

Examining the Effects of Recycling Outreach on Recycling Behavior in Residence Halls at the University of California, Berkeley

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Abstract Recycling outreach (also called recycling education) is a method that recycling organizations use to promote recycling behavior. Little is currently known about whether recycling outreach methods are successful at achieving the goal of increased recycling participation. This study examined the effect of recycling outreach on the weight of mixed paper recycled in four residence halls at University of California, Berkeley. After collecting initial baseline measurement for three weeks, posters aimed at changing attitudes and perceptions about recycling were placed in two of the four residence halls, and measurements were collected for a period of three more weeks. The data from residence halls with posters was compared to the control residence halls without posters, and to the baseline data. No significant difference was detected between the amount of mixed paper recycled in residence halls with poster and residence halls without posters. These results indicate that the recycling education poster approach used in this study is ineffective at increasing recycling participation in a university residence hall setting.

Introduction

One of the main ways that society engages in environmentally conscious behavior is by recycling goods and materials after they have outlived their usefulness to consumers. In the 1980's, state, local, and federal governments across the US began recognizing recycling as a socially and economically desirable behavior. Government agencies and legislators have implemented policies that encourage recycling activities using voluntary and mandatory standards or monetary incentives (De Young 1990, Margai 1997). In some cases, governments have mandated recycling quotas for counties and municipalities. However, in practice, convincing people to recycle is a long and difficult process (Bauer 2001, pers. comm.). Therefore it benefits recycling managers and policy makers to determine what factors influence recycling behavior.

Many studies have identified factors that predict whether people recycle. These include: economic and cultural background, educational level, motivation, attitude, demography, ease of recycling, and concern for the environment (De Young 1990, Katzev *et al.* 1990, Oskamp *et al.* 1991, Goldenhar *et al.* 1993, Howenstine 1993, Chung *et al.* 1996, Berger 1997, Margai 1997, Vencatasawmy *et al.* 1999, Butler *et al.* 2000). However, although such studies outline the major determinants of recycling behavior, they give little indication about proven methods to change the behaviors themselves. Furthermore, many of these factors that influence recycling participation, like demography and socio-economic status, cannot be directly influenced by policy makers and recycling managers.

Of the factors identified in previous studies, the ones that recycling managers can reasonably expect to influence are: attitudes about recycling, motivation to recycle, and awareness of environmental issues (Goldenhar 1993, Shapek 1993, Skumatz *et al.* 2001). One of the main ways in which recycling managers attempt to affect these factors is through the use of recycling outreach (Bauer 2001, pers. comm., Skumatz *et al.* 2001). The California Department of Conservation, the Alameda County Waste Management Authority, and the University of California, Berkeley, all engage in recycling outreach as a method of increasing recycling participation.

The most comprehensive research regarding the effects of recycling outreach looked at the effects of 140 recycling and diversion outreach campaigns upon rates of recycling participation in cities and counties (Skumatz *et al.* 2001). This research assumed that any change in recycling

participation was due to a change in recycling behavior caused by the educational outreach approaches used. Skumatz and Green found that educational outreach methods including mailings, brochures, billboards, and newspaper ads, did increase recycling participation. However, the study did not use controls, relying instead upon baseline data for each municipality as a standard for comparison. It is possible that influences other than recycling outreach, such as changes in consumption patterns and market rates of recyclable materials, could have influenced recycling participation in the communities that were studied. Because the Skumatz and Green study was large in scope, it is not likely that the results are compromised by the absence of control data.

Furthermore, the findings of Skumatz and Green cannot be directly applied to university living situations because student housing differs from most cities and counties in demography, social and physical environments, and methods of recycling. Therefore, it is not correct to assume that students will be influenced by the same educational outreach methods which increased recycling participation in the Skumatz and Green study. For example, the student population in dormitories changes from year to year, which requires that recycling education campaigns in dorms be applied repeatedly and be informative to new residents. The same cannot be said of municipalities, whose populations are largely static. Unlike the methods used by Skumatz and Green, this experiment uses control and treatment study sites to control for variation in recycling participation due to factors other than the applied recycling outreach.

The objective of this research project was to determine the effects of a poster campaign aimed towards increasing recycling participation in a UC Berkeley Residence Hall. Based upon a general consensus in the recycling field that outreach education is effective at changing recycling behavior (Bauer 2001, pers. comm., Skumatz *et al.* 2001), my hypothesis was that the recycling outreach campaign would positively increase recycling participation. This hypothesis was made on the basis that the recycling outreach poster used in this study was modeled after other educational recycling outreach campaigns used by the California Department of Conservation, and the Alameda County Waste Management Authority.

