Hapres | Journal of Sustainability Research

sustainability.hapres.com

Article

Comparing Goal Setting Approaches to Boosting Pro-Environmental Behaviors

Sandy Staples [1], Jane Webster [1,*], Shunan (Catherine) Lv [2]

[1] Smith School of Business, Queen's University, 143 Union St., Kingston, ON K7L 3N6, Canada

[2] Parks Canada, 3620 Kingston Road, Scarborough, ON M1M 1R9, Canada

* Correspondence: Jane Webster, Email: jwebster@queensu.ca.

ABSTRACT

Background: Corporations face challenges to adopting appropriate practices to effectively respond to environmental sustainability concerns. To help address this, the present research focuses on improving employees' pro-environmental behaviors related mostly to information technology and system use. To do so, we draw on and extend goal-setting theory by comparing three goal interventions: goal-setting, goal-setting plus implementation plans, and goal-setting with both implementation plans and visualization of success. For these, we also examine the role of individuals' environmental values as well as their conflicts with competing goals.

Methods: Two longitudinal studies examine individuals' self-set goals: the first examines employees' computer-based electricity usage in the workplace over six weeks and the second utilizes a diary approach method over four weeks to examine the effects of different environmental goal setting conditions on students' environmental outcomes. The impacts of environmental values (self-congruence) and conflicting goals are also explored in the second study.

Results: Both studies find that setting goals increases pro-environmental behaviors. However, rebound effects can occur when interventions are removed. Visualization of success appears to reduce this rebound effect and we suggest that future research continue to investigate methods for reducing rebound.

Conclusions: This paper contributes to environmental sustainability research in several ways: conceptually (by responding to calls for more theory-based research), methodologically (by measuring objective computer-based energy usage in study 1 and by utilizing a diary method in study 2), and practically (by demonstrating the effectiveness of visualization to goal setting and exploring the role of competing goals in this process).

KEYWORDS: environmental initiatives and impacts; green information systems; pro-environmental behavior; sustainability; goal setting; field experiment; rebound; values; goal conflict

Received: 31 March 2020
Accepted: 25 July 2020
Published: 06 August 2020

INTRODUCTION

Corporations face challenges to adopting appropriate practices to respond effectively to environmental sustainability concerns. Corporations of all types are introducing environmental initiatives, ranging from sustainable supply chains, energy management, and green information systems, to sustainability reporting. However, a significant gap remains between corporate sustainability goals and results [1,2]. It is demanding for organizations to successfully implement environmental initiatives [3] due to the complexities of environmental issues [4] and the uncertainties concerning business and the natural environment [5].

To help corporations meet some of their environmental challenges, this research focuses on improving pro-environmental behaviors (PEBs) through goal setting. Environmentally responsible behaviors in organizations, or PEBs, represent any actions taken by individuals that they believe will improve the environmental performance of the organization [6]. These may include such behaviors as conservation of resources, recycling, pollution prevention, and advocacy for environmental change [7]. Focusing on individuals has high potential for impact since their behaviors facilitate corporate social responsibility initiatives and organizational efforts to protect the environment [8]. All individuals consume materials and energy in their workplaces and they can influence others to adopt behaviors that are better for the environment [9].

Most past corporate research has been conducted at the organization level [10,11]. These top-down initiatives represent a key part of solving the greening puzzle (e.g., [12]), yet bottom-up interventions are also needed. Focusing on individuals is important, as their effects can go well beyond themselves [13]. For example, research has demonstrated that individual employees can have significant effects on the environmental sustainability of IS projects, even when their organizations' management has no interest in sustainability [14]. However, research that investigates pro-environmental behaviors of individuals in organizations is scarce and needed [15,16]. In contrast, most PEB research at the individual level has been conducted in households, rather than in organizations [17]. Further, past research tends to show a lack of long-term effects [18].

While most previous sustainability studies have focused on household settings (e.g., [19–21]), organizational factors such as power relations, group influences, reward structures, competing goals, and corporate norms and values create a different context than private life. This may alter the effects of any intervention. For example, an individual citizen (i.e., a person who acts individually or within a family unit) prompting a friend to recycle may be perceived as a gentle reminder while a boss prompting his employee to recycle may be perceived as an admonishment or reprimand: this means that the organizational recycling reminder will likely lead to different outcomes than the recycling reminder in one's personal life. The motivation and rewards for individuals to set goals and

change behaviors at home when they pay directly for their utilities (so they benefit from savings) may be more transparent than in an organization setting. On the other hand, in contrast to citizens, individuals in organizations can have wider-ranging influences. Not only may their own behaviors change, but they may have a greater impact by influencing their peers and managers to act more responsibly [9]. Thus, even though goal-setting is considered a valid and practical motivational theory often applied in the workplace [22], research is needed on the effectiveness of setting goals related to sustainability in this context. Moreover, goal setting is often combined with other interventions so that its specific effects cannot be determined (e.g., [23–25]). Researchers emphasize the importance of both management goal-setting and user goals for sustainable work practices and call for further research in this area (e.g., [26]). Additionally, they call for more research on environmental interventions that draw on socio-psychological theories and that utilize longitudinal experimental designs (e.g., [27]). Thus, to address the limitations of past studies, the present research focuses on whether goal setting is effective in encouraging PEBs and how the effects of goal-setting can be prolonged. As part of this investigation, we examine the role of individuals' environmental values and the effects of their multiple, potentially competing goals. To do so, we examine PEBs, such as computer-related energy savings, via two longitudinal experimental studies. The details of these studies and their findings are described below; before doing so, the next section provides a brief overview of goal-setting theory and then explains the hypotheses examined in our studies.

GOAL SETTING TO INCREASE PRO-ENVIRONMENTAL BEHAVIORS

In this research, we focus on how individuals can change their pro-environmental behaviors, that is, on Elliot's ([28], p. 32) proposition that "Human beings can change their behavior to have a less negative impact on the environment". To do so, we focus on interventions that can help conserve environmental resources. Interventions are generally categorized into a range of manipulations, ranging from more passive ones, like ease of use, to more engaging ones, like goal setting. Goal setting represents one of the most effective, yet understudied, interventions for environmental sustainability [17]. Thus our studies draw on goal-setting theory to examine the effects of setting PEB-related goals.

Goal setting has been used at the highest levels, such as UN conventions, to guide sustainability [29]. Reflecting this, sustainability goals are one of the three core themes in a proposed research platform for sustainability science [29]. The effect of goal setting has been studied in a number of sustainability contexts, including: bus usage [30], entrepreneurs [31], environmental education programs [32], metal recycling [24], paper recycling in schools [23], personal driving of employees [33], residential electricity consumption [34], shopping [30], solid waste reduction and recycling [35], and washing machine use [21]. A meta-analysis of pro-

environmental behavior experiments found that only 15 experiments of the 253 in their analyses used a goal-setting intervention [17]. The authors suggested that this powerful intervention has been underutilized by researchers and called for more research using goal setting [17].

Goal Setting Theory Background

Goal setting theory was formulated in the 1960s by Edwin Locke and is still undergoing development to the present day (e.g., [22,36]). It represents a middle-range theory, in that it is close enough to data to enable empirical validation while abstract enough to allow for generalizations [37]. It has emerged as a powerful, reliable theory to predict, influence and explain human behavior [22]. Consciously setting a goal, depending on the circumstances, can motivate individuals, resulting in changes in behavior. Goal setting creates obligations and intentions to attain a goal or desired behavior, so that individuals' attention is regulated towards goal-related activities over longer periods of time [38].

Behaviors result from individual cognition and motivation, and goals can influence behavior via motivational mechanisms [39]. There are four causal mechanisms identified in goal setting theory. First, committing to a goal focuses attention and effort on goal-relevant activities and away from other activities. Being aware of a specific goal provides purpose and directs activity. Second, challenging goals can energize people and cause higher effort than easy goals. This finding has been found for both goals that require physical and cognitive effort [40]. A positive, linear relationship has been observed between goal difficulty and performance, up to the point where the goal exceeds an individual's ability [22]. At that point, performance levels off and eventually decreases. Third, setting challenging goals can increase persistence and prolong effort. Fourth, goals affect action by motivating people to use the knowledge they have relevant to the task and/or discover the knowledge and strategies needed.

Research has found several important moderating factors on the relationship between goal setting and behavior [22]. When people are committed to the goals they set, the goal-behavior relationship is strongest. Commitment is strong when people believe the outcomes related to the goal are important to them (e.g., goal outcomes are aligned with personal values) and believe they can attain the goal (self-efficacy beliefs). Feedback is another important moderator. Feedback on goal progress allows individuals to adjust their efforts and/or strategies to fit what is needed to reach the goal. A third goal-effects moderator is the complexity of the task. The effects of goal setting depend on a person's ability to discover appropriate task strategies. The effect size for goal setting is smaller on complex tasks versus simple tasks because people vary in their ability to develop effective goal strategies.

Individuals are likely to have multiple goals active at any given time. Goals can interact with each other for attention and resources and may be complimentary or in conflict. Researchers have developed different

classification schemes for goals. Kruglanski et al. [41] present a system of goals to help explain cognition and resulting motivation. Their goal system has three levels (from highest to lowest): goals, sub-goals, and means (to accomplish the goal). Unsworth, Yeo and Beck [39] describe a four-level goal hierarchy (from lowest, shortest-term to highest-order, longer term): tasks (similar to Kruglanski et al.'s [41] means), project goals, identities, and values. Lindengerg and Steg [42] proposed three different types of goals that are inclusive in terms of including sub-goal areas, knowledge and attitudes. These were hedonic goals (ways to improve how one feels in a given situation), gain goals (to protect and improve one's personal resources), and normative goals (to act appropriately, with respect to what one thinks one ought to do). These three goals help direct attention and influence the information noticed, what knowledge is accessible, what alternatives are considered, and how people act [43]. Environmental goals are typically normative goals [42].

Setting Pro-Environmental Goals

Goal-setting theory provides the underlying mechanism for goal-setting interventions [44]. Goal setting interventions usually ask individuals to aim for an assigned or self-set goal, such as saving 15% in energy consumption. For example, studies focusing on energy conservation (e.g., [20,25,27,45–47]) demonstrate that goal setting represents an effective way to reduce energy consumption and that adding feedback strengthens its effectiveness. Similarly, a recent meta-analysis found that feedback has a positive effect on energy consumption behavior, but that goal setting strengthens this effect [48]. Because these studies were set in the context of energy consumption for individuals at home, we explore whether goal setting will have similar effects in organizational settings. Thus, we suggest:

H1: Setting goals for improving the environment will increase pro-environmental behaviors as compared with no goal setting for the environment.

Although goal-setting interventions are potentially effective, the behavior change may not continue once the intervention stops [23]. Therefore, researchers have proposed several enhancements to goal-setting, including making plans and visualizing success.

Making Implementation Plans

Even though setting a goal is the key component that prompts goal activation, having a goal does not guarantee its successful accomplishment. That is, goal setting helps individuals form intentions to perform particular behaviors, but a substantial gap often exists between peoples' goal intentions and their subsequent goal achievements [18]. Gollwitzer and Brandstätter [49] proposed the concept of implementation plans to improve goal achievement and there is considerable evidence that planning how to achieve a goal does help to predict goal attainment [39].

Specifically, the goal requires an if-then plan specifying when, where, and how to carry out goal-related behaviors that should promote successful goal attainment. The if-then plan takes the format of: "If situation A occurs, then I will begin goal-directed behavior B" (e.g., "if I leave my desk at work, then I will turn off my computer screen"). To form an implementation plan, one must identify a behavioral response that will encourage goal achievement (the then-component) and determine a suitable situation to carry out that response (the if-component) [18]. For example, a reminder of the if-then plan could encourage the desired response.

Implementation plans mimic the mechanism responsible for habitual processes and the aim is to attain goals without conscious thoughts [50]. That is, after forming implementation plans, individuals should perform the desired behavior automatically using pre-determined responses when the situations occur [18]. Therefore, conscious planning is potentially helpful to initiate the goal-related behaviors and further facilitates the forming of long-term habitual PEBs [51]. Several studies have shown the effectiveness of implementation plans in areas such as transportation, recycling, and organic food purchasing [52–56]. Developing effective task strategies related to specific goals is an important determinant of goal success [22], potentially increasing goal intensity and enhancing goal commitment [57]. Thus, we hypothesize that:

H2: Goal setting plus implementation plans will increase pro-environmental behaviors as compared with only goal setting.

Visualizing Success

Although implementation plans show promise for increasing PEBs, these plans may not result in long-term behavior change. The well-known rebound effect can occur when a person initially performs PEBs but later switches to other goals, resulting in lower PEBs [58]. Nisa et al.'s [59] meta-analysis illuminates the challenges of creating enduring PEB changes and creating interventions that have long-lasting effects. However, having individuals visualize successfully implementing their plans may increase the efficacy and duration of the effect of defining implementation plans by creating stronger, persistent skills and beliefs regarding goal efficacy. For example, Koestner et al. [60] suggest that individuals should list specific obstacles to reaching their goals and then should develop strategies for managing these obstacles. Further, Dalton and Spiller [61] propose that participants should rehearse their plans.

