulation and proposes a new avenue of research in pediatric obesity by presenting novel results that suggest that mindfulness and self-compassion skills might be modifiable factors that can be associated with emotional eating in adolescents with overweight/obesity. Although the role of these positive psychological resources has been investigated in adult populations (Gilbert and Waltz 2010; O'Reilly et al. 2014), few studies to date have explored them among children and adolescents with overweight/obesity (Moreira and Canavarro 2017). The innovative findings of this study highlight the need for future longitudinal studies and randomized controlled trials on mindful- and self-compassion-based interventions to better understand the presumed positive impact of developing these skills.

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Author Contributions MJG: designed and executed the study, conducted the data analyses, and wrote the paper.

MCC: collaborated in the editing of the final manuscript.

HM: collaborated with the design and writing of the study and assisted with the data analyses.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964

Helsinki declaration and its later amendments or comparable ethical standards. The Ethics Committee of the Faculty of Psychology and Educational Sciences of the University of Coimbra approved the study.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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Belief in Environmentalism and Independent/Interdependent Self-Construal as Factors Predicting Interest in and Intention to Purchase Hybrid Electric Vehicles

Volkan Dogan¹ · Mujdat Ozmen¹

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Abstract Hybrid electric vehicles (HEVs), the most salient environmentally responsible vehicles, can help to make the world cleaner and more livable. Although studies have yielded an impressive set of findings about consumers' intention to purchase HEV from the perspective of economic, environmental, and social concerns, much less attention has been paid to self-related concerns for consumers' intention to purchase HEVs. The present study investigated whether relative level of environmentalism and self-construal jointly predicted degree of interest in and intention to purchase HEVs. Seven hundred and fifty-two respondents (mainly from the U.S. and India) completed a survey, but the results for the different levels of environmental belief and self-construal were based on 289 participants. The results showed that level of environmentalism interacted with self-construal to predict the degree of interest in HEVs and intention to purchase HEVs. Post hoc tests revealed that among participants who had relatively low level of environmentalism, participants with interdependent self-construal had a greater degree of interest in HEVs and greater intention to purchase HEVs than did participants with independent self-construal. In contrast, among participants who had relatively high levels of environmentalism, participants with independent self-construal had a greater degree of interest in HEVs and greater intention to purchase HEVs than did participants with interdependent self-construal. However, the effect of the interaction between relative level of

environmentalism and self-construal on intention to purchase HEVs was not significant when the degree of interest in HEVs was controlled.

Keywords Hybrid electric vehicles · Level of environmentalism · Self-construal · Optimal distinctiveness theory · Self-construal theory

Abbreviations

ODT Optimal distinctiveness theory
SCT Self-construal theory
HEVs Hybrid electric vehicles

There is no doubt that vehicle emissions are one of the biggest barriers for better (higher quality) air. Approximately 19 million barrels of oil per day are consumed in the United States just for transportation purposes (Union of Concerned Scientists 2015), which is likely to impair air quality. What can individuals do about this issue? One answer is to prefer environmentally responsible vehicles. Hence, over the past ten years, several studies have examined the adoption process and intention to purchase these vehicles (Aksen and Kurani 2012; Aksen and Kurani 2013; Beresteanu and Li 2011; Diamond 2009; Egbue and Long 2012; Gallagher and Muehlegger 2011; Gupta and Ogden 2009; Kim 2011; Oliver and Lee 2010; Ozaki and Sevastyanova 2011; Potoglou and Kanaroglou 2007; Schuitema and De Groot 2015; van Vliet et al. 2010).

Previously, consumers' interest in and intention to purchase HEVs has been examined with practice theory, rational choice theory, theory of planned behavior, value-belief-norm theory, an innovation diffusion model, consumer innovativeness, signaling theory and self-image congruence theory (Rezvani

✉ Volkan Dogan
vodogan@ogu.edu.tr

Mujdat Ozmen
mujdat26@yahoo.com

¹ Department of Marketing, Faculty of Economics and Administrative Sciences, Eskisehir Osmangazi University, 26480 Eskisehir, Turkey

et al. 2015). Although this past research has contributed to our understanding of consumers' intention to purchase HEVs, two potentially important subject variables have not been jointly examined: relative level of environmentalism, which is the degree of environmentalism compared to surroundings, and consumers' self-construal, which refers to perceptions of individuals, such as their thoughts, feelings, and actions (Markus and Kitayama 1991). To this end, we adopted two theories as our framework, namely, optimal distinctiveness theory (Brewer 1991) and self-construal theory (Markus and Kitayama 1991). These two theories provide some advantages over previous theoretical approaches. Past research focused on the evaluations of consumers' interest and purchase intention from the perspective of absolute level of environmentalism (Graham-Rowe et al. 2012; Ma et al. 2014; Oliver and Lee 2010). Put more simply, they postulated that the higher the absolute level of environmentalism, the higher consumers' degree of interest in and intention to purchase HEVs would be. This approach evaluated the consumers' degree of interest in and intention to purchase HEVs from an isolated perspective. However, people live with other people with whom they interact. In other words, people are social beings (Aronson 1994). Consumers' relative level of environmentalism would be one example of this interaction since consumers' relative level of environmentalism is dependent on the surrounding level of environmentalism. In addition, people care about their positions compared to their surroundings (Kitayama et al. 2003). Particularly, this tendency is high among Eastern people (Nisbett et al. 2001). Use of the two theories allowed us to examine the consumers' interest and purchase intention from the perspective of consumers' relative level of environmentalism (rather than absolute level of environmentalism) and how the construction of the self interacts with this relative level of environmentalism.

We claim that consumer's relative level of environmentalism interacts with self-construal to predict interest and purchase intention. Specifically, we hypothesize that among consumers who have a relatively low level of environmentalism, consumers with interdependent self-construal will have greater interest in HEVs and greater intention to purchase HEVs than will consumers with independent self-construal. In contrast, we also hypothesized that among consumers who have a relatively high level of environmentalism, participants with independent self-construal will have greater interest in and greater intention to purchase HEVs than will participants with interdependent self-construal.

In summary, this study examined consumers' interest in and intention to purchase HEVs from the perspectives of optimal distinctiveness theory and self-construal theory. The current study contributes to the literature by being the first to jointly examine consumers' interest and purchase intention.

The results of this study may also have implications for policy makers who are trying to improve the world. In

particular, they may show how classifications based on relative level of environmentalism and the way people construe their lives can benefit policies by making them more efficient and effective.

Literature Review

Environmentally responsible vehicles are also known as electric vehicles, alternative fuel vehicles and green vehicles in the literature. The most salient feature of environmentally responsible vehicles, which differentiates them from internal combustion engine (ICE) vehicles, is their low emissions and reduced harm to the environment. Environmentally responsible vehicles include plug-in hybrid electric vehicles (PHEVs), extended-range vehicles (E-REVs), battery electric vehicles (BEVs) and hybrid electric vehicles (HEVs). The HEVs have an internal combustion engine and a battery-powered electric motor. The HEV battery is charged during braking or by the ICE powertrain and cannot be charged via a plug-in (Rezvani et al. 2015).

Most consumers support the idea of purchasing green products (Kodjak 2012). However, this support generally does not translate to purchase behavior (Schuitema and De Groot 2015). Several studies have been conducted to determine why individuals do not buy HEVs.

In particular, consumers' intention to purchase HEV and adoption processes have attracted the attention of many researchers. The studies on the economic concerns of the intention to purchase HEVs and adoption process for HEVs, such as gas/fuel prices, financial incentives, operating costs, tax subsidies, free parking, and initial prices, have provided several insights. It was revealed that financial incentives and gas/fuel prices are positively related to HEV sales volume (Beresteanu and Li 2011; Diamond 2009; Gallagher and Muehlegger 2011). Furthermore, financial incentives seem less effective than gas/fuel prices on consumers' HEV adoption processes (Diamond 2009). In the conclusion of a study conducted in Canada, it was noted that tax subsidies and free parking encourage consumers to adopt HEVs (Potoglou and Kanaroglou 2007). It was also discussed that the higher initial price of HEVs compared to ICE vehicles was a barrier for consumers to purchase HEVs (van Vliet et al. 2010).

Motor vehicles symbolize not only mobility or transportation but also other ideas (Heffner et al. 2007). For instance, people can obtain some symbolic benefits from their HEVs. Put another way, HEVs can represent the sophisticated style of their owners so that HEV owners can transmit some intended message to their surroundings. Along with these different meanings of HEVs, it is possible to divide the studies on consumers' intention to purchase HEV and adoption processes into two groups: environmental concerns and social concerns. Past studies that examined consumers' intention to purchase

HEV and adoption processes in terms of environmental concerns have expanded our understanding of HEVs. As a result of the study by Kishi and Satoh (2005) conducted in Japan, it was discovered that concerns about the environment did not actually encourage consumers to purchase low-pollution vehicles. However, studies have shown that environmentalists (compared to non-environmentalists) were more likely to purchase HEVs (Kahn 2007). Findings from a study conducted on U.S. and Korean drivers revealed that willingness to seek green options and feelings about personal control over emissions were positively associated with consumers' intention to purchase HEV (Oliver and Lee 2010). There are also studies in the literature that specifically investigated the role of social concerns on consumers' HEV purchases and adoption processes. Social concerns refer to that what social benefits the ownership of an HEV would provide to the consumers. Let us suppose, for example, that obtaining a desired social identity would be possible through being the owner of the Toyota Prius. For instance, Oliver and Lee (2010) found that these social concerns predicted consumers' intention to purchase HEV more than environmental concerns. In addition, it was asserted that consumers were motivated to purchase environmentally responsible vehicles not only due to functional considerations but also due to symbolic and social concerns (Axsen and Kurani 2012, 2013). In detail, functional concerns are the economic benefits that stem from the ownership of the HEV. Particularly, an individual who lives in a crowded city with traffic congestion problems can save a remarkable amount of money through driving an HEV. HEVs have lower maintenance costs than ICE vehicles. On the other hand, symbolic concerns refer to what benefits the ownership of the HEV would provide to the sense of self of the consumer. For instance, ownership of the Toyota Prius might provide a positive reflection of the consumer's self-image. Additionally, Gupta and Ogden (2009) revealed that expectation of others' cooperation and group identity was higher in green consumers. A study on consumers who purchased a Toyota Prius in England demonstrated that the social norms and consumer willingness to comply with the norms of their groups were antecedents of consumers' intention to purchase a Toyota Prius (HEV) (Ozaki and Sevastyanova 2011). It was also asserted that being influenced by other people around had an impact on consumers' HEV adoption (Egbue and Long 2012; Zhang et al. 2011). The studies on social concerns demonstrated that consumers' intention to purchase HEV and adoption process was formed not only through economic concerns but also by the symbolic and social concerns.

Problem Definition

Despite the advantages, consumers are still pessimistic about purchasing environmentally responsible vehicles (Carley et al.

2013). When evaluating the costs, 10-year ownership of ICE vehicles (\$46,381) and HEVs (\$47,518) are almost the same (Egbue and Long 2012). HEVs have less gas emission compared to ICE vehicles (van Vliet et al. 2010), but it is obvious that consumers' behavior is inconsistent with the actual facts and costs. In their study, Schuitema and De Groot (2015) illustrated that the process of purchasing a green product is shaped by the trade-off of biospheric values and egoistic values. Specifically, they defended that if a product does not fulfill the self-serving needs of egoistic attributes, then it will not move the consumer to purchase it, even if it has biospheric (green product) attributes. In other words, unless green products' attributes fulfill self-serving needs, biospheric values will not move consumers to buy green products (Schuitema and De Groot 2015). However, environmentalists are more likely to purchase HEVs than non-environmentalists (Kahn 2007), and an interdependent view of self is positively related to green product purchase behavior (Kim 2011). These findings suggest that the self is the fundamental issue for consumers' green product purchases.

In addition to the self, the environment where people live is also very important in terms of HEV purchase decisions. Due to the social nature of human beings, the interaction of their selves and the social environment might have an impact on the decision to purchase an HEV. By social environment, we refer to people who live nearby. This paper proposes the idea that consumers' degree of interest in HEVs and intention to purchase an HEV are formed by how consumers construe their selves and their relative level of environmentalism compared to other people around them. To test this idea, this paper draws on the optimal distinctiveness theory and self-construal theory.

Social norms influence the decisions of consumers. The HEV purchase decision is also one of the decisions that is influenced by social norms. Social norms refer to common practices that are exhibited by other people in the area. For instance, if you work in an office with nine workers who all smoke, smoking would be a social norm in that office. Social norms may serve as a gate to be a part of this specific social group. Put another way, obeying the social norms of the specific group is required to be a member of this specific group. Additionally, human beings need to belong some social group or culture (Baumeister and Leary 1995). Therefore, people have an intrinsic motivation to obey the social norms of the context where they live. Past research findings seem to support this idea. A study on consumers who purchased a Toyota Prius demonstrated that willingness to comply with the norms of the consumer's group affected the consumer's intention to purchase a Toyota Prius (HEV) (Ozaki and Sevastyanova 2011). This finding implies that consumers' relative level of environmentalism compared to other people nearby can influence consumers' intention to purchase HEVs. Consider a person who has a lower level of environmentalism than those

nearby. This person will probably feel some incongruence. In other words, this person needs to change his/her level of environmentalism to be in line with the surrounding level of environmentalism. More precisely, an individual who has low level of environmentalism compared to his/her surroundings' level of environmentalism needs to increase his/her level of environmentalism to fit with social norms (the surroundings' average level of environmentalism). However, can we presume that people who have dissimilarities with their surroundings will always try to be similar to their surroundings? The response to this question uncovers the boundary condition of this assumption. The response might depend on the person's self-construal type. That is, how people construe their selves affects people's inclination to change their level of environmentalism to be fitted with the level of environmentalism of the other people nearby.

As mentioned before, human beings need to belong to some group (Baumeister and Leary 1995). That is, people pursue a social identity. Optimal distinctiveness theory (ODT) provides some explanations about this process. Briefly, ODT postulates that people exhibit two competing needs, namely, differentiating the self from other people and a countervailing need to assimilate the self with others (Brewer 1991). According to ODT, these two opposing needs govern the relationship between the self and membership in social groups (Brewer 2003). According to these two needs, people might act in two different ways. They may use a dissimilation strategy or an assimilation strategy. In a dissimilation strategy, people try to act in a way that increases the differences between them and the people around them. In an assimilation strategy, they try to act in a way that decreases the differences between them and the people around them. Both strategies are tools that people use to reach their desired level of distinctiveness. Distinctiveness refers to the discrepancy between the behavior, action, and interest of the individual and the actions of the people around who are members of the same society. The people around refers the people other than you who live in the same society with you. Therefore, these people compose a culture, which is a common and intrinsically acknowledged set of practices among people who live in the same society (Baumeister 2005). Whether a particular person will follow an assimilation strategy or a dissimilation strategy might be impacted by the culture in which a particular person lives. Consistent with this approach, the need for differentiation was found to be higher in individualist cultures than collectivist cultures (Ma et al. 2014). This finding implies that people who live in individualist cultures desire to be different from the rest of the society so that the strategies people use to reach their desired level of distinctiveness might depend upon culture. Additionally, what makes the culture individualist or collectivist is the way most of the people from this culture construe their selves (Hofstede 2001). Taken together, people's strategies to find an optimal distinctiveness of

their selves—differentiating the self from other people around or assimilating the self with others—depends on the way how they construe their selves.

Self-construal theory focuses on the way people construe their selves. Self-construal refers to perceptions of individuals, such as their thoughts, feelings, and actions (Markus and Kitayama 1991). For instance, an individual may either construe himself/herself as a distinguishable person from other people around or as an ordinary piece of the society. Self-construal theory (SCT) mainly concerns these two different ways of the construing the self. SCT proposes that people construe their selves in two different ways: independent construal or interdependent construal. While interdependent construal of the self views the self as connected with others, the independent construal of the self views the self as separate from others. People from Western societies have more developed independent self-construal, while people from Eastern societies have more developed interdependent self-construal (Markus and Kitayama 1991; Singelis 1994). Put another way, people from Western societies have a higher tendency to see themselves as distinctive and independent beings, whereas people from Eastern societies have a higher tendency to see themselves as an ordinary piece of the society in which they live (Roland 1988).

Past research has demonstrated that the levels of environmentalism of the people who live with us have an impact on our HEV adoption process (Egbue and Long 2012; Zhang et al. 2011). According to these findings, if we live in a social environment in which many individuals have a high level of environmentalism, the probability of our HEVs adoption would be high. However, this paper postulates that people's degree of interest in HEVs and intentions to purchase HEVs are not only influenced by the environmentalist friends they have but also how they construe their selves.

To this end, we propose that a consumer's degree of interest in HEVs and intention to purchase an HEV are formed by an interaction between their relative level of environmentalism (compared with surrounding level of environmentalism) and the way they construe their selves (independent self-construal or interdependent self-construal). Specifically, we hypothesized that among consumers who have a relatively low level of environmentalism, consumers with interdependent self-construal will have a greater degree of interest in HEVs and intention to purchase HEVs than consumers with independent self-construal. Because an individual who construes him/herself as interdependent desires to be seen as an indistinguishable part of the society (Markus and Kitayama 1991), a consumer with an interdependent self-construal who has a relatively low level of environmentalism will probably try to increase his/her level of environmentalism to be on the same level as the surrounding level of environmentalism. In contrast, we also hypothesized that among consumers who have a relatively high level of environmentalism, participants with

independent self-construal will have a greater degree of interest in HEVs and intention to purchase HEVs than participants with interdependent self-construal. Because an individual who construes him/herself as independent desires to be different than the surrounding people (Markus and Kitayama 1991), a consumer with an independent self-construal who has a relatively high level of environmentalism will probably try to increase his/her level of environmentalism to be on a very different level from the surrounding level of environmentalism. Put another way, an individual with an independent self-construal who has a relatively higher level of environmentalism compared to surrounding people will probably have a high degree of interest in HEVs and a high intention to purchase an HEV since an individual with independent self-construal desires to maximize the difference between his/her level of environmentalism and the level of environmentalism of the people around him/her.

Methodology

Participants

To accomplish our research objective, data were collected from 752 participants (371 males) via an internet-based survey. The participants were recruited from the Amazon Mturk platform (Paolacci and Chandler 2014). In exchange for their participation, they were paid 30 cents (US dollar). Mturk is an online platform that allows rapid, inexpensive and high-quality data collection from respondents with more demographic diversity than standard internet samples (Buhrmester et al. 2011).

Participants ranged in age from 18 to 63 years ($M = 28.39$, $SD = 2.52$). Most of the participants were from United States of America (86.2%) and India (11.9%). Approximately, a quarter of all participants (25.8%) had a lower level of education than a college or undergraduate degree. The average income of the participants was USD 41,880 ($SD = 14.660$).

Materials and Procedure

As mentioned above, data were collected with an online questionnaire. First, participants read the informed consent form and were requested to confirm their agreement in order to move forward. In the informed consent form, participants were informed that the aim of this study was to make a cross-cultural comparison of environmentalism. Following the informed consent form, participants were asked to rate their level of environmentalism relative to the environmentalism of the people around them (*When you compare yourself to people around you, how would you rate your level of environmentalism?*). Respondents rated their relative level of

environmentalism using a 7-point scale ($1 = \text{extremely low}$, $4 = \text{same level with levels of people around me}$, $7 = \text{extremely high}$). Respondents were also provided the definition of an environmentalist, which is “a person who works to protect the natural world from pollution and other threats” (Merriam-Webster 2004). The definition of environmentalism was provided to participants in order to prevent inconsistent interpretations of the environmentalist concept among participants. Subsequently, participants were asked to answer the *Self-Construal Scale* (SCS; Singelis 1994), which comprises 24 items (see Appendix). The SCS has two dimensions: *independent self-construal* and *interdependent self-construal*. Participants responded to items assessing in a random order. Participants reported their response to SCS items using a 7-point-scale ($1 = \text{strongly disagree}$, $7 = \text{strongly agree}$). After the SCS, participants first rated their degree of interest in HEVs (*How would you rate your interest in hybrid electric vehicles?*) followed by their degree of intention to purchase HEVs (*When you purchase your next or first vehicle, how likely are you to purchase a hybrid electric vehicle?*). The participants responded on a 4-point scale to the first question ($1 = \text{very unlikely}$, $4 = \text{very likely}$), whereas participants responded to the latter question on a 4-point scale with different anchoring ($1 = \text{no interest}$, $4 = \text{high interest}$). These two questions were adopted from past research (Egbue and Long 2012; Oliver and Rosen 2010). Next, participants were asked to report some demographic characteristics: age, income, education, and gender. Participants reported their age ($1 = \text{lower than 20}$, $2 = 21\text{--}30$, $3 = 31\text{--}40$, $4 = 41\text{--}50$, $5 = 51 \text{ and higher}$), income ($1 = \text{lower than } \$30,000$, $2 = \$31,000\text{--}\$60,000$, $3 = \$61,000\text{--}\$90,000$, $4 = 91,000 \text{ and higher}$), and education level ($1 = \text{lower than high school degree}$, $2 = \text{high school degree}$, $3 = \text{college (undergraduate) degree}$, $4 = \text{graduate degree}$) through an ordinal response format, however, but they reported their completed education level by choosing one of the four response options. In addition, participants reported their gender by choosing one of the two response options ($1 = \text{male}$, $2 = \text{female}$). Before being debriefed about the aims of the study, participants were asked what they thought the study was about to test for awareness of the study hypotheses. None of the participants were aware of the hypotheses.

Data Preparation for Analysis

Participants were divided into two groups according to their level of environmentalism relative to the level of environmentalism the people around them. To this end, we split participants by using a value of 4 as the cut-off value; participants who rated themselves higher than 4 (out of 7) were recorded as *relatively high environmentalists* ($n = 377$), and participants who rated themselves lower than 4 (out of 7) were recorded as *relatively low*

environmentalists ($n = 297$). Additionally, participants who rated themselves a 4 (78) were excluded from further analysis. The value of 4 was used as a cut-off value to group participants since this value indicates a participant is equally level of environmentalism compared with people around them. We did not use a median-split approach to divide participants into two groups, since we a priori created a middle option response (4 = *same level with levels of people around me*) as per our purpose. Thus, people who rated themselves with less than 4 evaluated their level of environmentalism as lower than those around them, whereas people who rated themselves with greater than a 4 evaluate their level of environmentalism as higher than those around them. According to the skewness (skewness = $-.21$, $p = .11$) and kurtosis (kurtosis = $-.08$, $p = .17$) values of relative environmentalism scores, it is probably safe to say that relative environmentalism scores have a normal univariate distribution since skewness and kurtosis values are between -2 and $+2$ (George and Mallery 2003).

Participants were also grouped into *pure independent self-construal* and *pure interdependent self-construal* according to their responses to the SCS. To accomplish that, we first divided participants into *high independent self-construal* ($n = 322$) and *low independent self-construal* ($n = 352$) by using a median-split (Mdn = 5.08). We also applied the same procedure to create *high interdependent self-construal* ($n = 313$) and *low interdependent self-construal* ($n = 361$, Mdn = 4.67). The logic of splitting the data by median value rather than the value of 4 is based on the fact that the distributions of independent self-construal (skewness = $-.18$, $p = .14$) and interdependent self-construal (skewness = $-.38$, $p = .09$) were negatively skewed. Furthermore, mean values of the independent self-construal ($m = 5.05$) and interdependent self-construal ($m = 4.66$) scores were quite different from 4. To create an orthogonal contrast, we eliminated participants who had both high independent self-construal level and high interdependent self-construal ($n = 173$) as well as participants who had both low independent self-construal level and low interdependent self-construal ($n = 212$). It was not surprising to identify some participants as highly independent and interdependent since people can develop these two different self-concepts simultaneously (Yamada and Singelis 1999). However, the aim of this study was to compare independent and interdependent self-construal. Thus, we needed to create fully contrasting groups. Finally, we were able to create two fully contrasting group, namely, *pure independent self-construal* ($n = 149$) and *pure interdependent self-construal* ($n = 140$). Participants in the former group had high independent self-construal and low interdependent self-construal, whereas participants in the latter

group had low independent self-construal and high interdependent self-construal.

