

# Dalhousie University Students Recycling and Composting Habits, Knowledge, and Barriers Study

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## Executive Summary

In this study the habits and opinions of Dalhousie Students on the topic of recycling and composting will be shown. Dalhousie University is located in Halifax Nova Scotia with a student population of roughly 16 500 students in over 180 degree programs. Green and sustainable issues are often advocated for at Dalhousie through the Environmental Science Program and the College of Sustainability, as well as various student organizations such as the Dalhousie Student Union Sustainability Office, Environmental Programs Student Society and Your Environment Sustainability and Society Student Society. Our research aimed to assess the differences in recycling habits and understanding amongst Dalhousie students between different faculties, year of study, on-campus versus off-campus living, confidence level and perceived importance of recycling. Using a ten-question survey in addition to a waste sorting quiz, we received feedback on the habits of students and what they believed was their biggest barrier to effective waste disposal. We analyzed the scores of the waste sorting quizzes versus the answers to the survey questions. In this analysis, we did not find any significant results between the students' demographics and the results of the waste sorting quiz. However, we did receive valuable insight into the barriers which prevent students from appropriately disposing of waste. Throughout this report, we will provide recommendations and insight into how the current recycling system at Dalhousie, as well as the greater Halifax community, can be improved.

## Introduction

There has been some improvement of waste diversion programs in Canada since the 1990's, though further improvement is required. In 2002, Canadians disposed and diverted 30.7 million tonnes of waste, and by 2012 that figure increased to 33.5 million tonnes. In that same period of time, the amount of solid waste diverted from landfills increased from 21.6% to 25.2% (ECCC, 2016). The percentage of waste diversion can be increased by better understanding of the factors that influence an individual's recycling and composting behaviours. Tonglet et al. (2004) suggest that recycling behaviours can be influenced by previous experiences, having ample opportunities to partake in the activity, knowledge of proper techniques and having enough motivation so as to not be deterred by barriers such as time, space or feelings of inconvenience.

Previous research suggests that the number of waste receptacles and their proximity to an individual significantly improves sorting compliance (Duffy and Verges, 2009). In their study, Duffy and Verges (2009) went one step further to look at the effect specialized lids had on public recycling behaviour. Their results found that using a unique lid for garbage, recyclables and compost increased recycling compliance by 34%, while significantly reducing how often waste was sorted incorrectly. Other researchers have found that recycling behaviour may be affected

not only by bin proximity, but by proper prompting strategies as well. Miller et al. (2016) studied university recycling rates between time periods when there were adequate recycling bins with prompts and when there were only trash bins within classrooms. There was a slight reduction of recycled materials being incorrectly placed in garbage bins when there were recycling bins with signs inside the classroom. More significant results were seen in the O'Connor et al. (2010) study with similar methods. The amount of plastics recycled increased in buildings where there was a greater number of recycling bins with information on which materials should be placed in them compared to when there were only garbage bins present.

In terms of waste materials diverted in each province on a per capita basis, Nova Scotia is fourth on the list. In 2014, Nova Scotians disposed of 386 kg of waste per capita, for a total of 364 193 tonnes sent to landfills that year (Statistics Canada, 2016). The province diverted 296 kg per capita for a total of 279, 031 tonnes in 2014 (Statistics Canada, 2017). A 2008 study for Divert Nova Scotia (formerly known as Resource Recovery Fund Board) reported in its *Key Findings and Recommendations* section that the majority of Nova Scotians engage in recycling and composting: 91% always recycle, 63% always return recyclable containers and 76% always compost (Bristol Omnifacts Research, 2008). However, the research also showed places where improvements in education and support would be most beneficial in the Halifax Regional Municipality (HRM), amongst Nova Scotians aged 18-34 (Bristol Omnifacts Research, 2008). We believe that researching waste-sorting habits in the university campus environment is extremely important due to the number of institutions in the province of Nova Scotia and the rest of Canada, as well as their relative size. Institutions of higher learning must embody the ideal of critical thinking that students are encouraged to engage in, which means looking closely at the institution as well as actions taken by its members. We are aware that waste diversion and proper sorting is a secondary action to simply consuming less but maintain that since consumption rates show no sign of slowing down, it is imperative that we determine why students do or do not properly sort their waste. The hedonic treadmill in which we take part goes as such: purchasing items, feeling good about purchasing items, and then repeating these actions, as the rush is fleeting but easily re-creatable. Consumerism is built into the lives of virtually every human, by way of capitalism and its cyclic nature of production. What is easily forgotten by the average consumer is the amount of waste that is incurred from all the products.