Mental visualization is a way to rehearse plans and improve the efficacy of implementation intentions. This is because using imagery strengthens the relationship between the cue ("if") and the behavior ("then") [62,63]. This may be because "visualization facilitates cue detection by increasing the activation of the cue in memory or even by increasing the commitment to the intention" ([64], p. 648). Using an imagery exercise helps "make participants anticipate experientially what

they are instructed to do" ([65], p. 31). This has the potential to enhance an individual's goal self-efficacy (i.e., task-specific confidence), which has been positively linked to goal commitment and goal performance [22]. Taken together, research suggests that mental visualization reinforces cognitive pathways turning behaviors into habits—and once a behavior becomes a habit, the individual is less likely to rebound (that is, return to previous behaviors). Thus, we suggest that describing obstacles, developing strategies to address these obstacles, and then mentally visualizing successfully overcoming these obstacles may help to minimize the rebound effect, thereby increasing PEBs.

H3: Adding mental visualization of overcoming barriers to implementation plans for goal success will increase pro-environmental behaviors as compared with only goal setting plus implementation plans.

Self-Concordance

In addition to enhancing goal progress via the characteristics of the goal intervention, personal beliefs about the value of pursing a goal may influence goal activation and progress. Unsworth et al. ([58], p. 34), call this self-concordance, which is defined as "the degree to which the pro-environmental behavior expresses any of the employee's stable interests and values". Previous research suggests that the degree to which the potential behavior represented in a goal matches stable interests and values will influence the attractiveness of the behavior, and that this in turn, will influence goal activation and effects [58]. That is, the fit between a person's values and a goal could be affected by the process of setting the goal and initial goal activation. Therefore, initial self-concordance (i.e., values and interest before the intervention) should be examined separately from on-going self-concordance and longer-term goal activation [58] and we propose separate hypotheses for each:

H4: Initial self-concordance (i.e., environmental values) will positively moderate the relationship between the intervention and initial goal success regarding pro-environmental behaviors.

H5: On-going self-concordance (i.e., values congruence) will positively moderate the relationship between the intervention and longer-term goal success regarding pro-environmental behaviors.

The Effect of Multiple Goals

As described earlier, individuals generally have multiple goals active at any given time, and these goals may be complimentary or in conflict. Goal conflict "occurs when the pursuit of one goal undermines the pursuit of another valued goal" ([66], p. 433). For instance, a person may have an environmental goal to print less at work, but a conflicting expectation to create high-resolution reports for her boss to review off-line. In fact, work-related performance goals probably represent focal goals for employees,

and are more important in their hierarchy of goals than environmental ones. That is, employees (or university students for that matter) may put more weight on their performance–related goals than on environmental ones.

Little is known about the effects of multiple goals [67] or goal hierarchies [58] and their relation to goal conflict. However, goal conflict represents an important psychological barrier to PEBs [68]. Following Schultheiss and Brunstein's [65] suggestion to examine the effects of goal imagery on outcomes, we propose that people who utilize goal imagery may experience less goal conflict. This may be because imagery helps them to understand and overcome obstacles in attaining their goals, whereas our other goal-setting interventions may be less effective in this regard. Understanding that they can accomplish multiple goals may result in individuals prioritizing many of them, not one to the detriment of others ([39], principle 6]). In addition, visualizing success may increase positive affect. Goals with positive affective value, or "the degree to which the goal is associated with positive feelings", are more likely to be prioritized ([39], principle 4). Therefore, because past empirical research and theory suggest both positive and negative effects, we explore whether individuals experience differing levels of goal conflict across our goal-setting interventions by posing this exploratory research question:

Exploratory Research Question 1: What is the impact of multiple goals on goal success and does this vary depending on the nature of the goal-setting intervention (i.e., goal setting with and without implementation plans or visualization)?

To examine these hypotheses in the context of office work, two studies were conducted that built on each other. The first, examining hypotheses 1 and 2 concerning goal setting and implementation plans, was a between- and within-subject six-week study of computer-related energy use by employees (Both received institutional ethics approval (#s GENSC-065-14 and GBUS-463-15, respectively)). In it, we observed the rebound effect. Thus, we conducted a second study focusing on understanding more about this effect. In this between-subjects study, we introduced two new conditions, a control condition and a visualization condition, requiring a larger sample size: to gain access to a bigger group, we studied business students. This study, examining hypotheses 1 through 5 and our exploratory research question over a four-week period, examined computer-related and other PEBs.

STUDY 1

This study examined employees' computer-based electricity usage in the workplace over six weeks. We focus this study on IS-related PEBs due to the significant potential gains that may be achieved in this area. The Climate Group [69] suggested that smarter use of IS could lower global emissions by 15%; others have suggested that more than half of computer-

related energy use is wasted due to inefficient technologies, uninformed behaviors, or poorly designed systems [70]. IS-specific PEBs that employees can practice might include behaviors such as substituting desktop videoconferencing for travel, turning off computer equipment when not in use, choosing new equipment based on its environmental footprint, printing wisely, donating or recycling old equipment, and influencing coworkers to do the same.

Research on IS environmental issues, typically called Green IS research, can be considered from two perspectives, as a contributor or as a solution to environmental degradation [26,28,71]. For example, from the first perspective, we might investigate reducing electricity consumption of computers, and from the second, we might develop software to help change beliefs about environmental sustainability. This study falls in the first category, that is, it examines the reduction of environmental impacts of using computer-based systems. It is important to examine ways to reduce energy to enhance sustainability because the amount of electricity used by devices plugged into outlets in buildings is significant [47]. Currently, 33% of electricity use in residential and commercial buildings is from plug load, and this is expected to rise to 49% by 2030 [72].

Before conducting Study 1, we piloted our materials with seven individuals, and then pretested them in a 1.5-h office simulation experiment with 40 undergraduate business students. For the Pretest, the students were randomly assigned to control, goal setting, or goal setting + plans conditions (as described below for the main study), and then completed a series of office tasks on laptop or desktop computers. Their electricity usage was monitored with a wattmeter and hypotheses 1 and 2 were supported. Specifically, an ANCOVA (with laptop versus desktop as a covariate, because these types of computers use differing amounts of electricity) demonstrated a difference in electricity usage between the three conditions ($F = 5.26$, $p < 0.05$; mean electricity usage (control) =35.00 watts, mean (goal-setting) = 31.67 watts, mean (goal-setting + plans) = 30.00), although the two goal setting conditions were close. Thus, H1 was supported for goal-setting but goal setting + plans appear to have marginal improvement over goal-setting (H2) in our pretest.

For the main study, participants were employees who used computers regularly at work. A convenience sample of sixteen employees from several organizations (university, security, auto parts, and engineering) participated, although we lost one due to some missing electricity values: the average age was 55, 56% were female, and 73% had a university education.

Procedure

Unlike the pretest (a between-subjects design), this study was a field experiment using a between- and within-subjects design (two goal-setting conditions, with each participant acting as his/her own control). The first two weeks of the study represented the control period, during weeks 3 and

4 participants were randomly assigned to either the goal or goal + plans condition, and weeks 5 and 6 were the post-condition period.

On day 1, participants completed a background survey on their demographics. Then, a watt meter, a power bar, and an electricity recording chart were provided. We plugged all computers and computer-related devices, such as printers, external monitors, and speakers, into the extension cord and then connected it to the watt meter. The extension cord and watt meter were placed on participants' desks to provide accessibility. Participants were asked to record the reading from their watt meters at the beginning and end of each workday. Using this data from the first two weeks, we were able to calculate typical (pre-intervention) energy usage for each participant: that is, we could establish a baseline of the average amount of electricity consumed by each participant for control purposes.

For the next two weeks, participants were assigned to one of the two interventions: a goal setting or a goal setting plus implementation plans. Goal-setting condition participants set goals to consume less electricity with computers; participants in the goal-setting plus implementation plans condition also set goals and then made plans on ways to implement these goals. To facilitate setting goals and making plans, a list of tips on saving electricity consumed by computer-related equipment was provided to all participants. This list of six electricity-saving tips (such as "turn off any peripheral devices (e.g., printer) when not in use") were taken from a review of the popular literature (to create this list, we hired two research assistants from Environmental Sustainability who reviewed the practice literature, e.g., https://www.ghacks.net/2009/05/29/7-computer-energy-saving-tips/. In addition, we conducted a brainstorming session with executives, asking them for tips. We selected tips that could be implemented by individuals in the workplace—rather than by organizations). Participants were asked to choose at least three tips that they usually did not perform, set electricity-saving goals based on the tips, and write down the goals on a form. One example was provided on the form: "I agree to my goal of conserving electricity on my computer and computer-related devices, and will do so by dimming my screen brightness." For the goal-setting plus implementation plans condition, participants also designed situations/opportunities to act on the goals they chose and wrote down these plans and initialed them to indicate agreement. The example listed on the form was "If I leave work, then I will shut down my computer" (see Appendix E1). For both conditions, their goal forms were left on their desks for the next two weeks to enhance attention and goal saliency. Two weeks later, the goal forms were collected. Participants continued to record twice-daily electricity consumption for another two weeks.

Results

The amount of electricity used by employees was subjected to a factorial (two conditions) repeated-measures (three time periods) analysis

of variance. There were main effects for time ($p < 0.05$), but the two conditions did not differ ($p > 0.10$). The statistically significant change in electricity consumption was generated from the baseline period (weeks 1 & 2) to the intervention period (weeks 3 & 4). For the post-intervention period (weeks 4 & 5), mean electricity usage increased but remained lower than the baseline period (see Figure 1 and descriptive statistics in Appendix C).

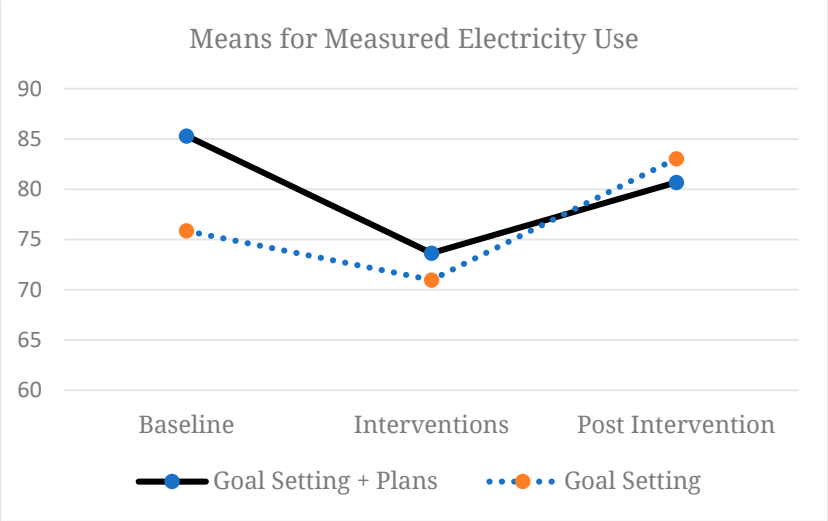

Figure 1. Study 1 energy usage across time periods.

These results demonstrate support for *H1*, but not for *H2* (that is, there is no significant difference between the goal setting and goal-setting + plans conditions). Further, findings support the effects of goal-setting in the short-term (the difference between the first two time periods), but demonstrate a rebound effect when the interventions are removed (for the last time period). Thus, examining whether visualization (*H3*) might relate to the rebound effect was the main purpose of the next study.

STUDY 2

Study 2 builds on Study 1 to focus more on the rebound effect. In this between-subjects study, we introduced two new conditions, a control condition and a visualization condition, requiring a larger sample size: to gain access to a bigger group, we studied business students. Utilizing students not only provides convenience and cost savings, it helps to provide confidence in findings from other studies [73], in our case, Study 1. The present study, examining hypotheses 1 through 5 and our exploratory research question over a four-week period, examined computer-related and other PEB-related goals that were of interest to participants.

Over a period of 4 weeks, a longitudinal, diary approach method was used to examine the effects of different goal setting conditions on PEBs. We incorporated four conditions in our experiment: setting a wellness goal (our control or 'no goal setting for the environment' condition) or

setting an environmental goal (three conditions: goal-setting, goal-setting + plans, or goal-setting + plans + visualization). Participants were told that they would be randomly assigned to a wellness or environmental condition. We included a wellness goal to be able to test *H1* (that is, providing the control condition) and to help minimize hypothesis guessing [74]: that is, by providing two contexts (wellness and the environment), we hoped that they would not guess our interest in the environment, and potentially responding in socially desirable ways concerning sustainability. The hypothesis testing and analyses presented below focus mainly on the three environmental conditions.

Participants were full-time undergraduate business students in a North American university. The median age was 19 to 20, with a fairly even gender split (47% male, 53% female). The majority had full-time work experience (79%) with the average amount being 7.5 months (standard deviation = 13.6). Participants also had considerable part-time work experience (average = 16.2 months; standard deviation = 17.0).

