Effectiveness of Drinking Fountain Wayfinding Signage at the Nest, UBC

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Executive Summary

The SEEDS (Social Ecological Economic Development Studies) program in UBC has been promoting the use of tap water drinking to meet the goal of Zero-Waste Action Plan by reducing 80% of all waste from the landfill by 2020. In this study, a mixed-method approach consists of two surveys (i.e. baseline survey and post-signage survey) and systematic observations were conducted to test if displaying drinking fountain wayfinding signage increase drinking fountain usage at The Nest. The post-signage survey (n=100), showed that only 25% of the participants noticed the recently installed wayfinding signage; and when they were asked to guess the purpose of the signage, only 35% participants responded with direction or tap water drinking related key words. 40 hours of systematic observation (i.e. 20 hours for each condition) showed increases of direct drinking and water bottle filling behaviors after wayfinding signage were installed; but by conducting the chi-square test, it revealed the differences were not statistically significant. The hypothesis that suggest displaying drinking fountain wayfinding signage near the drinking fountain would increase the usage of the drinking fountain, therefore, was rejected. Insights gained from this study will help develop practical implications of current signage design and future signage installation plan.

Keywords: sustainability, environmental, drinking founfain, signage

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Introduction

Global Environmental Facility (2015) listed the promotion of sustainable water consumption as one of the cores in their five-year plan. It is estimated that twice the amount of water that were bottled were used in the production process (The Pacific Institute, 2007). In UBC, despite of having over 220 drinking fountains on campus in 2010, the Office of the Vice President Finance, Resources, and Operations reported that over 178,000 bottled water were sold annually from food outlets across campus (Sadowski & Willock, 2010). If the average climate change impact of bottled water is 0.16 kg CO_2-eq per bottle (Makov, Meylan, Powell, & Shepon, 2016), which means the process of producing and shipping 178,000 bottled water released around 30,000 kg CO_2-eq; this is equivalent to driving an average car for one-and-a-half months non-stop.

Aside from the positive environmental impact of choosing tap water over bottled water, the installation of drinking fountains is associated with reduction in body mass index (BMI) (Moreno, 2016), and drinking sugar-sweetened beverages is associated with higher ricks of type 2 diabetes and obesity (Mekonnen et al., 2013). Promoting consumption of tap water with reusable bottles, especially with the data supporting the safety of water from drinking fountains (Tran, Li, McNicholl, Dijk, & Lee, 2012), support one of the SEEDS (Social Ecological Economic Development Studies) program's goal to reduce the use of bottled water and encourage health beverage consumption habits.

Some researches had shown that signages are effective in changing and most often increasing health conscious behaviours and environmental protection actions. According to the theoretical model of sign-to-behaviour process, people go through two stages when encountered with a sign for behavioural changes to occur: comprehension process and decision process (Meis & Kashima, 2017). A familiar sign (e.g. common toilet sign images) or high clarity of purpose for an unfamiliar sign (e.g. danger toxic hazard sign) (see Appendix A) will facilitate a smooth comprehension process, which will lead to the decision process on the enactment of the signaled behaviour, where convenience of performing the action is important.

Sané, Tran, Bedek, and Yu (2018) conducted a SEEDS student study, and found that 86% of their participants (n=125) claimed that drinking fountain signages installed near washrooms, along hallways, at entrance of buildings and near food vendors will be effective in facilitating their use of those drinking fountains. One of the proposed locations is marked as drinking fountain #1 in the Nest, located on G/F between men's washroom and Blue Chip Café (see Appendix B), which is in proximity of all four requirements listed above.

Research Question and Hypothesis

In this paper, we examined the effectiveness of drinking fountain wayfinding signage on G/F at the Nest in UBC. The proposed research question was "Does displaying drinking fountain wayfinding signage increase drinking fountain usage at The Nest, UBC?". With reference to previous studies proposing the model of sign-to-behaviour process and the relevance of the chosen location, we projected the displaying of drinking fountain wayfinding signage near the drinking fountain would increase the usage of the water fountain when comparing to without signage.

