THE EFFECTS OF A SELF-MONITORING PROCEDURE ON SUSTAINABLE BEHAVIOR

Chinedu Peter Eni, B.S.

Thesis Prepared for the Degree of

MASTER OF SCIENCE

UNIVERSITY OF NORTH TEXAS

August 2011

APPROVED:

Richard G. Smith, Major Professor and Chair of the Department of Behavior Analysis
Einar Ingvarsson, Committee Member
Traci Cihon, Committee Member
Todd Spinks, Committee Member
Thomas Evenson, Dean of the College of Public Affairs and Community Service
James D. Meernik, Acting Dean of the Toulouse Graduate School

Eni, Chinedu Peter. *The effects of a self-monitoring procedure on sustainable behavior*. Master of Science (Behavior Analysis), August 2011, 46 pp., 1 table, 8 figures, references, 42 titles.

Self-monitoring procedures are commonly used to assess environmentally sustainable behavior. The current experiment evaluated the effects of a self-monitoring procedure on two sustainable behaviors within a university office. A senior assistant was asked to report on light usage and energy-saver use on the copier in an office break room. Her reports were then compared with independent observations. Results showed that her reports were highly correspondent with independent observations although no change in target behaviors occurred. Changes in behavior occurred when she was asked to engage in the target behaviors. Results suggest that although self-monitoring procedures can correctly assess sustainable behaviors, they may not be suitable for behavior change.

ACKNOWLEDGEMENTS

I would like to express my gratitude to Rick Smith who made this project possible and whose feedback proved invaluable during the writing process. I would also like to thank the entire department of behavior analysis at the University of North Texas as well as my thesis committee members for their insightful feedback. Finally, thanks to my family for their unwavering support throughout my graduate career.

TABLE OF CONTENTS

LIST OF TABLES

Page

LIST OF ILLUSTRATIONS

Page

CHAPTER 1

INTRODUCTION

Sustainability

The United Nations (1987) defines sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (p. 1). Grant (2010) defines sustainability as "our ability to engage in behaviors that adequately reinforce the behavior of the current population and are repeatable over long times without having harmful effects on future generations" (p. 5). Over the past 30 years, the definition of sustainability has evolved to include both public and private (or business) points of view. From the public perspective, sustainability involves the satisfaction of basic economic, social and security needs, now, and in the future, without undermining the natural resource base on which life depends. The business point of view emphasizes long-term shareholder value while reducing negative impacts on the environment as the goal of sustainability (EPA, 2011).

A constant among definitions of sustainability is that it involves the preservation of the environment for future use. However, it has become increasingly apparent that many of our culture"s current practices have not favored the long-term preservation of our environment (Abramovitz & Matoon; Oskamp, 2000; Thompson, 2010). Human activity has led to increased air pollution (Lehman & Geller, 2004), water pollution and depletion (Thompson, 2010), increased production of solid waste (Lehman & Geller) and climate change through global warming (Lehman & Geller). In fact, Whiteman (2009) estimates that the increased flooding and draught caused by climate change results in about $125 billion in economic losses per year. The

air has become increasingly polluted by carbon dioxide (CO_2) and nitrogen – byproducts of fossil fuels such as oil and coal. It is evident that sustainable development can be attained only through large-scale changes in human behavior.

The need for substantial behavior change to improve sustainability presents both a challenge and an opportunity for the field of behavior analysis; in fact, behavior analysts have addressed issues of sustainability for over three decades (cf., Burgess, Clark, & Hendee, 1971). Lehman and Geller (2004) reported that behavior analysis has been successfully utilized to increase recycling in neighborhoods (DeLeon & Fuqua, 1995; Werner et al., 1995) and universities (Ludwig, Gray, & Rowell, 1998). Behavior analysts have also successfully intervened in the areas of litter control (Geller, Brasted, & Mann, 1980; Hayes, Johnson, & Cone, 1975), transportation (Bamberg, 2002; Mayer & Geller, 1982, 1983), and energy conservation (Brandon & Lewis, 1999; Staats, van Leeuwen, & Wit, 2000; Winett, Leckliter, Chinn, Stahl, & Love, 1985). For example, Winett and colleagues conducted a series of large-scale analyses in which they evaluated the effects of a variety of behavioral interventions to improve energy conservation behaviors. They demonstrated that a) video modeling and feedback can be effective in improving energy conservation behaviors (Winett et al., 1982) and b) television modeling alone can lead to a reduction in energy consumption (Winett et al., 1985). It is worth noting that these analyses focused on thermostat adjustments as the primary form of energy conservation.

Researchers from other disciplines such as environmental psychology have also developed a variety of programs and initiatives to assess and improve sustainable behavior (cf., Stan & Vleg, 2009). A primary difference between these studies and most behavior analytic

research is that most research in environmental psychology utilizes participant self-report through surveys and questionnaires as the primary and, frequently, sole source of data. Typically, these surveys and questionnaires require individuals to observe and record their own behavior and then report on it. Nelson (1977) refers to this process as self-monitoring.

According to Nelson (1977), self-monitoring is a two-stage process that involves discrimination of a target behavior and recording its occurrence. Self-monitoring procedures are appealing to researchers for a number of reasons. First, they are very easy to administer. Typically, participants are given a questionnaire asking them to record or estimate the number of times they engage in behaviors of interest, thus requiring little effort on the part of the researcher. Second, in the area of sustainability, the nature of the behaviors of interest can make it impractical to use direct observation procedures. For instance, covert behaviors, such as recycling at home, can be hard to capture using observers. Third, self-monitoring procedures should yield more data since the participant can capture every instance of the target behavior rather than a sample of behavior obtained by outside observers (Nelson, 1977). However, self-monitoring is not without its drawbacks. Perhaps the most obvious disadvantage is that data derived from self-monitoring cannot be checked for accuracy due to the presence of only one observer. Although, this problem can be mitigated by having a second, independent observer to corroborate the data whenever possible; such checks are not often seen in the non-behavioral literature (Ebreo & Vinning, 1994; Goldenhar & Connell, 1993). The result is that data obtained through self-monitoring procedures are often not considered to be sufficiently trustworthy for scientific analysis (Corral-Verdugo, 1997; Steg & Vlek, 2009). One purpose of the present experiment was to utilize independent measurement to evaluate correspondence between

independent observations and participant reports (or accuracy) of self-monitoring of energy conservation behaviors.

A second issue related to self-monitoring is the reactive nature of the measurement procedure (Broden, Hall, & Mitts, 1971; Herbert & Baer, 1972). This means that behavior may change as a function of obtrusive measurement procedures such as self-observation – typically in the desired direction (Nelson, 1977). For example, unwanted behaviors typically decrease as a function of being observed while desired behaviors increase when monitored (Broden, et al.). Although this creates challenges to the validity of data obtained through self-monitoring, it also may be used as an intervention strategy to improve behavioral performances. Thus, self-monitoring can potentially serve two functions: as a method of assessment and as a therapeutic strategy (Jason, 1975).

Previous research on self-monitoring has failed to yield consistent results; in some situations, it appears the mere act of self-monitoring has been sufficient to produce behavior change (Broden, et al., 1971; Herbert & Baer, 1972). In other cases, no such effects have been observed (Berecz, 1972; Fixen, Phillips, & Wolf, 1972; Mahoney, Moura, & Wade, 1973). Broden et al. (1971) conducted two experiments to assess the effects of self-recording on two students‟ classroom behavior. In the first experiment, a student was given a piece of paper by the school counselor and instructed to record instances of her study behavior during class. The dependent variable was the percentage of class time spent engaging in study behaviors. Following instruction, her study behaviors increased from 30% during baseline to 78% of the class period. Study behavior decreased to 27% following a withdrawal of the procedure and increased to 80% when it was reintroduced. In a final condition, the self-monitoring procedure

was withdrawn and replaced with teacher attention and study behavior remained at very high level – about 80%. This is worth noting because while the self-monitoring procedure was in effect, the student shared the results of her recording with the school counselor who "…praised Liza‟s [the student] reports of study behavior emphasizing the days when the percent of plus marks (study behavior) was high" (Broden et al., p. 193). It is unclear if the increase in study behavior was due to the self-monitoring procedure or to the statements of approval by her counselor that may have served as reinforcement. In their second experiment, Broden et al. instructed a student to record instances of his "talk-outs" during a class period. The result was a substantial reduction in instances of talk-outs per minute from baseline. However, this effect was short-lived; following the withdrawal condition, the reintroduction of the self-monitoring procedure failed to replicate the effects of the initial self-monitoring condition.

Winett, Neale, and Grier (1979) showed that a self-monitoring procedure was effective in reducing energy consumption. Participants were divided into three groups – feedback, self-monitoring and control. The feedback group was given information on energy conservation emphasizing thermostat control and a booklet showing potential savings based on an effective use of appliances. The feedback group also received a sheet showing their percentage change in energy consumption compared to baseline and an estimated monthly electricity bill based on their previous day‟s energy consumption. On the other hand, the self-monitoring group was taught how to read electricity meters and was provided with form to fill out daily readings. In addition, the self-monitoring group was provided with information stating their expected energy consumption based on the household size and weather. Results showed that both groups reduced

their energy consumption compared to the control group with the feedback group showing a larger reduction (13% versus 7% reduction).