Note that the split procedures for the self-construal and relative level of environmentalism were conducted on all data. In other words, we did not conduct a nested split procedure. Put more simply, following simultaneous splitting for self-construal and relative level of environmentalism, two dichotomic variables were crossed to form the four groups of pure independent and relatively low level of environmentalism ($n = 63$, 21 female), pure independent and relatively high level of environmentalism ($n = 86$, 33 female), pure interdependent and relatively low level of environmentalism ($n = 61$, 28 female), and pure interdependent and relatively high level of environmentalism ($n = 79$, 28 female). We prefer simultaneous splitting for these two different variables since nested splitting might cause a bias due the correlation between these two variables. Nevertheless, the dichotomous variables for self-construal and level of environmentalism were found to be uncorrelated ($\chi^2 = .05$, $df = 1$, $p = .83$).

Furthermore, the results of the chi-square analysis showed that the distribution of gender (1 = *male*, 2 = *female*) was similar among the four groups that we created across level of environmentalism and self-construal ($\chi^2 = 2.42$, $df = 3$, $p = .49$). Put more simply, there was matching across the four groups. Furthermore, education level (1 = *lower than high school degree*, 2 = *high school degree*, 3 = *college (undergraduate) degree*, 4 = *graduate degree*) was also independent of these four groups ($\chi^2 = 11.97$, $df = 9$, $p = .22$). On the other hand, age ($\chi^2 = 17.38$, $df = 12$, $p = .14$) and income ($\chi^2 = 14.54$, $df = 9$, $p = .11$) matched across the four groups. The final sample size for further analysis was two hundred and eighty nine.

Results

The SCS demonstrated good psychometric properties in the current study. As expected, exploratory factor analysis of the SCS revealed a two-factor solution: independent self-construal and interdependent self-construal (explained variance = 56.51%, KMO = .84, $p = .001$). There were no cross-loadings, and all items loaded higher than .50, ranging from .52 to .81. Furthermore, independent self-construal and interdependent self-construal showed good performance in terms of internal consistency ($\alpha_{\text{independent}} = .82$, $\alpha_{\text{interdependent}} = .85$) since these values were higher than the recommended .70 cut-off value (Nunnally 1978). This finding indicates good reliability.

In addition, we conducted a confirmatory factor analysis of the SCS with AMOS 23.0 statistical package program (Arbuckle 2014). The confirmatory factor analysis demonstrated that the model fits the data fairly well

($\chi^2/\text{df} = 2.80$, GFI = .93, CFI = .92, RMSEA = .05). All items loaded higher than .70 on the factors to which they belonged. This finding indicates factorial validity. The covariance path between an independent self-construal and an interdependent self-construal was found to be significant ($r = .17$, $t = 3.66$, $p = .001$), indicating that convergent validity was established since convergent validity is established when the two related constructs or dimensions are found to be associated (Bagozzi et al. 1991). Therefore, the significance path between an independent self-construal and an interdependent self-construal suggests that these two dimensions are associated (Byrne 2001). Furthermore, we tested a model in which the covariance path between independent self-construal and interdependent self-construal was fixed to 1. The results of this structural equation modeling analysis showed that the model did not fit the data ($\chi^2/\text{df} = 7.97$, GFI = .78, CFI = .65, RMSEA = .11) so that existence of the covariance between independent self-construal and interdependent self-construal cannot be omitted. This finding indicates that discriminant validity was established (Bagozzi and Yi 2012). Taken together, the SCS demonstrated satisfactory psychometric performance.

Additionally, we checked whether participants' degree of interest in HEVs and intention to purchase HEVs was correlated. A Pearson correlation analysis indicated that degree of interest in HEVs ($M = 2.83$, $SD = .82$) and intention to purchase HEVs ($M = 2.51$, $SD = .98$) was positively correlated ($r = .71$, $p = .001$), implying that the higher the degree of interest in HEVs, the higher the intention to purchase HEVs. Furthermore, we tested whether dependent variables, which consisted of relative level of environmentalism and self-construal, were different across demographics. A 2 X 2 (relative level of environmentalism X Self-construal) ANOVAs on income ($F(3, 284)_{\text{main}_1} = 1.46$, $p_{\text{main}_1} = .22$; $F(3, 284)_{\text{main}_2} = 1.35$, $p_{\text{main}_2} = .24$), age ($F(4, 285)_{\text{main}_1} = 1.84$, $p_{\text{main}_1} = .12$; $F(4, 285)_{\text{main}_2} = 1.12$, $p_{\text{main}_2} = .35$), and education level ($F(3, 285)_{\text{main}_1} = 1.08$, $p_{\text{main}_1} = .36$; $F(3, 285)_{\text{main}_2} = 1.26$, $p_{\text{main}_2} = .29$) demonstrated that results were not significant. In addition, independent sample t-test results showed that neither relative level of environmentalism ($t(287) = 1.17$, $p > .05$) nor self-construal ($t(287) = 1.28$, $p > .05$) is dependent on gender.

A 2 X 2 (Environmentalism Level X Self-construal) MANOVA with interest and intention to purchase as dependent variables was conducted to test differences among groups that were created according to relative level of environmentalism and self-construal. We conducted a MANOVA instead

of conducting two different ANOVAs¹ since 'degree of interest in HEVs' and 'intention to purchase HEVs' were positively correlated. A 2 (self-construal group) X 2 (relative level of environmentalism) MANOVA, showed a significant main effect of relative level of environmentalism, $F(2, 284) = 16.34$, $p = .001$, $\eta^2 = .103$, no main effect of self-construal group, $F(2, 284) = .09$, $p = .905$, $\eta^2 = .001$, and a significant interaction effect, $F(2, 284) = 5.34$, $p = .005$, $\eta^2 = .036$, on degree of interest in HEVs and intention to purchase HEVs. The results of the MANOVA are shown in Table 1.

Following the MANOVA, we conducted 2 X 2 (Environmentalism Level X Self-construal) ANOVAs for both degree of interest and intention to purchase HEVs. In these univariate ANOVAs, groups are as follows: independent self-construal and relatively low level of environmentalism, independent self-construal and relatively high level of environmentalism, interdependent self-construal and relatively low level of environmentalism, and interdependent self-construal and relatively high level of environmentalism. The main effect for relative level of environmentalism yielded an F ratio of $F(1, 287) = 68.71$, $p < .001$, for degree of interest in HEVs, indicating a significant difference between relatively high environmentalists ($M = 3.12$, $SD = .75$) and relatively low environmentalists ($M = 2.58$, $SD = .86$). Also, the main effect for relative level of environmentalism yielded an F ratio of $F(1, 287) = 49.92$, $p < .001$, for intention to purchase HEVs, indicating a significant difference between relatively high-level environmentalists ($M = 2.87$, $SD = .90$) and relatively low-level environmentalists ($M = 2.34$, $SD = .99$). The interaction effect was both significant for degree of interest in HEVs ($F(1, 287) = 8.06$, $p < .001$) and for intention to purchase HEVs ($F(1, 287) = 12.22$, $p < .001$). Post hoc test results showed that relatively high-level environmentalists with independent self-construal ($M = 3.24$, $SD = .72$) had a significantly higher degree of interest in HEVs than did relatively high-level environmentalists with interdependent self-construal ($M = 2.99$, $SD = .78$, $t(163) = 2.13$, $p < .05$). In contrast, relatively low-level environmentalists with independent self-construal ($M = 2.41$, $SD = .93$) had significantly less degree of interest in HEVs than did relatively low-level environmentalists with interdependent self-construal ($M = 2.70$, $SD = .79$, $t(122) = -2.21$, $p < .05$). The same were found for the degree of intention to purchase HEVs. Particularly, relatively high-level environmentalists with independent self-construal ($M = 3.01$, $SD = .91$) had significantly higher intention to purchase HEVs than did relatively high-level environmentalists with interdependent self-construal ($M = 2.73$, $SD = .89$, $t(163) = 2.03$, $p < .05$). In contrast, relatively low-level

¹ We would like to thank reviewer for this insightful contribution.

Table 1 Multivariate and univariate analyses of variance for the level of interest in HEVs and intention to purchase HEVs

Source	MANOVA $F(2, 284)$			ANOVA					
	F	p	η^2	Degree of interest in HEVs			Intention to purchase HEVs		
				F^a	p	η^2	F^b	p	η^2
Relative level of environmentalism (REL)	16.34	<.001	.103	68.71	<.001	.092	49.92	<.001	.069
Self-construal (SC)	.09	.905	.001	.01	.945	.000	.016	.899	<.000
REL x SC	5.34	.005	.036	8.06	<.001	.020	12.22	<.001	.030

Multivariate F ratios were generated from Wilks' statistic

^a Univariate $df = 1, 287$

^b Univariate $df = 1, 287$

environmentalists with independent self-construal ($M = 2.17$, $SD = 1.01$) had significantly less intention to purchase HEVs than did relatively low-level environmentalists with interdependent self-construal ($M = 2.52$, $SD = .97$, $t(122) = -2.03$, $p < .05$) (Fig. 1).

Post hoc tests also exhibited that those with independent self-construal with relatively high-level environmentalism ($M_{interest} = 3.24$, $SD_{interest} = .72$, $M_{intention} = 3.01$, $SD_{intention} = .91$) had a significantly higher degree of interest in HEVs ($t(115) = 5.90$, $p < .001$) and significantly higher degree of intention to purchase HEVs ($t(131) = 5.22$, $p < .001$) than did those with independent self-construal and relatively low-level environmentalism ($M_{interest} = 2.41$, $SD_{interest} = .93$, $M_{intention} = 2.17$, $SD_{intention} = 1.01$). However, those with interdependent self-construal and relatively high-level environmentalism ($M_{interest} = 2.99$, $SD_{interest} = .78$, $M_{intention} = 2.73$, $SD_{intention} = .89$) had a nonsignificantly higher degree of interest in HEVs ($t(119) = 1.79$, $p = .07$) and nonsignificantly higher degree of intention to purchase HEVs ($t(114) = 1.31$, $p = .19$) than did those with interdependent self-construal and relatively low-level environmentalism ($M_{interest} = 2.75$, $SD_{interest} = .79$, $M_{intention} = 2.52$, $SD_{intention} = .97$) (Table 2).

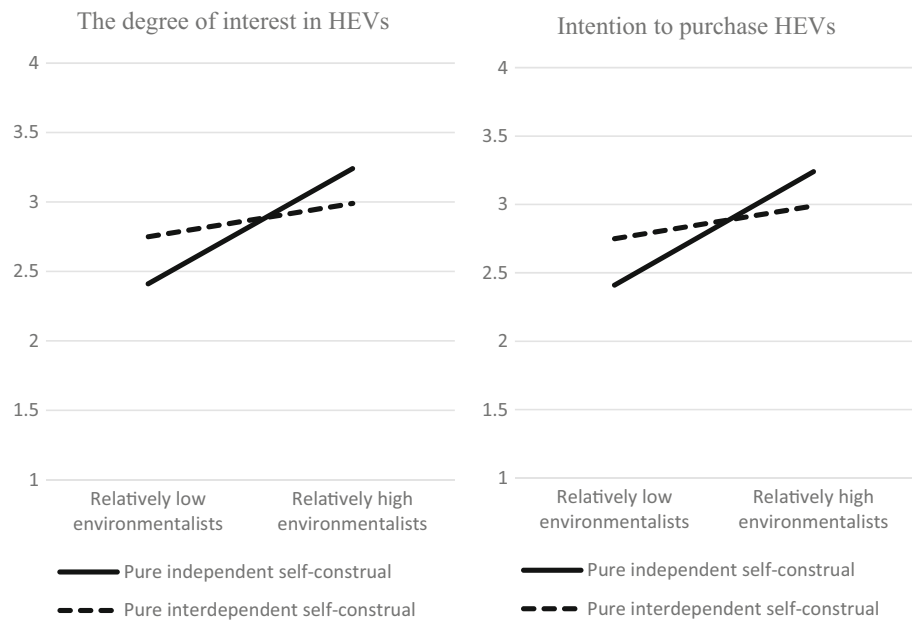
Lastly, we conducted a 2 X 2 (Environmentalist Level X Self-construal) ANCOVA² in which degree of interest in HEVs was a covariate and intention to purchase HEVs was a dependent variable. We entered the degree of interest in HEVs as a covariate since it was rated first. Additionally, according to the theory of reasoned action (Ajzen and Fishbein 1980), interest precedes intention; therefore, interest was evaluated as an antecedent of the intention. A 2 X 2 (Environmentalist Level X Self-construal) ANCOVA showed a nonsignificant interaction effect on intention to purchase HEVs, $F(1, 287) = .86$, $p = .769$, $\eta^2 = .000$. That is, the significant interaction effect (see Table 1) disappeared when the degree of interest in HEVs entered the model as a covariate, implying that differences in the degree of interest in HEVs across groups are resulted from the differences in the intention to purchase HEVs across groups. Furthermore,

we performed post hoc comparison tests in which the groups' mean intentions to purchase HEVs were compared controlling for the degree of interest in HEVs. Particularly, we first checked whether those with relatively low-level environmentalism and an interdependent self-construal had a greater intention to purchase HEVs than did relatively low-level environmentalists with an independent self-construal. Second, we checked whether those with relatively high-level environmentalism and an independent self-construal had a greater intention to purchase HEVs than did relatively high-level environmentalists with interdependent self-construal. The protected post hoc test by using estimated means did not reveal significant differences either for the first comparison (mean difference = .50, $SE = .14$, $p = .72$) or for the second comparison (mean difference = .06, $SE = .12$, $p = .96$) contrasts. These findings suggest that group differences in intention to purchase HEVs resulted from group differences in the degree of interest in HEVs.

Discussion

The purpose of the current study was to examine how consumers' self-construal and their relative level of environmentalism compared to the level of environmentalism of the people around them predicted the degree of interest in HEVs and intention to purchase HEVs. The results demonstrated that the interaction of self-construal and relative level of environmentalism predicted the degree of interest in HEVs and intention to purchase HEVs. In detail, relatively high environmentalists with independent self-construal had a greater degree of interest in HEVs and a greater intention to purchase HEVs than did relatively high environmentalists with interdependent self-construal. In contrast, relatively low environmentalists with independent self-construal had a lower degree of interest in HEVs and a lower intention to purchase HEVs than did relatively low environmentalists with interdependent self-construal. Furthermore, ANCOVA results revealed that significant differences for intention to purchase HEVs were accounted for by interest in HEVs.

² We would like to thank the reviewer for this insightful contribution.

Fig. 1 Graphical illustration of the mean scores of each group

The results of the current paper extend previous reports that environmentalists are more likely to purchase HEVs than non-environmentalists (Kahn 2007), and an interdependent self-construal is positively related to green product purchase behavior (Kim 2011) by showing the interaction between relative level of environmentalism and self-construal predicts both degree of interest in HEVs and intention to purchase HEVs. Put another way, self-construal is the boundary condition of the relationship between relative level of environmentalism and degree of interest in HEVs or intention to purchase HEVs. Additionally, a relative level of environmentalism is the boundary condition of the relationship between self-construal and degree of interest in HEVs or intention to purchase HEVs. For these boundary conditions, the degree of environmentalism in our social environment plays a critical role. To the best of our knowledge, this paper is the first (empirical) attempt to examine degree of interest in HEVs and intention to purchase HEVs from the perspective of relative level of environmentalism.

Table 2 The scores of degree of interest in HEVs and intention to purchase HEVs of each group

		Self-construal					
		Independent			Interdependent		
		<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>
Interest							
Environmentalism	High	86	3.24	.72	79	2.99	.78
	Low	63	2.41	.93	61	2.75	.79
Intention to purchase							
Environmentalism	High	86	3.01	.91	79	2.73	.89
	Low	63	2.17	1.01	61	2.52	.97

A great deal of previous research illustrated that economic concerns (Beresteanu and Li 2011; Diamond 2009; Gallagher and Muehlegger 2011; Potoglou and Kanaroglou 2007), environmental concerns (Kahn 2007; Kishi and Satoh 2005; Oliver and Lee 2010) and societal concerns (Axsen and Kurani 2012; Axsen and Kurani 2013; Egbue and Long 2012; Gupta and Ogden 2009; Ozaki and Sevastyanova 2011; Zhang et al. 2011) predict degree of interest in HEVs and intention to purchase HEVs. This paper makes a unique contribution to these past findings by adding that the interaction between self concerns and social concerns also predicts the degree of interest in HEVs and intention to purchase HEVs.

Interestingly, we found that the significant interaction effect, which consisted of relative level of environmentalism and self-construal, on intention to purchase HEVs disappeared when the degree of interest in HEVs was controlled. This finding suggests that differences in intention to purchase HEVs are accounted for by differences in degree of interest in HEVs. Additionally, this explanation implies that the degree of interest in HEVs might be a mediator variable in the relationship between the intention to purchase HEVs and the interaction of relative level of environmentalism and self-construal. This idea should be tested in future research.

This paper also suggests that policy makers should differentiate their strategies toward the HEV adoption process depending on the cultural characteristics of the society (collectivist vs. individualist). In collectivist societies, which heavily consist of people who have an interdependent self-construal (Markus and Kitayama 1991), policy-makers should focus more on the issue of increasing the level of environmentalism of the society. In other words, the policy makers from the collectivist societies should produce policies to create high social norms for

environmentalism since interdependent people experience a lower need for differentiation (Ma et al. 2014) and do not want to be different from their surroundings. Interdependent people will therefore try to increase their level of environmentalism. If policy makers create high norms of environmentalism in collectivist societies, we expect that people will probably show higher tendencies to adopt more HEVs. To accomplish that, some required courses about sustainability can be placed in educational systems to create high environmentalism.

The results of this paper imply that applying policies to increase environmentalism in society can provide either advantages or disadvantages for the policy-makers from individualist cultures, which heavily consist of people who have independent self-construals (Markus and Kitayama 1991). We expect that as the society's environmentalism increases, so does the degree of interest in HEVs and the intention to purchase HEVs of independents with relatively high levels of environmentalism. In contrast, we expect that as the society's environmentalism increases, the degree of interest in HEVs and the intention to purchase HEVs of independents with relatively low levels environmentalism compared to people around them decreases or at least remains stable because people with independent self-construal desire to be different from the other people around them (Brewer 1991).

The current paper also provides a novel classification approach, which was based on relative level of environmentalism and self-construal. This classification would be a beneficial tool for policy makers to increase the efficiency of the policies around people's adoption of HEVs. Creating policies according to this classification may increase the efficiency of public expenditure toward adoption of HEVs. Enhancing the level of environmentalism of the society can be efficient at various levels of the four groups based on the classification. For instance, a policy toward improving the level of environmentalism of the society may not be efficient for relatively low environmentalists with independent self-construal. However, the same policy may encourage relatively low environmentalists with interdependent self-construal to increase their environmentalism. To conclude, policy makers can improve the efficiency of their policies by adopting the classification approach that was developed in the current paper.

This paper is not without limitations and weaknesses. First, data were not collected with probability sampling. Therefore, the results of this paper should not be generalized. Second, self-report data were collected through an online survey, which is a nonexperimental method. Thus, causality cannot be inferred. Third, the questionnaire had four sections, but these sections were not counterbalanced. The order of the questionnaire sections was as follows: relative level of environmentalism, self-construal, interest in HEVs, intention to purchase HEVs, and demographics. This lack of counterbalancing may lead to biased results.

Conclusion

In summary, the current paper examined whether relative level of environmentalism, self-construal, and their interaction had an impact on degree of interest in HEVs and intention to purchase HEVs. The findings showed that the way people construe their selves (independent vs. interdependent) interacts with their relative level of environmentalism (compared to their surroundings) to predict degree of interest in HEVs and intention to purchase HEVs. These findings may provide insight for improving policies that enhance adoption of HEVs and improve strategies for companies to increase their HEV sales volume.

Compliance with Ethical Standards

Conflict of Interest Both authors declare that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

Appendix

SCS items

Independent self-construal (Singelis 1994) (1 = strongly disagree, 7 = strongly agree)

- I have respect for the authority figures with whom I interact.
- It is important for me to maintain harmony within my group.
- My happiness depends on the happiness of those around me.
- I would offer my seat on a bus to my professor.
- I respect people who are modest about themselves.
- I will sacrifice my self-interest for the benefit of the group I am in.
- I often have the feeling that my relationships with others are more important than my own accomplishments.
- I should take into consideration my parents' advice when making education/career plans.
- It is important to me to respect decisions made by the group.
- I will stay in a group if they need me, even when I'm not happy with the group.
- If my brother or sister fails, I feel responsible.
- Even when I strongly disagree with group members, I avoid an argument.

Independent self-construal (Singelis 1994) (1 = strongly disagree, 7 = strongly agree)

I'd rather say "No" directly than risk being misunderstood.
 Speaking up during a class is not a problem for me.
 Having a lively imagination is important for me.
 I am comfortable with being singled out for praise or rewards.
 I am the same person at home that I am at school.
 Being able to take care of myself is a primary concern for me.
 I act the same way no matter who I am with.
 I feel comfortable using someone's first name soon after I meet them, even when they are much older than I am.
 I prefer to be direct and forthright when dealing with people I've just met.
 I enjoy being unique and different from others in many aspects.
 My personal identity, independent of others, is very important for me.
 I value being in good health above everything else.

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The intergenerational transmission of nature relatedness predicts green purchase intention among Filipino adolescents: Cross-age invariance and the role of social responsibility

John Jamir Benzon R. Aruta¹ 

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Abstract

Environmental sustainability does not only involve the environmental behaviors of the present generation, but more importantly, it requires understanding how the future generations will interact with the natural environment. The overarching goal of this study was to investigate a serial mediation model showing the mediating role of social responsibility on the intergenerational transmission (i.e., from parents to their adolescent children) of nature relatedness, and how this transmission influences adolescents' green purchase intention in a non-Western country like the Philippines. Data were collected from 449 Filipino parent-adolescent dyads through an online administration of self-report measures. As a preliminary step to the examination of intergenerational transmission of nature relatedness, measurement invariance of the Nature Relatedness Scale (NR-6) was conducted. Findings revealed that the NR-6 is a valid, reliable, and invariant tool in assessing Filipino adults' and adolescents' sense of connection with nature. Path analysis through structural equation modeling confirmed the serial mediation model demonstrating that social responsibility mediated the parent-adolescent transmission of nature relatedness, leading to adolescents' greater green purchase intention. The study offers novel findings with important implications for research, parenting, and policies toward environmental sustainability.

Keywords Nature relatedness · Social responsibility · Green purchase intention · Intergenerational transmission · Philippines

Introduction

Today's younger generation will face the future consequences of environmental problems. A growing literature on the intergenerational transmission, or the passing on of values, beliefs, attitudes, and behaviors from one generation to the other through socialization processes and modeling, showed that people's environmentalism can be transmitted within the family (Katz-Gerro et al., 2020; Leppänen et al., 2012;). To effectively address environmental issues, there is a need for a stronger commitment to engage in pro-environmental behaviors not only for the current generation but more importantly for the next generations as they are the ones who will inherit the benefits of environmental sustainability and the consequences of environmental degradation. The overall aim of this study was to examine the intergenerational transmission of

nature relatedness from parents to their adolescent children. Specifically, the overarching goal of this study was to determine how the younger generations' sense of social responsibility mediates the intergenerational transmission (i.e., from parents to their adolescent children) of nature relatedness leading to adolescents' green purchase intention using parent-adolescent dyads from the Philippines. As a preliminary step in the examination of intergenerational transmission of nature relatedness, this study tested the cross-age invariance of the short-form of Nature Relatedness Scale (NR-6) between Filipino parents and their adolescent children. This provides a more objective basis for the existence of intergenerational transmission of nature relatedness.

