Promoting Recycling Behavior in Office Environments

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ABSTRACT

Rapid declines in available landfill space have sparked specific interest in recycling programs focused on increasing the quantity of materials recycled. This focus on quantity, rather than quality, has produced a glut of paper which currently comprises nearly 40% of all solid waste produced each year in the U.S. In recent years, recycling facilities have become increasingly selective with regard to the paper materials they accept because contaminants (e.g., food, gummy labels, carbon paper, staples, styrofoam products) reduce the recyclability of the collected material. In this study, a "low-tech" sort separation intervention was used to decrease the amount of contaminants in recyclable paper collected from four campus office buildings. A multiple baseline design across settings was used to evaluate the intervention, that consisted of an educational pamphlet, interactive group discussion, attention-getting posters, and environmental arrangement of color-coded paper collection bins to increase ease of use and convenience. Following the intervention, the percentage of correctly sorted paper increased from 25.5% during baseline to 83.5%. The results show that "low-tech" interventions can be used successfully to improve paper recycling practices in office settings. Implications of these results are discussed.

INTRODUCTION

The United States will produce an estimated 192.7 million tons of solid waste by the year 2000 (Environmental Protection Agency, 1989), an increase of 52.1 million tons over the amount produced in 1986. Over 86% of the solid waste in the United States is deposited in landfills or is incinerated (EPA,1990a). One alternative to the extensive use of these methods is recycling, although currently, the U.S. recycles only about 13% of its solid wastes. A reduction in the volume of solid waste entering landfills and incinerators may not only add useful life expectancy to the landfills, but also reduce the increasing costs of disposing solid wastes (EPA, 1989; New York State Department of Environmental Conservation, 1988).

Reluctance on the part of consumers to recycle can be traced, at least in part, to marketing campaigns aimed at persuading consumers to buy disposable items because of their attractiveness and convenience (EPA, 1990b). These "throwaway behaviors" have contributed greatly to the increase in solid waste deposited in landfills and incinerators. Not surprisingly, the EPA (1990b) estimates that many of the nation's landfills will be filled to capacity in the next several years, and only a few new landfill sites are expected to be opened to replace them.

The EPA (1990a) indicates that paper comprises as much as 40% of the solid waste produced in the United States each year. The proliferation of computers and photocopy machines have dramatically increased the amount of paper entering the solid waste stream (State of New York Office of General Services, 1987). Since paper is one of the easiest materials to recycle, it offers the potential for tremendous savings in landfill space and the natural resources required to produce new paper. Thus, work settings that use computers, photocopy machines and, in general, produce a great deal of paper, are appropriate environments in which to establish and investigate the effectiveness of paper recycling programs.

Despite the increased focus on recycling, there is currently a glut of recyclable paper collected. This over-abundance is partly due to the fact that a majority of recycling programs have focused solely on increasing the quantity of recyclable materials returned, and not on their quality. Recycling facilities have become increasingly selective with regard to the materials they accept because contaminants (e.g., food, gummy labels, carbon paper, staples, styrofoam products) reduce the recyclability of the collected material. Recycling facilities routinely refuse entire loads of paper waste (often tons of paper) because of the presence, or suspected presence, of contaminants.

As a consequence, recycling efforts have recently focused on improving the quality of recyclable materials via a process termed *sort separation*. There are two general approaches to sort separation. In the centralized, or "high-tech" approach, recyclables are sorted upon delivery to a recovery plant. Due to its high cost in equipment and manpower, "high-tech" sort separation procedures are used primarily by large corporations and municipalities. Not surprisingly, this approach is not cost effective or feasible in many settings (Geller, 1980a). In the decentralized, or "low-tech" approach, recyclable materials are correctly sorted at a point near their use (Luybens and Cummings, 1982; Geller, 1980b). The decentralized approach is an attractive alternative because it does not require the purchase and maintenance of expensive "high tech" facilities nor the hiring of specific individuals to do the job. However, it is not as convenient to consumers as the centralized approach, and therefore, may require planned efforts to encourage their participation (Geller, 1980a).

