UBC Social Ecological Economic Development Studies (SEEDS) Sustainability Program

Student Research Report

The Promotion of Indoor Drinking Water Fountains at UBC

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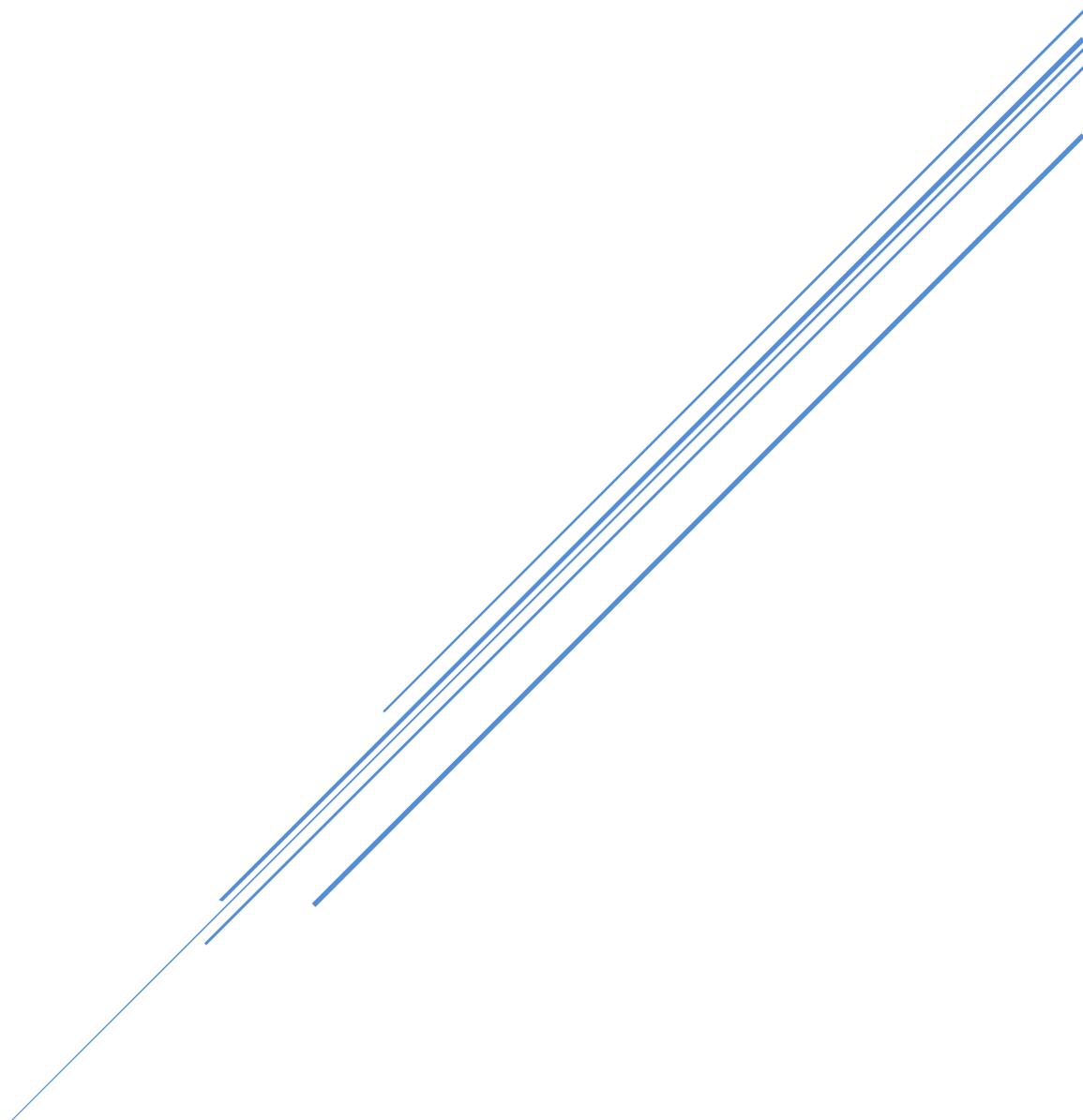
Executive Summary

The University of British Columbia (UBC) Vancouver campus has been working hard to improve public access to drinking water, reduce the use of bottled water, and encourage healthy beverage consumption habits through their SEEDS (Social Ecological Economic Development Studies) program and their Water Action Plan (Cheng, 2014). For our research group we have partnered with SEEDS in the Siting Indoor Drinking Fountain Signage project to assist with their objectives. In this project, we address the difficulties of locating drinking fountains at UBC and the issues surrounding water consumption, to come up with a list of recommended locations where signage could be installed and be most useful.