It is likely that the information on expected energy consumption served as feedback mechanism for the self-monitoring group. Consequently, the reduction in energy consumption cannot be attributed solely to the self-monitoring procedure. The data seem to support this account, given that feedback was more effective in reducing energy consumption. Other procedures that have been shown to improve energy conservation are written feedback (Bekker et al., 2010; Hayes & Cone, 1980; Palmer, 1977); monetary payments and incentives (Bekker et al., 2010; Hayes & Cone, 1980) and visual prompts (Bekker at al., 2010; Palmer, 1977).

In another evaluation of self-monitoring, Herbert and Baer (1972) instructed two mothers to record instances of attention to their children following appropriate behavior. Self-monitoring led to an overall increase in attention to appropriate behaviors as well as an increase in the children‟s appropriate behavior compared to baseline. For one parent, the overall increase in attention carried over to inappropriate behavior, so she was explicitly instructed to ignore inappropriate behavior while continuing to attend to appropriate behavior. Two points are worth noting in this experiment. First, when the parents were instructed to self monitor, they were told that self-monitoring sometimes changes behavior and that the experimenters were interested if asking them to report on attention to appropriate behaviors would increase their attention to appropriate behaviors. Second, parents were told to differentially reinforce the children‟s behaviors. Thus, it is unclear if the changes in parental attention can be attributed solely to self-monitoring; it is possible that the nature of the instruction and prompting to implement a reinforcement contingency could account for these effects (Nelson, 1977). Similarly, Akande

(1997) instructed tutors to deliver statements of approval whenever they observed the children playing and to record each instance of delivery. Results showed an increase in the number of approval statements compared to baseline.

Other experiments have shown no effects of self-monitoring on the behavior being observed. Fixen, Phillips, and Wolf (1972) instructed teenage boys living a rehabilitative home to report on the cleanliness of their rooms and their peers‟ rooms. They found no effects of the self-monitoring procedure on the cleanliness of their rooms. The experiment also showed a low correspondence between the reports of the participants and those of an independent observer. Only when contingencies were attached to accuracy did the participants‟ reporting improve. This is an interesting finding because other research (Broden et al., 1971; Herbert & Baer, 1972) has shown the reactive effects of self-monitoring to be independent of participant/observer correspondence.

Berecz (1972) asked participants to estimate the number of cigarettes they smoked daily and later were instructed to keep a daily record of how often they smoked. The author predicted that self-monitoring using the daily record would reduce the frequency of smoking; however, no clear effects on cigarette consumption were evident. Mahoney et al. (1973) instructed participants in their weight-loss experiment to: a) record their daily weight and eating habits and b) conduct bi-weekly weigh-ins with the experimenter for four weeks. They found that self-monitoring had no effects on weight or eating habits when compared to a group that earned money for losing weight.

Given the mixed results on the effects of self-monitoring and its perceived utility as an assessment method (Steg & Vlek, 2009), the present experiment sought to address two issues.

First, our team of researchers (hereafter referred to as we) attempted to evaluate the accuracy of self-recorded data on sustainable behaviors in a university business office. Two, we evaluated if asking an individual to report on certain sustainable behaviors would cause a change in those behaviors. Consistent with the literature on self-monitoring, accuracy was defined as the correspondence between independent experimenter observations and participant reports of the target behaviors (Nelson, 1977).

CHAPTER 2

METHOD

Participant

Ann worked as a senior assistant in the administrative office of a college at the University of North Texas (UNT), hereafter referred to as the Dean‟s Office. Her office contacted the Office of Sustainability and expressed interest in participating in a program to improve sustainability practices within their office. Ann served as the "green representative" for her office, which meant that she was responsible for interfacing with the Office of Sustainability‟s Green Office Certification Program assessment team (Students for Sustainable Office Practices, or SSOP) and participating in the development and implementation of a plan of action for her office. She was also responsible for keeping the other members of her office up-to-date on developments in the university‟s sustainability initiative. Our participant was not informed of the experiment because doing so would have compromised our ability to assess accuracy. She might have reported differently if she was aware that her data were being compared with ours.

Setting

Observations occurred in the breakroom of the Dean‟s Office. The breakroom contained a copier, refrigerator, and microwave oven. It also contained a fax machine, toaster oven, electric three-hole punch and coffee maker which were plugged into a surge protector located on a table. Among other items in the room were a dish rack which was placed next to the kitchen sink, coffee cups, plastic utensils and other kitchen supplies, a trash bin and two recycling bins – one for paper and the other for plastic and aluminum. The cabinet underneath the sink contained cleaning supplies, paper towels and napkins. The Dean‟s Office staff consisted of two senior

assistants (Ann was one of them), an assistant, a receptionist, the Associate Dean, and the Dean. Only Ann directly participated in the experiment.

Preliminary Observation

The assessment team met with Ann to conduct a preliminary observation of the Dean‟s Office. Each office was examined to identify possible areas for improvement, particularly areas in which quantifiable measures could be observed repeatedly. During the meeting, Ann was asked about a) the reason for her office‟s interest in the sustainability initiative b) her office‟s current sustainable practices and c) any areas her office would like to improve. Ann reported that her office had recently installed a recycling bin in every office and bought a water filter to reduce the use of disposable plastic bottles within the office. Although Ann did not identify any specific areas of improvement, she reported that her office could do more to help the environment.

Experimental Design

A multiple-baseline across behaviors design was used to determine the effects of self-reporting and instructions on two behaviors of interest. The behaviors of interest were: turning off the lights in the breakroom when it was unoccupied and using the energy-saving feature on the copier during the workday.

Behavioral Measures, Data Collection, and Interobserver Agreement (IOA)

Behavioral measures. The behaviors of interest were selected for a number of reasons. First, they were identified by the university‟s Office of Sustainability as energy-saving office practices targeted for increase. Second, they were discrete behaviors that were appropriate for repeated measurement. For example, the office breakroom was used frequently but also was frequently unoccupied, providing many opportunities to measure whether lights were turned off

when the room was left unoccupied. Similarly, the energy-saver mode on the copier could be engaged by pressing the energy-saver button. The copier remained in energy-saver mode until the next copy job was completed. After use, it was necessary to press the button again to re-engage the energy-saver mode. Third, we wanted to be as unobtrusive as possible during data collection so as not to disrupt the typical activities of the office; therefore, we selected behaviors that could be measured easily and quickly – most observations took less than one minute. Fourth, we chose behaviors that required very little response effort and were amenable to change.

We chose to measure light usage in the breakroom for two reasons. First, it was a room we could readily access at any time during business hours. We could not readily access any of the personal offices without being obtrusive. Second, we wanted to pick a relatively public area within the office because we were interested in identifying if the intervention would result in generalized changes in behavior across office staff.

Data collection. The dependent variables were: cumulative instances of lights turned off when the breakroom was unoccupied (hereafter referred to as "lights off") and cumulative instances of the energy-saving mode being used on the copier (hereafter referred to as "energy-saver use"). The independent variable was providing Ann with a data sheet and asking her to record how often these behaviors occurred during the workday. Observers used a modified scatter plot to record data. The data sheet was apportioned into 30-min intervals and observers entered codes representing dependent variable values in cells corresponding to the time of observation. A copy of the form used by observers is provided in Appendix A. The observers scored lights off by entering a 0 if the lights were on and the breakroom was unoccupied; entering a 1 if the lights were off and the breakroom was unoccupied; and entering an X if the

breakroom was occupied. The observers scored energy-saver use by entering a 1 if the copier was in the energy-saving mode and the room was unoccupied. This was easy to identify because the display on the copier was turned off when in energy-saving mode. A simple button press turned the copier in and out of energy-saving mode. The observers entered a 0 if the energy-saving feature was not on and the room was unoccupied. Observers entered an X if the room was occupied. An X was used to denote an occupied room because we assumed all appliances were being used if the room was occupied. Data were collected two or three times per day with at least one hour between observations, five days a week for approximately eight weeks.

Interobserver agreement (IOA). Interobserver agreement (IOA) was conducted by having a second trained observer independently measure instances of lights off and energy-saver use during independent experimenter observations. Data records were inspected on an observation-by-observation basis, and interobserver agreement was calculated by dividing agreements by total number of observations (agreements + disagreements) and multiplying the result by 100. Interobserver agreement was conducted for 34% of all observations.

Procedures

Baseline. During this phase, data were collected on the condition of the lights and copier prior to the introduction of the independent variable. During this condition, our observations were naturalistic in the sense that no experimental manipulations were made.

Condition 1 (self-monitoring). Ann was provided with a checklist on which she could record how often lights were left on in the breakroom when it was unoccupied and how often the energy-saver was used on the copier. This condition was implemented twice, once for the lights and

once for the copier, respectively. A copy of the light checklist is provided in Appendix B. The checklist contained the following written instruction:

> We appreciate your assistance with this project. To conduct breakroom checks, just observe if there are any people in the room at the moment of the check (as soon as you look into the room). If persons are present, circle "Y", if not, circle "N". At the same time, check if the lights are on and circle "Y" or "N" accordingly. Please conduct at least 2 checks per day, with one check in the morning and another in the afternoon. If time permits, additional checks, up to 4 checks per day would be helpful. Please allow 1 hour between checks. If you have questions about how to conduct the checks or complete the form, please contact [the experimenter].

