UBC Social Ecological Economic Development Studies (SEEDS) Sustainability Program

Student Research Report

The Good, The Bad and The Ugly: Assessing Indoor Water Fountains on the UBC Campus

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THE GOOD, THE BAD AND THE UGLY

ASSESSING INDOOR WATER FOUNTAINS ON THE UBC CAMPUS

GEOG371: FINAL REPORT

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ABSTRACT

This research project is in collaboration with the SEEDS (Social Ecological Economic Development Studies) program at UBC to assess the quality of indoor water fountains, increase accessibility and usage of water fountains, and promote healthier drinking choices on the UBC campus. Regarding existing research on water fountains, there exists a gap where the only comprehensive inventory list of water fountains was compiled seven years ago and is since outdated. In addition, not much research has been done to assess behaviors and factors influencing fountain usage of UBC students. To achieve our goals of assessing the quality of water fountains, increasing accessibility and usage of water fountains whilst promoting healthier drinking choices on the UBC campus, we identified three research aims:

1. To compile a comprehensive inventory list of water fountains and their characteristics from publicly accessible buildings within our area of study.
2. Increase accessibility of water fountains that are inconveniently located by suggesting improvements to existing water fountains.
3. Conduct an online survey to understand student perceptions, factors, and behaviors of water fountains and potential barriers to their usage.

Our inventory list of water fountains was conducted through a participant observation in which we noted their characteristics such as location, fountain type, cleanliness, taste, water pressure, etc. Because we aim to improve water fountains in publicly accessible student buildings, we excluded buildings such as sport facilities, laboratories, buildings scheduled for demolition or renovation, residences, and dormitories, office, and administrative buildings from our prioritized inventory list. To mitigate subjectiveness in our ethnography, we created predetermined measures and conducted a test run to confirm synchronized categorization. Our ethnography was also conducted in pairs to ensure accurate classification. Given how our research was more quantitative, we conducted a non-probability online survey to incorporate qualitative measures. We distributed our online survey through word of mouth, social media outlets, and wide broadcasted emails. From our survey responses, the most significant findings were that the biggest obstacle in fountain usage was students locating the fountains, students were less environmentally friendly when it came to drinks other than bottled water, and views on added signage were mixed. From our inventory list of water fountains, we found that many fountains across campus lacked signage and mapping. Fountains in buildings on the southside of campus were on average of lower quality than those on the northside. Another pressing finding was that a sizable number of fountains across campus did not have refill spouts, making it difficult to refill reusable bottles.

INTRODUCTION

UBC SEEDS's Water Action Plan and Healthy Beverage Initiative has set overall goals of reducing energy usage, plastic waste, and reducing water cost among

others (Water Action Plan, 2020). The objectives of this research on the indoor water fountains project are thus to assess the current state of indoor water fountains on UBC campus, increase the usage and consumption of tap water through indoor fountains around campus to reduce plastic bottle waste, reduce the cost of water, and support healthier drinking choices. In alignment with UBC SEED's Water Action Plan and Healthy Beverage Initiative objectives, we intend to research ways to increase access and usage of indoor fountains, in tandem with determining barriers of fountain usage around campus.

To increase the overall usage of indoor fountains at UBC, we must first look at the current state of indoor fountains on campus and prior research and assess if there are any improvements to be made. Given that the last inventory list of indoor water fountains on campus was completed in 2013 (Cheng, 2013), there exists a research gap given a lot has changed to the current state of water fountains from seven years ago. Research done by the 2018 SEEDS indoor water fountain (Sané, Tran, Bebek, & Yu, 2018) has resulted in successful signage installation into student buildings such as the Nest and Life Building, but accessibility remains low in many other student buildings where appropriate signage is lacking. The 2018 project also conducted a questionnaire that successfully identified physical barriers to fountain use such as difficulty locating fountains or lack of bottle refill spouts. However, not much is known about the factors and barriers that influence students' fountain usage.

Given the gaps in previous research, our first plan of action is to update the outdated inventory list, which included an evaluation of fountain qualities. Secondly, because a number of these water fountains are not easily accessible due to them being inconveniently located, we plan to increase accessibility to the fountains through improvements to existing fountains, such as signage or wayfinding where appropriate. Finally, to learn about factors influencing student usage and consumption of water fountains to better understand what barriers remain in fountain usage. Therefore, our research questions are how can barriers to accessibility and water quality be addressed to decrease the consumption of single-use water bottles at UBC? To what extent do behaviors at home dictate the consumption of single-use water bottle consumption? More specifically, what improvements and updates are needed to the 2013 inventory list of fountains on campus? Where are signs needed where water fountains are inaccessible and difficult to locate? How to identify what factors and barriers there are to fountain usage? In tandem with our research questions, we have identified three main problems:

1. **Inventory Update:**
   The last comprehensive inventory list of indoor water fountains at UBC was conducted in 2013 and has since been outdated (Cheng, 2013). There is a need to update this inventory list as much has changed since then.

2. **Accessibility:**
   Based on previous SEEDS research, a number of these water fountains are not easily accessible due to being inconveniently located.
3. **Barriers:**
   Even if we updated the inventory list and improved accessibility of water fountains, usage of water fountains

by students is influenced by several factors outside of our control, such as student behaviors at home. Therefore, there remain certain factors and barriers to fountain usage.

Along with being aligned with UBC SEED's Water Action Plan and Healthy Beverage Choice Initiative objectives, it is important to tackle these problems to increase the usage and consumption of tap water through indoor fountains by improving accessibility and promoting healthier beverage choice. Updating the inventory list of indoor water fountains and improving their accessibility on UBC is for the benefit of everybody in the UBC community. Studying and determining which barriers remain to water fountain usage will also help in future research and healthy initiative campaigns to promote healthy choices.

LITERATURE REVIEW

Globally, there is a necessity to move towards more sustainable practices as climate change and the overall wellbeing and health of our planet are becoming increasingly pressing issues. There is a growing amount of literature supporting the environmental benefits of drinking tap water as opposed to bottled water or other beverages (when available) (Khioroni, Anggorro & Sudarno 2019; Willis, Wilcox, Vince, & Hardesty 2019). Similarly, growing interests about behaviors and encouraging tap water consumption is reflected in the variation of literature on the topic (Santos & van der Linden 2016; van der Linden 2015). Moreover, as a part of the series of on-going research towards the advancement of UBC's water fountains, we must review previous SEEDS research to see what has already been done. To further learn about how to increase the usage of indoor fountains on campus, complete an inventory of water fountains on campus with a focus on their accessibility and quality, and also to determine what the students' perspectives on water quality is, this literature review will focus on four themes. The following themes from previous research have been identified as the most pertinent to our research: environmental sustainability, accessibility, water fountain quality, and water drinking behaviors.

Environmental Sustainability

As a component of UBC's Water Action Plan, environmental sustainability is also the underlying component of our research project. As climate change becomes a larger issue, there is a wider need to reduce waste and greenhouse gasses. Studies by Willis et al. (2019) and Khoironi et al. (2019) show that plastic bottles have led to an increase in carbon emissions, a variety of negative effects to the environment, and indirect harm to human health. These studies have proven that elimination, or reduction at the very least, of single-use plastic water bottles, are shown to be beneficial for the environment. These issues matter to our study as this proves that bottled water is less healthy for humans, via the production methods, and it is harmful to the environment compared to clean fountain water. Khoironi et al. (2019), notes that lifestyle heavily affects the consumption of single-use plastic bottles, and possibly the local drinking water quality affecting consumer behavior. Nonetheless, they noted that consumption is still high due to the convenience of bottled water. We hypothesized that convenience may still factor into why students on campus still buy

bottled water. There is also a belief that bottled water is cleaner, convenient, and tastier (Willis et al, 2019), and in past studies done by other SEEDS projects, convenience and lack of awareness were reasons for students to consume bottled water (Sané et al. 2018).

A study by Uehara and Ynacay-Nye (2018) stated that light changes such as installing water refill stations instead of large changes may be able to develop a behavior over time for people to gradually stop buying bottled water as they can refill their bottles conveniently at public places. This overtime can save large numbers of plastic bottles being produced and lower carbon emissions due to a drop in the consumption of plastic bottles, which is also the aim of the UBC Water Action Plan. In an article by Khoironi et al. (2019), they suggest implementing a plastic bottle tax, and awareness programs, by the government or at a grassroots level, which can be another method to increase the use of fountains. Biodegradable plastic bottles could be a solution to the growing use of plastic bottles, but it will not change consumer habits of buying and using bottled water over drinking clean fountain water which is what our study wishes to do.

These studies illustrate how crucial it is to investigate the role that drinking fountains potentially have as a method to reducing the consumption of bottled water. Uehara and Ynacay-Nye's study highlights the significance of water fountains and their roles in changing behaviors of students through gradual methods rather than extreme ones.

Accessibility

Previous SEEDS projects often raised the issue of accessibility in terms of wayfinding, distance to the nearest fountain, and the ease of utilization for all. Sané et al. (2019) found that the optimal places to install water fountains were near washrooms, along hallways, entrances of buildings, and near food shops, in this order. This information will be important in investigating optimum places to put signage and determining which fountains to prioritize in terms of access.

Research conducted by Cheng (2014; 2013) called for more signage installation as a way to boost the utilization and accessibility of water fountains, especially for fountains that are not visible from entrances. Based on the suggestions of Cheng, signage has been installed in newer buildings since. However, the effectiveness of signage has been called into question by Xu et al. (2019), Hsu et al (2019), and De La Cruz et al. (2019), which suggests that the current wayfinding signage placement at the Nest and Life building is too high, is too small, hard to understand and should be brighter. Additionally, some had trouble associating the wayfinding signage design with water fountains. This is an important consideration to keep in mind for future installations of signage since many building users did not notice the wayfinding signages at all nor did these signages boost the utilization of the water fountains. However, it is important to note their study is limited to a few high traffic buildings, therefore the results may differ at a building with lower traffic.

Moreover, Sane et al.'s research about accessibility in IKB, Nest, and Life building suggests that the layout of and familiarity with a building is also important in determining the ease of accessibility (2018). While all three of the buildings receive high foot traffic, the Life building was newly remodeled compared to IKB and the Nest, thus making it easier to navigate and access

water fountains in the latter rather than the former. As expected, those who are mostly unfamiliar with the building had a harder time locating and using the water fountains. Another important point to note is that Life building has more hidden fountains compared to the Nest and IKB, which contributes to the lower water fountain usage at the Life building.

Taking previous findings into account, our research needs to consider how factors such as signage design, placement, and building familiarity may come into play when making recommendations to improve accessibility. Blindly recommending signage for all the water fountains that may seem to be more obscured may not be the most effective way to improve access, especially when many other factors determine the ease of access. For example, a faculty-specific building may not need signage since only a specific group of UBC students will frequent that building, therefore they may be more familiar with the layout and have more knowledge about the locations of fountains.

Signage is a more economically feasible solution to address the problem of accessibility and visibility of fountains. While previous SEEDS research has shown that signage is not the only important aspect to consider in terms of accessibility, it is still an important aspect to investigate. An important area to consider is to expand this research beyond the few buildings mentioned and see if signage is needed and if they would be effective in improving accessibility in other buildings.

Water Fountain Quality Assessment

A general quality check of water fountains on campus was last performed by Cheng in 2013. Using the methodology of participant observation, Cheng established a set of variables to assess the quality of existing water fountains under visual appeal, taste, water color, water pressure, water flow rate, and electrical conductivity. Also, Cheng assessed the quality of water within the first 15 seconds of a flush. The scope of Cheng's was limited to the water fountains in high traffic buildings that were frequently accessed by students. Our project took a lot of inspiration from Cheng's 2013 inventory of the buildings as it is the latest one available. To have some sort of continuity for future comparisons, we will use most of the variables that Cheng had used in her report, however, some will be excluded due to time constraints and the large scale of the project. Moreover, these variables are important in encouraging people to use a water fountain.

The visual appeal of a water fountain is a crucial component that could become a deterrent to users if it is not properly maintained, or if it seems unhygienic. According to Cameron et al. (2018), noticeable signs of neglect will deter people from drinking from these water fountains. Visual contaminants around the nozzle, dirty fountains, poor water pressure, faulty/leaking fountains are indicators of contaminant intrusion. For example, a study by Avery & Smith believed that the height of the water from the spout four inches or lower resulted in lower usage of fountains. Thus, these indicators are important to measure and address to increase water fountain usage.

While Cheng's research is useful as a foundation for our research, our research is concerned with the state of all student accessible fountains on campus, rather than just a select few buildings with the highest traffic. Our project seeks to update the findings of Cheng's project with both an accessibility and water fountain quality

assessment while expanding this to other buildings, however, our sample will be limited to water fountain dispensers and bottle dispensers. Another area we are interested in are barriers to the usage of water fountains. More specifically, how student behaviors, perceptions, and background affect the utilization of water fountains.

Behaviors and Barriers

Survey methods have been used extensively to understand the drinking habits of university students and the quality of tap water on campus. For instance, if we look at Qian's (2018) research on water drinking behaviors at universities located in Singapore, Hong Kong, and Macau, we see their research relies on survey data. Qian used convenience sampling, social networks, and wide broadcast emails to distribute their survey, which resulted in a small sample.

Previous SEEDS studies also conducted surveys to understand student habits, perceptions, and their environmental beliefs. Sané et al. (2018), investigated student perception of the water fountains on campus through a survey distributed through social media. Their survey found that 96% of on-campus use reusable water bottles. Most of their respondents believed that signs would help facilitate their use of drinking fountains. However, the survey did not ask for any sort of background information from respondents as they saw that it was not important.

Similarly, Cameron et al (2018), also conducted a similar survey looking at habits around water consumption, however, they did ask for some background information (ie. Undergraduate, graduate, faculty, and domestic, and international status). This informed our decision to look at how behaviors at home and where someone grew up may be a significant indicator of water consumption habits.

A study by Khoironi et al. (2019) notes that lifestyle heavily affects the consumption of plastic bottles and the local drinking water in Indonesia quality affecting consumption behavior. On the same note, Levêque (2018) researched at one university in West Virginia, a place with a long history of water quality issues and compared drinking habits at home and on campus. Those who came from West Virginia were more likely to use bottled water compared to those who were from elsewhere. Previous SEEDS studies have yet to look at how backgrounds can influence the perceptions and behaviors surrounding water consumption.

Overall, with the goal of minimizing waste and propelling UBC's Water Action Plan, these studies have informed our research questions and focus. We are interested in expanding and updating previous research that has already been conducted by Cheng (2013). At the same time, we are interested in student behavior with regards to a person's background in determining water consumption behaviors as it has never been addressed by previous SEEDS research. Ultimately, through examining these factors we aim to make future recommendations to increase the usage of reusable water bottles and minimize waste generated by bottled water and other beverages.

METHODOLOGY

We used a mixed methodological approach by conducting a participant observation and distributing an online survey. One of our goals involved ascertaining the current state

of water fountains. We determined the best way to obtain this information was to walk around the UBC campus and locate all the fountains in our subject area. As UBC only conducts water quality tests on select fountains every few years and prior inventory checks were outdated, there wasn't any secondary data source we could rely on for the current conditions of fountains. Prior inventory checks also did not include all our desired variables such as water pressure. The best option was to conduct our ethnographic study and get the necessary data for our research questions. However, this approach did not consider UBC students' perceptions, so we distributed an online survey.

Strengths and Limitations

Although this mixed-methods approach was best suited for our research, they still have their limitations. As online surveys are more likely to have a higher response rate with fewer questions and shorter time requirements only a minimum amount of questions can be incorporated (Laaksonen 2018, pp. 36-37). Therefore, we limited our questions and we were unable to attain in-depth answers to questions like one would get from an interview. Online surveys also have a limited scope as we are unable to reach those without internet access. On the other hand, the strengths of online surveys are their fast distribution and collection of data, in addition to its being cost-effective as there are many free source options (Laaksonen 2018, pp. 29).

Additionally, a participant observation has the strength of allowing researchers to obtain their desired dataset instead of relying on compromising datasets of other researchers, but it has its weaknesses too. For example, there is a constant revision in data collection and notetaking, because it can be difficult to record all observations made and be consistent among team members. It also has few standard scientific controls and is thus highly subjective due to its reliance on the researcher's biased observations (Banta, 2020). It being highly interpretive brings into question the validity and the objectivity of the study, more so in our case, as we are a part of the population and survey area we study (Cook, 2005, pp. 181).

Challenges

It was especially difficult to create a finely tuned method that could be applied to our data collection. We often ran into situations that we had not anticipated beforehand and had to find a way to incorporate it into our dataset. For instance, during our participant observation, we did not consider the presence of single and paired water fountains. A paired fountain being when two fountains are side by side and a single fountain just being the one. We only started to note down whether a fountain was single or paired after beginning our participant observation, as we never noticed it beforehand.

Moreover, this mixed-method approach of qualitative and quantitative methods gave us the opportunity "to examine the partiality of knowledge produced in [the] different theoretical and methodological contexts" of an ethnography and an online survey (Nightingale, 2003, pp. 79). In other words, by triangulating the data, a technique that compares the results from multiple methods, we can ensure the results are consistent with each other.

