

USING BEHAVIORAL PROCEDURES TO ESTABLISH AN ELEMENTARY SCHOOL PAPER RECYCLING PROGRAM*

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ABSTRACT

An elementary school recycling program was developed in which students could deliver paper when they arrived at school each day. For a period of eight-months, feedback, goal setting and self-recording conditions were evaluated. The largest quantity of paper was recycled during the goal setting condition and the greatest number of students participated when they recorded their own participation. The impact newspaper recycling had on energy consumption was estimated and the advantage of using the school system as an "agent" for wide scale recycling operations is discussed.

Resource recovery is viewed as an important practice for promoting environmental protection. When solid waste is recycled, three important events happen that reduce detrimental environmental impact:

1. energy is saved when new products are manufactured from secondary wastes;
2. the rate at which solid waste accumulates decreases; and,
3. natural resource depletion occurs at a slower rate [1].

Of these three, reducing energy impact may be the most important at a time when energy supplies are rapidly dwindling.

Additional energy savings that can result from recycling vary as a function of the collection procedures used in the reclamation process. For example, energy savings of 15 per cent result when solid waste is collected from "curbsides" rather than "backyards" because of the differences in idling time of collection

*This manuscript is part of a dissertation submitted by the first author to the Department of Human Development, University of Kansas, in partial fulfillment for the requirements for the Ph.D. degree.

vehicles [2]. Collection currently accounts for 80 per cent of the total solid waste processing budget [3].

Behavioral researchers have recently begun to address issues involved in the recycling process. It would appear that the problem should be considered on at least two different dimensions. First, there is a need to develop and evaluate procedures that promote recycling participation. Several researchers [4, 5] have reported that participation in school recycling programs can be increased by arranging contests and awarding prizes to groups of students that recycle the most paper. Reid, Luyben, Rawers and Bailey have found that easily accessible collection containers promote increased participation in a recycling program [6]. Second, the procedure must be cost/effective. If, for example, a lottery procedure is used to generate two tons of newspaper delivered by 1,000 individuals (average 4 pounds each) and delivered by cars traveling an average of five miles each, it is unlikely that the energy savings derived from recycling two tons of paper would offset the energy expended by 5,000 miles of vehicular travel. It is necessary therefore to identify recycling procedures that produce energy savings.

The purpose of the present study was to analyze the effects of a permanently-based paper collection system. A newspaper collection center was established at an elementary school where students were provided with the opportunity to deliver papers when they arrived at school each day. By arranging collection time in this manner, papers were able to ride "piggyback" to school thus decreasing the energy cost of the reclamation process.

METHOD

Subjects and Setting

An elementary school in a predominantly middle class neighborhood in a small midwestern city served as the setting. The study lasted approximately thirty weeks, from October, 1976 to May, 1977. Eleven classrooms, grades 1-6, with a total of 259 students (95% of the school) were eligible to participate in the project.

Collection Center

Two plywood boxes, measuring approximately 356cm by 105cm by 63cm, divided into eleven separate compartments and labeled according to classroom teacher, were used to collect papers. The boxes were placed near one of the three front entrances to the school. The words "Newspaper Recycling" were printed on the front of each compartment. The school custodian kept the boxes locked, except during the collection period from 8:00 to 8:30 a.m. each school day.

Procedure

On the first day of the project, the school principal provided each student with a written memo to take home. The memo detailed the times paper would

be collected, and stated that money collected from the resale of papers would be given to the school's PTA. It also outlined how much money had been collected during the previous year's recycling drive [5] and encouraged children and parents to continue to bring papers to school.

Data Collection

Pounds of paper collected was the main dependent variable and was measured every Monday, Wednesday, and Friday during data collection sessions, although the boxes were open for students to deliver papers every school day. A Hanson kitchen scale was used to weigh the paper collected by each classroom. Paper was stored in an empty corridor until it was removed and resold, approximately once every two weeks.

Student participation was also measured. At least once every week, an observer recorded the number of times students deposited paper in the collection center. Participation was defined as the delivery of at least one sheet of paper. The observer parked in an automobile across from the boxes and placed a mark next to the teacher's name on the observation record corresponding to the appropriate compartment each time paper was deposited by an individual student.

The order of experimental conditions was as follows:

Baseline 1 (A)—From Session 1 to Session 28 (approximately nine weeks) the papers were weighed and frequency of participation was measured with no experimental intervention.

