

UBC Social Ecological Economic Development Studies (SEEDS) Sustainability Program

Student Research Report

Effectiveness of Posters to Increase Water Fountain Usage Among International Students

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Executive Summary

Our study was intended to investigate how the design and content of a poster influence water fountain usage among international students. We first conducted a survey study amongst international students to get insights on what kind of poster is more preferable and to learn about their water drinking habits. We then planned to observe the frequency of water fountain usage in Vantage College before and after the presence of a poster. Unfortunately, our observation was interrupted due to the recent pandemic. With only survey results available, we analyzed the survey data to answer several exploratory questions. The result shows that 75.9% of the participants prefer a poster that follows certain design guidelines, implying that poster design is an important aspect to consider to increase water fountain use among international students. We also found that the time international students spent in Canada is positively correlated to their perception of tap water safety and campus water fountain usage. This suggests that there is a knowledge gap amongst international students who have only been in Canada for a short time, so future tap water campaigns should aim to address this issue.

Introduction

In 2018, UBC launched the Healthy Beverage Initiative to promote the wellbeing of all members of the community. UBC Drinks Tap Water campaign was then launched to increase tap water usage, and some posters from the campaign have been put into use to reach this goal. However, no research had tested how effective these posters were. Some student-led researches used wayfinding signages in their experiments. One study suggested that 86% of 152 participants believed signs would promote their use of water fountains (Sané et al., 2018). However, a later study in UBC found no significant relationship between wayfinding signs and drinking behaviors. They concluded that the design of signage should be standardized in the future (Hsu et al., 2019).

Amongst published research, only a few studies investigated the effectiveness of posters, whilst a lot studied the design of signs. One study in UBC found that signs with only words are less effective than signs with images, and this could influence people's waste disposal behaviors (Wu et al., 2018). It was also proven that the clarity of the purpose of the signage is important to deliver information and initiate behavioral change (Meis & Kashima, 2017). Furthermore, *Processing fluency*, the level of difficulty for viewers to process the information, was shown to affect which sign seemed more appealing to people (McDougall et al., 2016).

In general, research on the effectiveness of posters on behavioral changes was neglected. Previous student-led researches displayed contradicting results, and the signage they used were not shown or analyzed. We found it necessary to test the appeal and effectiveness of current campaign posters. The UBC Drinks Tap Water campaign expressed interests to learn about international students' drinking behaviors, which was also not extensively studied. Therefore, we formed our research question, that is how will the design and content of a poster influence the frequency of water fountain usage amongst international students? This question is associated with *nudge theory* and behavioral changes (Zhao, 2020). Seeing a poster is a sensory cue that reminds people of certain concepts and changes their behaviors. Poster design is related to the design principles of *nudge theory*, such as the use of graphics and simplification to reduce mental burdens (Zhao, 2020). We hypothesized that the presence of a poster which follows design principles will increase water fountain usage amongst international students. We planned to launch a survey study and an observational study. The survey helps us to investigate how the poster design influences its appeal, and the observation allows us to test the effectiveness of posters to promote behavioral changes.

Methods

Research Design

We planned on doing a two-part study. The first step was sending out a survey to international students of UBC to ask about their perceptions and behaviors relating to tap water consumption, and to identify a preferred poster that we would use in the following observation. We redesigned a poster following previously established design principles (see Appendix A), and we selected one of the campaign posters to compare with our redesigned poster in the survey (see Appendix B). In the observation study, we would first observe how many people would use a particular water fountain in Vantage College, located in the Orchard Commons building, as a baseline condition. Vantage College is a program exclusively for international students, so we

would be able to limit the demographic of our participants. We would then observe the usage after the use of a poster to see whether the poster had a significant effect on water fountain usage.

Due to the COVID-19 pandemic, we were unable to complete our observational study to the extent we had planned. We only launched 3 baseline observations with 8 participants. Given the interrupted data collection process, we switched our research focus towards an exploratory analysis of our existing survey data. Therefore, we will provide the methods we used both in the planned observational study, and in our actual analyses of survey data.

