OFFICE PAPER RECYCLING: A FUNCTION OF CONTAINER PROXIMITY

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We investigated the effects of proximity of containers on pounds of office paper recycled and not recycled by 25 employees. During a memo and central container condition, one container for recyclable paper was provided; in a memo and local container condition, desktop recycling bins, announced by memo, were successively introduced across administrative, office, and instructional settings using a multiple baseline design. Only 28% of paper was recycled in the central container condition, but when recycling containers were placed in close proximity to participants, 85% to 94% of all recyclable paper was recycled. Follow-up assessments, conducted 1, 2, 3, and 7 months after all settings received local recycling containers, showed that 84% to 98% of paper was recycled. Providing desktop recycling containers was a cost-effective procedure with long-term maintenance and program survival.

DESCRIPTORS: organizational behavior, paper recycling, stimulus control, cost effectiveness, maintenance

“Industrial nations, with 25% of global population, consume 70% of all resources” (Smith, Woodruff, & Templeton, 1992, p. 69). Americans have been besieged with such information recently as politicians and world leaders attempt to develop policies to preserve the environment, or more accurately, to increase environment-preserving behavior.

In 1991, the United States generated 280.6 million tons of trash; over three fourths of this trash was buried in a decreasing number of landfills (Glenn, 1992). Contrary to popular belief, paper is the only material increasing in American landfills; its volume and weight have doubled since 1964,

and “there is no evidence that any significant quantity of paper products have [*sic*] biodegraded over 25 years of burial” (Rathje, Hughes, Archer, Wilson, & Cassells, 1989, p. 29). Hence, reducing the amount of paper entering the waste stream would be beneficial.

New Jersey became the first state to legislate reduction of the waste stream by establishing recycling goals for residents and businesses (New Jersey P.L. 1987, c. 102). This measure was an effort to reduce the state’s need for landfills. Such legislation may provide the impetus for reducing waste stream, but it does not prescribe procedures for effective and efficient recycling.

Although recycling procedures have been studied in residential neighborhoods (Burn & Oskamp, 1986; Jacobs & Bailey, 1982–1983; Jacobs, Bailey, & Crews, 1984), university dormitories (Couch, Garber, & Karpus, 1979; Geller, Chaffee, & Ingram, 1975; Witmer & Geller, 1976), apartment complexes (Reid, Luyben, Rawers, & Bailey, 1976), mobile home parks (Luyben & Bailey, 1979), and elementary schools (Hamad, Cooper, & Semb, 1977), only two investigations have examined interventions to increase office paper recycling in a

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work setting (Austin, Hatfield, Grindle, & Bailey, 1993; Humphrey, Bord, Hammond, & Mann, 1977). Investigations have typically found immediate increases in recycling behavior with prompting and reinforcement procedures, but maintenance of recycling behavior has presented problems.

For example, although Geller *et al.* (1975) used raffle tickets to reward college students for increasing their delivery of recyclable paper to a dormitory drop-off site, and Witmer and Geller (1976) used raffles and contests with groups of dormitory students, both experiments found that recycling behavior failed to be maintained when these rewards were eliminated. In an effort to achieve response maintenance, Couch *et al.* (1979) gradually reduced reinforcement density in a similar study with university dormitory residents; systematically increasing the amount of paper to raffle ticket ratio did not produce maintenance either.

Jacobs *et al.* (1984) conducted a series of experiments using stimulus-control procedures in single-family home neighborhoods. They showed that when informational brochures were provided in addition to newspaper advertising, participation in curbside recycling increased two to four times over ads alone. They also found that provision of source-separation containers and handbill prompts increased recycling more than did handbills alone. Maintenance was observed for residents who received prompts and containers, but the authors noted that this procedure was not cost effective.

Other studies also suggest that convenience affects participation. When Luyben and Bailey (1979) placed recycling containers throughout mobile home parks, the amount of newspaper recycled was 44% and 59% greater than when containers were placed at entrances only. Witmer and Geller (1976) reported that "students whose [dormitory] rooms were closest to the collection center showed the greatest participation" (p. 315). Humphrey *et al.* (1977) found fewer contaminants in recycling containers located in close proximity to office workers, and Austin *et al.* (1993) increased the number of recyclable items in recycling containers and decreased the number of recyclable items in adjacent

trash containers by posting prompts above the containers.