Public feedback (B)—From Session 29 to 45 (approximately six weeks) the total weight of papers collected by students in each classroom was publicly displayed on a 90cm by 150cm piece of cardboard in a school hallway located in the main entrance of the school. A "thermometer" scale in 100 pounds gradations was used to post individual classroom feedback; the same scale in 500 pound gradations was used for the total amount of paper collected. The words "Newspaper Recycling" were printed near the top of the poster. The amount of paper collected was posted at the end of each day paper was weighed.

Information on the number of trees estimated to be saved as a result of recycling was also provided for the total school recycling effort. Based on the estimate that 120 pounds saves one tree from being cut down [7], a small emblem of a tree was stamped in green ink to the scale for each 120 pounds of paper collected. Fractions of the 120 pound figure were credited to the next collection session.

Baseline 2 (A)—For Sessions 46 through 54, the feedback sign was removed and the conditions were the same as in the first baseline period.

Goal setting (C)—On Day 55 the principal sent home a memo with students stating that a school-wide collection goal of 20,000 pounds had been set for the next three-week period (sessions 55 through 65). Each student was asked to

bring paper to school every day and to aim for an individual goal of 120 pounds, which would easily surpass the 20,000 pound figure. They were also informed that the money collected during this period would be used to help purchase small trees to be given to students at the end of the three week period. Attaining the school or individual goal or individual participation was not a requirement for receiving a tree.

Baseline 3 (A)—On Day 66 every student who wanted a small tree was given one. For sessions 66-74, conditions were the same as in the previous baseline conditions.

Self-recording plus rewards (D)—The following message was typed on class rosters and placed in individual classrooms:

Students: Place a check next to your name on the days you bring newspapers to school for recycling during the next two weeks. An extra ten minutes of recess will be given to your class if at least twenty (this figure varied for each classroom but the criteria was approximately 75 per cent for each class) of you bring in papers seven out of the next nine school days. Be sure to record your participation on the day you bring in papers. Try to bring in at least one newspaper every day.

Teachers were instructed to explain the self-recording plus rewards procedure to their students. A grid, corresponding to the dates the procedure was in effect (sessions 75-79), was used for students to check in.

On four of the five self recording plus reward days, participation frequency data were collected to estimate the accuracy (reliability) with which students recorded their own behavior.

Baseline 4 (A)—On Session 79 the principal announced which classes had met the participation criteria during the self-recording plus rewards condition and would be allowed one day of extra recess. Students were also told that papers would be collected for one additional week (sessions 80 through 82).

Measurement Reliability

Once a week usually on Friday for the duration of the study, a second observer made independent weighings of the paper collected. The primary observer weighed and recorded a quantity of paper that would not exceed the weight limits of the scale (32 pounds). The second observer then independently made the same weighing.

A second observer also independently recorded participation frequency data. The primary and secondary observer sat in the same automobile and independently recorded participation frequencies.

RESULTS

Interobserver agreement for pounds of paper collected ranged from 83-100 per cent (mean = 99%). Reliability estimates were calculated by dividing the

smaller number by the larger number. Interobserver agreement on frequency participation measures was assessed on five of the twenty-nine sessions when this measure was taken. Reliability ranged from 91-100 per cent (mean = 98%). Reliability estimates were calculated by dividing the smaller number by the larger number.

Pounds of paper collected during each experimental condition is presented in Figure 1. The total quantity of paper collected for all experimental conditions was 19,749 pounds. The first three baseline conditions produced a mean of 235 pounds per session. The fourth baseline condition had a mean of 114 per session. The Public Feedback produced a mean of 157 pounds per session; a decrease of approximately 50 per cent from baseline levels. The largest quantity of paper collected was during the Goal Setting condition when the mean reached 366 pounds per collection session. Self-Recording plus Rewards had a mean of 296 pounds per session. Only one class met the criteria during this condition and was awarded extra recess.