<u>Objectives</u>

- Determine priority water fountains in the targeted high student traffic buildings at UBC
- Propose 1-5 locations that need signage in the 2 of the 3 targeted high student traffic buildings at UBC
- Identify barriers that inhibit water fountain usage

<u>Methods</u>

We chose a mixed-methods approach where we examined the results from observations of drinking fountains in three buildings and responses from an online questionnaire directed to students. For our observations we chose the Irving K. Barber Learning Centre (IKB), the AMS Student Nest building (Nest), and the UBC LIFE building (LIFE) due to their high traffic study spaces and gathered information on the visibility, access, and usage of the relevant fountains. Our second method was an online questionnaire where we gathered insight on students' perceptions expectations regarding water fountain usage and the data that helped us produce criteria to specify locations in the targeted buildings for signage to be placed.

Results

What we found from our observations and questionnaire was substantial information that helped us further understand the needs of students in regard to water fountain use, access, and visibility. From our observations, we found that IKB has the highest number of water fountains, which are being fairly and evenly used. However, the Nest and LIFE buildings have different results. The Nest has an uneven number of users for its fountains, as the main floor (1) receive a lot more traffic than its counterparts on other floors, while the LIFE building's fountains receive very little users despite the high volume of students within its study spaces. From the results of our questionnaire of 125 participants, 82% of respondents most often drink tap water, 96% of participants use reusable water bottles with 85% of them "always" bringing their reusable bottles to campus. The main identified barriers that keep participants from using water fountains were the difficulties in locating them and the absence of a bottle filler. To add, many participants (86%) indicated that signs would help facilitate their use of drinking water fountains. The top locations for these signs were ordered accordingly: close to washrooms, along hallways, at entrances of buildings and near food shops.

Literature review

Reviewing the related literature for the focus of this study has revealed health and environmental consequences from bottled beverage use and vending machines. This section outlines the importance of water intake and how students who regularly use school vending machines are linked to increased consumption of sweetened beverages and frequent fast-food restaurants. This is an important aspect to note as UBC has a large number of vending machines located around the campus with some having accompanied signage to promote it. With UBC's goals to improve campus sustainability measures and promote public access to drinking water, the literature reviewed revealed negative environmental effects from plastic consumption. Other pertinent academic articles have expressed how promoting the use of reusable water bottles can lead to positive effects that can divert from plastic consumption. However, this section will also outline the limited range in this specific field of study and address research gaps.

What we concluded from our findings is that a vast majority of students do use reusable water bottles on campus and are somewhat aware of the benefits that water fountains/reusable bottle usage have. Based on our survey, two demands were revealed. The first demand is a wayfinding system where students can properly locate fountains within buildings, as sometimes they can be obscured. The second demand was that many students who use reusable bottles need fountains that have bottle fillers to properly refill them. Additional details that were revealed from our observations were that the distribution of fountain users on each floor of a building can greatly vary, causing an uneven number of users. Therefore, we recommend for signage to be placed in the buildings in the following order according to priority; the LIFE building, the Nest, and IKB.

Abstract

The University of British Columbia (UBC), located in Vancouver, Canada, offers its students, staff and visitors free tap water through campus-wide drinking fountains (water fountains). However, there are currently no measures to facilitate locating these drinking fountains for the campus community, neither through physical signage or via digital maps. Facilitating fountain use through signage has the potential to help mitigate issues related to campus sustainability and health. Within the UBC campus there are a number of restaurants, stores and vending machines that provide the community with bottled water and sweetened beverage. These beverages often involve disposable, one-time use plastic bottles which produce immense waste, and consequently, severely impact the environment. Relatedly, sweetened beverages not only contribute to waste from disposable containers, but adversely impact consumer health.

In this study, we have partnered with UBC SEEDS in the Indoor Drinking Water Locations and Signage project. The objectives of UBC SEEDS are to assist the transition of bottled water to tap water, reduce plastic waste and support healthier beverage consumption at the UBC campus, as part of their Water Action Plan. This study strives to address the issue of locating drinking fountains by promoting usage, accessibility and visibility of drinking fountains on the UBC campus through signage ("UBC SEEDS Sustainability Program: Research Project Description Form," 2018). Within the study, we adopt a mixed-methods approach, utilizing the results from observations of drinking fountains on the UBC campus, and responses from an online questionnaire directed to students, in order to develop a list of recommended locations for drinking fountain signage.

According to the questionnaire responses, the majority of participants consumed tap water and brought reusable water bottles to campus regularly. Half of the respondents reported obtaining their beverages through campus drinking fountains, while over one third obtained water at their homes and dorms. Further, respondents expressed an awareness of the environmental benefits of consuming tap water in contrast to bottled water, citing plastic waste as a primary factor for this decision. In addition, respondents reported a number of barriers to drinking fountain use on campus, with inability to locate them being the number one concern, followed by the non-existence

of bottle fillers. Respondents further suggested signage be placed near washrooms, along hallways and by food shops. Collectively, respondents agreed that signage would help facilitate their use of drinking fountains on campus.