Intergenerational Transmission in the Environmental Domain

Intergenerational transmission in the environmental domain is an important area of research due to its potential to help us understand how (lack of) environmentalism is passed on from one generation to another. Additionally, scientific attention to intergenerational transmission is imperative given that the

✉ John Jamir Benzon R. Aruta
aruta_johnjamirbenzon@yahoo.com

¹ De La Salle University, 2401 Taft Avenue, 1004 Manila, Philippines

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younger generations are the ones who will face the future brunt of environmental problems, and also because solving environmental problems require a continuous commitment from every generation. Environmental scholars studying intergenerational transmission (e.g., Collado et al., 2019; Grønhoj & Thøgersen, 2009, 2017; Katz-Gerro et al., 2020; Leppänen et al., 2012; Matthies et al., 2012; Meeusen, 2014) proposed that the development of environmentalism, including sustainable consumption (Matthies & Wallis, 2015), is first socialized at home through modeling, socialization, and imitation. Despite the importance and urgency of improving the youth's environmentalism, limited research has been done in studying how environmentalism is developed within the family. Moreover, one noticeable gap in the literature is the dearth of studies on intergenerational transmission of environmentalism beyond WEIRD (Western, Educated, Industrialized, Rich, Democratic) countries despite the global nature of environmental problems and in spite of environmentalism being culture-bound (Ando et al., 2015; Tam & Milfont, 2020). As a response to the recent call to study environmentalism beyond WEIRD contexts (Tam & Milfont, 2020), the present study investigates the intergenerational transmission of nature relatedness in a non-WEIRD country such as the Philippines.

Filipino families endorse collectivistic values (i.e., close family ties, parental authority, and hierarchy) (Alampay, 2014; Aruta, Antazo, Briones-Diato, et al., 2021a). These cultural values lead to cohesiveness among immediate members and extended kin (David, 1994) and expectations of obedience among younger members of the family (Alampay, 2014). Filipino parents teach their children unique Filipino values which emphasize social responsibility. For example, the Filipino values including *"pakikipagkapwa-tao"* (interconnectedness with people) and *"hiya"* (propriety and dignity) are modeled within the family to teach children the importance of social sensitivity, preserving personal and family reputation, and prioritizing other people's welfare (Aruta, 2019; Aruta, Antazo, Briones-Diato, et al., 2021a; Aruta, Antazo, & Paceno, 2021b; Enriquez, 1994). Through role modeling, Filipino parents teach their children these prosocial values (Aruta, 2019), explaining how Filipino cultural values that prioritize social responsibility may play an important role in the transmission of nature relatedness from parents to their adolescent children, and in the development of young Filipinos' tendency to purchase green products.

The Philippine Context

Despite being labeled as a biodiversity hotspot, the Philippine forests have declined rapidly from about 60% forests covering the land area in the 1930s to <20% in 2011 (Carandang et al., 2013). At present, the forested areas in the country were estimated to have dwindled further (Estoque et al., 2018).

Human-caused drivers of forest loss including overpopulation, illegal logging, national drive for economic progress, and destructive agricultural practices are some of the main causes of deforestation in the Philippines (Bankoff, 2007; Carandang et al., 2013; Maohong, 2012). Additionally, plastic pollution is an extremely serious problem in the Philippines. In fact, the country is one of the three biggest contributors of plastic waste that end up in the oceans (Jambeck et al., 2015; United Nations [UN], 2018). This is due to existing individual practices and societal purchasing systems. For example, sachet marketing (locally known as *sari-sari* stores), or a system where people can purchase products in small quantities, is a prevalent practice in the country. This type of purchasing system is common in developing nations as it allows daily wage earners to purchase in small amounts and at an affordable price (Sy-Changco et al., 2011). Consequently, this type of purchasing system produces more plastic to wrap multiple smaller chunks of products instead of one bulk packaging. Despite the seriousness of environmental problems in the Philippines, studies that examine the predictors of green purchasing in the country are sparse. This study attempts to fill this gap by looking at the predictors of green purchase intention among Filipino youth.

Predictors of Green Purchasing

Past literature documented several predictors of green purchasing. For instance, previous research showed that physical (Alcock et al., 2020) and virtual nature experience encourage people's purchasing of green products (Klein & Hilbig, 2018) due to positive emotional benefits (Hartmann & Apaolaza-Ibáñez, 2008). More recent studies showed that internal factors such as personality, motivation, environmental concern, attitudes, and efficacy could increase people's purchasing of green products (Al-Swidi & Saleh, 2021; Kumar et al., 2021; Lee, 2017; Suki & Suki, 2019; Yang et al., 2020; Yang & Zhang, 2021). On the other hand, external factors including the seriousness of environmental problems, peer influence, norms, and cultural orientation (i.e., collectivism) influence people's green purchase intention (Kumar et al., 2021; Lee, 2017; Suki & Suki, 2019; Yang et al., 2020). Nature relatedness was found to consistently predict pro-environmental behavior (Aruta, 2020; Martin et al., 2020) including green purchasing (Weber et al., 2020). One critical limitation in the literature is the lack of studies that examined the role of intergenerational transmission of nature relatedness in the development of green purchase intention of the youth. This study addresses this gap by looking at the influence of the parent-adolescent transmission of nature relatedness on the intention of Filipino adolescents to buy green products.

Measurement of Nature Relatedness

Nature relatedness is defined as the extent to which an individual feels affiliated with the natural world (Nisbett et al., 2009). Environmental psychologists have developed measurement tools to assess people's nature relatedness. The pioneering research in the development of the Nature Relatedness Scale has established 21 items with three first-order factors (i.e., NR-Self, NR-Perspective, and NR-Experience) representing the overall latent factor of nature relatedness (see Nisbett et al., 2009). Previous studies (Nisbett et al., 2009) showed that the three-factor and single-factor structures of nature relatedness are both valid in assessing people's connection with the natural world, with the single-factor structure as a more viable model due to cross-loading of several items to different factors and strong intercorrelations of the first-order factors (Nisbett et al., 2009).

To address the need for a brief and efficient assessment tool for nature relatedness, Nisbett and Zelenski (2013) developed the NR-6, which is a six-item tool that evaluates people's sense of connection with the natural world. NR-6 yielded a unidimensional factor that is valid and reliable in measuring people's nature relatedness (Nisbett & Zelenski, 2013). However, despite the global nature of environmental problems (Aruta, 2020, 2021), no research has been done to examine the NR-6 beyond the original study which is based on Western samples. Additionally, no studies have been conducted to examine the measurement invariance of NR-6 across age groups or between older and younger generations. To address these gaps, the current study conducts a cross-age measurement invariance of NR-6 between parents and their adolescent children based on a sample from a non-Western country such as the Philippines. I reason that examining the cross-age measurement invariance of NR-6 is an imperative research pursuit given that today's youth are the ones who will face the future consequences of the previous and current environmental problems. Further, it is noteworthy that the measurement invariance of NR-6 is a preliminary step for the main objective of the present study, which is to examine the intergenerational transmission of nature relatedness from parents to their adolescent children. To ensure the robustness of the findings on intergenerational transmission of nature relatedness in this study, it is necessary to examine whether the NR-6 invariantly assesses the nature relatedness across parent and adolescent participants.

The Role of Social Responsibility

While extant literature showed that environmental responsibility, or the extent to which a person commits to individual sacrifices including adjustment of lifestyle to protect the natural environment (Stone et al., 1995), is an important factor for environmentalism and green purchasing (Al-Swidi & Saleh,

2021; Dagher & Itani, 2014; Suki & Suki, 2019; Zheng et al., 2021), a growing body of literature documented that social responsibility, or the extent to which a person adheres to written or unwritten social rules and expectations about broader ethical issues which promotes the common good (Wentzel, 1991), is also a strong predictor of environmentalism (Ballantyne et al., 2018; Chu & Chen, 2019; Nguyen et al., 2017) and green purchasing (Dagher & Itani, 2014; Schuitema & de Groot, 2015). An important limitation in the literature is the dearth of studies that focus on the role of social responsibility in intergenerational transmission in the environmental domain. In this study, I argue that social responsibility mediates the positive influence of parents' nature relatedness on their adolescent children's nature relatedness. This is because parents' connection to nature, as reflected by their concern for and actions towards protecting the natural environment, may signal a sense of social responsibility to their children. Social responsibility is an important precursor of values and behavior including environmentalism and green purchasing (Lee, 2017; Rahimah et al., 2018) especially in a collectivistic culture like the Philippines due to the high priority given to sensitivity to the welfare of social others (Aruta, 2016; Aruta, 2019; Aruta et al., 2021a, b; Roxas et al., 2019). The current study addresses this limitation by examining the mediating influence of adolescents' social responsibility on the parent-adolescent transmission of nature relatedness and its indirect impact on adolescents' green purchase intention.

Theoretical Perspective

The present study was anchored on two theoretical perspectives to explain how nature relatedness can be transmitted from parents to their children via social responsibility, leading to adolescents' higher green purchase intention. First, Bandura's (1977) Social Cognitive Theory argued that observation and imitation are the primary modes in which children learn from other people's behaviors, especially that of their parents as primary caregivers. Parental and family practices including story-telling, outdoor experiences, and teaching through role modeling, are some of the activities that help facilitate the transmission of environmentalism from parents to their children (Stevenson et al., 2014). In the Philippines, studies on intergenerational transmission outside the environmental domain showed that parental role modeling facilitates intergenerational learning (Garcia et al., 2019). I reason that the adolescents' exposure to their parents' environmental actions and purchasing practices can serve as role modeling channels that facilitate the intergenerational transmission of nature relatedness leading to adolescents' greater willingness to buy green products. Second, Schwartz's (1992, 1994) Theory of Basic Values proposed that people's social values orientation can be characterized by two-dimensional spaces with four value categories. The first dimension reflects an

openness to change (i.e., valuing independence, self-directedness, uniqueness, and self-expression) versus conservatism values (i.e., valuing tradition, rules, and conformity) while the second dimension represents self-enhancement (i.e., valuing active pursuit of power, personal achievement, and ego-driven interests) versus self-transcendent values (i.e., valuing universalism, interpersonal welfare, and prosocial interests). The present study focused on the second dimension in examining the role of social responsibility as a prosocial and self-transcendent value. I argue that social responsibility mediates the intergenerational transmission of nature relatedness from parents to their adolescent children. In other words, witnessing their parents' genuine affiliation with nature may signal a sense of social responsibility among adolescents, which facilitates the development of their sense of relationship with nature. While it is true that children can foster environmentalism among their parents (Lawson et al., 2019), the present study argues that the influence of parents' nature relatedness to that of their children via social responsibility is a more viable pathway. The explanation is that sense of social responsibility is more often modeled by parents to their children rather than vice versa (Gunnore et al., 1999).

The Present Research

The current study has two main objectives. First, this study aimed to examine the cross-age measurement invariance of the NR-6, a well-known measure of nature relatedness, across Filipino parents and their adolescent children. To date, no research has been done to investigate the cross-age invariance of the NR-6. I reason that this is an imperative research pursuit in the context of intergenerational transmission of environmentalism because establishing the measurement invariance of the instruments that assess parents' and their children's environmentalism potentially provides greater accuracy of the intergenerational transmission findings. The invariance of the NR-6 offers greater confidence that it assesses a similar nature relatedness construct among parent and adolescent participants. Second, the current study aimed to examine a serial mediation model representing the intergenerational transmission of nature relatedness from Filipino parents to their adolescent children via adolescents' social responsibility and how this promotes adolescents' green purchase intention. Simply put, I propose the following hypotheses:

Hypothesis 1: NR-6 will demonstrate a valid single-factor model and reliable items that could effectively assess Filipino parents' and adolescents' nature relatedness. In addition, the NR-6 will yield configural, metric, and scalar measurement invariance between Filipino parents and their adolescent children.

Hypothesis 2: Adolescents' social responsibility will mediate the positive influence of parents' nature relatedness on adolescents' nature relatedness.

Hypothesis 3: Adolescents' nature relatedness will mediate the positive influence of social responsibility on their green purchase intention.

Hypothesis 4: A serial mediation effect linking parents' nature relatedness → adolescents' social responsibility → adolescents' nature relatedness → adolescents' green purchase intention.

Method

Participants

449 Filipino parent-adolescent dyads participated in the study. Parents' ages ranged from 35 to 75 years (Mean age = 49.86 years, SD age = 5.36 years). Parent participants reported having one to six children. Specifically, 11.77% of the parents have one child, 34.16% have two children, 33.94% have three children, 13.12% have four children, 5.43% have five children, and 1.58% reported having six children. In terms of parents' educational attainment, 71.49% of the parent participants received a bachelor's degree, 12.47% received postgraduate degrees (e.g., masteral or doctoral degrees), 10.69% have reached college but did not finish, 3.35% finished high school, and 2% received a vocational or technical degree. In terms of parent-reported family income, more than half of the dyads (51.23%) receive higher than average income, almost a third (30.96%) reported having much higher than average, while some receive average (14.92%), lower than average (1.56%), and much lower than average (1.34%) income. Adolescents' ages ranged from 17 to 23 years (Mean age = 19.19 years, SD age = 1.02 years). For clarity purposes, the present study operationalized adolescents as undergraduate students who were still financially dependent on their parents. Political identity was measured using a 7-point scale (1 = very conservative to 7 = very liberal), with parents and adolescents reporting an average of 4.15 (SD = 1.21) and 4.65 (SD = 1.20), respectively. Three quarters (75.05%) of the parent-adolescent dyads were currently residing in urban areas, while the rest were based in suburban (13.81%) and rural (11.14%) areas in the Philippines. There was no information on the gender of the participants.

Instruments

Nature Relatedness This study employed the short-form Nature Relatedness Scale (NR-6; Nisbet & Zelenski, 2013) to assess the parents' and their adolescent children's sense of affiliation with the natural world. Participants rated the six

items of NR-6 using a 5-point Likert scale, ranging from 1 = strongly disagree to 5 = strongly agree. A sample item is, “*I always think about how my actions will affect the environment.*” Previous studies used the NR-6 as a valid tool in measuring people’s sense of relationship with nature, with comparable predictability with the original 21-item Nature Relatedness Scale (Zelenski & Nisbet, 2014). In past studies, NR-6 yielded excellent reliability among university students ($\alpha = .89$) and community residents ($\alpha = .85$) in Canada (Zelenski & Nisbet, 2014). For the present study, the psychometric properties of NR-6 were discussed in the results section.

Social Responsibility The study utilized the 7-item Perceived Social Responsibility Scale (PSRS; Anderson-Butcher et al., 2016) to evaluate the degree to which adolescent participants adhere to social rules and expectations concerning broader ethical issues and promote the common good. One sample item is, “*I can make a difference in my community.*” Adolescent participants rated each item through a 5-point Likert scale (1 = not at all true to 5 = really true), with higher scores indicating higher levels of social responsibility. In the original study (Anderson-Butcher et al., 2016), PSRS demonstrated a unidimensional latent factor of social responsibility which yielded a reliability of $\alpha = .87$. In the current research, adolescent participants’ scores in PSRS yielded a reliability of $\alpha = .86$ and $\omega = .86$.

Green Purchase Intention To assess the adolescent participants’ intention to purchase eco-friendly products, the current study used the three items (e.g., “*I will purchase green products for personal use.*”) employed by Kim et al. (2013). These three items were later adopted by recent studies to measure intention to purchase green products among adult consumers in India (Yadav & Pathak, 2016). Adolescent participants responded by rating a 7-point scale, ranging from 1 = strongly disagree to 7 = strongly agree. Past research showed high reliability for these items ($\alpha = .85$) among Indian adults (Yadav & Pathak, 2016). In the present study, the adolescent participants’ scores yielded a reliability of $\alpha = .88$ and $\omega = .88$.

Procedures

Through sending email messages, university students were invited to participate and ask one of their parents to take part in the study. All parent and adolescent participants provided informed consent to participate in the study. Additionally, parents provided parental consent for the participation of their adolescent children. All participants were informed about the purpose of the study, confidentiality of the data, and anonymity of their identity. Participants were also informed about their right to withdraw from their participation at any point. Upon securing the consent, an online survey with two parts was provided. The first part was completed by the adolescents while the second part was completed by one of their parents.

All participants who completed the online survey provided answers to all the items and no missing data were found.

Data Analysis

This study involved two phases. In Phase 1, I examined the factor structure of the NR-6 separately for parents and adolescents using Confirmatory Factor Analyses (CFA) as a baseline step for measurement invariance. Guided by the literature (Nisbet & Zelenski, 2013), I performed CFA to examine whether the single-factor model of the NR-6 remains true for each age group. The goodness of model fit was examined using comparative fit index (CFI), Tucker-Lewis index (TLI), and root mean square error approximation (RMSEA with 90% confidence interval). An adequate model fit is indicated by CFI and TLI values of $\geq .90$ and RMSEA values of $\leq .08$, while a good model fit should yield CFI and TLI values of $\geq .95$ and RMSEA values of $\leq .05$ (Byrne, 2013; Hu & Bentler, 1999). Moreover, factor loadings of $\lambda \geq .50$ were considered as strong indicators of the latent factor (Renshaw, 2018). In addition, Cronbach’s alpha (α) and McDonald’s omega (ω) were utilized to determine the internal consistency of the items. Furthermore, measurement invariance of the latent structure of the NR-6 was examined at the configural, metric, and scalar levels across Filipino parent and adolescent participants. To determine the data-model fit, similar above-mentioned fit indices were evaluated using the same set of rules and criteria. To determine the invariance of the NR-6 across parent and adolescent participants, Δ CFI, Δ TLI, and Δ RMSEA were used as critical indicators. Cheung and Rensvold (2002) recommended that Δ CFI and Δ TLI of $\leq .01$ and Δ RMSEA of $\leq .015$ indicate measurement invariance. It is noteworthy that in the present study, achieving measurement invariance for the NR-6 across parents and their adolescent children is a necessary preliminary step before proceeding to the examination of intergenerational transmission of nature relatedness through path analysis.

In Phase 2, I employed descriptive statistics and correlations as a preliminary analysis. More importantly, path analysis through structural equation modeling (SEM) with 5000 bootstrap samples was utilized to examine the serial mediation model testing the intergenerational transmission of nature relatedness from parents to their adolescent children via adolescents’ social responsibility and to test whether adolescents’ social responsibility and nature relatedness would mediate the influence of parents’ nature relatedness on their adolescent children’s green purchase intention.

Results

Phase 1.1. CFA and Reliability of NR-6 for Parents and Adolescents

As a baseline analysis, two separate CFA were employed to examine the structural validity and model fit of the NR-6

among Filipino parents and their adolescent children. Findings from the CFA (see Table 1) which structured the six items of the NR-6 as indicators of a latent factor representing nature relatedness yielded good model fit for both parent ($\chi^2 = 1140.637$, $df = 15$, $p < .001$, CFI = .982, TLI = .970, RMSEA [90% CI] = .071 [.043, 1.00]) and adolescent participants ($\chi^2 = 1129.648$, $df = 15$, $p < .001$, CFI = .987, TLI = .978, RMSEA [90% CI] = .060 [.031, .090]). Substantial factor loadings were found in the NR-6 items, ranging from $\lambda = .51$ to $\lambda = .91$ and $\lambda = .50$ to $\lambda = .87$ for parents and adolescents, respectively. Note that no further modification was done to improve model fit. In terms of reliability, the NR-6 scores of parents ($\alpha = .85$, $\omega = .85$) and adolescents ($\alpha = .84$, $\omega = .84$) yielded high reliability indicating high internal consistency of the items for both groups.

Phase 1.2. Cross-Age Measurement Invariance of the NR-6

To test Hypothesis 1, measurement invariance of the NR-6 across parent and adolescent age groups was conducted. Table 2 presents the multigroup CFA measurement invariance across the two age groups which indicated that there was a good data-model fit at the configural (examining the equality of the latent factor structure between parents and adolescents) and metric levels (examining the equality of factor loading between parents and adolescents). However, suboptimal data-model fit was found at the scalar level (examining the equality of measurement intercepts between parents and adolescents). After exploring the parameters, constraints for items 3 and 5 were freed up and partial scalar measurement invariance was employed, resulting in a good data-model fit. In sum, findings from the measurement invariance provided support for Hypothesis 1 by showing that the NR-6 was sufficiently invariant between the parent and adolescent participants. Given that the NR-6 was found to be invariant across Filipino parents and their adolescent children, the current study proceeded with the analysis of the intergenerational transmission of nature relatedness through path analysis.

Phase 2.1. Descriptive Statistics and Correlations

Table 3 summarizes the descriptive statistics including the mean, standard deviation, and the estimate of normality for

Table 1 CFA model fit statistics for NR-6 of parent and adolescent groups

Age Groups	χ^2 (df)	CFI	TLI	RMSEA [90% CI]
Parents	1140.637 (15)	.982	.970	.071 [.043, .100]
Adolescents	1129.648 (15)	.987	.978	.060 [.031, .090]

parents' nature relatedness, adolescents' nature relatedness, social responsibility, and green purchase intention. The data distribution in all variables was approximately normal (skewness and kurtosis $< |2|$). Intercorrelations of all the variables were in the predicted direction. In particular, parents' nature relatedness was positively and significantly correlated with their adolescent children's nature relatedness ($r = .33$), social responsibility ($r = .17$), and green purchase intention ($r = .17$). Additionally, adolescents' nature relatedness was positively and significantly correlated with social responsibility ($r = .37$) and green purchase intention ($r = .37$). Additionally, adolescents' social responsibility and green purchase intention were positively and significantly correlated ($r = .34$).

Phase 2.2. Path Analysis

Using Structural Equation Modeling, I tested Hypotheses 2, 3, and 4, which consist A) the mediation effect of adolescents' social responsibility on the impact of parents' nature relatedness on their adolescent children's nature relatedness, B) mediation effect of adolescents' nature relatedness on the impact of their social responsibility on their green purchase intention, and C) the serial mediating role of adolescents' nature relatedness and social responsibility on the influence of parents' nature relatedness on their adolescent children's green purchase intention. The overall model showed good fit ($\chi^2 = 376.43$, $df = 203$, $p < .001$, CFI = .991, TLI = .990, SRMR = .055, RMSEA [90% CI] = .044 [.037, .051]). Figure 1 shows the final path model illustrating a serial mediation model of intergenerational transmission of nature relatedness from parents to their adolescent children via adolescents' social responsibility, which ultimately predicts adolescents' green purchase intention. Confirming Hypothesis 2, results showed adolescents' social responsibility partially mediated the positive influence of parents' nature relatedness on their adolescent children's nature relatedness ($\beta = .06$, $SE = .02$, $z = 3.31$, $p < .001$, CI = .02, .09), indicating intergenerational transmission of nature relatedness from parents to their adolescent children. Specifically, parents' nature relatedness positively predicted their adolescent children's social responsibility ($\beta = .18$, $SE = .06$, $z = 3.73$, $p < .001$, CI = .11, .36), and in turn adolescents' social responsibility positively predicted their nature relatedness ($\beta = .38$, $SE = .05$, $z = 7.32$, $p < .001$, CI = .26, .41). Providing support for Hypothesis 3, results showed that adolescents' nature relatedness partially mediated the positive influence of social responsibility on their green purchase intention ($\beta = .19$, $SE = .04$, $z = 4.95$, $p < .001$, CI = .11, .26). In particular, adolescents' social responsibility positively influenced their nature relatedness ($\beta = .34$, $SE = .05$, $z = 7.32$, $p < .001$, CI = .26, .41), and in turn adolescents' nature relatedness positively predicted their green purchase intention ($\beta = .27$, $SE = .13$, $z = 5.08$,

Table 2 CFA model fit statistics for NR-6

Invariance level	χ^2 (df)	CFI	TLI	RMSEA [90% CI]	Δ CFI	Δ TLI	Δ RMSEA
Configural	50.901 (18)	.986	.977	.063 [.043, .083]	—	—	—
Metric	58.065 (24)	.986	.982	.055 [.037, .073]	.000	.005	-.008
Scalar	121.749 (35)	.964	.969	.073 [.059, .087]	-.022	-.013	.018
Partial scalar	76.424 (27)	.979	.977	.063 [.046, .079]	-.007	-.005	.008

$p < .001$, $CI = .41, .93$). Confirming Hypothesis 4, results demonstrated a significant full serial mediation influence of parents' nature relatedness on their adolescent children's green purchase intention via adolescents' social responsibility and nature relatedness ($\beta = .02$, $SE = .007$, $CI = .007, .033$).

Taken together, the results offered support for all the four hypotheses in the current study.