The checklist asked Ann to record the following information for each observation: a) was the room occupied? b) was the light on? and c) what time of day the observation occurred. The checklist provided her with four observation opportunities during the day. If she entered the breakroom when it was occupied, she indicated this on the checklist and left. If the room was unoccupied, she noted this on the checklist and also noted if the lights were on. Ann was given a checklist at the beginning of each Monday during the intervention and checklists were collected at the end of each workweek. Observers continued to conduct independent experimenter measurements of lights off and energy saver use throughout this intervention.

Next, Ann was provided with a checklist on which she could record the number of times the copier was in the energy-saver mode. A copy of this checklist is provided in Appendix C. It also contained the following instruction:

> We appreciate your assistance with this project. To conduct breakroom checks, just observe if there are any people in the room at the moment of the check (as soon as you look into the room). If persons are present, circle "Y", if not, circle "N". At the same time, check if the Xerox energy-saver mode is on and circle "Y" or "N" accordingly. You can tell by checking the display. When the copier is in energy-saver mode, the display is blank. If you can read the display, the copier is not in energy-saver mode. Please conduct at least 2 checks per day, with one check in the morning and another in the afternoon. If time permits, additional checks, up to 4 checks per day would be helpful. Please allow 1 hour between checks. If you have questions about how to conduct the checks or complete the form, please contact [the experimenter].

All other procedures were identical to the previous condition. Ann was asked to continue to complete the checklist for lights off and observers continued to conduct independent experimenter measurements of lights off and energy-saver use.

Condition 2 (self-monitoring + instruction). This condition was identical to condition 1 except that Ann was asked to turn the light off and engage the energy-saver on the copier if the breakroom was unoccupied following her observation. This condition was also implemented twice for each dependent variable. That is, if the light was on and the room was unoccupied at the time of observation, Ann was asked to report that the room was unoccupied and the light was on; however, she was asked to turn off the lights as she left the room. The instruction read:

> We are introducing a slight change in our observation procedures for checking lights on/off. We"d like to ask you to turn off the lights in the breakroom after your observations if the room is unoccupied. So, if the lights are off when you check, you can note that on the data sheet and just leave them off. If the lights are on when you do your check, please note that they"re on and turn them off when you leave. I'll be collecting

> both checklists [Light checklist and Xerox checklist] this Friday as usual. As always, thanks for helping our team with our "We Mean Green Office Certification Program!"

Next, Ann was asked to engage the energy-saver mode on the copier following her observation if it was not already on. That is, Ann was asked to report on the state of the lights and copier when entered the room, then turn off the lights and put the copier into energy-saver mode as she left if the breakroom was unoccupied. Independent experimenter observations continued in this condition. The instruction read

> We have modified our observation procedure for conducting the Xerox check. We would like for you to turn on the energy-saver mode on the Xerox copier after your observations if the room is unoccupied. If the copier is not in energy-saver mode when you check, note that on your checklist and turn it on as you leave by pushing the energy-saver button. If the copier is in energy-saver mode when you check, then record accordingly. I will be collecting both checklists [light checklist and Xerox checklist] this Friday as usual. Let me know if there are any questions. As always, thanks for helping our team with our "We Mean Green Office Certification Program!"

CHAPTER 3

RESULTS

Table 1 shows the results of interobserver agreement (IOA) across all conditions. During baseline, IOA coefficients averaged 100%. During conditions 1 and 2, IOA also averaged 100%. Figure 1 shows a multiple-baseline graph of instances of lights off and energy-saver use on the copier – the dependent variables. The data depicted in Figure 1 were generated by independent experimenter observations; participant-generated data are shown in Figure 2. The x-axis shows consecutive observations and the y-axis shows cumulative instances of lights off and energy-saver use. Both axes are scaled equally to represent each opportunity for the target behaviors to occur. In Figure 1, there were 67 observations; therefore, there were 67 opportunities for the lights to be off and for the energy-saver on the copier to be used. If perfect performance had been observed, a linear function extending from the intersection of the x and y-axes to the upper right corner of the graph would be seen. Scaling both axes equally allows for a direct comparison between the participant‟s graph and the independent experimenter‟s graph. Thus, although the total number of observations in both graphs is different, the slope of the data paths would be identical, given an identical effect of the independent variable(s). Figure 3 shows a multiple-baseline graph of independent experimenter observations. The y-axis in this graph has been scaled to provide a clearer and more detailed depiction of the behavior changes observed during the self-monitoring plus instruction phase. Similarly, Figures 5 and 6 show the effect of the self-monitoring plus instruction phase on independent experimenter-observed instances of lights off and energy-saver use respectively by graphing this condition alone. The x-axes in both graphs begin at the first observation following the introduction of this phase. Again, clear and

substantial increases in target behaviors are apparent following the introduction of the self-monitoring plus instruction phase.

Data from Figure 1 show that during baseline, there were zero instances of lights off or energy-saver used across X and Y observations, respectively. When the checklist was introduced, there were zero instances of lights off across 25 observations. One instance of energy-saver use occurred during the baseline period for that behavior; however this occurred after the participant had been instructed to turn off the lights following observations. Following the 15th observation Ann was asked to turn off lights following her observations. This resulted in an increase in lights-off to 12 of 27 observations, compared to zero instances during the first 40 observations during the baseline and checklist conditions. This effect was replicated when she was instructed to use the energy-saver on the copier; six occurrences of energy-saver use were recorded during the last 13 observations compared to one occurrence during the previous 54 observations. Figure 2 shows a multiple-baseline graph of the participant"s report of lights off and energy-saver use on the copier. As with the independent experimenters" records, the x and y-axes have been equally scaled in order to facilitate comparison of effects across target behaviors. Figure 4 shows these data with the y-axes scaled in order to provide a clearer and more detailed depiction changes in target behaviors. Figures 7 and 8 show the effect of the self-monitoring plus instruction phase on the participant"s reports beginning at the points on the x-axes when the instruction was introduced; thus, Figures 7 and 8 include the self-monitoring plus instruction condition only. Similar to independent experimenters" observations, Ann reported only one instance of lights off out of 27 checklist observations. Ann reported 6 instances of energy-saver use out of 49 checklist observations; however, as previously noted the last three incidences of

energy-saver use occurred after she had been instructed to turn off the lights following observations. When she was instructed to turn off the lights beginning at observation 28, her reports of lights off increased to 13 of 38 observations. Her reports of energy-saver use increased to 14 of 20 observations following the instruction to place the copier in energy-saver mode following each observation, beginning at observation 50.

Following the experiment, Ann was given a debriefing questionnaire where she reported that she instructed (and observed) other members of her office to begin to turn off the lights and use the energy-saver on the copier although many of them failed to do the latter. Ann also reported that she began to turn off the lights in other offices when they were unoccupied and that she intended to continue engaging in the target behaviors after our daily checks were discontinued.

CHAPTER 4

DISCUSSION

The results of this study show that the introduction of the checklist had little to no effect on the dependent variables when compared to the self-monitoring plus instruction condition. For the participant, the latter was more effective in producing behavior change than the introduction of the checklist. Contrary to other findings (cf., Nelson, 1977) these data show that the self-monitoring procedure was ineffective in producing behavior change. The results of the present experiment show that Ann"s self-monitored data were highly consistent with those of the independent experimenters, even though her observations occurred at different times during the day. These results suggest that Ann accurately reported data on the dependent variables and replicate previous findings that show that accuracy and reactivity in self-monitoring are independent of one another (Broden et al., 1972; Fixen et al., 1972; Herbert & Baer, 1972).

The correspondence observed between observer and participant data in the current study suggest that the self-monitored data were at least relatively accurate. Previous research has demonstrated that self-monitored data are often inaccurate and in many cases, accuracy can only be obtained through training (Fixen et al., 1972). Nelson (1977) described variables that can affect the accuracy of self-monitored data. First, self-monitored data have been shown to be more accurate when the self-monitors were informed that their data were being checked for accuracy than when accuracy was covertly assessed (Nelson, Lipinski, & Black, 1975). The data from the present experiment seemingly contradict this finding in that we were able to obtain accurate data even though accuracy was assessed covertly. Our participant was not informed that her data were being checked for accuracy; however, the participant was aware that the investigators conducted

"daily observations" throughout the experiment, although the nature of those observations was not described to her. Thus, it is possible that she suspected that her data were being checked for accuracy. Although her office was not close to the breakroom, other office members may have alerted her to our daily observations of the breakroom. If so, this might have influenced the accuracy of her reports.

A second variable that has been shown to affect the accuracy of self-monitored data is the presence of a contingency on accuracy (Nelson, 1977). Fixen et al. (1972) and Lipinski, Black, Nelson, and Ciminero (1975) reported highly accurate self-monitored data when accuracy was positively reinforced. In the present experiment, we obtained accurate self-monitored data despite the absence of an explicit contingency on accuracy. However, because the research team was known to her as representatives of the university"s Office of Sustainability, it is possible that "greening" of the office functioned as reinforcement for the participant and, thus, she was motivated to collect accurate data. She may have been more likely to report accurately if she expected that the results of her data collection would be used to improve sustainable behaviors within her office.