Methods

Study Sites A set of four residence halls within the UC Berkeley's Unit I were chosen as the experimental sites. Cheney, Putnam, Deutch, and Freeborn Residence Halls, were nearly

identical in layout, demography, and completely identical in the recycling and trash services provided. Each building consisted of eight floors, each with about 30 residents per floor. Every building had separate trash and mixed paper recycling chutes that ran the entire height of the building, and emptied out into the basement. Then the materials were put into separate trash and recycling 96-gallon roll-away carts and placed outside the building for daily pickup. Both the trash and mixed paper recycling chutes were accessible on every floor of each hall. The doors to the chutes were located directly next to one another, and were identical in design. Each chute door was labeled with a plaque stating whether the chute was for recycling or trash. Additionally, above many of the recycling chute doors were signs indicating what could be recycled in those chutes.

Data Collection Mixed paper was collected and weighed approximately three times weekly during the duration of the study, from the middle of January 2002 to the end of March 2002. Measurement and collection of mixed paper occurred at the same time of day for each sampling. The dependent variable for this study was the daily average weight of mixed paper collected per sample date from each residence hall. Since it is conventional in waste management to measure quantities in terms of weight rather than mass or volume all data were recorded in pounds (Bauer 2001, pers. comm.). A data point consisted of the total weight of mixed paper recycled in each hall since the last collection date, divided by the number of days since. This was determined to be the best way to record a data point since it decreased the human error of measurement by reducing the number of measurements taken, and made the workload of emptying the chutes more manageable. Pre-treatment data was collected for four weeks prior to treatment application in mid February. Post-treatment data was collected for a period of four weeks following posting of the recycling outreach.

Treatment consisted of a recycling outreach poster designed to address perceptions and attitudes about mixed paper recycling and to provide information about mixed paper recycling services in the residence halls (Appendix 1). In Putnam and Freeborn halls, posters were placed directly above the door to the mixed paper recycling chutes on every floor. Deutch and Cheney, the control halls, were not subjected to any recycling outreach education other than 'what and where to recycle' signs that existed in all four buildings. Each residence hall was considered a separate replicate study site because the recycling output of each was independent of the others. Assuming that repetition is a significant factor in persuasive advertising techniques, it was

reasonable to assume that the populations of each hall were relatively independent from the others, even though students inter-visit between halls. Most likely, students that lived in the treatment halls saw the posters more often than students who lived in control halls.

Data Analysis After all measurements were collected, the data was analyzed using a BACI approach (Stewart-Oaten *et al.* 1986). A BACI ‘sample’ was calculated by taking the difference between treatment and control groups for each measurement date. Five sets of BACI samples were calculated; four between the two treatment and two control groups individually, and a fifth sample as the sum of the treatment groups minus the sum of the control groups. Once the BACI samples were calculated, a non-parametric Mann Whitney U-test (since the data were non-normal and non-transformable) was run on the five sets of BACI samples, comparing the pre-treatment and after post-treatment data for each set.

Results

There were 14 pre-treatment and 11 post-treatment BACI data points per sample set. The results of the Mann Whitney U-test are in Table 1. The high u-statistics indicate that there was not a statistically significant difference between the treatment and control sites.

Treatment - Control	Freeborn - Deutch	Freeborn - Cheney	Putnam - Cheney	Putnam - Deutch	(Freeborn + Putnam) - (Deutch + Cheney)
u- statistic	.979	.893	.979	.609	.809

Table 1. Results of Mann Whitney U-test for BACI Samples paired between individual treatment and control halls, and as the sums of treatment and control halls.

Figure 1 shows that the post-treatment mean daily weight of mixed paper recycling was greater than the pre-treatment mean for Deutch, Cheney, and Freeborn Halls, and less than the pre-treatment mean for Putnam. One reason for the smaller post-treatment mean in Putnam Hall was because Putnam Hall had a relatively high mean of recycled mixed paper during the pre-treatment data collection period. This high mean was a result of one outlying data point in Putnam Hall on the first measurement date. When the first day of data collection is omitted from the analysis (Figure 2) the difference between post and pre-treatment means for Putnam Hall more closely resembles those for the other residence halls, while the values for those halls remain similar to the values in Figure 1. The mean values for all residence halls during the post-treatment collection period were all slightly higher than the pre-treatment values.

It was reasonable to assume that the outlying values from the first day of data collection were not representative of normal recycling behavior due to the fact that the spring semester had just begun, and residents had just returned from winter break. At this time of year, disposal patterns are usually erratic or enhanced; during the rest of the semester disposal patterns tend to be more uniform (Bauer 2002, pers. comm., Kinnard 2002, pers. comm.).