Dalhousie University separates its solid waste into four sections: recyclables, paper products, compost and garbage. The university currently uses unique lid types on most of its bins, with a few open garbage containers placed intermittently around campus and in residences. Dalhousie University also places signs describing what materials can go in compost, recyclables and in the trash in all residence buildings and above most waste receptacles. The school is attempting to improve student recycling attitudes and behaviours on campus by increasing prompts and knowledge. As stated in Dalhousie's Solid Waste Management Plan (DUOS, 2015), approximately 60% of campus waste is diverted from the landfill. The future goal is to reach a

70% school wide diversion rate by 2020. It is important for Dalhousie University campuses to collect data on which waste diversion and education programs work and which ones do not in order to improve student diversion behaviours in order to achieve that future goal. To achieve this goal, the school would benefit from continued environmental education.

This study aims to determine what level of recycling literacy do different demographics of Dalhousie students possess regarding waste products, according to Halifax Regional Municipality guidelines, and what factors influence their behaviours. Our study does not simply focus on student recycling and composting behaviour on campus. We also aim to focus on how well students recycle in their own home. Do Dalhousie University students have a greater understanding of the HRM recycling guidelines while living off-campus? Do they have a higher recycling compliance as they are always in close proximity to waste receptacles or do they fail because of a lack of prompts or signage? Previous studies on household curbside collection suggest that demographics and previous environmental education can affect recycling behaviour (Swami et al., 2010). All of this previous research leads us to predict the following: students living off-campus will score higher on the quiz and confidence level than students living in residence, students in residence will score higher on how often they recycle and compost because they have more opportunities, and students in sustainability or environmental majors will score higher on confidence level, how often they recycle and compost, and on the waste sorting quiz than respondents in other majors.

## Methods

The sampling was conducted through a pencil and paper in person survey, at three specific locations on Dalhousie's Studley Campus over a period of two weeks. The sites for sampling were selected specifically for their neutrality and universal student use, so as not to prioritize one student group over another. Sampling was conducted on weekdays during school hours to ensure high student presence. The survey was one page long, double sided, with questions determining demographics, recycling habits, attitudes and barriers on the first side. A quiz out of 16 marks that tested sorting knowledge was on the second side.

The pencil and paper survey was the preferred metric for measuring students recycling and composting habits as it provided the best way of ensuring participants were relevant to the survey. This also allowed us to create a quiz portion which would not have been possible in a browser based survey on the budget available to us. The research topic is also not sufficiently nuanced to require a more in depth understanding available from an interview or focus group. Hence the paper and pen survey was deemed the best sampling method as it was well suited to attract respondents and gather responses most appropriate for our research topic.

## Procedures

### Sampling

We conducted a one page, double sided, pencil and paper style survey at three locations on Dalhousie University's Studley Campus: The Killam Library, Wallace McCain Learning Commons, and the Student Union Building. Our research team positioned themselves within view of foot traffic in the area and asked passing students if they'd like to partake. Candy for a range of dietary preferences was used as an incentive. If a passerby indicated willingness to participate the research team then verified they were students and that they had the time to reduce rushed answers which may be incorrect. In total, 144 students were surveyed. Three surveys were found to be incomplete, giving the survey a response rate of 98%.

### Survey

The purpose of the survey was to ascertain 1) students' attitudes towards recycling; 2) determine any differences between composting and recycling habits; 3) ascertain how well students understood Halifax Regional Municipality's recycling guide and lastly; 4) to understand if any of these responses were influenced by faculty or living situation (i.e. on-campus versus off-campus)

The first series of questions (1-3) determine the participants' demographics. The second series of questions (4-5) determine a baseline of student's commitment to sorting waste, experience/ability. The third series of questions (6-7) ascertain respondents' habits and waste diversion skills. The last three questions are designed to understand possible barriers to proper recycling and composting. By asking how complicated participants find HRM's system and rating their exposure to the *What Goes Where Guide*, we seek to ascertain their recycling literacy. The last question is open ended and asks respondents which barriers there are to properly recycle. This question is open ended to ensure we do not miss any causes for waste that the research team could not foresee. We then follow up the survey with a quiz on the back of the survey to check participants' skills and knowledge in regard to composting and recycling.

### The Quiz

The quiz served a double function of engaging the respondent and rating the respondent's recycling ability. The quiz provides a series of items and asks the respondent to draw a line to the appropriate disposal bin. The quiz is scored based on how many items participants sort correctly. Different levels of scoring indicate recycling skills, with the theory being that students who *do* sort their waste appropriately will score higher than those that do not, as they will be familiar with the correct HRM recycling guidelines. Those that do not score well, we assume, are not aware of HRM recycling guide. This will serve as a check to ensure that our research will correct

results so that where students may overrate their sorting ability (due to unawareness, different definitions of ‘good’ or exaggeration) or underrate themselves, the research is accurate.