The nature of the target behavior is yet another variable that has been shown to influence the accuracy of self-monitoring (Nelson, 1977). Cavior and Marabotto (1976) reported that self-monitored data of nonverbal responses are generally more accurate than self-monitored data of verbal responses, although the reason for this remains unknown. That the current target behaviors were non-verbal responses could have contributed to the accuracy of the data obtained in the present experiment. Other studies (e.g., Epstein, Webster, & Miller, 1975) have also suggested that the accuracy of self-monitored data decreases when concurrent response

requirements are placed on the self-monitors. It is unknown if our participant engaged in other responses during observations; however, it is very unlikely that the presence of a competing response would have impeded her ability to make accurate observations. In addition to being nonverbal responses, the target behaviors were extremely easy to identify. The participant simply had to look at the display on the copier and note the state of the lights in order to produce an accurate observation.

Finally, although we characterized the participant‟s measures as self-monitoring, it is not entirely clear that the measures reflect only the behavior of the participant. Although Ann was almost always present in the office during regular office hours, several other staff, students, and faculty also were present throughout the day. Therefore, it is possible that Ann‟s data are not properly characterized as "self-monitoring" but, rather, a combination of self-monitoring and observation of the behavior of other individuals who were present in the office environment.

The absence of a noticeable change of behavior during the checklist (or self-monitoring) condition indicates that self-monitoring in this experiment was not reactive. In other words, the introduction of the checklist did not cause a change in behavior. This finding is consistent with Berecz (1972), Fixen et al. (1972), and Mahoney et al. (1973) who reported that self-monitoring did not affect behavior. This absence of reactivity during the self-monitoring conditions could be due to a number of factors. First, although the checklist required our participant to report on her behavior, she was also reporting on the behavior of fellow office members and anyone who used the breakroom, as noted above. Whereas previous studies on the reactivity of self-monitoring have involved the behavior of a single individual (Berecz, 1972; Broden et al., 1971); the data in the current study may have reflected the collective behavior of several individuals. That said, if

Ann‟s behavior had changed as a function of the observation procedure, it would have been expected that at least some behavior change would have been evident in the resulting data.

The context of the current experiment may also have contributed to the ineffectiveness of the checklist. In many offices, breakrooms are considered public space, so Ann may have been uncomfortable turning off the lights in a shared room. It is possible that the checklist would have been more effective in a private setting such as a home.

Experimenter instruction has been shown to influence the reactivity of self-monitoring. For instance, when experimenters assign positive or negative valences to the same target behavior, the behavior has been shown to increase or decrease, respectively, when self-monitored (Nelson, 1977). The addition of a reinforcement contingency and feedback have also been shown to influence reactivity (Nelson, 1977). Changes in behavior have been observed when feedback on performance was regularly provided versus when no feedback was given (Kolb, Winter, & Berlew, 1968). This is consistent with the finding in the present experiment that no behavior change was observed when there were no instructions, no reinforcement contingency, and the participant received no feedback.

When instructions to engage in the targeted behaviors following observations were provided in the current study, changes in those behaviors were observed. It is important to note that changes in the targeted behaviors corresponded with specific instructions; that is, when instructed to turn lights off following observations, only lights off increased. Changes in energy-saver usage were not observed until a specific instruction to engage in that response was issued. Although this finding increases the confidence with which one may attribute the observed changes in behavior to the implementation of the final phase of intervention (consistent with the

logic of the multiple baseline experimental design), it also indicates that generalization from one form of sustainable behavior to a second type of sustainable behavior did not occur. Thus, the current data suggest that generalization of instructed behavior may not be expected to occur without programming for such generalization (Stokes & Baer, 1977). Future research might investigate conditions under which generalization of sustainable behavior can be promoted.

It is possible that a different type of written instruction would have made the checklist more effective. For instance, if the instructions had been modified to include the sentence, "Offices that conserve energy often are viewed favorably and are recognized by the university", the checklist might have produced behavior change. This modification would have included two variables that have been shown to affect reactivity – the valence of the target behavior (in this case, positive) and the addition of an implicit reinforcement contingency (Nelson, 1977). For instance, when Broden et al. (1971) instructed a student to self-monitor her study behavior, she met weekly with a counselor who "…praised Liza"s [the student] reports of study behavior emphasizing the days when the percent of plus marks [plus marks denoted study behavior] was high" (p. 193). In this example, the self-monitoring procedure was confounded with feedback and social reinforcement from the counselor. Similarly, when Herbert and Baer (1972) successfully used self-monitoring to increase the delivery of attention to appropriate behavior, the participant"s instruction read: "Sometimes merely keeping a record of what you do will change what you do. For example, counting how many cigarettes you smoke will often reduce the number you smoke each day. We want to see if counting your attention to Frankie for appropriate behavior will have an effect on your attention to his appropriate behavior" (p. 142). It is perhaps not surprising that self-monitoring produced an increase in attention to appropriate

behavior given the nature of the written instruction. Kazdin (1974) noted "…several reports sometimes cited as support for the efficacy of self-monitoring have been confounded with other procedures (e.g., reinforcement, punishment, nonspecific treatment effect, therapeutic instruction and suggestion) that in themselves could account for behavior change" (p. 705). Consequently, it makes sense that behavior change occurred only when the instructions were modified to require our participant to engage in the target responses. The self-monitoring plus instruction condition proved very effective in producing behavior change. Even though the instruction required behavior change solely on the part of our participant, it also appears to have produced a change in the behavior of other members of her office. During debriefing, Ann reported that she asked other office members to turn off the lights when leaving the breakroom and using the energy-saver on the copier and observed them doing so. In fact, experimenters occasionally observed office staff members rushing to the breakroom to turn off the lights before checks were conducted; thus, it appears that the presence of the independent experimenter served as a prompt for other members of the office staff to turn off the lights. It is important to note that a combination of the self-monitoring procedure and instructions led to the change in behavior. It is possible that an instruction to engage in the target behaviors without the checklist would have led to a change in behavior; however, previous research indicates that instructions alone may have limited effects (Quilitch, 1975). It is likely that the checklist functioned to provide a) a reason to visit the breakroom at specified times during the day and b) the means to document the state of the breakroom (i.e. lights on/off and whether or not the energy-saver was being used). Thus, the self-monitoring procedure in the current study may have set the occasion for "precurrent" behaviors that increased the probability that Ann would ultimately engage in target responses.

The current experiment successfully replicated a Luyben (1980) that showed that instructions to a single individual was effective in increasing the frequency of lights being turned off in an unoccupied room. Similar to the current experiment, the instruction required college professors to turn off the lights following their class period if the room was unoccupied similar to the current experiment. The present experiment extended these findings to also show that a) self-monitoring can be an effective assessment method for sustainable behaviors b) self-monitoring alone was ineffective as a behavior change strategy. In order to produce substantial and meaningful increases in sustainable behaviors, other interventions should be used in addition to self-monitoring. Although energy waste from leaving lights on in university rooms and failing to utilize energy-saver modes in office equipment is relatively small in comparison to carbon emissions from cars or factories, if procedures aimed at decreasing energy use on small scales were replicated in universities, business offices, and private homes, a substantial impact in our collective efforts to preserve the environment could be made. Furthermore, demonstrations of the effects of small-scale interventions may provide useful for the development of larger, more environmentally impactful initiatives that can only be undertaken after the procedures have been validated with smaller issues such as those addressed in the current investigation.

The present experiment is not without its limitations. Perhaps the most significant limitation is that the effectiveness of the instruction condition may not maintain due to the absence of programmed consequences. Although our participant reported that she intended to continue engaging in the target responses after daily checks were discontinued, there were no programmed contingencies in place to insure maintenance of this behavior change. A positive reinforcement-based intervention in which the participant earned a meaningful consequence for

persisting in sustainable behavior may have promoted lasting behavior change. Unfortunately, implementing a reinforcement contingency for sustainable behavior in the current study would have represented a confounding variable that would have impeded our ability to evaluate the effects of self-recording or instructions on the behaviors of interest or participants to report inaccurately or cause reactivity during the self-monitoring process. A possible extension of the current experiment may be to address these experimental questions in the context of a reinforcement contingency for sustainable behavior. Outcomes showing non-correspondence between self-monitored data and independent experimenter observations would suggest that reinforcing consequences might inadvertently result in inaccurate self-reports. Another possible extension of the current experiment could be to replicate the self-monitoring procedures in other settings, such as homes or businesses, in which the natural contingencies for sustainable behavior (e.g., lower energy costs) might provide added incentive for behavior change.

The current study demonstrated that, under certain conditions, self-monitoring can serve as an effective method for assessing sustainable behaviors; however, the current outcomes do not indicate that self-monitoring alone produced meaningful behavior change. These outcomes suggest that programs promoting sustainability can make data-based decisions with a modicum of confidence provided that the necessary conditions for accuracynce are met. The present experiment also showed that antecedents in the form of instructions can be effective in producing behavior change, although the durability of such behavior change was not demonstrated. For long-term sustainable behavior change, instructions, combined with reinforcement-based interventions may be most efficacious.