Procedure

Observational study

We planned to choose two days of the week: one from Monday, Wednesday or Friday; and one from Tuesday or Thursday, to minimize the confounds caused by the different class schedules. On each day we would spend one hour in the morning and one hour in the evening to observe. We chose one water fountain located on the second floor of Vantage College (see Appendix C) in the Orchard Commons. We planned to have 6 observations for each of the two different conditions.

Survey

Because there had been no previous study targeting international students' water drinking behavior, we designed a 7-item survey to gauge pre-existing water consumption habits, and to learn about students' preferences of the posters (see Appendix D). Most questions mainly asked them about their awareness and willingness to drink tap water. We approached participants and asked if they would be interested in completing a sustainability survey in person on March 4th in Orchard Commons on an iPad or Laptop. We also asked to make sure that all participants were international students. After reading and accepting the consent form, participants were presented with the survey. The rest of the data were collected online through posting a Google Form in international student group chats. With access to a Chinese students community, we translated the survey into Mandarin and presented the students the translated version.

Participants

Observational Study

Our expected number of participants was 480 international students selected by convenience sampling from Orchard Commons. We planned to launch the observations for 12 times. We estimated to see 40 people who would use targeted water fountains in each observation. 480 was then calculated as a result of the multiplication. Our actual participant number was 8 (3 male, 5 female), because our observational study was interrupted.

Survey

The target sample size was 150 participants. Due to unforeseen situations we were not able to reach that number. 62 international students in UBC gave responses to the survey questions. We collected their responses over eight days, of which 4 were incomplete and 58 were valid. The participants were within the ages of 17-24 (27 male, 30 female, and 1 other). All participants consented to participate in the study.

Measures

Observational study

The measure was the number of times the water fountain was used in the duration of all the observations. We discreetly monitored the target water fountain and counted the number of times it was used either for drinking directly or refilling a water bottle. This measure was defined so that the effectiveness of the poster to initiate behavioral change could be observed and quantified.

Survey

Four analyses would be performed based on the data in the survey. (a) Analysis 1: The measure was the time these international students had stayed in Canada for, (b) Analysis 2: The measure was the time they had stayed in Canada for, (c) Analysis 3: The measure was the time they had stayed in Canada for, (d) Analysis 4: The measure was based on the question asking how likely they are to drink from water fountains after seeing a poster.

The time students spent in Canada was measured so that we could study whether more exposure to the environment, where tap water is safe to drink, would influence their perceptions and behaviors. The willingness to drink the tap water was measured to compare the differences in psychology between people who chose poster A and those who chose poster B.

Conditions

Observational Study

The control condition was the water fountain without a poster put up nearby. The experimental condition was the water fountain with a selected poster put up nearby.

Survey

(a) Analysis 1: The condition was based on one question that asked students' awareness of tap water hygiene in Vancouver. We grouped the responses into two conditions, which are "yes" and "no or I'm not sure", (b) Analysis 2: The conditions were the different choices of drinking water on campus. We grouped the responses into two conditions, which were "drinking from water fountains" and "buying bottled water or beverages", (c) Analysis 3: The conditions were the choice of drinking water at home. The three conditions we formed were "tap water", "boiled or filtered tap water" and "non tap water choices", (d) Analysis 4: The conditions were students' choice of two posters, which were "poster A" and "poster B"

The conditions of students' awareness and drinking habits were set to measure the correlation between these psychologies and the time students had spent in Canada. The condition of two poster choices were set to both learn about which poster was preferable and student's different mentalities for making the choices.

Results

Analysis 1

An independent t-test was used to examine the relationship between time spent in Canada for students who are aware of tap water safety ($M = 3.419$, $SD = 1.468$) with those who aren't ($M = 2.4$, $SD = 1.242$). As Table 1 suggests, we found there is a significant relationship between the time international students spent in Canada and their awareness of tap water safety in Canada, $t(56) = 2.4$, $p = .02$, with effect size $d = 0.720$.

Analysis 2

Another independent T-test tested over the time spent in Canada for students who drink from a water fountain on campus ($N = 38$, $M = 3.447$, $SD = 1.446$) and for those who buy bottled water or beverages on campus ($M = 2.600$, $SD = 1.392$). The results were also significant, $t(56.00) = 2.148$, $p = .036$, with effect size $d = 0.593$ (see Table 2).