Ethics

To uphold ethical practices, we focused on consent, confidentiality, and cultural awareness as those were most pertinent (Iain Hay, 2010). In terms of our ethnography, we surveyed public places that did not require consent to enter and avoided any restricted areas, however, we made it known whenever asked that we were researchers. As we are also part of the UBC community, being students of the institution, we already had the cultural awareness needed to act ethically in the physical space. In terms of our online survey, we maintained the privacy of participants by using the UBC survey tool powered by Qualtrics which stores its data in Canada. Furthermore, not only were our actions ethically sound through these actions, but the objectives of our project are also ethical, as our research aims are to improve the facilities publicly available for everyone on campus and reduce any negative environmental impact.

Participant Observation

Our participant observation involved an inventory of indoor water fountains in select buildings across the UBC campus. Excluded buildings included recreational facilities, laboratories, buildings scheduled for demolition or renovation, residences, administrative buildings, and shopping areas such as Wesbrook Mall. These buildings were excluded because they were either outside the campus, did not have fountains, were not publicly accessible, or were meaningless to take inventory of because the building was to be destroyed or renovated. Our ethnography was meant to focus on the student's experience and so we prioritized buildings students frequented. Moreover, to mitigate the subjectiveness of this method we first defined the boundaries of all variables and conducted a test run to synchronize our categorization. All of it was done in pairs to further ensure more accurate classification.

After a prioritized building list was made, we took inventory of their locations and the type of fountain. For types, we noted whether it was metal, plastic, ceramic, or an Elkay, and the type of spouts. We also implemented measures to check the quality, accessibility, and promotional of each fountain. For quality, we checked the temperature, water pressure, taste, odor, color, and cleanliness of the fountain. They were recorded on the following scales:

> Temperature - Cold, Lukewarm, or Hot
> Taste - Good, Off, or Bad
> Cleanliness - 1 to 5 (1 being low)
> Water pressure - Height of the water's peak in centimeters
> Odor - Yes or No
> Colour - Yes or No

Some of these measures were based on what other studies had tested for in the past such as odor and color. Other measures such as temperature and taste were simplified to 3 options to decrease subjectivity in our results, as picking between more values would have a higher likelihood of misclassification. Water pressure was an included measure to determine if students would be able to refill their reusable bottles without a refill spout.

For accessibility, we determined if the fountain is easily found, obscured, and if there was any signage to help with wayfinding. These were more subjective measures as they depended on the buildings and our perspectives, but we did set some

guidelines to better classify the variables. For instance, a water fountain was considered obscured if something was blocking it from view. These variables allowed us to determine which fountains were more accessible and provided insight into their usage. Our final check was for promotion, which included taking note of building maps, and the placement of new signage. This measure gave insight into the promotion of fountains as if there were building maps we would be able to place stickers on them to indicate the location of fountains.

Our field notes for these observations were collected on an excel document to avoid data errors in transitioning from paper to electronic documents and with an online platform all team members could access the data.

Online Survey

Our online survey focuses on perceptions of water, drinking habits, and understanding the barriers to fountain usage. We theorize, based on our literature review, that household water consumption habits, perceptions of the safety of tap water, and the availability of water are predicting variables to the usage of tap water. For instance, if a student commonly drinks water from filtered sources at home they would be more likely to continue that habit on-campus. Furthermore, a person's perception of their hometown's water quality can also affect their perception of tap water globally and therefore their usage of it depending on the water quality they are accustomed to. As we see in Levêque's (2018) research in West Virginia, as the local residents were more likely to drink bottled water due to the multiple contamination events in the area (pp. 827). We were also looking to understand how a student's local geography on campus affects their usage of water fountains, as not all fountains on campus will be of the same quality or easily accessible.

Other drinking habits of interest is the student's preference for tap water, bottled water, and other beverages. As one of our goals is to reduce waste, such as single-use plastic, we believed this information would improve waste management.

Our representative population would consist of UBC students in all faculties, including international and domestic students, and students of all years of study. To increase the probability of getting a representative sample we distributed our online survey using wide broadcasted emails and other departmental emails. We also utilized social media platforms such as Facebook, Instagram, and Reddit with an emphasis on reaching out to all faculties through classes, groups, clubs, and our networks. The survey was an anonymous submission and was relatively short to increase completion of the survey (Laaksonen 2018, pp. 36-37). We also provided an incentive by giving students a chance to win a gift card. The format of the survey was a combination of a Likert scale and multiple-choice and allowed students to provide any comments or suggestions at the end of the survey.

RESULTS

We had a total of 201 participants for our survey with at least 1 person from every faculty except Community Planning. Most of our participants were from Arts (38%) and Science (26%). Most of our participants were also domestic students making up 79 percent of the population and the remaining 21 percent being international students.

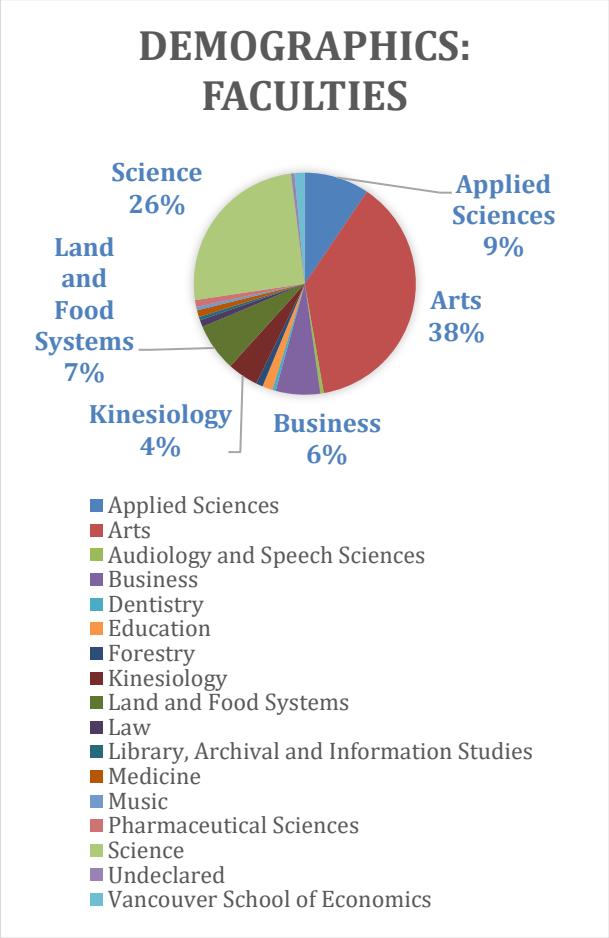

Figure 1: Graph showing the what percentage of students were from which faculty

A majority of our survey participants were upper years students (third year and above), which over 75 percent of participants were upper-year or graduate students. So, most of our participants were familiar with the UBC campus due their many years on campus, and because only 8 percent of our participants were in their first year, we were unable to get the perspective of those new to campus.

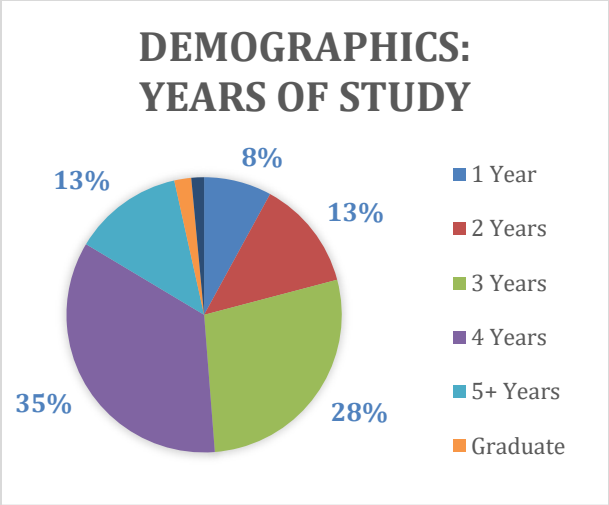

Figure 2: The demographics of how many years a student had studied at UBC

Due to the limited time and recent COVID19 outbreak, we utilized our immediate social circles, social media, networks, and email lists available at hand and thus may have skewed the demographics of the survey. The survey was up on UBC Qualtrics for two weeks.

Online Survey

Based on our literature review we found that the state of water quality in a person's home country can affect their view on tap water, so we were interested to see if this trend was also present with UBC students. We asked participants if they grew up in British Columbia and if they did not, we asked which continent they grew up on. 43 percent of our respondents grew up outside BC, with most being from Asia (22%) and only 1 percent being from South America.

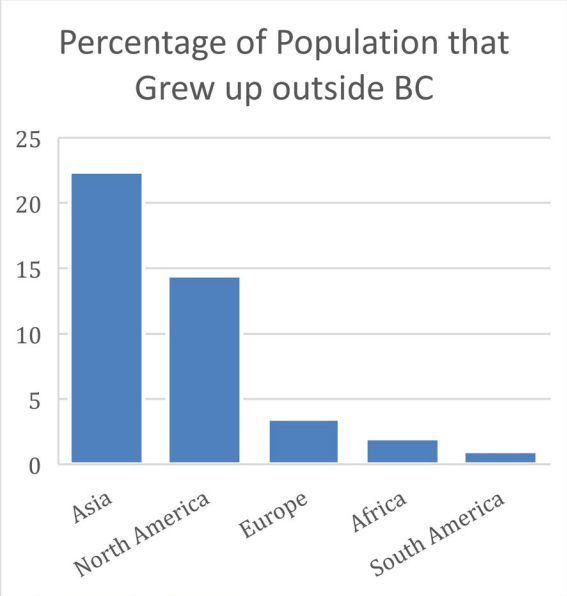

Figure 3: Percentage of the student population that grew up outside of BC

When asked if bottled water is safer than water from water fountains, most students disagreed with the statement, however, when it came to the population from Asia they equally agreed and disagreed with it.

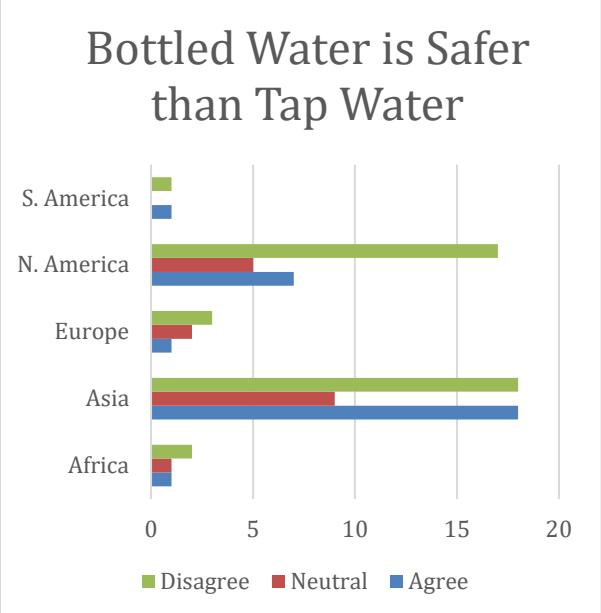

Figure 4: Students who grew up outside BC response to whether bottled water is safer than water from water fountains

When asked about the health benefits between the two types the vast majority disagreed that bottled water is healthier. On the other hand, almost 100 percent of students agreed that reusable water bottles are better for the environment. We also asked about the cleanliness level of UBC fountains and most respondents found that they were kept clean.

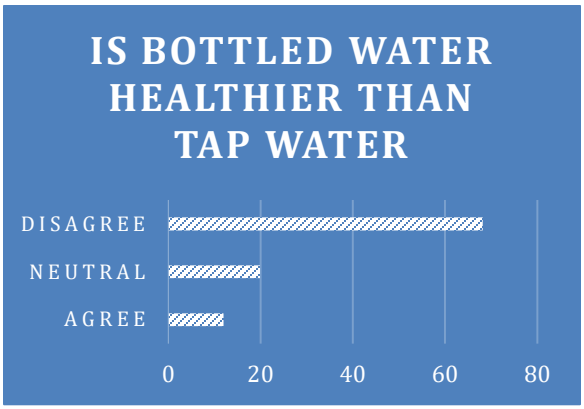

Figure 5: The percentage of the population that agreed or disagreed if bottled water is healthier than water from water fountains

When the drinking habits of students indicated that most drank water straight from the tap without using any filtering methods. The second popular trend was filtered tap water such as faucet filters or refrigerator water. Students were least likely to purchase water such as bottled water or jugs. This trend was present among students who grew up inside and outside of BC. Other notable trends were that people from Asia were more likely to boil water. Although only a small sample of our participants were from Africa, most of them stated they are more likely to buy bottled water.

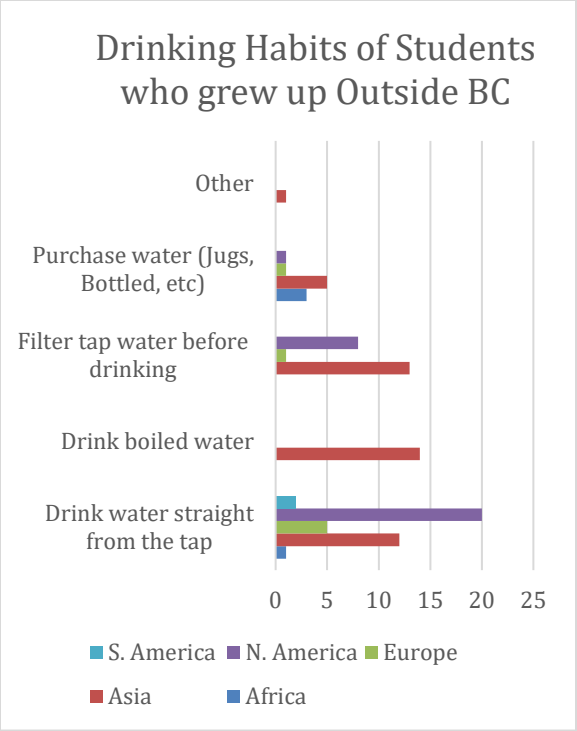

Figure 6: This chart shows the drinking habits of students who grew up outside BC

We also found that students prefer to use reusable bottles more so than plastic or single-use bottles, only a few answered that they never use a reusable bottle. This is reflective of over 80 percent of the population never purchasing bottled water, and no respondents answered that they always buy bottled water. The result was that students only bought bottled water if they forgot their reusable water bottles, thus buying single-use plastic water bottles as a temporary necessity. We furthermore found that students overall preferred to drink water from fountains than bottled water. However, when we asked how often they bought other beverages such as carbonated drinks, tea, milk, 60 percent of the population said they would do so sometimes.

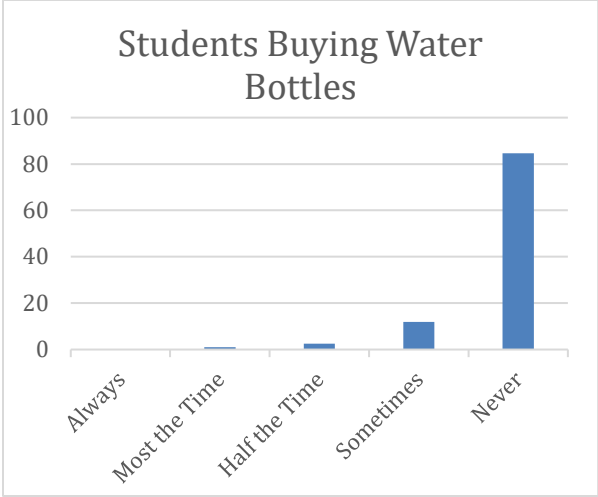

Figure 7: Student Populations response to their purchasing of bottled water

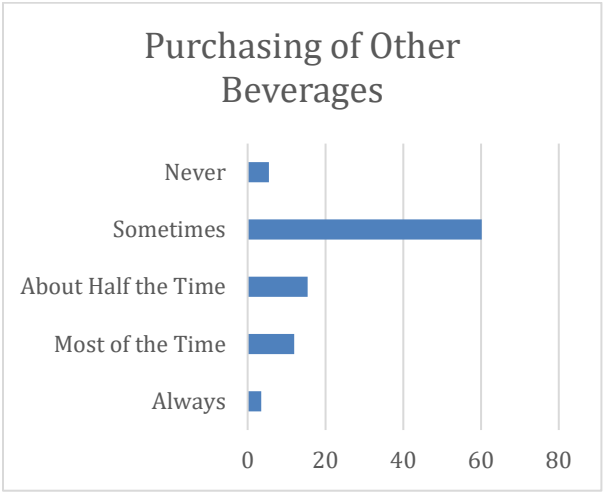

Figure 8: Student populations response to their purchasing of other beverages such as tea, carbonated drinks, energy drinks, etc.