## Reliability

This study has the potential to produce false findings in a few circumstances. The results rely on the validity of the quiz results to rate student’s recycling ability. Incorrect answers assume insufficient knowledge or recycling habits. Incorrect answers, however, could be attributed to design flaws in the quiz. For example, items to be recycled have coloured rings around them which match the disposal units. This may have led respondents to answer incorrectly due to subconscious colour sorting. Students who were rushing may have misread the quiz, leading to false negatives in the quiz results.

Despite the fact the quiz was created directly from the HRM *What Goes Where Guide*, to avoid ambiguity, some students still expressed confusion. The item ‘Oily Paper Towel’ is mentioned as a compostable item in the *What Goes Where Guide* however, students asked the kind of oil (for example bitumen oil which would be hazardous waste). Due to this ambiguity, some students with strong knowledge of the *What Goes Where Guide* may have obtained a false negative on the quiz. However, most questions asked by students indicating ambiguity with the quiz demonstrated lack of knowledge with HRM’s sorting system. For example, many asked which kind of milk carton the quiz was asking, paper or plastic, when both go into a blue recycling bag. Therefore, overall the ambiguity mentioned by respondents was not significant enough to majorly impact the results of the survey.

## Validity

Responses to the survey and quiz were not equally distributed among faculties. Therefore, some averages were calculated over a larger range of faculty responses than others, possibly making some answers more valid than others.

## Limitations and Delimitations

Due to time constraints and limited resources we were unable to survey more than 144 students and we were unable to conduct the survey over a long period, with a sampling time of just two weeks. Therefore, it was necessary to limit our research strategically to collect the most results. Thus, the research was limited to the Studley campus, excluding Sexton, Carlton and Truro Campuses. This was to concentrate our resources to develop consistent and reliable results within the largest and most academically diverse campus. In addition, we limited our sampling to three prominent locations on campus. This was to strategically gain access to the largest number of students across faculties, however in doing so we may have accidentally excluded students from obscure faculties such as costume design, whose lab is in a separate part of Studley campus, or Law students who have a separate library and study space on Studley campus.

## Results

Data collection yielded 144 survey responses; 141 that were filled out to completion and used during analysis, resulting in a 98% response rate among students. The following aggregate data compiles some of the survey and quiz responses. Visual representations were simply made in Excel or in SPSS. The analysis of our data revealed non-significant results, meaning that we were not able to support our hypothesis.

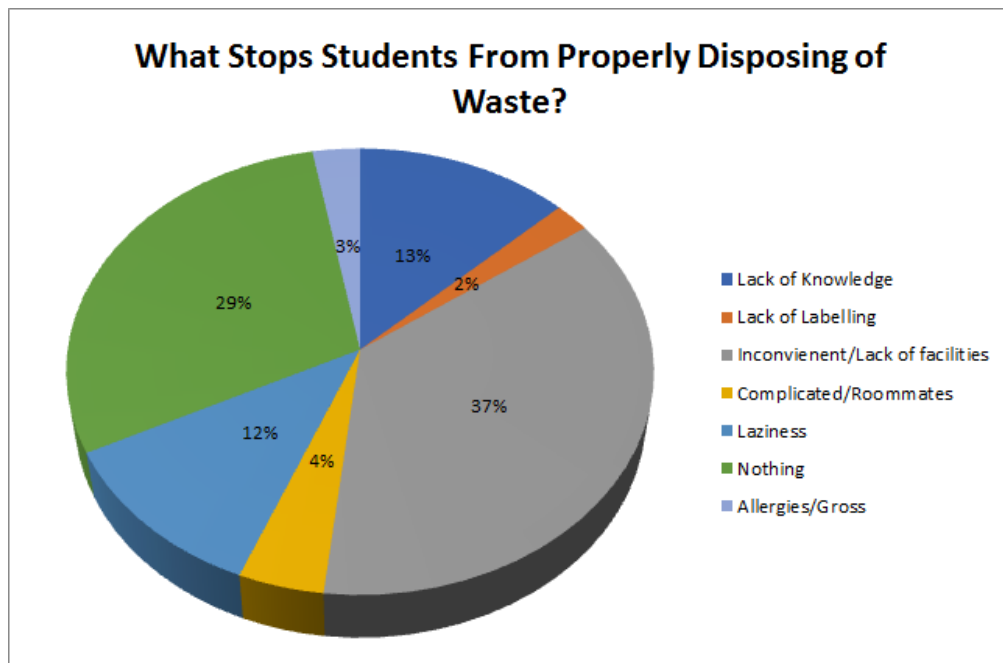


Figure 1: Pie chart of survey question 10 responses of barriers to recycling and composting.