Table 1

Interobserver Agreement during Baseline (BL), Condition 1 (C1), Condition 2 (C2)

	BL	C 1	C 2
Instances of lights off	100%	100%	100%

Table 2

Interobserver Agreement during Baseline (BL), Condition 1 (C1), Condition 2 (C2)

	BL	C 1	C 2
Instances of energy-saver use	100%	100%	100%

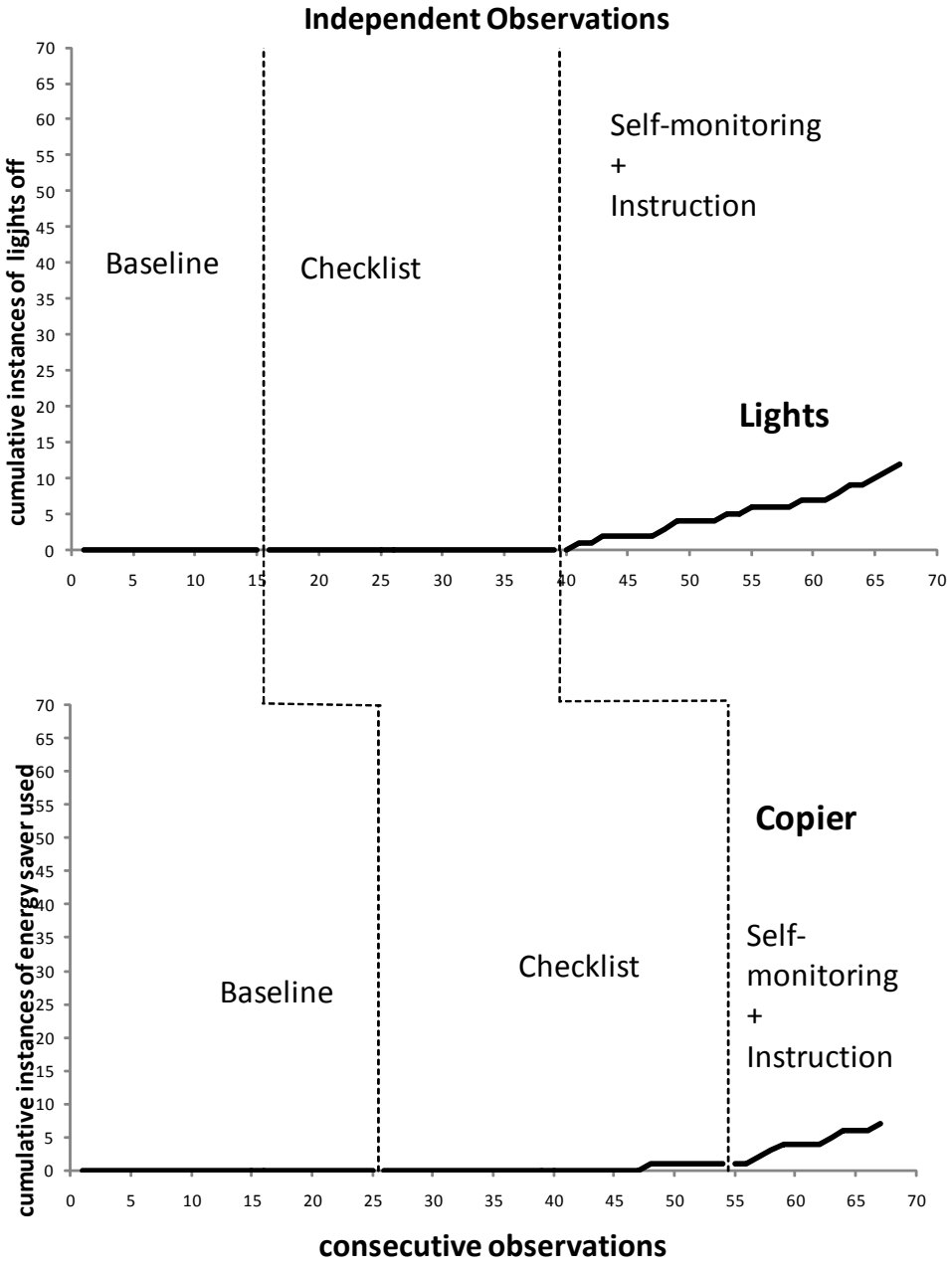

Figure 1. Shows the independent experimenter observations of the lights and copier.

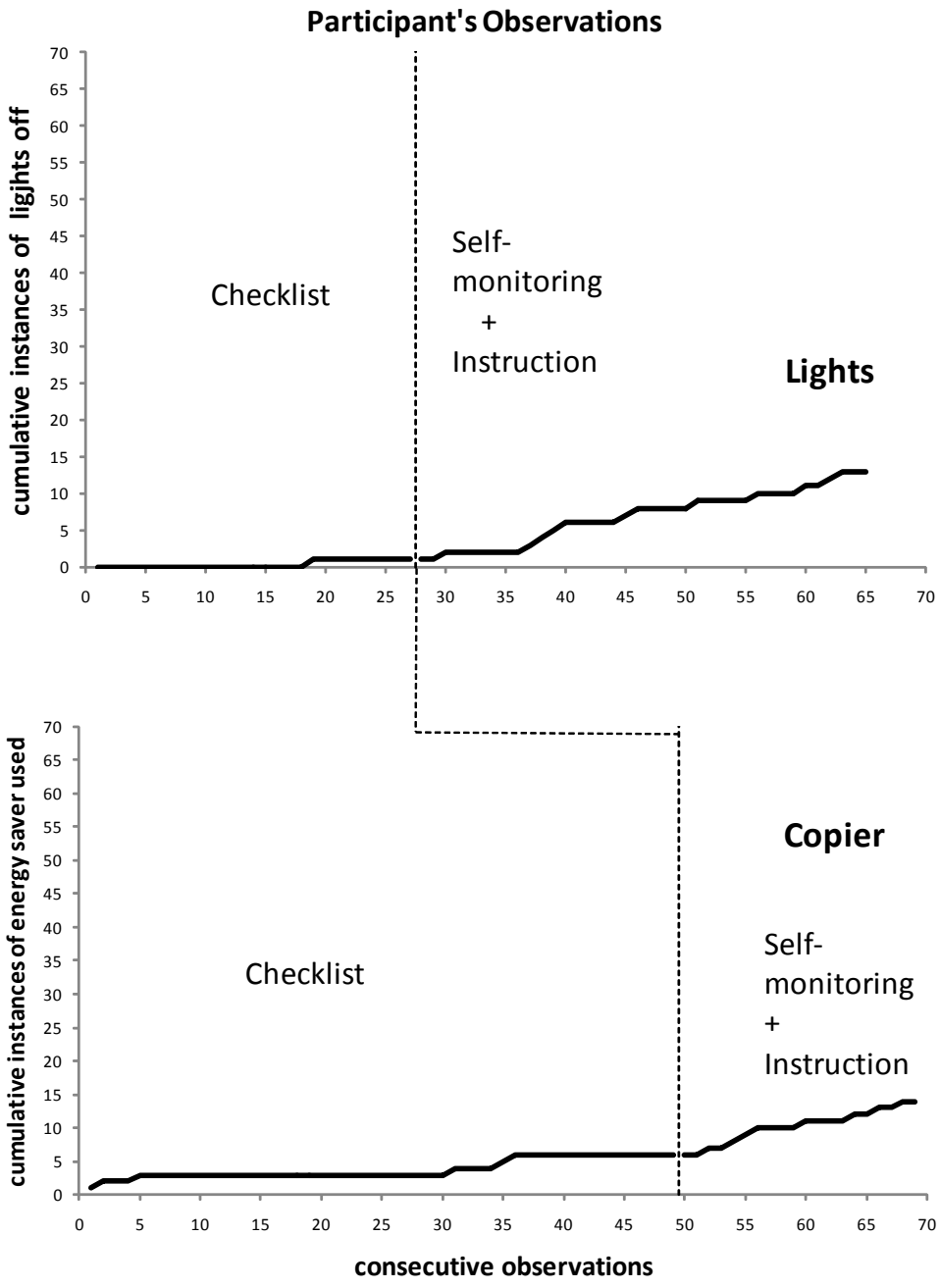

Figure 2. Shows Ann‟s observations of the lights and copier.