The conditions of the fountains were a major concern listed by several students in the survey. They believed fountains were of poor quality. Several comments listed how the older fountains were of poor quality and they either did not trust the fountain due to rust and metal oxidization being visible on the fountain, having an off taste, possible metal (lead) or plastic contamination in the water, not being able to drink out of the fountains or refill their bottle due to low water pressure, and the fountains being dirty (visible stains or gunk in the fountains). During our

ethnography, we saw signs that people would pour beverages and other food in the fountain. This correlated with locations in which the fountains were of poorer quality such as the Civil and Mechanical Engineering Building, MacLeod Building, and Allard Hall (main floor) even though there were signs posted to not use the fountains as drains. Students also noted that over time, their water tasted off after sitting in their bottle for a few hours.

Accessibility was another major concern for students. In terms of students' perceptions of water fountains, the most common reason that discourages students from water fountains was that they were too difficult to find. However, when asked if they agreed with the statement that water fountains are easy to locate the majority stated they agreed. This could be due to how the questions were phrased or the order in which they were asked.

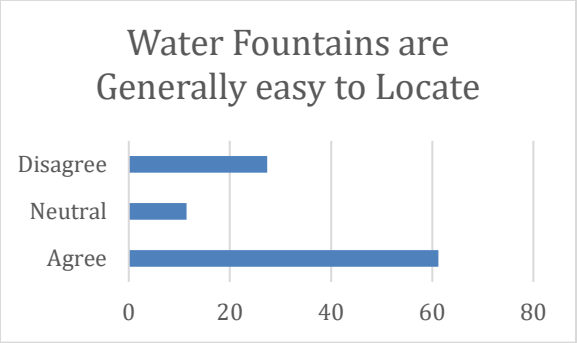

Figure 9: Student populations response to the ease of locating fountains on the UBC campus.

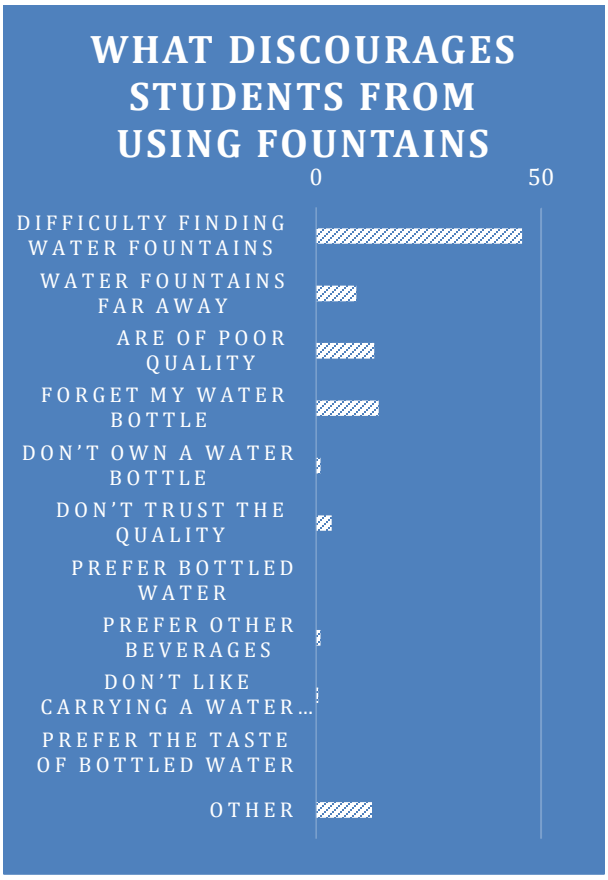

Figure 10: What discouraged the student population from using water fountains

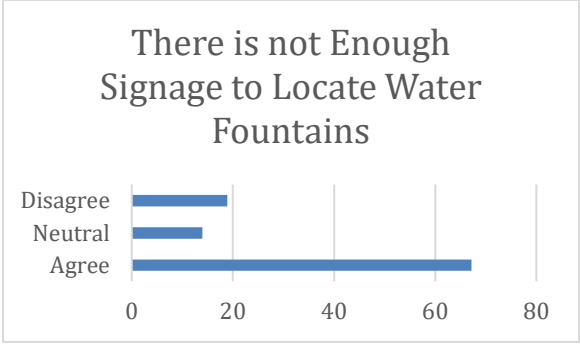

Figure 11: Student populations response to if there is enough wayfinding signage to help them locate fountains across campus

Furthermore, almost 70 percent of respondents agreed that there is not enough signage to help them locate water fountains. In contrast, several students listed in the survey that signage would be a huge factor in aiding them in finding fountains. Some students stated that they could not find fountains in certain buildings and had to go

to the next closest one to refill their water. In the worst case, students stated they would refill their bottles in the washroom sink which they found to be inefficient or unhygienic. Therefore, there were some contrary results from our survey especially when it came to signage and locating fountains.

Participant Observation

We found a total of 166 fountains within our field area of study within the UBC campus. We found that only 52 of the buildings we entered had water fountains. To understand which buildings on campus had better fountains in terms of our measures of accessibility, quality, and cleanliness we used an aggregated scoring method. It is important to note certain buildings, for example, Frank Forward (Mining Engineering) and Douglas T. Kenny (Psychology), did not contain any fountains and instead had their water coolers which were refilled via large water jugs that had been purchased, or had vending machines in place of water fountains. Some fountains included refill stations such as the ones located in cafes in CIRS and Henry Angus. This affected the scoring results of certain buildings as we could only score those fountains on its refill ability. In our ethnography, we noticed that certain parts of the campus had better performing and scoring fountains than others. For example, the Engineering buildings and the south side of campus (south of University Boulevard), were quite low in terms of accessibility, quality, and overall scoring. The Engineering buildings such as MacLeod and Kaiser had outdated fountains, low or non-existent water pressure, tasted off, and some of them had signs of oxidation. Overall, the best quality fountains were the Elkay EZH2O fountains located on campus, which could be found in newer buildings, high traffic buildings, and on the north side of campus such as Irving K. Barber Learning Centre, the War Memorial Gym, and the Robert H. Lee Alumni Centre.

Buildings and Fountains of Note

Below are buildings and fountains (individual ones or multiple we found in the same building) that we have noticed during our field research that is of significant notice as they were scored rather low. These fountains, we believe, should be looked at for maintenance, upgrading, or even a replacement.

Figure 12: Fred Kaiser Building, 3rd, and 4th floor fountain:

- Both fountains are located by the washrooms (same layout across both floors).
- 4th floor fountain's pressure is low.
- Water tastes off in both fountains located in this building.

Figure 12.1 (L) & Figure 12.2 (R) - Fred Kaiser, 3rd floor (L) and 4th floor (R), Fred Kaiser Building

Figure 12.3 - Fred Kaiser, 4th floor fountain, taken at a different angle shows signs of oxidation on the bowl and the drinking spout.

Figure 13: MacLeod Building, 2nd floor fountains (near Room 214 and Room 249)

- The building is to be fully renovated meaning these fountains will be upgraded.
- Signs of oxidation apparent on the fountain.
- Drinking spout head is missing.
- Both have extremely low water pressure to the point where it is near impossible to drink from without touching the drinking spout.
- Both are located beside waste bins which is a bit unsanitary.

Figure 13.1 and 13.2 - MacLeod, 2nd floor fountain (Room 214) taken at different angles facing the waste bins

Figure 14: Hugh Dempster, 1st floor, by the washrooms

- The fountain has no refill spout.
- Fountain's water tasted rather off (water had a plastic taste).
- The water temperature was lukewarm even after running it for more than 10 seconds to see if there was a noticeable difference in taste.

Figure 14.1 - Hugh Dempster, 1st floor fountain, photo taken facing towards the elevator

Figure 15: Food and Nutritional Health Building (Basement and 2nd Floor)

- The fountain is located on the lower floor (basement).
- Both Fountains had a strange taste when tested. A staff member also warned us to avoid using the fountain and instead use the lounge water dispenser.
- Both are obscured and not easily located.
- No refill spout for either fountain.

Figure 15.1 (L) and 15.2 (R) - Food and Nutritional Health Building, Figure 4.1 located in the basement floor, Figure 4.2 located beside the administration office

Figure 16: Brock Hall, 1st floor by the men's washroom

- Fountain showed signs of oxidation and was unclean.
- Had low water pressure.
- The fountain water was warm and tasted bad.
- Several of the water fountains at Brock Hall Annex also had an odd taste with an oxidizing spout.

Figure 16.1 - Brock Hall, 1st floor by the men's washroom

SIGNIFICANCE OF PROPOSED RESEARCH

Given that existing literature or research regarding student behaviors and factors influencing indoor water fountain use on UBC campus remains rather limited, our research will greatly help gain insight into such gaps in research. Data collected from our online survey regarding background behavioral factors influencing water fountain usage may help directly in improving targeted campaigns and workshops such as Water Action Plan and Healthy Beverage Initiative objectives. While data collected through our online survey is limited and not as exhaustive due to the limited amount of questions we could include and limited time, we hope to use data collected on our online survey as a departure point, as something future studies and research on student behaviors influencing fountain usage can build upon. Such a massive demographic and diversity of students at UBC will require more detailed and extensive research to attain more concrete findings.

Other results from our online survey include student recommendations, which is direct feedback from the population that utilizes such water fountains. Having such valuable first-hand feedback allows us to hone in directly on specific problems from certain buildings. While our conducted fieldwork in updating the inventory list of water fountains did survey the state of every fountain on our list, such direct feedback from students will only help in reiterating which fountains are in urgent need of fixing, upgrades, or changing, etc. Feedback received can also be tallied to see which buildings are considered priority buildings in need of fountain upgrades. Such recommendations from students will directly help in improving the state of water fountains on the UBC campus.

Lastly, given the last comprehensive inventory list of indoor water fountains on the UBC campus was compiled seven years ago (Cheng, 2013), an update is long overdue. Updating the inventory list of indoor water fountains helps as a master list with assessing the current state of water fountains on campus, fountains in need of upgrades, etc. Furthermore, when compared with the 2013 inventory list, we can see whether certain fountains have improved, or retrogressed over these seven years. Having an updated inventory list and feedback from students on the survey can help to see if previous contributions by water fountain projects have made a considerable impact.

CONCLUSIONS AND RECOMMENDATIONS

Based on our findings, several upgrades should be done to ensure optimal usage of water fountains on campus. Certain fountains on campus were unhygienic, needed refill spouts, or had low water pressure thus not being used. We also suggest having more refill locations, since many students mentioned difficulties in refilling their bottles via the drinking spouts, or (worst case) via washroom sinks. This matched our observation notes as we did find fountains that were oxidized, hard to refill bottles with, or did not work at all. We also noticed that there was inconsistency across buildings where we were able to find refill spouts regardless if they were newer or older buildings. Some buildings, such as Biological Sciences, had no refill spouts on any fountains. We also noticed that older

fountains, particularly ceramic or plastic types, had lower water pressure, poorer user ergonomics, and were oxidized. We suggest that these older fountains be upgraded to newer models.

There were certain buildings in which fountains were in low traffic locations in the building, such as the top floor or the basement. Most students entering a building would usually look for one near the entrance or the washrooms (high-traffic locations) and would thus miss fountains in low traffic locations. Students also mentioned this difficulty when trying to locate fountains. Often, these locations would have low student traffic as there were no classrooms, study spaces, or lecture halls in these locations. On the contrary, we also found buildings where there was a singular fountain at a high traffic location such as the main entrance, but none throughout the rest of the building. This suggests fountains should be placed more equally in optimal locations. Buildings where we found optimal layouts included the Geography Building, the Nest, and Allard Hall, where there was at least one fountain on every floor, or it had fountains in higher traffic locations. Overall, more fountain installations on campus are suggested as certain buildings have an uneven distribution, especially high traffic ones, like Buchanan which only had four in total.

During our ethnography, we found it difficult to locate fountains, as most lacked maps or signs and thus we had to ask for directions from peers or staff when we were unable to find a fountain on our own. Similar opinions were shared by students in our survey results. Suggestions to improve wayfinding include having a map with fountain locations indicated. This also correlates to previous SEEDS projects regarding signage being effective (Sané et al., 2018). Due to lack of signage and wayfinding aids, we may have missed fountains especially in buildings where we found none, causing us to go back and do a second sweep of the building (in which we would sometimes find fountains). Due to this experience, we recommend having wayfinding maps with water fountain icons to support student's locating of water fountains.

In addition to increasing signage, we suggest creating an interactive app that shows fountain locations across campus. This would be a convenient access point for students and can be more easily updated than building maps. Key features we recommend to be included in the interactive map is marking which fountains on campus have bottle refilling capabilities so students know if they can refill their bottles easily. We also suggest that the map application have more than just water fountains on it if we wish to see a sizable number of students using it. We recommend the map be a UBC guide for not just water fountains, but also washrooms, specific waste bins (such as compost, battery recycling), or other student utilities and services on campus. This can be created in collaboration with other SEEDS projects or even as a cross-departmental project. Moreover, the app could have the potential to crowdsource information and provide an easier way for users to report faulty equipment and cleanliness. This project can serve two purposes of increasing accessibility while mitigating the immediate need to install fountains in buildings that do not currently have water fountains. As we have found that students are concerned about the lack of water fountains within their buildings. While installing new fountains may not be in the budget, creating an app may be

able to satisfy that need in the meantime as students can use it to locate water fountains in buildings near them.

Some suggestions brought up by students included making the fountains and signs more colorful or noticeable by letting students decorate them, have a refillable non-water drink tap like the one CIRS temporarily had in their lobby. Other student suggestions included a temperature check since cold water was preferred to warm water. During our ethnography, we observed that water temperatures were inconsistent throughout campus. We noticed warm or off-tasting water correlated with the location of the fountain (piping) or the water sitting in the pipes for too long. This requires the user to run it for a while before noticing changes in taste and temperature. This was more noticeable in fountains that were not used often or harder to locate. However, with the large scope of the project, we were unable to test all fountains to see how running the water for different durations of time may improve the project.

Students and faculty had raised concerns about lead in the drinking water. To address hygiene and safety concerns we recommend that quality assurance signs or stickers be placed on water fountains to show they are safe to use. It may also be helpful to include when the last inspection of the fountain was conducted so users can feel safer.

FUTURE RESEARCH DIRECTIONS

For future projects, qualitative and anecdotal interviews might give us more insight into certain buildings or faculties on their opinions regarding the water fountain quality in UBC. During our participant observation fieldwork, we came across several curious passersby who gave anecdotal insight in person. For example, when we tested the fountains in the Food and Nutritional Health Building staff told us not to use the fountains and instead use their water cooler because the quality of the fountains was bad. Anecdotal insight such as this opened a new line of inquiry: if we had time to interview people on campus would it uncover more details that can assist in our research?

If future projects plan to use our ethnography measures and process to do inventories, we recommend they test the taste and pressure of refill spouts as we have found the drinking spout and refill spout can vary greatly in these measures.

Moreover, our survey was limited to a certain amount of questions, and so we were unable to investigate all our inquiries. We have provided those questions and topics below for future projects to utilize.

1) Is there a difference between commuters and students who live on campus with regards to bringing and using a reusable water bottle.
2) If non-water beverages such as soft drinks, caffeinated beverages, or bubble tea affect the amount of waste created on campus.
3) Due to the recent COVID-19 outbreak, a small number of students voiced concerns about using water fountains; we were, therefore, wondering if future water fountain usage will significantly decrease due to COVID-19?
4) The length of being a student at UBC (years on campus) in correlation to the knowledge of fountain location and which

fountains are preferred by them versus newer students and how they handle finding and using fountains. We suggest that students be asked to draw a mental map on fountain locations they know of between first years and higher-level students.

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Appendices

Appendix (I)

Survey Questionnaire - UBC Survey Tool Qualtrics

SEEDs Water Fountain Survey

Block 2

This **5 minute** questionnaire is conducted by a *GEOG 371 student team* in partnership with the *SEEDS Sustainability Program and UBC Sustainability and Engineering* to better understand water fountain usage on campus. Your answers will help us improve existing water fountains on campus and increase accessibility and promote healthier beverage choices on Campus.

By completing this survey you also have the chance to win a **$50 gift card to the UBC Bookstore**. To be entered please include your email at the end of this survey.

SEEDS Water Quality

What Faculty are you in?

How long have you been studying at UBC?

- 1 Year
- 2 Years
- 3 Years
- 4 Years
- 5+ Years
- Graduate
- Post-Graduate

Are you an International or Domestic Student?

- International Student
- Domestic Student

Did you grow up outside of British Columbia?

- Yes
- No

What Continent did you grow up on?

At home when I drink water, I usually:

- Drink water that has already been boiled
- Filter tap water before drinking (Water filter pitcher, Faucet filters, Refrigerator water dispensers, etc.)
- Drink water straight from the tap (no filtration, or boiling)
- Purchase water (Jugs, Bottled, etc)
- Other

How often do you use a reusable water bottle on campus?

- Always
- Most of the time
- About half the time
- Sometimes
- Never

In general, how often do you buy bottled water on campus?

- ○ Always
- ○ Most of the time
- ○ About half the time
- ○ Sometimes
- ○ Never

How often do you buy other beverages on campus (e.g bubble tea, soda, juice, energy drinks, tea based, coffee, etc.)?