Method

In order to compare the effectiveness of displaying a drinking fountain wayfinding signage based on the water fountain usage, a mixed-method approach consisting of systematic observation and surveys are examined. Both pre- and post-survey refers to Cheong, Davies, Tulipano and Wong's (2013) survey questions. Whether or not the wayfinding signage is installed, we conduct a week of systematic observation and data collection for the survey. In other words, the independent variable is whether or not there is the wayfinding signage; the dependent variable is the usage of the water fountain. Thus, there are two conditions in this research: a condition without the wayfinding signage and another condition with the wayfinding signage.

Participants

In the condition without the wayfinding signage, 108 respondents participated in the pre-survey, but only 105 (69 females, 36 males; mean age = 20.28 years) data from UBC students was valid because of the requirement of participants (see Appendix C). As a combination of systematic observation, 1460 people performed behaviors related to the water fountain (see Appendix D). On the other hand, 107 respondents participated in the post-survey in the condition with the wayfinding signage. Of the total number, 100 (73 females, 27 males; mean age = 20.63 years) UBC students provided valid responses (see Appendix E), and 1624 people used the water fountain in the systematic observation (see Appendix F).

Measures

Since there are two conditions, we chose Chi-square to analyze the frequency of drinking fountain usage behaviors for systematic observation. Furthermore, because surveys were conducted through Google Forms, descriptive statistics are presented immediately after the data collection. Our surveys were designed to eliminate participants who were not UBC student, and also to understand their perception and thoughts about the water fountains. Thus, both pre- and post- surveys contained general questions for the baseline information, such as habits of bring a reusable water bottle and the frequency of buying bottled water (see Appendix G); and demographic questions which determined participants' status in UBC, gender, age and faculty. All data were collected by multiple choices and open-ended questions. Besides, the post-survey included extra questions aimed to assess the effectiveness and awareness of the wayfinding signage, such as the opinions on the newly installed wayfinding signage and the 5-point-scale evaluation on the helpfulness of it on directing people to the closest fountain (see Appendix G).

Procedure

The systematic observation was conducted in the AMS Nest Building; the frequency of every individual that used the water fountain were counted from Mondays to Fridays, between 11 am to 3 pm for both conditions (i.e. without wayfinding signage and with wayfinding signage); we chose this time period because it was right between classes and many students would have lunch at the Nest building. The water fountain observed was located outside the men's washroom on the ground floor; the entrance on the ground floor was between the bus-loops and the interior of the school, so high traffic near the area was expected. Our observation was to sit directly six meters in front of the men's Room. Besides, behaviors related to the water fountain were divided into three types: directly drinking (defined as the user operate and drink from the fountain bubbler), refilling water bottles (defined as the user fill a water bottle or cup using the bottle filler), and others

(defined as all actions related to water fountain other than the two listed before). In addition to the systematic observation, surveys were conducted through a convenience sample of UBC students. After finished the observation, we randomly asked the students sat inside the Nest building. The conditions were divided into two parts; the systematic observation and surveys were implemented in the first week without the signage, and repeated the whole procedures after the signage was installed in the second week. To minimize the errors, we started at the same weekday, time and location.