Discussion

The main objective of this study was to examine a serial mediation model representing the intergenerational transmission of nature relatedness via adolescents' social responsibility, and its influence on adolescents' green purchase intention using parent-adolescent dyads from the Philippines. As a preliminary procedure for the analysis of the intergenerational transmission of nature relatedness, the current study aimed to examine the configural, metric, and scalar invariance of the NR-6 between Filipino parents and their adolescent children. Specifically, four hypotheses were proposed. First, the study proposed that the NR-6 will show a valid single-factor and reliable tool in assessing Filipinos' sense of relationship with nature, and will show measurement invariance between parent and adolescent participants from the Philippines. Second, I hypothesized that parents' nature relatedness will positively predict their adolescent children's nature relatedness via adolescents' social responsibility. Third, the study proposed that adolescents' social responsibility will positively predict their green purchase intention via an increase in their nature relatedness. Fourth, the study hypothesized that there will be a serial mediation effect linking parents' nature relatedness to their adolescent children's green purchase intention

via adolescents' social responsibility and nature relatedness. Overall, findings provided support to the above-mentioned hypotheses by showing that: 1) NR-6 was a valid, reliable, and invariant measure of nature relatedness of Filipino parents and their adolescent children; 2) adolescents' social responsibility partially mediated the positive influence of parents' nature relatedness on their adolescent children's nature relatedness; 3) adolescents' nature relatedness partially mediated the positive impact of their social responsibility on their green purchase intention, and; 4) adolescents' social responsibility and nature relatedness fully mediated the positive impact of parents' nature relatedness on their adolescent children's green purchase intention.

Key Findings

Confirming Hypothesis 1, the first notable finding of the present study was that the NR-6 was a valid and reliable tool in assessing nature relatedness among Filipino adults and adolescents. The single-factor structure of the NR-6 was confirmed for both adults and adolescents through CFA. It is important to note that all analyses elucidated that the NR-6 has substantial and stable factor loadings and internally consistent items. Moreover, findings revealed that the responses to the NR-6 were invariant across parent and adolescent participants. The multigroup CFA demonstrated consistent response patterns across configural and metric levels and partially invariant at the scalar level. These findings provided support for the original proposition by Nisbet and Zelenski (2013) that NR-6 is a valid and reliable tool in measuring people's sense of affiliation with nature. The present study contributed to this line of research by demonstrating that the NR-6 can be used as a viable measure for nature

Table 3 Descriptive statistics and Pearson correlations

Variables	Mean (SD)	Skewness	Kurtosis	1	2	3
1. Parents' nature relatedness	3.58 (.78)	-.44	.19	—		
2. Adolescents' nature relatedness	3.54 (.77)	-.22	-.22	.33***	—	
3. Adolescents' social responsibility	4.07 (.59)	.97	1.87	.17***	.37***	—
4. Adolescents' green purchase intention	5.69 (1.05)	-.77	.51	.17***	.37***	.34***

*** $p < .001$

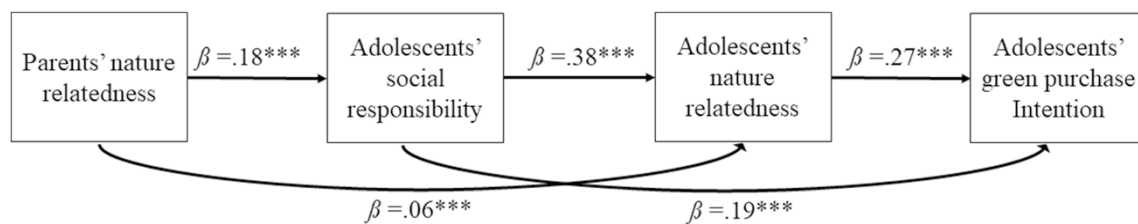


Fig. 1 Final serial mediation model representing the indirect influence of parents' nature relatedness on their adolescent children's green purchase intention via adolescents' social responsibility and nature relatedness $p < .001$ ***

relatedness across age groups in the Philippine context. More importantly, the confirmation of the cross-age invariance of the NR-6 offers a more accurate examination of the intergenerational transmission of nature relatedness.

This study highlights that the most important finding was that parents' nature relatedness can influence their adolescent children via an increase in adolescents' sense of social responsibility. Hence, it can be an indication of intergenerational transmission, which in turn predicts greater levels of adolescents' green purchase intention, providing support for Hypotheses 2, 3, and 4. This suggests that parents who endorse a strong sense of relationship with nature by taking care of the environment signal a sense of responsibility to promote the welfare of other people, which in turn results in a strong sense of affiliation with nature among their children. Consequently, this can lead to adolescents' greater willingness to purchase eco-friendly products as an expression of their relationship with nature. Viewed differently, parents who model a lack of nature relatedness through non-sustainable daily practices can indirectly promote a lack of social responsibility among their children, which may in turn lead to children's lower sense of relationship with nature. Consequently, this can increase their proclivity for lack of willingness to purchase products that promote environmental sustainability. The current findings lend support for the Social Cognitive Perspective (Bandura, 1977) by demonstrating the critical role of Filipino parents in the development of their adolescent children's environmentalism.

The findings also offered support for Schwartz's (1992, 1994) proposition that self-transcendent values encourage people to prioritize the welfare of other beings beyond the self, which includes nature. In the present study, findings revealed that social responsibility can motivate Filipinos to engage in behaviors that preserve the natural environment. Additionally, these findings provided support for previous empirical studies on intergenerational transmission in the environmental domain including concern, attitudes, intention, and behavior (e.g., Ando et al., 2015; Collado et al., 2019; Grønhøj & Thøgersen, 2009, 2017; Katz-Gerro et al., 2020; Leppänen et al., 2012; Matthies et al., 2012; Meeusen, 2014). The present study added to this line of research by demonstrating that nature relatedness can be transmitted from parents to their adolescent children leading to adolescents' higher

intention to buy eco-friendly products. More importantly, the current findings elucidated that social responsibility is an important mechanism that facilitates the intergenerational transmission of nature relatedness in the Philippines.

There are Filipino values that explain why social responsibility serves as a significant mediator in the intergenerational transmission of nature relatedness within the Filipino family, and in increasing Filipino youth's green purchase intention. For example, Filipino families place great importance on prosocial values such as "*pakikipagkapwa-tao*" (interconnectedness with people) and "*hiya*" (propriety and dignity), which emphasize social responsibility. These values are modeled by parents within the family to teach their children the importance of social sensitivity and concern for others' welfare (Aruta, 2019; Enriquez, 1994). The close family ties and value for parental authority make Filipino children very receptive to parental influences especially in the early stages of their development (Alampay, 2014; David, 1994), hence facilitating intergenerational transmission.

Taken together, the findings of the present study contribute to the literature in several important ways. First, while previous studies on intergenerational transmission in the environmental domain demonstrated that environmentalism is indeed socialized within the family (Ando et al., 2015; Collado et al., 2019; Grønhøj & Thøgersen, 2009, 2017; Katz-Gerro et al., 2020; Leppänen et al., 2012; Matthies et al., 2012; Meeusen, 2014), none of these past studies examined the invariance of the measurement tools that were used to assess the environmentalism-related constructs across parents and their children. The current findings have filled this gap by first examining and confirming the cross-age measurement invariance of the NR-6 as a necessary and preliminary step before the investigation of intergenerational transmission of nature relatedness. The examination of measurement invariance of instruments as a preliminary step significantly increases the validity of the findings on the intergenerational transmission of nature relatedness. Second, the findings of the present study demonstrated that nature relatedness can also be transmitted from parents to their adolescent children. Past studies focused on the parent-child transmission of environmental concern, attitudes, intention, and behaviors (Ando et al., 2015; Collado et al., 2019; Grønhøj & Thøgersen, 2009; Katz-Gerro et al., 2020; Leppänen et al., 2012; Matthies et al.,

2012; Meeusen, 2014). Third, this study showed that social responsibility is a socialization mechanism that facilitates the intergenerational transmission of nature relatedness. The study highlights that social responsibility is an important value in a collectivistic country like the Philippines, explaining why it served as an effective pathway for parent-child transmission of environmentalism in Filipino families. Identifying the potential factors that facilitate and hinder the transmission of environmentalism is necessary given the importance of enhancing the concern for the environment in the younger generations. Fourth, the current research showed the importance of looking into the family when studying the green purchase intention of the youth. The findings revealed that parents' sense of environmentalism plays a crucial role in promoting their adolescent children's intention to buy products that preserve and protect the natural environment. Lastly, this study contributed to the literature on cross-cultural environmental psychology (Tam & Milfont, 2020) by investigating intergenerational transmission beyond the WEIRD context. Tam and Milfont (2020) pointed out that there is a serious lack of literature that focuses on the psychology of environmentalism in a non-WEIRD context, especially in the area of intergenerational transmission (Katz-Gerro et al., 2020).

Limitations and Future Directions

The limitations of this study offer several opportunities for future research. First, this study employed self-report measures in collecting data from the participants and cannot establish cause-and-effect among the variables. Future researchers may consider conducting controlled experiments to determine intergenerational transmission and to examine whether nature relatedness and social responsibility can lead to greater green purchasing. Second, the current study used a quantitative approach in examining the intergenerational transmission of nature relatedness. Future studies may consider conducting in-depth qualitative studies that would explore the parental socialization processes and practices that facilitate or hinder the transmission of environmentalism within the family. Third, while the study was conducted in a non-Western nation such as the Philippines, there is a need to test the hypotheses cross-culturally to determine the culturally universal and specific patterns of intergenerational transmission of environmentalism across countries. Fourth, adolescent participants have only selected one of their parents to participate in the study. Future research may consider recruiting children/adolescents and both their parents to get more nuanced insights on the shared and differential influence of each and both parents on their children, respectively. Lastly, the present study did not examine the role of gender in the intergenerational transmission of environmentalism. Future studies may examine the role of the gender of parents and their children in

the intergenerational transmission of nature relatedness within the family.

Practical Implications

Despite the above-mentioned limitations, the current study provided important implications for research, parenting, and policy-making towards environmental sustainability. In terms of environmental research, the current study demonstrated that NR-6 is a valid and reliable tool in measuring the sense of relationship with nature among Filipino adults and adolescents. Scientists who aim to investigate Filipino adults' and adolescents' environmentalism may utilize the NR-6 in measuring nature relatedness. In terms of parenting, parents should model environmentalism and provide opportunities for their children to engage in environmentally sustainable household activities. The present findings showed that parents who have a strong sense of connection with nature influence their children's higher levels of nature relatedness. In addition, when guiding their children's sustainable behaviors, parents may consider teaching that taking care of the environment is a social responsibility not only for the people at the present but also for future generations. The findings of the present research showed that parents' nature relatedness signals a sense of social responsibility in their children, which in turn enhances their children's connection with nature and intention to purchase environmentally friendly products. Moreover, parents should teach their children the importance of selectively purchasing products that promote environmental sustainability. The present findings showed that parents have an important role in enhancing their adolescent children's green purchase intention. In terms of policy-making, the current research recommends the development and implementation of community programs that provide practical steps for household sustainable behaviors among Filipino parents. Such community programs should also include teaching parents effective practices in training their children in household activities that promote environmental sustainability. In addition, localized community and educational programs that teach Filipino adults and children about the preservation of nature and green purchasing as social responsibility is an important pursuit. This is particularly necessary given that Filipinos hold collectivistic values that emphasize prioritizing others' welfare (Aruta, 2016; Aruta, 2019; Aruta et al., 2021a, b; Roxas et al., 2019). Lastly, policies that promote the affordability of environmentally friendly products are necessary. For a developing country like the Philippines, economic hurdles can be a barrier to people's engagement in ecological behavior (Aruta, 2020). In sum, the present research offered novel insights on intergenerational transmission in the environmental domain and on how it could promote green purchase intention among Filipino youth. If we are serious about promoting a sustainable future for the next generations of Filipinos and

beyond, it is necessary to look into the factors and processes that facilitate environmentalism within the family.

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Data Availability The data associated with this study will be made available from any party upon reasonable request.

Declarations

Ethical Standards All procedures performed in the study were in accordance with the ethical standards of the 1964 Helsinki declaration or comparable ethical standards.

Conflict of Interest The authors declared no conflict of interest associated in this study.

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Normative Influence of pro-Environmental Intentions in Adolescents with Different Personality Types

Mykolas Simas Poškus¹

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Abstract

Persuasive messages that are tailored to target innate biases and behavioral tendencies have been shown to be effective in promoting pro-environmental behaviors. There is, however, a lack of understanding whether individuals who have different patterns of personality traits react to these stimuli differently. The present study addressed precisely this question. Persuasive pro-environmental messages were placed in a school and changes in pro-environmental intentions and related variables of the adolescents attending that school were observed. The findings show that adolescents with different patterns of personality traits are indeed differently affected by persuasive messages and people with different patterns of personality traits in general approach pro-environmental behaviors quite differently. This has important practical implications for the creation of public service announcements aimed at promoting pro-environmental behavior.

Keywords Sustainability · Normative influence · Personality traits · Person-oriented approach · Pro-environmental intentions

Introduction

Even though there is evidence for quite rapid (in evolutionary times) human evolution in the past 50,000 years (Bolhuis et al. 2011), the environmental problems we are facing today are very recent and only a few generations have passed with these problems in mind. The scale of environmental problems (pollution, depletion of natural resources, climate change) we are facing is unprecedented in our evolution – we are clearly not evolved to deal with them and it is certain that we will not be able to adapt to these problems before they get out of hand. This warrants an investigation on how existing adaptations can be exploited in tackling environmental problems, because we cannot afford to wait another 50,000 years for the problems to solve themselves.

One way of exploiting our innate behavioral tendencies in solving environmental problems is through the use of social norms (Cialdini 2003). Compliance with social norms is universal to all people and, therefore, can and should be used in promoting pro-environmental behaviors (Griskevicius et al. 2008; Nolan et al. 2008). Normative cues help individuals in quickly

making (mostly) correct behavioral decisions in varying environments (Jacobson et al. 2011). People tend to follow the behavior of others because it signals the most common and, therefore – effective (adaptive) way of achieving a goal (compliance with descriptive norms); people also tend to do what they perceive the society expects of them, taking into account what might be rewarded or punished for (compliance with injunctive norms) (Bergquist and Nilsson 2016; Cialdini et al. 1990).

It must be stressed that while perceived social norms provide information about what behaviors are adaptive in the sense of providing benefits to the individual, they are not necessarily beneficial on the societal level. For example, jaywalking is not socially desirable, but if an observer sees the majority of others jaywalking, it signals that this behavior is tolerated and provides an advantage – those who jaywalk get to their destination faster and without negative consequences. As a matter of fact, when injunctive and descriptive norms are incongruent, people tend to be more influenced by the descriptive norm (Goldstein et al. 2007; Jacobson et al. 2011; Rimal and Real 2005), because it more directly relates behaviors to certain desirable outcomes.

Both injunctive and descriptive social norms can be perceived quite subjectively and various normative cues can be effectively used to shape an individual's perception of what behaviors are common and desirable. Normative interventions have been used from reducing littering (Cialdini et al. 1990; de

✉ Mykolas Simas Poškus
mykolas_poskus@mruni.eu

¹ Institute of Psychology, Mykolas Romeris University, Vilnius, Lithuania

Kort et al. 2008) to household energy conservation (Nolan et al. 2008), or hotel towel reuse (Bohner and Schlüter 2014; Goldstein et al. 2008), and their effectiveness raises no questions (Poškus 2016b). However, the previous research on normative influence lacks a deeper look at the individual who is the most likely to be persuaded and, furthermore, it is unclear which individuals need the most persuading to behave in a more pro-environmental manner.

Personality traits are, to a substantial degree, inherited and evolved, and people with different patterns of personality traits tend to have different behavioral patterns as well (Buss 1991; Buss and Greiling 1999; DeYoung 2010; MacDonald 1995; Nettle 2006). Personality traits determine behavioral patterns that serve a purpose of dealing with real-life situations (DeYoung 2010; MacDonald 1995; Nettle 2006). Just as in the case of following social norms, “adaptive for the individual” does not necessarily translate into “good for the society”. For example, a person who is introverted and highly neurotic might deal with a problem by avoiding it, while a person who is extroverted and emotionally stable might try to solve the same problem by addressing its source. Both behaviors help the individual to deal with the situation and therefore both approaches can be considered effectively adaptive (Nettle 2005, 2006), however one is clearly more socially desirable than the other.

While approaching human behavior from an evolutionary perspective (Duntley and Buss 2008; MacDonald 1995), researchers too often ignore that a person is comprised not of one, but of many traits (Block 2010). The mere description of how a single trait relates to some variable lends no insight on the individual, only on the linear relationships between two variables (Bergman and El-Khoury 2001; Bergman and Trost 2006). These linear relationships, characteristic of the variable-oriented approach, are clearly insufficient to understand the individual to whom a given variable relationship applies because we still need to consider other traits of the person, e. g. a conscientious neurotic is quite different from an unconscientious neurotic (Nettle 2006).

We are aware of only one other study that investigated pro-environmental behavior by looking at differences among various personality types (Poškus and Žukauskienė 2017), needless to say – this particular approach is just starting to emerge in environmental psychology. However, there are many studies that investigated the relationship between personality traits and pro-environmental behavior by adopting the variable-oriented approach. Most researchers find that the personality traits that are generally regarded as positive and desirable (Nettle 2006) such as the trait of openness (Hirsh 2010; Luchs and Mooradian 2011; Markowitz et al. 2012), or the traits of agreeableness, extroversion, and conscientiousness are positively related to pro-environmental behaviors and related constructs (Kim et al. 2013; Swami et al. 2011). Identifying the relationships between personality traits and

pro-environmental behaviors, albeit valuable, is insufficient to make inferences about the personality of an individual who is most likely to behave in a pro-environmental manner.

To address the aforementioned shortcoming, the present study adopts a person-oriented approach in investigating pro-environmental behavioral intentions and their related constructs. The person-oriented approach considers an individual holistically, as a system with interacting parts (Bergman and El-Khoury 2001; Bergman and Wångby 2014). This approach also implies the use of certain methodology, that would enable making inferences about the individual (Bergman and Wångby 2014). Usually, when a person-oriented approach is adopted, individuals are grouped in clusters of similar cases based on a few variables and the pattern of variables becomes an indivisible unit of analysis (Bergman and Trost 2006). This grouping of individuals into types allows for more precise understanding of the individual than the traditional variable-oriented approach because the individual is regarded holistically, taking into account the pattern of traits of the individual (Bergman and El-Khoury 2001).

The design of the present study did not allow for direct behavioral observations, therefore, it was decided to investigate behavioral intention and its related constructs – attitudes towards behavior, subjective norms, and perceived behavioral control. These constructs comprise the Theory of Planned Behavior (Ajzen 1991) and were chosen for their popular use in research on pro-environmental behavior (Aguilar-Luzón et al. 2012; Bamberg and Möser 2007) and high relatedness to actual behavior (Ajzen 2011; Fishbein and Ajzen 2010), which is especially true in the case of behavioral intentions (Fishbein and Ajzen 2010).

In the present study, we use measures of subjective norms toward pro-environmental behaviors. The reason for this is that subjective (in-group) norms differ from descriptive and injunctive norms in the sense that subjective norms are internalized and represent the appraisal of one’s in-group’s behaviors (Thøgersen 2006; White et al. 2009), while descriptive and injunctive norms are reflective only of the immediate environment and provide information on the most adaptive behavior in immediate scenarios. Thus, subjective norms are more stable and represent the pressure one feels from one’s close others; subjective norms show the degree to which one is compelled to comply with in-group pressures, lest one is removed from the in-group. Therefore, affecting one’s subjective norms might result in a lasting change that is more likely to result in heuristic-driven behavior across contexts. While perceived descriptive and injunctive norms change depending on the immediate environment (Bator and Cialdini 2000; Nolan et al. 2008; Sundie et al. 2012), it still remains to be determined whether an individual’s subjective norms can be effectively changed without changing his or her perception of in-group members’ behavior.

Attitudes towards behavior represent one's subjective appraisal of that behavior. Generally, the more positive the appraisal, the more likely people are to exhibit said behavior (Fishbein and Ajzen 2010). Meta-analytical results show that attitudes are highly correlated with behavioral intention, more so than other TPB variables (Morren and Grinstein 2016). There are, however, cases where people hold positive attitudes towards certain behaviors, while not actually engaging in them (Poškus 2015; Wan et al. 2014), which implies that attitudes might function differently for people that differ by their demographic characteristics or personality traits (Fishbein and Ajzen 2010). Furthermore, attitudes can be self- or society-oriented in the sense that a person might have a positive appraisal of certain behaviors because they are pleasant *or* because they are perceived to be morally good (Fishbein and Ajzen 2010). While most researchers do not make this distinction and investigate attitudes as a whole, from an evolutionary point of view the perceptions of the costs and benefits of various behaviors might play a substantial role for different individuals. It is clear that positive self-oriented attitudes that reflect personal gain might function differently than society-oriented attitudes that reflect altruism and even loss of individual advantage. While some individuals might perform socially desirable behaviors in an attempt to increase their social status at the cost of lost resources (costly signaling), others might be more prone to seeking a tangible material reward that increases their fitness in real time (Bereczkei et al. 2010; Gintis et al. 2001; McAndrew 2002; Millet and Dewitte 2007). Both approaches are viable, but the benefit these strategies provide varies among individuals; e.g. individuals that have resources to spare might be more likely to engage in costly signaling, while others might be more self-oriented (Millet and Dewitte 2007). Furthermore, individuals with different personality traits might engage in different strategies as well. Based on the complexity and ambiguity of the construct of attitudes (Chan and Bishop 2013), and in hopes of capturing more diverse data, we assess both self-oriented and society-oriented attitudes in the present study.

Perceived behavioral control is formed largely by observing the environment and assessing the availability of certain behaviors (Ajzen 1991; Fishbein and Ajzen 2010). For example, if there are recycling bins available, one is more likely to throw trash in the appropriate bin, while the absence of recycling bins prevents the behavior from occurring in that particular setting altogether. In a way, perceived behavioral control is an indirect representation of perceived behavioral defaults – whether or not the environment encourages certain behaviors and makes them more available. The key aspect of this construct, however, is the subjective appraisal of the environment and, therefore, perceived behavioral control does not necessarily accurately represent the actual availability of certain behaviors (Ajzen 1991, 2011; Fishbein and Ajzen 2010). It is plausible that when one's perception of the

prevalence of a certain behavior changes, the perceived ease of performing that behavior changes in congruence because the perceived prevalence of said behavior signals its ease (e. g. one might perceive that running a 10 K race is much easier when one sees her colleagues successfully doing it). Thus, it is likely that by providing stimuli that signal the prevalence of pro-environmental behaviors one might affect the perceived ease of performing said behaviors as well, even if the environment remains stable and actual behavioral availability is unaffected.

While some pro-environmental behaviors can be considered as self-enhancing (e. g. conserving water and electricity to save money), some might be seen as altruistic (Corral-Verdugo et al. 2011; Tapia-Fonllem et al. 2013) in the sense that the one performing those behaviors makes sacrifices in order to help a greater cause (Dawkins 2006) (e. g. recycling might be inconvenient and therefore can be perceived as time wasting; various goods that are made in an environmentally conscious way often are more expensive and therefore one can perceive that the purchase of these goods is a waste of money). Other pro-environmental behaviors might be ambiguous and their altruistic or self-serving qualities might vary among individuals (e. g. the use of sustainable transportation – public transport, carpooling, cycling, walking – can be seen either as a way of saving money, or as a waste of time and uncomfortable, because getting around in a car can be perceived to be faster and more convenient). We collected measures on five pro-environmental actions: recycling, electricity conservation, water conservation, the use of sustainable transportation, and sustainable consumption. These actions were chosen because of their varied ease and availability, as well as their varied benefits to the person performing them (Poškus 2016a).

To summarize, the aim of the present study is to investigate whether different people are differently affected by evolutionarily tailored normative messages persuading them to behave pro-environmentally and whether different people approach pro-environmental behaviors differently in general.

Method

Participants

A total of 863 adolescents from five high-schools in Klaipėda (Lithuania) participated in the first wave of the study (54% female), which was intended for gathering information on participants' personality traits and creating robust personality clusters of adolescents from that area.

Two schools participated in the experimental part of the study, one school served as a control, while the other had normative messages placed in its interior. The N of the control group is 78 (76% of the first wave participants from that

school), while the N of the experimental group is 178 (80% of the first wave participants from that school).

Participation in both waves of the study was voluntary, which affected the turnover rate of the second wave. The schools that served as control and experimental conditions were chosen on a practical basis (school's staff agreement to further assist in conducting the study) and aiming to get at least 30 observations for each cluster in the experimental condition.