The observational research revealed a disconnect between the number of people on a given floor in a building, and the number of fountain users, especially in the LIFE building. As a result, we recommend the first drinking fountain blade sign be located in the cafeteria of the LIFE building. Based on the questionnaire and observations, it is clear that students more often use the bottle filler component of drinking fountains, both automated and gooseneck, than the spout. Therefore, we recommend that existing and future drinking fountains be retrofitted to include a bottle filler, in order to facilitate drinking fountain use.

By working alongside UBC SEEDS, consulting related literature and adopting a mixed-methods approach, this project provides signage recommendations to facilitate drinking fountain use, and in effect, promote campus sustainability and support student health in relation to beverage consumption.

1. **Introduction**

Based in Vancouver, the University of British Columbia resides in a prime location for pristine and abundant tap water. However, the prevalence of bottled water, vending machines with sweetened beverages, and on-campus restaurants and stores that stock bottled beverages, paired with the sometimes-inaccessible nature of drinking fountain (water fountain) systems on campus, contributes to the importance of facilitating drinking fountain use at UBC.

Facilitating access to drinking fountains is not only essential to addressing the environmental effects associated with one-time use plastic bottle waste, but also to support campus community health through increased consumption of water and decreased intake of sweetened beverages. These objectives have been outlined by our community partners, UBC SEEDS (Social Ecological Economic Development Studies), as part of their Indoor Drinking Water Locations and Signage project. As directed by SEEDS, signage appears to be a viable method of facilitating drinking fountain use, and in effect, reducing plastic waste and supporting healthier beverage consumption habits.

Previous studies that have addressed drinking fountain promotion through signage focused exclusively on elementary and high schools. To our knowledge, there is a research gap pertaining to postsecondary institutions, with an older, larger and more diverse student body, as well as a greater quantity of alternate beverage sources.

While other public amenities, such as washrooms, are located by blade signs and included on both physical and digital campus maps, drinking fountains are not explicitly mapped through signage, and do not appear on the UBC wayfinding page online. This project addresses the lack of signage for drinking fountains in three campus building, by providing a set of recommendations for signage locations, signage placement strategies and alternative approaches to promotion, derived from observational and questionnaire-based research.

2. Statement of the problem

By facilitating drinking fountain accessibility through signage, we aim to address a number of issues related to spatial wayfinding, campus sustainability and community health.

In terms of wayfinding, a number of campus amenities are complemented by physical signage and included on faculty building maps and/or digital wayfinding maps. These amenities include washrooms, food places and elevators. Even vending machines are identified through signage. However, there is a lack of indication as to where drinking fountains are located on the UBC campus. This failure to locate drinking fountains on campus may lead to reduced use, and consequently, increased plastic bottle beverage purchases and consumption.

According to UBC SEEDS, reducing plastic waste and supporting community health related to plastic bottle consumption is among their objectives as part of the Water Action Plan ("UBC SEEDS Sustainability Program: Research Project Description Form," 2018). Bottled water contributes to a large amount of plastic waste which has enormous environmental impacts, especially for marine and terrestrial ecosystems. Other forms of bottled beverage, such as sweetened beverages, are equally important to address in this context. Sweetened beverages not only contribute to plastic waste, but also health issues in consumers. Importantly, there are a high number of vending machines, restaurants, cafes and stores that sell sweetened beverages on the UBC campus, which impede on drinking fountain promotion strategies.

Thus, after significant research and discussion, we formulated our research question as such:

How can we promote and support access to drinking water fountains for the campus community through effective signage placement that accounts for student behaviour, building layout and thus, positively encourages environmentally conscious decision-making?

Overall, improving drinking fountain accessibility and visibility through strategic signage serves as an important method of promoting the use of drinking fountains for the campus community. Further, it may help fulfill environment and health-related objectives, in terms of reducing plastic

bottle waste and sweetened beverage intake. Our goal for this project is to develop a set of recommended locations for indoor water fountain signs (providing photos), thanks to the responses we gather from our questionnaires and the results from our observations. Moreover, we will conclude with the constraints that might arise regarding signage and eventually, we will suggest alternative recommended buildings to focus on in order to widen the campaign promoting the use of drinking fountains at UBC.

3. Literature review

The 'sustainability' mindset

Our project lies within a greater ecological framework (that is, global warming), thus, we decided to focus on the environmental aspect of using safe water stations in the context of UBC, in such way to produce a space ideal for greater drinking water fountains usage. Firstly, despite being an ambiguous and at times overused term, 'sustainability' refers in general to the harmonious coexistence of humankind with the natural world (Johnston, Everard, Santillo & Robert, 2007). Indeed, we interpreted the overwhelming number of definitions found in the academic literature as 'actions that can be sustained in the long-run, with potential net positive impacts on the biophysical environment', yet, the economic perspective of "ecodevelopment" often remains the predominant aspect of so-called 'sustainability' (Brown, Hanson, Liverman & Merideth, 1987, 713; 716; Johnston et al., 2007). Often adopted by UBC itself, this latter approach exemplifies the idea of 'sustainable development', which strives to balance the basic need for water consumption against the rising consciousness and concern of environmental (reduced plastic bottle purchase), social (healthy habits) and economic (costs of purchasing non-reusable plastic bottles) constraints we face at UBC and at the larger scale. Therefore, an effective promotion of indoor drinking water fountains is also encouraging an 'environmentally-friendly' lifestyle by promoting the use of reusable water bottles and allows UBC students to make more informed decisions regarding the purchase of single-use plastic ones. Eventually, it addresses the social wellbeing aspect of 'sustainability' by supporting water consumption as a healthier choice.