- ○ Always
- ○ Most of the time
- ○ About half the time
- ○ Sometimes
- ○ Never

What discourages you from drinking water from fountains/bottle refilling stations? Please choose all that apply to you.

- ☐ Difficulty finding the water fountains and refill stations
- ☐ Water fountains are too far usually
- ☐ Fountains are of poor quality in my buildings I frequent (e.g bad water pressure, poor water quality, etc.)
- ☐ I forget to bring my reusable bottle
- ☐ I don't own a reusable water bottle
- ☐ I don't trust the quality and cleanliness of the water fountains
- ☐ I prefer bottled water
- ☐ I prefer soft drinks and other drinks to water
- ☐ I don't like carrying a water bottle around
- ☐ I prefer the taste of bottled water over fountain water
- ☐ Other

Please indicate how much you agree or disagree with the following statements:

	Strongly agree	Agree	Somewhat agree	Neutral	Somewhat disagree	Disagree	Strongly disagree
"Bottled water is safer than water from water fountains"	O	O	O	O	O	O	O
"Bottled water is healthier than water from water fountains"	O	O	O	O	O	O	O
"I prefer to drink from water fountains than bottled water"	O	O	O	O	O	O	O
"UBC campus water fountains are usually kept clean (of debris, gunk, etc)"	O	O	O	O	O	O	O

Please indicate how much you agree or disagree with the following statements:

	Strongly agree	Agree	Somewhat agree	Neutral	Somewhat disagree	Disagree	Strongly disagree
"UBC campus water fountains are in general easy to locate"	O	O	O	O	O	O	O
"There is not enough signage to help me locate water fountains on campus"	O	O	O	O	O	O	O
"Reusable water bottles are better for the environment."	O	O	O	O	O	O	O
"I only buy bottled beverages when I don't have my water bottle on hand."	O	O	O	O	O	O	O

GEOG371: SEEDS FINAL REPORT

What student buildings do you frequent?

Do you have any other comments or suggestions you would like to share with us regarding indoor water fountains?

If you would like to get a chance to win a **$50 gift card to the UBC Bookstore** please provide us with your email below:

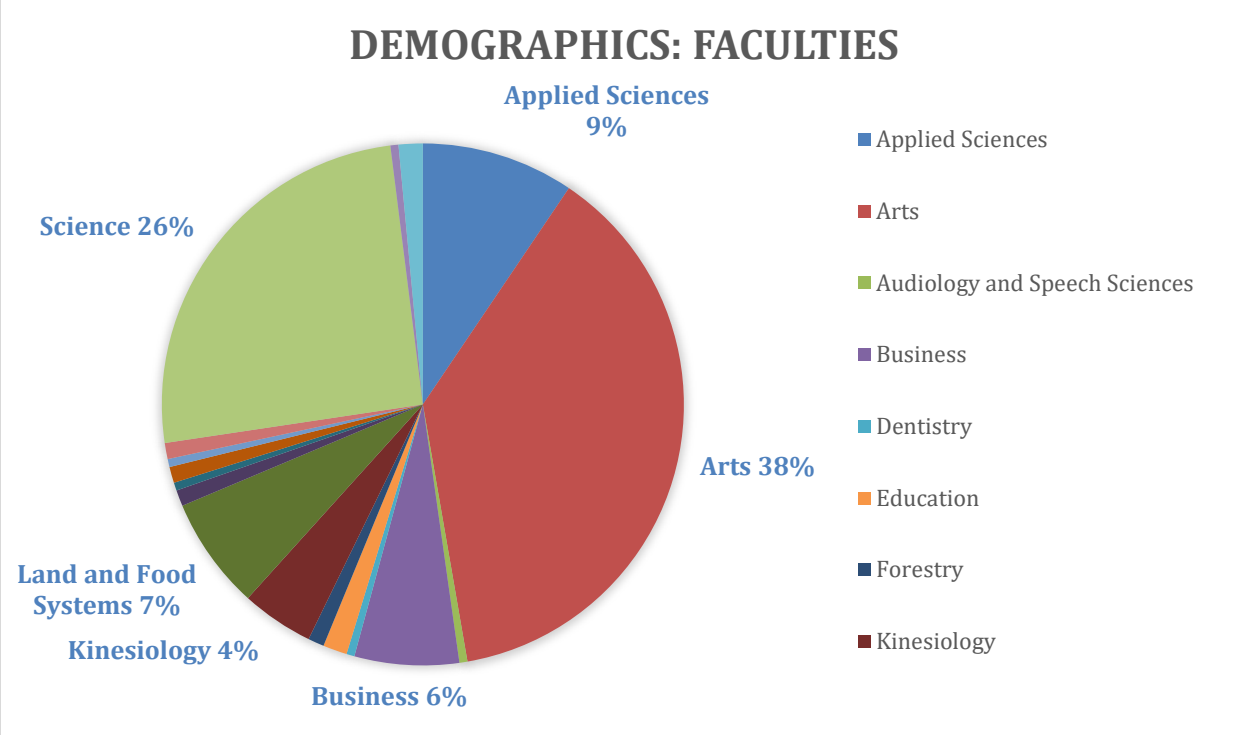
Block 1

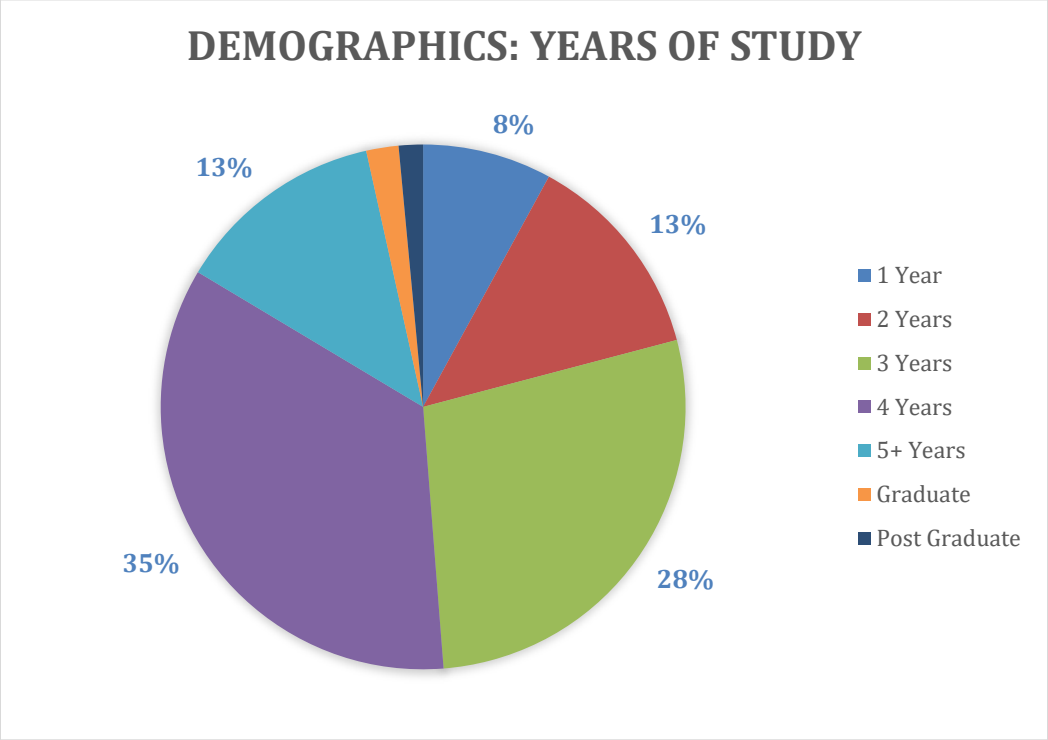
Thank you for participating in the **UBC SEEDS indoor water fountain project**! Your answers will help us in understanding water fountain usage on campus. Through your answers, we aim to increase water fountain accessibility and consumption in promoting healthier beverage choices on campus.

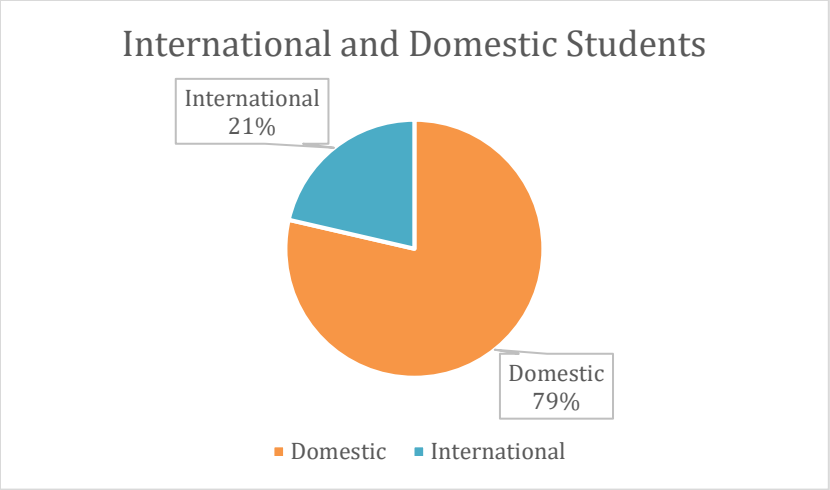
For more information please visit: https://sustain.ubc.ca/teaching-applied-learning/seeds-sustainability-program

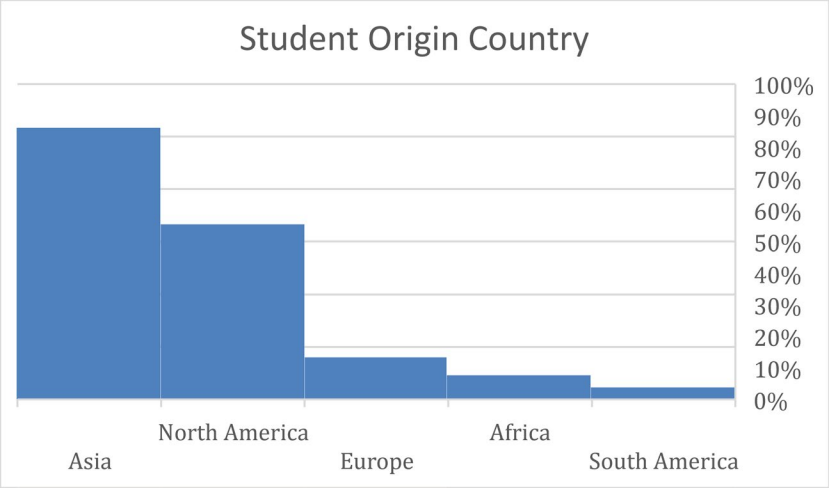
Appendix (II)

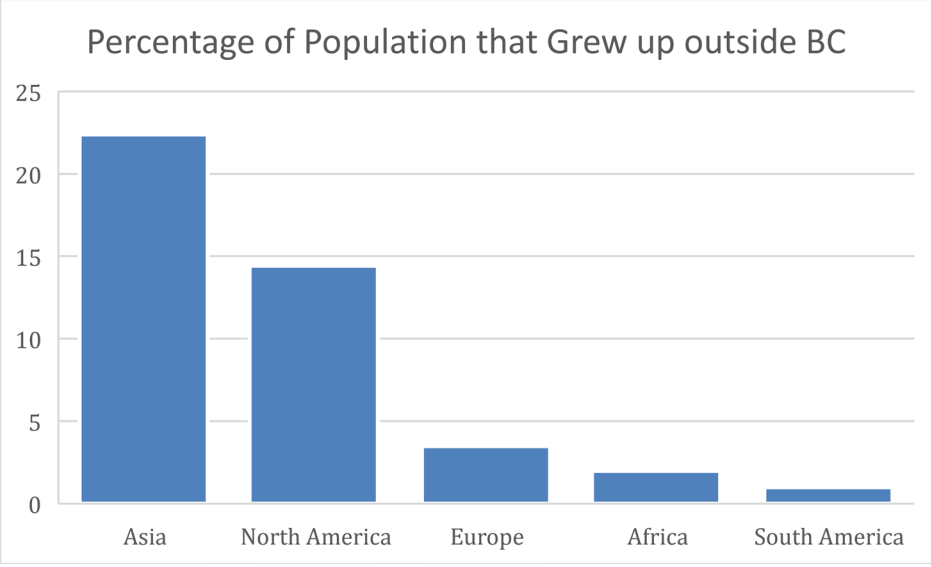
Survey Demographics and Results

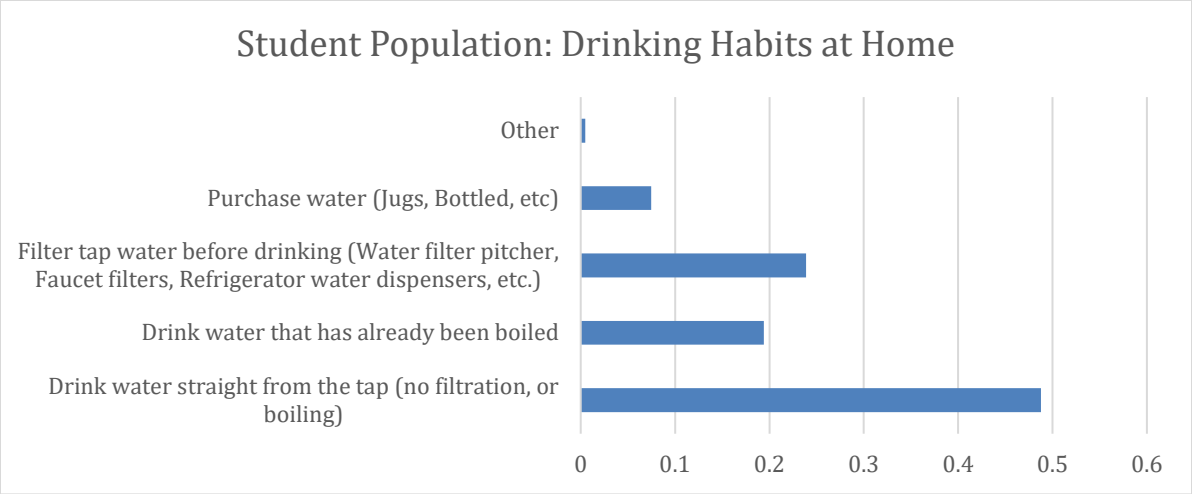


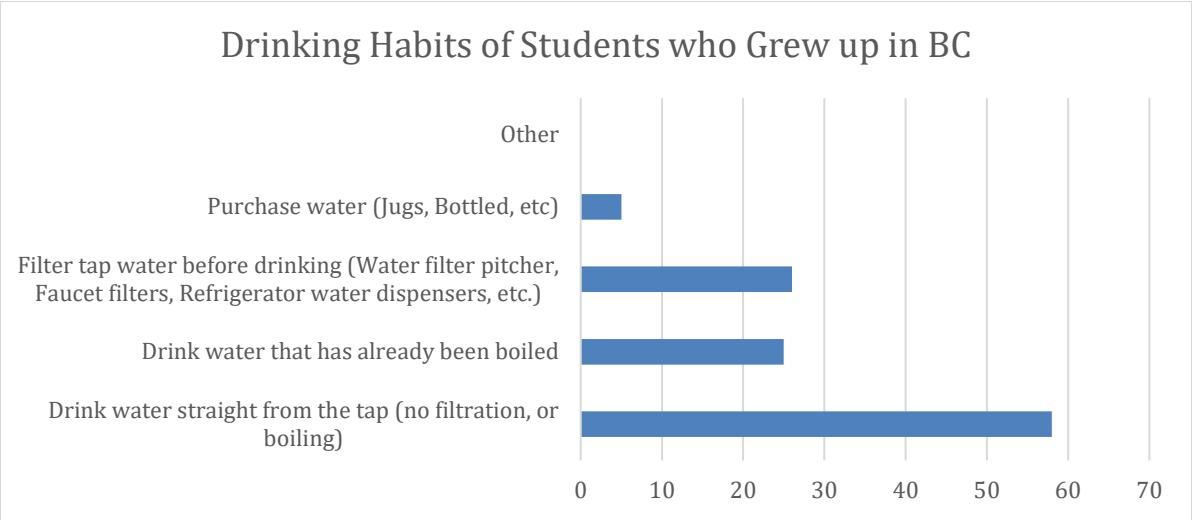


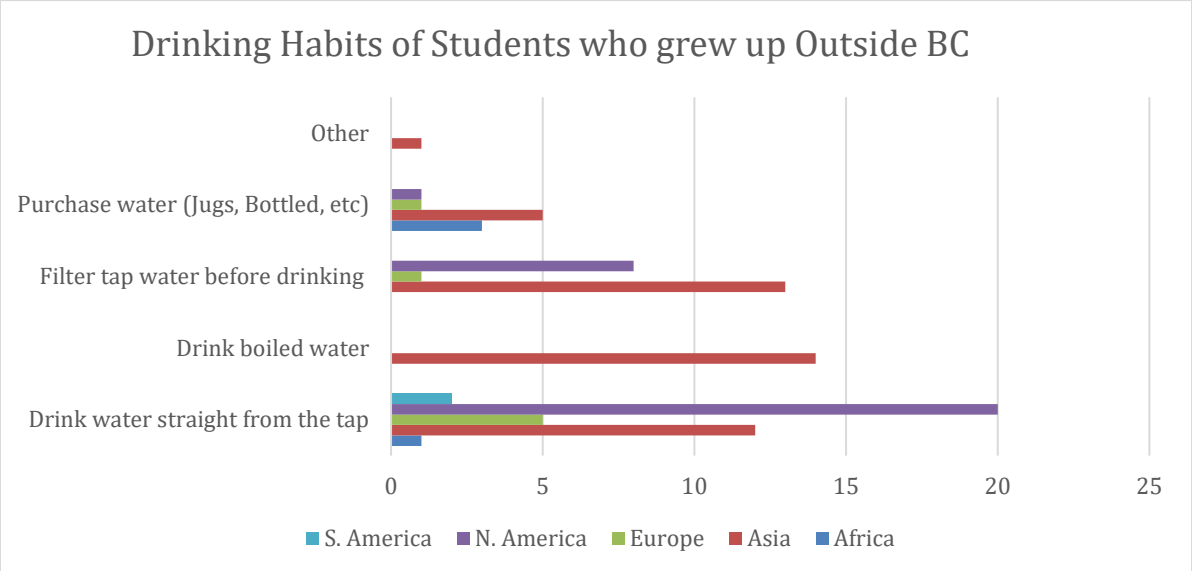

International and Domestic Students
International 21%
Domestic 79%
Domestic
International