Results

Overall, water fountain usage has increased with the wayfinding signage ($\chi2 = 7.8722$; p = .019524, <.05; see Fig. 1 Particularly, those who directly drink water have raised 20.43%, comparing with the condition of no signage. 8.05% of the growth rates in the usage category of bottled refilling. In contrast, other behaviors like wishing bottles and fruits have decreased 31.58% after the installation of the signage. However, the causal relationships between water usage and drinking water signage are unknown. In other words, even though more people use the water fountain after the installing of the wayfinding signage, behaviors of drinking and refilling are not significant ($\chi2 = 2.1183$; p = .145548; see Fig. 2). Concluded from the base level questions, the majority of students (90% in pre-survey, 87% in post-survey) bring their bottle to school, as opposed to 26% students in pre-survey, and 33% students in post-survey that purchased bottle water. Additionally, among the students who did not bring a reusable bottle, 50% of them claimed that it was too hard to remember. After the signage was installed, we asked an open-ended question to test students' perception and opinios. There was one student thought the signs were for indicating the garbage can, and the other one answered that the signage did not make much sense. In fact, most participants (74%) even did not notice the wayfinding signage for the water fountain. This demonstrated that the sinage ambiguity was also a factor of the lack of usage of water fountains. To avoid type I error, we have to reject the hypothesis, which means the hypothesis is not supported.

Discussion

Our project is concerned with the affectiveness of the signage in increasing awareness. The result of the study suggests that displaying wayfinding signage does not significantly increase the use of water fountain. Some of the challenges and limitations are regarded to the size, meaning, and location of the signage. According to the result of the survey, 73 % of the participants did not notice the sign in the first place and are confused about the meaning of the signage. The drinking fountain is located at a crowded area near the first-floor entrance of the NEST, where the water fountain is highly visible and frequently used without the assistance of directions or signage. Because of the location, the signage loses its original purposes, which were to increase people's awareness and provide guidance. If we were to re-run the study or design a new research, we would make the size of the signage bigger and make the meaning of the symbol more universal. In order to get a bigger effect in the future, the research can be done at locations where the signage could serve a bigger purpose. Further more, The location of this water fountain is surrounded by coffee shops, bubble tea shops, and other convenience store that provide alternative beverages. These alternative options could encourage people to purchase beraverages, which might decease their awareness of the drinking fountain. In addition, The time span of the study could also be extended

in order to collect more data. The participant samples for the survey were collected by convenience sample, so it might not represent the entire University of British Columbia (UBC) population.

Although the result was not statistically significant, it showed a slight numerical increase in the use of water fountain for drinking and filling. This result could be attributed to the posters (see Appendix H) displaying by the water fountains that promote the use of tap water. Overall, This research provides tips on promoting water usage by learning from the challenges and limitations. The findings from this study could be generalize into other communities like hospitals, mall, and other public places. Those tips can help achieve Vancouver's goal of expanding public access to drinking water and reducing the use of bottled, which promotes environmental sustainability by reducing plastic wastes. (Cheng, 2013)

Recommendations for UBC client

The findings from this study suggested UBC that the current signage is not enough to increase awareness and promote the use of drinking fountain. The discussion section outlined how UBC could develop further interventions that could work with the signage to create a more influential plan. Increasing the size of the signage may be beneficial to future research (Montuclard et al., 2017), because some students did not notice the sign even after the intervention. The height of the sign could also be lowered so that the sign could be parallel to the students' line of sight. In addition, familiarity is one the most important characteristics of signage in impacting drinking behaviors (Wu et al., 2018). Many students cannot relate the drinking behavior to the sign. The study and creation of standardized water fountain signs are also critically important. We suggested 2 ways that could promote the use of water fountain. One, eco-friendly cups can be provided beside the water fountain, which could increase convenience for the students who do not have a bottle or are not used to drinking directly while reducing the purchase of bottled water. Second, UBC can develop a campus wide interactive map that allow students to access the location of water fountains through phone applications. (Cheng, 2013) This could allow students to locate the water fountain in every UBC buildings even in unfamiliar places.