Health and consumption habits

The evident health benefits of an adequate daily consumption of water – including "improved cognitive functions" – are an important aspect to consider in this educational setting (Patel, Hecht, Kampton, Grumbach, Braff-Guajardo & Brindis, 2014, p. 1314). However, in addition to considering the health benefits associated with water consumption, it is equally important to examine health barriers that exist in schools, particularly through the provision of sweetened beverages in school vending machines. According to Wiecha et al. (2006) students that use school vending machines regularly are linked to increased consumption of sweetened beverages and frequenting of fast-food restaurants. Despite the narrow scope of their study, focusing only on pre-tertiary schools, these results may be applicable to UBC student's beverage consumption habits, especially considering the prevalence of both vending machines and fast-food restaurants on the UBC campus. However, as part of this UBC SEEDS initiative, the approach to addressing unhealthy beverage consumption contrasts those offered by Wiecha et al., namely their recommendations of reducing bottled-beverage sources or altering availability of products (2006). Instead of direct beverage intervention, which may interfere with revenue accumulated, UBC has more interest in enhancing campus spaces to promote water fountain use and encourage healthier consumption habits. This issue of student consumption habits, however, transcends human health and extends to environmental health, particularly through the waste produced by plastic bottles.

The global context of plastic overuse

In the era of climate change, concerns started arising as the spread of bottled water has been associated with pollution, substantial energy use and increasing greenhouse gases emissions (Makov, Meylan, Powell & Shepon, 2016). The massive amounts of plastics that have accumulated in the environment over the years were proven to have significant bio-ecological impacts (i.e. ingestion by wildlife), as well as potential risks to human because of single-use plastic bottles' additives and their probable biomagnification effect within the food chain (Thompson, Moore, Vom Saal & Swan, 2009; Makov et al., 2016). Indeed, the studies reviewed convincingly assess the urgency of the plastic crisis and come to similar conclusions in terms of the importance of individual actions, by emphasizing their global and concrete values, thus revealing the immediate need for 'sustainable solutions'. The comparative experiment carried out by Makov et al., revealed that the drinking fountains have "lower climate change impacts [...] than the average bottled water

system" (2016, p. 8). Indeed, their results are not exceptional, as the "Drink Local" initiative carried out by Princeton University showed similar results, as they discovered the positive influence of providing reusable water bottles to students, who then divert away from plastic bottle purchase (Santos & Van der Linden, 2016). Our project relies on the importance of individual actions in order for the UBC society to adopt environmentally respectful behaviours. Nonetheless, we would like to recognise that despite deciding to focus on the importance of students' individual actions, we fully acknowledge that the latter lie within a more global framework. Indeed, UBC's large infrastructure expansion projects do not seem compatible with their self-promoted 'sustainable' policies. All in all, despite a clear need for further research on the topic, the articles evaluated provide good context and information regarding environmental promotion and the benefits of water stations on achieving 'environmentally positive' behaviours.

Public perceptions of tap water

In addition to the importance of environmentally conscious decision-making for beverage choices, is the public perception towards tap water consumption can also play a major factor in the trend of water fountain usage. In an extensive research done by Turgeon et al., the authors discussed the public perception towards drinking water in detail. The study, set in the Quebec City region, focused on how the public view might have changed towards the quality of drinking water from 1994 to 2001. The paper surveyed the local population at Quebec City and Sainte-Foy to find out what their thoughts on the general satisfaction, taste satisfaction, and risk perception are towards drinking water. Turgeon et al. drew upon the conclusion that even though the satisfaction has gone up along with a decrease risk perception in Quebec City, the view towards Sainte-Foy did not have a drastic change (2004).

It is important to consider the perception towards drinking water since it could potentially play a major role in our result when surveying the reasons why the water fountain usage at UBC is lacking. It would be unfair to only consider signage and environmental promotion if the main issue is on the hygiene aspect of public water fountains. Our study will also build upon studies such as Turgeon's since even though their study surveyed the public perception towards drinking water, it never provided a solution. Instead, this study focused on finding out the problem and pattern that might have caused the lack of improvement in public perception of drinking water in locations

such as Sainte-Foy. Our study would serve as further research, utilizing information provided by Turgeon et al. if and so our data shows a similar trend as the survey result Turgeon et al. discovered in Sainte-Foy.