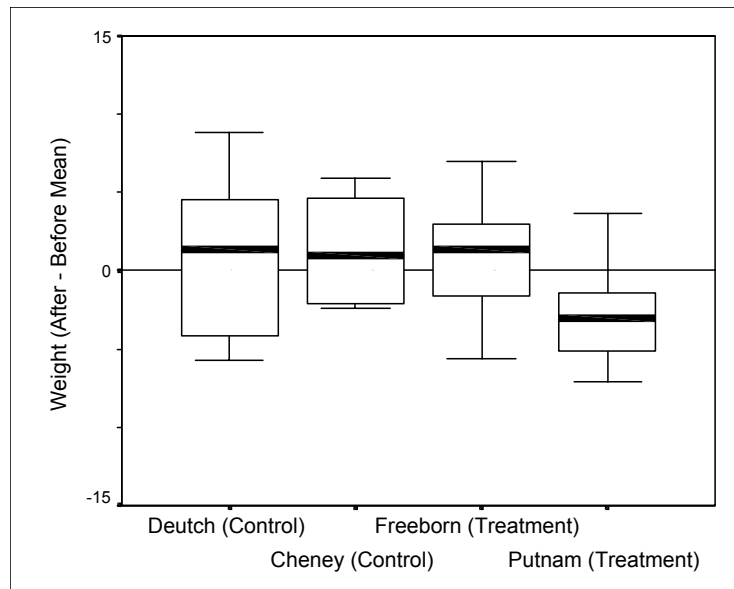


Figure 1. Difference between post-treatment and mean pre-treatment weights of mixed paper for each residence hall starting January 24, 2002.

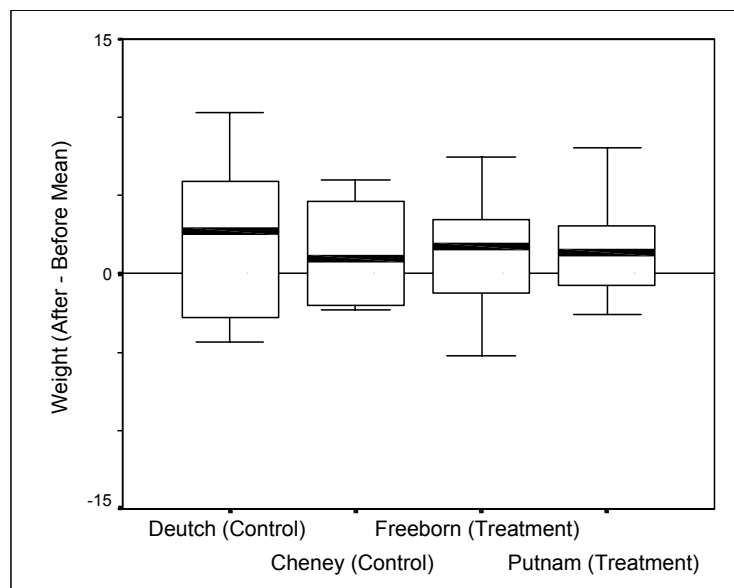


Figure 2. Difference between post-treatment and mean pre-treatment weights of mixed paper for each residence hall starting January 25, 2002.

Discussion

Table 1 and Figure 2 indicate that no change in recycling behavior resulted from the application of educational outreach posters to the residence halls. There is still a potential for increased recycling behavior at these sites, as mixed paper is still present in the garbage.

An interesting trend in the data was the increase in mean weight mixed paper collected across all the residence halls. This may reflect an increase in paper consumption and use during the course of the academic semester, and not a change in recycling behavior. That is, because the academic semester was well underway, students might have had more paper to dispose of than they did early in the semester. If the same residents continued to recycle in the same way then an increase of mixed paper recycled would have been observed. However, the proportion of mixed paper in the trash would have increased as well. If this were true, then a comparison of daily measurements of recycling and trash from each building would show that the proportion of recycled mixed paper to trash post-treatment did not increase relative to pre-treatment data. If the opposite were true, then a weight comparison of mixed paper recycling to trash would show that the proportion of post-treatment mixed paper to trash increased relative to the pre-treatment data, reflecting an increase in recycling participation. Causes for such an increase across both treatment and control sites may have been sources of recycling outreach external to the treatment sites, like Recycling Week at the University of California, Berkeley, or advertisements and campaigns from other recycling organizations.