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Appendix A: Familiar vs. Unfamiliar sign

a. An example of familiar sign – common toilet sign images

b. An example of unfamiliar sign with high clarity of purpose - danger toxic hazard sign

Appendix B: Drinking Fountain #1 in Nest proposed by Sané, Tran, Bedek, and Yu (2018)

Appendix C
Demographic information (gernder, occupation and age) of participants in pre-survey

Gender

- Female
- Male
- Prefer not to say

36.1%

Female
69 (63.9%)

Occupation

97.2%

Student
105 (97.2%)

1 (0.9%)   12 (11.1%)   30 (27.8%)   27 (25%)   14 (13%)   11 (10.2%)   8 (7.4%)   1 (0.9%)   1 (0.9%)   2 (1.9%)   1 (0.9%)

17   18   19   20   21   22   23   24   25   28   TwentyT…
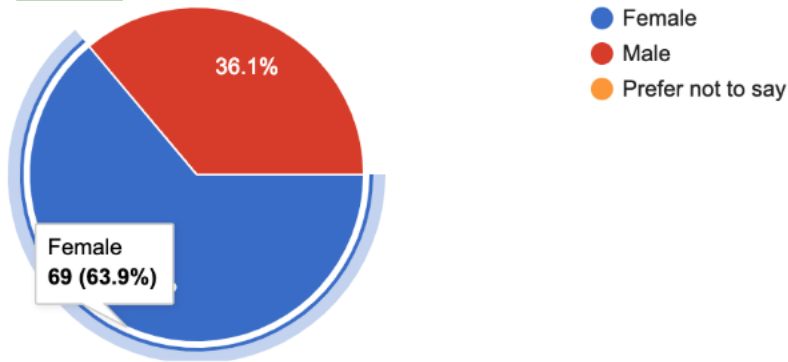
Appendix D
Frequency in observation without signage

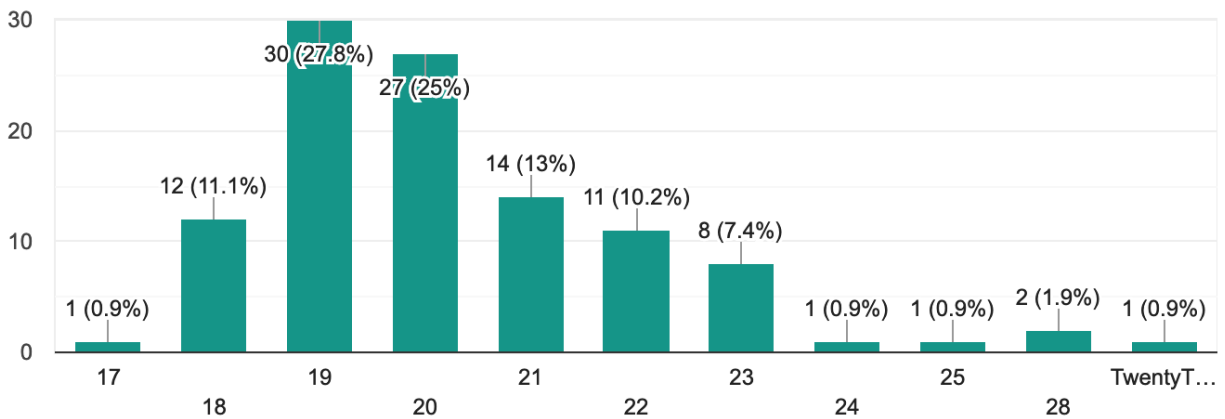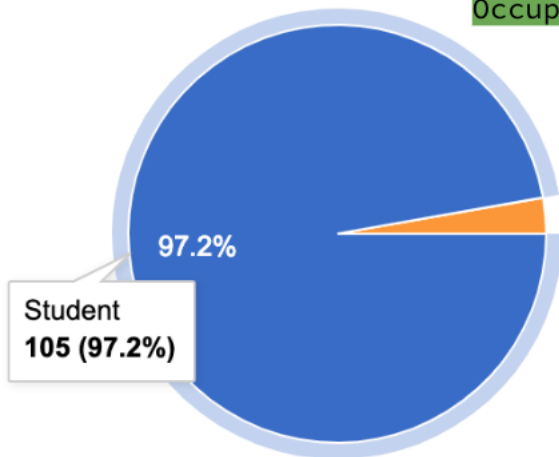|						total
drinking						
	Monday	Tuesday	Wednesday	Thursday	Friday	
11:00	20	17	22	26	20	
12:00	29	35	32	25	22	
13:00	29	24	40	34	22	
14:00	36	36	32	32	25	
	114	112	126	117	89	558
refill						
	Monday	Tuesday	Wednesday	Thursday	Friday	
11:00	42	28	26	22	34	
12:00	40	63	45	54	34	
13:00	38	59	50	70	42	
14:00	41	43	43	39	32	
	161	193	164	185	142	845
other						
	Monday	Tuesday	Wednesday	Thursday	Friday	
11:00	3	5	5	1	7	
12:00	2	0	7	0	6	
13:00	0	2	3	0	5	
14:00	1	2	3	1	4	
	6	9	18	2	22	57
total						1460

