Team 6

CIS 362

Empirical Methods in Computer Science

Project 1 Phase 3

March 20, 2020

Recycling Cultures and Practices

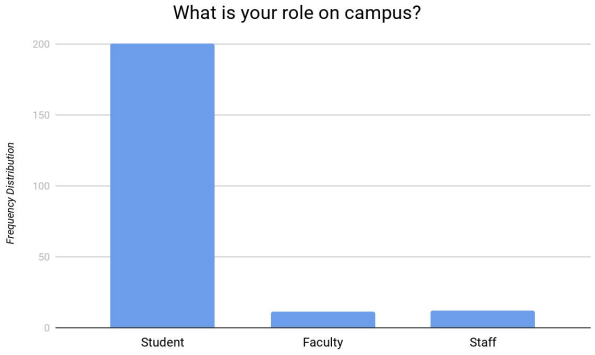
Introduction

In late February and early march, the UMass Dartmouth campus was supplied with a recycling survey created by our group. It boasted 17 questions, 6 demographic questions and 11 recycling related questions, the goal of which was to uncover underlying recycling habits of faculty, staff and students at UMass Dartmouth. Our survey went through 3 versions before finalization and distribution. The first round of edits were heavily influenced by a focus group, all members of which gave us invaluable feedback and helped us improve survey version one greatly. Version 2 was distributed to a small control group to participate in. We collected and processed the data and again consulted a focus group. After much feedback from the participants, the focus group, and inner group consensus, we fine-tuned the final version of the survey and began mass distribution and data collection.

Similarly, the University of Rochester River, conducted a similar campus wide survey(Akadrie). While the questions of said survey range. The results are not unlike our own. In the questions that have similarities, both campuses generally agree the following: recycling can be more convenient on campus, people can generally be more educated on what to recycle and what not to recycle, and if said people know something can be recycled, they will recycle it if it does not require additional effort. This and many more similarities can be deduced from these sister surveys, suggesting that there is a possibility that college campuses in general feel the same way. Although it would clearly take more research to make such a statement.

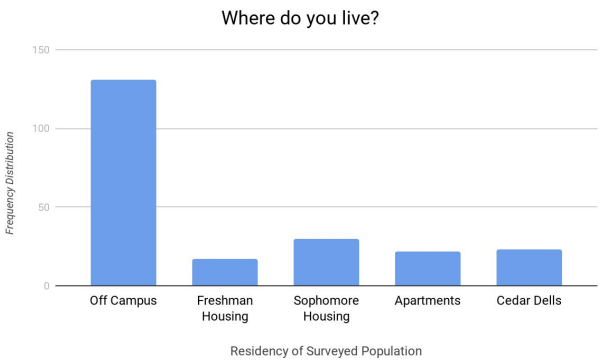
Results

1. What is your role on campus?



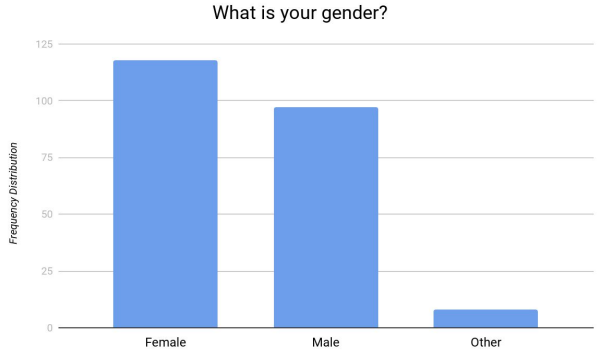
Mean- 1.16
Median - 1.0
Standard Deviation - .49
Variance - 0.24
Range - 2
Skewness - 3.11
Quartiles - Q1= 1 Q2= 1 Q3= 1
Outliers - Faculty
Z score - 3.75

2. Where do you live?



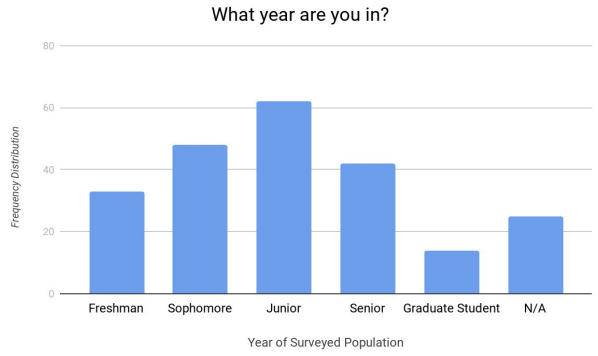
Mean- 2.054
Median - 1.0
Standard Deviation - 1.43
Variance - 2.05
Range - 4
Skewness - 0.963104
Quartiles - Q1= 1 Q2= 1 Q3= 3