Because personal data was gathered, it was decided not to assess the participants' socio-economic status so as not to discourage participation in the study. All participating schools were publicly funded and there are no grounds for assuming socio-economic differences among individuals from different schools.

Procedure

Prior to conducting the study, consent of participants and participants' parents was obtained. Participants were informed that they could freely opt-out of the study at any point.

During the first wave of the assessment, the participants of the study filled in on-line questionnaires at school during a pre-scheduled time in their school's computer class. School staff members aided in organizing the students and were there to answer any questions the participants might have had regarding the questionnaire.

In two weeks' time after the participants filled in the questionnaires, interventions consisting of normative messages urging to recycle and conserve water and electricity were placed in the school that was assigned to the experimental condition. After two months from the placement of the interventions, participants were once again asked to fill in an on-line questionnaire during a pre-scheduled time in their school's computer class.

Materials

Three types of normative messages were introduced into the school's interior. Several A5 sized plaques that urged to turn off the lights when they are not needed were placed on the walls next to light switches in the corridors of the school. Similarly, A5 sized stickers that asked to conserve water were put on the bottom of the mirrors in the bathrooms. Several A1 sized posters that urged people to recycle their waste were placed in the most used corridors and in the cafeteria (Appendix 1).

The appeals were similar in their design. Drawing from the insights of evolutionary psychology, the appeals were tailored to make use of innate behavioral tendencies (Cialdini 2003; Goldstein et al. 2007; Griskevicius et al. 2008; Nolan et al. 2008). The participants were reminded of the positive descriptive norm towards pro-environmental behavior and the injunctive norm was highlighted as well. This was done to both reinforce the salience of the rules and to persuade the

observers that the behavior in question is indeed common. The appeal was brightly colored and accompanied by a *kawaii* anthropomorphic mascot (a trash can, a faucet, and a light bulb for recycling, water conservation, and electricity conservation, respectively).

A more detailed appeal was presented at the bottom of the interventions. The appeal highlighted the personal benefits of pro-environmental behaviors, followed by two sentences stating that individuals and their behavior do have a positive and significant effect on the environment. The following paragraph appealed to the observer's self-image by implying that the observer is *cool* and that *cool people actively care for the environment*. All interventions had a QR code at the bottom right corner that would direct them to a pro-environmental blog where they could find additional information on how to behave pro-environmentally.

Measures

Personality Traits

The Big Five Inventory (BFI) consisting of 44 items was used to assess the five personality traits: extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience (John and Srivastava 1999). Items were scored on a five-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). Personality traits were assessed during the first wave of the study only.

The measures of extraversion ($\alpha = .71$), agreeableness ($\alpha = .63$), conscientiousness ($\alpha = .74$), neuroticism ($\alpha = .75$), and openness to experience ($\alpha = .80$) showed sufficient internal consistency.

Pro-Environmental Intention

Based on previous research (Poškus 2016a), intention to perform pro-environmental behaviors was assessed with one item for each behavior. For example, the intention to recycle was assessed with the item "in the upcoming few months I intend to recycle and I truly know I will do that". Items were scored on a five-point Likert scale from 1 (strongly disagree) to 5 (strongly agree).

Pro-Environmental Attitudes

Two types of attitudes were assessed: those that are focused on the self, and those that are focused on the society. For each behavior, each type of attitudes were assessed with two items, e.g. the self-oriented attitudes towards recycling were assessed with the items "it would be fun for me if I were to recycle in the upcoming two months" and "it would be interesting for me if I were to recycle in the upcoming two months", while the society-oriented attitudes towards recycling were assessed

with the items “it would be meaningful if I were to recycle in the upcoming two months” and “it would be beneficial if I were to recycle in the upcoming two months”. Items towards other behaviors were worded in a similar fashion. Each item was rated on a Likert scale from 1 (completely disagree) to 5 (completely agree). Item ratings of each type of attitude were averaged to compute the self-oriented and society-oriented attitude scores. An exploratory principal component analysis with a fixed two-factor solution was run on the data gathered on the first wave of the study. The analysis revealed that the items function as predicted and form two distinct components of self- and society-oriented attitudes (Appendix 2).

Subjective (in-Group) Norms Towards pro-Environmental Behaviors

Based on similar research (Poškus 2016a; Tonglet et al. 2004), subjective norms for every behavior were assessed by presenting two items for each behavior. One item was directed at the perceived in-group norm of the participant, and the other item – at the motivation to comply with that norm. For example, the subjective norm towards recycling was assessed with the items “people, who are important to me, whom I like and respect, would agree with my decision to recycle in the upcoming two months” and “I am concerned with what the people who are close to me, whom I like and respect, think about me recycling in the upcoming two months”. Items were rated on a 5-point Likert scale from 1 (“Completely disagree”) to 5 (“Completely agree”). The subjective norm score for each behavior was computed by multiplying the scores of the two corresponding items. The correlations between the corresponding items for each behavior ranged from .33 to .44.

Perceived Behavioral Control of pro-Environmental Behaviors

Perceived behavioral control was assessed with two items for each behavior. One item was directed at the capability to perform a behavior (e. g. “it would be easy for me to recycle in the upcoming two months”) and the other item was directed at the controllability of a behavior (e. g. “it is completely up to me whether I will recycle in the upcoming two months”). Items were rated on a 5-point Likert scale from 1 (“Completely disagree”) to 5 (“Completely agree”). The ratings of the two items were multiplied to compute the perceived behavioral control score for each behavior. The correlations between the corresponding items for each behavior ranged from .20 to .40.

Results

The equivalence of the Experimental and the Control groups were assessed using a *t*-test comparing the values of all

variables at the pre-test (T1). Paired samples *t*-tests were run to test the general effectiveness of the intervention in the Experimental and Control conditions. Results of the aforementioned tests are presented in Table 1. It must be noted that the Control and Experimental conditions were not fully equal at T1; the Control condition reported slightly higher scores which were significant regarding 11 out of the 25 variables that were tested. However, the slight inequality between the Control and Experimental groups does not prevent the investigation of the effectiveness of the intervention in the Experimental group.

While the Control condition showed no improvement in regards to the measured variables, the Experimental condition showed statistically significant improvement on all occasions. This finding is not at all surprising, given the high effectiveness of normative interventions (Cialdini et al. 1990; Griskevicius et al. 2008; Poškus 2016b).

A hierarchical cluster analysis using Ward’s clustering method was run to group similar individuals by their personality traits. In order to obtain robust usable clusters, the analysis was run on the first wave data ($N = 863$). Various cluster solutions were tested and a four-cluster solution presented itself as the most meaningful and theoretically sound (Fig. 1). The clusters derived in the present study are similar to those obtained in previous research (Poškus and Žukauskienė 2017).

The first cluster can be best described as *negative* – characterized primarily by high scores in neuroticism and lower scores in desirable traits such as extraversion, agreeableness, conscientiousness, and average scores in openness. The *conservative* cluster, titled as such because of the members’ low openness to new experiences, shows average scores in neuroticism and slightly lower scores in other traits, when compared to other clusters. The *outgoing* cluster’s main characteristic is its members’ high extraversion and average scores in other traits. Lastly, the *positive* cluster encompasses a combination of socially desirable traits: high scores in the traits of extraversion, agreeableness, conscientiousness, and openness, and low scores in neuroticism.

The four clusters are similarly sized, and the mean participant age in all clusters is similar. However, the *negative* cluster is overrepresented by females, while the *conservative* cluster has more males (Table 2). This is not unexpected, as males and females do somewhat differ in their personalities (Nettle 2005, 2006). In the experimental condition, however, the sex distributions do not differ among clusters and both sexes can be assumed to be equally represented in all clusters.

Paired *t*-tests were run for all study variables in the four clusters (Table 3). Most effects were significant for the *outgoing* and *positive* clusters, while roughly half of the effects were significant for the *conservative* cluster and only a few were significant for the *negative* cluster. These results provide support for our choice of analysis and indicate that

Table 1 Paired samples *t*-test results in the Control and Experimental conditions and *t*-test results of T1 comparisons between the Control and Experimental conditions

	Control condition (<i>N</i> = 78)			Experimental condition (<i>N</i> = 178)			Comparison of Control and Experimental conditions at T1 <i>t</i> (254)
	T1 M(SD)	T2 M(SD)	<i>t</i> (77)	T1 M(SD)	T2 M(SD)	<i>t</i> (177)	
Recycling							
Self-oriented attitude	3.31(0.93)	3.13(1.01)	1.40	3.08(0.90)	3.42(0.85)	4.61**	1.86
Society-oriented attitude	3.79(0.87)	3.77(0.98)	0.14	3.54(0.9)	3.78(0.85)	3.27**	2.09*
Subjective norm	12.37(6.54)	12.04(6.31)	0.39	11.33(5.79)	12.85(6.07)	2.99**	1.28
Perceived behavioral control	11.96(5.67)	11.54(5.67)	0.60	10.84(6.11)	12.57(5.43)	3.67**	1.38
Intention	3.24(1.18)	3.13(1.11)	0.39	2.88(1.13)	3.37(1.04)	5.62**	2.33*
Water conservation							
Self-oriented attitude	3.37(0.79)	3.2(1.02)	1.41	3.11(0.93)	3.5(0.81)	5.33**	2.18*
Society-oriented attitude	3.92(0.69)	3.8(0.93)	1.06	3.53(0.93)	3.78(0.93)	3.39**	3.40**
Subjective norm	12.95(5.57)	12.13(6.05)	1.28	11.56(5.71)	13.24(5.83)	3.24**	1.81
Perceived behavioral control	14.15(6.58)	12.85(5.77)	1.60	12.74(6.41)	14.25(6.39)	2.55**	1.62
Intention	3.58(1.19)	3.41(1.1)	1.15	3.19(1.14)	3.6(1.05)	4.46**	2.49*
Electricity conservation							
Self-oriented attitude	3.37(0.82)	3.31(0.99)	0.46	3.16(0.91)	3.48(0.89)	4.13**	1.69
Society-oriented attitude	3.8(0.78)	3.8(0.96)	0.39	3.51(0.90)	3.75(0.82)	3.17**	2.48*
Subjective norm	12.96(5.96)	11.73(5.83)	1.80	11.78(6.19)	13.61(6.10)	3.5**	1.42
Perceived behavioral control	14.15(6.00)	12.94(6.21)	1.47	12.35(6.24)	13.76(6.33)	2.63**	2.15*
Intention	3.45(0.98)	3.36(1.04)	0.69	3.29(1.07)	3.6(1.02)	3.41**	1.11
Sustainable transportation							
Self-oriented attitude	3.34(0.82)	3.21(0.90)	1.25	3.06(0.90)	3.51(0.86)	5.88**	2.38*
Society-oriented attitude	3.81(0.75)	3.69(0.95)	1.04	3.48(.89)	3.74(0.81)	3.42**	2.87**
Subjective norm	11.95(5.79)	11.5(6.04)	0.62	10.56(5.68)	13.02(6.06)	5.21**	1.79
Perceived behavioral control	10.91(6.09)	11.04(6.06)	−0.16	10.42(5.39)	12.42(5.94)	4.04**	0.64
Intention	3.03(1.23)	3.04(1.33)	−0.09	2.94(1.11)	3.31(1.03)	3.98**	0.56
Sustainable consumption							
Self-oriented attitude	3.27(0.89)	3.22(1.01)	0.36	3.11(0.85)	3.55(0.83)	6.07**	1.33
Society-oriented attitude	3.79(0.87)	3.69(0.95)	0.84	3.46(0.88)	3.74(0.8)	4.03**	2.85**
Subjective norm	12.44(5.61)	11.59(6.54)	1.06	10.79(5.43)	12.85(5.83)	4.59**	2.20*
Perceived behavioral control	11.1(5.24)	10.35(5.53)	1.01	10.71(5.34)	12.31(5.75)	3.18**	0.54
Intention	2.99(0.92)	2.95(1.06)	0.27	2.81(1.10)	3.27(1.02)	5.68**	1.25

p* < .05; *p* < .01

the intervention indeed had different effect for different people. The graphical comparison of the effect sizes presented in Fig. 2 provides more apparent support for this.

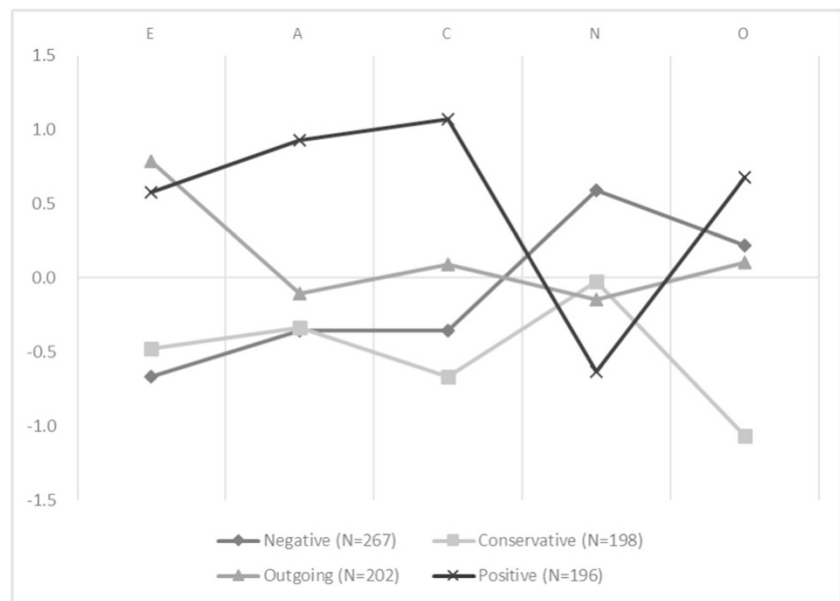
It is worthy to point out that not only did the clusters were differently affected by the experimental stimuli, but their starting points were quite different as well (see Figs. 3 and 4). For example, the scores of the intention of sustainable consumption in the *negative* cluster changed significantly after the intervention, but the substantially changed intention of this cluster is still not as highly expressed as the *positive* cluster's intention of sustainable consumption prior the intervention (see Table 3). This clearly illustrates that different people have different

starting points and, therefore, different capacity for attitudinal and behavioral change (Fishbein and Ajzen 2010).

An apparent ranking of sustainable personality types can be seen in Fig. 3, which shows the standardized values of pro-environmental intentions and related variables prior the intervention: the *positive* cluster reveals itself to be positive not only in personality traits, but the most environmentally-conscious as well, while the *conservative* cluster reveals itself as the least environmentally-friendly, with the other two clusters falling in between.

After the intervention, the ranking of the clusters shifts and becomes more differentiated (Fig. 4). The *positive* cluster preserves its rank as the most environmentally-friendly, however

Fig. 1 Profiles of personality clusters in the present sample. E – extraversion, A – agreeableness, C – conscientiousness, N – neuroticism, O – openness



the *outgoing* cluster emerges as a close second and appears to be the most affected by the intervention (see Table 3). The *negative* cluster, albeit relatively unaffected by the intervention, still is more environmentally-friendly than the *conservative* cluster.

Discussion

In evolutionary terms, adopting sustainable behaviors is a novel practice. Therefore, it is reasonable to assume that people with different patterns of personality traits that shape their reactions and interactions with the environment would differently accept novel things, even if environmental pressures

(real or perceived) sway them one way or the other. In fact, recent work by Kanazawa (2010) suggests that open and more intelligent people would be more likely to adopt novel ideas and values. Sustainable behavior can be considered one of these novelties that society is faced with.

It is a well-established fact that normative interventions are an effective means of changing behavior (Cialdini 2003; Griskevicius et al. 2008; Poškus 2016b). Although we were unable to measure behavior in the present study and measured behavioral intention, subjective norms, attitudes, and perceived behavioral control instead, the present study still provides support for the effectiveness of normative interventions and messages crafted in a way that is tailored towards innate biases. In general, the normative intervention used in the present study had a positive effect on all measured variables.

The present study adopts a person-oriented approach (Bergman and Wångby 2014) and its aim was to investigate whether different people approach sustainable practices differently. Therefore, the effectiveness of the intervention was assessed in clusters of people grouped by the patterns of their personality traits. This is a rarely practiced approach in sustainability research and it brings forth some important insights and implications.

First of all, it appears that not all personalities are equally sustainable to begin with. Those individuals who exhibit a pattern of socially desirable traits (the *positive* cluster in the present study) hold the most favorable attitudes and intentions towards pro-environmental behaviors. It seems that this cluster is not only positive in the sense of the social desirability of their traits, but in their actions as well. More open and intelligent people tend to be quicker in adopting new ideas (Kanazawa 2010), and the patterns observed in this cluster

Table 2 Sex and age comparisons in clusters

Cluster	Cluster membership frequency			Mean age
	Female	Male	Total	
First wave (N = 863)				
Negative	164	103	267 (31%)	15.86 (1.07)
Conservative	66	132	198 (23%)	15.61 (1.13)
Outgoing	117	85	202 (23%)	15.83 (1.13)
Positive	115	81	196 (23%)	15.52 (1.05)
Experimental condition (N = 178)				
Negative	25	26	51 (28%)	15.53 (0.70)
Conservative	13	22	35 (20%)	15.00 (1.00)
Outgoing	24	20	44 (25%)	15.36 (0.97)
Positive	29	19	48 (27%)	15.42 (0.90)

Gender distribution among clusters differs significantly in the first wave ($\chi^2(3) = 42.81, p < .01$), but not in the experimental condition group ($\chi^2(3) = 4.69, p = .20$)

Table 3 Paired samples *t*-test results in the Experimental condition by cluster

	Negative (<i>N</i> = 51)			Conservative (<i>N</i> = 35)			Outgoing (<i>N</i> = 44)			Positive (<i>N</i> = 48)		
	T1 M(SD)	T2 M(SD)	<i>t</i> (50)	T1 M(SD)	T2 M(SD)	<i>t</i> (34)	T1 M(SD)	T2 M(SD)	<i>t</i> (43)	T1 M(SD)	T2 M(SD)	<i>t</i> (47)
Recycling												
Self-oriented attitude	3.23(0.82)	3.28(0.84)	-0.43	2.73(0.83)	3.17(0.93)	-2.77**	2.93(0.93)	3.56(0.72)	-3.92**	3.31(0.91)	3.61(0.86)	-2.38*
Society-oriented attitude	3.77(0.83)	3.69(0.86)	0.64	3.19(1.01)	3.63(1.01)	-2.23*	3.36(0.83)	3.82(0.79)	-3.05**	3.70(0.85)	3.97(0.75)	-2.22*
Subjective norm	11.63(5.83)	12.61(5.93)	-0.93	9.77(6.05)	11.11(6.42)	-1.26	10.66(5.01)	13.02(5.23)	-2.33*	12.75(6.04)	14.23(6.50)	-1.54
Perceived behavioral control	11.65(5.36)	12.24(4.69)	-0.89	8.43(5.51)	10.54(5.29)	-2.18*	10.39(6.49)	12.73(5.78)	-2.24*	12.17(6.53)	14.25(5.54)	-1.96†
Intention	3.00(1.12)	3.31(1.00)	-2.00†	2.71(1.15)	2.94(1.03)	-1.16	2.70(1.03)	3.41(1.02)	-3.92**	3.04(1.07)	3.71(1.03)	-4.07**
Water conservation												
Self-oriented attitude	3.03(0.90)	3.27(0.78)	-1.91†	2.89(0.93)	3.31(0.87)	-2.50*	3.09(0.82)	3.57(0.73)	-3.24**	3.38(1.00)	3.81(0.77)	-2.96**
Society-oriented attitude	3.61(0.93)	3.69(0.88)	-0.49	3.13(1.06)	3.45(1.08)	-1.63	3.45(0.75)	3.97(0.89)	-4.19**	3.79(0.90)	3.96(0.84)	-1.33
Subjective norm	10.49(5.62)	13.35(5.48)	-3.01**	10.46(5.23)	12.26(5.47)	-1.58	12.20(5.71)	12.52(6.46)	-0.28	12.90(5.94)	14.48(5.79)	-1.67
Perceived behavioral control	13.16(5.90)	13.51(5.73)	-0.34	10.66(5.86)	11.46(6.46)	-0.67	12.16(6.66)	15.73(6.49)	-2.63*	14.33(6.77)	15.73(6.27)	-1.21
Intention	3.12(1.16)	3.39(1.04)	-1.70†	2.86(1.03)	3.20(1.16)	-1.79†	3.07(1.17)	3.77(1.10)	-3.02**	3.60(1.09)	3.96(0.77)	-2.27*
Electricity conservation												
Self-oriented attitude	3.24(0.80)	3.28(0.90)	-0.29	2.97(0.90)	3.14(0.90)	-0.96	3.01(0.94)	3.65(0.83)	-3.76**	3.36(0.98)	3.79(0.79)	-3.34**
Society-oriented attitude	3.67(0.79)	3.73(0.81)	-0.40	3.00(1.04)	3.61(0.90)	-3.23**	3.47(0.76)	3.77(0.82)	-2.01†	3.76(0.88)	3.85(0.79)	-0.82
Subjective norm	11.78(5.88)	12.88(5.74)	-1.31	8.91(6.14)	12.00(6.46)	-3.09**	12.52(6.27)	13.77(6.33)	-0.95	13.19(5.96)	15.40(5.69)	-2.23*
Perceived behavioral control	13.20(6.37)	12.84(6.09)	0.32	10.00(5.60)	11.46(6.31)	-1.49	11.52(5.98)	15.05(6.39)	-2.85**	13.94(6.31)	15.23(6.07)	-1.59
Intention	3.33(1.05)	3.35(1.04)	-0.11	2.69(1.13)	3.31(1.11)	-3.19**	3.30(0.90)	3.82(0.92)	-2.66*	3.69(0.99)	3.88(0.91)	-1.32
Sustainable transportation												
Self-oriented attitude	3.07(0.84)	3.49(0.83)	-3.05**	2.76(0.90)	3.23(0.97)	-2.53*	2.99(0.87)	3.58(0.92)	-3.72**	3.33(0.89)	3.67(0.73)	-2.37*
Society-oriented attitude	3.53(0.86)	3.62(0.76)	-0.55	3.33(0.99)	3.49(1.00)	-0.89	3.36(0.87)	3.88(0.77)	-3.12**	3.64(0.84)	3.94(0.67)	-2.63**
Subjective norm	10.88(5.63)	13.12(6.29)	-2.38*	8.77(5.09)	11.17(5.84)	-2.66*	10.05(5.57)	13.27(6.36)	-2.93**	12.00(5.98)	14.02(5.57)	-2.54*
Perceived behavioral control	10.82(5.51)	11.47(6.03)	-0.74	9.03(5.15)	9.74(5.56)	-0.74	9.45(4.75)	14.09(5.54)	-4.61**	11.90(5.72)	13.85(5.72)	-1.95†
Intention	2.98(1.18)	3.18(1.03)	-1.00	2.66(1.06)	2.97(1.01)	-1.61	2.77(1.05)	3.39(1.06)	-3.18**	3.25(1.06)	3.65(0.91)	-2.36*
Sustainable consumption												
Self-oriented attitude	3.20(0.83)	3.45(0.85)	-1.8†	2.73(0.75)	3.16(0.87)	-2.45*	2.99(0.85)	3.64(0.61)	-5.08**	3.42(0.85)	3.88(0.82)	-3.29**
Society-oriented attitude	3.63(0.82)	3.63(0.77)	0.00	3.10(0.96)	3.44(1.01)	-2.01†	3.39(0.82)	3.83(0.66)	-2.94**	3.59(0.87)	3.99(0.69)	-3.84**
Subjective norm	10.65(5.29)	11.92(5.70)	-1.49	9.63(4.84)	11.71(6.11)	-2.33*	10.38(5.15)	12.59(5.35)	-2.20*	12.17(6.07)	14.92(5.83)	-3.28**
Perceived behavioral control	11.75(5.28)	11.51(6.12)	0.24	8.60(5.15)	9.63(4.40)	-1.37	9.68(4.47)	13.59(6.01)	-3.59**	12.10(5.73)	13.96(5.23)	-1.92†
Intention	2.67(1.11)	3.18(0.95)	-3.85**	2.43(0.88)	2.74(1.01)	-1.61	2.86(1.05)	3.50(1.07)	-3.63**	3.21(1.01)	3.54(0.92)	-2.22*

† $p < .1$, * $p < .05$, ** $p < .01$

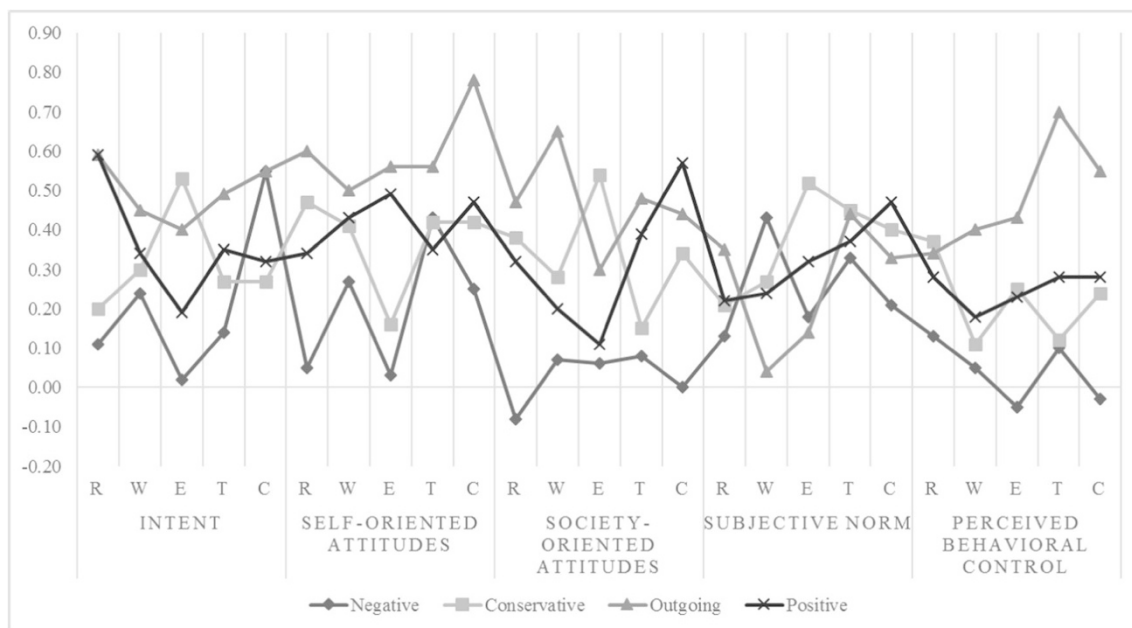


Fig. 2 Comparison of effect sizes (d) among clusters in the experimental condition. Effect sizes are corrected for the correlations between T1 and T2 measures. R- recycling, W – water conservation, E – electricity conservation, T – use of sustainable transportation, C – sustainable consumption

provide further proof for this. What is perhaps most interesting, is that the *positive* clusters already had higher scores on all variables, when compared to other clusters and, therefore, had lower comparative capacity for change. However, the relative situation of the cluster did not prevent positive changes from occurring and, in a Matthew effect-like manner, the individuals in this cluster became even more environmentally friendly.