Figure 1 communicates the reasoning behind why students may not be sorting their waste properly. 29% of respondents indicated that nothing stops them from properly disposing of their waste, which is conflicting with the low average received on quiz scores.



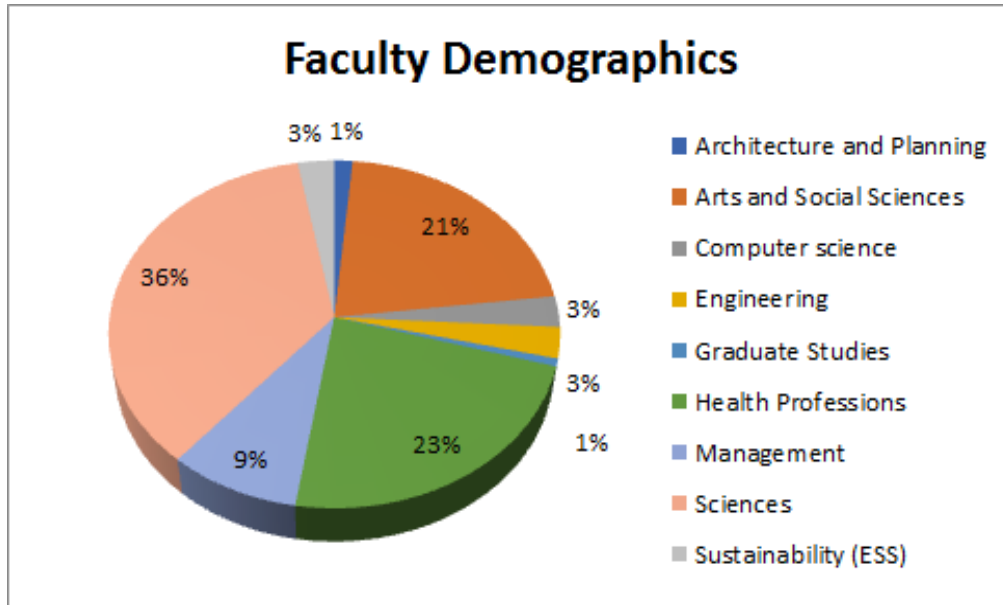


Figure 2: Pie chart of percentage of faculty survey response.

In Figure 2, we see the percentages of each of the different faculties that participated in this study.

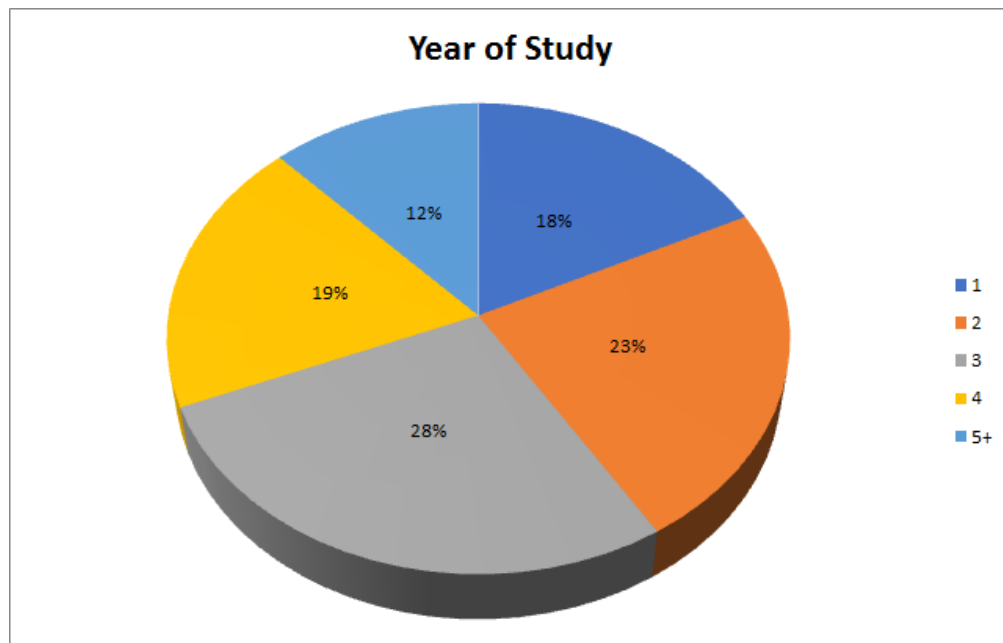


Figure 3: Pie chart of percentage of response rate per year of study.

Figure 3 shows the percentages of each year of study that participated in this study. Third year Dalhousie University students made up the largest proportion of respondents, with first year students being the smallest.