3. What is your gender?



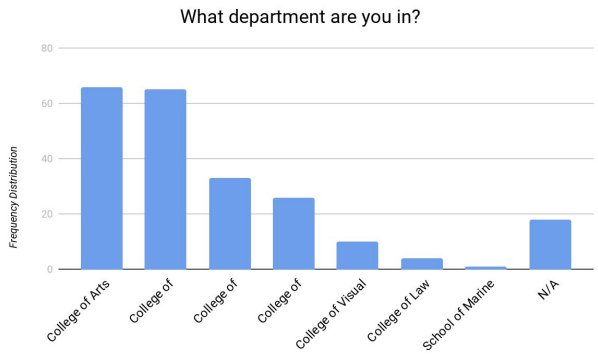
Mean-1.51
Median - 1.0
Standard Deviation - 0.5
Variance - 0.323153
Range - 2
Skewness - 0.57
Quartiles - Q1= 1 Q2= 1 Q3= 2

4. What year are you in?



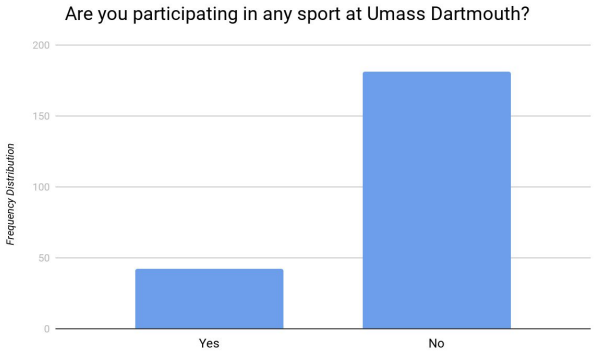
Mean- 3.17
Median - 3.0
Standard Deviation - 1.50
Variance - 2.27
Range - 5
Skewness - 0.41
Quartiles - Q1= 2 Q2= 3 Q3= 4

5. What department are you in?



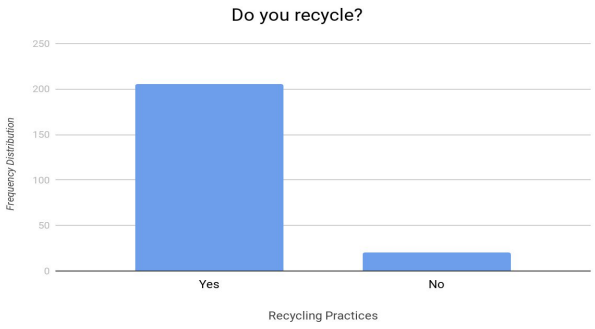
Mean- 2.84
Median - 2.0
Standard Deviation - 1.99
Variance - 3.96
Range - 7
Skewness - 1.37
Quartiles - Q1= 1 Q2= 2 Q3= 4

6. Are you participating in any sport at Umass Dartmouth?



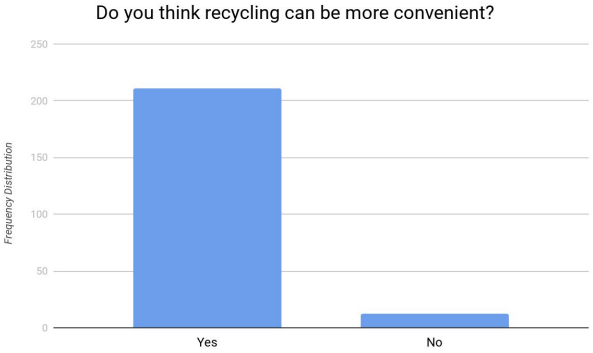
Mean- 1.79
Median - 2.0
Standard Deviation - 0.40
Variance - 0.161799
Range - 1
Skewness - -1.496139
Quartiles - Q1= 2 Q2= 2 Q3= 2

7. Do you recycle?



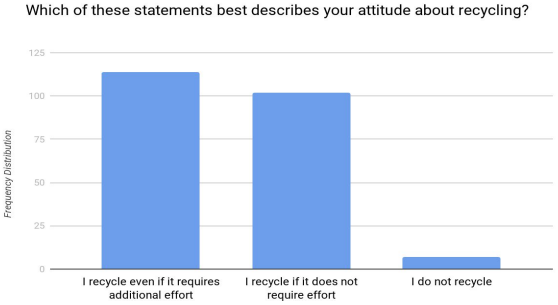
Mean- 1.09
Median - 1.0
Standard Deviation - 0.28
Variance - 0.08
Range - 1
Skewness - 2.99
Quartiles - Q1= 1 Q2= 1 Q3= 1
Outliers - 2
Z score - 3.27

