

2012

Recycling Habits in Classrooms on the University of Redlands Campus

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Moore, M. (2012). *Recycling Habits in Classrooms on the University of Redlands Campus* (Undergraduate honors thesis, University of Redlands). Retrieved from http://inspire.redlands.edu/cas_honors/24

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Recycling habits in classrooms on the University of Redlands Campus:

Evaluating current recycling habits of students on the University
of Redlands campus and determining whether implementation
of new bins in classrooms will decrease contamination in
recycling bins

Senior Capstone Paper

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April 1, 2012

Background

In the *Ecology of Commerce*, Paul Hawken (2010) lays out the simple truth: almost every industry around the world takes, makes, and wastes. They run linearly. Companies overuse resources for production, waste extreme amounts of energy and water during production, and items are made to be thrown away once they have finished their lifecycle. This is not how industries should run. Industries should have a closed-loop system. The best example in the world of this type of system is nature. Everything in nature is recycled. Everything produced can become something else at the end of its lifecycle. This is how our industries should run.

However, this is a long-term solution to a short term problem. In the mean time, we need to focus on the solid waste. Currently, the United States of America produces too much waste. Unfortunately, a significant amount of waste sent to the landfill could have been recycled. Recycling is a great way to move towards a closed-loop system and reduce the amount of waste that sits in landfills. Recycling should be a priority in homes, complexes, offices, schools and universities across the world.

Previous research

In 2010, Emily Graf (Graf, 2010) studied recycling on the University of Redlands campus by conducted her senior capstone titled *Implementing a better waste diversion strategy at the University of Redlands*. Graf's objectives were to quantify the amount of contamination found in outside recycling bins around the University of Redlands campus, identify past and present problems the University has faced with their recycling program, and create suggestions for the University to better their recycling program. Graf determined that there was a wide range (6 to 88 percent) of contamination in recycling bins around campus. The variety of recycling bins

around campus was determined by Graf to be confusing for users. As a result, Graf suggested that the University choose one standard recycling bin and paint the plastic rollaway bins blue for uniformity.

In 2011, Katie Decker (Decker, 2011) furthered Graf's research by studying recycling programs on three different university campuses in her senior capstone titled *Evaluating essential components and costs in university recycling programs and implementing and improving recycling efforts at the University of Redlands: senior capstone 2011*. Decker's purpose was to research and compare the success of recycling programs at two private universities to that of the University of Redlands. She did this through obtaining information on recycling programs from each university, conducting surveys, and determining the costs and incomes of each recycling program. Decker discovered that the University of Redlands had two significant problems with their recycling program. One, there are not enough recycling bins on the University of Redlands campus, especially in high traffic areas. Two, recycling bins on the University of Redlands campus are not uniform.

Decker made two good observations about the University of Redlands recycling program. The second is related to what Graf determined in her study. The University needs to have uniform recycling bins around campus. Since Graf and Decker's experiments, the Facilities department at the University of Redlands has started to paint the plastic rollaway recycling bins blue to create unity across the campus. The long-term goal of the University is to replace all the outdoor recycling bins to a uniformed bin. Unfortunately, outdoor recycling bins are expensive (Sorenson, 2011).

Decker and Graf's research thoroughly examined the use of outdoor recycling bins. Therefore, there is a gap in the research completed on the University of Redlands campus regarding recycling. There was no study performed on the effects of implementing recycling bins in the classrooms and apartments around campus. My study will fill this gap in knowledge by evaluate recycling habits in classrooms and apartments. Classrooms and apartments are high traffic areas on a campus. The addition of recycling bins will divert recycling from the landfill. This will address the first problem with the University of Redlands' recycling program established in Decker's research (implementing more recycling bins around campus) because recycling bins will be added for the duration of my study.

Current University of Redlands recycling practices

In 2010, the University of Redlands created 3,553 pounds of aluminum, glass, and plastic; 454 cubic yards of paper; and 709.59 tons of compacted solid waste. The recycling around campus is sorted by University employees or student employees because diversion of items from the landfill can create revenue for the University. The University pays for city recycling and trash but if they sell the aluminum and plastic to Amegos recycling, the University can gather approximately \$100.00 per month. If the University can sell recyclable items instead of sending them to the city, they will do so. However, all items that can be recycled are sent to some sort of a recycling facility (Sorenson, 2011).