Recruitment was done through the school's participant pool (participating students received course credit, as well as the possibility of winning a draw for a bookstore gift certificate). One hundred and eighty-two students started in the study at time zero; however, there was some attrition during the 4 weeks (16 participants). A total of 166 students completed the study, with the breakdown across conditions 1 to 4 being 39, 46, 42, and 39, respectively. Before the main study, a pre-test was conducted with three other students to refine the materials and procedures.

Procedure

At time zero, participants met with the researchers face-to-face and completed a paper-based questionnaire measuring values related to environmental concerns and several control and demographic variables (see Figure 2 for a summary of the study procedures). They were then randomly assigned to one of the four treatment groups in which they set a daily goal, such as "Read documents online instead of printing (when possible)" or "Turn off external devices for computer when not in use for more than 15 min (computer monitor)" or "Reduce water usage (e.g., take shorter showers) ". In condition 1, they set a wellness goal (the control condition). Condition 2 participants set an environmental goal. Condition 3 participants set an environmental goal and then also defined three goal implementation plans (as in Study 1). Condition 4 participants did everything in condition 3 but also defined three barriers/distractions to reaching their goals and corresponding strategies to overcome these barriers; they also visualized themselves using these strategies. They did so by closing their eyes for one min for each barrier to mentally visualize themselves successfully managing the specific barrier such that they reached their goals (see Appendix E2 for the visualization).

While we could focus just on energy use of IT-related equipment in Study 1 because all of our participants were office workers, we needed to provide our more varied Study 2 participants with the freedom to choose an environmental goal that they were interested in and was relevant to them. Over the three environmental goal conditions: 42% of the goals were related to reducing electricity (via their use of computer equipment, lights, etc.), 24% related to reducing water use, 19% related to increasing composting or recycling or reducing waste, and 13% related to reducing paper usage.

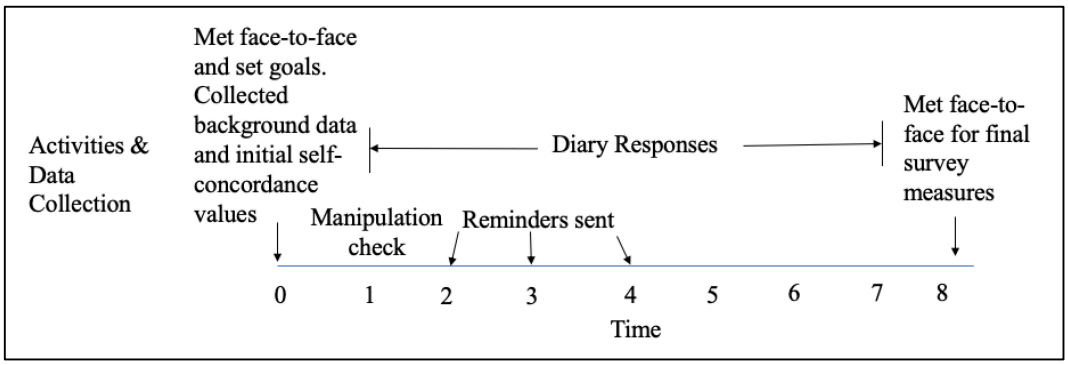

Figure 2. Study 2 design.

At time 0, the survey assessed initial self-concordance with Groot and Steg's [75] Biospheric Value Orientation 4-item scale (alpha = 0.89). Respondents rated the importance of the value statements and aspirations as guiding principles in their lives, assessed on a 9-point scale (−1: Opposed to my Values to 7: Extremely Important). An example of one of the items is: "Respecting the earth (harmony with other species)".

During the next four weeks, participants completed seven short electronic diary surveys (about one every 3 days) that asked about their progress in reaching their goal, their commitment to their goal, and their goal attainment (times 1 to 7). As is typical with diary studies, these online surveys used single-item measures to keep them short [76]. Progress was measured using a 0 to 100 slider scale asking the following question: "On the slider below, please indicate how well you have met your daily goal over the past several days" (adapted from [77]). For Commitment, a 9-point scale was used, asking "How committed do you feel towards this goal?" [77]. Goal Attainment utilized a 9-point scale to ask "How well do you feel you are attaining your goal?" [78]. In the surveys for times 2 to 4, all respondents were provided with reminders of the goals they had set. Conditions 3 and 4 also received reminders of their plans at T3, and condition 4 received a reminder of their plans and possible distractions and strategies at T4.

At the end of week 4 (time 8), participants met with the researchers again face-to-face to complete a final paper-based survey. Specifically, we assessed their on-going self-concordance with Cable and DeRue's [79] three-item values congruence scale (alpha = 0.91). An example question,

assessed on a 9-point scale (Strongly Disagree to Strongly Agree) is "The things that I value in life are very similar to the goal that I set for this study". In addition, we assessed two dependent variables, goal satisfaction and spillover. We measured their perceived goal satisfaction using Koestner et al.'s [80] seven-item scale (alpha = 0.82). Participants were asked "To what extent do you feel each of the following emotions regarding your current standing on this goal?" on a 9-point scale with items such as "Dissatisfied" (reverse-scored). We assessed positive environmental spillover, which occurs when "one pro-environmental behavior increases the likelihood of performing additional pro-environmental behaviors" ([81], p. 127). We measured this by adapting an organizational citizenship behavior for the environment measure ([82]; 11 items, alpha = 0.91) and asking "For each of the following behaviors over the last 3 weeks, please indicate your level of disagreement or agreement" on a 9-point scale, listing items such as "I encouraged others to adopt more environmentally conscious behaviors".

To investigate the potential impact of multiple goals, qualitative data were also collected (via open-ended questions) in all time periods. In the T1 to T7 surveys, participants were asked to describe if they had experienced any barriers in moving toward their goals, and were asked to list up to three time-consuming activities that created demands on their time since they completed the previous survey. In the final survey (T8), respondents indicated if and what challenges they faced in reaching their goals. Two of the authors created a preliminary coding sheet for the qualitative data. A research assistant, blind to the overall study, was engaged to code the data. After some initial training, one author and the RA independently coded ten percent of the data. Agreement was found on 89% of the coding, indicating adequate inter-rater reliability. After discussing the areas of disagreement, the RA coded the rest of the data. Refer to Appendix A for the list of codes.

Results

We first screened for several analysis assumptions. In terms of required sample size, we conducted a power analysis in G*Power [83] for a MANOVA with four conditions and two dependent variables (using an alpha of 0.05, a power of 0.80, and a medium effect size of $f = 0.25$). Based on these assumptions, the desired sample size is 116; adding in the additional analyses including biospheric values results in a desired sample size of 158 (as compared to our actual size of 166 participants). To check the efficacy of our manipulation, we asked participants at time 1 to describe the goal they had set at T0: 89.2% of participants accurately recalled their goal. Further, an analysis of univariate and multivariate outliers indicated one multivariate outlier that we deleted from our data set.

To determine whether condition affected the DVs of goal satisfaction and positive environmental spillover (H1–H3), we conducted a MANOVA (using the SPSS procedure General Linear Model—Multivariate). The

overall test was significant (Wilks' lambda = 0.87; $p < 0.001$), and Condition related significantly to both goal satisfaction ($F = 4.33$; $p < 0.01$; means of 5.00, 5.56, 5.44, and 6.19, for conditions 1–4, respectively) and positive environmental spillover ($F = 4.11$; $p < 0.01$; means of 3.10, 3.96, 4.08, and 4.09). Although the means are generally in the expected direction, a Bonferroni analysis demonstrates that all do not differ significantly from each other. Thus, there is some support for H1 through H3, but it is not clear whether the environmental conditions differ from each other. We next examined the diary data over the 7 time periods to determine whether differences between the environmental conditions exist.

For each of the three constructs measured over T1 to T7 (progress, commitment and goal attainment), a mixed ANOVA analysis was conducted for repeated measures (using the SPSS procedure General Linear Model—Repeated Measures). Mauchly's test of sphericity indicated that the assumption of sphericity had been violated in the analyses of the three outcome variables. Therefore, the degrees of freedom were corrected using Greenhouse-Geisser estimates (and are reported in Table 1).

To further investigate Hypothesis 3 concerning the visualization condition (the effect of defining goal distractions, strategies to overcome these distractions, and visualizing these working), we compared the results for this condition to the other two environmental conditions. To do so, we combined the other two conditions (as there were no significant differences between them, as indicated in the previous pairwise Bonferroni analysis): we call these 'other environmental conditions' as compared to the visualization condition. To investigate Hypothesis 4, the potential moderating effect of initial self-concordance (Biospheric Value Orientation) on initial goal activation, we included this in the mixed ANOVA analysis.

The main effect of goal progress and the interaction effect of goal progress by condition type (visualization versus other environmental conditions) were both significant ($F = 2.64$, $p = 0.03$; $F = 2.82$, $p = 0.21$, respectively). Neither the interaction effect of Biospheric Value nor the main effect were significant ($F = 1.09$, $p = 0.36$; $F = 0.53$, $p = 0.47$, respectively). The main effect of condition type was also non-significant ($F = 0.18$, $p = 0.67$). See Table 1 for more details and Figure 3, panel 1 for the patterns of goal progress over time. The means of the two conditions at T7 were statistically different (unpaired t-test: $t = -2.48$, $p = 0.02$—refer to Appendix D for descriptive statistics). This provides support for Hypothesis 3, but not for Hypothesis 4.

Table 1. Testing differences in conditions over time periods 1 to 7.

	Type III Sum of Squares	df	Mean Square	*F*	Sig.
Goal Progress:					
Test of Within-Subject Effect					
• Progress—main effect	2791.16	4.35	641.46	2.64	0.03
• Progress × condition—interaction effect	2978.75	4.35	684.58	2.82	0.02
• Progress × Biospheric Value—interaction effect	1153.91	4.35	265.19	1.09	0.36
Test of Between-Subject Effect					
• Condition—main effect	406.57	1	406.57	0.18	0.67
• Biospheric value—main effect	1190.30	1	1190.30	0.53	0.47
Goal Commitment:					
Test of Within-Subject Effect					
• Commitment—main effect	5.72	3.93	1.46	0.89	0.47
• Commitment × condition—interaction effect	15.71	3.93	4.00	2.45	0.05
• Commitment × Biospheric Value—interaction effect	3.18	3.93	0.81	0.50	0.74
Test of Between-Subject Effect					
• Condition—main effect	0.54	1	0.54	0.02	0.88
• Biospheric value—main effect	23.09	1	23.09	1.03	0.31
Goal Attainment:					
Test of Within-Subject Effect					
• Goal Attainment—main effect	20.54	4.54	4.53	2.47	0.04
• Goal Attainment × condition—interaction effect	17.52	4.54	3.86	2.10	0.07
• Goal Attainment × Biospheric Value—interaction effect	7.76	4.54	1.71	0.93	0.46
Test of Between-Subject Effect					
• Condition—main effect	0.83	1	0.83	0.05	0.83
• Biospheric value—main effect	18.51	1	18.51	1.03	0.31

The interaction effect of commitment by condition type was significant (F = 2.45, p = 0.047): see panel 3 of Figure 3. However, the main effects of condition type, goal commitment and Biospheric values were all non-significant (F = 0.02, p = 0.88, F = 0.89, p = 0.47; and F = 1.03, p = 0.31, respectively). The moderating effect of Biospheric values was also non-significant (F = 0.89, p = 0.47). The mean differences of commitment for the two conditions at T7 were non-significant (unpaired t-test: t = −1.27, p = 0.21). This provides some support for Hypothesis 3, but not for Hypothesis 4.

The main effect of goal attainment was significant (F = 2.47, p = 0.04). The interaction effect of goal attainment by condition type was marginally significant (F = 2.10, p = 0.07). The main effect of condition and Biospheric value were non-significant, as was the interaction effect of Biospheric value (F = 0.05, p = 0.83; F = 1.03, p = 0.31; F = 0.93, p = 0.46, respectively). See Figure 3, panel 3 for the patterns of goal attainment over time. This shows that participants in the visualization condition reached their goals more often than participants in the other conditions (unpaired t-test is

marginally statistically significant: $t = -1.90$, $p = 0.06$). Again, this provides some support for Hypothesis 3, but not for Hypothesis 4.