There are two types of "low-tech" techniques that have been used to increase environmentally responsible behaviors: (1) those with a focus on events preceding recycling behavior, termed antecedents; and (2) those with a focus on consequences (Ester and Winett, 1982). Consequence strategies (e.g., reward or punishment procedures) are typically more powerful in motivating short-term recycling behavior, but they are often expensive and perceived as contrived, compared to antecedent strategies (Ester and Winett, 1982). Consequence strategies may also require a certain amount of policing in order to justify the use of a reward or punishment, and therefore, the targeted behavior(s) may not be maintained once the rewards or

punishers are removed. In contrast, antecedent strategies are less expensive, do not require policing, and often result in higher maintenance of the targeted behavior(s) (Geller, Rudd, Streff, Kalsher, and Lehman, 1987). Antecedent techniques that have been used successfully to promote general recycling behavior include educational programs (e.g., Ester and Winett, 1982; Weigel, 1983), prompting (e.g., Geller, Winett, and Everett, 1982; Reid, Luyben, Rawers, and Bailey, 1976;), and environmental arrangement (Geller, 1989, 1992; Witmer and Geller, 1976).

Unfortunately, only limited empirical research exists to guide the design of "low tech" interventions specifically directed at improving the quality of recyclables through sort separation. One study by Humphrey, Bord, Hammond, and Mann (1977) showed that it is possible to increase correct sort separation simply by offering participants the opportunity to do so. However, because some people may not respond on the basis of opportunity alone, more research aimed at developing cost-effective techniques to increase sort separation is needed.

Prior to this study, Rensselaer Polytechnic Institute, a medium-sized technical university in Troy, New York, had a paper recycling program in place. Over the past several years, this program has generated revenue for the university. However, because the excess supply of collected paper products in the Troy area exceeds demand, local paper mills routinely refuse Rensselaer's paper wastes when they contain contaminants. Moreover, due to increasing demand on local landfills, Rensselaer has had to pay to dispose of its paper wastes when they were rejected by recycling facilities. Therefore, the primary purpose of this study was to develop a simple, low-cost, and effective intervention to increase the amount and proportion of correctly sorted paper obtained from offices located on campus.

METHOD

Setting

Departmental offices in four buildings on the Rensselaer campus provided the setting for this study. Offices in these buildings were equipped with sets of colored bins for the purpose of sort-separating three types of recyclable paper waste. The red bins were used to collect white office paper (e.g., bond paper, Xerox paper, laser paper); the yellow bins were used to collect all colored paper; and the blue bins were used to collect high grade computer paper. Each bin is 30.5 cm (12 in.) x 27.9 cm (11 in.) x 12.7 cm (5 in.). The bins and their arrangement are shown in Figure 1.

Data Collection Procedures

Throughout the study, paper from each of the bins was collected daily. After the contents were removed from each of the bins, they were placed in separate plastic bags, tagged to note their point of origin, and taken to a central location for weighing using a Pelouze model P1-Y25 heavy-duty package scale which was frequently checked to ensure it was correctly calibrated. Once the overall weight of the contents was determined, contaminants were removed from the collected material and the remaining contents were then re-weighed. These data were then used to compute the total weight of correctly sorted paper, total weight of contaminants, and the overall proportion of correctly sorted recyclable paper for each of the four buildings. The recyclable portion of the paper was transported to a local papermill and the non-recyclable portion was transported to a local landfill.

Figure 1. Poster used to prompt correct placement of paper wastes. The bins depicted in the poster were colored to correspond to each bin's purpose (i.e., red for white paper, yellow for colored paper, blue for computer paper). The poster dimensions were 27.9 x 35.6 cm (11 x 14 in.).

Intervention

The intervention program incorporated several features that have been successfully used to increase recycling behavior in previous research, including an informational campaign, prompting, and environmental arrangement. The theme *Recycle Now* was used throughout the intervention and placed on all program materials.