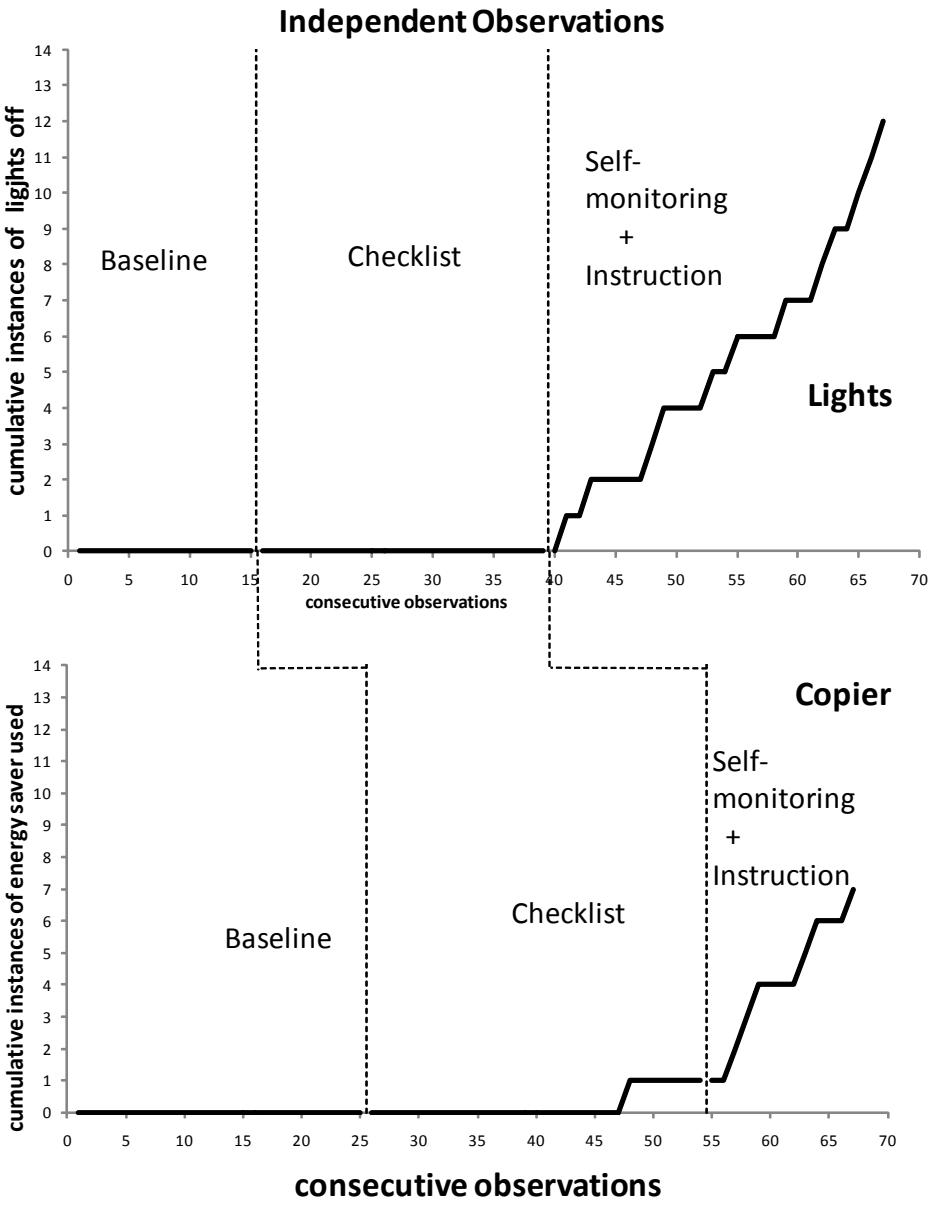

Figure 3. Y-axis is reduced for a detailed look at the data.

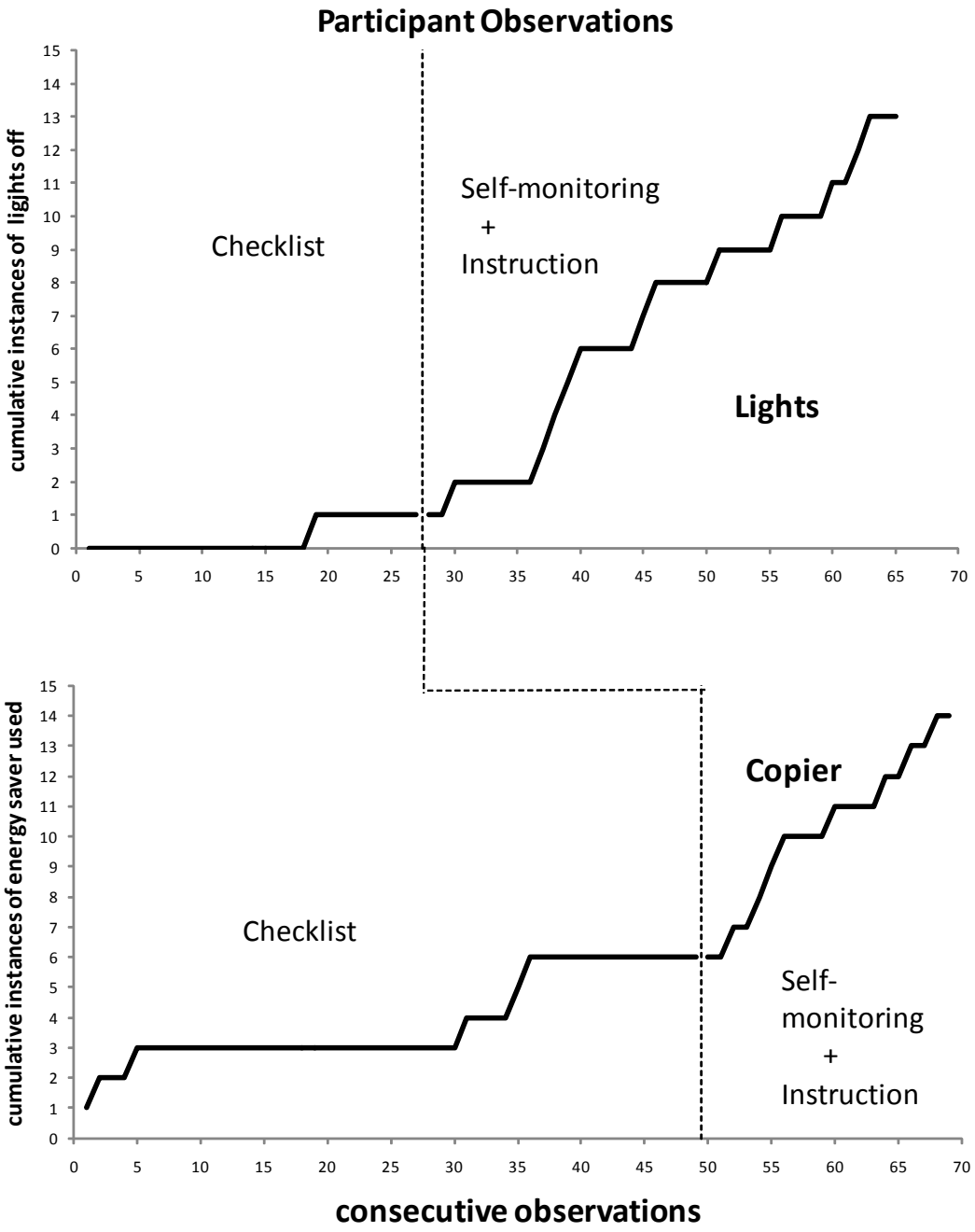

Figure 4. Y-axis is reduced for a detailed look at the data.

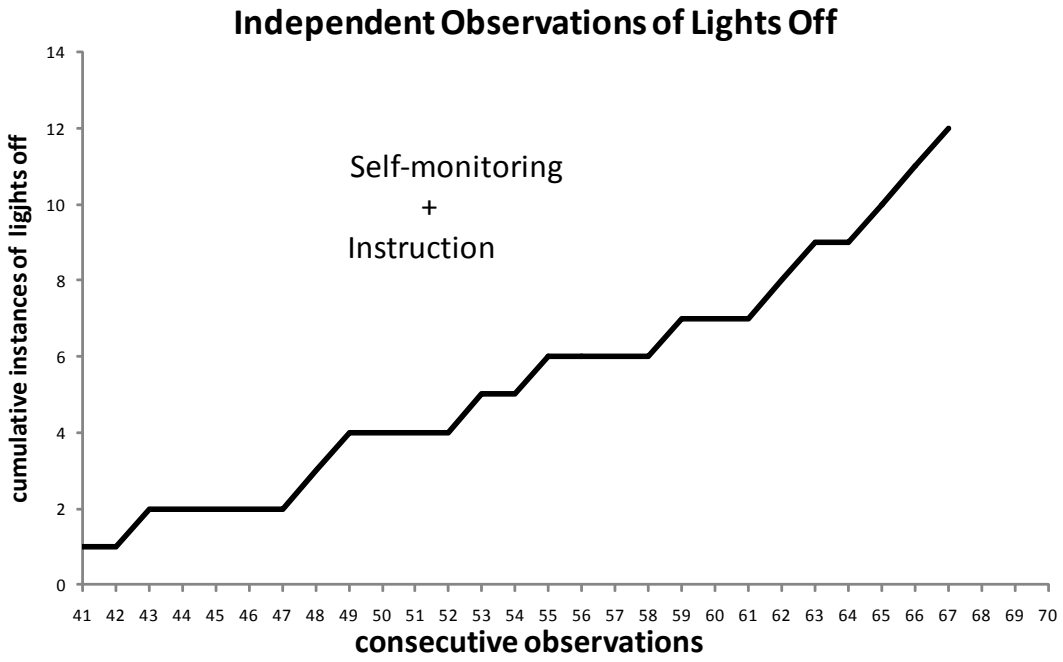

Figure 5. Shows the self-monitoring plus instruction condition only. X-axis begins at observation #41, the first observation after the instruction condition was introduced.