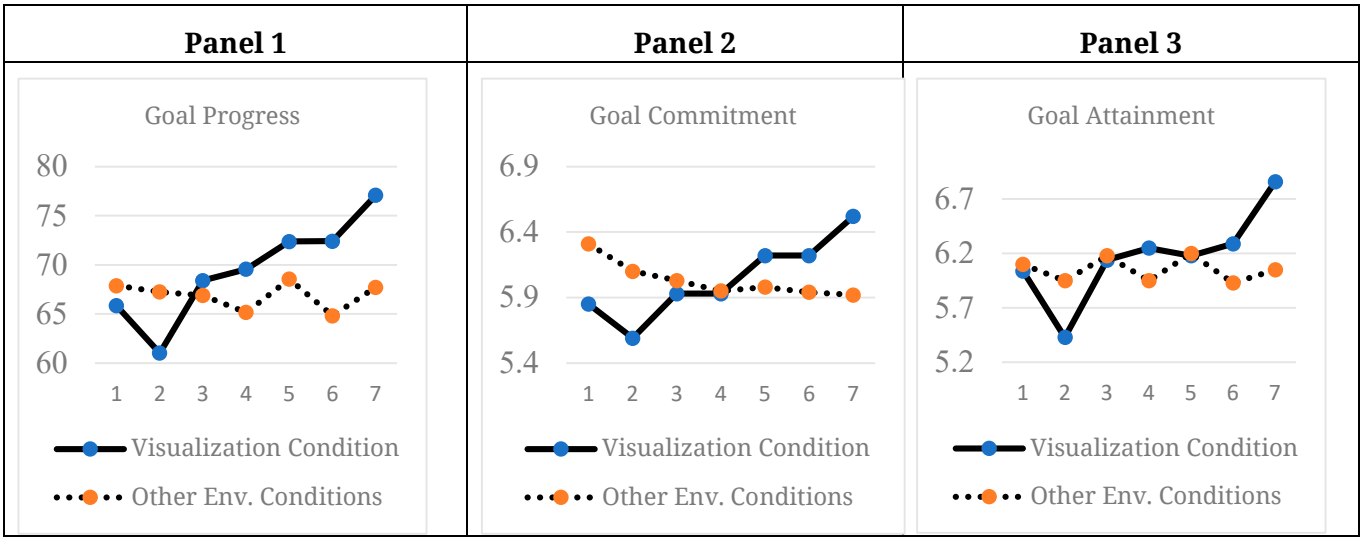

Figure 3. Study 2 goal perceptions across time periods.

In summary, it appears that visualization has potential for reducing rebound effects (H3). Even though the interaction effect of Biospheric value was not statistically significant for the three goal-dependent variables (H4), we did investigate this further by comparing the top and bottom quartile respondents (see Appendix B). The patterns indicate some support for the logic behind Hypothesis 4: the plots (panel 2 in Figure A1, A2 and A3) illustrate that, for people high in Biospheric values, the visualization condition out-performed the other conditions. This pattern was not observed for participants with low Biospheric values (panel 1 in the figures).

To test *H5*, the relationship of on-going self-concordance (values congruence) and the conditions to pro-environmental behaviors, we conducted a MANCOVA (using the SPSS procedure General Linear Model—Multivariate). The potential moderator, values congruence, was measured at T8. We investigated the impact on our dependent variables: goal satisfaction and positive environmental spillover. The multivariate test for values congruence was statistically significant (Wilks' lambda = 0.74, $F = 20.67$, $p < 0.001$), whereas the multivariate tests for condition and the interaction of condition and values were both non-significant (Wilks' lambda = 0.99, $F = 0.54$, $p = 0.58$; Wilks' lambda = 1.00, $F = 0.09$, $p = 0.92$, respectively). The tests of between-subject effects showed that values congruence was strongly related to environmental spillover and goal satisfaction ($F = 26.44$, $p < 0.001$; $F = 19.13$; $p < 0.001$, respectively). We conducted a similar analysis with another measure of on-going self-concordance Burkley et al.'s [84] single-item goal fusion scale. The results were very similar and are available upon request from the authors.

To explore the effect of multiple goals (research question 1), we started by counting the frequency that participants identified barriers or

challenges, as well as relationships with goal success indicators. We found high numbers of barriers and challenges experienced during the T1 to T7 surveys: on average, participants reported 24.84 barriers across these time periods. The most frequently-reported goal conflict related to schoolwork. For example, participants made comments such as: “Too much work in school to focus on my goal”; “Not really having the goal on the top of my mind due to distractors such as tests and assignments in the next week or two”; “Very consumed with studying which distracted me/made me forget about my goal at times”; and “I found that as I was trying to achieve my goal, other goals in my life came into play like doing well in school and it affected how focused I was on this goal. I got distracted”.

Comparing the conditions, the open-ended comments suggest that the visualization condition may have helped participants become more resilient, increasing their goal efficacy. For example, at Time 7 for the visualization condition, there was a positive relationship between schoolwork goal conflicts and commitment (+0.36, $p < 0.05$), while the relationship was not significant for the other two conditions. That is, the more the visualization condition participants perceived demands on their time from schoolwork, the more motivated they seemed to become to accomplish their environmental goals. For instance, visualization participants made comments such as: “One night, I was really tired and still had to prepare for multiple classes the next day, starting at 8:30 am. I considered just printing all the slides, but remembered my new goal and downloaded all the slides. The next morning, I woke up earlier to review them and only printed half the amount of slides”; “I think that the barriers present last week have been removed and I am slowly achieving my goal. Sometimes I forget to use both sides of the page because I am so used to not doing so. Slowly, however, my brain is adjusting to my new lifestyle”; “In the last two days, I have worked to leave for class with enough time remaining so as to avoid grabbing a bottle of water for the benefit of convenience; therefore, the stress of not having enough time to use a reusable container before class starts is not present, and neither is the barrier that it presented. There have been otherwise no barriers to achieving the goal”; “In the past, I have spent too long in the shower because I am tempted to practice a speech or presentation while showering. This was a problem that I never anticipated but nonetheless caught myself doing once this week”; “Many time consuming activities in relation to school projects have taken up a lot of my time. However these barriers haven't had a significant impact on my ability to work towards my goal”; and “I stayed up late at night for 2 nights to complete an assignment. This made me tired, however, I still found the time to turn off my computer once I was done using it”. As these quotes demonstrate, visualization participants appear to have strengthened their goal self-efficacy that is their resilience in the face of competing goals.

DISCUSSION AND CONCLUSIONS

Organizations face challenges in responding to environmental sustainability concerns. To help address this, our research focused on improving individuals' pro-environmental behaviors. Consistent with goal-setting theory, Study 1 found that PEBs increased for employees in their work after setting environment-related goals. In that study, we found that computer-related pro-environmental behaviors increased after setting environmental goals: goal behavior was maintained during the intervention period, possibly due to the attention and saliency created by having accessible goal prompts. After these prompts were removed, PEB behaviors declined, demonstrating the rebound effect. This decline could have been due to employees pursuing other goals and behaviors; this is not very surprising as they would have had many goals relevant to their professional and personal lives. Unsworth et al.'s [58] model of psychological conditions underlying PEB change suggests several explanations for these findings. That is, long-term goal activation depends on several things, including the fit with the individual's values and beliefs (a stronger fit increases motivation), behavioral expectations from other sources (potentially creating goal conflict), and perceived abilities to achieve the goal (goal efficacy).

Although our research did not find that setting implementation plans strengthens behaviors beyond goal-setting itself, our second study suggests that visualizing success may improve progress in meeting goals, presumably by strengthening individuals' goal efficacy. Participants in the visualization condition, who identified barriers, strategies to overcome the barriers, and visualized being successful in these strategies, continued to be more successful over time in reaching their goals (see Figure 3). The results over time for participants in the other environmental conditions were flatter (or declined). This suggests that visualizing themselves overcoming obstacles has stronger and longer-lasting effects than simply defining plans to reach goals. Participants' open-ended comments support this explanation of more enduring resilient behaviors in the face of competing goals. The visualization results are also consistent with causal mechanisms in goal theory that suggest being motivated to search out and use knowledge about how to achieve a goal, along with having challenging goals, leads to goal persistence. Nevertheless, more research is needed to examine the effects of imagery and visualization interventions in encouraging goal success in differing contexts [85].

More generally, our research highlights the importance of considering the influence of other goals in addition to environmental ones. As we saw in the open-ended comments, participants' organization-related goals represent focal goals to them and were prioritized over environmental ones. The positive correlation between school-work goal conflict and goal commitment in the visualization condition could be due to school-work acting as a complementary, reinforcing goal. The participants chose to volunteer for the study as part of a participant-pool where one of the

incentives was related to school performance. This leads us to speculate that perhaps this created a perceived link between school work and the study activities.

Finally, we explored the influence of self-congruence or environmental values. Like other research examining environmental values (e.g., [86,87]), the relationships to outcomes were not always significant. In our study, initial self-concordance was not related, but on-going self-concordance was strongly related to outcomes. Individual values are stable, long-term beliefs, representing the highest level in Unsworth et al.'s [39] goal-hierarchy. Perhaps initial values were too far from the short-term goals set by our participants to meaningfully affect goal activation. That is, although environmental values may be held, other values may become more important [87], as our open-ended comments support (see Appendix B). Nevertheless, the direct effect of on-going self-concordance, measured at the end of our study with a values congruence measure, was significant. Consistent with the value-belief-norm model [58], it was strongly related to goal outcomes and positive environmental spillover. Similarly, Maki et al.'s [88] meta-analysis found the effect of positive spillover to be stronger when the actions were related to intrinsic motivation. This supports the hypothesis that self-concordance makes a goal more attractive and stimulates goal activation and on-going goal and related behaviors.

Strengths and Limitations

This research offers contributions to research on how individuals can enhance environmental sustainability in organizations, including employees in corporations. Our studies have a number of strengths, including allowing individuals to set their own goals, longitudinal data collection, and objective goal attainment data (for Study 1). Study 2 contributes methodologically by using a "diary study"/experience sampling method. Although the diary method is rarely used, it has several advantages. Participants do not need to recall information but instead report on their current activities and thoughts as they occur [89]. This minimizes recall bias [90] and thus is preferable to retrospective reports [91]. However, unlike most dairy studies that are 'passive' in nature (examining what happens over time), we conducted an experiment for our diary study. Diary studies that are designed as experiments are more powerful, improving the internal validity of the research [92].

This research also responds to calls for more research on goal-setting in environmental research [17] and for more research on improving goal-setting, such as using goal imagery [65]. This paper also contributes to goal-setting research more generally. Most goal-setting studies in psychology and management have been conducted in isolation [36], yet we draw on both fields (e.g., [58,60]). For organizational research, the findings of Study 1 suggest that goal setting does have the potential to change employees' behaviors and thereby reduce an organization's environmental impact. We anticipate that future research will yield further insights into how to

strengthen the impact of goal setting and other interventions on environmental behaviors.

Study 1 also responds to calls for more Green IS studies (e.g., [3,93]) and investigations of the role of goals in particular (e.g., [26]). The focus of Study 1 was on ways to reduce computer-related energy consumption in the workplace. Participants in Study 2 were given the flexibility to choose the type of environmental goal they set; almost half set a goal related to the use of IT equipment. Unlike most past empirical Green IS research that has been largely atheoretical [11,28], we drew on and extended goal-setting theory to explore how to conserve environmental resources. In addition, unlike other studies that do not perform interventions, but instead ask participants to indicate goals that might be relevant for them (e.g., [94]), we conducted controlled experiments. For this research, we did not assign goals, but allowed participants to select their own from suggestions we provided, making these 'their own goals' and helping to ensure that they would be committed to them [22].

Nevertheless, both studies have limitations. Although we were able to collect objective energy data from Study 1 employees over 6 weeks, it had a small sample size, with a post-hoc power of 0.54. Previous research has found the effect of positive spillover on actual behaviour to be quite weak, suggesting that more statistical power could be valuable to see if positive spillover could counteract rebound tendencies [88]. In terms of Study 1 goals, we suggested six electricity saving tips based on the practice literature, but did not ask participants for their perceptions of these tips. Future research should address this limitation by examining the fit of these specific goals with participants' values, as this could be a more direct test of value congruence than what we measured with initial Biospheric values in Study 2. Study 2 utilized students, but we were able to track their goal attainment over 4 weeks. For this study, it could have been the case that students responded in socially desirable ways (we did not collect objective data, as in Study 1). However, because of our experimental design, this would be less of a concern because it would potentially apply equally to all of our conditions. In addition, socially desirable responding is less likely when participants are randomly assigned to conditions and anonymity and confidentiality are promised [95]. Another potential limitation for both studies concerns collecting data from participants over multiple time periods, which could have reminded them of their goals and reinforced the goals' effects. For instance, having employees periodically record their energy use from the wattmeter in Study 1 could have represented a type of feedback: although feedback is an important component of goal-setting, it would also serve to remind participants of the study.

The studies were also limited in the number of conditions in the experimental designs. For example, to keep the sample size manageable for Study 2, we examined the effect of visualizing how to overcome barriers as a potential way to strengthen the effect of setting

implementation plans. Further, the conditions built on each other, such that those in higher conditions had a few more minutes to consider their goals. Future research could use a more complete factorial design such as 1 (goal setting) × 2 (with/without implementation plans) × 2 (with/without visualisation) with equivalent times per condition to help understand the unique effects of each type of intervention.

The use of students in Study 2 also represents a possible limitation in generalizing to varying types of organizations, age groups, and working arrangements. Studying business students as proxies for employees is a compromise that is often made to be able to gain a large enough sample size to conduct controlled experiments [73]. Nevertheless, best practices need to be followed in using university students as proxies for other adults. Here, we followed Compeau et al.'s ([95], p. 1101) recommendations to:

(1) specify the goal for generalization—office work
(2) identify intended populations for study—office workers and business students;
(3) justify the use of students:
    (i) the business students had work experience and were part of a not-for-profit organization (i.e., part of their university)
    (ii) these students were not studied on their own, but as one study out of two; multiple studies with diverse participants provide both convenience and more reliable results [73];
(4) identify potential limitations of the research samples—we acknowledge that students, on average, are younger, have less work experience, and do not work for their organization (the university);
(5) develop implications consistent with the samples—we were careful to enumerate implications and limitations by study.