Although the University creates some profit from recyclable materials, the amount that is generated is approximately equivalent to the amount of money spent on salaries for employees to sort the recycling (Sorenson, 2011). Therefore, the University does not gather large sums of money from this system. It could be assumed that an increase in recycling bins

and student education would decrease the amount of time and money required for sorting trash and recycling on campus. This decrease in sorting could lead to an increase in revenue for this system.

Currently, the University of Redlands has recycling bins at the Brockton Apartments, on the first floor of residence halls, in the Hunsaker plaza, in the Armacost library, in the new Ann Peppers building, by Hall of Letters, by the Rose Garden, between Hentschke and Hornby halls, and by the Central Avenue Apartments (University of Redlands, 2008). The University does not have recycling bins in the classrooms.

Statement of research

I was interested in evaluating the amount of recycling that is placed in the garbage bins in the classrooms of the science buildings (Appleton and Lewis halls). I will determine how this would change with the addition of recycle bins in every classroom and the availability of recycling education for students.

Methods

Step 1: Discussion with facilities [Jenny Sorenson (Associate Director of Operations), Larry Teat (Custodial Services General Manager), and Jeff McClintock (Facilities Management Ground Supervisor) to determine my plan of action.

I talked with facilities to determine the feasibility of my project. I needed to determine if they would be willing to have temporary recycling bins in each classroom on campus (since this would create more work for them). For the purpose of my study, the recycling bins added to classrooms would be used to determine if students would change their behaviors with a recycling bin present.

After talking with facilities, I was able to learn that the trash from classrooms is collected between 10:30pm and 6am Monday through Friday. Before my study began, I added trash bags labeled with the building, room number, and bin type (trash or recycling) to each bin so that facilities did not have to keep the bags separate. The labeled bags were placed in the bottom of the trash or recycling bins so facilities could pull out a new bag after emptying the bin. For the duration of my study, the custodial team collected the trash and, at the end of my study, recycling bags from the classrooms of Appleton and Lewis halls. The bags were brought to a sorting location and placed in totes (raised bins that held the bags). Monday through Friday, I sorted the trash and recycling at the sorting location.

Step 2: Initial evaluation of classrooms (February 3rd to February 10th).

Facilities placed the trash bags in the totes in the early morning. The next weekday, I collected the bags from the totes and placed them on the sorting table. A bag at a time, I spread the contents on the table then took a picture. I recorded the building, room number, bin type, and picture number.

Building	Room #	Bin Type (Trash or Recycling)	Picture #

Step 3: Initial analysis of classrooms.

The pictures were loaded onto my computer and examined. The sorting day, building (Appleton or Lewis), room number, bin type (trash or recycling), item classification (trash, recycling, or contaminated recycling), description of the item (such as coffee cup, paper, plastic bottle, etc), the total number of items in the bin, the total number of trash, recycling, and

contaminated recycling in the bin, and the percentage of trash, recycling, and contaminated recycling in the bin (see table below).

Sorting Day	Building: Lewis (L), Appleton (A)	Room #	Bin Type: Trash (T), Recycling (R)	Item classification: Trash (T), Recycling (R), contaminated recycling (R,C)	Description of item	Total # of items	Total # of T items	Total # of R, C items	Total # of R items	% T in trash or recycling bin	% R,C in trash or recycling bin	% R in trash or recycling bin

Step 4: Adding recycling bin to classrooms (February 10th to February 23rd).

Blue recycling bins were added to the classrooms in Appleton and Lewis halls. A handout was taped to the side of the recycling bins which explained what can be placed in the bins (see attached "What is recyclable?" handout). On another side of the bin, a sign saying, "Temporary, Senior Project," was placed so that students did not expect the bins to be permanent.

Step 5: Secondary evaluation of classrooms.