Appendix E
Demographic information (gernder, occupation and age) of participants in post-survey

Occupation

93.5%

Student
100 (93.5%)

Gender

31.8%

- Female
- Male
- Prefer not to say

Female
73 (68.2%)
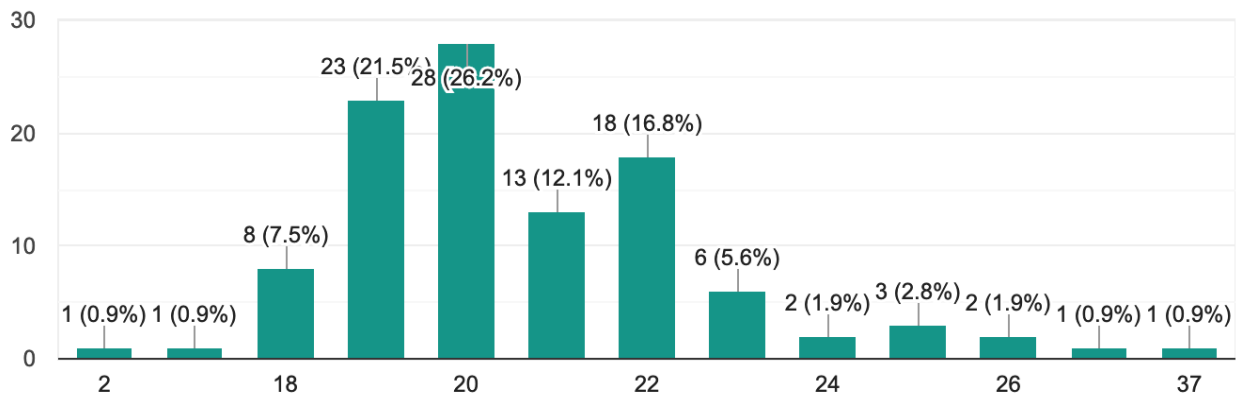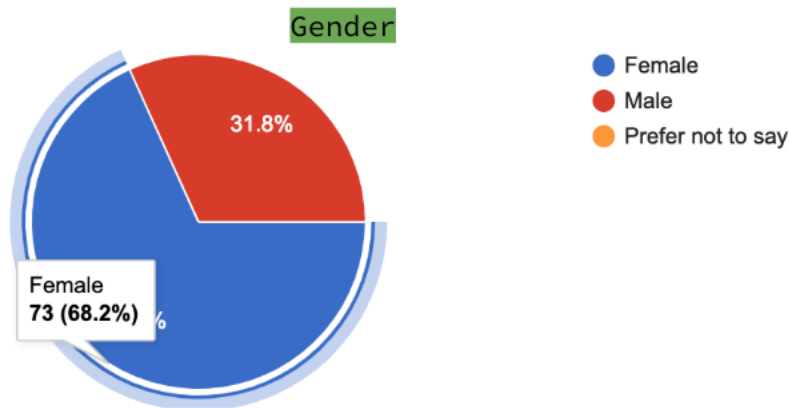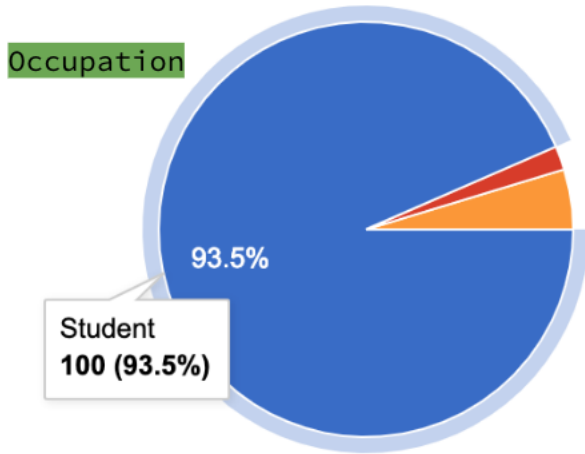
Appedix F
Frequency in observation with signage