Initially, key individuals in each office setting (e.g., department heads) were contacted to solicit their participation in the program. There were no instances in which an individual refused participation, and almost without exception, people expressed enthusiasm for the program. The informational campaign consisted of distributing a pamphlet to all faculty, staff and administrative personnel in each participating building. The pamphlet described the *Recycle Now* program in detail, including: (1) why the recycling program was needed, (2) the purpose of each of the colored bins and (3) the sort separation process and what constituted a "non-recyclable" material or contaminant. Small group discussions were also conducted with office staff to review the materials in detail and to elicit greater personal commitment from each participant.

Posters that prompted appropriate placement of each type of paper waste were located directly above each set of bins (see Figure 1). The design of the posters used in the intervention was based on elements found to be successful in previous human factors research (e.g., Kalsher, Clarke, and Wogalter, 1993). Several posters were also placed around each departmental office to remind the participants to recycle their waste paper.

The three colored bins described previously were placed side-by-side in high traffic areas of the office to maximize convenience (Wogalter, Allison, and McKenna, 1989). Prior to this study's intervention, these same bins were typically placed in locations not easily accessible, and therefore, recycling was inconvenient for most office occupants. Additionally, the bins were usually arranged vertically which also hindered their recycling efforts, especially when the lower bins were overfilled.

RESULTS

The impact of the campus recycling program was evaluated using a multiple baseline design across settings (Baer, Wolf, and Risley, 1968). In this design, responses are measured over time to provide baselines (as control conditions) against which the effect of the intervention can be evaluated. Then, the intervention procedures are applied to each setting in a sequential fashion over time, and in so doing, attempting to demonstrate that the observed changes are due to the intervention, and not to other factors.

Figure 2 shows that the mean total sorted weight (collapsed across five-day weeks) of recyclable paper observed during baseline, was low across all four buildings. Mean total weights, standard deviations, and number of daily observations comprising the baselines for each building are presented in Table 1. The percentages of paper sorted correctly across the four building during baseline varied from 12.4% in Building 1 to 60.2% in Building 4 (the Control site). Mean percentages of correctly sorted paper, standard deviations, and number of daily observations for this dependent measure (across the four buildings) are presented in Table 2.

The tables as well as Figure 2 also show that both total sorted weight and the percentage of correctly sorted paper increased greatly in Buildings 1, 2, and 3 following implementation of the intervention. Building 4 was maintained as a control condition throughout the eleven-week period.

DISCUSSION

The recycling literature is replete with examples of interventions designed to increase the quantity of recyclable materials, including paper. However, this study shows that well-designed behavioral interventions can also be effective in increasing their quality via sort separation. The *Recycle Now* program, which consisted of several "low-tech" components (i.e., informational pamphlets, posters, and environmental arrangement), dramatically increased the percentage of correctly sorted office paper produced in three campus office buildings. The cost for the materials used in this program was less than $200.

Large-scale implementation of similar programs could greatly reduce the amount of solid wastes entering landfills, thereby increasing the useful life expectancy of existing landfill sites, reducing the need to build new ones and saving the natural resources required to produce "virgin" paper products. An important feature of the study is that the problem was addressed near the point where it occurs (in office settings), and focused responsibility for performing the correct behavior (sort separation) on the individual office workers. Elimination of problems (e.g., hazards) through environmental design is not new to human factors

