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A DIAGNOSTIC APPROACH TO INCREASE REUSABLE DINNERWARE SELECTION IN A CAFETERIA

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The current project tested a diagnostic approach to selecting interventions to increase patron selection of reusable dinnerware in a cafeteria. An assessment survey, completed by a sample of 43 patrons, suggested that the primary causes of wasteful behavior were (a) environmental arrangement of dinnerware options and (b) competing motivational variables. A functional relation between environmental arrangement and reusable product selection was demonstrated in a reversal design. However, the largest effect occurred as function of a multicomponent intervention involving environmental arrangement, employee involvement, and personal spoken prompts with motivational signs. The results support the use of informant assessments when designing community interventions.

DESCRIPTORS: community interventions, environmental interventions, informant assessment, product reuse, waste reduction

Average personal daily waste in the United States rose from an estimated 2.7 lb in 1960 to 4.4 lb in 2003 (Environmental Protection Agency [EPA], 2005). U.S. residents now generate more than 236 million tons of municipal solid waste each year, which is comprised mostly of paper products (35%), yard and food waste (24%), and plastics (11%). Recycling and composting diverted 72 million tons of waste from landfills in 2003, but there is still substantial room for improvement. For example, only 5.2% of plastics and just less than half of paper products were recovered in 2003 (EPA). Although recycling diverts material from landfills, reprocessing such material consumes energy and produces additional waste. Therefore, waste reduction initiatives should also encourage product reuse. Product reuse can prevent solid waste from entering landfills and decrease fiscal and environmental costs associated with manufacturing and recycling.

The first step toward increasing reusable choices is to make such products affordable and available to consumers. However, people may persist in choosing disposable products even when reusable alternatives are available (e.g., paper coffee cups vs. refillable coffee mugs). In such cases behavioral interventions can facilitate environmentally friendly choices. A large body of community-based research shows that a variety of interventions can increase proenvironmental behaviors; however, the process of selecting an effective intervention for a specific community context has received less empirical attention. Behavioral interventions for individuals are more effective when based on a prior assessment of behavioral causes (e.g., functional assessment), and recent organizational research

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suggests that this principle holds true for interventions for groups of individuals (e.g., Austin, Olson, & Wellisley, 2001; Pampino, Heering, Wilder, Barton, & Burson, 2003; Pampino, Wilder, & Binder, 2005).

Community-based interventions to improve proenvironmental behaviors have been studied for more than three decades (see Porter, Leeming, & Dwyer, 1995, for a literature review). Such interventions have generally been classified as antecedent or consequence based, depending on whether treatments occurred prior to or after target behaviors. Antecedent engineering interventions, such as the physical arrangement of waste containers, can be effective for increasing recycling or correct disposal of waste (e.g., Humphrey, Bord, Hammond, & Mann, 1977; Jacobs, Bailey, & Crews, 1984; Luyben & Bailey, 1979; Luyben, Warren, & Tallman, 1979–1980; Reid, Luyben, Rawers, & Bailey, 1976). Other antecedent interventions include written or spoken prompts, such as letters, brochures, signs, and personal pleas or requests (Arbuthnot et al., 1976–1977; Austin, Hatfield, Grindle, & Bailey, 1993; Geller, Farris, & Post, 1973; Jacobs et al., 1984; Spaccarelli, Zolik, & Jason, 1989–1990). Although individuals may habituate to prompting interventions over time, the effects of prompts can be enhanced when supplemented with additional interventions. For example, Austin et al. demonstrated that signage changes were more effective at increasing recycling when combined with proximal arrangement of receptacles.

A practical consequence-based intervention for improving proenvironmental behavior is providing feedback to individuals about their behavior (e.g., Katzev & Mishima, 1992; Schultz, 1998). Feedback is generally less expensive than financial incentives and can produce reliable and sometimes large effects. For example, Katzev and Mishima provided students with daily group feedback about their previous day's paper recycling and produced a 77% improvement. Although feedback is often conceptualized as a consequence, information about previous behavior can serve multiple functions, which may explain its reliability as an intervention (Peterson, 1982). For example, feedback may simultaneously reinforce previous behavior while providing discriminative stimuli for future behavior. The results of a literature review suggested that feedback increases the effectiveness of antecedent interventions (Alvero, Bucklin, & Austin, 2001). Feedback that is provided just prior to opportunities to emit target behaviors is sometimes called "feedforward." It is possible that feedforward may sometimes function as an antecedent motivating operation (Laraway, Snycerski, Michael, & Poling, 2003; Michael, 1993; Olson, Laraway, & Austin, 2001). For example, information that reveals a gap between current behavior and a group norm may motivate a person to decrease the gap in the future (i.e., a conditioned establishing operation for escape reinforcement).