drinking	Monday	Tuesday	Wednesday	Thursday	Friday	total
11:00	33	25	38	23	28	
12:00	27	44	33	23	33	
13:00	33	45	47	40	30	
14:00	25	33	39	38	35	
	118	147	157	124	126	672

bottle	Monday	Tuesday	Wednesday	Thursday	Friday	
11:00	45	36	37	24	43	
12:00	40	48	46	45	56	
13:00	47	63	54	53	58	
14:00	37	41	48	40	52	
	169	188	185	162	209	913

other	Monday	Tuesday	Wednesday	Thursday	Friday	
11:00	6	2	2	1	0	
12:00	3	0	0	0	2	
13:00	7	2	3	0	3	
14:00	5	0	2	1	0	
	21	4	7	2	5	39

total						1624

Appendix G
Survey Questions

A. The survey administered before wayfinding signs are displayed

1. How often do you purchase bottled water on campus?
    Never
    1-2 times a week
    3-4 times a week
    More than 5 times a week

2. How often do you bring a reusable water bottle with you to campus?
    Never
    1-2 days a week
    3-4 days a week
    More than 5 days a week

2a. If never, what prevents you from bringing a reusable bottle with you to campus? (Select all that is applicable)
    Bottled water is cleaner than water sources on campus
    Bottled water is healthier than water sources on campus
    Bottled water tastes better than water sources on campus
    Too heavy to carry around all day
    Too hard to remember to bring my reusable bottle
    Water isn't easily accessible on campus
    I do not own a reusable water bottle
    Other:_____

2b. If yes, why do you bring a reusable bottle to campus?(Select all that is applicable)
    Protects the environment
    It is part of my daily routine
    I can fill it up easily on campus
    The tap water on campus is clean
    I save money because tap water is free
    Water bottles on campus are too expensive
    Others:_____

2bi. How often do you refill your water bottle with water from the drinking fountain on campus?
    Never
    1-2 times a week
    3-4 times a week
    More than 5 times a week

3. In my opinion, water from the drinking fountain on campus is… (Select all that is applicable)
    Just as clean or even cleaner than bottled water
    Convenient

Free
Less wasteful than bottled water
Bottled water is better
Too far to get to
Freezing cold
Others:_____

4. How many times do you use the drinking fountain per week?
Never
1-2 times a week
3-4 times a week
More than 5 times a week

5. Do you know where the closest drinking fountain is?
Yes
No

6. Do you think the drinking fountains on campus are accessible?
Yes
No

Demographic Questions:
1. Status in UBC
Student
Staff
Visitor
Others:_____

1a. Which School / Faculty are you in?
Applied Science
Architecture and Landscape Architecture
Arts
Audiology & Speech Sciences
Business (Sauder School)
Community and Regional Planning
Dentistry
Education
Extended Learning
Forestry
Graduate and Postdoctoral Studies
Journalism
Kinesiology
Land and Food Systems
Law (Peter A. Allard School)
Library, Archival & Information Studies
Medicine