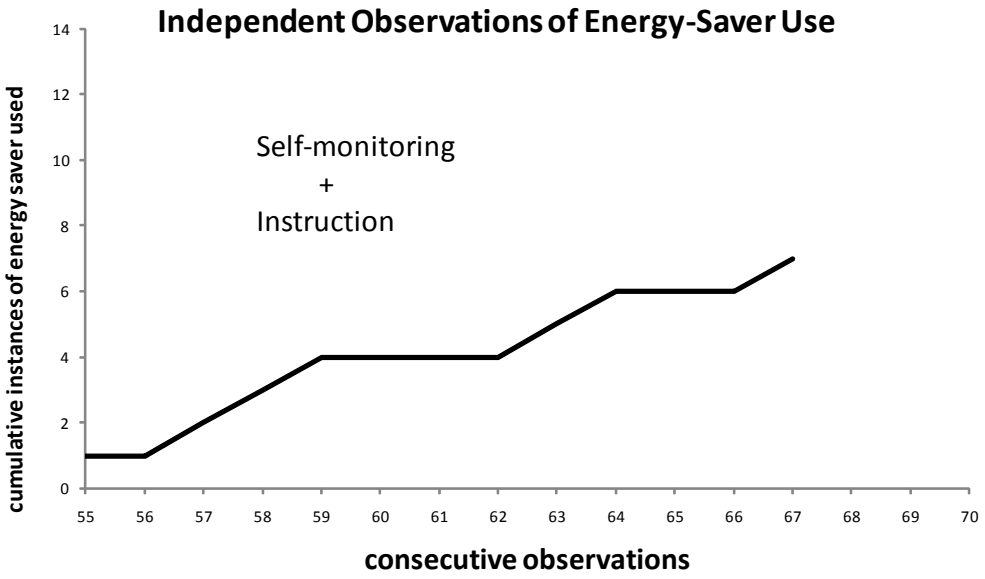

Figure 6. Shows the self-monitoring plus instruction condition only. X-axis begins at observation #55, the first observation after the instruction condition was introduced.

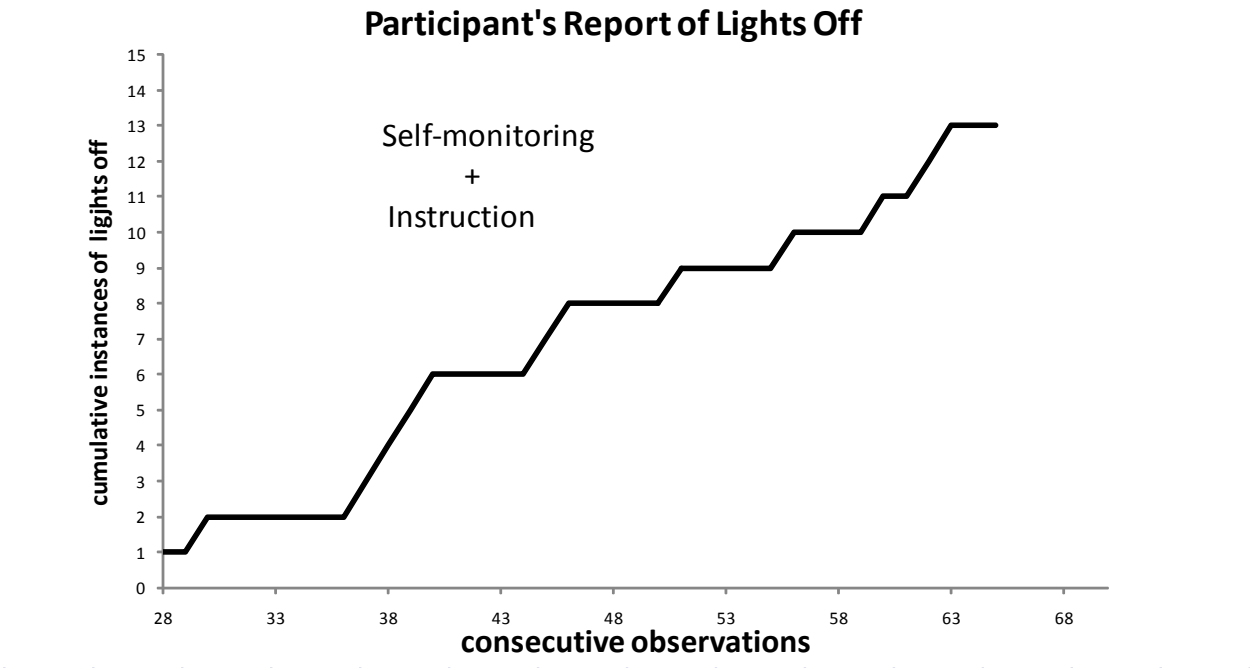

Figure 7. Shows the self-monitoring plus instruction condition only. X-axis begins at observation #28, the first observation after the instruction condition was introduced.

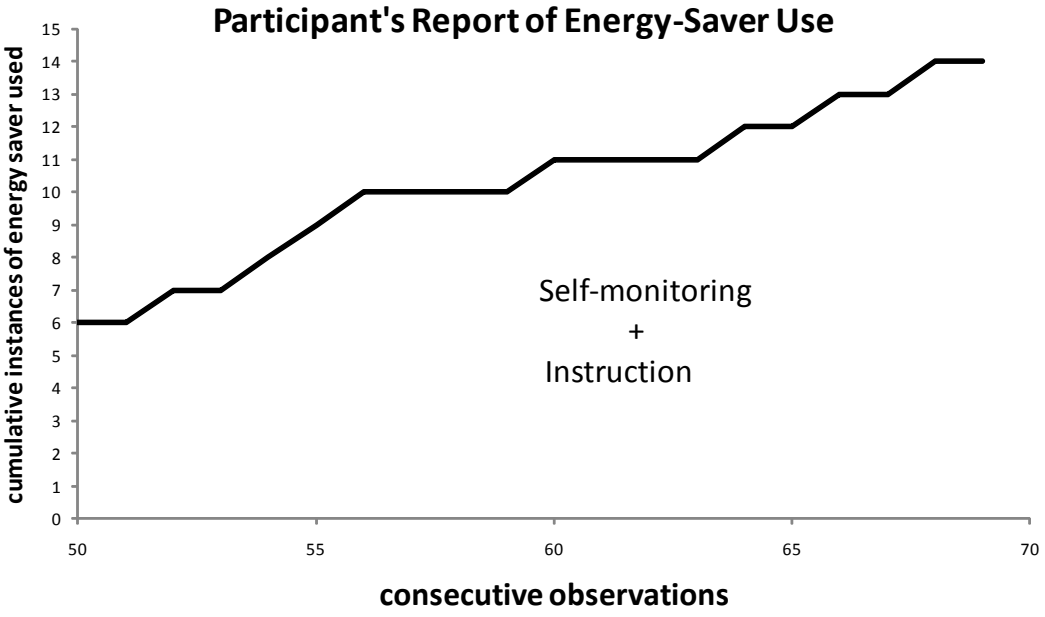

Figure 8. Shows the instruction condition only. X-axis begins at observation #50, the first observation after the instruction condition was introduced.

APPENDIX A

INDEPENDENT EXPERIMENTER OBSERVATIONS DATASHEET

DATA COLLECTION FOR OFFICE TYPE/NUMBER:____________________________ MONTH:______________

	1					2					3					4					5					6					7					8					9					10					11					12					13					14					15				
	L	X	S	A	P	L	X	S	A	P	L	X	S	A	P	L	X	S	A	P	L	X	S	A	P	L	X	S	A	P	L	X	S	A	P	L	X	S	A	P	L	X	S	A	P	L	X	S	A	P	L	X	S	A	P	L	X	S	A	P	L	X	S	A	P	L	X	S	A	P	L	X	S	A	P
8:00 - 8:30																																																																												
8:30 - 9:00																																																																												
9:00-9:30																																																																												
9:30-10:00																																																																												
10:00-10:30																																																																												
10:30-11:00																																																																												
11:00-11:30																																																																												
11:30-12:00																																																																												
12:00-12:30																																																																												
12:30-1:00																																																																												
1:00-1:30																																																																												
1:30-2:00																																																																												
2:00-2:30																																																																												
2:30-3:00																																																																												
3:00-3:30																																																																												
3:30-4:00																																																																												
4:00-4:30																																																																												
4:30-5:00																																																																												

TARGET BEHAVIORS:

0	ON	X	Room Occupied
1	OFF		

NOTES:

LEGEND: L	Lights	S	Surge Protector	P	Paper Recycling
X	Xerox	A	Aluminum Recycling		

APPENDIX B

PARTICIPANT LIGHT CHECKLIST

BREAKROOM LIGHT-CHECK FORM

Week of _____

	CHECK 1		CHECK 2		CHECK 3		CHECK 4	
	Occupied?	Lights On?	Occupied?	Lights On?	Occupied?	Lights On?	Occupied?	Lights On?
Monday	Time: Y N	Y N	Time: Y N	Y N	Time: Y N	Y N	Time: Y N	Y N
Tuesday	Time: Y N	Y N	Time: Y N	Y N	Time: Y N	Y N	Time: Y N	Y N
Wednesday	Time: Y N	Y N	Time: Y N	Y N	Time: Y N	Y N	Time: Y N	Y N
Thursday	Time: Y N	Y N	Time: Y N	Y N	Time: Y N	Y N	Time: Y N	Y N
Friday	Time: Y N	Y N	Time: Y N	Y N	Time: Y N	Y N	Time: Y N	Y N

We appreciate your assistance with this project. To conduct breakroom checks, just observe if there are any people in the room at the moment of the check (as soon as you look into the room). If persons are present, circle "Y", if not, circle "N". At the same time, check if the lights are on and circle "Y" or "N" accordingly. Please conduct at least 2 checks per day, with one check in the morning and another in the afternoon. If time permits, additional checks, up to 4 checks per day would be helpful. Please allow 1 hour between checks. If you have questions about how to conduct the checks or complete the form, please contact _____

APPENDIX C

PARTICIPANT COPIER CHECKLIST

BREAKROOM XEROX-CHECK FORM

Week of _____ *Energy-saver (ES)