Although these studies demonstrated functional prompting and reinforcement procedures, the benefits were ephemeral. Further, the effectiveness of all but one of these programs (Austin *et al.*, 1993) is difficult to assess because measures of amounts *not* recycled were not reported. Measures of amounts recycled *and* not recycled permit assessment of effectiveness (e.g., percentage of discarded paper recycled) and generate important information for recycling program planners.

The need for a technology of durable behavior-change procedures exists because business and community organizations are increasingly held responsible for recycling. Because identification of relevant discriminative stimuli could lead to better maintenance, this study examined the role of recycling container proximity on office paper recycling. Measures of paper recycled and not recycled were obtained to better assess the value and impact of this intervention.

METHOD

Participants and Setting

The participants ($N = 25$) were employees of the Princeton Child Development Institute, a private nonprofit research and treatment program for children and adults with autism. They included all staff members employed at the school headquarters building (except the authors and one other full-time employee who served as reliability scorer). Monday through Friday, the building was also occupied by 25 children and as many as five adults with autism.

For purposes of the study, the building was divided into three environments: (a) administration, including reception, secretarial, bookkeeping, conference, and copy rooms; (b) instructional areas (i.e., 12 classrooms, dining room, and gym); and (c) offices, both private and shared, that included 20 work spaces. The research was conducted in all areas of the building except closets and bathrooms.

Apparatus

A yellow Huskee® container (75.6 L) was used for central location recycling; a list of recyclable paper was taped to the side of this container. Blue Rubbermaid® desktop recycling paper trays were introduced during the memo and local container condition. The sides of these stackable trays were embossed with the message "Recycle office paper only." A Rubbermaid® janitors' cart was used to transport materials to the scale (a Chatillon® T40, 40 lb × 2 oz dial spring scale).

Measurement

Recyclable office paper found in recycling and trash receptacles was the dependent variable. Recyclable office paper included letterhead paper (any color), white copy paper, white lined tablet paper, envelopes without cellophane windows, white phone message slips, white index cards, calculator tape, and white computer paper. These papers were acceptable whether blank or imprinted with colored ink or graphite. Nonrecyclable paper included glossy paper, foil-lined paper, hard board boxes (e.g., boxes used to package pens), and paper soiled with solid waste material such as food, tape, or adhesive.

The number of pounds and ounces of recyclable office paper found in recycling and trash containers was recorded. Measures were obtained Monday through Friday, on every day that staff and students were present. Data collection began after the work day ended, usually after 7:00 p.m. and never before 4:30 p.m. Before the study began, observers reviewed written measurement procedures and the definition of recyclable paper, and pilot data were collected. Observers systematically alternated position of first sorter/measurer each time a new setting was measured (i.e., three times a day) and independently sorted, measured, and returned recyclable paper to the trash. Collection of interobserver agreement data on sorting was discontinued after observers reached criterion of nine consecutive measures with 94% to 100% ($M = 97\%$) agreement.

During the study, the roles of primary and secondary scorer were systematically rotated across days.

The primary scorer sorted, weighed, and recorded the weight of recyclable paper in the trash and in recycling containers in each environment; the second observer then weighed the recyclable material. While one observer sorted paper from trash or recorded weights, the other remained outside the utility room.

Recyclable paper in the trash. Beginning with the administrative environment, contents of each trash container were emptied into the refuse sack of a janitor's cart. When all containers in this environment were emptied, an observer transported the trash to a small utility storage room. The scale was then calibrated by pressing the platform with sufficient pressure to cause the indicator needle to pass the 20 lb point, releasing pressure, and adjusting the indicator needle to zero. This process was repeated until two consecutive trials required no adjustment to zero. Trash was sorted by stacking recyclable paper and discarding trash into a trash bag; then, recyclable paper found in the trash cans was weighed. Scale calibration and sorting and weighing procedures were repeated for office and instructional settings; these procedures remained the same throughout all conditions.

Recyclable paper in recycling containers. During memo and central container, memo and local container, and follow-up conditions, recyclable paper in recycling containers was collected and taken to the utility room. Nonrecyclable and recyclable materials found in recycling containers were separated, the scale was calibrated, and the weight of recyclable paper in recycling containers was recorded. The weight of nonrecyclable contaminants (e.g., colored paper and newsprint found in recycling containers) was also recorded.

Assessment of the independent variable. During the memo and central container condition, the memo and local container condition, and follow-up, the presence or absence of recycling containers in specified locations was scored each work day. Observers marked a plus for each container found in a designated location (e.g., on counter in Classroom 6; on the head teacher's desk) and a minus if a recycling tray was absent from that location. The primary observer entered each room first, ob-

served for containers, and then scored; subsequently, the second observer entered the room and independently recorded the presence or absence of receptacles. Once provided, all recycling containers were scored as present in designated locations every work day.