Increasing the number of samples collected, lengthening the duration of study from two months to a full semester, and measuring trash in addition to mixed paper would help to identify the reasons for the overall increase in mixed paper recycled in this study. For example, even though standard errors were on the order of 1.5 lbs./day for means on the order of 15 lbs./day, the magnitude of uncertainty made it impossible to differentiate between the means (see Figures 1 and 2). Therefore, even if recycling behavior had increased slightly (about 2-3 lbs./day) in the treatment halls relative to the control halls, it would not have been possible to statistically prove the difference. Assuming a relatively constant flow of recycled mixed paper, an increase in the number of samples would decrease the size of the standard errors to the point where a difference between means could be statistically supported.

This study had some experimental design problems. The posters used in this study were designed with the understanding that recycling outreach was not present in the study sites in any form other than signs indicating where recycling bins are located, or flyers that new residents received at the beginning of the year. It was expected that this study's posters would stand alone, and not inhibit any other type of recycling outreach present in the Unit I study sites. However, when the posters were hung in the Freeborn and Putnam Halls, it was observed that other recycling outreach posters were already posted in the same spot in which the treatment posters were intended to be posted. Further observation found these same posters on most of the floors of the control buildings as well. Since it was not feasible or permissible to take these other posters down, the treatment posters were posted over the posters that were already present (permission to post the treatment posters above the chutes had already been obtained). The effect was neither aesthetic nor professional, and may have compromised the effects of the treatment posters.

Furthermore, the location of the posters above the recycling chute doors may have influenced their effectiveness. While the recycling and trash chute doors were close together, it is possible that residents only read or saw the posters when they using the recycling chute. If this is the case, then putting the posters up over the trash chute door may influence residents to recycle components of their trash that would otherwise have ended up in the trash chute. Indeed, posting in other locations throughout each residence hall may have made the posters more effective. More visible locations like doors and entrances may have increased the effects of repetition, while posting on bulletin boards may have put them in a more official and respected context.

There are likely to be difficulties when extrapolating the finding of this study to other living environments and other types of recycling outreach. As previously noted in this paper, student living situations differ from more homogeneous living situations in cities and larger communities in demography, layout, and the amount of outreach present. Relationships between recycling outreach and recycling participation determined in a student housing context might not hold in other situations. Furthermore, it should be noted that University of California Residence Halls are a venue for many different kinds of postering outreach. This over-saturation of poster information may have rendered the recycling outreach ineffective, however the same posters may have an effect in other types of living environments that are not desensitized to posters.

Additionally, while the posters used in this campaign were intended to be similar to the types of educational outreach used by prominent recycling organizations they were designed without the benefit of knowledge about advertising and persuasive media. In short, the posters may have been poorly designed. For example, color, content, orientation, and any number of other variables that professional designers are likely to be aware of may have been poorly used in this poster. Additionally, the poem was chosen as a means of influencing recycling perceptions by making recycling seem fun and a socially desirable activity. It may have been more effective to use information and images that conveyed a sense of urgency about environmental issues, illuminated the costs and benefits of recycling, and presented recycling as a much needed socially desirable behavior.

Lastly, other types of recycling outreach, like flyers in mailboxes, door to door outreach, or workshops, may have different effects upon the target populations in this study. In the recycling field, there is a generally recognized order for the perceived effectiveness of recycling outreach, with the least effective level being less personal (and less costly) approaches like posters and flyers and the more effective level being more personal and costly approaches like workshops and door to door communication (Bauer 2001, pers. comm.). It is possible that the residents living in the Unit I study sites may have already been recycling beyond a critical point of recycling behavior at which the poster-type recycling outreach used in this study was ineffective. Therefore, more personal and costly recycling outreach approaches like workshops may be necessary to increase recycling behavior in residence halls. An economic cost-benefit analysis could be done to determine the most cost effective means of increasing recycling behavior, and whether those means influence recycling behavior enough to merit their use.

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RECYCLE MIXED PAPER!

Recycle Mixed Paper 'cause recycling's cool
Recycle so Mr. T won't call you a foo'
Recycle junk mail and that program from Rent
Recycle those love letters, the ones you never sent
Recycle your newspaper, old homework and tests
Recycle 'cause then people think you're the best
When you're a RECYCLER, people think you're cute
So throw your mixed paper down the RECYCLIN' chute

 for more information about how
to recycle mixed paper, visit
<http://recycle.berkeley.edu/reshall.htm>



Appendix 1. The recycling outreach poster used in this study. Printed posters were 11'' x 17'', laminated, with blue and pink background, and dark blue text. The web site is to a section of the Campus Recycling and Refuse Service web-page that describes how to recycle mixed paper, and includes other information about recycling at the University of California, Berkeley. The logos belong to the sponsoring organizations.