Conversely, individuals that are not open to experience, best represented by the *conservative* cluster in the present study, are slow to adopt novel practices. The individuals in this cluster started with the most unfavorable attitudes towards pro-environmental behaviors and ended in the same relative place, even though they were slightly affected by the intervention. These people are not hard to reach per se, but their attitudinal changes have the farthest distance to travel if they are to reach

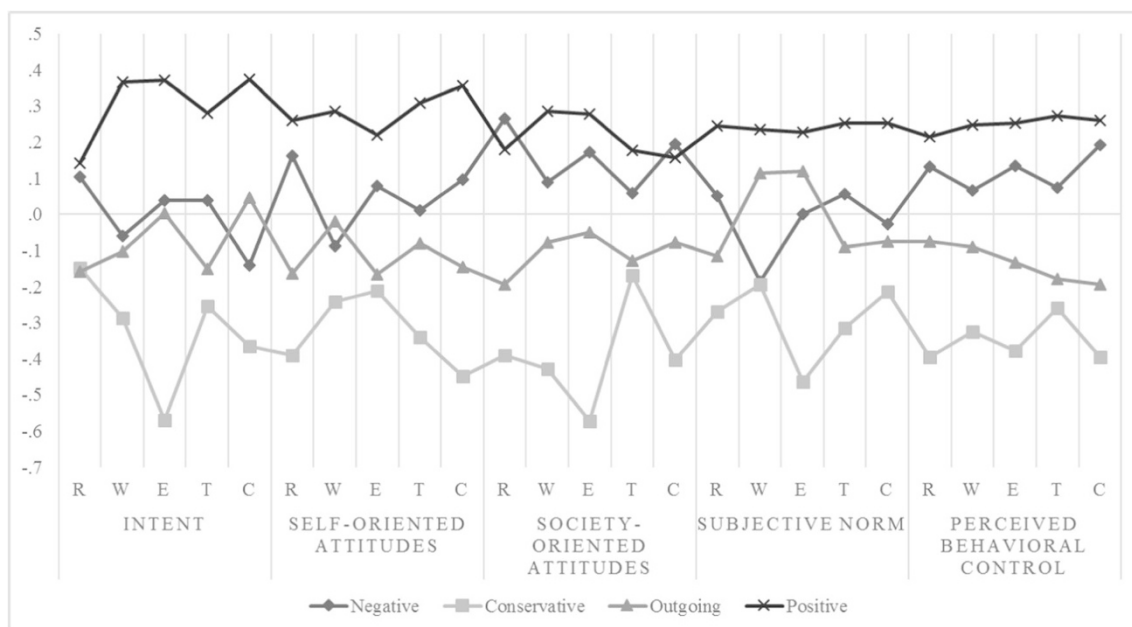


Fig. 3 Cluster comparison of Z-scores of behavioral intention and related variables prior the intervention. R- recycling, W – water conservation, E – electricity conservation, T – use of sustainable transportation, C – sustainable consumption

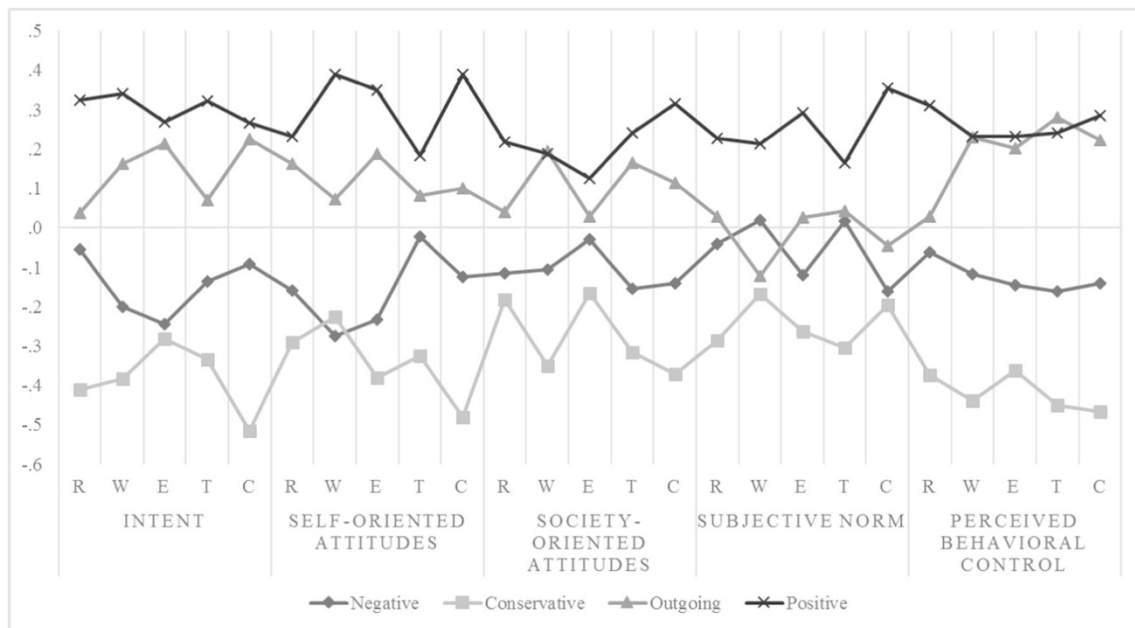


Fig. 4 Cluster comparison of Z-scores of behavioral intention and related variables after the intervention. R- recycling, W – water conservation, E – electricity conservation, T – use of sustainable transportation, C – sustainable consumption

the level of attitudes of the *positive* cluster, therefore constant and consistent environmental reinforcement of pro-environmental norms might be needed to effectively influence this cluster. To put it simply, the *conservative* cluster is slow to change, but the results of the present study show that changes can and do occur in this cluster.

The intervention was the most effective for the *outgoing* cluster, characterized by its high extraversion. The individuals in this cluster are more socially engaged and explorative (Nettle 2005, 2006), therefore, more reactant to salient social norms and appeals to self-image and social status. The messages in the interventions in the present study exploited exactly this – made pro-environmental social norms salient and appealed to the observer’s social status by declaring that “*cool people*” are friendly to the environment and, surely, the observer is one of the “*cool people*” as well. Effective appeals and the cluster’s relatively high capacity for change resulted in a substantial positive change in this cluster.

The *negative* cluster, although starting from a better relative place than the *conservative* cluster, was the least affected by the intervention. The *negative* cluster, titled thusly because of its by high neuroticism and low extraversion, agreeableness, and conscientiousness, is more prone to avoidant behavior and a generally more suspicious (or cautious) view of external influences (Nettle 2006). This might have led the people in this cluster to be skeptical of the normative messages introduced into their environment and therefore they were the least affected by them. For this cluster, it seems, a mere salient social norm and an appeal to social status might not be enough to persuade them. Other or additional means of reaching this

cluster should be employed (e. g. changing behavioral defaults and empowering pro-environmental behavior).

The normative messages in the present study were only directed towards three behaviors: recycling, electricity conservation, and water conservation. The observers had an additional opportunity to learn more about pro-environmental behaviors by scanning a QR code on the messages that were introduced into the environment. The QR code directed them to a webpage where short everyday tips on how to behave more pro-environmentally were presented and these tips addressed the use of sustainable transportation and sustainable consumption as well. It is unclear how many observers visited the webpage, but the results of the present study show positive changes in all behaviors, those directly addressed by the intervention and those only mentioned in the webpage. This indicates possible spillover effects of normative interventions on all related behaviors, not only those directly referenced in the normative messages.

The possible spillover effects can be best explained by making the idea of pro-environmental behavior salient in the observers, thus prompting them to think about their actions and make them consistent. The need for consistency in behaviors and beliefs is an innate predisposition that we all share (Sundie et al. 2012) and it seems that it can be cost-effectively employed in promoting “packages” of pro-environmental behaviors.

Practical Implications

The use of social norms has long been regarded as an overwhelmingly effective tactic of promoting desirable behaviors

(Cialdini 2003; Griskevicius et al. 2008; Poškus 2016b). The present study sheds light that normative appeals function differently for different people and, therefore, should be crafted in such a way that addresses different types of observers. It is not enough to make social norms salient, the normative message should be persistent and reinforced with an enabling environment (i. e. it is not enough for people to believe that recycling is prevalent, they also need to have consistent access to recycling bins to actually recycle).

However, given that positive social norms and other evolutionarily tailored approaches are to this day underused in PSAs in Lithuania, a broader recommendation for organizations engaged in promoting pro-environmental behaviors would be to use the available evidence-basis to craft messages that are effective in promoting behaviors, even if their effectiveness seems counterintuitive or unapparent at a glance (Griskevicius et al. 2008; Nolan et al. 2008).

Limitations

The present study adopts a rarely used person-oriented approach, which can be considered novel in the context of pro-environmental behaviors. This leads to some limitations and shortcomings that will need to be addressed in future research.

First of all, the present study used a sample of adolescents and the interventions were placed in a school. This enabled to gather a sample of similar individuals with relative ease and their exposure to the interventions can be considered fairly consistent. Even though understanding pro-environmental behaviors of adolescents and finding ways to positively affect their attitudes towards the environment is needed and valuable, future research should also look into adult samples and how adults with different patterns of personality traits are affected by persuasive messages (e. g. conducting research in organizations to ensure consistent exposure to the intervention). Additionally, the control and experimental groups of the present study were not completely equivalent, i. e. in some cases the control group had higher values of pro-environmental intentions and related variables at the pre-test than the experimental group. Practical reasons prevented us from recruiting more similar schools to participate in the study and while this does not invalidate the fact that there were significant changes in the experimental condition, future research should strive to avoid this limitation and use more equivalent groups.

Another limitation of the present study was the inability to assess actual or self-reported past behaviors at both time points. While investigating changes in behavioral intentions, attitudes, subjective norms, and perceived behavioral control provides important and valuable insight, actual behavioral observations could provide a more precise practical measure of the effectiveness of persuasive messages for different types of people.

There is some debate on the use of various clustering procedures in person-oriented research (Bergman and El-Khoury

2001; Bergman and Wångby 2014). Some authors suggest that latent class analysis should be used in order to obtain likelihood-based classes of observations, however the present study uses empirical clustering procedures in order to obtain clusters that are closer to real life (Bergman and Wångby 2014), since latent class analysis might not be as accurate in detecting subtle differences between cases using continuous data from personality measures (while means-based approaches work in a way that maximizes the difference between clusters). While we stand by our choice of using a means-based clustering procedure in the present study, we must acknowledge that some authors (perhaps unduly) view this as an inferior method when compared to latent class analysis.

Future Directions

The current state-of-the-art research in the field of pro-environmental behavior is overwhelmingly variable-oriented and little-to-no effort is being spent in understanding the individual. It is the hope of the author of the present study that this research will inspire others to undertake a more person-oriented approach when investigating pro-environmental behaviors. Only by understanding the individual, with her particular set of traits and adaptations, can we come up with ways of addressing social problems in a way that is truly effective and can reach everyone.

Future person-oriented investigations of pro-environmental behaviors should investigate the change in attitudes and intentions of individuals from a longitudinal perspective in order to understand the attitudinal change dynamics of various individuals as well as how long it takes to persuade different types of individuals to adopt an environmentally friendly lifestyle. Longitudinal research with normative interventions would lead to an understanding of how long the stimuli remain effective and whether the effect diminishes or is sustainable over time (and whether these dynamics are different among individuals).

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Compliance with Ethical Standards

Conflict of Interest The author(s) declare no conflict of interest regarding the publication of this article.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

Appendix 1



Fig. 5 S1 was directed at water conservation; S2 – at recycling; S3 – at electricity conservation. The message in S1 translates to “Everyone conserves water. Don’t waste water!” S2 and S3 follow a similar pattern. The bottom text was identical for all three stimuli: “Did you know that many of pro-environmental actions are beneficial to you as

well? Did you know that your efforts have a tangible positive impact on the environment? Your actions here and now matter. Most likely, as all cool people, you already care actively for the environment. If not – now is the time to start! Scan the QR code and learn more about the ways you can contribute to preserving the natural environment”

Appendix 2

Table 4 Principal component analysis results of the attitude items for each behavior

Item	Component		Correlation between components
	Society-oriented	Self-oriented	
Recycling			
It would be fun for me if I were to recycle in the upcoming two months		.93	.47
It would be interesting for me if I were to recycle in the upcoming two months		.79	
It would be meaningful if I were to recycle in the upcoming two months	.94		
It would be beneficial if I were to recycle in the upcoming two months	.78		
Water conservation			
It would be fun for me if I were not to waste water in the upcoming two months		.95	.49
It would be interesting for me if I were not to waste water in the upcoming two months		.75	
It would be meaningful if I were not to waste water in the upcoming two months	.81		
It would be beneficial if I were not to waste water in the upcoming two months	.92		
Electricity conservation			
It would be fun for me if in the upcoming two months I were not to leave electrical appliances on when they are unused		.98	.46
It would be interesting for me if in the upcoming two months I were not to leave electrical appliances on when they are unused		.67	
It would be meaningful if in the upcoming two months I were not to leave electrical appliances on when they are unused	.86		
It would be beneficial if in the upcoming two months I were not to leave electrical appliances on when they are unused	.87		
Sustainable transportation			
It would be fun for me if in the upcoming two months I were to choose the most environmentally-friendly transportation		.93	.49

Table 4 (continued)

Item	Component		Correlation between components
	Society-oriented	Self-oriented	
It would be interesting for me if in the upcoming two months I were to choose the most environmentally-friendly transportation		.79	
It would be meaningful if in the upcoming two months I were to choose the most environmentally-friendly transportation	.92		
It would be beneficial if in the upcoming two months I were to choose the most environmentally-friendly transportation	.80		
Sustainable consumption			
It would be fun for me if in the upcoming two months I were to buy the most environmentally-friendly products		.97	.53
It would be interesting for me if in the upcoming two months I were to buy the most environmentally-friendly products		.70	
It would be meaningful if in the upcoming two months I were to buy the most environmentally-friendly products	.91		
It would be beneficial if in the upcoming two months I were to buy the most environmentally-friendly products	.85		

N = 863. Loadings lower than .6 are not shown

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Green HRM, psychological green climate and pro-environmental behaviors: An efficacious drive towards environmental performance in China

Shumaila Naz¹ · Samia Jamshed² · Qasim Ali Nisar² · Nadia Nasir²

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Abstract

This study is undertaken to examine that how Green human resource management practices heightens environmental performance via employees' psychological green climate and pro-environmental behaviors. It also assesses the moderating role of environmental knowledge between pro-environmental behaviors and organizational environmental performance that was almost unnoticed in the preceding studies. Data were collected from the employees who were directly engaged with the implementation of green practices in manufacturing firms located in Jiangsu, China. 450 employees completed the questionnaires and finally, 370 valid responses the green HRM practices were used for the PLS-SEM analysis. The analytical findings revealed that the green HRM practices and corporate environmental strategy are positively related to the psychological green climate that subsequently leads to generate pro-environmental behaviors in employees. Furthermore, the results shed light on the precise development of the corporate level environmental strategy to motivate employees for the creation of an eco-friendly workplace leading to optimizing environmental performance. Further, results postulate that environmental knowledge moderates between pro-environmental behaviors and environmental performance. This research is an extension of existing literature by adding the predictor of corporate environmental strategy as one of the significant antecedents of pro-environmental behaviors and environmental performance. Secondly, it contributes to the existing body of literature through the incorporation of environmental knowledge as a moderator between pro-environmental behaviors and environmental performance. This research study provides valuable practical implications to the top management, and policymakers for ensuring the commitment of employees towards implementation of Green human resource management practices and corporate environmental strategy to achieve environmental performance.

Keywords Green human resource management practices · Corporate environmental strategy · Environmental knowledge · Pro-environmental behaviors · Psychological green climate environmental performance

Introduction

In recent years, irretrievable environment changes, the pervasiveness of environmental pollution, devastation of natural ecosystems, and implementation of environmental laws have increased the pressure to exert deliberate efforts to mitigate the negative effects towards environments by firms (Ahmad, 2015). The industrial sector is forced to improve environmental performance by acting ecologically and socially sustainable (Ardito & Dangelico, 2018) due to stress imposed by the large community such as stakeholders (Paillé, Chen, Boiral, & Jin, 2014). The corporate sector is taking serious measures to develop congruence between achieving the milestones of both economic goals and environmental goals which will be a win-win situation in lieu of environmental protection and sustainable development. Moreover, customers and societies are behaving more responsibly by taking into notice the

✉ Shumaila Naz
shumaila.superior@gmail.com

Samia Jamshed
samiajamshed@gmail.com

Qasim Ali Nisar
qasimalinisar@yahoo.com

Nadia Nasir
nadia.nasir@superior.edu.pk

¹ Faculty of Business Administration, Iqra University, Main Defence View, Shaheed-e-Millat Road, Karachi 75500, Pakistan

² Faculty of Business and Management Sciences, The Superior College Lahore, 17-km, Main Raiwind Road, Lahore 55150, Pakistan

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organizational environmental behaviors prior to make purchase decisions (Longoni, Luzzini, & Guerri, 2018). Therefore, manufacturing firms across the globe and in particular the People's Republic of China have taken multiple pro-environmental initiatives (Zibarras & Coan, 2015). Many manufacturing firms are powered by the desire to abolish wastes produced during the production process and dumping their products which will ultimately upgrade environmental performance (Melnik, Sroufe, & Calantone, 2003). Previous investigations proclaimed that an efficacious portrayal of organizational environment heavily contingent on employees' pro-environmental behaviors (Robertson & Barling, 2012). Consequently such, pro-environmental behaviors ensure and drive firms' environmental performance to a greater extent (Blok, Wesselink, Studynka, & Kemp, 2015). These implications aren't validated only in the context of the natural environment but also applicable for corporate sector performance and their employees' attitudes and behaviors (Norton, Parker, Zacher, & Ashkanasy, 2015).

Consistent with extant literature, the present study views that human resource management plays a central role in magnifying environmental performance. Organizations ensure environmental management through Green human resource management practices (GHRMP) encompassing, green hiring, training & development, green performance management & compensation by integrating these practices with environmental goals (Ren, Tang, & Jackson, 2018). The construct of green human resource management (GHRM) has notably gained attraction in the dilemma of environmental management (Ren et al., 2018). Being the catalyst agents of GHRMP, employees who spend ample time at workplace climate can exhibit pro-environmental behavior and exert efforts to gain environmental performance and sustainable development (Ruepert et al., 2016) and facilitate the organization to create a balance between two divergent goals (economic goals and environmental goals). Thus, organizational members may contribute drastically to the accomplishment of corporate greening and environmental performance through a profound series of pro-environmental behaviors (Lülfes & Hahn, 2013).

Though a decent amount of recent studies focuses on pro-environmental behaviors and environmental performance (Norton et al., 2015; Paillé et al., 2014). Nevertheless, these constructs need to be rigorously researched upon due to its complex and dynamic nature and it yet remains misunderstood which employees' pro-environmental behavior is more important in aggregating environmental performance. Previous studies proclaimed that organizational practices and activities, for instance, GHRMP, outline individuals' psychological climate, which is narrated as, people's perceptions of the working environment (Li, Frenkel, & Sanders, 2011). Relying on the psychological climate scholarly work, GHRMP stimulates a psychological green climate, which will in turn enforce employees to demonstrate pro-environmental

behavior (Paillé et al., 2014). The effectiveness of managing an organization's environment heavily hinges on pro-environmental behavior since their behavior determine the company's environmental performance at large (Kim et al., 2019). Knowledge is an integral construct in achieving environmental performance in the manufacturing sector. The lack of knowledge among employees could be a major impediment to effective environmental performance. The absenteeism of environmental knowledge may bring a feeling of coercion and circumvention of pro-environmental behavior (Okumus, Köseoglu, Chan, Hon, & Avci, 2019), which in turn delineates that insufficient environmental knowledge may impede environmental management initiatives. It is obviously evident that employees who have undergone through extensive green training will become more knowledgeable about environmental issues and will be more equipped with resources to alleviate these concerns (Pinzone, Guerri, Lettieri, & Huisin, 2019).

Despite the intense knowledge on the said constructs, it is still subject to query that how GHRMP and corporate environmental strategy may play its dramatic role in fostering environmental performance via psychological green climate and employees' pro-environmental behaviors (Ojo & Raman, 2019). By investigating aforesaid relation, the current study responds to call of Dumont, Shen, & Deng (2017a, b) who opined that other psychological and individual factors may be found more suitable to interpret the role of GHRMP on pro-environmental behavior and environmental performance. This research extended their model by incorporating corporate environmental strategy and GHRMP as antecedents of pro-environmental behavior and environmental performance. A keen analysis reported that the role of GHRMP and corporate environmental strategy to affect such pro-environmental behavior is still deficient (Dumont et al., 2017a, b) and needs to be studied in a different corporate context, such as the industrial context (Yong, Yusliza, & Fawehinmi, 2019). Having said that such relation is being neglected (Zibarras & Coan, 2015), it implies authors to further research deeply into said phenomena to identify more psychological and behavioral antecedents. Additionally, a study by recent scholars (Saeed et al., 2019) confers that mediating and moderating roles should be established between GHRMP and pro-environmental behavior to find underlying mechanisms. In a more recent study, it is highlighted that environmental knowledge has been less studied in the milieu of GHRMP (Ren et al., 2018).