       Music
       Nursing
       Pharmaceutical Sciences
       Population and Public Health
       Science
       Social Work
       Others:_____

2. Where do you live?
       On campus
       Off campus

B. Survey administered after wayfinding signs are displayed

1. How often do you purchase bottled water on campus?
       Never
       1-2 times a week
       3-4 times a week
       More than 5 times a week

2. How often do you bring a reusable water bottle with you to campus?
       Never
       1-2 days a week
       3-4 days a week
       More than 5 days a week

2a. If never, what prevents you from bringing a reusable bottle with you to campus? (Select all that is applicable)
       Bottled water is cleaner than water sources on campus
       Bottled water is healthier than water sources on campus
       Bottled water tastes better than water sources on campus
       Too heavy to carry around all day
       Too hard to remember to bring my reusable bottle
       Water isn't easily accessible on campus
       I do not own a reusable water bottle
       Other:_____

2b. If yes, why do you bring a reusable bottle to campus? (Select all that is applicable)
       Protects the environment
       It is part of my daily routine
       I can fill it up easily on campus
       The tap water on campus is clean
       I save money because tap water is free
       Water bottles on campus are too expensive

Others:_____

2bi. How often do you refill your water bottle with water from the drinking fountain on campus?
        Never
        1-2 times a week
        3-4 times a week
        More than 5 times a week

3. In my opinion, water from the drinking fountain on campus is… (Select all that is applicable)
        Just as clean or even cleaner than bottled water
        Convenient
        Less wasteful than bottled water
        Bottled water is better
        Too far to get to
        Freezing cold
        Others:_____

4. How many times do you use the drinking fountain per week?
        Never
        1-2 times a week
        3-4 times a week
        More than 5 times a week

5. Do you know where the closest drinking fountain is?
        Yes
        No

6. Do you think the drinking fountains on campus are accessible?
        Yes
        No

7. Have you used the water fountain in the past 7 days?
        Yes
        No

8. Have you noticed the new signs related the drinking fountains?
        Yes
        No

9. What do you think the signs are for?
_____

10. How helpful were the signages for wayfinding to the nearest drinking fountain?
 (not helpful at all)   1   2   3   4   5 (extremely helpful)

Demographic Questions:
1. Status in UBC
     Student
     Staff
     Visitor
     Others:_____

1a. Which School / Faculty are you in?
     Applied Science
     Architecture and Landscape Architecture
     Art
     Audiology & Speech Sciences
     Business (Sauder School)
     Community and Regional Planning
     Dentistry
     Education
     Extended Learning
     Forestry
     Graduate and Postdoctoral Studies
     Journalism
     Kinesiology
     Land and Food Systems
     Law (Peter A. Allard School)
     Library, Archival & Information Studies
     Medicine
     Music
     Nursing
     Pharmaceutical Sciences
     Population and Public Health
     Science
     Social Work
     Others:_____

2. Where do you live?
     On campus
     Off campus

Results						
	before	after				**Row Totals**
drinking	558 (582.30) [1.01]	672 (647.70) [0.91]				1230
refiiling	845 (832.26) [0.20]	913 (925.74) [0.18]				1758
other	57 (45.45) [2.94]	39 (50.55) [2.64]				96
Column Totals	1460	1624				**3084 (Grand Total)**

The chi-square statistic is 7.8722. The *p*-value is .019524. The result is significant at *p* < .05.

Figure 1. Chi-square table for dringking, refilling and other.

Results						
	before	after				**Row Totals**
drinking	558 (577.54) [0.66]	672 (652.46) [0.59]				1230
refiiling	845 (825.46) [0.46]	913 (932.54) [0.41]				1758
Column Totals	1403	1585				**2988 (Grand Total)**

The chi-square statistic is 2.1183. The *p*-value is .145548. The result is *not* significant at *p* < .05.

Figure 2. Chi-square table for drinking and refilling.

Appendix H: Poster