Figure 1 also shows student participation for each condition. As indicated, the largest amount of student participation was observed during the Self-Recording plus Rewards condition. Roughly 30 per cent of the students participated during this condition compared to a mean of 2 per cent for all other conditions (the largest number of participants for any single session prior to Self-Recording plus Rewards was 7%). For four sessions during the Self-Recording plus Rewards condition student participation data was taken by observers to assess the accuracy with which students self-recorded their participation. A comparison of "externally" recorded and self-recorded participation showed that for all four days, the levels of self-recorded participation, were higher than the externally recorded data. The average percent agreement (calculated by dividing the smaller number by the larger one) was 71 per cent. For the four sessions, students recorded 412 instances of participation while the experimenters recorded 294 instances.

Cost Benefit

Receipt from the sale of newspaper totaled \$205.18. Most of the paper was sold at \$20.00 per ton. Overall, approximately 10 tons of solid waste were prevented from entering the solid waste stream. At \$22.00 per ton [1] this represents a savings of \$220.00. Thus, the "benefit" portion of the project is estimated at \$425.18. Other benefits include natural resource savings [3] and reduced energy use when recycled paper rather than wood pulp is used in the manufacture of paper—13 million BTU's of energy per ton [8].

The major costs of the program included:

1. transporting papers to be resold, \$41.20—206 miles at \$0.20 per mile (National Travel Expenditure Act, 1975) and truck rental of approximately \$50.00;
2. price of trees used in the Goal Setting condition, \$25.00;
3. handling papers, estimated to be 30 minutes for each collection session or 42 hours at \$2.95 per hour, minimum wage, \$123.90.