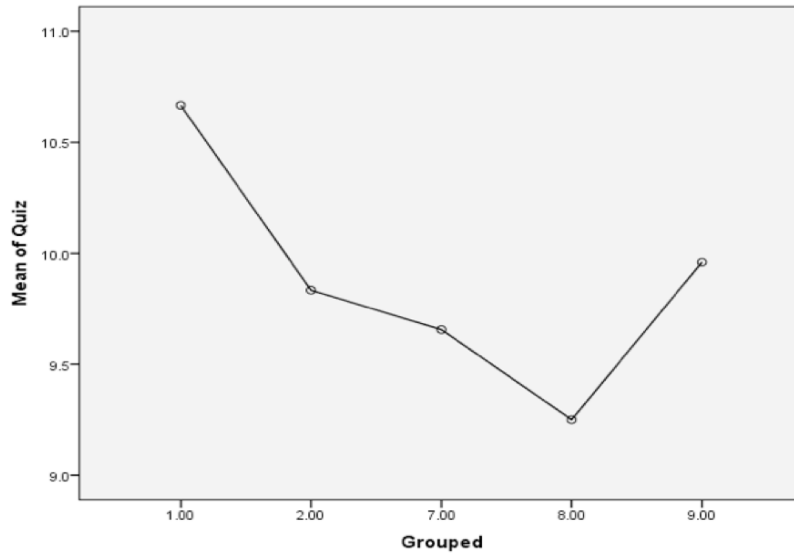


Figure 4: ANOVA test of average quiz scores out of 16 versus grouped faculties. Group 1 includes faculties of architecture and planning, computer science, dentistry, engineering, graduate studies, and college of sustainability. Group 2 consisted of arts and social sciences. Group 7-9 consisted of health promotion, business and management, and sciences respectively.

Figure 4 represents the average quiz scores on the y-axis, and the grouped faculty on the x-axis. The one-way ANOVA found a P-value of 0.490, which is not significant at a 95% confidence interval.

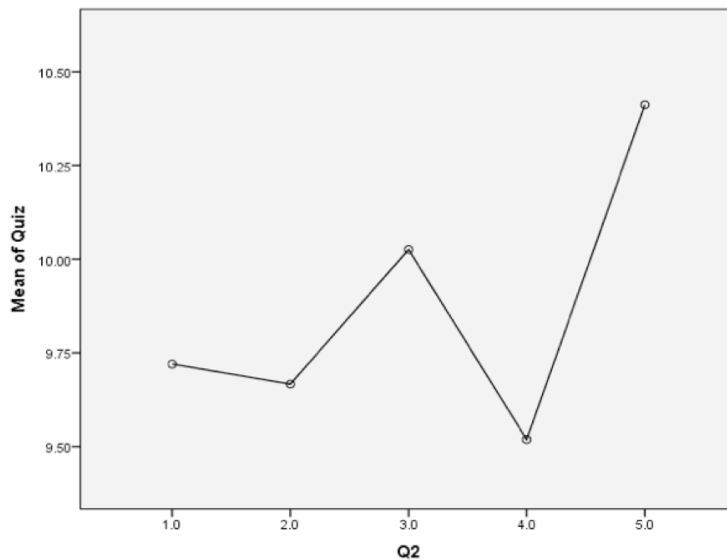


Figure 5: ANOVA test of average test scores out of 16 versus year of study, from first year to fifth year and above.

Figure 5 shows the average quiz scores on the y-axis and year of study on the x-axis. It communicates a P-value of 0.662, which like the above graphic, is not significant. The one-way ANOVA test on quiz scores versus year of study had a P-value of 0.662, which was not significant at the 95% confidence interval.

The one-way ANOVA test of quiz scores versus students living on campus or off campus found a P-value equal to 0.320, which is not significant at a 95% confidence interval.