Nevertheless, the generalizability of the findings should be validated in future studies with paid staff in for-profit organizations, as well as with a variety of ages and occupations.

Implications for Research and Practice

Our studies have implications for both research and practice. Goal setting theory specifies that setting goals is an effective way to create motivation and direct attention and resources towards goal-related tasks. We suggest that we contribute to this mid-range theory by adding testable generalizations about how to extend the effective duration of setting a goal. Specifically, the effectiveness of setting goals on outcomes depends on the ability of an individual to work towards the task. Developing implementation plans can help make these abilities salient; however, our studies found little difference in the effectiveness of setting goals alone, versus setting goals and making plans. Study 1 found that both interventions did have a positive effect during the treatment period, but that effects diminished post-treatment. Looking at Study 2 patterns in Figure 3 for setting goals and goals with plans (the dashed line for Other

Env. Conditions), we see similar results: a pattern where progress and goal attainment were again relatively flat during the duration of the study. In contrast, when participants identified goal barriers, strategies to overcome the barriers, and then visualized themselves successfully overcoming these barriers, a different pattern of performance emerged. Goal performance and commitment were stronger at the end of the Study 2. We suggest this could be due to enhancing self-efficacy and helping participants activate relevant knowledge regarding effective strategies. While the increasing levels of goal commitment over time lends support to this suggestion (i.e., self-efficacy has been found to be positively associated with goal commitment: [22]), future research should be conducted to empirically validate this suggestion. Another individual difference variable that might be particularly relevant for students is diligence [97]. It may be that more diligent students are more likely to: sign up for research studies, report conflicts with school-work goals, and spend time on goal-related activities during studies. Hence, future research should consider assessing diligence when studying students.

In Study 2, the early patterns for goal performance and commitment for the visualization condition show an interesting dip at time 2 (and generally start somewhat lower than the other condition: see Figure 3). We theorize that this could have been caused by the act of identifying barriers. Identifying barriers could highlight to people the challenges of reaching their goals. Previous research has found that goals that are perceived as highly complex and difficult can be demotivating, leading to poor performance [22]. In our study, the dip in performance and commitment was short-lived, as participants recovered and ended up with stronger performance and commitment. Future research should empirically study self-efficacy beliefs over time, varying the degree of challenge presented in possible barriers to determine at what point identifying barriers impedes performance gains longer-term.

Although we explored the effects of multiple goals, additional research is needed. Little is known about goal-directed behaviors with multiple goals [67,98] and future research should help to shed light on how organizations can help individuals reach PEB goals, which typically are not the first-priority goals for employees [15]. Examining the interaction of hedonic and gain goals on environmental goals, which are typically more normative, could also be a useful lens for future research. Environment goals for individuals in the workplace may have the challenge of creating few individual positive gains, leading to lower stability for normative goal activities.

Our research helps address calls for more studies at the employee level (e.g., [11,28]). Although there is little research on interventions encouraging employee PEBs, research on citizens provides some important lessons for employee behaviors and ideas for future research. A meta-analysis examining ten interventions ([17], p. 272–3) highlight four interventions with the strongest effects: in addition to goal setting,

prompts ("non-informational reminders that focused only on when to perform the next specific action"), social modelling ("passing of information via demonstration or discussion in which the initiators indicate that they personally engage in the behavior"), and cognitive dissonance ("accessed pre-existing beliefs or attitudes… to make participants behave in ways that were consistent with those beliefs to reduce the dissonance") are most effective. Future research needs to extend and test these other interventions in organizational contexts. However, as described earlier, organizational factors may alter the effects of any intervention, and understanding the interventions (and their combinations) that are most effective in organizations as well as the theoretical mechanisms behind them are needed. Future research that compares the efficacy of goal setting in organizational and home settings could also be valuable.

Research on interventions helps enrich more traditional research on change. For instance, Melville's [99] belief-action-outcome framework assumes that changing beliefs will result in behavioral change. However, with sustainability research, we often assume the opposite direction for effects: if one can change individuals' behaviors, then their beliefs will follow. This is because individuals start thinking about themselves in different ways after observing their own behaviors. In support of this, it has been demonstrated that information alone is not a strong predictor of PEBs [100]; rather, interventions are needed to influence them. Thus, we suggest that organizational frameworks be extended to consider feedback loops, in which beliefs are affected by behaviors.

We also suggest that future organizational interventions should be developed using multiple approaches. Environmental research at the individual level generally takes a behavioral-science approach (as we did in these studies) or a solution-oriented (design science) approach [10]. In the future, researchers should combine the two, for instance, by developing a system to help automate environmental interventions and the recording of computer-based sustainability outcomes. For instance, researchers have installed wireless plug-load sensors in employees' offices to measure their appliance use and then provided a web-based game to encourage them to save energy [72]; developed a gamified mobile application to encourage more environmentally sustainable behaviors in organizations [70]; and installed smart plugs and sensors in employees' offices and provided them with a game to encourage energy reduction [101].

More generally, serious games and gamification hold promise for the future design of environmentally based systems in organizations [102,103]. However, these systems need to be designed carefully for several reasons. First, gamified systems should not remain static but should keep the user intrinsically motivated over time. In contrast, Chen et al. [104] created a digital aquarium that reflects energy use in group offices, measured through sensors. They found decreases in energy use in the beginning, but

then rising energy use over time. They suggested that this could be due to 'user fatigue' with the aquarium, or users becoming used to the system. Instead, they could have helped maintain engagement through using progression elements such as quests, levels, progressive disclosure, or adjusting the levels of difficulty [103]. A second concern relates to privacy: because energy use in gamified systems is often tracked with sensors, users can become concerned with who will see their data [105]. However, if users understand the individual benefits of electronic monitoring, they will be more likely to accept the system [106]. A third consideration involves matching gamified elements with the intended goals for the system [103]. For example, the biking study described earlier found that those who accessed gamified rankings travelled different distances based on their goals: those accessing rankings with competition or climate protection goals travelled further than those accessing rankings with self-exploration goals, while those with collaboration and climate protection goals who accessed the CO2 savings displays appear to have travelled the furthest [94]. Thus, more research is needed to determine how multiple goals should be linked to gamified elements [94].

Turning to implications for practice, our findings could be used by organizations during PEB training sessions and to help them implement and encourage PEBs among their employees. Identifying barriers, strategies to overcome the barriers, and visualizing success could be added to these processes to promote longer-term effects and avoid rebound effects. When employees identify barriers, management could help them identify strategies and resources to address these barriers, as individual employees may not have control over resources needed to implement the desired strategies. Capturing and sharing this knowledge could enhance PEBs more generally within their workplaces.

In conclusion, this paper contributes to organizational sustainability research in several ways: conceptually (by responding to calls for more theory-based research), methodologically (by measuring objective computer-based energy usage in study 1 and by utilizing a diary method in Study 2), and practically (by demonstrating the effectiveness of visualization to goal setting). We encourage future research that adds to theory and practical understanding for organizations working to enhance pro-environmental activities in their workplaces.

AUTHOR CONTRIBUTIONS

SS and JW developed the theoretical background, with contributions from SL. SL and JW designed, conducted, and analyzed Study 1, while SS and JW designed, conducted, and analyzed Study 2. SS and JW edited and revised the paper.

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest.

FUNDING

This research was supported with funding from the *Social Sciences and Humanities Research Council of Canada,* #435-2013-0716. This funding source was not involved in any aspect of this research.

ACKNOWLEDGMENTS

An earlier version of this paper was presented at the 2017 *European Conference on Information Systems.* The authors would like to thank their participants and their research assistants, Yulia Belik, Lauren Martin, Ali Khan, Mikhail Tsoy, and Indrani Karmakar.

APPENDICES

Appendix A: Qualitative Codes for Challenges and Barriers Identified

Type A: Related to things other than the goal defined in the study

- A—Lack of time (without the reason specified)
- A1 Socializing
- A2 Schoolwork
  - A2.1 Lectures
  - A2.2 Assignments/Projects
  - A2.3 Readings
  - A2.4 Meetings
  - A2.5 Studying/general homework/quiz prep
  - A2.6 Exams (final and/or midterms)
- A3 Personal demands:
  - A3.1 Sleeping
  - A3.2 (Long/hot) showers
  - A3.3 Family needs/issues
  - A3.4 Housemates/ Housing issues/housing work chores/house hunting
  - A3.5 Meals (Eating, cooking meals)
  - A3.6 Washing, cleaning
  - A3.7 Health related issues
- A4 Work-related:
  - A4.1 Recruiting
  - A4.2 Current job (including part-time)
  - A4.3 Volunteering
- A5 Conference
- A6 Leisure activities
  - A6.1 Fitness/Sports
  - A6.2 Reading
  - A6.3 Gaming/ TV / Internet
  - A6.4 Travelling
  - A6.5 Shopping (non-groceries)

Type B: Related to individual factors

- B1 Sleep issue
- B1.1 Lack of sleep/tired
- B1.2 Inability to get to sleep
- B2 Procrastination
- B3 Time management Skills
- B4 Lazy
- B5 Sick

Type C: Related to the Study Goal

C1 Lack of interest in/ commitment to goal

- C1.1 Forgot?
- C1.2 Lack of external influences/rewards?

C2 Lack of support/options to help achieve goal, e.g.:

- C2.1 Unsure how to achieve goal/lack of knowledge or skills
- C2.2 Difficulty of goal/habit/convenience
- C2.3 Technology issues/interference
- C2.4 Cravings
- C2.5 Difficulty of implementing goal, e.g.: grocery shopping /finding compost bins/etc.
- C2.6 Poor choices when eating out
- C2.7 Money
- C2.8 Interference/ indifference from others?
- C2.9 Weather

Type D: General Code if explicitly stated there were no barriers or challenges

Appendix B: Post-Hoc Analyses of the Impact of Initial Self-Concordance on Early Goal Success

Even though hypothesis 4 was not statistically supported (initial self-concordance did not moderate the effect of the treatment on goal outcomes), we did explore whether the patterns of goal outcomes differed for people who had stronger versus weaker initial self-concordance values (measured with the Biospheric Value construct). The plots below compare the bottom quartiles versus the top quartiles for goal progress (Figure A1), goal commitment (Figure A2), and goal attainment (Figure A3).

The plots in Panel 2 below demonstrate that the participants in the visualization condition who had high Biospheric values (top quartile) had consistently higher goal progress, commitment, and attainment across the time periods compared to participants in the other environmental conditions. This pattern was not observed for participants who had lower Biospheric values (bottom quartile). The Panel 1 figures for the bottom quartile show that the visualization condition sometimes under-

performed and sometimes out-performed the other environmental conditions (i.e., no consistent patterns). Therefore, this suggests that there may be differences due to Biospheric values that warrant further investigation.

Reinforcing the patterns illustrated below, we examined the participants' open-ended comments. Comments from the bottom quartile of the Biospheric Value measure demonstrates that some participants weren't passionate about the environment, saying "I don't care that much about the environment and thus I don't really care about this 'energy conservation' mechanism". Comments from the top quartile suggest they were trying hard to make progress on their goal, e.g., "Overall my progress in the last few days has been very strong. The only barrier I have experienced is occasionally going back to old/bad habits".

Others acknowledged their environmental values, but noted that other values sometimes came to the fore: "There are a variety of times where other simple values become more important than my goal of conserving more paper. For instance, I'd pick comfort or convenience sometimes over my goal, even though I am conscious that I am trying to attain my goal of conserving paper".