Experimental Design and Procedures

A multiple baseline across three settings was used to evaluate the effects of proximity of recycling containers on pounds of paper recycled. Following baseline and the memo and central container condition, desktop recycling bins were successively introduced in administration, office, and instructional settings. Follow-up measures were obtained for up to 7 months.

Baseline. There were no recycling containers in the building during baseline. Each work day, the contents of all trash containers were collected, and recyclable paper was sorted and weighed.

Memo and central container condition. At the end of the work day before this condition began, employees received a memo in their paycheck envelopes, indicating that a centrally located recycling container would be available the next work day. The memo provided a uniform means of notifying all participants of the definition of recyclable paper and the location of the container. The recycling container was placed in a large utility room at the approximate center of the building.

Memo and local container condition. A memo distributed in paycheck envelopes announced the presence of desktop recycling bins on the next work day and defined recyclable paper. The memo was provided first to employees whose work spaces were located in the administrative setting, then to those with work spaces in the office setting, and finally to those with work spaces in the instructional setting. Desktop recycling trays were placed on each work surface (i.e., office desktops and counters in the dining room and classrooms).

Follow-up. Local containers remained available. Follow-up assessments were conducted at monthly intervals for 3 months, beginning 1 month after the last day of the memo and local container con-

dition; a fourth and final measure was obtained after 7 months.

Interobserver Agreement

Independent variable. Interobserver agreement on the presence or absence of desktop recycling containers in specified locations was obtained on at least 57% of the work days during the memo and central container and memo and local container conditions. Percentage of interobserver agreement was calculated by dividing the number of agreements by number of agreements plus disagreements and multiplying by 100%. There was 100% agreement on the presence and absence of recycling containers.

Dependent variable. Reliability estimates were taken across all conditions and during each phase of the memo and local container condition. Interobserver agreement on weight of paper found in the trash was obtained on 30 of 54 work days (56%). Interobserver agreement on weight of paper recycled was obtained on 26 of the 44 days that recycling containers were present (59%). A total of 158 measures were scored for interobserver agreement throughout the study.

Percentage of interobserver agreement was calculated by dividing the smaller of two measures by the larger and multiplying the quotient by 100%. Observers achieved perfect agreement on 75% of their observations, disagreed by only 1 oz (28.35 g) (measurement was made in nonmetric units and converted to the rounded SI equivalent) on 22% of their observations, and disagreed by 2 oz (56.70 g) on 3% of their observations; they never disagreed by more than 2 oz (56.70 g). Throughout the study, mean interobserver agreement on the weight of recyclable paper in the trash was 98% (range, 50% to 100%). Mean agreement on weight of recyclable paper in the recycling container for the memo and central container condition was 94% (range, 67% to 100%). During the memo and local container condition, overall agreement on weight of recyclable paper in recycling containers was 98% (range, 93% to 100%); mean percentage by area was 97% for administration, 100% for offices, and

99% for instructional areas. During follow-up, mean agreement on weight of recyclable paper in trash cans and recycling containers was 100%. Agreement on weight of contaminants in recycling containers was 100% across all conditions.

RESULTS

During baseline, mean number of pounds of recyclable paper in the trash was 1 lb 11 oz (0.76 kg) for the administrative area, 2 lb 12 oz (1.25 kg) for offices, and 1 lb 1 oz (0.48 kg) for the instructional area (see Figure 1). During the memo and central container condition, means of 1 lb 6 oz (0.62 kg), 1 lb 2 oz (0.50 kg), and 13 oz (369 g) of recyclable paper were thrown away in administrative, office, and instructional areas, respectively. But during the memo and local container condition, mean weights of recyclable paper discarded were only 4 oz (114 g), 3 oz (85 g), and 3 oz (85 g) for the administrative, office, and instructional settings. Although Figure 1 shows a slight descending trend in the office area during the central container condition, there was only one overlapping data point between this and the subsequent condition.