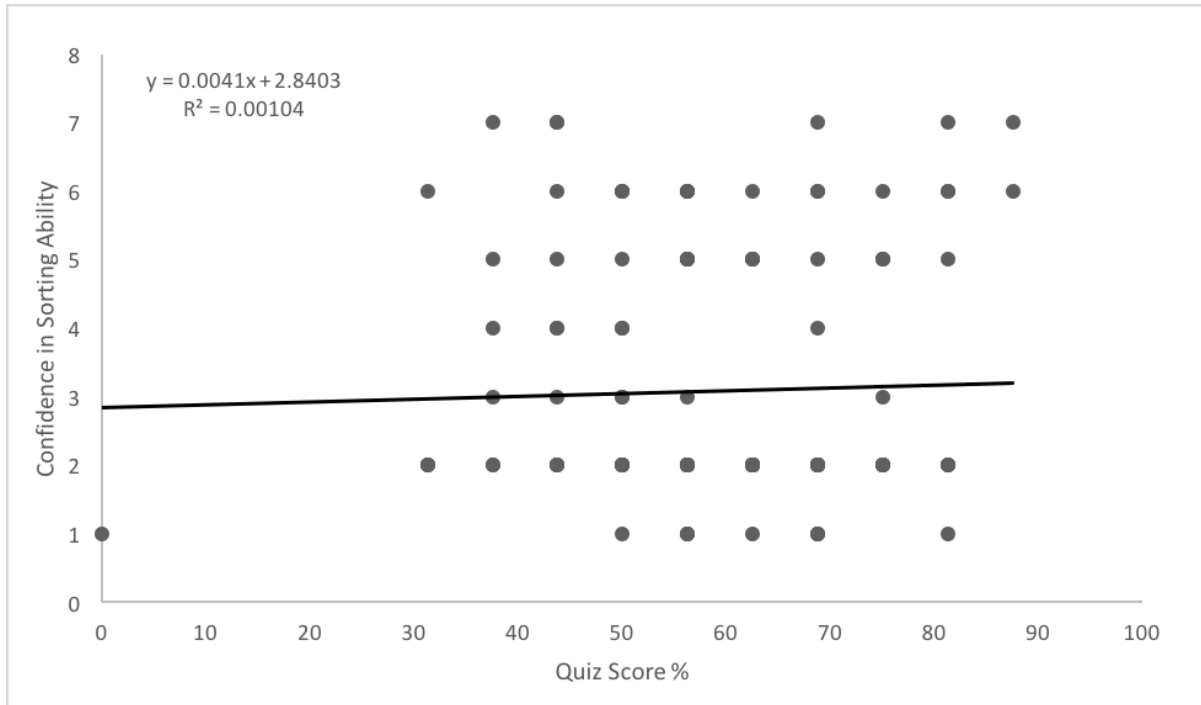


Figure 6: Regression analysis of quiz score percentage versus confidence in respondents sorting ability where  $R^2 = 0.00104$  and  $y = 0.0041x + 2.8403$ .

There was a slight positive correlation between the confidence in sorting ability on the y-axis and quiz score percent on the x-axis in Figure 6 (above), meaning that students who reported having confidence in their sorting abilities did slightly better on the quiz. However, since  $R^2 = 0.00104$  and our sample was roughly .75% of the Dalhousie population, it is not a strong enough correlation to convey a significant result.

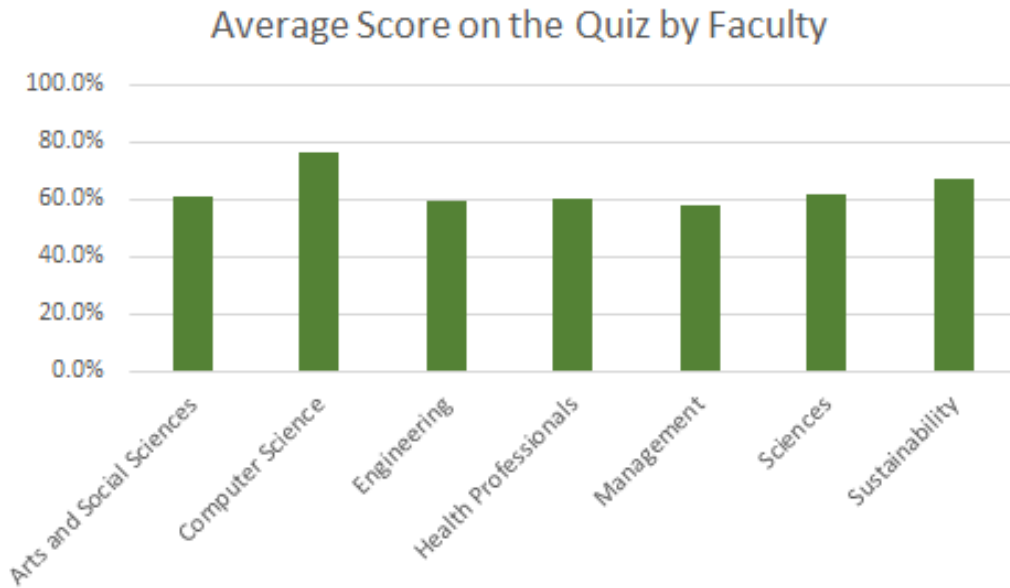


Figure 7 Average quiz scores in percent by non-grouped faculties.

In average test score by faculty, computer science and sustainability students scored highest on the quiz compared to other faculties. However, it is extremely important to point out that participation by students in these faculties was low; only five students each from these two faculties participated in this study, thus the difference is not that significant.