Due to the extensive array of options, preintervention assessments may be useful for identifying the most effective community-based interventions. Behavioral diagnostic strategies are classified as experimental, descriptive, or informant assessments (Austin, Carr, & Agnew, 1999; Lennox & Miltenberger, 1989). Informant assessments, which rely on interviews or surveys with relevant individuals, have been applied to improve performance in organizational settings for decades, and recent research has begun explicitly testing various assessment models (e.g., Austin et al., 2001; Pampino et al., 2003, 2005). An example of an organizational assessment method is the performance diagnostic checklist, which includes questions for workers about antecedents and information, equipment and processes, knowledge and skills, and consequences in their organizational setting (Austin, 2000).

The goal of the present study was to test an informant assessment approach to designing

interventions to increase reusable dinnerware selection by cafeteria patrons. The need for an intervention was established by observing wasteful patron choices and through consulting with the cafeteria manager, who estimated spending over $80,000 per year to purchase disposable cups and food containers that were not recyclable. Informal observations and an informant assessment survey were used to develop hypotheses about the causes of wasteful behavior and design appropriate interventions. Interventions were evaluated across two academic quarters and included environmental arrangement, feedforward, employee involvement, and personal spoken prompts with motivational signs.

METHOD

Participants and Setting

Participants included cafeteria patrons who completed an informant assessment survey ($N = 43$; mean age = 20 years, $SD = 3.9$) and all other patrons who purchased food during observations. The setting was the primary student cafeteria at a private university. The cafeteria included outside dining areas, an inside dining room, and a service room. The inside dining room was approximately 60 m by 40 m and included table seating for approximately 200 patrons. Patrons walked through the inside dining room and through a dividing wall to enter the service room where they selected food and beverage items. Patrons then left the service room and stood in line to purchase items from one of two cashiering areas (two registers in each area).

Assessments

Prior to the experiment, researchers observed patrons dining in with disposable cups and containers even though reusable options were available. The existing environmental arrangement seemed to discourage the selection of reusable cups in particular; disposable cups occupied more than twice the reusable cup counter space; reusable cups were placed between large beverage machines making them difficult to see; disposable cups were brightly colored but reusable cups were made of darkly colored translucent plastic; and disposable cups were available in an additional larger size (32 oz). With regard to reusable dinnerware choices, reusable soup bowls and glass salad bowls were difficult to see or were similar in appearance to disposable options. Food servers could encourage the selection of reusable plates for hot food items, but did not consistently do so. Some workers appeared to select disposable containers by default, forcing patrons to ask for reusable dinnerware if they wanted it.

Informant assessment participants were recruited from the primary dining area by researchers. Those who agreed to participate signed a consent form, listened to instructions, and completed the survey at their table at their own pace while experimenters waited. The informant assessment survey asked patrons about their (a) knowledge of reusable and recyclable choices, (b) frequencies of choices, (c) motives for choices, and (d) opinions about potential interventions.

Participants averaged 74% correct on questions regarding knowledge of available reusable products. The majority of participants reported selecting disposable cups between 60% to 70% of the time and disposable plates between 30% and 40% of the time. Patrons were asked to select and rank their top three reasons for choosing disposable cups and plates from among a list of 14 possible reasons. The reason that received the most ranks for plates was "I am not eating my meal in the cafeteria" ($f = 36$). Other reasons receiving the most ranks for plates were "I want the option of taking my meal with me if I don't finish" ($f = 26$), and "group plans (dining in or out) unknown" ($f = 12$). With regard to motives for selecting disposable cups, the reason that received the most ranks was "I want the option of taking it with me if I don't finish at the cafeteria" ($f =$

29), "I'm not going to drink the beverage at the cafeteria" ($f = 26$), and "easier or less effort to choose a paper cup" ($f = 9$). Participants also rated their level of concern about financial and environmental impacts of their cafeteria choices on 5-point scales (5 = *highest concern*). Mean ratings were 2.2 ($SD = 1.2$) and 3.4 ($SD = 1.4$) for fiscal and environmental concerns, respectively. Opinions about the potential effectiveness of different interventions were captured by asking participants to review a list of seven possible interventions and select the top three. The intervention that participants thought was most likely to be effective was ranked 1. The intervention that received the most top rankings was "better signs that point out reusable containers and cups" ($f = 10$). The intervention that received the most total ranks was "information about the waste generated/environmental impact associated with customer choices at the cafeteria" ($f = 22$).