Faculties placed the trash bags in the toters in the early morning. The next weekday, I collected the bags from the toters and placed them on the sorting table. A bag at a time, I spread the contents on the table then took a picture. I recorded the building, room number, bin type, and picture number.

Building	Room #	Bin Type (Trash or Recycling)	Picture #

Step 6: Secondary and final analysis of classrooms.

The pictures were loaded onto my computer and examined. The sorting day, building (Appleton or Lewis), room number, bin type (trash or recycling), item classification (trash,

recycling, or contaminated recycling), description of the item (such as coffee cup, paper, plastic bottle, etc), the total number of items in the bin, the total number of trash, recycling, and contaminated recycling in the bin, and the percentage of trash, recycling, and contaminated recycling in the bin (see table below).

Sorting Day	Building: Lewis (L), Appleton (A)	Room #	Bin Type: Trash (T), Recycling (R)	Item classification: Trash (T), Recycling (R), contaminated recycling (R,C)	Description of item	Total # of items	Total # of T items	Total # of R, C items	Total # of R items	% T in trash or recycling bin	% R,C in trash or recycling bin	% R in trash or recycling bin

The data was examined to determine how the addition of recycling bins in classrooms affected recycling habits of students. Based on this information, I determined whether or not recycling bins should be implementation in all the classrooms around campus.

Results

Overall, 2,854.5 items were sorted from February 3rd to February 24th. 1,382.0 of these items were trash, 1,148.5 recycling, and 324.0 contaminated recycling. Trash made up about 48% of the items sorted while recycling made up about 40%, (see Table 1).

Table 1: Percent of recycling in trash bins before the addition of recycling bins.

	Number of items	Percentage
Total	2,854.5	100.00%
Trash	1,382.0	48.41%
Recycling	1,148.5	40.23%
Contaminated recycling	324.0	11.35%

This table shows the total number of items sorted as well as the number and percentage of trash, recycling, and contaminated recycling items sorted.

The average percent of recycling in the trash bins before recycling bins were added to the classrooms was 32.13%. After the addition of recycling bins, the average percent of recycling in the trash bins was 28.91%, (see Table 2).

Table 2: Percent of recycling in trash bins before and after the addition of recycling bins.

		Before		After	
Building	Classroom number	Number of times sorted	Average % of R per classroom	Number of times sorted	Average % of R per classroom
A	102	2	100.00%	1	66.67%
A	116	6	25.20%	8	23.89%
A	117	1	42.86%	7	14.83%
A	201	6	31.82%	8	34.05%
A	202	4	15.57%	6	19.08%
A	215	5	24.76%	8	32.58%
A	216	6	32.69%	4	18.20%
A	217	5	25.85%	4	27.82%
A	233	6	26.16%	7	18.94%
L	103	6	11.74%	9	31.42%
L	104	5	22.25%	9	25.73%
L	111	2	26.67%	6	33.70%
Average		4.5	32.13%	6.4	28.91%

This table shows the average percent (by classroom) of recycling in the trash bin before and after recycling bins were added to classrooms. It also shows the number of times sorted which is the number of times facilities collected a bag from the trash bin and placed it in the totes. This table only includes classrooms which had trash collected before recycling bins were added, trash collected after recycling bins were added, and recycling collected. The last row of this table shows the average amount of recycling in trash bins before and after recycling bins were added.

The average percent of recycling in the trash bins before recycling bins were added to the classrooms was 16.21%. After the addition of recycling bins, the average percent of recycling in the trash bins was 16.27%, (see Table 3).

Table 3: Percent of contaminated recycling in trash bins before and after the addition of recycling bins.