Gaps in previous research

Past studies that address signage strategies with respect to water fountain promotion were fairly limited in scope (Kenney et al., 2015; Patel and Hampton, 2011). Both Kenney et al. (2015) and Patel and Hampton (2011) centred their studies on pre-tertiary education facilities, in other words, elementary schools and high schools. They focussed only on in-school cafeterias and small-scale high school campuses as opposed to larger and more public institutions such as UBC (Kenney et al., 2015; Patel and Hampton, 2011). Further, they did not represent the behaviour of an older, post-secondary student body, with more diversity in cultural backgrounds than local elementary and high schools. Due to the high number of international students enrolled at UBC, there is likely a range of perspectives and habits to be considered with respect to drinking fountain use and associated promotion.

To our knowledge, there have not been any studies conducted on the topic of drinking fountain promotion through signage for post-secondary schools, a research gap that we aim to address in this paper.

In order to address our research question – *How can we promote and support access to drinking water fountains for the campus community through effective signage placement that accounts for student behaviour, building layout and thus, positively encourages environmentally conscious decision-making?* –, we have designed the following methodology.

4. Methodology

As this project is focused on increasing accessibility and visibility of drinking water stations in order to promote their usage, our approach will consist in 2 methods: observational experiments of water fountain users on campus, as well as the distribution of online questionnaires to UBC students. We decided to use mixed methods for our research, as the combination of qualitative and quantitative data allows us to gain a broader and more in depth understanding of students' perception of the water fountains at UBC. These methods seemed like the most appropriate, as interviewing students would have been too time-consuming, therefore resulting in a smaller sample size, while other methods did not correspond to our research. Moreover, the observations reveal information regarding the usage of the water stations at 3 carefully-selected places on campus, while the questionnaire offers a great supplement, as the responses will shed light on the underlying reasons for our observations. Indeed, adopting a mixed-method research allowed us to offset of the disadvantages of each approach and to make potential assumptions, relating a given observation with students' responses.

Observational Experiment

Our observational method was quite straight forward. We collected our data through tallying every individual that used the water fountain we observed within a specific time period. All of the water fountains we observed had bottle fillers, therefore allowing us to divide the tallying into three different categories: drinking directly from the fountain, filling their bottle, or others. The time period we chose was between 11:10 – 11:40 a.m., a time we decided to use because it fell under the ending of a class period (11:20-11:30) and also due to the fact that it was around noon, so we would be experiencing more people in food locations. The locations we chose were Irving K. Barber Learning Centre (IKB), LIFE Building, and the AMS Student Nest. We chose these locations because they are very neutral especially between faculties (hence we are not doing buildings such as Buchannan A because the majority of students are Arts students). Also, because they are public buildings where we would expect more traffic, therefore students should have more access to water fountains.

Even though we are observing the amount of people using the water fountain, we also have taken into consideration the ratio between the usage and the flow of people in the building. This is because we are trying to find which water fountains are more obscure and need promotion, therefore it will be important to take into consideration if the water fountain is not used by the people in the building or if there's just not enough people in the area. This also leads to the main limitation of our data collection. Since it will be impractical to observe the exact number of people in the location, we only had an approximation for that variable. We divided each location into either low, medium, or high flow of people and then compared it with the usage of the water fountain. This might delegitimize our data since we are creating a ratio with quantitative and qualitative data. On top of that, there are variables we could not consider, such as the weather or students' workload (which might affect the attendance on campus) as well as the different class times between Monday/Wednesday/Friday classes and Tuesday/Thursday classes.

The reason we chose this method is due to it being a very direct way for us to find out which water fountains are being used and which are not. Such information can help us discover a pattern and find out which types of water fountains (as well as buildings) might require more promotion. Dividing the tallying into three different categories is also fairly important to us due to the fact that along with promoting water fountain usage, we are also promoting the usage of reusable water bottles. Observing the factors that might affect the usage of water fountains in a location also helps us determine the location as well as format of signage we will be suggesting in order to promote said water fountains. In this case, the selection of a combination of quantitative and qualitative data (between the tallied usage of water fountain and our approximation of the traffic in the location) helps us have a better understanding of the usage compared to looking at the quantitative data alone. With the combination, we can observe the accessibility of the fountain instead.

Questionnaire (cf. Appendix I)

In addition to our observations, we conducted a questionnaire in order to draft a criteria list that will summarize the most important elements to consider so as to define 'priority areas', where the need for effective and eye-catching signs would be recommended. The interrogations tackled students' perceptions and expectations regarding drinking water stations on campus. Therefore, thanks to their responses, we were able to know what measures would encourage them to use those

facilities more, how they are used and why, as well as their knowledge regarding the health, safety and environmental aspects (defined as the reduced demand for single-use plastic bottles) of drinking fountains. The survey consequently allowed us to create a list of criteria for recommended sign locations.