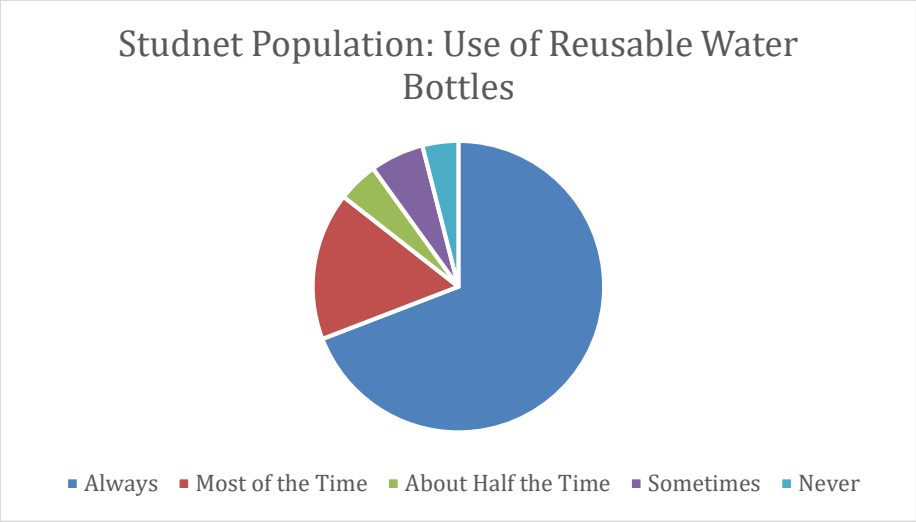

Student Origin Country
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Asia
North America
Europe
Africa
South America

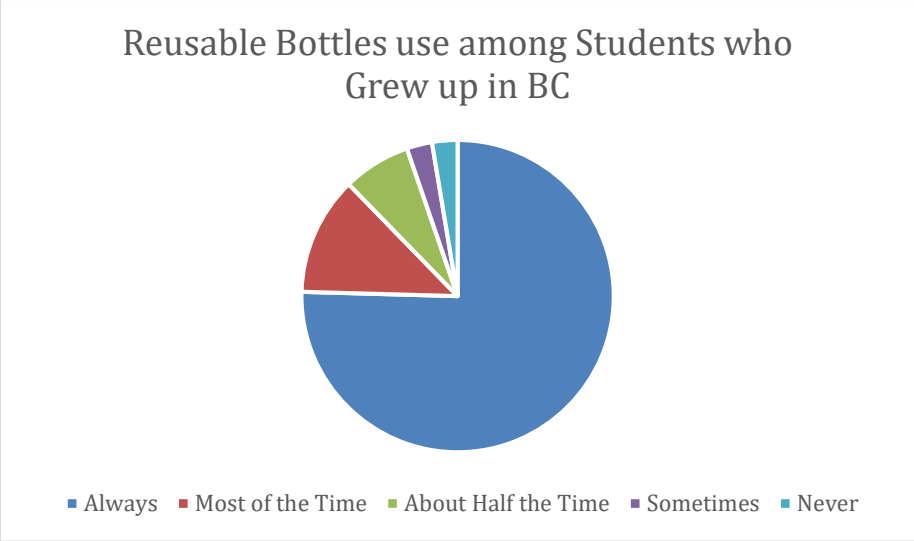

Percentage of Population that Grew up outside BC
25
20
15
10
5
0
Asia
North America
Europe
Africa
South America

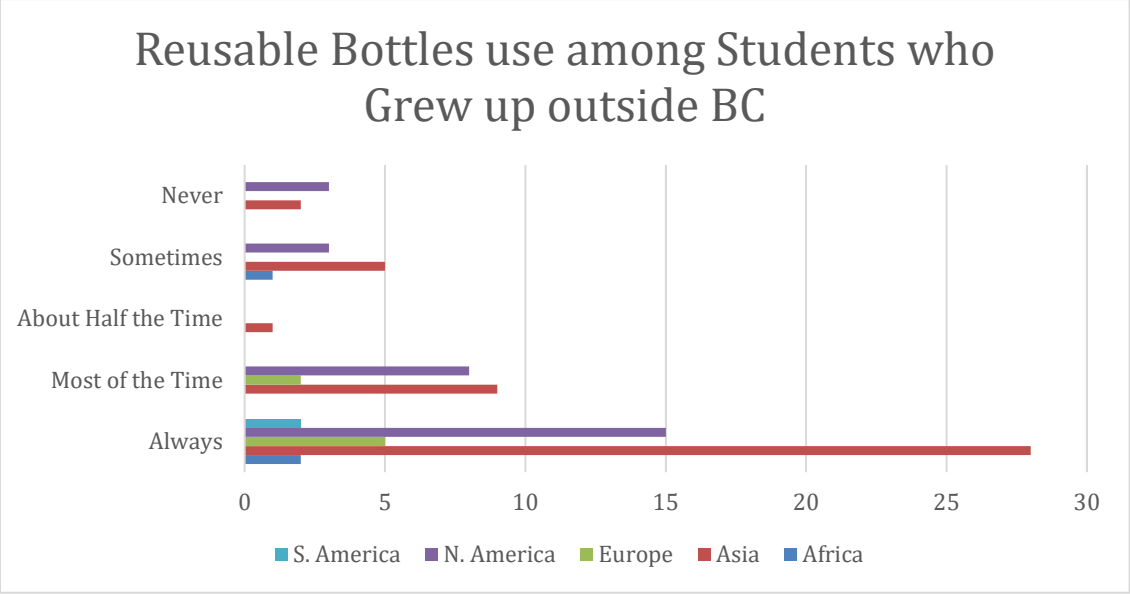

Student Population: Drinking Habits at Home
Other
Purchase water (Jugs, Bottled, etc)
Filter tap water before drinking (Water filter pitcher, Faucet filters, Refrigerator water dispensers, etc.)
Drink water that has already been boiled
Drink water straight from the tap (no filtration, or boiling)
0
0.1
0.2
0.3
0.4
0.5
0.6

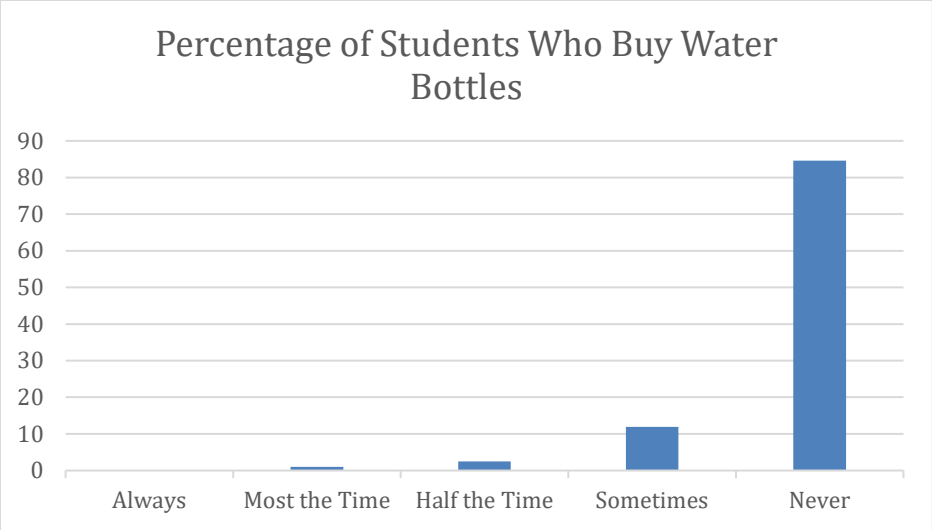

Drinking Habits of Students who Grew up in BC
Other
Purchase water (Jugs, Bottled, etc)
Filter tap water before drinking (Water filter pitcher, Faucet filters, Refrigerator water dispensers, etc.)
Drink water that has already been boiled
Drink water straight from the tap (no filtration, or boiling)
0
10
20
30
40
50
60
70

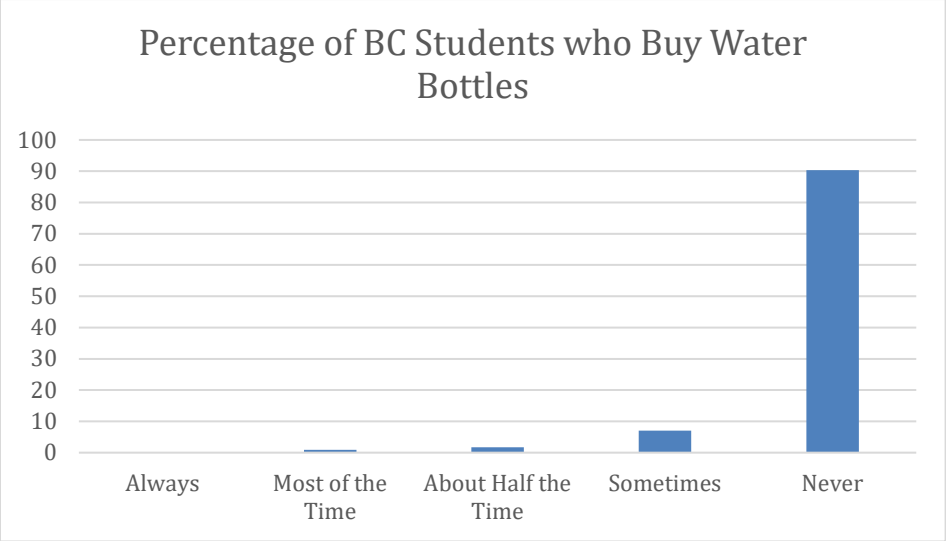

Drinking Habits of Students who grew up Outside BC
Other
Purchase water (Jugs, Bottled, etc)
Filter tap water before drinking
Drink boiled water
Drink water straight from the tap
0
5
10
15
20
25
S. America
N. America
Europe
Asia
Africa

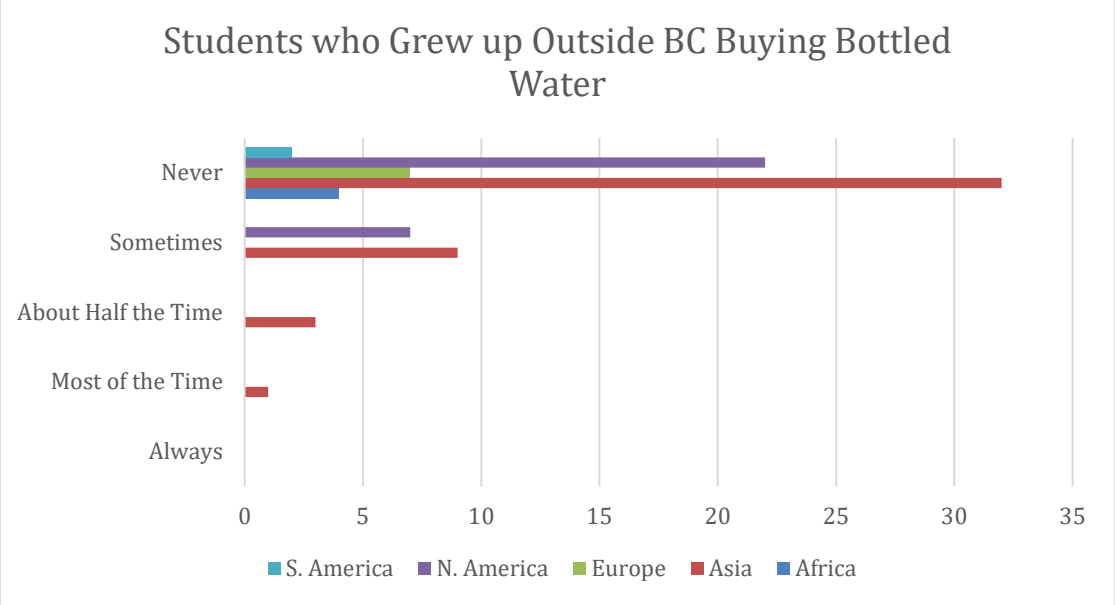

Studnet Population: Use of Reusable Water Bottles
Always
Most of the Time
About Half the Time
Sometimes
Never

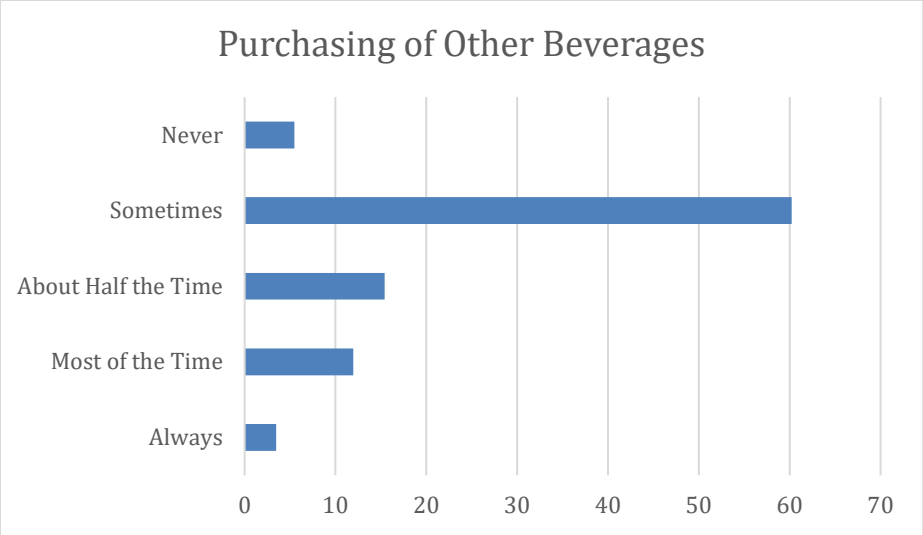

Reusable Bottles use among Students who Grew up in BC
Always
Most of the Time
About Half the Time
Sometimes
Never

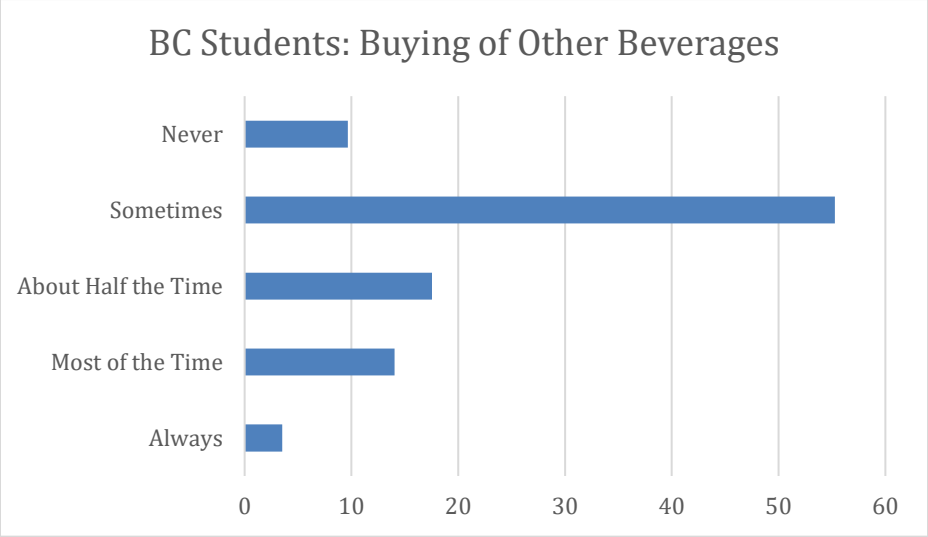

Reusable Bottles use among Students who Grew up outside BC
Never
Sometimes
About Half the Time
Most of the Time
Always
0
5
10
15
20
25
30
S. America
N. America
Europe
Asia
Africa