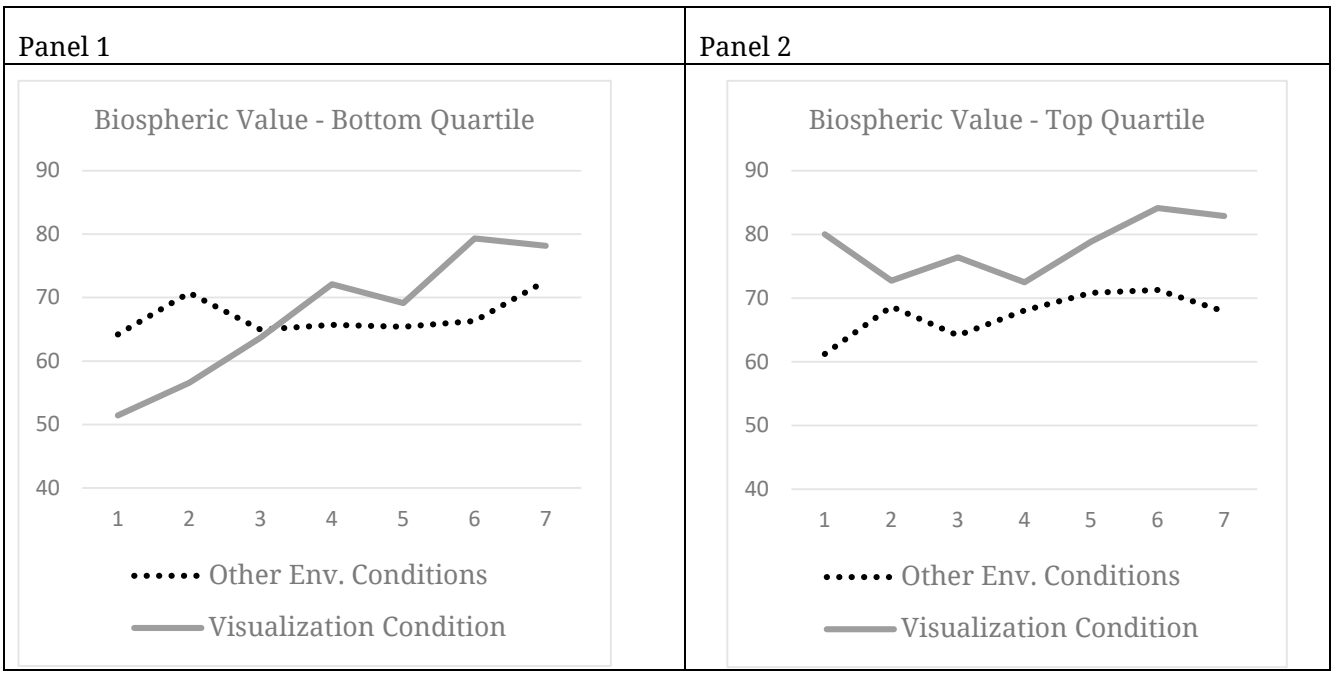

Figure A1. Study 2 Perceptions of Goal Progress across Time Periods for High and Low Initial Self-Concordance.

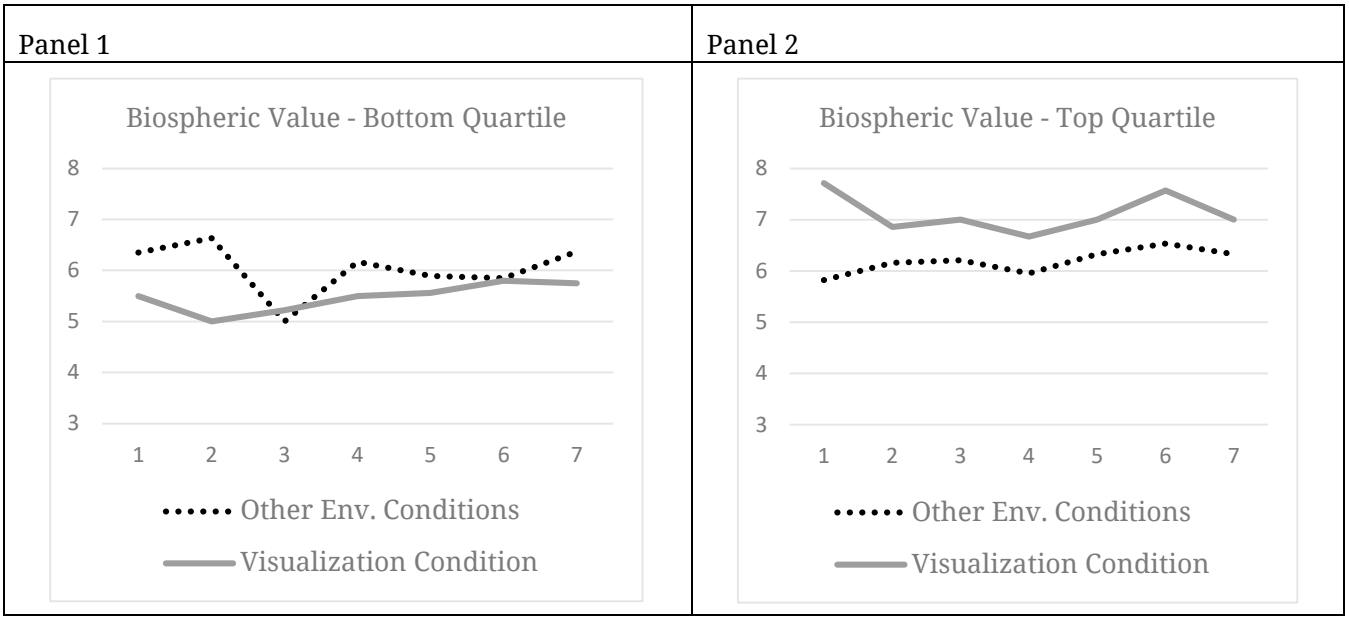

Figure A2. Study 2 Perceptions of Goal Commitment across Time Periods for High and Low Initial Self-Concordance.

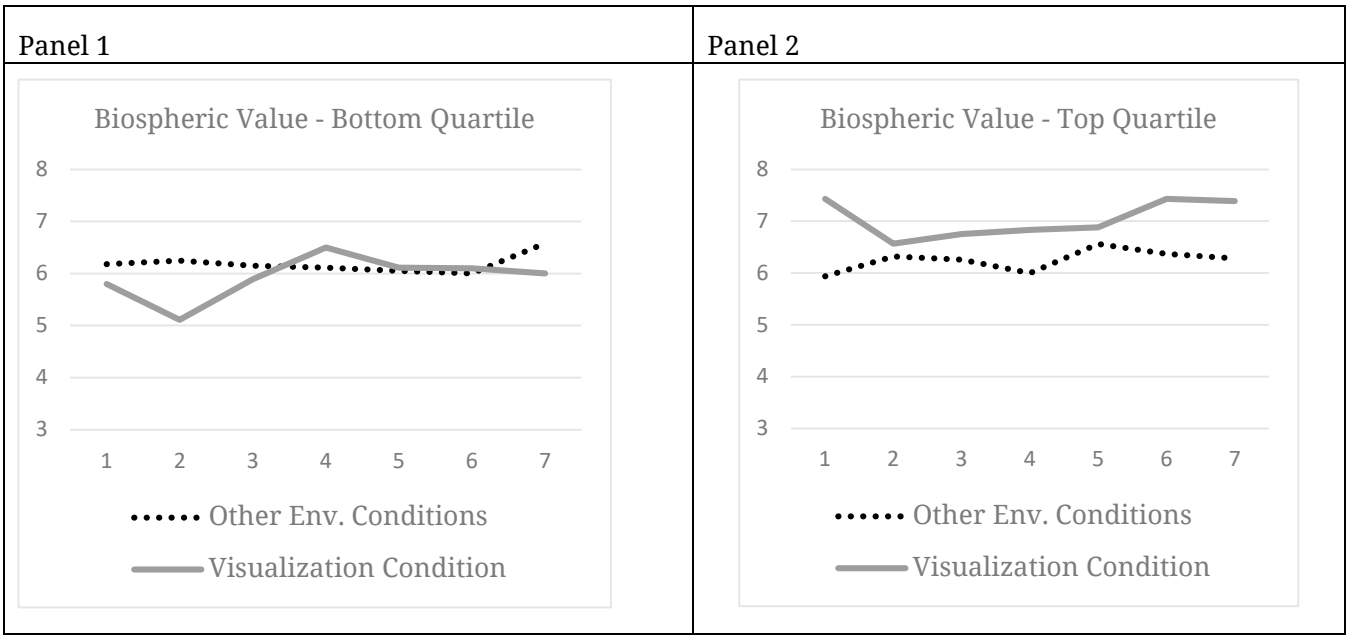

Figure A3. Study 2 Perceptions of Goal Attainment across Time Periods for High and Low Initial Self-Concordance.

Appendix C: Descriptive Statistics for Study 1

Table A1. Times 1 to 3 Means and Standard Deviations

	Conditions	Mean	Std. Deviation	*N*
Baseline	Goal	75.8673	48.86683	8
	Goal + Plans	85.2995	55.65024	7
	Total	80.2690	50.44287	15
Intervention	Goal	70.9813	48.25583	8
	Goal + Plans	73.6481	49.72125	7
	Total	72.2258	47.17759	15
Post-Intervention	Goal	83.0408	43.58849	8
	Goal + Plans	80.6866	59.09465	7
	Total	81.9422	49.47832	15

Appendix D: Descriptive Statistics for Study 2

Table A2. Time 8 Construct Details for H1–3 testing.

Construct	Condition 1 Mean; Standard Deviation	Condition 2 Mean; Standard Deviation	Condition 3 Mean; Standard Deviation	Condition 4 Mean; Standard Deviation
Goal Satisfaction	5.00; 1.78	5.56; 1.27	5.44; 1.46	6.19; 1.21
Positive Environmental Spillover	3.10; 1.49	3.96; 1.62	4.08;1.48	4.09; 1.46

Table A3. Time 1 to 7 Means and Standard Deviations.

Construct: Goal Progress

Time Period	Other Environmental Conditions Mean; Standard Deviation	Visualization Condition Mean; Standard Deviation
Time 1	65.59; 23.14	66.53; 23.06
Time 2	66.92; 19.81	62.78; 24.97
Time 3	66.01; 20.76	68.92; 23.56
Time 4	65.32; 23.04	69.94; 23.18
Time 5	67.37; 23.81	70.82; 23.75
Time 6	64.65; 25.72	75.58; 18.79
Time 7	67.87; 22.32	77.76; 17.60

Construct: Goal Commitment

Time Period	Other Environmental Conditions Mean; Standard Deviation	Visualization Condition Mean; Standard Deviation
Time 1	6.19; 2.08	6.11; 1.70
Time 2	6.15; 1.76	5.72; 2.04
Time 3	6.01; 1.90	6.03; 1.79
Time 4	5.90; 2.03	5.94; 2.00
Time 5	6.00; 2.30	6.24; 1.88
Time 6	5.91; 2.19	6.49; 1.84
Time 7	6.00; 2.11	6.53; 1.99

Construct: Goal Attainment

Time Period	Other Environmental Conditions Mean; Standard Deviation	Visualization Condition Mean; Standard Deviation
Time 1	5.99; 2.00	6.30; 1.70
Time 2	5.91; 1.66	5.64; 2.14
Time 3	6.06; 1.76	6.30; 1.85
Time 4	5.94; 2.18	6.36; 1.82
Time 5	6.09; 2.19	6.24; 2.02
Time 6	5.91; 2.18	6.54; 1.89
Time 7	6.10; 2.04	6.82; 1.75

Table A4. Time 8 constructs for testing H5 (MANCOVA).

Constructs	Other Environmental Conditions Mean; Standard Deviation	Visualization Condition Mean; Standard Deviation
Goal Satisfaction	6.48; 1.59	7.33; 1.21
Positive Environmental Spillover	4.02; 1.55	4.09; 1.46
Value Congruence	6.04; 1.68	5.87; 1.65

Appendix E. Study materials

Appendix E1: Study 1

Goal Setting Condition

I would like to ask you to (A) **set a goal** to conserve electricity with your computer and computer-related devices.

1. Setting Goals

The following are some **electricity-conserving tips**. Please look through them and choose at least **3** tips that you would like to follow (that you normally do not do) during this study:

a. Turn off your computers whenever possible.
b. Turn off external monitors whenever possible.
c. Set your computer's display settings to automatically turn off the monitor after 5 min of idle time.
d. Turn off any peripheral devices (e.g., printer) when not in use.
e. Unplug (or turn off the power bar) on all your computer-related devices when not in use.
f. Close your Internet browser and any other programs when not in use.

Please write down your chosen tips, and initial to indicate that you agree to implement these tips:

	I agree to my goal of conserving electricity on my computer and computer-related devices, and will do so by:	**My initials, indicating agreement**
(example)	(dimming my screen brightness)	(initials)
Tip #: _____		
Tip #: _____		
Tip #: _____		
Tip #: _____		
Tip #: _____		
Tip #: _____		

2. Goal Setting plus Implementation Intentions Condition

I would like to ask you to (A) **set a goal** to conserve electricity with your computer and computer-related devices and (B) **develop a plan** to implement that goal.

A. Setting Goals: Same Material as First Condition

B. Plans to Implement My Tips

Now, please plan the situations in which your chosen tips will apply to conserve electricity with your computer and computer-related devices.

Please write down your plans following the structure: "If situation X occurs, then I will perform the chosen tip Y".

For example: "If I leave my desk, then I will turn off my monitor."

	Situation + Tips	**Initials, indicating agreement**
(example)	(If I leave work, then I will shut down my computer.)	(initials)
Tip #: _____	If _____, then I will _____.	_____
Tip #: _____	If _____, then I will _____.	_____
Tip #: _____	If _____, then I will _____.	_____
Tip #: _____	If _____, then I will _____.	_____
Tip #: _____	If _____, then I will _____.	_____

Appendix E2: Study 2 environmental conditions

1. Condition 2: Goal Setting

Setting My Daily Environmental Goal

To help you think up a daily goal for the next 3 weeks, review the list below.