The results of assessments suggested two primary hypotheses about the causes of wasteful behavior: (a) The existing environmental arrangement discouraged the selection of reusable products and encouraged the selection of disposable products, and (b) motivational variables encouraged disposable product selection and were deficient for reusable product selection.

Observations and Dependent Variables

Observations were conducted by the first three authors and seven additional trained observers, who sat at tables approximately 7 m from each of the two cashier areas and recorded patrons' choices on paper forms. Each observation session required two observers, one for each cashier station. Observation sessions lasted 30 min and were conducted every weekday during peak lunchtime. On Mondays, Wednesdays, and Fridays peak time was 11:45 a.m. to 12:15 p.m. and on Tuesdays and Thursdays peak time was 1:30 p.m. to 2:00 p.m. An average of 251 ($SD = 52.2$) patrons were observed per session during the experiment. Patrons' dinnerware choices were classified as (a) reusable plates, (b) reusable cups, (c) disposable plates, and (d) disposable cups. Reusable plates included all ceramic and clear glass plates and bowls available in the cafeteria and plastic baskets for fries and other side items. Reusable cups included small (16 oz) and medium (22 oz) beverage containers and patron-owned refillable coffee containers. Disposable cups included small (16 oz), medium (22 oz), and large (32 oz) moisture-resistant paper beverage cups. Disposable plastic plates included clear plastic clamshell-style food containers, clear plastic bowls, styrofoam cups for soup, and cardboard pizza boxes. Dependent measures were (a) percentage of patrons who selected reusable cups and (b) percentage of patrons who selected reusable plates. For both dependent measures, percentage selection was calculated as the number of reusable products observed divided by the number of reusable plus disposable products observed multiplied by 100%.

For 27% of sessions, a reliability observer sat near one of the two primary observers and independently scored patron choices at the same cashier station to assess interobserver agreement. Percentage agreement was calculated by comparing total frequencies for each variable observed by the two scorers, in which the smaller observed frequency was divided by the larger frequency and multiplied by 100%. Interobserver agreement averaged 91% ($SD = 5.7$).

Experimental Design

Single and multiple-component interventions were designed to address the two hypothesized causes of wasteful behavior and were evaluated with an A-B-A-(BC)-A-B-(BD)-(BDE)-B reversal design. Phase changes were implemented when data for both primary dependent measures were stable, which was defined as no new highs and no more than three consecutive upward trending data points. Exceptions to this rule occurred when the end of an academic

quarter terminated a phase (e.g., the BDE phase ended with the Fall quarter, and the final B phase occurred 3 months later).

Phase A: Baseline. Patron choices were measured without any experimenter intervention during three baseline phases. However, the third baseline occurred after a summer break, and cafeteria workers had partially maintained the environmental arrangement intervention (Phase B) (counterspace for cups remained the same but some signs were removed, and reusable cups were no longer placed in front of disposable cups).

Phase B: Environmental arrangement. This intervention was informed by the environmental arrangement hypothesis. Counterspace for reusable cups was doubled by placing an additional reusable row in front of the disposable cup section. Signs were created and displayed directly in front of reusable cups at all stations that read "DINE-IN REUSABLE" in black ink in approximately 48-point Arial font. Changes were not possible for the most commonly used reusable plates because they were available only upon request from food servers. Reusable bowls were also not movable; however, signage for all reusable plates was improved in the same fashion as for cups. This condition was replicated in isolation three times.