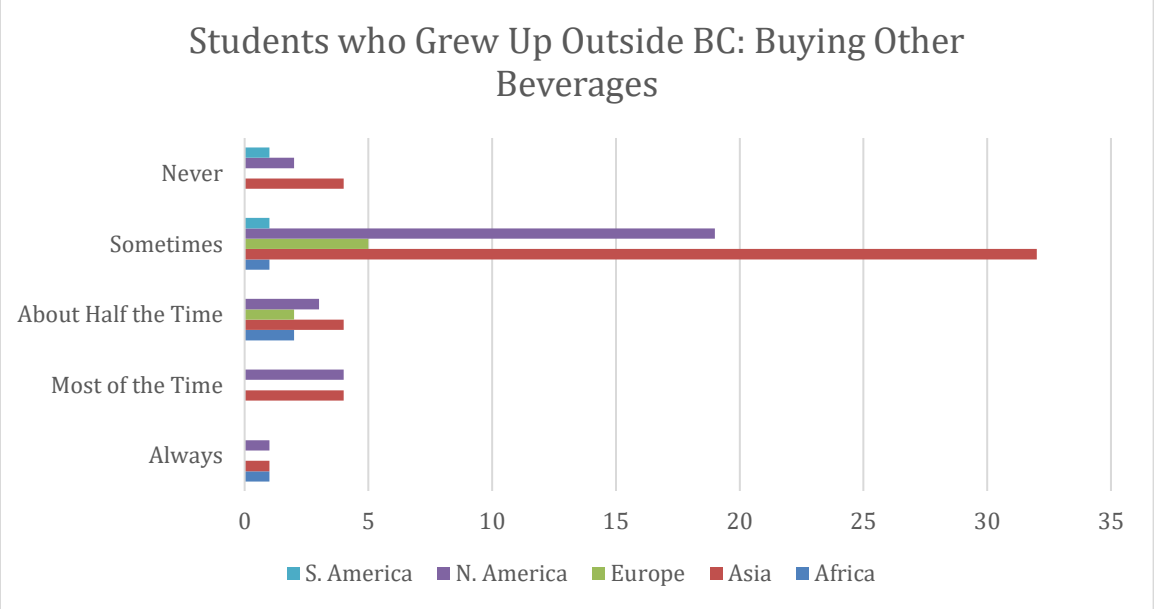

Percentage of Students Who Buy Water Bottles
90
80
70
60
50
40
30
20
10
0
Always
Most the Time
Half the Time
Sometimes
Never

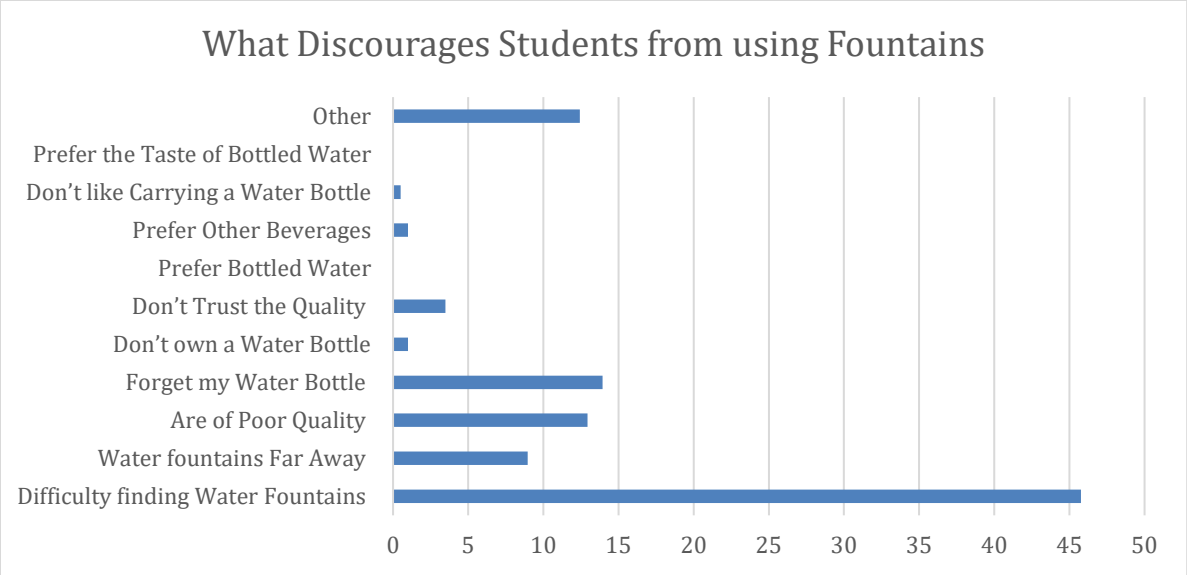

Percentage of BC Students who Buy Water Bottles
100
90
80
70
60
50
40
30
20
10
0
Always
Most of the Time
About Half the Time
Sometimes
Never

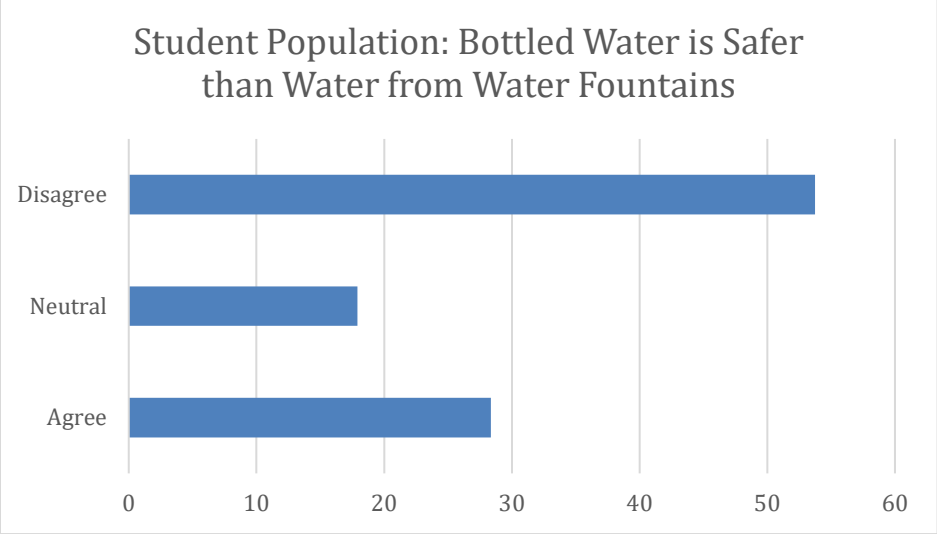

Students who Grew up Outside BC Buying Bottled Water
Never
Sometimes
About Half the Time
Most of the Time
Always
0
5
10
15
20
25
30
35
S. America
N. America
Europe
Asia
Africa

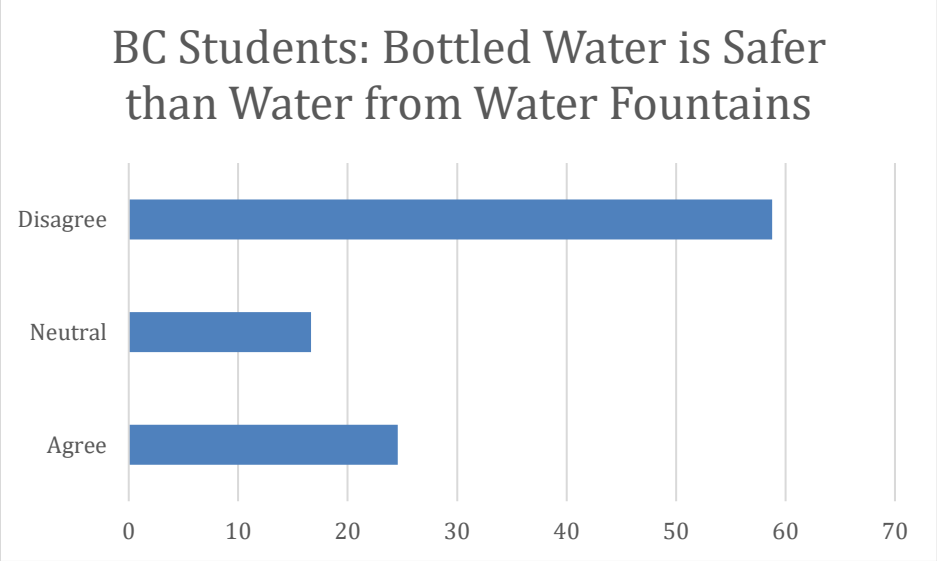

Purchasing of Other Beverages
Never
Sometimes
About Half the Time
Most of the Time
Always
0
10
20
30
40
50
60
70

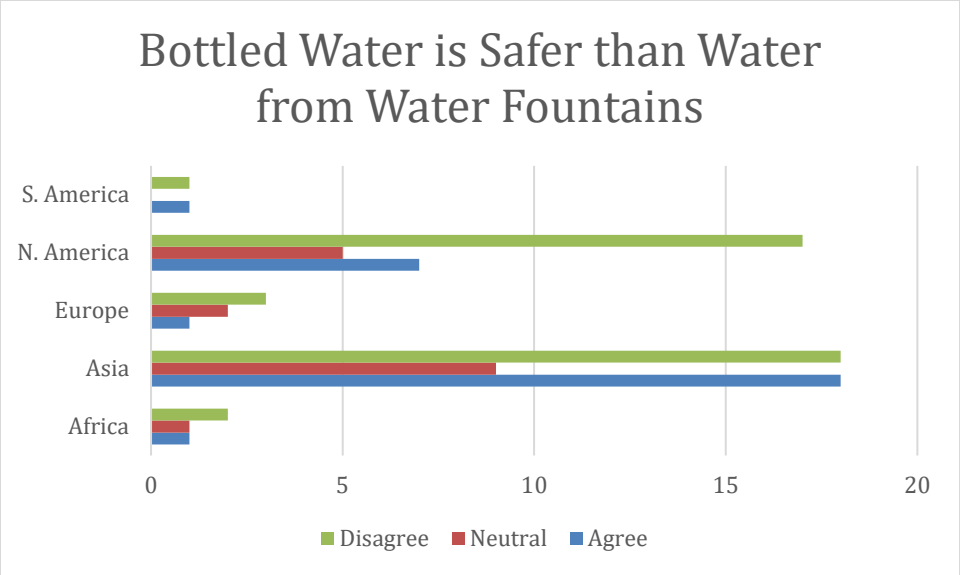

BC Students: Buying of Other Beverages
Never
Sometimes
About Half the Time
Most of the Time
Always
0
10
20
30
40
50
60

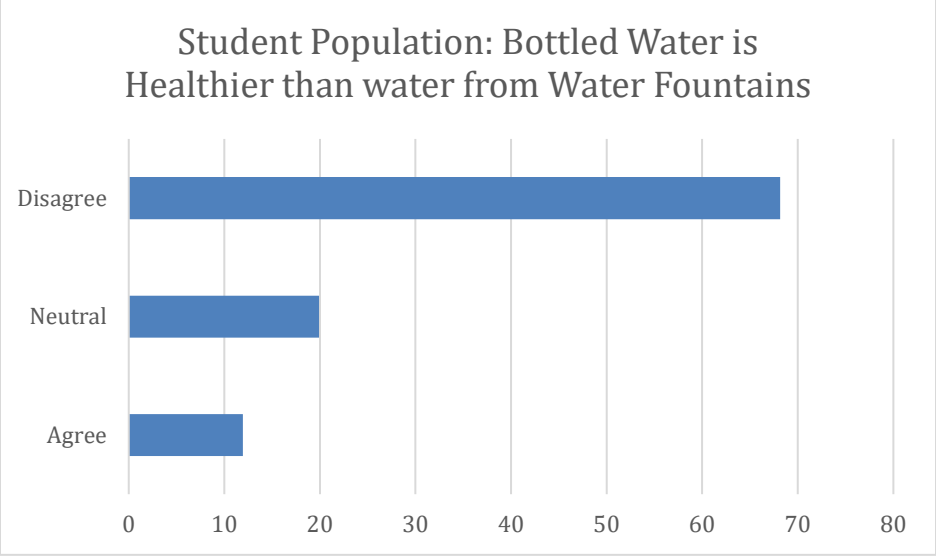

Students who Grew Up Outside BC: Buying Other Beverages
Never
Sometimes
About Half the Time
Most of the Time
Always
0
5
10
15
20
25
30
35
S. America
N. America
Europe
Asia
Africa

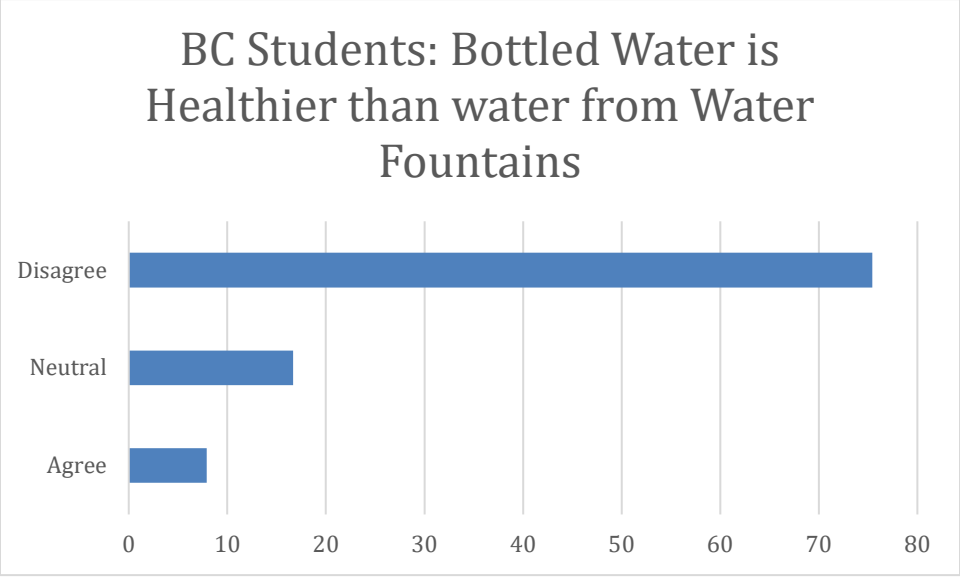

What Discourages Students from using Fountains
Other
Prefer the Taste of Bottled Water
Don't like Carrying a Water Bottle
Prefer Other Beverages
Prefer Bottled Water
Don't Trust the Quality
Don't own a Water Bottle
Forget my Water Bottle
Are of Poor Quality
Water fountains Far Away
Difficulty finding Water Fountains
0 5 10 15 20 25 30 35 40 45 50

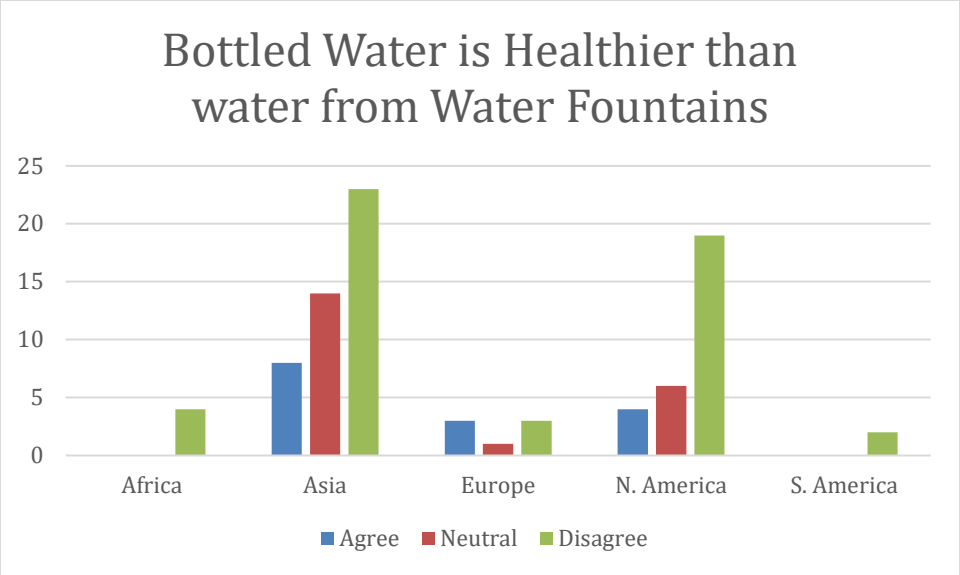

Student Population: Bottled Water is Safer than Water from Water Fountains
Disagree
Neutral
Agree
0 10 20 30 40 50 60