Analysis 3

A one-way ANOVA test was performed to compare the time spent in Canada for students who drink tap water at home, those who drink boiled or filtered tap water at home and those who don't drink tap water at all at home. There was no significant difference found in the group means, $F(2.00, 55.00) = 2.937$, $p = 0.06$ (see Table 3).

Analysis 4

An independent T-test was used to test if there was a significant difference in students' willingness to drink tap water between those who choose poster A (see Appendix A), ($M = 3.500$, $SD = 1.210$) and poster B (see Appendix B), ($M = 3.143$, $SD = 1.099$). The descriptive plot shows that the students who choose A tend to show higher willingness to drink tap water, but the test shows no statistical significance in this relationship, $t(56.00) = 0.982$, $p = .0330$, $d = 0.301$ (see Table 4).

Discussion

More students prefer our redesigned poster, which followed design principles such as being concrete, simple and clear. Though our original hypothesis wasn't tested, this result aligns with our overall expectation that posters following design principles would be preferred by viewers. Moreover, the statistical analyses show that students who have doubts in tap water safety have stayed in Canada for a relatively shorter time, as shown in the descriptive plot (see Figure 1). Similarly, students who buy bottled water or beverages also have spent less time in Canada (see Figure 2). These results provide insights to our exploratory investigations. They show that the amount of time international students spend in Canada is a key factor that has implications on their knowledge and behaviors. This connection implies that people's pro-environmental behaviors may be impeded when they are in an unfamiliar cultural environment, and they need time to accept these contradictory beliefs from the new community. Therefore, relevant information should be delivered to eliminate their concerns.

Our finding is also meaningful to the larger population, especially to people in Vancouver, where immigration population accounts for 42% of the total population. (NewToBC, 2018) Consequently, there may be a potential knowledge gap over tap water safety for the general immigrant population. Effective communications to address these issues will help Vancouver, or other immigration based cities, to be a more sustainable community.

The reliability of our results are influenced by the fact that we had a very small sample size. Our research hypothesis was not tested, and we don't know whether the presence of a poster can help increase water fountain use. Moreover, our redesigned poster tries to encourage people to use reusable water bottles, but this action can hardly be initiated by the poster, because bringing a water bottle from home is not an imminent action performed near a water fountain. Therefore, we should instead deliver other information, such as telling people to drink directly from the water fountain. Alternatively, we can put up posters in international students'

dormitories to study how likely they would start bringing water bottles to campus. Lastly, we did not design our survey question effectively, because we planned to focus more on the observational study. Therefore, we later had to form our conditions and measures after the responses were collected, and this practice also undermined the reliability of our results. Furthermore, because of how we designed our survey questions, we could not draw causal relationships between variables; instead, our results were only correlational.

Recommendations

A previous UBC study targeting the general UBC students population reported that the awareness of tap water safety is not an issue among students, and 82% of the participants drink tap water (Sané et al., 2018). However, in our study 38.6% expressed concerns over the taste of tap water, and 36.4% think tap water is not safe to drink (Figure 3). This implies that international students may be less likely to drink from water fountains than local students. We also proved that there is a knowledge gap for international students, especially those who just arrived in Canada. Since 28.1% of UBC students are international students (the University of British Columbia, 2019), we suggest UBC Drinks Tap Water to target new incoming international students to reduce their concerns and help them form new habits of drinking tap water.

We also found that 75.9% of the participants in our survey prefer a more clear and concrete poster over the UBC Drinks Tap campaign poster (see Appendix B). This implies that the current posters, which use a lot of innuendos, cannot speak effectively to international students who may have a language barrier in processing these information. According to the Healthy Beverage Initiative, they have already been installing signages to encourage tap water consumption. We strongly encourage them to consider utilizing more design principles in signages and posters, especially in places where international students tend to gather. For example, a poster should use simple and direct language to deliver educational information, and tell people what actions are expected next.

References

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Appendix

Table 1

Independent Samples T-Test Time in Canada and Awareness of Drinking Water Safety ▼

Independent Samples T-Test ▼

	t	df	p	Cohen's d
Time in Canada	2.401	56.000	0.020	0.720

Note. Student's t-test.