Table 1  
Frequency of incorrectly sorted items out of 141 responses.

|                  |     |                      |    |
|------------------|-----|----------------------|----|
| lightbulb        | 124 | plastic shopping bag | 50 |
| aerosol can      | 115 | wax paper            | 30 |
| milk carton      | 98  | coffee cup           | 27 |
| wine cork        | 80  | used tea bag         | 10 |
| oily paper towel | 70  | glass mason jar      | 8  |
| coffee cup lid   | 63  | battery              | 6  |
| soup can         | 63  | banana peel          | 3  |

## Discussion

Determining Dalhousie University's student waste disposal attitudes and competency provides an opportunity to create organizational changes that allow for the improvement of waste disposal and waste diversion across Dalhousie's campus. The purpose of this study was to explore the waste disposal habits, attitudes, and literacy amongst Dalhousie University students. While the majority of the results of this study comparing recycling competency with demographics were not significant, it is still possible to infer about what these results may mean. The quiz in this study allowed for student waste disposal abilities to be determined. The survey allowed for collection of student demographics, as well as student attitudes regarding waste disposal and any barriers that may prevent Dalhousie students from properly disposing of waste.

Students who were in the Faculty of Computer Science and students in Sustainability programs performed higher overall on the recycling competency quiz than other faculties and programs, as seen in Figure 7 (above). Other programs had relatively similar quiz score averages that were lower than these two programs. As sustainability is an environmental program, it was expected that students in this program would perform higher on the recycling quiz as these students may be more apt to either be concerned about properly disposing of waste, or may simply have prior knowledge regarding how to properly dispose of waste. However, participation from the faculty of computer science and the college of sustainability was low, and therefore, these results cannot be concluded as significant. This does, however, speak to the notion of providing education to students regarding waste disposal as a method to improve waste disposal efforts across Dalhousie's campuses.

Overall, students' quiz scores were not high, with an average of 62.5% for all participants. Thus, there is room for improvement in Dalhousie Students recycling habits and attitudes. With a goal of 70% waste diversion by 2020, Dalhousie will need to increase their efforts in order to improve composting and recycling by students throughout the Studley campus. One of the main reasons that students did not properly dispose of their waste was due to a lack of recycling facilities or inconvenience, as seen in Figure 1 (above). Other barriers preventing students from properly disposing of waste included laziness, lack of knowledge, and the perceived complexity of the program. Some of the complications experienced by participants included roommates who make properly disposing of waste more difficult by not properly recycling or composting themselves. Lack of facilities, however, was the most common reason for not properly disposing of waste after nothing, as seen in figure 1. By providing more recycling facilities across campus, Dalhousie may aid in reducing barriers to proper waste disposal. Many of Dalhousie's residence dorm rooms, for instance, do not have compost bins. If students living in residence had compost bins in their dorm rooms, the University may see a decrease in compostable items being placed in garbage bins where these items do not belong. However, 87% of the participants in this study lived off-campus, which means that improving

waste disposal is not only an effort that needs to be made by Dalhousie University, but is an effort that needs to be made by the Halifax Regional Municipality as well. If students living off-campus do not have access to proper waste disposal facilities, then more unnecessary waste may be making its way into Halifax's landfill.

An article regarding student waste disposal habits and attitudes by Kelly et al. (2006) found that the largest reasons for university students failing to properly recycle were that recycling was either inconvenient, or there was a lack of facilities. In addition to this, Kelly et al. (2006) noted that proximity of recycling facilities to students positively impacted their decision to properly dispose of waste. Kelly et al. (2006) also note that an environmental background plays a role in waste disposal habits. In the study performed by Kelly et al. (2006), a questionnaire determined that university students would recycle more frequently if more recycling facilities were made available to them across campus. Kelly et al. (2006) study results are similar to the results of our study, with access to recycling facilities and inconvenience being a major influence on student recycling habits. As a method to improve student recycling habits, Kelly et al. (2006) recommend strategically placing waste disposal bins throughout campus, as well as providing students with education regarding what happens to their recyclables once they are disposed of as a method to improve student recycling habits.

This study also compared student confidence in sorting ability, as determined by the survey, to actual sorting ability, as determined by the quiz. While there was a slightly positive correlation between quiz score and confidence in sorting ability, as seen in Figure 6, the correlation was small and thus not significant. This indicates that regardless of an individual's confidence in their sorting ability, most students performed very similarly on the quiz. Thus, confidence in sorting ability had little to no effect on a participant's quiz result. Anova tests between quiz score and faculty and quiz score and year of study were also shown to not be significant, as seen in Figures 4 and 5. This is indicative that faculty/program of study and year of study had little to no effect on the ability of an individual to properly dispose of waste relative to the Halifax Regional Municipalities *What Goes Where Guide*. It was anticipated that students in higher years would score higher on the waste disposal quiz and therefore have a better understanding of proper waste disposal in the HRM. We visualized that these participants would have better waste disposal attitudes and literacy due to the fact that many of the upper year students have likely lived in Halifax (or the HRM) for several years. Studies suggest that continued education would improve recycling behaviour (Tonglet et al., 2004). However, the results indicate that students performed very similarly on the waste disposal quiz, suggesting that students are at the same level of waste disposal understanding regardless of how long they may have lived in the HRM.