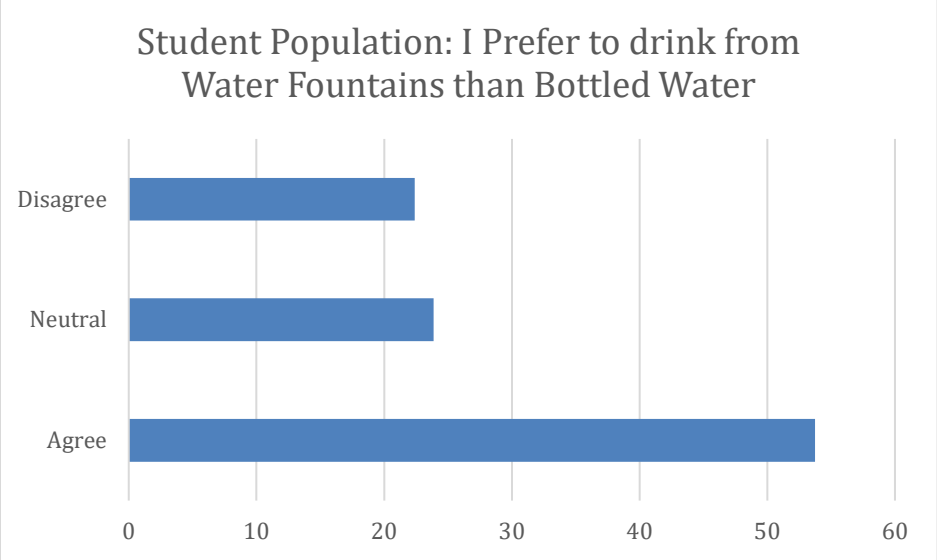

BC Students: Bottled Water is Safer than Water from Water Fountains
Disagree
Neutral
Agree
0 10 20 30 40 50 60 70

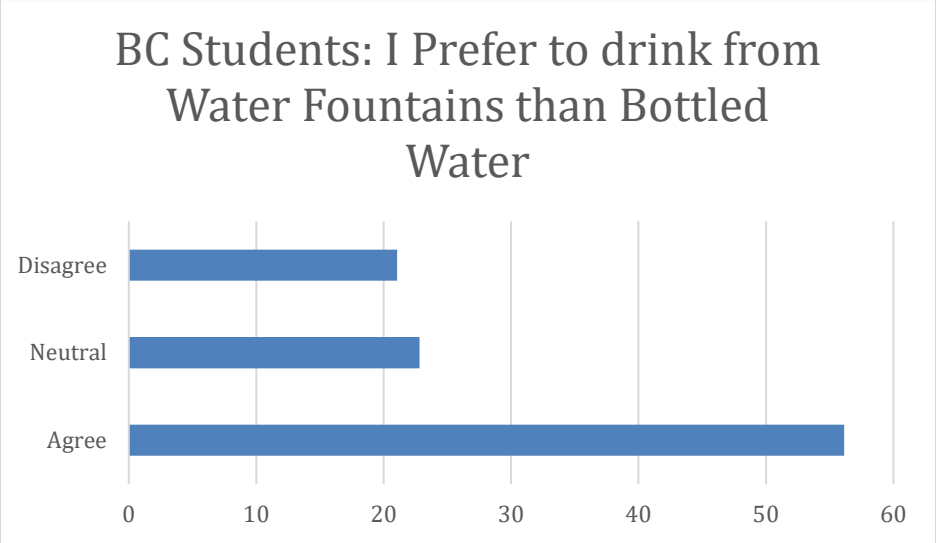

Bottled Water is Safer than Water from Water Fountains
S. America
N. America
Europe
Asia
Africa
0
5
10
15
20
Disagree
Neutral
Agree

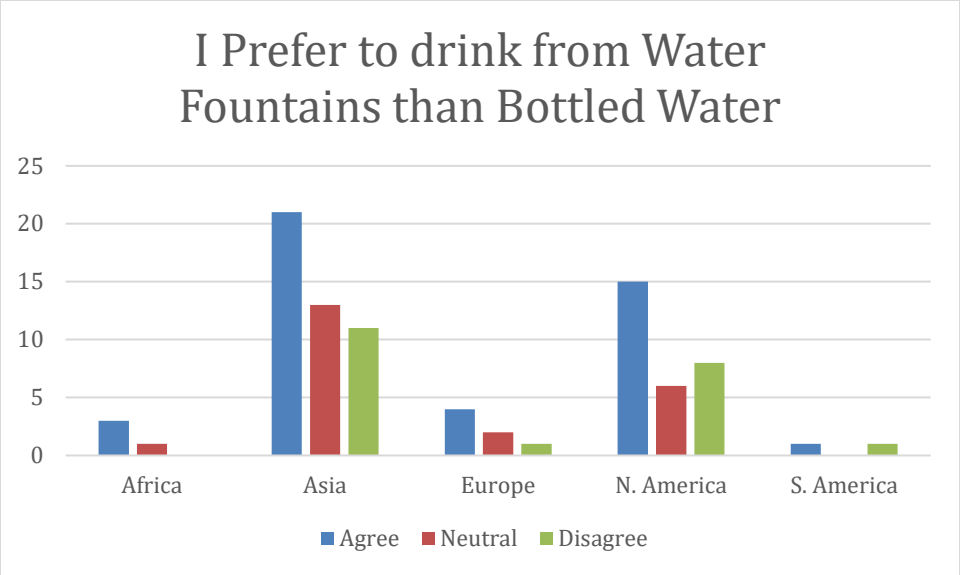

Student Population: Bottled Water is Healthier than water from Water Fountains
Disagree
Neutral
Agree
0
10
20
30
40
50
60
70
80

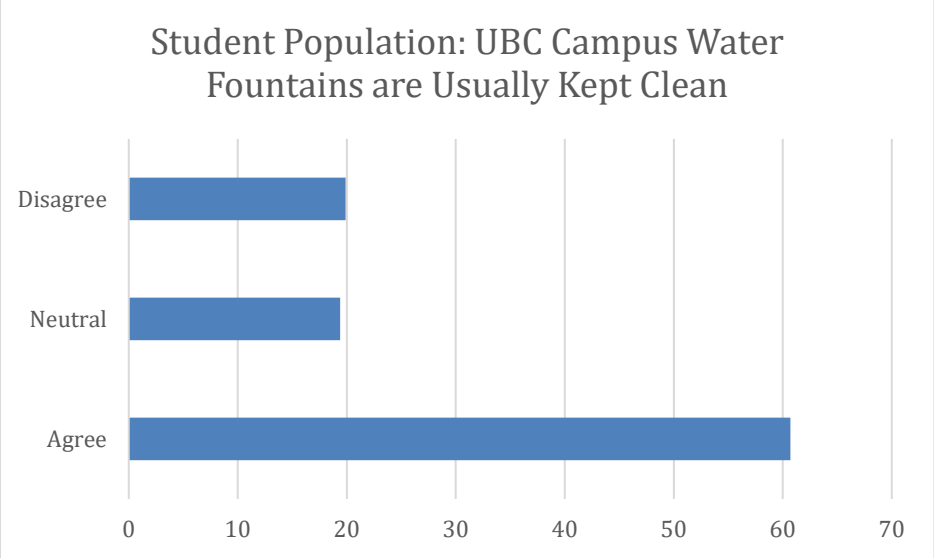

BC Students: Bottled Water is Healthier than water from Water Fountains
Disagree
Neutral
Agree
0
10
20
30
40
50
60
70
80

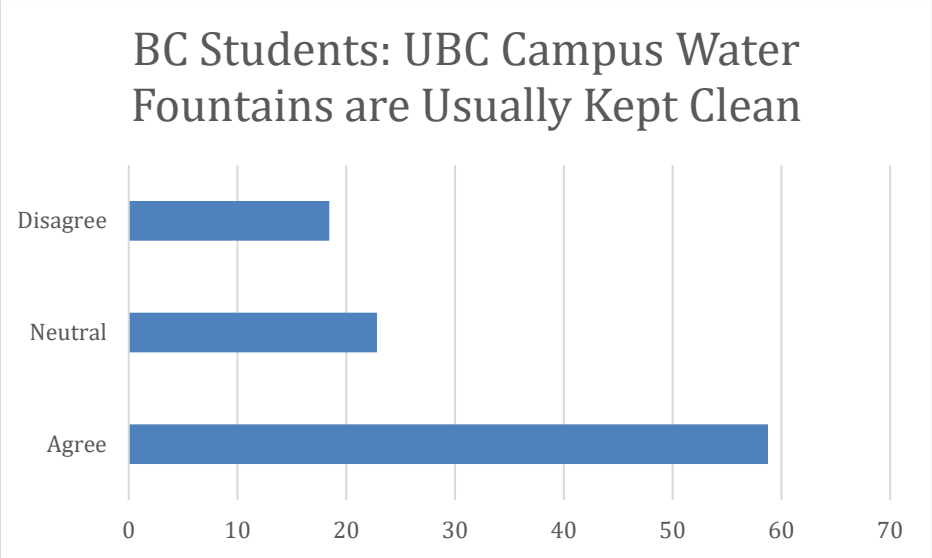

Bottled Water is Healthier than water from Water Fountains
25
20
15
10
5
0
Africa
Asia
Europe
N. America
S. America
Agree
Neutral
Disagree

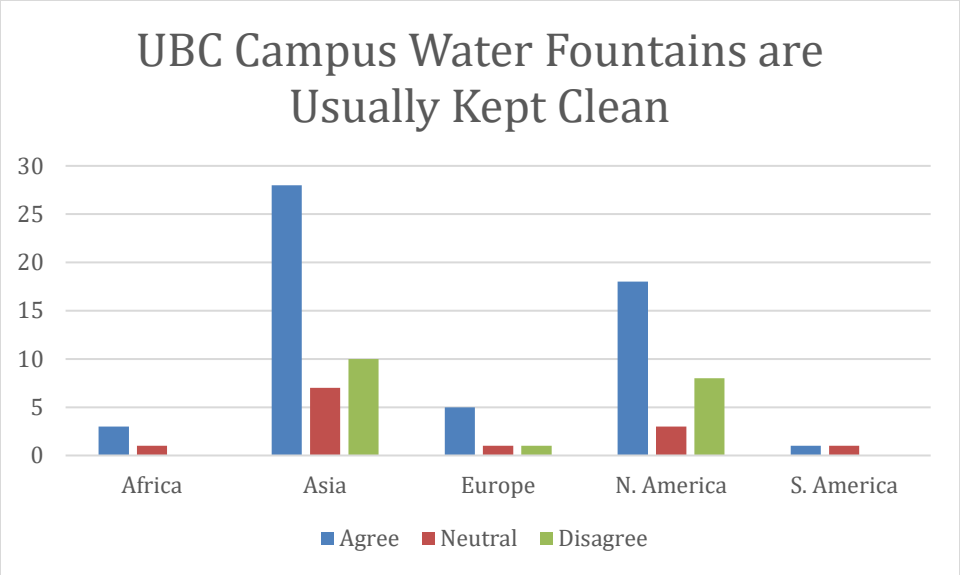

Student Population: I Prefer to drink from Water Fountains than Bottled Water
Disagree
Neutral
Agree
0
10
20
30
40
50
60

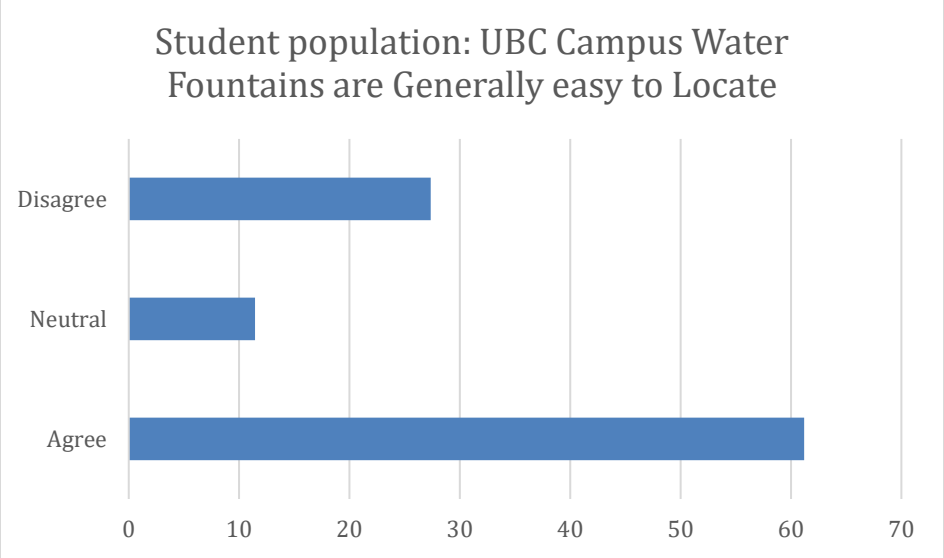

BC Students: I Prefer to drink from Water Fountains than Bottled Water
Disagree
Neutral
Agree
0
10
20
30
40
50
60

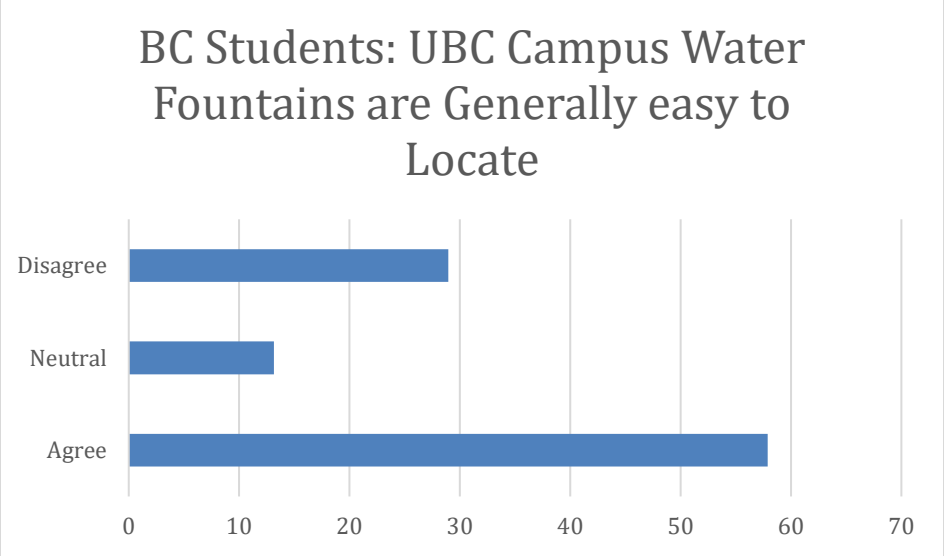

I Prefer to drink from Water Fountains than Bottled Water
25
20
15
10
5
0
Africa
Asia
Europe
N. America
S. America
Agree
Neutral
Disagree

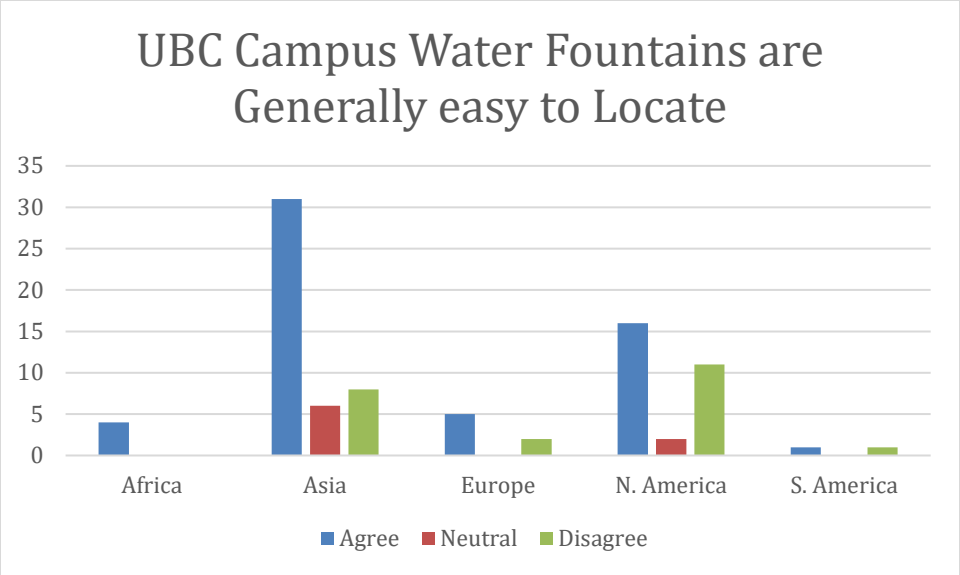

Student Population: UBC Campus Water Fountains are Usually Kept Clean
Disagree
Neutral
Agree
0
10
20
30
40
50
60
70