Phase C: Feedforward. This intervention was informed by the motivational hypothesis. Posters were created that were expected to function as motivating operations by either increasing the reinforcing effectiveness of reusable dinnerware or by abolishing the reinforcing effectiveness of disposable dinnerware. Two types of posters (0.75 m by 1 m) were displayed for patrons to view as they entered the service room and were presented on alternating days. Environmental impact posters displayed histograms for average monthly waste associated with disposable choices in the cafeteria. Fiscal impact posters displayed histograms for average monthly dollar cost of disposable choices in the cafeteria. During four feedforward sessions, the first author informally counted the percentage of patrons who appeared to look at posters as they entered the service room and found that approximately 37% of patrons did so.

Phase D: Employee involvement. This intervention was also informed by the motivational hypothesis and encouraged employees to prompt and reinforce desirable patron choices. Employee involvement was implemented by meeting with employees in person, and included requests to engage in behaviors that would encourage reusable dinnerware selection by patrons, feedback about rates of resusable dinnerware selection, and goal setting. The second author met with employees, shared the general goal to increase reusable patron choices, and distributed a list of employee behaviors that would encourage desirable patron choices (e.g., suggesting dine-in plates, stocking reusable products frequently, thanking patrons who selected reusable cups and plates). Feedback cards were then distributed to employees every other day thereafter, along with a personal "thank you" for their participation. Feedback cards showed current reusable product selection rates and included a goal line set at the previous high for each target behavior.

Phase E: Personal spoken prompts with motivational signs. This intervention was also informed by the motivational hypothesis. During this phase, an experimenter stood near each entrance to the service room and cheerfully said "Please choose reusable cups and plates!" or "Don't forget to choose reusables!" to every group or person entering the service room. Next to each prompter was a small table that displayed all reusable dinnerware options. Behind each prompter was a large poster (1 m by 1.25 m) with a picture of a tree and the text "People who love the environment choose reusable cups and plates!" Smaller versions of these signs were displayed in several locations inside the service room including each food and beverage station. Patrons could also hear and see

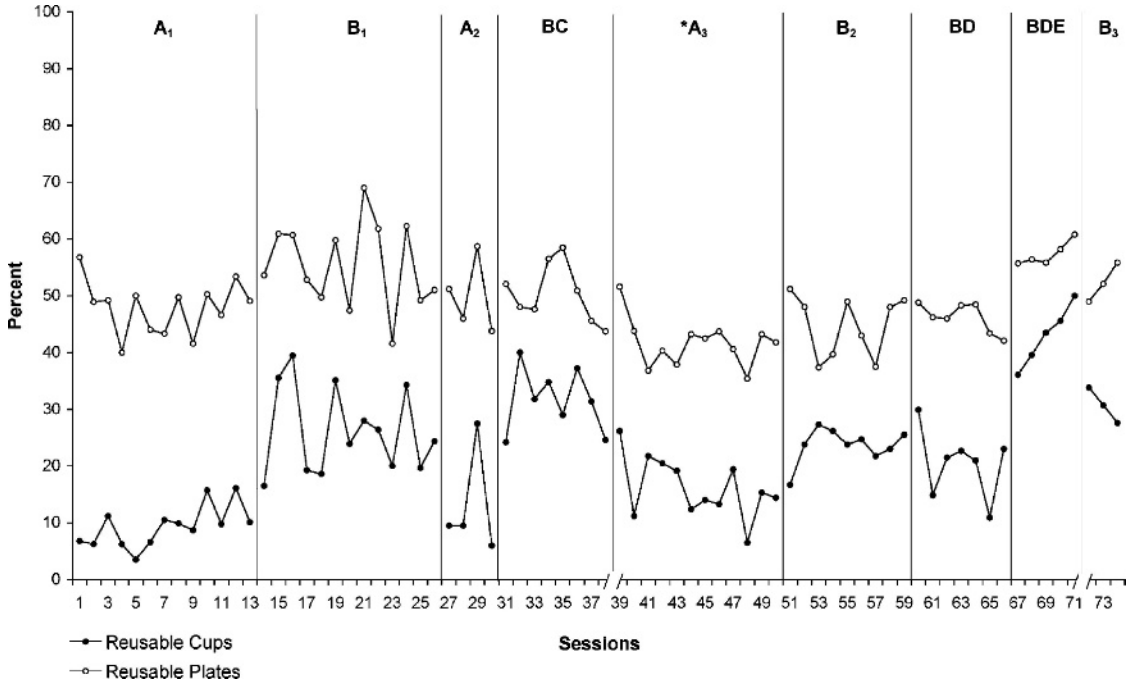

Figure 1. Reusable dinnerware selection by cafeteria patrons by experimental phase. Open data points represent reusable plates, and filled data points represent reusable cups. The durations of breaks following Sessions 38 and 71 were approximately 4 and 3 months, respectively. A = baseline, B = environmental arrangement, C = feedforward, D = employee involvement, and E = spoken prompts with motivational signs. *This withdrawal phase was partially contaminated by the presence of some Phase B components.

prompters and view the motivational signs while they waited to pay cashiers. Prompters informally counted the number of prompts they delivered per session and found an average of 185 per session.