Overall, none of the results from this study could be concluded as significant, with relatively weak correlations. One reason for this could be due to the fact that this study had 144

participants, which is less than 1% of Dalhousie University's student population. In order to improve this study in the future, a larger sample size should be used in order to create more significant results. This study was also limited by time and monetary funds as the time allotted for collecting data was two weeks and funds for this study were those that could be provided by the researchers in this study. In addition to this, further improvement could be made by improving aspects of the waste disposal quiz that was distributed to participants. Some of the items on this quiz were difficult to place due to the presence of a *special waste* bin and a *glass and plastic* bin instead of a simple recycling bin. For instance, some participants placed a metal can in the special waste bin, indicating that having the recycling bin labeled *glass and plastic* confused some participants. Another fault of this study was that the majority of participants lived off campus. Due to this, comparisons between on-campus and off-campus students could not be made as the sample size of the on-campus students was too low to provide significant results. Further limitations to this study includes the fact that there were only three sampling locations within Dalhousie's Studley campus that were used, which may have influenced the demographics of this study. In the future, studies should aim to include participants of equal demographics, with a larger sample size that is more representative of the Dalhousie University student body as a whole, to improve significance of the results. However, non-significant results are still results, and thus it can be concluded that recycling habits, attitude, and literacy amongst Dalhousie students must be improved.

## Conclusions

Based on our study it would appear that regardless of age, faculty or accommodation, students at Dalhousie University exhibit similar waste disposal habits. Similarly, we have also found that students share the same barriers to appropriately disposing and diverting waste. Using the results of this study, we have been able to make strong recommendations for Dalhousie University based on the common barriers of lack of accessibility and lack of understanding on proper waste separation and disposal. By increasing the number of general and special waste disposal bins, while improving their visibility on campus, the physical barriers of accessibility can be addressed. Beyond this, there is the very real issue of education. Given that the majority of students at Dalhousie are from out-of-province, adjusting to the new regulations and system of waste disposal can confuse students and lead to improper waste disposal. To combat this, we suggest that using education based campaigns will help Dalhousie University reach its 2020 goal of 70% waste diversion. If these recommendations are implemented then Dalhousie will be well on its way to its 2020 goal and its long-term goal of 75% of waste diversion.

## Acknowledgements

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# Appendix A

## Survey

### ENVS 3502 Solid Waste Sorting Survey

**1. Do you live in residence or off campus?**

Residence                      Off campus

**2. What year of study are you currently in?**

1st              2nd              3rd              4th              5+

**3. What program are you in currently?** \_\_\_\_\_

**4. How important is it for you to sort your waste?**

Not at all important    1    2    3    4    5    6    7    Extremely important

**5. How confident are you in your ability to sort waste?**

Not at all confident    1    2    3    4    5    6    7    Complete confidence

**6. How often do you sort your recycling?**

Never              Not Often              Sometimes              Often              Always

**7. How often do you compost (put items in the green bin)?**

Never              Not Often              Sometimes              Often              Always

**8. Have you ever used Dalhousie University's "What Goes Where" guide?**

No              Yes

**9. How complicated do you find the HRM's sorting guidelines to understand?**

Not at all complicated    1    2    3    4    5    6    7    Complicated

**10. What stops you from recycling or composting (more or at all)?**

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# Appendix B

## Survey Quiz

# QUIZ: How well do you Know HRM Recycling Guidelines

Draw a line from the word bubble to the appropriate bin

The diagram features five recycling bins at the bottom, each with a specific color and label:

- Orange Bin:** Paper and Cardboard
- Blue Bin:** Glass and Plastic
- Green Bin:** Compost
- Dark Blue Bin:** Garbage
- Red Bin:** Special Waste

Scattered around the bins are 15 word bubbles, each containing a different waste item:

- Milk Carton (blue bubble)
- Coffee Cup Lid (blue bubble)
- Battery (green bubble)
- Oily Paper Towel (red bubble)
- Coffee Sleeve (green bubble)
- Wine Cork (blue bubble)
- Pizza Box (yellow bubble)
- Used Tea Bag (blue bubble)
- Glass Mason Jar (yellow bubble)
- Soup Can (blue bubble)
- Banana Peel (red bubble)
- Waxed Paper (blue bubble)
- Coffee Cup (green bubble)
- Plastic Shopping Bag (yellow bubble)
- Light Bulbs (blue bubble)
- Empty Aerosol Can (blue bubble)

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