In conclusion, there has been a notable lack of literature that investigates how GHRMP and corporate environmental strategy empowered firms to enhance their environmental performance. Therefore, focal input and purpose of the present study is to investigate green psychological climate as an antecedent of pro-environmental behavior and explore how environmental knowledge act as a moderator between pro-

environmental behavior and environmental performance in the case of industrial firms in China to fill aforesaid knowledge gaps. The study further attempts to assess the mediating role of green psychological climate between the relation of GHRMP and pro-environmental behavior to respond to the call of the recent study (Saeed et al., 2019). The following section, reports a section on theoretical foundation and literature review. The methodology Section exhibits the results and analysis. Next section renders a paramount explanation in the discussion, theoretical & practical implications/contributions, limitations, and future research directions. To end, last Section delivers the conclusion of the paper.

Literature Review

Theoretical Foundation

The current study model (given in Fig. 1) is grounded on two models namely **Social Cognitive Theory (SCT)** and **Norm Activation Model (NAM)**. These theories try to indicate the work and execute it for their predictable consequences (Lee & Lee, 2008). People are responsive to outer impacts; however, they are additionally proactive and ready to self-manage due to socio-cognitive aspects and their perceptions (Dumont et al., 2017a, b). In these theories, the focus is on “person’s beliefs”. When the individual believes themselves responsible and values their efforts to support the environment, then they can work to reduce the harmful effect as a result positively influences the environment (Dumont et al., 2017a, b).

The model of triadic mutual benefit explained human functioning indicated by social-cognitive theory. Social cognitive theory is based upon three factors i.e. cognitive and other personal factors, external environmental influences, and overt behavior. No doubt they affect each other and these factors are usually integrated and aligned and may leave their influences (Dace, Stibe, & Timma, 2020).

The social-psychological model presented by Stern, Dietz, & Kalof (1993) that was initially presented by Schwartz’s (1977) Norm Activation Model (NAM) is considered for the current study. In the 1960s, Schwartz initially introduced the norm activation model and gone through a series of articles

that have been prepared by him for this model with modifications. Usually recycling and conserving factors have been provided by norm model activation (Xiao & Buhrmann, 2019). In the past decades, three types of pro-social behavior that are: (a) awareness of consequences, (b) responsibility, and (c) personal norms (Rosa & Collado, 2019). In this theory, the main crux lies in the fact to generate awareness of harmful effects on people with regard to the environment. According to Schwartz’s, an individual’s norm increased, when people get outcomes from awareness of the environment then they accept their responsibility. The combined effort is required to stop harmful effects and by doing so it becomes a social norm to be followed and aligned with seeking optimum benefits. The pro-environmental behaviors have been considered more effective in the latest studies admitted (De Groot & Steg, 2009; Esfandiar, Dowling, Pearce, & Goh, 2020; Onwezen, Antonides, & Bartels, 2013).

This study proclaims that GHRMP influences the organizational environmental performance through green psychological climate inclining towards pro-environmental behaviors. The construct environmental knowledge may strengthen the interactions addressed in Fig. 1 through the moderating role of environmental knowledge within the relationship between pro-environmental behaviors and organizational environmental performance. This model highlights that the individuals are well equipped with the awareness regarding their role in adding value to society and they follow the norms responsibly. Certainly on the basis to support the environmental knowledge in the moderating role in the between have focused on pro-environmental behaviors and organizational environmental performance (Han, Hwang, & Lee, 2017). Usually, when individuals have the knowledge they try to follow conserving behaviors (Chandra, 2018; Kim & Seock, 2019). GHRMP disclosed the outcomes based on employees’ perceptions on the basis of the organization’s pro-environmental knowledge and psychological green climate under the umbrella of the Social Cognition Theory (SCT) and Norm Activation Model (NAM). So, considering SCT and NAM the GHRMP elucidates the employees’ cognition to deal with and manage the knowledge and expertise to focus on the values and awareness to protect the environment.

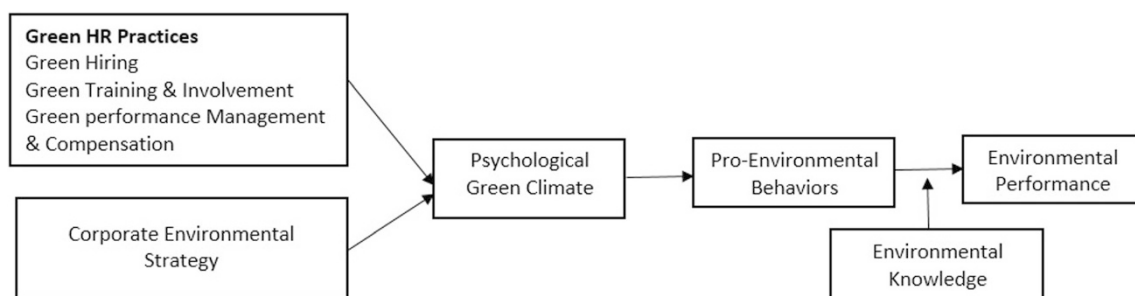


Fig. 1 Research Framework

Hypotheses Development

Green Human Resource Management Practices and Psychological Green Climate

GHRMP is standing on the sustainability troika of maintaining economic, social, and environmental balance and reaping long term benefits for the organization as well (Dumont et al., 2017a, b). The emphasis regarding environmental concerns to follow the relevant principles and theories through human resource management is considered as GHRMP (Renwick, Redman, & Maguire, 2013). Employees' willingness in organizations to follow eco-friendly practices is an important aspect of contributing to pro-environmental behaviors. The execution of GHRMP initiates with recruitment and selection to training and development, employee relations, performance, and appraisals and it is usually emphasized that this whole process goes through multiple dimensions (Das, Biswas, Abdul Kader Jilani, & Uddin, 2019). The betterment in environmental performance can always be attained by considering the HRM practices.

In the same manner if workplace context encourages its staff to seek information and follow environment supportive practices may bring an effective change in the form of psychological green climate. GHRMP designs job and workplace scenario that induces the green psychological climate even in the personal lives of stakeholders (Dumont et al., 2017a, b). The stakeholders at workplace consider the GHRMP as a major stimulator of the employees work scenarios (Das et al., 2019).

Eco-friendly vision and mission along with organizational nitty grit ties have been considered as a multidimensional phenomenon in few studies (Pham, Thanh, Tučková, & Thuy, 2020). Literature has depicted that climate influences the employees' behavior (Das et al., 2019; Dumont et al., 2017a, b; Pham et al., 2020; Yusliza, Othman, & Jabbour, 2017). The ecological realm has reflected the norms associated with throwing mess, reprocessing, and reutilizing the things and conservative behaviors. We extend this study to the organizational scenario that highlights the GHRMP followed by the mindset regarding psychological climate and pro-environmental behaviors to be operative and suitable for promoting organizational performance. So, in this regard, we may hypothesize

H1: Green HRM practices are related to psychological green climate.

Corporate Environmental Strategy and Psychological Green Climate

Corporate environmental strategy determines diverse options that reflect the planned and unplanned phases of any

organization (Norton, Zacher, Parker, & Ashkanasy, 2017). Generally, the managers deal with numerous consequences to follow environmental strategies. The diverse environmental strategies may perhaps be followed by considering the period and the organizational cost benefits requirements (Paillé & Raineri, 2015). Universally the corporate environmental strategies may encompass the corporate environmental risks and performance. The corporate environmental strategy and induces the green psychological climate among the stakeholders at workplace (Norton et al., 2017). As in case the corporate strategy is to support environment for which employees may exhibit behaviors that are influenced by psychological green climate. If the corporate strategy is to reward employees for innovative environmental the initiatives the green psychological climate would be reflected by the employees being motivated and stimulated to engage in environment supportive practices (Aguinis & Glavas, 2013).

Organizations' concern for environmental strategies is increasing and includes different challenging issues i.e. eco efficacy, prevention of pollution, developing products, and corporate social responsibility (Dumont et al., 2017a, b). At the national level, the dynamic environmental protocols and social scenario require operational flexibility to deal with and manage the environmental standards in the best possible manner (Aguinis & Glavas, 2013; Khan, Ali, Usman, Saleem, & Jianguo, 2019). Some organizations feel it more important to compete on corporate environmental strategy along with other strategies. The environmental standards are important to be followed by the organizations to keep working and following proper environment friendly phenomenon (Sharma, 2000). This study focuses the elements that may enhance the preservation and execution of corporate environmental strategy. We hypothesize

H2: Corporate environmental strategy is related to psychological green climate.

Psychological Green Climate and pro-Environmental Behaviors

Green psychological climate implies the employees combined perception regarding the organization's potentials to enhance the green standards (Dumont et al., 2017a, b). GHRMP is followed by the organization that wants to add value beyond the economic perspectives and consider ecological benefits as well (Chatelain et al., 2018). For this, the organization's strategic management tries to induce green psychological and pro-environmental awareness among employees (Saeed et al., 2019). Organizations attempt to transform the mindset of the employees by implying the green objectives and to get them engaged in pro-environmental behaviors. Organizations if do not go green than the employees may perceive the

organization to be less responsible socially and hence it may deteriorate the psychological climate perceptions and pro-environmental behaviors (Whitmarsh & O'Neill, 2010). So the organizations need to clarify the stakeholders even from the job designing to environmental management and ultimately towards enhancing the organizational environmental performance (Saeed et al., 2019). In this regard, the employees become aware of their roles and responsibilities to be involved in green activities (Pinzone et al., 2019). So, this study is an attempt to explain the relationship between the green psychological climate and pro-environmental behavior of employees. We have come up with the following hypothesis:

H3: The psychological green climate has a relationship with pro-environmental behaviors.

Pro-Environmental Behavior and Environmental Performance

Considering the previous literature, the researchers have been concerned about the influences of environmental management on organizational performance rather than focusing on the pro-environmental behaviors influencing the organizational environmental performance (Suganthi, 2019). Pro-environmental behavior reflects the integration of organizations' effectiveness in seeking ecological betterment. The impact of environmental management has been studied on environmental performance as one aspect of human resource practices depicting that HR practices supported by environmental management improve environmental performance (Alt & Spitzack, 2016). Likewise, a study highlighted that the organizations that consider environmental management through HR practices particularly by training their workforce regarding protecting the natural environment add value in environmental performance (Sawitri, Hadiyanto, & Hadi, 2015). For the present study, the researchers are concerned to focus on going through the relationship regarding pro-environmental behaviors and organizational environmental performance in the manufacturing context as limited studies are available in this regard. So, it is hypothesized;

H4: Pro-environmental behaviors are positively related to environmental performance.

Mediating Role of Psychological Green Climate

The psychological green climate brings about employees a shared perspective that reflects the workplace concerns regarding ecological wellbeing (Chatelain et al., 2018). Employees shared perception regarding environmental concerns followed by the organization's rules and regulations,

norms and customs, policies, and procedures may well be depicted through GHRMP and pro-environmental behaviors. The green psychological climate is based on the social cognition process (Dumont et al., 2017a, b). Employees' interaction with each other and the policies executed through the management shape up the psychological climate and if the concern is to support the environment it implies to green psychological climate. GHRMP usually establishes the standards and criteria which in return are being pursued by the employees.

Moreover, GHRMP encourages the employees to raise their concerns regarding pro-environmental behaviors through green psychological climate (Saeed et al., 2019). The organizational strategies particularly the corporate strategy is expected to persuade and motivate employees regarding environmental standards. Employees' social interactions within their diverse social circles such as supervisors, peers, and relatives, etc. form employees shared perceptions entail implicit processes that support the environment. Green psychological climate not only stimulates environment supportive behaviors but also encourages the stakeholders to exhibit discretionary and pro-social behaviors (Sawitri et al., 2015). Previous studies highlighted the green psychological climate encourages pro-environmental behaviors (Whitmarsh & O'Neill, 2010). So this study is an attempt to investigate the mediating role of green psychological climate between GHRMP and pro-environmental behaviors and corporate environmental strategy and pro-environmental behaviors. We hypothesize

H5: Psychological green climate mediates the relationship between green HRM and pro-environmental behaviors.

GHRMP highlights the importance of the organization's corporate strategy established through the standards to encourage the stakeholders (Saeed et al., 2019). By devising the corporate strategy, the management tries to align the organization's concern to environment supportive practices with the employees' psychological green climate. GHRMP not only enforces the standards through rewards and punishments but also encourages the stakeholders to consider the raised concern regarding the ecological culture not only at the workplace but also beyond it (Chatelain et al., 2018). Though pro-environmental behaviors are of ethical concern and consider it important to protect the natural environment so it is likely to develop and promote environmental standards through inducing environment supportive corporate strategy. The organization's agenda regarding pro-environmental behaviors are supported through the organizational policies and procedures to support the natural environment and also signify through employees' values and working patterns. So, this study is an effort to examine the mediating role of green psychological climate between corporate environmental strategy and pro-environmental behaviors. We may hypothesize

H6: Psychological green climate mediates the relationship between corporate environmental strategy and pro-environmental behaviors.

Mediating Role of pro-Environmental Behaviors

The pro-environmental behavior highlights the combination of an organization's effectiveness in pursuing environmental improvement. The influence of environmental management has been focused on the eco-friendly practices describing that HR practices usually supported by green psychological climate increase the environmental performance (Alt & Spitzack, 2016). Individuals usually learn by observing and following others (Suganthi, 2019). Considering this, literature has depicted that the organization's environment and policies influence the employees and the workplace is so influential that it shapes up the employees' behaviors Alt & Spitzack, 2016).

The organizational culture molds the employees' conduct and concerns regarding pro-environmental behaviors (Suganthi, 2019). A stable procedure of pro-environmental behaviors, management indicates employees to follow such behaviors that are appreciated and expected in the workplace. So, stakeholders grasp that enacting such behavior will lead to anticipated concerns and consequently will be encouraged to involve in these same conducts themselves (Sawitri et al., 2015). Similarly, a psychological green climate involves workplace pro-environmental behaviors to be aligned with the organizational values rather than through any intent to influence others (Sawitri et al., 2015). When employees see their organizational management to be concerned about the pro-environmental behaviors, the green psychological climate influences them by improving environmental performance. Thus, we develop this hypothesis

H7: Pro-environmental behaviors mediate the relationship between psychological green climate and environmental performance.

Moderating Role of Environmental Knowledge

Seeking knowledge and awareness about environmental aspects and coming up with devising betterment in these concerns is called environmental knowledge (Paço & Lavrador, 2017). Usually, employees' understanding and knowledge seem to affect the decision making and intentions of an organization. Individuals at the workplace usually avoid themselves to be part of those situations about which they feel ignorant (Otto & Pensini, 2017). If people seem to have awareness and knowledge about something their propensity to buy that product also increases. Awareness regarding

environmental concerns makes individuals perform social responsibility by indulging in pro-environmental behaviors and affecting organizational environmental performance (Zareie & Navimipour, 2016).

People having awareness regarding the environment tend to play their role in protecting the environment by spending on green products, using natural and organic products indulging in green activities and recycling waste, etc. Environmental knowledge influences the intentions to be engaged in pro-environmental behaviors. The individual who seeks more knowledge seems to be involved in environmental supporting behaviors (Zareie & Navimipour, 2016). Hence, the environmental knowledge of the individuals at the workplace may moderate the workplace pro-environmental behaviors and organizational environmental performance. We hypothesize;

H8: Environmental knowledge moderates the association of pro-environmental behaviors and environmental performance.

Methodology

Design and Participants

Data were collected from manufacturing firms located in Jiangsu, China, as these manufacturing organizations were following the green practices and strictly ensuing the rules and regulations mentioned under the 'Environmental Protection Law'. A self-administered questionnaire was employed for data collection from selected firms and purposive sampling was used. Data were collected from the employees who were directly engaged with the implementation of green practices. Surveyors were hired for data collection. As per the instructions provided to the surveyors, they informed all the respondents regarding the research purpose and then asked them to fill the questionnaire. After they agreed they were handed over with the questionnaire to fill it. Out of twenty selected firms, 450 employees completed the questionnaires. Finally, 374 valid responses were used for the data analysis.

A total of 374 employees participated in this survey from different manufacturing firms in China. Findings showed that out of 374 participants, 55.3% (207) were male and 44.7% (167) were female. The majority of the employees were aged from 26 to 45 years. The survey accounted for 67.1% (251) of respondents being in that age group. While 24.9% (93) of them were of ages up to 25 years old, and the remaining 8% (30) belonged to the age group of 46–55 years. In terms of qualification, 74.6% (279) of participants had bachelor's degree, followed by 21.4% (80) with Master's degree, 2.4% (9) fell in the others' category (Diploma or Professional

Qualification), and the remaining 1.6% (6) had obtained their Ph.D. Meanwhile, 56.7% (212) of respondents had permanent job positions, while 40.1% (150) were on the contractual nature of employment and the remaining 3.2% (12) were Internees in their respective firms. The results relating to their length of service, found that 21.1% (79) had up to one-year job experience, 47.9% (179) of participants had 2–5 years of experience, while 19.3% (72) had 5–10 years of experience, and remaining 11.8% (44) had 10+ years of job experience in their respective firms.

Questionnaire and Pre-Test

All the measuring instruments to measure the underlying constructs were adapted from the previous studies. All of them were multi-item measures. A scale of Green human resource management practices is comprised of three dimensions named as green hiring, green training & involvement, and green performance management & compensation. Based on a recent study by Mousa and Othman (2020), six items scale was adapted to measure green hiring. Eight items were used to measure the green training & involvement that were adapted from a study by Yusoff, Nejati, Kee, and Amran (2018). Based on a recent study by Tang, Chen, Jiang, Paille, and Jia (2018), four items were used for green performance management & compensation. A four items scale was used to measure the corporate environmental strategy that was developed by Ramus and Steger (2000). Besides this, five items scale was used to measure the psychological green climate that was developed by Norton, Zacher, and Ashkanasy (2014). Moreover, 6 items were used to measure the pro-environmental behavior that was developed by Roberson and Carleton (2018). Environmental knowledge was measured by nine items that were developed by Gatersleben et al. (2002). Lastly, a 7-item scale that was developed by Kim et al. (2019) was used to measure the environmental performance in manufacturing firms (Table 4).

Content validity was performed by sending the measurement instrument to five experts including two human resource managers of selected firms and three assistant professors having specialized education in human resource management. Based on their suggestions, some minor adjustments were made. To ensure clarity, a pilot study was conducted, and the questionnaire was given to 45 respondents to seek their feedback. The questionnaires required no amendments at all. Moreover, a reliability analysis was conducted to find out the internal consistency of the scales used in the study.

Data Analysis

The current study deployed PLS-SEM for testing the proposed hypothesis by using Smart PLS 3 because it is widely used and believed as a modern assessment technique in all business

sectors, particularly in the hospitality and tourism area (Rasoolimanesh, Ali & Jaafar, 2018). This empirical investigation aimed to predict and explain the studied latent variables grounded with contemporary theory. PLS-SEM has been revolutionized as an effective technique when the subject matter is to be tested for the purpose of implementing the structural modeling is elucidation and the estimation of constructs (Hair, Hult, Ringle, & Sarstedt, 2016). Additionally, it is assumed as a flexible technique for model assessment (Ringle, Wende, & Will, 2005). The next reason for adopting PLS-SEM is concerned with the lesser requirements with respect to sample size as compared to Amos and normality of data (Hair et al., 2016) therefore, this research used PLS-SEM to avoid data normality issues and sample size. Besides this, the PLS algorithm and bootstrapping technique are conducted to find factor loadings for testing the construct validity and internal consistency reliability (Rasoolimanesh et al., 2018), path coefficients, and corresponding significant level to test the hypotheses. First, the measurement model was calculated then estimations were found through structural model assessment.

Common Method Bias

It was more likely that common method bias (CMB) can accompany our data due to the nature of the research design of this study as data were taken from single source i, e. only from managerial employees. Past research proclaimed that full collinearity test could be deployed to find whether data was flamed with the issue of common method bias while using structural equation modeling (SEM) in partial least squares (PLS-SEM) technique (Kock (2015). Asserting on this study by Kock (2015), existing work attempted to estimate common method bias by viewing variance inflation factors (VIF) computed through a full collinearity test. The scores of VIF determine that the cut-off value of higher than 3.3 designate that estimated model might accompany the issue of CMB and in case the values are lesser than the said value of 3.3, then the tested model could be declared as free from CMB. Results demonstrated that all the scores of VIFs for all studied latent variables lie below than said cut off value thereby claiming that data was not contaminated with the error of CMB in extant research. In conclusion, CMV was not an issue of this study and can be proceeded for further empirical analysis.

Measurement Model Assessment

The measurement model was evaluated, and convergent validity was assessed by using loadings, average variance extract, and competitive reliability. Refer to Table 1 and Fig. 2, except for a few values, factor loadings exceeded the recommended value of 0.60. Similarly, all values of composite reliability (CR) also exceeded the recommended value of 0.70. All the values of average variance extract (AVE) for all under-

Table 1 Convergent Validity

1st Order Constructs	2nd Order Constructs	Items	Loadings	CR	AVE		
Green Hiring	Green HRM	GH1	0.829	0.934	0.780		
		GH2	0.911				
		GH3	0.920				
		GH4	0.869				
Green Training & Development		GTI1	0.890	0.909	0.626		
		GTI2	0.847				
		GTI3	0.733				
		GTI4	0.691				
		GTI5	0.738				
		GTI6	0.828				
Green Performance Management & Compensation		GPMC1	0.889	0.928	0.810		
		GPMC2	0.928				
		GPMC4	0.883				
		GH	0.818				
Corporate Environmental Strategy		GTI	0.513	0.919	0.559		
		GPC	0.847				
		CES1	0.904			0.942	0.765
		CES4	0.927				
		CES5	0.895				
		CES6	0.795				
CES8	0.846						
Psychological Green Climate	PGC1	0.870	0.912	0.723			
	PGC2	0.711					
	PGC3	0.892					
	PGC4	0.913					
Pro-Environmental Behaviors	PEB1	0.948	0.942	0.720			
	PEB3	0.980					
	PEB6	0.950					
Environmental Knowledge	EK1	0.873	0.792	0.501			
	EK2	0.547					
	EK3	0.638					
	EK5	0.717					
Environmental Performance	EP1	0.808	0.931	0.729			
	EP2	0.885					
	EP3	0.848					
	EP4	0.898					
	EP5	0.826					

Note: CR- Composite Reliability; AVE- Average Variance Extracted

study constructs exceeded the recommended values of 0.50 (Hair et al., 2016). Items were deleted with the lowest factor loadings (<0.50). Likewise, the findings from Heterotrait-Monotrait Ratio (HTMT) validated discriminant validity of the measurement as from Table 2, it can be seen that all values are less than the confirmed cut off value of 0.85 as discussed by Kline (2011) that if values are less than 0.85 then measurement confirmed its discriminant validity. On the whole, both results

ensured that discriminant validity is not a threat to the existing research.