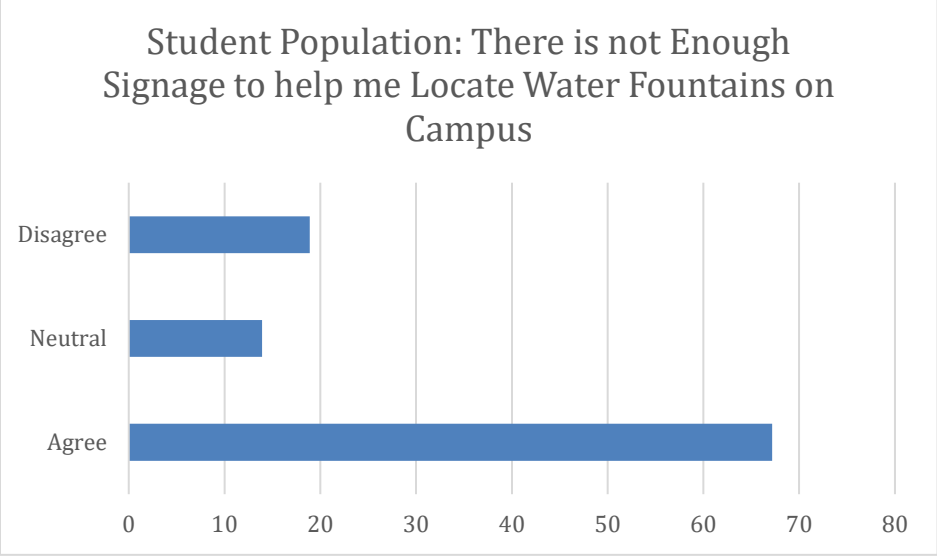

BC Students: UBC Campus Water Fountains are Usually Kept Clean
Disagree
Neutral
Agree
0
10
20
30
40
50
60
70

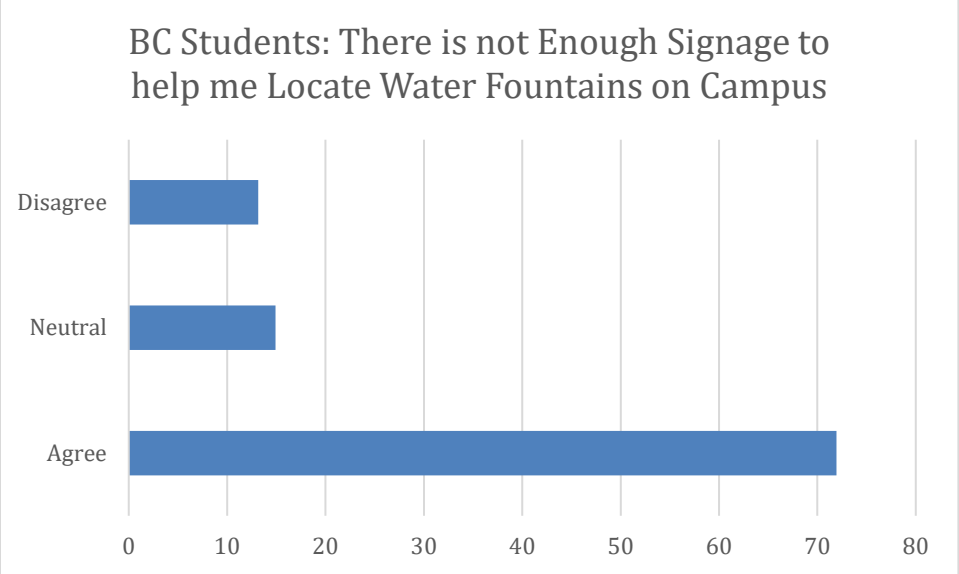

UBC Campus Water Fountains are Usually Kept Clean
30
25
20
15
10
5
0
Africa
Asia
Europe
N. America
S. America
Agree
Neutral
Disagree

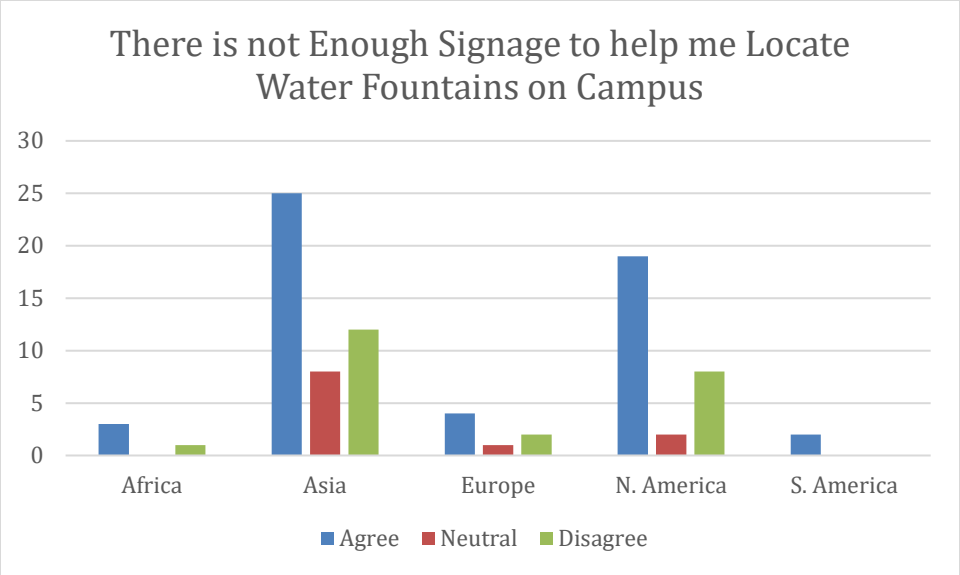

Student population: UBC Campus Water Fountains are Generally easy to Locate
Disagree
Neutral
Agree
0
10
20
30
40
50
60
70

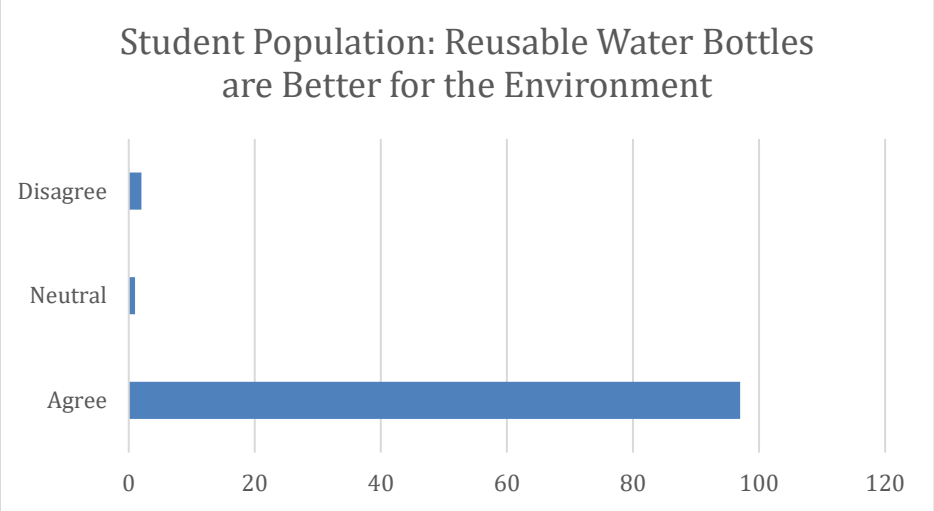

BC Students: UBC Campus Water Fountains are Generally easy to Locate
Disagree
Neutral
Agree
0
10
20
30
40
50
60
70

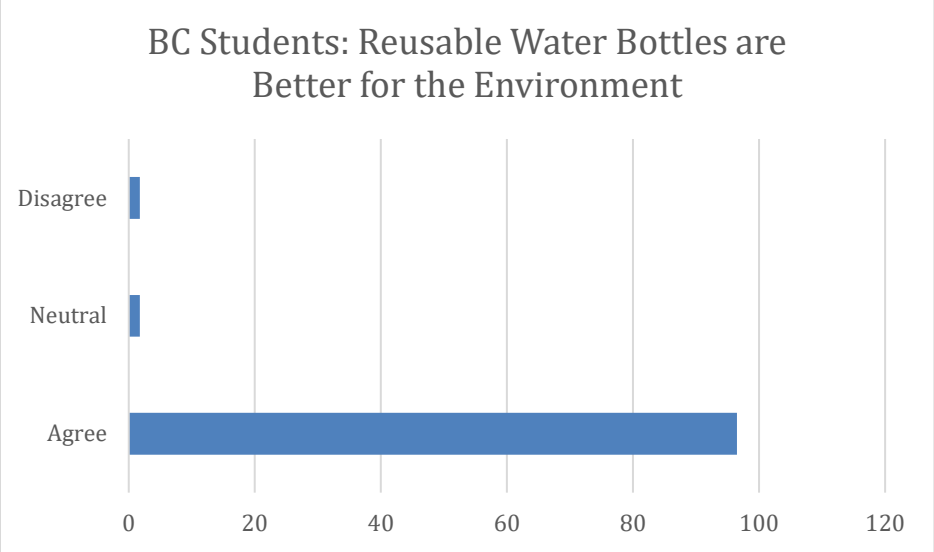

UBC Campus Water Fountains are Generally easy to Locate
35
30
25
20
15
10
5
0
Africa
Asia
Europe
N. America
S. America
Agree
Neutral
Disagree

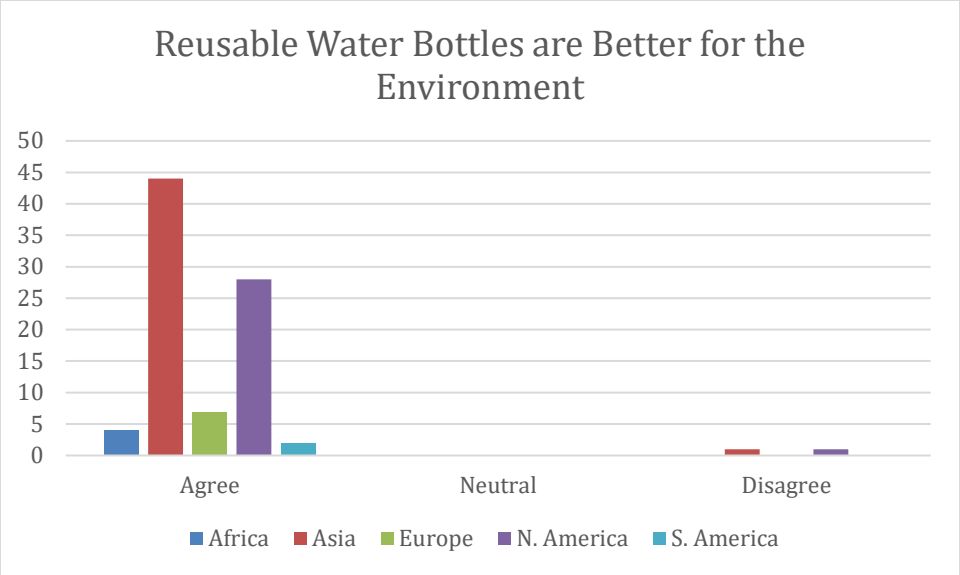

Student Population: There is not Enough Signage to help me Locate Water Fountains on Campus
Disagree
Neutral
Agree
0
10
20
30
40
50
60
70
80

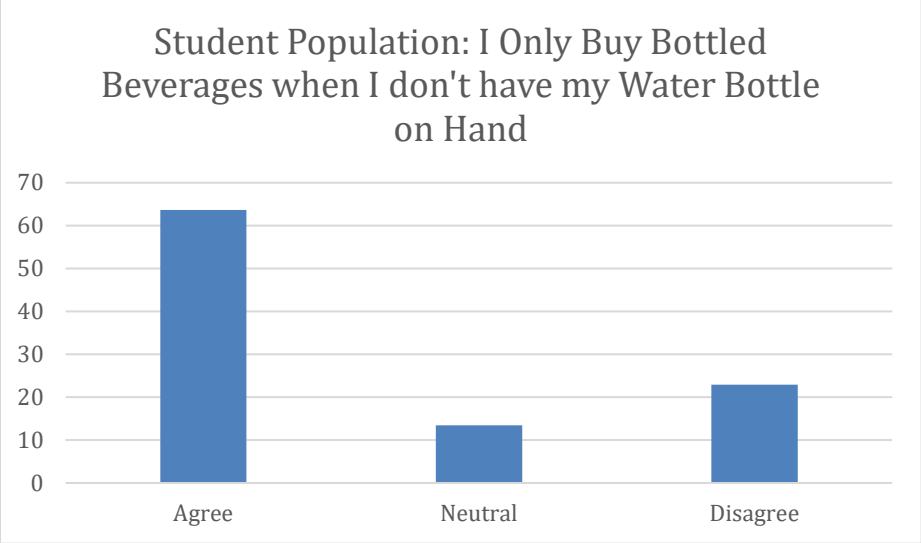

BC Students: There is not Enough Signage to help me Locate Water Fountains on Campus
Disagree
Neutral
Agree
0
10
20
30
40
50
60
70
80

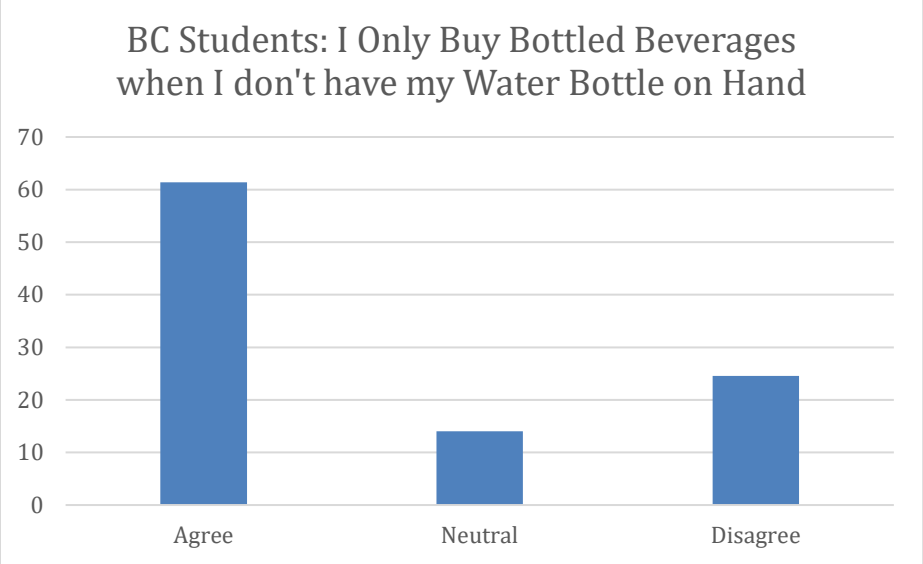

There is not Enough Signage to help me Locate Water Fountains on Campus
30
25
20
15
10
5
0
Africa
Asia
Europe
N. America
S. America
Agree
Neutral
Disagree

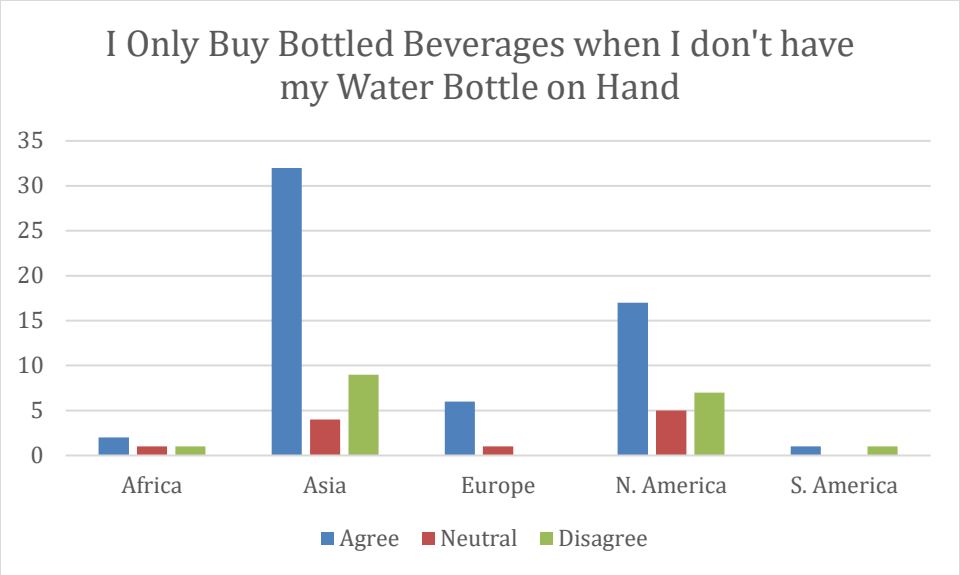

Student Population: Reusable Water Bottles are Better for the Environment
Disagree
Neutral
Agree
0
20
40
60
80
100
120


BC Students: Reusable Water Bottles are Better for the Environment
Disagree
Neutral
Agree
0
20
40
60
80
100
120


Reusable Water Bottles are Better for the Environment
50
45
40
35
30
25
20
15
10
5
0
Agree
Neutral
Disagree
Africa
Asia
Europe
N. America
S. America


Student Population: I Only Buy Bottled Beverages when I don't have my Water Bottle on Hand
70
60
50
40
30
20
10
0
Agree
Neutral
Disagree


BC Students: I Only Buy Bottled Beverages when I don't have my Water Bottle on Hand
70
60
50
40
30
20
10
0
Agree
Neutral
Disagree



Appendix (III) - Water Fountain Inventory and Data Analysis

See attachments below:

Building List.xlsx

Survey Data_SEEDS.xlsx

Fountains Needing Service.xlsx