Created with the UBC Survey Tool, our questionnaire complied with the ethical regulations taught in class to ensure the moral validity of the questions asked and was short and specific enough to ensure maximum response rates from students. Besides, we decided against adopting a particular sampling strategy, given that we would have to account for multiple factors that we did not initially consider in our literature review (i.e. ethnicity, gender affiliation, …), which thus did not seem relevant. Consequently, given that our objective was to gather as many possible responses, such that we set our goal at 100 for the most accurate data, we distributed the questionnaires online, encouraging students to complete them on social media platforms (i.e. UBC Facebook groups), as well as advertising for it within our social network.

The questions were repeatedly drafted, reviewed, and revised, in order to make the survey as quick and efficient as possible, to ensure maximum response rate. The order was designed such that none of the questions would be influential to the following ones, as they simply specified a context sufficient to knowledgeably answer. Moreover, the data collected consisted in a mix of quantitative data regarding students' most consistent source of beverage, preference of sign locations or familiarity with the three buildings studied in our observations (Nest, LIFE and IKB). Furthermore, the open-ended answer options on many of our questions helped us collect precious qualitative data, such that we were able to record alternative responses that could potentially help us in our project.

Limitations to our methodology

Regarding the questionnaire, our goal of 100 students was more likely include upper-year students, as we shared this questionnaire on social media platforms. Therefore, our acquaintances on these platforms were more likely to complete them, rather than students who were not familiar with our profiles, despite our attempt to share it among a larger audience. Moreover, a sample of 100 students was not based on eligibility to complete the questionnaire, rather volunteering to do so,

and it consequently did not generate a sample representative of the UBC population. We initially considered the possibility of not reaching our goal of 100 participants in the questionnaire, especially considering the fact that the latter was voluntary and only available only. Indeed, we were relying on social media sharing and general social networking for promoting our questionnaire among the UBC population. Moreover, the closed-ended questions with given statements to choose from, provided restricted options, which could vary from the reality, but were designed for simplicity in order to generate more responses. The open-ended questions too, might have yielded questionable or unclear results. Opting to pose only 9 questions in our questionnaire was another limit, as we might not get the full picture from our results, however, the short and simple nature of our questionnaire strove to target our specific project goals. This way, we did not have to account for too many external factors, a strategy we decided to adopt based on the scope of our project. Another important limit to consider was the anonymity of online questionnaires, which inhibited us from verifying identities, and meant we were relying on students to be truthful and accurate in their response, in order to design our criteria list. Nevertheless, despite these limitations, this questionnaire allowed us to identify specific options for sign locations.

5. Results and analysis

Observations

First step into analyzing our observational data, we processed the raw data by picking out two of the three categories we observed (bottle filler usage and spout usage). The averaged data was still divided into the three locations: IKB, LIFE Building, and Nest (refer to Appendix IV). It is also important to know use the average of each location since there are locations with more water fountain present. This data does not take the ratio into consideration, but it will be considered in further analysis. First pattern we took into consideration was that over all, there are far more bottle filler users in all 3 locations compared to spout users with the average bottle filler users of all three locations being 19.09 and the average of spout users being 7.42. The second trend noticed was that IKB experienced more usage for both methods while LIFE building experiences the least.

Taking into consideration the ratio, the LIFE building will still be the worst performing since the traffic is usually medium or medium to high. The Nest became better performing since it experienced relatively high usage seeing how the traffic is usually medium to low. IKB still performed fairly well seeing how the usage is pretty high and matches with the medium to high traffic. There are multiple variables that can explain this trend but, in this paper, we wanted to focus on only a few.

The first variable would be the visibility of the fountain. According to our photo evidence of the water fountains (refer to Figure 2), the water fountains in the LIFE building (especially the two on the main floor) is barely visible to the public and are in very inconvenient locations (beside the bathroom and behind food vendors). On the other hand, water fountains at IKB and the Nest are very visible to the public being placed in hallways and crossing areas (such as beside the elevator).

The second variable is a student's familiarity with a building or area. IKB has high usage most likely due to the fact that students are going to lectures in the building therefore have sufficient time to familiarize themselves with the building/floor. The main floor of the LIFE building on the other hand is very different. It is a new and public area in which most students are not familiar with (as revealed in our questionnaire), this paired with the visibility of the water fountains led to the poor results in LIFE building. However, the bottom floor of the LIFE building shows different pattern, having a total of 8 people using the water fountain (compared to 3 and 4 people using it on the main floor). This is most likely due to the fact that the bottom floor is where the ARC fitness center is located. Regular gym members would most likely be more familiar to the area compared to students passing by the main floor of the building.

Lastly, the alternative to water fountains also plays a factor. With multiple food vendors (as well as a Starbucks) at the LIFE building, the area provides a lot of alternative beverages rather than water. This, also paired with the poor visibility of the water fountains would most likely encourage purchases of beverages.