Structural Model Assessment

Structural modeling was performed to estimate hypotheses in the context of manufacturing firms after confirming that the model is reliable and valid by evaluating the measurement model. Path coefficients, t-values, and standard errors are

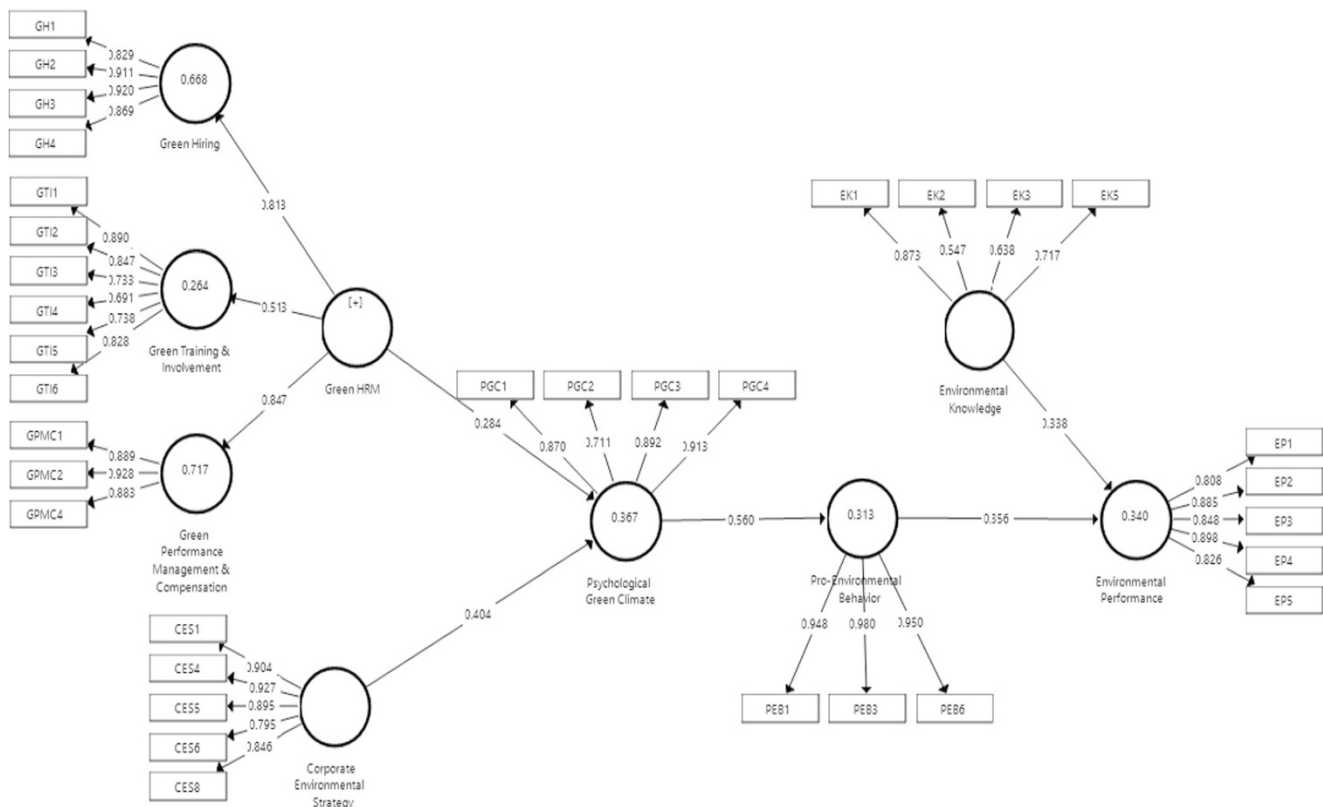


Fig. 2 Measurement Model Assessment

computed to determine that model and relationships are significant with collected data. The values of path coefficients showed whether hypotheses were supported or not supported. The bootstrapping procedure was calculated in Smart PLS 3 (Ringle et al., 2005) to estimate for the main and moderation effects. As shown in Table 3 and Fig. 3, green HRM significantly and positively associated with psychological green climate ($\beta = 0.284$, $t = 5.645$; $LL = -0.208$, $UL = -0.372$), thereby H1 is supported. The findings also exposed that there was a statistically significant relationship between corporate environmental strategy and psychological green climate ($\beta = 0.404$, $t = 8.985$; $LL = 0.329$, $UL = 0.482$), thus H2 is

supported. In addition to this, psychological green climate has significant relationship with pro-environmental behaviors ($\beta = 0.560$, $t = 14.293$; $LL = 0.493$, $UL = 0.619$), thereby H3 is supported.

Besides this, it was also found that pro-environmental behavior has significant and positive association with environmental performance ($\beta = 0.387$, $t = 8.320$; $LL = 0.294$, $UL = 0.452$) thus, H4 is supported. Refer to Table 3 and Fig. 3, it could be seen that psychological green climate significantly mediated that relationships of green HRM ($\beta = 0.159$, $t = 4.954$; $LL = 0.114$, $UL = 0.218$) and corporate environmental strategy ($\beta = 0.226$, $t = 7.442$; $LL = 0.172$, $UL = 0.275$) with

Table 2 Discriminant Validity (HTMT Ratio)

	CES	EK	EP	GHRM	GH	GPMC	GTI	PEB	PGC
CES									
EK	0.536								
EP	0.801	0.612							
GHRM	0.584	0.529	0.624						
GH	0.471	0.33	0.511	0.811					
GPMC	0.432	0.537	0.524	0.828	0.556				
GTI	0.535	0.675	0.669	0.57	0.354	0.576			
PEB	0.472	0.493	0.527	0.363	0.219	0.342	0.463		
PGC	0.596	0.679	0.734	0.557	0.35	0.495	0.858	0.608	

Table 3 Path Analysis

Relationships	Beta	S.D	T-value	P Value	L.L	U.L	Decision
H1 Green HRM ->Psychological Green Climate	0.284	0.05	5.645	0.034	0.208	0.372	Supported
H2 Corporate Environmental Strategy ->Psychological Green Climate	0.404	0.045	8.985	0.021	0.329	0.482	Supported
H3 Psychological Green Climate ->Pro-Environmental Behavior	0.56	0.039	14.293	0.011	0.493	0.619	Supported
H4 Pro-Environmental Behavior ->Environmental Performance	0.387	0.047	8.32	0.022	0.294	0.452	Supported
H5 Green HRM ->Psychological Green Climate ->Pro-Environmental Behavior	0.159	0.032	4.954	0.043	0.114	0.218	Supported
H6 Corporate Environmental Strategy ->Psychological Green Climate ->Pro-Environmental Behavior	0.226	0.03	7.442	0.029	0.172	0.275	Supported
H7 Psychological Green Climate ->Pro-Environmental Behavior ->Environmental Performance	0.217	0.035	6.227	0.039	0.154	0.27	Supported
H8 PEB*EK ->Environmental Performance	0.184	0.048	3.838	0.042	0.109	0.267	Supported

pro-environmental behaviors, so H5 and H6 are statistically supported. Moreover, it was also evident that pro-environmental behavior mediated the association of psychological green climate with environmental performance ($\beta = 0.217$, $t = 6.227$; $LL = 0.154$, $UL = 0.270$), thus H7 is supported. Last but not least environmental knowledge significantly and positively moderates the relationship between pro-environmental behavior and environmental performance ($\beta = 0.184$, $t = 3.838$; $LL = 0.109$, $UL = 0.267$) thus, H8 is supported.

Furthermore, Smart PLS 3 produces a simple slope analysis to interpret the moderation (interaction) results and for the visual presentation of the strength and direction of the moderating effect. Slope plots are usually used to visualize the interaction terms and to have an insightful understanding of the moderation effect (Memon et al., 2019). As shown in Fig. 4, a high level of environmental knowledge strengthened the positive associations between pro-environmental behaviors and environmental performance.

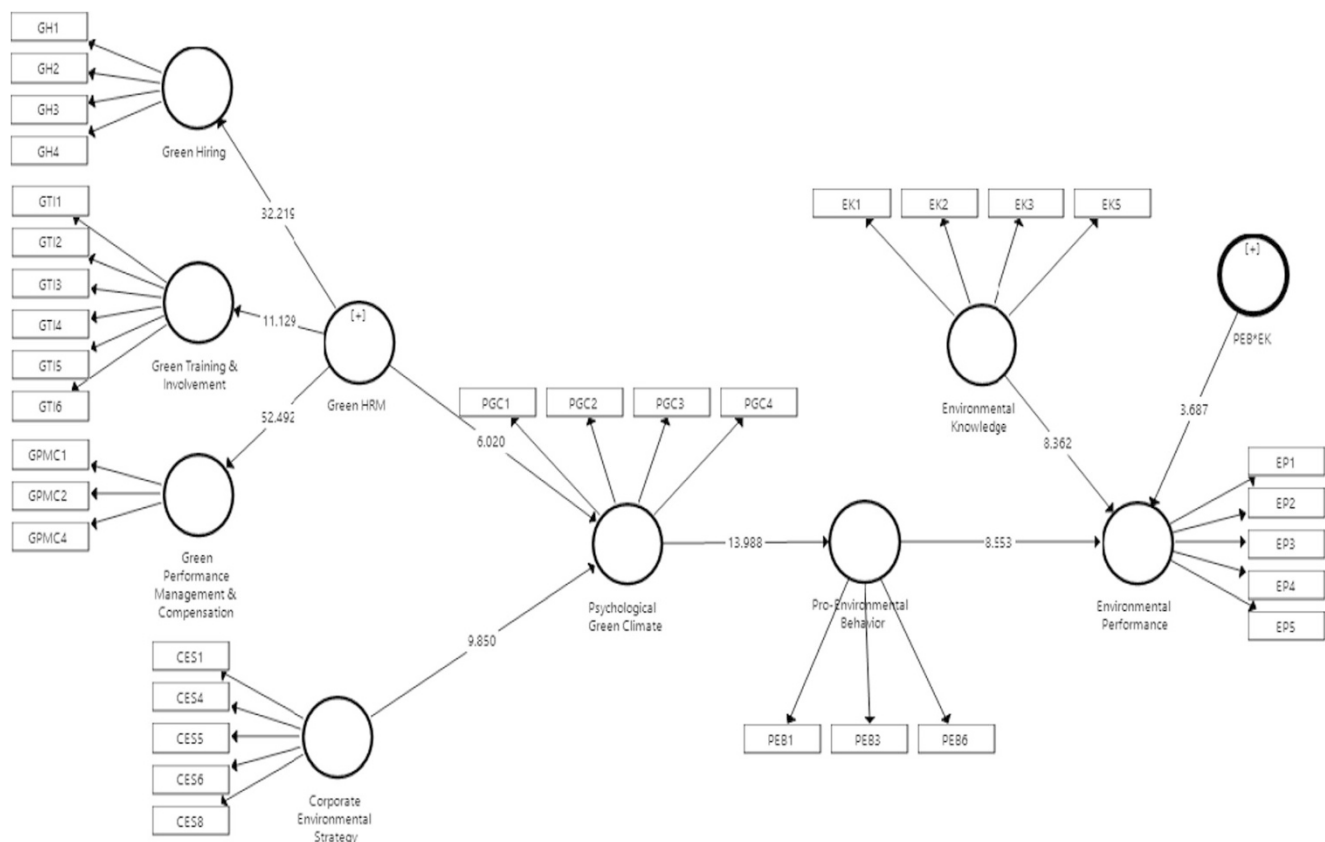
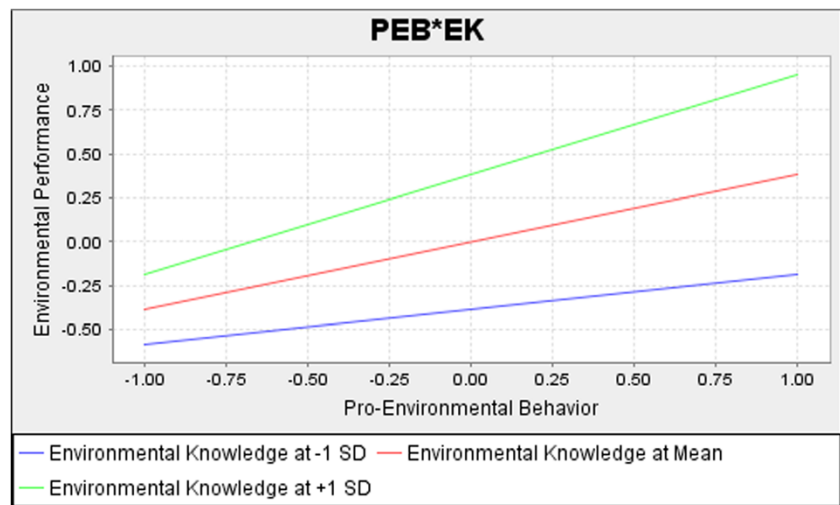
**Fig. 3** Structural Model Assessment

Fig. 4 Simple Slope Analysis



Discussion

The findings of the current study postulate the significance of the GHRMP (Green hiring, green training & involvement, green performance management & compensation) in amplifying environmental performance under the theoretical underpinnings of Norm Activation Model and Social Cognition Theory. The results verified green psychological climate as an antecedent of pro-environmental behavior and exerts significant impact on pro-environmental behaviors. Furthermore, environmental knowledge moderates the relationship of pro-environmental behavior and environmental performance. The findings suggest that human resource professionals working in manufacturing firms could one of the active agents who can involve other employees by creating and developing environmental knowledge base HR practices. Such environmental knowledge further induces employees to adopt pro-environmental behavior which could respond in optimizing environmental performance. Hence, the study bridges the gap by empirically verified the moderating influence of environmental knowledge. The study findings indicated that GHRM has a significant association with the psychological green climate. It suggests that eco-friendly organizational strategies and commitment to implement GHRMP influence employee behaviors while working in a psychological green climate as confirmed by earlier research (Das et al., 2019; Dumont et al., 2017a, b; Pham et al., 2020; Yusliza et al., 2017). Similarly, the corporate environmental strategy positively predicts the psychological green climate. The positive findings indicated that employees' positive perceptions about the importance of corporate strategy enable the creation of the green psychological climate. The creation of such an environment urges employees to adopt the pro-environmental behavioral leading to improved environmental performance. The valuable insights unveiled by employees about the corporate environmental strategy is important for adopting pro-environmental behaviors as such behaviors are

not officially appraised and compensated as per usual HRM practices (Das et al., 2019). Furthermore, the study findings advocated that pro-environmental behaviors contribute positively to building environmental performance. The current research by collecting data from employees working in manufacturing forms of China and analytical findings supported the hypotheses. Thus, the study filled a gap in the existing literature by evaluating the mediating role of green psychological climate between the relation of GHRMP and pro-environmental behavior (Saeed et al., 2019).

The green psychological climate turned out to an important resource that can strengthen the relationship between GHRMP and pro-environmental behaviors. Despite the significance of green psychological climate and pro-environmental behaviors there still an area of comprehensive empirical research associated with the proposed research framework Norton et al., 2015; Paillé et al., 2014). Hence in this study, we author examined the moderating effect of environmental knowledge on the relationship between pro-environmental behavior and environmental performance. Employees having awareness and knowledge of environmental issues stimulate them to adapt to pro-environmental behaviors which could have a significant influence on the organizational environmental performance (Chandra, 2018; Kim & Seock, 2019). Empirically tested observation provides support for this moderating relationship and has postulated that employees with enhanced environmental knowledge inculcate pro-environmental behaviors within employees which ultimately augments organizational environmental performance. Concerning the current environmental challenges; the corporate strategic directions paved environmental issues in their organizational corporate strategy to deliver sustainable performance outcomes as indicated by the research findings. The implementation of GHRMP is not a novel concept. However, the importance of such practices is progressing in the current global era where nations are putting deliberate

efforts to achieve corporate greening by acclimatizing individuals to perform pro-environmental behaviors. Thus, the study recognized that employees play a pivotal role in environmental performance while displaying pro-environmental behavior by employing green human resource practices and discern corporate environmental strategy with a central aim to promote psychological green culture.

Theoretical Contributions

As discussed above, environmental performance has become a significant research area due to the ever-increasing concern to protect the environment. Despite the research conducted in this domain, it remains unclear how corporate environmental strategy and GHRMP builds mechanism to enhance environmental performance (Norton et al., 2015; Paillé et al., 2014; Saeed et al., 2019). The present study theoretically contributes in a number of ways. Firstly, to bridge the research gap the current research theoretically contributes by testing the relationships amongst the study constructs under the integrated theoretical paradigms of SCM and NAM in the context of Chinese manufacturing firms. Secondly, while reviewing the growing research trends in the Chinese context, the current research study is undertaken to fill the research gap and get in-depth knowledge about the complex phenomenon of the pro-environmental behavior of the employees and how it is related to the environmental performance. Thirdly, the researcher builds consensus that knowledge is one of the important components which improves the environmental performance (Ojo & Raman, 2019). Irrespective of the massive research, the research is silent concerning how GHRMP and corporate environmental strategy contributes to optimizing environmental performance. Hence the current study advances the literature by investigating the positive role played by GHRMP and corporate environmental strategy via the intervening mechanism of psychological green climate and employees' pro-environmental behaviors. Fourthly, the current research responds to the scholarly work conducted by (Dumont et al., 2017a, b) who advocated that in addition to the psychological green climate the individuals' pro-environmental behavior influences environmental performance. Hence this research is in extension by adding the predictor of corporate environmental strategy as one of the significant antecedents of pro-environmental behavior and environmental performance. Lastly, this study contributes to the existing body of literature through the incorporation of environmental knowledge as a moderator between pro-environmental behavior and environmental performance to fill the knowledge gap highlighted in earlier studies (Otto & Pensini, 2017; Ren et al., 2018). Hence the current research study extends the blended paradigms of SCM and NAM by providing empirical evidence of the moderating impact of environmental knowledge on the pro-environmental behavior and environmental performance

Practical Implications

This research study provides valuable practical implications to the top management, policymakers ensuring the commitment of employees towards corporate environmental strategy. As such strategies foresee, design, and incorporate the corporate level environmental risks which envision the employees' interest in environmental performance. The study provides practical implication to the managers of the firms who are looking towards their employees to adopt pro-environmental behavior and implement the GHRMP for the enhanced environmental performance at the organizational level. As earlier research (Ren et al., 2018; Saeed et al., 2019; Li, Naz, Khan, Kusi, & Murad, 2019; Naz et al., 2020) recommended that organizations should focus on GHRMP (hiring, training & involvement, performance management & compensation for effective implementation of green policies. Organizations should strive hard to build a green psychological climate by implement GHRMP and corporate environmental strategy. The environmental concern at the managerial level; led them to be responsible for implementing green HRM policies. So, managers should be accountable to perform their HRM activities with the central concern of GHRMP.

Further to gauge and augment environmental performance the corporate environmental strategies should be cascade within the firms by setting performance goals and targets of the employees regulated by green performance management and compensation system. Such policies motivate them to perform their role befitting organizational social and environmental outcomes. Lastly, the study findings provide directions to practitioners to rewards employees through monetary as well as non-monetary ways to motivate them to participate in pro-environmental behaviors. To encourage employees to perform pro-environmental behaviors; managers should seek their suggestions to overcome environmental issues. Practicing these activities subsequently increases employees' interest to perform pro-environmental behaviors.

Limitations and Future Research Directions

Though the current research study has achieved its objectives there are certain limitations associated with it. Firstly, the data was collected from manufacturing firms located in Jiangsu, China only by employing a purposive sampling technique. So future research could be conducted by collecting data from different geographical locations of china who follow the green practices to bring forth valuable insights in regard to the role of GHRMP towards environmental performance. Secondly, there could be an issue of CMV; as self-reported survey questionnaires were used to collect data via a single source of the data. However various statistical procedures were deployed to eliminate the potential influence resulted from CMV. It is recommended to conduct future research while collecting multi-

source data for different measures. Utilizing different sources of data collection utilizing different sources for independent and dependent constructs from multiple sources could minimize the shortcomings of single-source data sets which may impact testing of hypotheses. Finally, this research study examined environmental knowledge as a moderating variable on the relationship between pro-environmental behavior and environmental performance. Employees performing extra-role behavior and having a sense of corporate social responsibility could also influence the criterion variable of the study. Therefore, we author call for future researches to explore the moderating influence of organizational citizenship behavior at the individual as well as at the organizational level and modeling corporate social responsibility as a mediator. Exploring organizational citizenship behavior and corporate social responsibility will make greater contributions to the literature of GHRMP and environmental performance.

Conclusion

This research study concludes that GHRMP and corporate environmental strategy hinges as an important antecedent of green psychological climate and pro-environmental behaviors in the context of manufacturing firms of china to augment environmental performance. The study minutely examined how GHRMP and corporate environmental strategy develops the psychological green climate for employees to adopt pro-environmental behaviors. The analytical findings revealed that the corporate environment strategy adequately explains the psychological green climate which subsequently stimulates

employees to perform pro-environmental behaviors to bloom green initiatives. Furthermore, the results shed light on the precise development of the corporate level environmental strategy to motivate employees for the creation of eco-friendly workplace leading to optimizing environmental performance. Finally, to elicit the comprehensive benefits of pro-environmental behaviors demanded by the organization's study revealed the moderating influence of environmental knowledge for enhanced environmental performance.

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Materials Availability Not applicable.

Author Contributions All authors read and approved the final manuscript.

Data Availability We have data set which can be available on request.

Declarations

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

Conflict of Interest The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest. The author declares that he/she has no conflict of interest.

Appendix 1

Table 4 Note: This data is mandatory. Please provide

	Items	Source
	Green Hiring	Mousa and Othman (2020)
GH1	The hotel prefers to recruit employees that have knowledge about environment.	
GH2	Applicants for jobs in the hotel are subject to interviews to test their knowledge about environment	
GH3	In addition to other criteria, employees are selected based on environmental standards.	
GH4	Job seekers are attracted by the environmental image and policies of the hotel	
GH5	The job description includes the job's environmental aspects	
GH6	The recruitment message includes hotels' environmental values in job advertisement	
	Green Training and Involvement	Yusoff et al. (2018)
GTI1	Training programs about environment are provided to large-scale individuals in the hotel.	
GTI2	In general, staff are satisfied with the hotel's green training.	
GTI3	Topics offered through green training are modern and suitable for the institution's activities.	
GTI4	The hotel provides formal environmental training programs for employees to increase their ability to promote them.	
GTI5	Environmental training is a priority and an important investment.	
GTI6	The need assessment for green training helps to familiarize employees with environmental practices.	

Table 4 (continued)

	Items	Source
GTI7	Evaluation of green training and development helps to measure the employees' level of green knowledge and awareness.	Tang et al. (2018)
GTI8	Environmental objectives contain green training and development aspects green performance management & compensation	
GPMC1	We use green performance indicators in our performance management system and appraisals.	
GPMC2	Our hotel sets green targets, goals and responsibilities for managers and employees.	
GPMC3	In our hotel, managers are set objectives on achieving green outcomes included in appraisals.	Norton et al. (2014)
GPMC4	In our hotel, there are dis-benefits in the performance management system for non-compliance or not meeting environment management goals Psychological Green Climate	
PGC1	Engaging in and supporting green and sustainable initiatives is important in this hotel.	
PGC2	Saving energy is important.	
PGC3	Saving water is pivotal.	Ramus and Steger (2000)
PGC4	Reduction in the use of disposable products is critical.	
PGC5	Waste reduction and the control of harmful materials mean a lot to this hotel. Corporate Environmental Strategy	
CES1	Our hotel publishes an environmental policy.	
CES2	Our hotel has specific targets for environmental performance.	Roberson and Carleton (2017)
CES3	Our hotel publishes an annual environmental report.	
CES4	Our hotel uses an environmental management system.	
CES5	Our hotel applies environmental considerations in purchasing decisions.	
CES6	Our hotel provides environmental training to employees.	Gatersleben et al. (2002)
CES7	Our hotel makes employees responsible for environmental performance.	
CES8	Our hotel uses life cycle analysis of products/services.	
CES9	Our hotel's management understands/addresses issue of sustainable development.	
CES10	Our hotel systematically reduces use of toxic chemicals/fuel.	Kim et al. (2019)
CES11	Our hotel applies the same environmental standards anywhere. Pro-Environmental Behavior	
PEB1	Recycling cans, bottles and newspapers, etc., is inconvenient.	
PEB2	I hate having to wash out bottles for recycling.	
PEB3	Conserving materials, energy, etc., is inconvenient.	Gatersleben et al. (2002)
PEB4	I hate remembering to turn off lights, computers, etc., to conserve energy/materials.	
PEB5	Engaging in pro-environmental behaviors is inconvenient.	
PEB6	I hate the time and effort it takes to engage in pro-environmental behaviors. Environmental knowledge	
EK1	I know about the problem of environmental pollution caused by chemicals.	Kim et al. (2019)
EK2	I have a good knowledge about the environmental issues.	
EK3	I can see with my own eyes that the environment is deteriorating.	
EK4	I am aware of how to protect the environment from pollution.	
EK5	I am aware about climate change.	Kim et al. (2019)
EK6	I know what is clean energy and how to promote it.	
EK7	I have knowledge of landfill waste and its hazards.	
EK8	I am aware about unsustainable consumption.	
EK9	I know about land degradation and ways to stop it. Environmental Performance	Kim et al. (2019)
EP1	Environmental management within our hotel has...	
EP2	Our hotel has reduced wastes	
EP3	Our hotel has conserved water usage	
EP4	Our hotel has conserved energy usage	Kim et al. (2019)
EP5	Our hotel has reduced purchases of non-renewable materials, chemicals, and components.	
EP6	Our hotel has reduced overall costs	
EP7	Our hotel has improved its position in the marketplace	
EP8	Our hotel has helped enhance the reputation of our hotel	

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