Building	Classroom number	Before		After	
		Number of times sorted	Average % of R,C per classroom	Number of times sorted	Average % of R,C per classroom
A	102	2	0.00%	1	0.00%
A	116	6	24.90%	8	19.00%
A	117	1	28.57%	7	50.23%
A	201	6	12.19%	8	15.67%
A	202	4	18.28%	6	19.62%
A	215	5	20.35%	8	14.68%
A	216	6	12.94%	4	15.60%
A	217	5	8.34%	4	15.34%
A	233	6	9.82%	7	11.90%
L	103	6	13.79%	9	8.66%
L	104	5	23.73%	9	10.58%
L	111	2	21.67%	6	13.93%
Average		4.5	16.21%	6.4	16.27%

This table shows the average percent (by classroom) of contaminated recycling in the trash bin before and after recycling bins were added to classrooms. Contaminated recycling was classified as items that were situated with liquids or foods. It also shows the number of times sorted which is the number of times facilities collected a bag from the trash bin and placed it in the totes. This table only includes classrooms which had trash collected before recycling bins were added, trash collected after recycling bins were added, and recycling collected. The last row of this table shows the average amount of contaminated recycling in trash bins before and after recycling bins were added.

The average percent of recycling in the trash bins in Appleton hall before the addition of recycling bins was 36.10%. This percentage decreased to 28.45% after the addition of recycling bins. The average percent of recycling in the trash bins in Lewis hall before the addition of recycling bins was 20.22%. This percentage increased to 30.28% after the addition of recycling bins, (Table 4).

Table 4: Average percent of recycling in trash bins per hall before and after the addition of recycling bins.

	Before	After
Average % of recycling in Appleton	36.10%	28.45%

Average % of recycling in Lewis	20.22%	30.28%
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This table shows the average percent of recycling in the trash bins in Appleton and Lewis halls before and after the addition of recycling bins.

The average percent of contaminated recycling in the trash bins in Appleton hall before the addition of recycling bins was 15.04%. This percentage increased to 18.04% after the addition of recycling bins. The average percent of contaminated recycling in the trash bins in Lewis hall before the addition of recycling bins was 19.73%. This percentage decreased to 11.06% after the addition of recycling bins, (Table 5).

Table 5: Average percent of contaminated recycling in trash bins per hall before and after the addition of recycling bins.

	Before	After
Average % of contaminated recycling in Appleton	15.04%	18.01%
Average % of contaminated recycling in Lewis	19.73%	11.06%

This table shows the average percent of contaminated recycling in the trash bins in Appleton and Lewis halls before and after the addition of recycling bins.

The average percentage of recycling in the recycling bins was 65.55% while the average percentage of contaminated recycling was 4.26%. Appleton hall had a higher average percentage of recycling and contaminated recycling than Lewis hall, (Table 6).

Table 6: Average percent of recycling and contaminated recycling in Appleton and Lewis recycling bins.

	Appleton & Lewis	Appleton	Lewis
Average % of recycling	65.55%	66.19%	63.66%

Average % of contaminated recycling	4.26%	4.49%	3.58%
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This table shows the average percent of recycling and contaminated recycling in the recycling bins in Appleton and Lewis halls together and separately.

Discussion

The percentage of recycling in the trash bins in five classrooms in Appleton (102, 116, 117, 216, and 233) decreased with the addition of recycling bins, while three classrooms in Appleton (201, 202, and 215) increased. The three classrooms in Lewis (103, 104, and 111) saw an increase in percentage of recyclable materials in the trash bins.

Six classrooms in Appleton (117, 201, 202, 216, 217, and 233) saw an increase in average percentage of contaminated recycling in the trash bins. An increase in this percentage is a positive outcome because contaminated recyclable items need to be placed in the trash. If contaminated recyclable items are placed in the recycling, then most of the recyclable items in that bin cannot be recycled. This increase could be a result of the handouts on the side of the recycling bins. The three Lewis classrooms as well as the remaining two Appleton classrooms (116 and 215) saw a decreased in the average percentage of contaminated recycling in trash bins.

Overall, recycling bins in Appleton and Lewis halls were full of 65.55% of recyclable items. Appleton hall had a slightly higher average percent of recyclable items in the recycling bins. Only 4.26% of the items in the recycling bins were contaminated. Again, Appleton hall had a slightly higher average percent of contaminated recyclable items in the recycling bins.

When talking with facilities, contamination was a big issue. If one contaminated item is placed in the recycling bin, it can contaminate the whole bin of recyclable items. However, the average percent of contaminated items in the recycling was much less than expected.