RESULTS

Results are presented in Figure 1. During baselines (A_1, A_2, and A_3), the mean percentage of patrons selecting reusable cups was 9%, 13%, and 16%. During Phases B_1, B_2, and B_3 (environmental arrangement), reusable cup selection means were 26%, 24%, and 31%, respectively. Although there was some data overlap between baseline and environmental arrangement conditions, lower levels of reusable cup selection were evident in all baselines relative to environmental arrangement conditions. Thus, a functional relation between the environmental arrangement condition and reusable cup selection was demonstrated by withdrawing and reintroducing the condition twice. The effects of environmental arrangement on reusable plate selection were less consistent and smaller; however, all environmental arrangement phases produced reusable plate selection rates higher than the most recent baseline. During Phases A_1 and B_1, reusable plate selection averaged 48% and 55%, respectively; during Phases A_3, B_2, and B_3, reusable plate selection averaged 42%, 45%, and 52%, respectively. Nevertheless, because of overlap in these data, particularly between Phases B_1 and A_2 and A_3 and B_2, it does not appear that environmental arrangement had a reliable impact on reusable plate selection.

The addition of motivational interventions to the environmental arrangement condition produced mixed results. Environmental arrangement

Table 1
Descriptive Statistics for Reusable Dinnerware Selection by Phase

	Reusable cups			Reusable plates		
Phase	*M*	*SD*	*d*	*M*	*SD*	*d*
A_1	9.3	3.5		47.9	4.5	
B_1	26.2	7.4	3.1	55.4	7.4	1.3
A_2	13.1	8.4	0.8	49.9	5.7	0.4
BC	31.6	5.3	5.3	50.4	4.8	0.5
A_3	16.2	5.2	1.6	41.7	4.0	–1.4
B_2	23.6	2.9	4.4	44.8	5.1	–0.8
BD	20.6	5.7	2.6	46.2	2.4	–0.5
BDE	43.0	4.8	8.7	57.4	1.9	2.5
B_3	30.7	2.5	6.4	52.3	2.8	1.3

Note. d = effect size relative to A_1, where d is the difference between phase means in pooled standard deviation units. Standard deviations were calculated as descriptive statistics and not estimates of population parameters (i.e., degrees of freedom were not subtracted from the denominators during calculations).

plus feedforward (BC) produced slight improvements in reusable cups beyond environmental arrangement alone (5% increase). However, the BC phase produced levels of reusable plate selection similar to environmental arrangement alone. Environmental arrangement plus employee involvement (BD) also failed to produce changes in the level of target behaviors greater than environmental arrangement alone. However, environmental arrangement, employee involvement, and spoken prompts with motivational signs (BDE) resulted in large increases in reusable and cup and plate selection (22% and 11% increases, respectively, relative to the prior BD phase). During the final follow-up phase (B_3), conducted 3 months after the termination of the BDE phase, reusable cup and plate selection was observed at lower levels than in the previous phase (BDE). These decreases in behavior suggested that the motivational interventions (employee involvement, spoken prompts with motivational signs) had appreciable effects. This final phase left environmental arrangement intact, and reusable cup and plate selection was observed at 21 and 4 percentage points above original (A_1) baseline levels, respectively.

Table 1 reports means, standard deviations, and effect sizes for all phases of the experiment. Effect sizes reflect mean differences between each phase and the original baseline (A_1) in pooled standard deviation units ($M_{\text{intervention}} - M_{\text{baseline}}/SD_{\text{pooled}}$). This formula is a common variant of Cohen's d statistic in which variability information from both comparison conditions is pooled in the denominator (Cohen, 1988; Rosnow & Rosenthal, 1996). Effect size statistics are important because they enable comparisons of intervention effectiveness across experiments with diverse dependent measures (e.g., meta-analyses of research literatures; see Faith, Allison, & Gorman, 1996, for discussion of effect sizes in single-case designs). For between-groups experiments, d statistics of 0.2, 0.5, and 0.8 are considered small, medium, and large, respectively (Cohen). According to these standards, which may not generalize perfectly to repeated measures designs, all intervention effects in the current experiment were large for reusable cups. Large effects were observed for reusable plates during Phases B_1, BDE, and B_3. The largest effects were observed in Phase BDE for both items.