8. Do you think recycling can be more convenient?



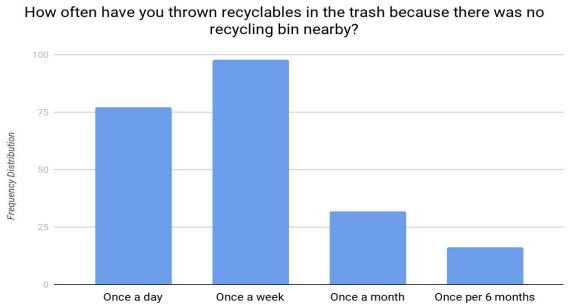
Mean- 1.06
Median - 1.0
Standard Deviation - 0.24
Variance - 0.06
Range - 1
Skewness - 3.63
Quartiles - Q1= 1 Q2= 1 Q3= 1
Outliers - 2
Z score- 3.8550781006453887

9. Which of these statements best describes your attitude about recycling?



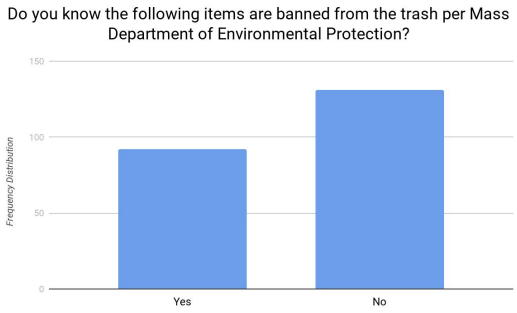
Mean- 1.51
Median - 1.0
Standard Deviation - 0.55
Variance - 0.31
Range - 2
Skewness - 0.44
Quartiles - Q1= 1 Q2= 1 Q3= 2

10. How often have you thrown recyclables in the trash because there was no recycling bin nearby?



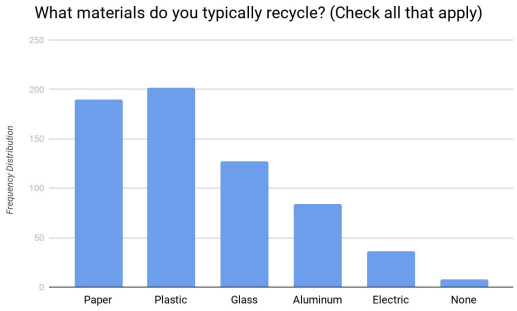
Mean- 1.92
Median - 2.0
Standard Deviation - 0.88
Variance - 0.77
Range - 3
Skewness - 0.81
Quartiles - Q1= 1 Q2= 2 Q3= 2

11. Do you know the following items are **banned** from the trash per Mass Department of Environmental Protection?
-Paper Cardboard
-Yard Waste
-Plastic containers
-Glass containers
-Aluminum and Metal containers



Mean- 1.58
Median - 2.0
Standard Deviation - 0.49
Variance - 0.24
Range - 1
Skewness - -0.34
Quartiles - Q1= 1 Q2= 2 Q3= 2

12. What materials do you typically recycle? (Check all that apply)

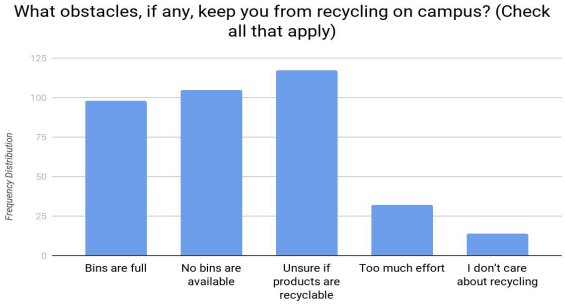


Statistical measures not applicable

13. How do you dispose of plastic grocery bags?

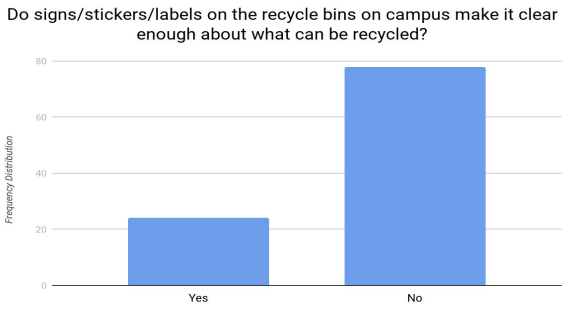
Mean- 3.19
Median - 4.0
Standard Deviation - 1.07
Variance - 1.14
Range - 3
Skewness - -0.98
Quartiles - Q1= 2.5 Q2= 4 Q3= 4