On the whole, Appleton hall showed a decrease in the average percentage of recycling in trash bins and an increase in average percentage of contaminated recycling in the trash. These outcomes are both positive. Ideally, the percentage of recycling in the trash bin would decrease due to the addition of recycling bins and the percentage of contaminated recycling would increase due to the information provided by the recycling handout on the side of the recycling bin. However, Appleton hall had an overall higher average of contamination of recyclable items in the recycling bin when compared to Lewis hall.

On the other hand, Lewis hall showed an increase in the average percentage of recycling in trash bins and a decrease in average percentage of contaminated recycling in the trash. These outcomes are both negative. It seems that Lewis hall was negatively affected by the addition of recycling bins to the classrooms.

Unfortunately, my data was inconclusive. The addition of recycling bins in Lewis and Appleton Halls did not result in a decrease of contamination in the trash bins in the classrooms of these halls. I believe that more recycling education is needed on our campus before the addition of recycling bins is beneficial.

Future research on this topic could include a similar experiment with the addition of recycling education. Also, it would be interesting to examine how the addition of recycling bins would affect the dormitories or Brockton Apartments. Recycling bins could be added to these rooms and students would be charged if they were lost (like the trash bins in the rooms).

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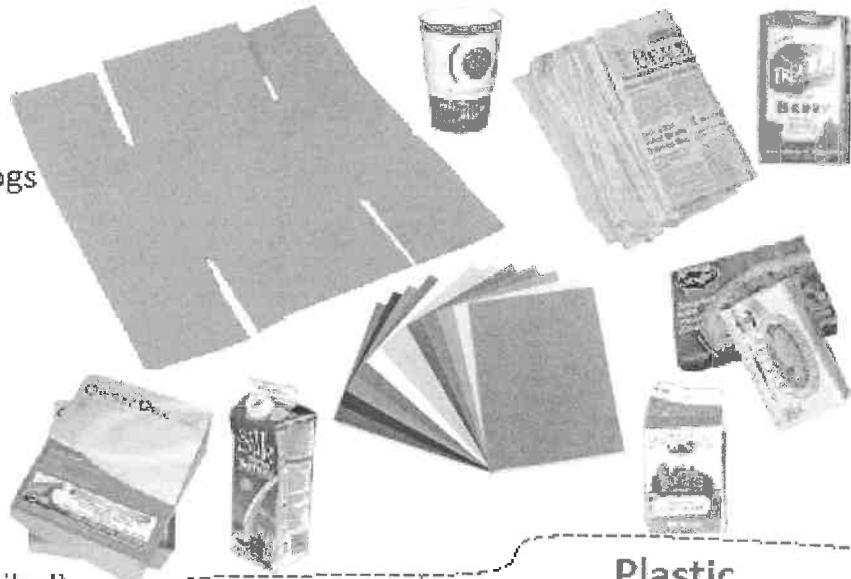
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WHAT IS RECYCLABLE?

Paper

- Printer Paper
- Cardboard
- Brochures/Catalogs
- Envelopes/Mail
- Magazines
- Newspaper
- Paper Tubes
- Wrapping Paper
- Cereal Boxes
- Phone Books
- Grocery Bags
- Pizza Boxes (unsoiled)



Plastic

- Commons to go containers
- Laundry Bottles
- Plastic Milk/Water Jugs
- Soda & Water Bottles



Metal

- Aluminum, Tin, & Steel Cans
- Aluminum foil (clean)



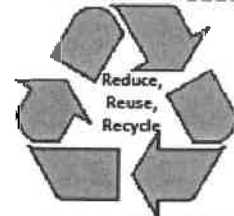
Glass

- Bottles & Jars



Please rinse out all bottles, cans, jars, and containers before placing them in your recycling bin.

For more information on what can be recycled in Redlands, CA, please visit the City of Redlands, Solid Waste and Recycling website at RedlandsRecycles.org



Special thank you to President Jim Appleton for funding these recycling bins.

No Food or Liquid in Recycling Bin