Table 2

Independent Samples T-Test Time in Canada and On campus drinking behavior ▼

Independent Samples T-Test

	t	df	p	Cohen's d
Time in Canada	2.148	56.000	0.036	0.593

Note. Student's t-test.

Table 3

ANOVA Time in Canada and At Home Drinking Behavior ▼

ANOVA – Time in Canada

Cases	Sum of Squares	df	Mean Square	F	p
(At home)Primary drinking water source	11.927	2.000	5.964	2.937	0.061
Residual	111.676	55.000	2.030		

Note. Type III Sum of Squares

Table 4

Independent Samples T-Test Choice of Poster and How Likely to Drink Tap Water ▼

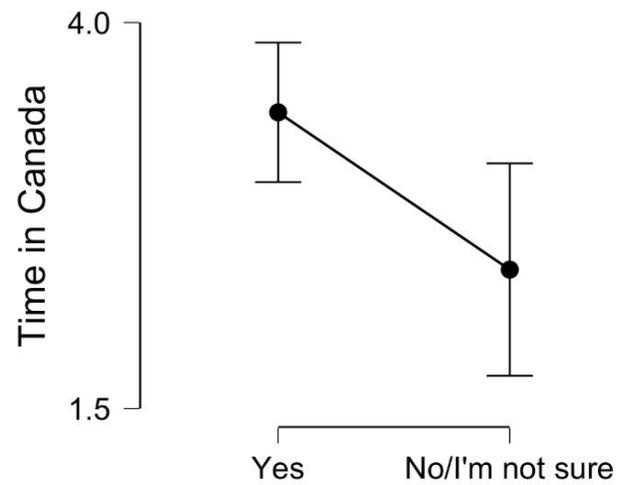
Independent Samples T-Test

	t	df	p	Cohen's d
If you see the poster, will you try drinking tap water and/or using water fountain more?	0.982	56.000	0.330	0.301

Note. Student's t-test.

Figure 1**Descriptives Plot**

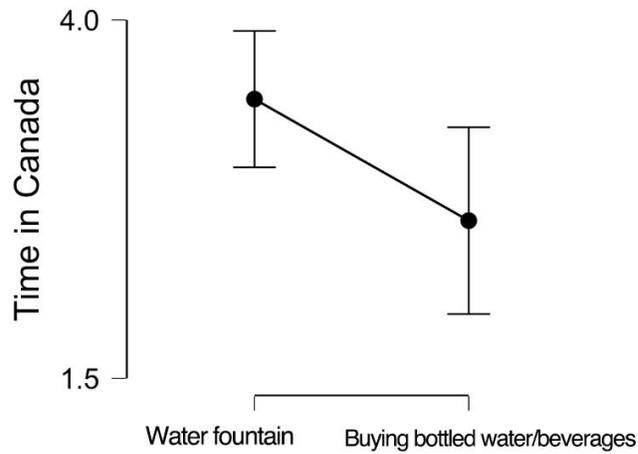
Time in Canada



Are you aware that tap water is safe in Vancouver

Figure 2

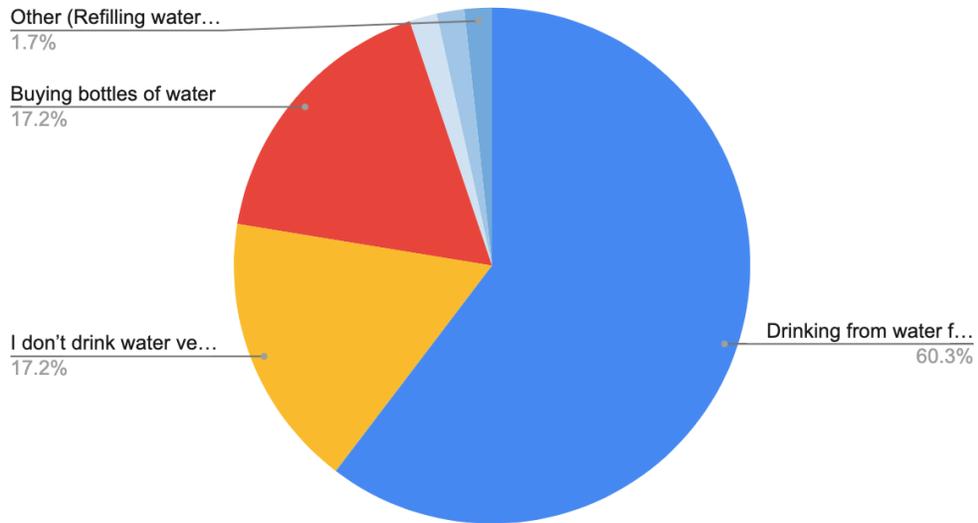
Time in Canada



On campus, what's your primary drinking source?