Questionnaire (cf. Appendix II)

Firstly, we exceeded our set respondent goal as we were able to gather 125 responses from UBC students, a very important aspect contributing to the validity and credibility of the data. The majority of students who participated in our questionnaire obtained their beverages on campus from their homes or drinking water fountains, with 82% of participants most often drinking tap water as opposed to the only 4% that consumed mostly bottled water. Water was the most popular beverage choice among the participants, followed by coffee and tea. Further, nearly all (96%) of the participants used reusable water bottles, with 85% of them bringing their reusable bottles to campus every day. Relatedly, the vast majority (86%) of participants utilized the bottle filler attachment to drinking water fountains, emphasizing the importance of upgrading fountains to include bottle filler components. Of the five participants that do not utilize reusable bottles, three considered using them in the future, one of which citing environmental effects as a reason for purchasing a reusable bottle. In fact, 96% of participants claimed to be aware of the environmental benefits of consuming tap water, most of which naming the reduction of plastic waste as an example of a benefit. Two of the five participants that did not use reusable water bottles affirmed that they would be more willing to purchase one if they were made aware of the environmental benefits of consuming tap water.

Participants indicated that difficulty locating water fountains was the primary barrier preventing or restricting their water fountain use. In addition, the absence of a bottle filler was another barrier major for participants. Further, the vast majority of participants (86%) indicated that signs would help facilitate their use of drinking water fountains. The top locations for these signs were ordered accordingly; close to washrooms, along hallways, at entrances of buildings and near food shops.

Additionally, our survey suggested that perception of tap water hygiene was not a major issue within the UBC student body. When asked whether one drinks tap water or bottled water, 82% responded with 'tap water' while 13% responded with 'either'. This piece of data implies that students are generally satisfied with the quality of the tap water and do not have a significant risk perception. This facilitates our result on how the lack of usage of water fountains are due to reasons such as obscurity.

In terms of primary locations for drinking fountain signs, participants revealed an uncertainty toward the location of fountains within the LIFE building. The buildings that were easier to locate fountains were identified by participants as the Irving K. Barber Library and the Nest.

Consequently, our survey data allowed us to discuss a set of criteria that are important to consider for greater fountain use and the installation of a sign locating them. This set of criteria, deliberately established in no specific order of importance (as we believed they were equally significant), is nonetheless based on 3 specific buildings on the UBC campus: LIFE building (Old Sub), the Nest and the Irving K. Barber Learning Center.

- Occupancy/traffic of a given area/building
- Proximity to eating areas/food shops/restaurants/coffee shops
- Study areas
- Classroom areas
- Visibility of the water fountain itself
- Number of water fountains within a given building

LIFE BUILDING

The LIFE building can be classified as the highest-priority location, given that about 56% of students were "unsure" of their way around the building (that is, their familiarity). Given that it was recently renovated and reopened by the end of the summer 2018, it is a new and unfamiliar building for many UBC students. Despite this limitation, our observations concluded that LIFE was one of the busiest areas on campus, where students often eat and study (given the presence of a Starbucks, Booster Juice and Subway), thus, we can assume that despite the relatively low recorded usage of the water fountains in the washrooms and in the study/eating area, students seem simply unaware of their location, as they are rather difficult to locate. Eventually, the majority of respondents believed that a sign locating water fountains close to the washrooms would be highly significant and would influence their behaviour regarding drinking fountains' usage. Given that a water stations is located inside the LIFE building's washrooms, we certainly recommend the addition of a sign before entering the washroom area.

NEST

Given the popularity of this building – about 66% of students' respondent believed they "knew their way around" it – we can assume that the majority of the UBC population is somewhat familiar with the Nest. Indeed, as our observations demonstrated, the Nest recorded the highest performance of water fountain usage relative to traffic. Nonetheless, these results are rather limited to the main floor and the basement areas, as water fountain usage decreased significantly when considering the 2nd, 3rd and 4th floors, given that the traffic and occupancy of these areas was also decreasing. Consequently, we recommend adding signs on the 2nd floor of the Nest due to its relatively medium to high traffic, yet low fountain usage. Nevertheless, it would also be very efficient to add signs for the main and basement as they are in close proximity to restaurants, food and coffee shops. Given that about 55 out of 125 respondents to our survey were in support of a sign locating water fountains in proximity to food locations, we can assume that the Nest would be an ideal place to add signs, in order to encourage students to drink tap water and deter away from sweetened drinks; but also encourage water consumption between and during meals. Moreover, the water fountain on the main floor is located in front of the men's washrooms, thus, given that, as previously stated, the majority of respondents believe a sign locating drinking water stations in close proximity to the washrooms would be efficient, we absolutely recommend one in this case.

IRVING K. BARBER LEARNING CENTER (IKB)

The IKB library is arguably the most popular place on campus, where many students study, eat or simply enjoy each other's company, as about 68% of the respondents believed they knew with certainty "their way around" the building. As suggested for the other 2 buildings studied, we recommend a sign for the water fountains close to the washrooms, as it seems the most efficient way to encourage their usage. Nonetheless, in the scope of our project, this location was established as a non-priority area, as our observations and questionnaire revealed that most students were aware of the location of each water fountain – given that they are situated at the exact same spot on each floor.