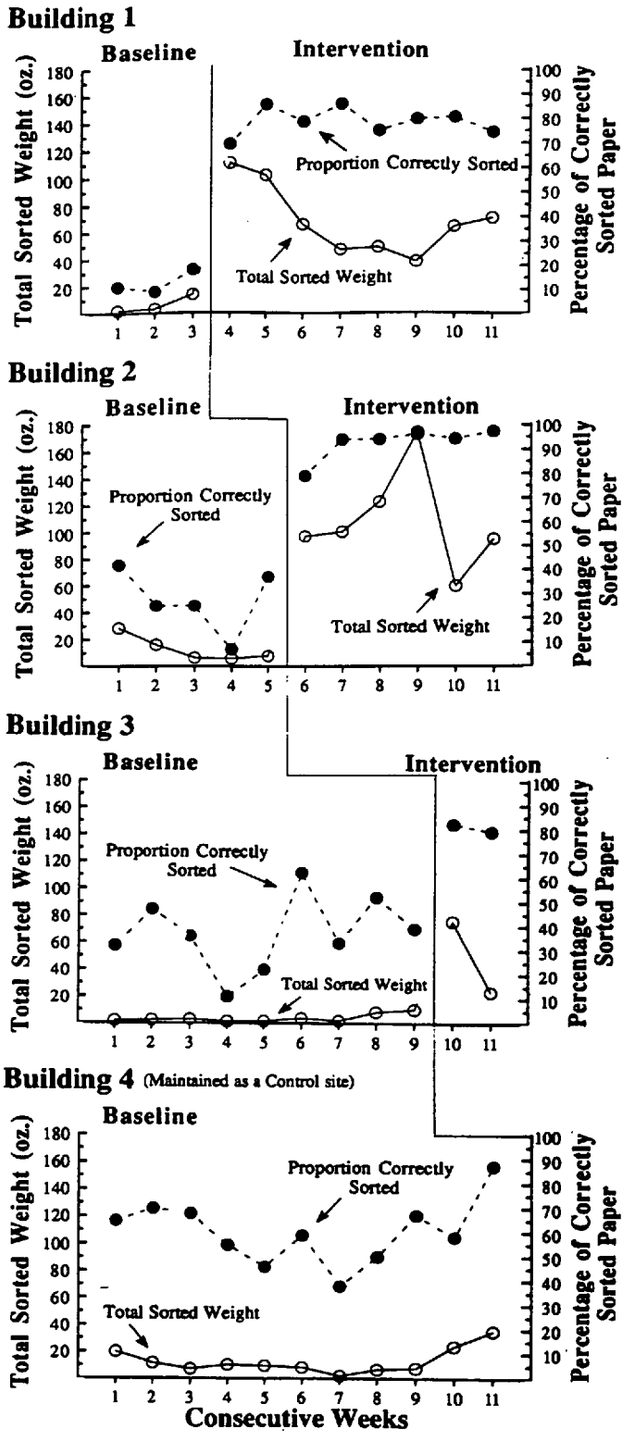

Figure 2. Total sorted weight (in oz) and proportion of correctly sorted paper waste collected in each of four buildings across consecutive five-day weeks during baseline and intervention. Building 4 was maintained as a Control throughout the eleven-week study.

Table 1. Mean Total Sorted Weight across Buildings 1 - 4 during Baseline and Intervention.

	BUILDING 1			BUILDING 2			BUILDING 3			BUILDING 4		
	Mean	Stnd. dev.	Days (#)	Mean	Stnd. dev.	Days (#)	Mean	Stnd. dev.	Days (#)	Mean	Stnd. dev.	Days (#)
Baseline	6.4	6.5	16	12.9	9.5	27	4.0	3.2	45	13.0	9.5	54
Intervention	68.4	25.7	38	108.3	38.2	27	49.4	37.0	9	-----	----	----

Table 2. Mean Percentage of Correctly Sorted Paper across Buildings 1 - 4 during Baseline and Intervention.

	BUILDING 1			BUILDING 2			BUILDING 3			BUILDING 4		
	Mean	Stnd. dev.	Days (#)	Mean	Stnd. dev.	Days (#)	Mean	Stnd. dev.	Days (#)	Mean	Stnd. dev.	Days (#)
Baseline	12.4	4.7	16	27.2	13.5	27	37.1	15.4	45	60.2	13.3	54
Intervention	77.9	5.5	38	92.4	6.7	27	80.3	2.1	9	-----	----	----

professionals, but traditional environmental designs often remove individuals' perceived responsibility for their own behavior. Although not assessed in this study, an added benefit may have been generalization of recycling behaviors to other settings and to other potentially recyclable materials (Streff, Kalsher, and Geller, in press).

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