	CHECK 1				CHECK 2				CHECK 3				CHECK 4			
	Occupied?		ES On?		Occupied?		ES On?		Occupied?		ES On?		Occupied?		ES On?	
Monday	Time:	Y N		Y N	Time:	Y N		Y N	Time:	Y N		Y N	Time:	Y N		Y N
Tuesday	Time:	Y N		Y N	Time:	Y N		Y N	Time:	Y N		Y N	Time:	Y N		Y N
Wednesday	Time:	Y N		Y N	Time:	Y N		Y N	Time:	Y N		Y N	Time:	Y N		Y N
Thursday	Time:	Y N		Y N	Time:	Y N		Y N	Time:	Y N		Y N	Time:	Y N		Y N
Friday	Time:	Y N		Y N	Time:	Y N		Y N	Time:	Y N		Y N	Time:	Y N		Y N

We appreciate your assistance with this project. To conduct breakroom checks, just observe if there are any people in the room at the moment of the check (as soon as you look into the room). If persons are present, circle "Y", if not, circle "N". At the same time, check if the Xerox energy-saver mode is on and circle "Y" or "N" accordingly. You can tell by checking the display. When the copier is in energy-saver mode, the display is blank. If you can read the display, the copier is not in energy-saver mode. Please conduct at least 2 checks per day, with one check in the morning and another in the afternoon. If time permits, additional checks, up to 4 checks per day would be helpful. Please allow 1 hour between checks. If you have questions about how to conduct the checks or complete the form, please contact _____

REFERENCES

Abramovitz, J. N., & Mattoon, A. T. (1999). Reorienting the forest products economy. In L. R. Brown, C. Flavin, H. French, J. Abramovitz, S. Dunn, G. Gardner, et al. (Eds.), *State of the world 1999* (pp. 60-77). New York: Norton.

Akande, A. (1997). The role of reinforcement in self-monitoring. *Education, 118,* 275-281.

Bamberg, S. (2002). Effects of implementation intentions on the actual performances of new environmentally friendly behaviors – Results of two field experiments. *Journal of Environmental Psychology, 22,* 399-411.

Berecz, J. (1972). Modification of smoking behavior through self-administered punishment of imagined behavior: A new approach to aversion therapy. *Journal of Consulting and Clinical Psychology, 38,* 244-250.

Brandon, G., & Lewis, A. (1999). Reducing household energy consumption: A qualitative and quantitative field study. *Journal of Environmental Psychology, 19,* 75-85.

Broden, M., Hall, R. V., & Mitts, B (1971). The effect of self-recording on the classroom behavior of two eight-grade students. *Journal of Applied Behavior Analysis, 4,* 191-199.

Burgess, R. L., Clark, R. N., & Handee, J. C. (1971). An experimental analysis of anti-littering procedures. *Journal of Applied Behavior Analysis, 4,* 71-75.

Cavior, N., & Marabotto, C. M. (1976). Monitoring verbal behaviors in a dyadic interaction: Valence of target behaviors, type, timing, and reactivity to monitoring. *Journal of Consulting and Clinical Psychology, 44,* 68-76.

Corral-Verdugo, V. (1997). Dual „realities" of conservation behavior; self-reports vs observations of re-use and recycling behavior. *Journal of Environmental Psychology, 17,* 135-145.

DeLeon, I. G., & Fuqua, R. W. (1995). The effects of public commitment and group feedback on curbside recycling. *Environment and Behavior, 27,* 233-250.

Ebreo, A., & Vinning, J. (1994). Conservation-wise consumers: recycling and household shopping as ecological behavior. *Journal of Environmental Systems, 23,* 109-131.

Environmental Protection Agency. (2011). *What is sustainability?* Retrieved March 28, 2011 from http://www.epa.gov/sustainability/basicinfo.htm.

Epstein, L. H., Webster, J. S., & Miller, P. M. (1975). Accuracy and controlling effects of self-monitoring as a function of concurrent responding and reinforcement. *Behavior Therapy, 6,* 654-666.

Fixen, D. L., Phillips, E. L., & Wolf, M. M. (1972). Achievement place: The reliability of self-reporting and peer-reporting and their effects of behavior. *Journal of Applied Behavior Analysis, 5,* 19-30.

Geller, E. S., Brasted, W., & Mann, M. (1980). Waste receptacle designs as interventions for litter control. *Journal of Environmental Systems, 9,* 145-160.

Goldenhar, L. M., & Connell, C.M. (1993). Understanding and predicting recycling behavior: an application of the theory of reasoned action. *Journal of Environmental Systems, 22,* 91-103.

Grant, L. K. (2010). Sustainability: from excess to aesthetics. *Behavior and Social Issues, 19,* 5-45.

Hayes, S. C., Johnson, V.S., & Cone, J. D. (1975). The marked item technique: A practical procedure for litter control. *Journal of Applied Behavior Analysis, 8,* 381-386.

Herbert, E. W., & Baer, D. M. (1972). Training parents as behavior modifiers: Self-recording of contingent attention. *Journal of Applied Behavior Analysis, 5,* 139-149.

Jason, L. (1975). Rapid improvement in insomnia following self-monitoring. *Journal of Behavior Therapy and Experimental Psychiatry, 6,* 349-350.

Kazdin, A. E. (1974). Reactive self-monitoring: The effects of response desirability, goal setting, and feedback. *Journal of Consulting and Clinical Psychology, 42,* 704-716.

Kolb, D. A., Winter, S. K., & Barlew, D. E. (1968). Self-directed behavior change: Two studies. *Journal of Applied Behavior Science, 4,* 453-471.

Lehman, P. K., Geller, E. S. (2004). Behavior analysis and environmental protection: accomplishments and potential for more. *Behavior and Social Issues, 13,* 13-32.

Lipinski, D. P., Black, J. L., Nelson, R. O., & Ciminero, A. R. (1975). The influence of motivational variables on the reactivity and reliability of self-recording. *Journal of Consulting and Clinical Psychology, 43,* 637-646.

Ludwig, T. D., Gray, T. W., & Rowell, A. (1998). Increasing recycling in academic buildings: A systematic replication. *Journal of Applied Behavior Analysis, 31,* 683-686.

Mahoney. M. J. (1971). The self-management of covert behavior: A case study. *Behavior Therapy, 2,* 575-578.

Mahoney, M. J., Moura, N. G. M., & Wade, T. C. (1973). Relative efficacy of self-reward, self-punishment, and self-monitoring techniques for weight loss. *Journal of Consulting and Clinical Psychology, 40,* 404-407.

Mayer, J., & Geller, E.S. (1982-1983). Motivating energy efficient travel: A community-based intervention for encouraging biking. *Journal of Environmental Systems, 12,* 99-112.

Nelson, R. O. (1977). Assessment and therapeutic functions of self-monitoring. In R. M. Eisler & P. M. Miller (Eds.), *Progress in behavior modification* (Vol. 5, pp. 263–308). New York: Academic Press.

Nelson, R. O., Lipinski, D. P., & Black, J. L. (1975). The effects of expectancy on the reactivity of self-recording. *Behavior Therapy, 6,* 337-349.

Oskamp, S. (2000). A sustainable future for humanity? How can psychology help? *American Psychologist, 55,* 496-508.

Quilitch, H. R. (1975). A comparison of three staff management procedures. *Journal of Applied Behavior Analysis, 8,* 59-66.

Staats, H., van Leeuwen, E., & Wit, A. (2000). A longitudinal study of informational interventions to save energy in an office building. *Journal of Applied Behavior Analysis, 33,* 101-104.

Steg, L., & Vlek, C. (2009). Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology, 29,* 309-317.

Stokes, T. F., & Baer, D. M. (1977). An implicit technology of generalization. *Journal of Applied Behavior Analysis, 10,* 349-367.

Thompson, L. G. (2010). Climate change: The evidence and our options. *The Behavior Analyst, 33,* 153-170.

United Nations. (1987). *Report of the world commission on environment and development: Our common future.* Retrieved from http://www.un-documents.net/wced-ocf.htm.

Werner, C. M., Turner, J., Shipman, K., Twitchel, F. S., Dickson, B. R., Bruschke, G. V., & von Bismark, W. B. (1995). Commitment, behavior and attitude change: An analysis of voluntary recycling. *Journal of Environmental Psychology, 15,* 197-208.

Whiteman, H. (2009). *Report: Climate change crisis "catastrophic."* Retrieved from http://www.cgi.cnn.com/2009/WORLD/europe/05/29/annan.climate.change.human/index.html.

Winnet, R. A., Neale, M. S., Grier, H. C. (1979). Effects of self-monitoring and feedback on residential electricity consumption. *Journal of Applied Behavior Analysis, 12,* 173-184.

Winett, R. A., Hatcher, J. W., Fort, T. R., Leckliter, I. N., Love, S. Q., Riley, A. W., & Fishback, J. F. (1982). The effects of videotape modeling and daily feedback on residential electricity conservation, home temperature and humidity, perceived comfort, and clothing worn: Winter and summer. *Journal of Applied Behavior Analysis, 15*, 381-402.

Winett R. A., Leckliter, I. N., Chinn, D. E., Stahl, B., & Love, S. Q. (1985) Effects of television modeling on residential energy conservation. *Journal of Applied Behavior Analysis, 18,* 33-44.