Please pick one of these behaviors or another one of your own choosing that can be performed every day:

Example Daily Environmental Goals
Reduce electricity use of my computer (e.g., turn off computer when not using it for 30 min or more; close programs when not in use, such as my web browser and MS Office).
Turn off external devices for computers (e.g., monitor, printer, external hard drive) when not in use for more than 15 min.
Conserve paper (e.g., double-sided printing, reuse scrap paper, read documents online instead of printing, recycling).
Save power (e.g., turn off lights when leaving a room for more than 15 min; turn down heat at night; wash clothes in cold water).
Reduce use of disposable dishes (e.g., carry a water bottle/mug when away from home; pack lunches in reusable packaging).
Substitute daily car driving with walking/biking/public transportation.
Reduce water usage (e.g., take shorter showers; turn off water when brushing teeth and washing dishes).
Compost more.
Goal of my own choosing
I have set my environmental goal to be _____ and I will keep this goal in mind during the study.
By initialing here, I agree to this goal: _____

2. Condition 3: Goal Setting + Plans

Step 1. Goal Setting: same as previous condition

Step 2. Making Plans to Implement My Daily Goal

After reading the example plans below, please complete three plans for accomplishing your goal:

Example Plans	**Situation + Activity**	
(Example Goal)	*(Turn off computer when not using it for 30 min or more)*	
(Example Plan #1)	*(When I leave school, I will shut down my computer.)*	
(Example Plan #2)	*(While I am eating lunch, I will turn off my computer.)*	
(Example Plan #3)	*(When I am in class, I will only start my computer when requested to do so by the instructor.)*	
My Plans	**Situation + Activity**	**My initials, indicating agreemen**
My Goal	_____	
Plan #1:	**When I _____, I will _____**	
Plan #2:	**When I _____, I will _____**	
Plan #3:	**When I _____, I will _____**	

3. Condition 4: Goal Setting + Plans + Visualization

Step 1. Goal Setting: same as previous condition

Step 2. Making Plans: same as previous condition
Step 3. Visualization

Thinking about Potential Daily Distractions

After thinking about possible daily distractions, read the example below, and then please list three possible distractions and develop strategies for overcoming these distractions:

Daily distractions to completing goal	**Strategies for Overcoming Daily Distractions**
Example: Pressures of work leave little time for remembering to turn off my computer at lunchtime	*Example:* Put a reminder in my lunch bag
1.	
2.	
3.	

Managing My Distractions

The following instructions, provided via PowerPoint presentation, were used to guide participants through the visualization of overcoming their barriers:

Next, please review your first distraction and strategy:

(a) Read the first distraction & strategy to yourself.
(b) Close your eyes and spend one min visualizing yourself successfully managing this distraction.

These instructions were repeated for the second and third distractions.

REFERENCES

1. Cantor DE, Morrow PC, McElroy JC, Montabon F. The role of individual and organizational factors in promoting firm environmental practices. Int J Phys Distrib Logist Manag. 2013;43(5/6):407-27. doi: 10.1108/IJPDLM-03-2012-0071
2. Nambiar P, Chitty N. Meaning Making by Managers: Corporate Discourse on Environment and Sustainability in India. J Bus Ethics. 2014;123(3):493-511. doi: 10.1007/s10551-013-1848-2
3. Jenkin TA, Webster J, McShane L. An agenda for 'green' information technology and systems research. Information and Organization. 2011;21(1):17-40. doi: 10.1016/j.infoandorg.2010.09.003
4. Bansal P, Gao J, Qureshi I. The Extensiveness of Corporate Social and Environmental Commitment across Firms over Time. Organ Stud. 2014;35(7):949-66. doi: 10.1177/0170840613515564
5. Sharma S, Vredenburg H. Proactive corporate environmental strategy and the development of competitively valuable organizational capabilities. Strat Manag J. 1998;19(8):729-53. doi: 10.1002/(SICI)1097-0266(199808)19:8<729::AID-SMJ967>3.0.CO;2-4
6. Ramus CA, Steger U. The roles of supervisory support behaviors and environmental policy in employee "ecoinitiatives" at leading-edge European companies. Acad Manage J. 2000;43(4):605-26. doi: 10.5465/1556357

7. Russell S. Getting to the heart of environmental issues. In: 67th Annual Meeting of the Academy of Management; 2007 Aug 3-8; Philadelphia, Pennsylvania, USA. Philadelphia (PA, US): Academy of Management; 2007.
8. Bissing-Olson MJ, Iyer A, Fielding KS, Zacher H. Relationships between daily affect and pro-environmental behavior at work: The moderating role of pro-environmental attitude. J Organ Behav. 2013;34(2):156-75. doi: 10.1002/job.1788
9. Smith AM, O'Sullivan T. Environmentally responsible behaviour in the workplace: An internal social marketing approach. J Market Manag. 2012;28(3-4):469-93. doi: 10.1080/0267257X.2012.658837
10. El Idrissi SC, Corbett J. Green IS research: A modernity perspective. Commun Assoc Inf Syst. 2016;38(1). doi: 10.17705/1CAIS.03830
11. Wang X, Brooks S, Sarker S. A review of green IS research and directions for future studies. Commun Assoc Inf Syst. 2015;37(1). doi: 10.17705/1CAIS.03721
12. Molla A, Abareshi A. Organizational green motivations for information technology: Empirical study. J Comput Inf Syst. 2012;52(3):92-102. doi: 10.1080/08874417.2012.11645562
13. Swim J, Clayton S, Doherty T, Gifford R, Howard G, Reser J, et al. Psychology and global climate change: Addressing a multi-faceted phenomenon and set of challenges. Washington, D.C. (US): American Psychological Association; 2009. Available from: http://www.apa.org/science/about/publications/climate-change.aspx. Accessed 2020 Mar 20.
14. Corbett J, Webster J, Jenkin TA. Unmasking corporate sustainability at the project level: Exploring the influence of institutional logics and individual agency. J Bus Ethics. 2018;147(2):261-86. doi: 10.1007/s10551-015-2945-1
15. Lo SH, Peters G-JY, Kok G. Energy-related behaviors in office buildings: A qualitative study on individual and organisational determinants. Appl Psychol. 2012;61(2):227-49. doi: 10.1111/j.1464-0597.2011.00464.x
16. Robertson JL, Barling J. Greening organizations through leaders' influence on employees' pro-environmental behaviors. J Organ Behav. 2013;34(2):176-94. doi: 10.1002/job.1820
17. Osbaldiston R, Schott JP. Environmental sustainability and behavioral science: Meta-analysis of proenvironmental behavior experiments. Environ Behav. 2012;44(2):257-99. doi: 10.1177/0013916511402673
18. Gollwitzer PM, Sheeran P. Implementation intentions and goal achievement: A meta-analysis of effects and processes. Adv Exp Soc Psychol. 2006;38:69-119. doi: 10.1016/S0065-2601(06)38002-1
19. Abrahamse W, Steg L, Vlek C, Rothengatter T. A review of intervention studies aimed at household energy conservation. J Environ Psychol. 2005;25(3):273-91. doi: 10.1016/j.jenvp.2005.08.002
20. Van Houwelingen JH, Van Raaij WF. The effect of goal-setting and daily electronic feedback on in-home energy use. J Consum Res. 1989;16(1):98-105. doi: 10.1086/209197
21. Conrady T, Kruschwitz A, Stamminger R. Influencing the sustainability of washing behavior by using motivational interviewing. Energy Effic. 2014;7:163-78. doi: 10.1007/s12053-013-9215-9

22. Locke EA, Latham GP. Building a practically useful theory of goal setting and task motivation: A 35-year odyssey. Am Psychol. 2002;57(9):705-17. doi: 10.1037/0003-066X.57.9.705
23. Hamad CD, Bettinger R, Cooper D, Semb G. Using behavioral procedures to establish an elementary school paper recycling program. J Environ Syst. 1980;10(2):149-56. doi: 10.2190/5TL9-EPP9-XKV1-3KJT
24. McCaul KD, Kopp JT. Effects of goal setting and commitment on increasing metal recycling. J Appl Psychol. 1982;67(3):377-9. doi: 10.1037/0021-9010.67.3.377
25. McCalley LT, Midden CJH. Energy conservation through product-integrated feedback: The roles of goal-setting and social orientation. J Econ Psychol. 2002;23(5):589-603. doi: 10.1016/S0167-4870(02)00119-8
26. Seidel S, Recker J, vom Brocke J. Sensemaking and sustainable practicing: Functional affordances of information systems in green transformations. MIS Q. 2013;37(4):1275-99. doi: 10.25300/MISQ/2013/37.4.13
27. Loock C-M, Staake T, Thiesse F. Motivating energy-efficient behavior with Green IS: An investigation of goal setting and the role of defaults. MIS Q. 2013;37(4):1313-32. doi: 10.25300/MISQ/2013/37.4.15
28. Elliot S. Transdisciplinary perspectives on environmental sustainability: A resource base and framework for IT-enabled business transformation. MIS Q. 2011;35(1):197-236. doi: 10.2307/23043495
29. Jerneck A, Olsson L, Ness B, Anderberg S, Baier M, Clark E, et al. Structuring sustainability science. Sustain Sci. 2011;6(1):69-82. doi: 10.1007/s11625-010-0117-x
30. Bamberg S. Effects of implementation intentions on the actual performance of new environmentally friendly behaviours—results of two field experiments. J Environ Psychol. 2002;22(4):399-411. doi: 10.1006/jevp.2002.0278
31. Muñoz P, Cohen B. Sustainable Entrepreneurship Research: Taking Stock and looking ahead. Bus Strategy Environ. 2018;27(3):300-22. doi: 10.1002/bse.2000
32. Sheehy LA. Goal setting for sustainability: A new method of environmental education [dissertation]. Murdoch (Australia): Murdoch University; 2005.
33. Foxx RM, Schaeffer MH. A Company-Based Lottery to Reduce the Personal Driving of Employees. J Appl Behav Anal. 1981;14(3):273-85. doi: 10.1901/jaba.1981.14-273
34. Katzev RD, Johnson TR. Comparing the effects of monetary incentives and foot-in-the-door strategies in promoting residential electricity conservation. J Appl Soc Psychol. 1984;14(1):12-27. doi: 10.1111/j.1559-1816.1984.tb02217.x
35. Lingard H, Gilbert G, Graham P. Improving solid waste reduction and recycling performance using goal setting and feedback. Construct Manag Econ. 2001;19(8):809-17. doi: 10.1080/01446190110070952
36. Latham GP, Stajkovic AD, Locke EA. The relevance and viability of subconscious goals in the workplace. J Manag. 2010;36(1):234-55. doi: 10.1177/0149206309350777
37. Hassan NR, Lowry PB. Seeking middle-range theories in information systems research. In: Proceedings of the Thirty-Sixth International Conference on

Information Systems. Fort Worth (TX, US): Social Science Research Network; 2015.

38. Miner JB. Goal setting theory 1: Essential theories of motivation and leadership organizational behaviour. Armonk (NY, US): M. E. Sharpe; 2005.
39. Unsworth KL, Yeo G, Beck J. Multiple goals: A review and derivation of general principles. J Organ Behav. 2014;35(8):1064-78. doi: 10.2307/26610949
40. Latham GP. The motivational benefits of goal-setting. Acad Manag Perspect. 2004;18(4):126-9. doi: 10.5465/ame.2004.15268727
41. Kruglanski AW, Shah JY, Fishbach A, Friedman R, Woo Young Chun, Sleeth-Keppler D. A theory of goal systems. Adv Exp Soc Psychol. 2002;34:331-78. doi: 10.1016/S0065-2601(02)80008-9
42. Lindenberg S, Steg L. Normative, gain and hedonic goal frames guiding environmental behavior. J Soc Issues. 2007;63(1):117-37. doi: 10.1111/j.1540-4560.2007.00499.x
43. Steg L, Bolderdijk JW, Keizer K, Perlaviciute G. An integrated framework for encouraging pro-environmental behaviour: The role of values, situational factors and goals. J Environ Psychol. 2014;38:104-15. doi: 10.1016/j.jenvp.2014.01.002
44. Osbaldiston R, Sheldon KM. Promoting internalized motivation for environmentally responsible behavior: A prospective study of environmental goals. J Environ Psychol. 2003;23(4):349-57. doi: 10.1016/S0272-4944(03)00035-5
45. Abrahamse W, Steg L, Vlek C, Rothengatter T. The effect of tailored information, goal setting, and tailored feedback on household energy use, energy-related behaviors, and behavioral antecedents. J Environ Psychol. 2007;27(4):265-76. doi: 10.1016/j.jenvp.2007.08.002
46. Becker LJ. Joint effect of feedback and goal setting on performance: A field study of residential energy conservation. J Appl Psychol. 1978;63(4):428-33. doi: 10.1037/0021-9010.63.4.428
47. Shen M, Young R, Cui Q. The normative feedback approach for energy conservation behavior in the military community. Energy Policy. 2016;98:19-32. doi: 10.1016/j.enpol.2016.08.014
48. Karlin B, Zinger JF, Ford R. The effects of feedback on energy conservation: A meta-analysis. Psychol Bull. 2015;141(6):1205-27. doi: 10.1037/a0039650
49. Gollwitzer PM, Brandstätter V. Implementation intentions and effective goal pursuit. J Pers Soc Psychol. 1997;73(1):186-99. doi: 10.1037/0022-3514.73.1.186
50. Gollwitzer PM. Implementation intentions: Strong effects of simple plans. Am Psychol. 1999;54(7):493-503. doi: 10.1037/0003-066X.54.7.493
51. Holland RW, Aarts H, Langendam D. Breaking and creating habits on the working floor: A field-experiment on the power of implementation intentions. J Exp Soc Psychol. 2006;42(6):776-83. doi: 10.1016/j.jesp.2005.11.006
52. Aarts H, Dijksterhuis A. Habits as knowledge structures: Automaticity in goal-directed behavior. J Pers Soc Psychol. 2000;78(1):53-63. doi: 10.1037/0022-3514.78.1.53
53. Bamberg S. The promotion of new behavior by forming an implementation intention: Results of a field experiment in the domain of travel mode choice.