Figure 3

On campus, what's your primary source of drinking water?

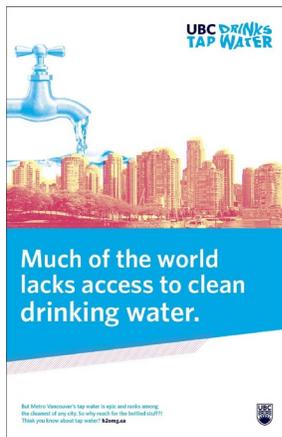


Appendix A



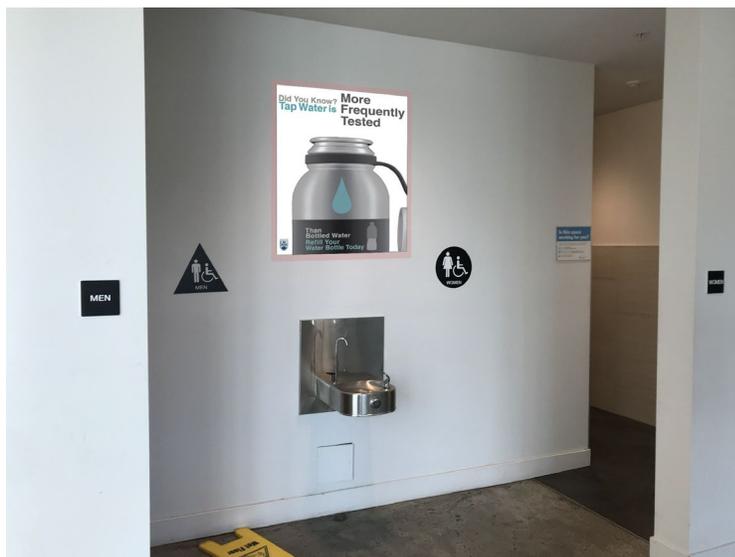
New poster we designed following design principles of using simple language, familiar objects and directives that tell the viewers what to do

Appendix B



One of the UBC Drinks Tap Water posters

Appendix C



Chosen water fountain in on the second floor of Vantage College, digitally edited with an example of poster placement

Appendix D: Survey

Age _____ Gender _____

How long have you stayed in Canada?

<6 months < 1 year < 2 year < 3 year >3 years

What's your source of drinking water at home?

- Tap water
- Boiled and/or filtered tap water
- Buying bottles of water
- I don't drink water very often, I drink other beverages
- Other _____
-

What's your primary source of drinking water on campus?

- Drinking from the water fountain / Refilling my own bottle
- Buying bottles of water
- I don't drink water very often, I drink other beverages
- Other _____

Are you aware that tap water in Vancouver is safe to drink?

- Yes
- No
- I'm not sure

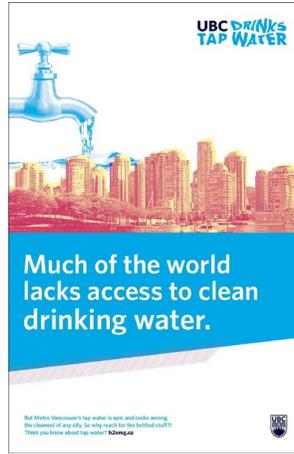
If you don't drink tap water, what's the reason?

- I'm not sure if it was safe to drink
- I don't like the taste
- I don't have the habit of bringing water bottle to school
- I have the habit of buying bottled water
- Other__

Of the two posters, which one do you think deliver more effective information to encourage tap water drinking?



Poster A



Poster B

If you see the poster, will you try using tap water more?

Not at all likely

Extremely likely

1 2 3 4 5