DISCUSSION

The current project used an informant assessment approach to design interventions for increasing reusable product selection in a cafeteria. The environmental arrangement intervention, based on the hypothesis that the existing arrangement made reusable dinnerware selection more effortful than disposable dinnerware selection, was supported through with-

drawal and replication phases. The motivational hypothesis was supported by the effects of adding spoken prompting plus motivational signs to environmental arrangement (Phase BDE). We believe that the environmental arrangement intervention was effective for reusable cups because it decreased response effort for selecting reusable cups while simultaneously increasing the response effort for disposable cups. Neither reusable cups nor plates were more available during environmental arrangement; however, the saliency of discriminative stimuli probably improved with signage changes. The smaller and less reliable effects of environmental arrangement on reusable plate selection were probably due to a weaker dose of the treatment (only signage changes, no changes to physical arrangement).

Spoken prompting with motivational signs probably functioned as a motivating operation by increasing the reinforcing effectiveness of reusable choices or abolishing the reinforcing effectiveness of disposable choices. This assertion is supported by that fact that (a) prompting was not associated with increased availability of reusable products and (b) reusable products were already highly visible due to the environmental arrangement condition. Prompting also created a social consequence for patron choices because patrons had to stand in line near the prompting experimenter to purchase their food and beverages. Eye contact with the prompter might have functioned as a social reinforcer or punisher, depending on the choices a patron had made.

By considering the extrapolated financial impact of the most effective condition for 1 year, the behavior changes created by the interventions may be deemed socially important. The cafeteria manager spent $84,480 annually for disposable cups and plates that were not recyclable. Relative to the original baseline, Phase BDE reduced disposable cup and plate selection by 34% and 9%, respectively. Disposable cups cost $36,480 annually (34% savings = $12,294) and disposable plates cost $48,000 annually (9% savings = $4,560). These annual expenditures translate into 912,000 disposable cups and 320,000 disposable plates (approximately 2,192 cubic yards). The estimated waste reduction would therefore be 307,344 (34%) fewer disposable cups and 30,400 (9%) fewer disposable plates (approximately 429 cubic yards). The disposal fee for each cubic yard of waste at the university was $16 (429 cubic yards = $6,864), bringing the total estimated annual savings of the intervention to $23,718 ($12,294 + $4,560 + $6,864). For a more conservative estimate of financial impact we can consider the effects of implementing the intervention only during the busiest portion of the lunch hour. Our data from experimental sessions suggest an annual savings of $2,088 (item purchase savings = $1,491; waste disposal savings = $597) plus 37 cubic yards of waste reduction. In either case, it should be noted that actual savings would be offset by the costs of collecting, washing, and maintaining the stock of reusable dinnerware, and by any personnel costs associated with prompting.

Limitations in the current project suggest areas for future research. The current project did not compare the differential effectiveness of function-based versus non-function-based community interventions. The current project also did not replicate or isolate the effects of feedforward, employee involvement, or spoken prompts with motivational signs. However, spoken prompts with motivational signs produced convincing effects; thus, future research should replicate this intervention and identify the conditions for the maintenance of effects. It is also possible that employee involvement interacted with spoken prompts and motivational signs to produce the observed effects. It is reasonable to assume that employee involvement of some kind is essential for long-term maintenance and improvement of interventions over time.

Previous research has demonstrated that a variety of community-based interventions

can improve proenvironmental behaviors. However, little empirical attention has been dedicated to diagnosing the causes of undesirable behavior prior to selecting specific community interventions. In the current project, informal and informant assessments resulted in a priori hypotheses about causes of wasteful behavior in a cafeteria. General hypotheses were supported by the results of assessment-based interventions, with some conditions producing large effects. Encouraging proenvironmental behaviors is a socially important concern, and behavioral diagnostic techniques are promising for improving the effectiveness of proenvironmental interventions.

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