J Appl Soc Psychol. 2000;30(9):1903-22. doi: 10.1111/j.1559-1816.2000.tb02474.x

54. Bamberg S. Implementation intention versus monetary incentive comparing the effects of interventions to promote the purchase of organically produced food. J Econ Psychol. 2002;23(5):573-87. doi: 10.1016/S0167-4870(02)00118-6
55. Fennis BM, Adriaanse MA, Stroebe W, Pol B. Bridging the intention–behavior gap: Inducing implementation intentions through persuasive appeals. J Consum Psychol. 2011;21(3):302-11. doi: 10.1016/j.jcps.2010.12.003
56. Rise J, Thompson M, Verplanken B. Measuring implementation intentions in the context of the theory of planned behavior. Scand J Psychol. 2003;44(2):87-95. doi: 10.1111/1467-9450.00325
57. Locke EA, Latham GP. A theory of goal setting & task performance. Englewood Cliffs (NJ, US): Prentice-Hall, Inc; 1990.
58. Unsworth KL, Dmitrieva A, Adriasola E. Changing behaviour: Increasing the effectiveness of workplace interventions in creating pro-environmental behaviour change. J Organ Behav. 2013;34:211-29. doi: 10.1002/job.1837
59. Nisa CF, Bélanger JJ, Schumpe BM, Faller DG. Meta-analysis of randomised controlled trials testing behavioural interventions to promote household action on climate change. Nat Commun. 2019;10(1):4545. doi: 10.1038/s41467-019-12457-2
60. Koestner R, Otis N, Powers TA, Pelletier L, Gagnon H. Autonomous motivation, controlled motivation, and goal progress. J Pers. 2008;76(5):1201-30. doi: 10.1111/j.1467-6494.2008.00519.x
61. Dalton AN, Spiller SA. Too much of a good thing: The benefits of implementation intentions depend on the number of goals. J Consum Res. 2012;39(3):600-14. doi: 10.1086/664500
62. Brewer GA, Ball BH, Knight JB, Dewitt MR, Marsh RL. Divided attention interferes with fulfilling activity-based intentions. Acta Psychol. 2011;138(1):100-5. doi: 10.1016/j.actpsy.2011.05.011
63. Marks DF. Consciousness, mental imagery and action. Br J Psychol. 1999;90(4):567-85. doi: 10.1348/000712699161639
64. Burkard C, Rochat L, Emmenegger J, Van der Linden A-CJ, Gold G, Van der Linden M. Implementation intentions improve prospective memory and inhibition performances in older adults: The role of visualization. Appl Cogn Psychol. 2014;28(5):640-52. doi: 10.1002/acp.3046
65. Schultheiss OC, Brunstein JC. Goal imagery: Bridging the gap between implicit motives and explicit goals. J Pers. 1999;67(1):1-38. doi: 10.1111/1467-6494.00046
66. Boudreaux MJ, Ozer DJ. Goal conflict, goal striving, and psychological well-being. Motiv Emot. 2013;37(3):433-43. doi: 10.1007/s11031-012-9333-2
67. Louro MJ, Pieters R, Zeelenberg M. Dynamics of multiple-goal pursuit. J Pers Soc Psychol. 2007;93(2):174-93. doi: 10.1037/0022-3514.93.2.174
68. Lacroix K, Gifford R, Chen A. Developing and validating the dragons of inaction psychological barriers (DIPB) scale. J Environ Psychol. 2019;63:9-18. doi: 10.1016/j.jenvp.2019.03.001

69. The Climate Group. SMART 2020: Enabling the low carbon economy in the information age. The Climate Group 2008. Available from: https://www.theclimategroup.org/what-we-do/news-and-blogs/SMART-2020-Enabling-the-low-carbon-economy-in-the-information-age. Accessed 2020 May 30.
70. Oppong-Tawiah D, Webster J, Staples S, Cameron A-F, Ortiz de Guinea A, Hung TY. Developing a gamified mobile application to encourage sustainable energy use in the office. J Bus Res. 2020;106:388-405. doi: 10.1016/j.jbusres.2018.10.051
71. Berthon P, Donnellan B. The greening of IT: Paradox or promise? J Strategic Inf Syst. 2011;20(1):3-5. doi: 10.1016/j.jsis.2011.02.001
72. Orland B, Ram N, Lang D, Houser K, Kling N, Coccia M. Saving energy in an office environment: A serious game intervention. Energy Build. 2014;74:43-52. doi: 10.1016/j.enbuild.2014.01.036
73. Ashraf R, Merunka D. The use and misuse of student samples: An empirical investigation of European marketing research. J Consum Behav. 2017;16(4):295-308. doi: 10.1002/cb.1590
74. Trochim WM. The Research Methods Knowledge Base. 2nd ed. Cincinnati (OH, US): Atomic Dog Publishing; 2006.
75. de Groot JIM, Steg L. Value orientations to explain beliefs related to environmental significant behavior: How to measure egoistic, altruistic, and biospheric value orientations. Environ Behav. 2008;40(3):330-54. doi: 10.1177/0013916506297831
76. Bissing-Olson MJ, Fielding KS, Iyer A. Diary methods and workplace pro-environmental behaviors. The psychology of green organizations, New York (NY, US): Oxford University Press; 2015. p. 95-116. doi: 10.1093/acprof:oso/9780199997480.003.0005
77. Koestner R, Lekes N, Powers TA, Chicoine E. Attaining personal goals: Self-concordance plus implementation intentions equals success. J Pers Soc Psychol. 2002;83(1):231-44. doi: 10.1037/0022-3514.83.1.231
78. Sheldon KM, Schüler J. Wanting, having, and needing: Integrating motive disposition theory and self-determination theory. J Pers Soc Psychol. 2011;101(5):1106-23. doi: 10.1037/a0024952
79. Cable DM, DeRue DS. The convergent and discriminant validity of subjective fit perceptions. J Appl Psychol. 2002;87(5):875-84. doi: 10.1037/0021-9010.87.5.875
80. Koestner R, Powers TA, Milyavskaya M, Carbonneau N, Hope N. Goal internalization and persistence as a function of autonomous and directive forms of goal support. J Pers. 2015;83(2):179-90. doi: 10.1111/jopy.12093
81. Truelove HB, Carrico AR, Weber EU, Raimi KT, Vandenbergh MP. Positive and negative spillover of pro-environmental behavior: An integrative review and theoretical framework. Global Environ Change. 2014;29:127-38. doi: 10.1016/j.gloenvcha.2014.09.004
82. Boiral O, Paillé P. Organizational citizenship behaviour for the environment: Measurement and validation. J Bus Ethics. 2012;109(4):431-45. doi: 10.1007/s10551-011-1138-9

83. Faul F, Erdfelder E, Lang A-G, Buchner A. G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. Behav Res Methods. 2007;39(2):175-91. doi: 10.3758/BF03193146
84. Burkley E, Curtis J, Burkley M, Hatvany T. Goal fusion: The integration of goals within the self-concept. Self Identity. 2015;14(3):348-68. doi: 10.1080/15298868.2014.1000959
85. Chan CKY, Cameron LD. Promoting physical activity with goal-oriented mental imagery: A randomized controlled trial. J Behav Med. 2012;35(3):347-63. doi: 10.1007/s10865-011-9360-6
86. Blok V, Wesselink R, Studynka O, Kemp R. Encouraging sustainability in the workplace: A survey on the pro-environmental behaviour of university employees. J Clean Prod. 2015;106:55–67. doi: 10.1016/j.jclepro.2014.07.063
87. Szabo S, Webster J. Perceived Greenwashing: The Effects of Green Marketing on Environmental and Product Perceptions. J Bus Ethics. 2020. doi: 10.1007/s10551-020-04461-0
88. Maki A, Carrico AR, Raimi KT, Truelove HB, Araujo B, Yeung KL. Meta-analysis of pro-environmental behaviour spillover. Nat Sustain. 2019;2(4):307-15. doi: 10.1038/s41893-019-0263-9
89. Csikszentmihalyi M, Hunter J. Happiness in everyday life: The uses of experience sampling. J Happiness Stud. 2003;4(2):185-99. doi: 10.1023/A:1024409732742
90. Schwenk CR. The use of participant recollection in the modeling of organizational decision processes. Acad Manag Rev. 1985;10(3):496-503. doi: 10.5465/amr.1985.4278971
91. Elfenbein HA. Emotion in organizations. Acad Manag Ann. 2007;1(1):315-86. doi: 10.1080/078559812
92. Beal DJ. ESM 2.0: State of the art and future potential of experience sampling methods in organizational research. Ann Rev Organ Psychol Organ Behav. 2015;2(1):383-407. doi: 10.1146/annurev-orgpsych-032414-111335
93. Watson RT, Boudreau M-C, Chen AJ. Information systems and environmentally sustainable development: Energy informatics and new directions for the IS community. MIS Q. 2010;34(1):23-38. doi: 10.2307/20721413
94. Ebermann C, Brauer B. The role of goal frames regarding the impact of gamified persuasive systems on sustainable mobility behavior. In: Proceedings of the European Conference of Information Systems. Atlanta (GA, US): Association for Information Systems; 2016.
95. Paulhus DL. Measurement and control of response bias. Measures of personality and social psychological attitudes. San Diego (CA, US): Academic Press; 1991. p. 17-59. doi: 10.1016/B978-0-12-590241-0.50006-X
96. Compeau D, Marcolin B, Kelley H, Higgins C. Research Commentary—Generalizability of Information Systems Research Using Student Subjects—A Reflection on Our Practices and Recommendations for Future Research. Inf Syst Res. 2012;23(4):1093-109. doi: 10.1287/isre.1120.0423
97. Arthur C, Shepherd L, Sumo M. The role of students' diligence in predicting academic performance. Res Schools. 2006;13(2):72-80.

98. Bateman TS, O'Neill H, Kenworthy-U'Ren A. A hierarchical taxonomy of top managers' goals. J Appl Psychol. 2002;87(6):1134-48. doi: 10.1037/0021-9010.87.6.1134
99. Melville NP. Information systems innovation for environmental sustainability. MIS Q. 2010;34:1-21. doi: 10.2307/20721412
100. McKenzie-Mohr D. Fostering sustainable behavior through community-based social marketing. Am Psychol. 2000;55(5):531-7. doi: 10.1037/0003-066X.55.5.531
101. Simon J, Jahn M, Al-Akkad A. Saving energy at work: the design of a pervasive game for office spaces. In: Proceedings of the 11th International Conference on Mobile and Ubiquitous Multimedia. Ulm (Germany): Association for Computing Machinery; 2012. p. 1-4. doi: 10.1145/2406367.2406379
102. Bui A, Veit D, Webster J. Gamification—A novel phenomenon or a new wrapping for existing concepts? In: Proceedings of the Thirty-Sixth International Conference on Information Systems. Fort Worth (TX, US): Springer; 2015.
103. Liu D, Santhanam R, Webster J. Toward meaningful engagement: A framework for design and research of gamified information systems. MIS Q. 2017;41(4):1011-34. doi: 10.25300/MISQ/2017/41.4.01
104. Chen H-M, Lin C-W, Hsieh S-H, Chao H-F, Chen C-S, Shiu R-S, et al. Persuasive feedback model for inducing energy conservation behaviors of building users based on interaction with a virtual object. Energy Build. 2012;45:106-15. doi: 10.1016/j.enbuild.2011.10.029
105. Jahn M, Schwartz T, Simon J, Jentsch M. EnergyPULSE: Tracking sustainable behavior in office environments. In: Proceedings of the 2nd International Conference on Energy-Efficient Computing and Networking. New York (NY, US): Association for Computing Machinery; 2011. p. 87-96. doi: 10.1145/2318716.2318733
106. Bolderdijk JW, Steg L, Postmes T. Fostering support for work floor energy conservation policies: Accounting for privacy concerns. J Organ Behav. 2013;34(2):195-210. doi: 10.1002/job.1831

How to cite this article:
Staples S, Webster J, Lv S. Comparing Goal Setting Approaches to Boosting Pro-Environmental Behaviors. J Sustain Res. 2020;2(4):e200034. https://doi.org/10.20900/jsr20200034