14. What obstacles, if any, keep you from recycling on campus? (Check all that apply)



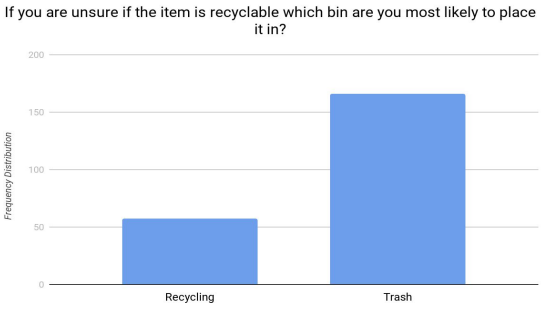
Statistical measures not applicable

15. Do signs/stickers/labels on the recycle bins on campus make it clear enough about what can be recycled?



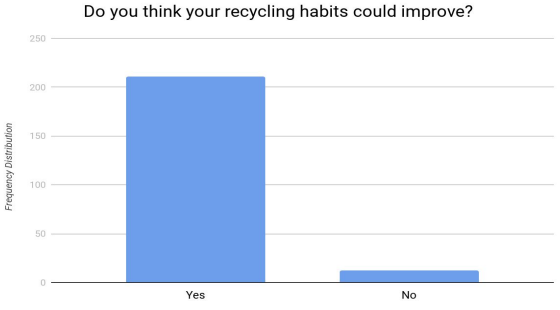
Mean- 1.34
Median - 1.0
Standard Deviation - 0.48
Variance - 0.23
Range - 1
Skewness - 0.68
Quartiles - Q1= 1 Q2= 1 Q3= 2

16. If you are unsure if the item is recyclable which bin are you most likely to place it in?



Mean- 1.76
Median - 2.0
Standard Deviation - 0.43
Variance - 0.18
Range - 1
Skewness - -1.24
Quartiles - Q1= 2 Q2= 2 Q3= 2

17. Do you think your recycling habits could improve?



Mean- 1.08
Median - 1.0
Standard Deviation - 0.27
Variance - 0.07
Range - 1
Skewness - 3.22
Quartiles - Q1= 1 Q2= 1 Q3= 1
Outliers - 2
Z score - 3.473

Interpretations

1. Based on the mean and the frequency distribution it is clear that the majority of surveys were completed by students with a very small minority of surveys completed by faculty or staff.

2. Based on the mean and the frequency distribution commuters were the largest individual group to respond to the survey. The range shows that surveys were completed by participants in each residence hall and the total number of residents surveyed was not far below the number of commuters.

3. The mean and standard deviation display that the number of males to females surveyed was fairly close.

4. The range shows that there were survey participants for each year of student. With the exception of N/A the frequency distribution takes on a normal distribution. This is evident by the value of 3.17 for the mean.

5. The mean and median are both far to the left of the frequency distribution. This shows that the majority of the surveys were completed by only two colleges, engineering and arts and science. The bias of surveys from engineering students could be caused by students in the CIS major feeling obligated to complete the survey.

6. The mean and quartiles clearly show that only a small percent of survey responses came from athletes. This is to be expected as the percent of students that are athletes is also small.

7. The low mean, median, and standard deviation show that participants heavily favored the choice that they do recycle. This is also evident by the fact that the only other option is an outlier. This could be due to the wording of the question, as a very large portion of the population recycles to some degree and participants may have answered yes even if that degree was tiny.

8. Question 8 has almost identical results to question 7. Again the heavy favor in the choice that recycling can be more convenient could be due to a poor question wording. Participants may have looked at the option in the sense that almost anything can be improved and made more convenient, especially something such as recycling which takes some amount of effort.

9. The mean and quartiles show that the first two options were heavily favored for this question. This was expected as it seems that very few people choose not to recycle at all but the option was left in for completeness. There is almost an even split in the number of participants who will recycle if it takes no extra effort and those who will put in extra effort.

10. The mean and median show that option two was favored by participants. Option one also had a lot of responses which doesn't match well with the amount of participants that stated they will put in extra effort to recycle. It appears that a much smaller percent of participants go more than a week without throwing recyclables away due to not wanting to hold on to them.

11. The mean shows that more participants choose option two than option one but not to the degree that was seen in some previous questions. The amount of participants aware of the ban on certain trash was much higher than expected which could show that recycling information is more widely known than anticipated.