Figure 2 shows that the percentage of paper recycled increased markedly each time recycling containers were introduced. During the memo and central container condition, a mean of 28% of paper was recycled. The mean percentage of paper recycled during the memo and local container condition was 55% when only the administrative area received local containers, 76% when both the administrative and office settings received local containers, and 88% after all areas of the building were equipped with local containers. Mean percentage of paper recycled during follow-up was 92%. Mean weight of recyclable paper generated across each condition was quite consistent: 5 lb 7 oz (2.464 kg) were generated in baseline, 5 lb 2 oz (2.324 kg) in the memo and central container condition, 5 lb 6 oz (2.436 kg) in the memo and local container condition, and 5 lb 9 oz (2.52 kg) during follow-up.

Contaminants were found on 4 of the 9 memo

and central container days (44%) and on 22 of the 36 days comprising the memo and local container and follow-up conditions (61%). A mean of 1% (range, 0 to 4%) of the weight of contents of recycling containers consisted of contaminants during the memo and central container condition. During the memo and local container and follow-up conditions, a mean of 2% (range, 0 to 12%) of the weight of contents of recycling containers consisted of contaminants.

DISCUSSION

This study found that providing recycling containers in close proximity to work areas resulted in a substantial proportion of office paper recycled (84% to 98%). Given mandates to reduce the solid waste stream by up to 60% (New Jersey P.L. 1987, c.102; California A.B. 939, 1989), this study documents the effects of procedures that may contribute to attainment of recycling requirements within office settings.

A particular strength of this study is the maintenance of the effects of the memo and local containers for 7 months; follow-up assessment showed 84% of paper recycled at 1 month, 89% at 2 months, 95% at 3 months, and 98% at 7 months. Eight new employees joined the staff at various points before follow-up. The addition of these employees increases the significance of the maintenance data, especially because these participants were not present when memos were distributed. Although it is possible that senior colleagues communicated the definition of recyclable paper to these new employees (i.e., in the same way that one might expect them to communicate other policies and procedures), it seems quite likely that local containers were relevant discriminative stimuli for recycling.

Announcing the definition of recyclable paper and the location of containers via memo, when providing desktop recycling trays, appears to be cost efficient. When the study began, trash was removed from the facility's dumpster twice a week; after all employees had access to desktop recycling containers, trash removal was reduced to once per

Figure 1. Number of pounds of recyclable paper in the trash.

Figure 2. The percentage of recyclable paper recycled during the memo and central container condition; during the memo and local container condition when recycling trays were successively introduced in administrative (A), office (B), and instructional (C) areas; and during follow-up.

week and trash removal costs were reduced by 50%. In addition, the agency received revenue from the recycling company that retrieved the recyclable paper. After the study ended, recycling containers were emptied daily by the building maintenance company at no additional charge. A total of \$1,230 was saved in reduced trash removal costs in the 1st year of paper recycling, and the cost of containers and memos was recovered during the 1st month of program-wide recycling. Thus, this approach appears to be feasible for many settings.

Using the mean number of pounds (5.5) of recyclable paper generated per day (i.e., the mean amount of paper discarded and recycled daily throughout the study) and the mean percentage of paper recycled in follow-up (92%), it is projected that 1,316 lb (595.11 kg) of paper could be diverted from the waste stream annually. Alterna-

tively, 1,316 lb is approximately 157,920 sheets of 8.5- by 11-in. paper (about 120 sheets weigh 1 lb). Therefore, the mean number of pounds of recyclable paper generated per day amounts to about 660 sheets, or 26 sheets per participant. These figures represent the efforts of only 25 employees; for larger organizations, the potential monetary savings and environmental benefits would be even more significant.

Errors (e.g., colored paper and newsprint in recycling containers) reduce the prices offered by recycling companies. Mean percentage of error (i.e., proportion of weight of contaminants in recycling containers) during memo and local container conditions was only 2%. This low percentage of error adds to the cost effectiveness of the procedure.

In addition to response maintenance and cost effectiveness, this study demonstrates program sur-

vival. Seven months after the memo and local container condition ended, recycling containers were in designated locations, paper continued to be collected by the maintenance company, and it became policy to distribute the memo used in the study to newly hired employees. Potential survival variables present in the current study include (a) employer adoption of the procedure as policy and (b) a 50% reduction in trash removal costs. Welsh, Miller, and Altus (in press) identified three strategies to increase program survival: (a) transferring supervisor responsibility to local staff members, (b) minimizing effort for staff members implementing the program, and (c) amplification of the existing natural contingencies. All three strategies were present in the current study. Research to identify other variables responsible for program survival is needed.

The American Paper Institute has announced goals to increase recovery of wastepaper to 40% by 1995 (Thompson, 1992), suggesting a growing need for the simple technology investigated here.

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