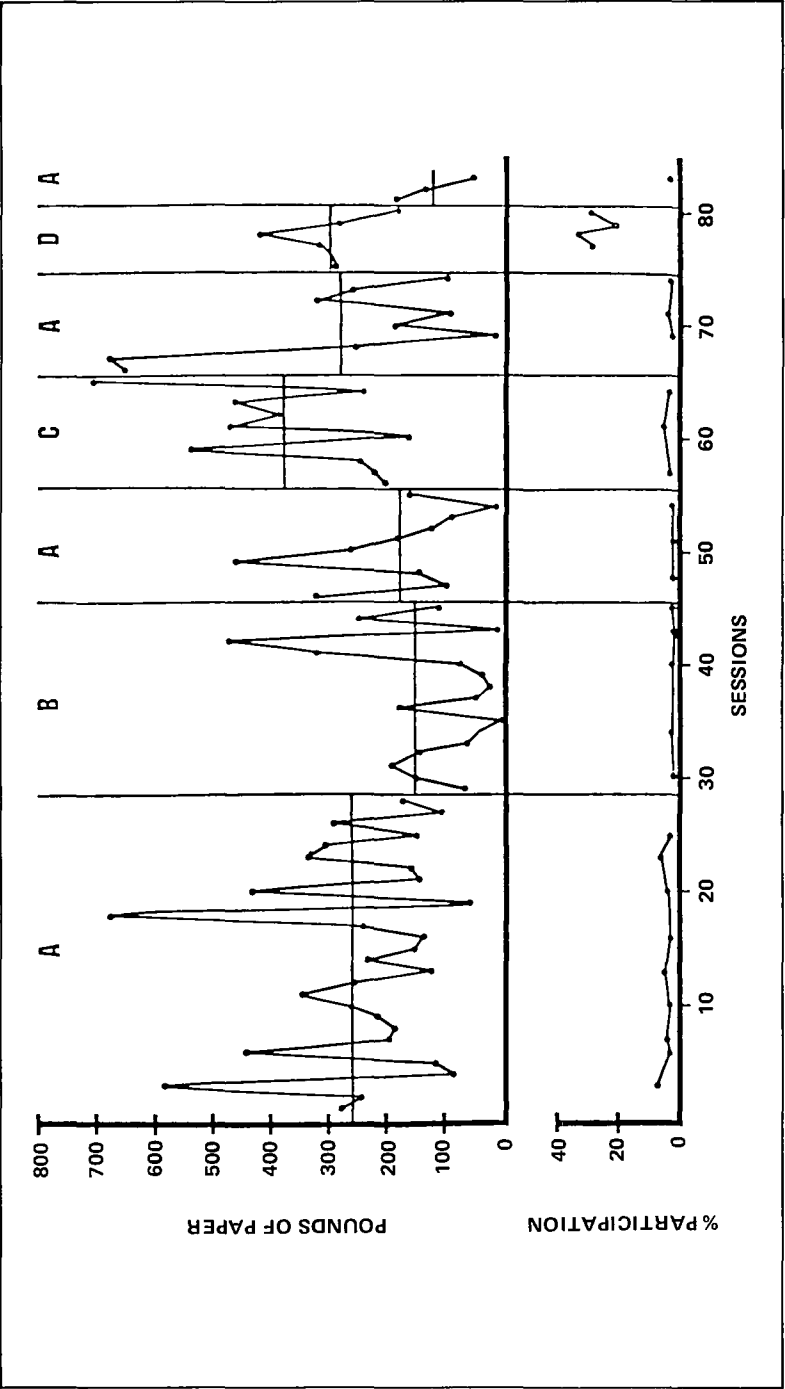


Figure 1. Pounds of paper recycled in each experimental condition (upper portion of the figure) and the percent of student participation (lower portion).

Thus, the total cost of the program was \$240.10. Another cost may be the energy parents used to transport papers to school. From the data reported above, it was impossible to determine the number of times parents drove their children to school with papers in the car, when the children would otherwise have walked.

DISCUSSION

Recycling solid waste poses a serious problem for behavioral researchers. Programs must focus not only on procedures that increase recycling participation but also on ones that are cost/effective. In this study, a school was used as a site for collecting recycled materials. Because students "piggy backed" papers to the site, the cost of transporting papers was probably negligible. Overall, 700 pounds of paper per week, the mean during baseline conditions, was found to be cost-effective.

The goal of the recycling project was to have every student carry papers to school. During baseline conditions, 2 per cent of the students recycled approximately 700 pounds of paper per week. Even when participation rose to 30 per cent (Condition D), there was no appreciable increase in the quantity of paper collected. This may have been attributable to the definition of participation which required only that the child bring at least one sheet of paper.

The experimental interventions used in this study had less effects on short-term recycling rates than seen in other similar studies [4, 5]. In this study, four months passed before a quantity of paper was collected that Hamad *et al.* [5] took 3.5 weeks to collect (approximately 11,000 pounds at 95 pounds per capita) in which 80 per cent of the papers were delivered by motor vehicle to a private collection site.

In the previous recycling studies, contingency arrangements stressed the generation of large quantities of paper, whereas in this study, quantity of paper although encouraged was not an explicit objective. In an elementary school system, because it is unlikely young school children could easily transport large amounts of paper, paper recycling programs should be directed to increasing participation by students.

Currently the decision to use recycled solid waste to manufacture new products is based almost entirely on economic factors rather than on issues of conservation or environmental protection. Thus, behavioral researchers must provide cost/benefit estimates of their procedures. It is conceivable that recycling can be adapted to existing institutions and settings such as schools, shopping centers and churches. This would stand in contrast to recycling systems which function independently and demand an additional energy budget. Future research should focus on ways to locate and use already existing institutions for recycling programs.

REFERENCES

1. Environmental Protection Agency, Second report to Congress, *Resource and Recovery and Source Reduction*, (SW-122), Office of Solid Waste Management, 1974 (a).
2. K. A. Shuster, Fuel Conservation in Solid Waste Management, *Virginia Town and City*, December 1974.
3. Environmental Protection Agency, *Resource Recovery and Source Reduction*, (SW-117), Office of Solid Waste Management Programs, 1974 (b).
4. J. Witmer and E. S. Geller, Facilitating Paper Recycling: Effects of Prompts, Raffles, and Contests, *Journal of Applied Behavior Analysis*, 9, pp. 315-322, 1976.
5. C. D. Hamad, D. Cooper and G. Semb, Resource Recovery: The Use of a Group Contingency to Increase Paper Recycling in an Elementary School, *Journal of Applied Psychology*, 62, pp. 768-772, 1977.
6. D. H. Reid, P. D. Luyben, R. J. Rawers and J. S. Bailey, Newspaper Recycling Behavior: The Effects of Prompting and Proximity, *Environment & Behavior*, 3, pp. 471-482, 1976.
7. NARI, Recycling Resources: A Guide to Effective Solid Waste Utilization, *National Association of Recycling Industries Publication*, 1973.
8. R. G. Hunt and W. E. Franklin, Environmental Effects of Paper Recycling, Paper presented at the 73rd National Meeting of the American Institute of Chemical Engineers, Aug. 27-30, 1972, Minneapolis, Minnesota. Reprinted by the Midwest Research Institute, Kansas City, Missouri.

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