13. The mean, median, and quartiles show that option four was heavily favored by participants. This was expected as it seems common place for people to reuse plastic shopping bags. It also seems that an even amount of participants place them in the trash as the recycling bin. This could be caused by a confusion over whether the bags are recyclable.

15. The mean shows that the majority of participants feel that recycling signage is adequate on campus. Based on this data there is a 87% confidence that the mean for the question would fall between 1.29 and 1.39 for the target population. This shows that the signs and labels on campus are not a large contributor to the issues with recycling on campus.

16. The mean, median, and quartiles show that option two was heavily favored by participants. Based on the data there is a 97% confidence that the mean will fall between 1.70 and 1.82 for the target population. The small range for such a high confidence interval also shows how favored option two was by participants. This could be causing people to throw away recyclables if they are unsure if they are recyclable. Only a small percent choose option one so it is unlikely that this is the primary cause of the amount of trash in recycle bins.

17. The quartiles clearly display that most participants chose option one. As visible in the frequency distribution very few participants chose option two. This is also made clear in the small value for standard deviation. This could be due to the way the question is worded as most people could feel that they could always improve.

Hypothesis

Before distributing our surveys we hypothesized Umass Dartmouth students are typically under-educated in regards to proper recycling practices and availability. In addition we hypothesized nearly every student is aware of their poor recycling practices. This stems from either being unaware of how to improve, or they are too lazy to change their habits.

With regards to our first hypothesis, we find from question 11, the number of students aware of banned materials is much higher than anticipated. In addition, we find again from question 15, many students feel the recycling signage is more than appropriate. Yet when looking at question 16 most students answer “if unsure they will throw away their recyclables”.

When we consider the second hypothesis, we find from question 17, well over 90% of students believe they can recycle better. And when considering the answers from question 10 we find the data skewed towards many students are often throwing away possible recyclables on a weekly or even daily basis. These data points indicate students believe they are more educated than we at first expected. However it is unclear if this is accurate as it seems students know less than they think they do.

Analysis

When analyzing our surveys and the data we recorded from them; as per instructions we created visualizations for each question which includes bar charts and/or box plots. In addition as per instructions we have included the raw data and calculations for each question including the following: mean, median, standard deviation, variance, range, skewness, correlation, quartiles, and outliers. As seen above we have placed the data directly next to the visualization for each question. This is quite important as it provides the reader with clear proof of the conclusive evidence we draw directly after each survey point.

While the survey was taken to gather important data and draw conclusions regarding our hypothesis, it is clear we can glean more knowledge than expected at first glance. For example, we can see that the number of commuter students is roughly equal to the number of students living on campus. We can also gather some conclusions about athletes on campus. That is, very few students are actually participating in sports at umass. Most importantly however, we find conclusive evidence for one of our hypotheses, that is to say Umass Dartmouth students are not recycling nearly as much as they should and they are aware this is true.

Conclusive evidence can be found for this as mentioned above in multiple responses, primarily Questions 11-17. It is important to have a hypothesis preceding our survey so our survey could be optimally created. With this being our guide we can then structure the data like a book and read the data for its evidence. Still we must consider the validity of our evidence and we have done this through calculation of confidence intervals. Since all of our z scores are above 3, we can safely assume we have a very high confidence interval and our data is a relatively accurate overview of the students at Umass Dartmouth.

Conclusion

In retrospect it is important to see many of the surveyed students are in the college of engineering. While this may potentially bias our results, there seem to be an overall well sampled group of students. As noted before there are very few faculty members which have been surveyed and therefore we cannot draw any conclusions in regards to faculty. Several of the questions on the survey also lend suspicion towards poor wording. Particularly question 17 “Do you think your recycling habits could improve?” to which nearly everyone answered yes. As mentioned previously, it is very plausible that almost anyone would agree they can always improve. For this reason our conclusions may be biased towards students needing more education on proper recycling.

Notwithstanding this fact, it seems we can safely assume there are a large number of students who remain unaware of what can or cannot be recycled. In parallel with the aforementioned, we also see many students find recycling to be inconvenient. These two factors should lead to potential changes in ease of access, and information more conveniently placed. This would reduce the number of people in the two largest groups of students which are not recycling. That is, those who are unaware of what to recycle and those who are too lazy to recycle.

References

Akadrie. “Results of the 2015 University of Rochester River Campus Recycling Survey.” The Green Dandelion, 27 Aug. 2015, blogs.rochester.edu/thegreendandelion/2015/08/results-of-the-2015-university-of-rochester-river-campus-recycling-survey/.