Besides, as the main recorded barrier to accessing water fountains was the difficulty to locate them, we believe that the addition of signs in the LIFE building primarily but also in the Nest, would

truly be beneficial to promote tap water consumption. A number of students requested the installation of more water fountains around campus, particularly "near classrooms", "near big lecture halls", and generally more fountains "distributed uniformly" within a floor and/or a building. Furthermore, as the majority of students surveyed declared that the primary reason for using reusable bottles and by extension tap water fountains around campus, was because of environmental benefits, we decided to design a poster (cf Appendix III) that could potentially be used as an encouragement for sustainable and ecologically-aware behaviours. Additionally, it would be interesting to combine such campaign with another one discouraging the purchase of single-use plastic bottles at campus shops, in order to foster a more environmentally-aware culture at UBC. Eventually, we recommend the addition of 'bottle fillers' to every single water fountain, as students esteemed this was a strong barrier to using the drinking fountain around campus (nonetheless, all water stations in LIFE, the Nest and IKB are equipped with such 'bottle fillers').

Recommended sign locations

LIFE Building

- Sign location: Each of the four entrances on the main-floor (floor 1) of the building
- Recommendation: A map displaying the location of the 2 drinking fountains on the main floor

Figure 1: Drinking Fountain #1 in LIFE

Fountain in the main hall

Location: Floor 1 of LIFE building, within cafeteria dining area near Subway

Recommendations:

- A blade sign pointing parallel to the wall (*red cross on the left*)
- Another blade sign pointing perpendicular to the wall, on top of the pillar between Subway and the study area facing the Aquatic centre (*red cross on the right*)

Figure 1 – LIFE building, floor 1, study area facing the Aquatic centre – proposed sign location 1 (photo facing wall)

Figure 2: Side-Profile view of Drinking Fountain #1 in LIFE

Recommendation: A blade sign sticking out of the wall where the water fountain is located
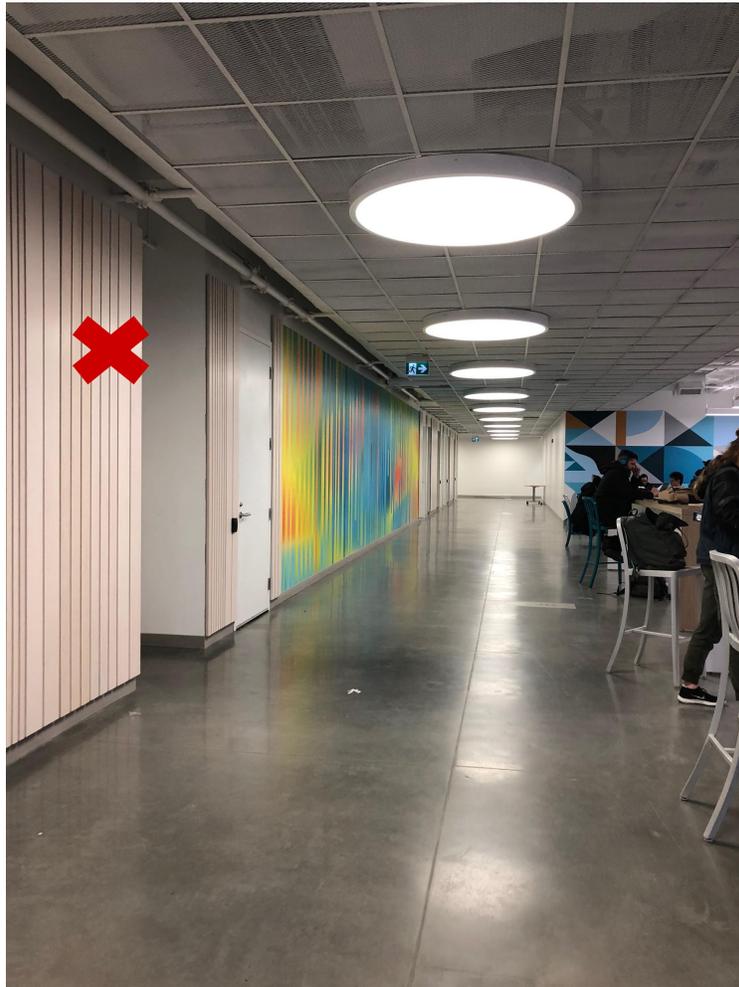
Figure 2 – LIFE building, floor 1, study area facing the Aquatic centre – proposed sign location 2 (photo facing the hallway, parallel to the windows)

Figure 3: Drinking fountain #2 in LIFE

Fountains in the washrooms

Location: Floor 1, large hallway leading to universal washroom, next to Starbucks

Recommendation:

- Hanging sign pointing towards the washrooms and the fountains (with a small arrow precising the fountain is on the right side of the washrooms)
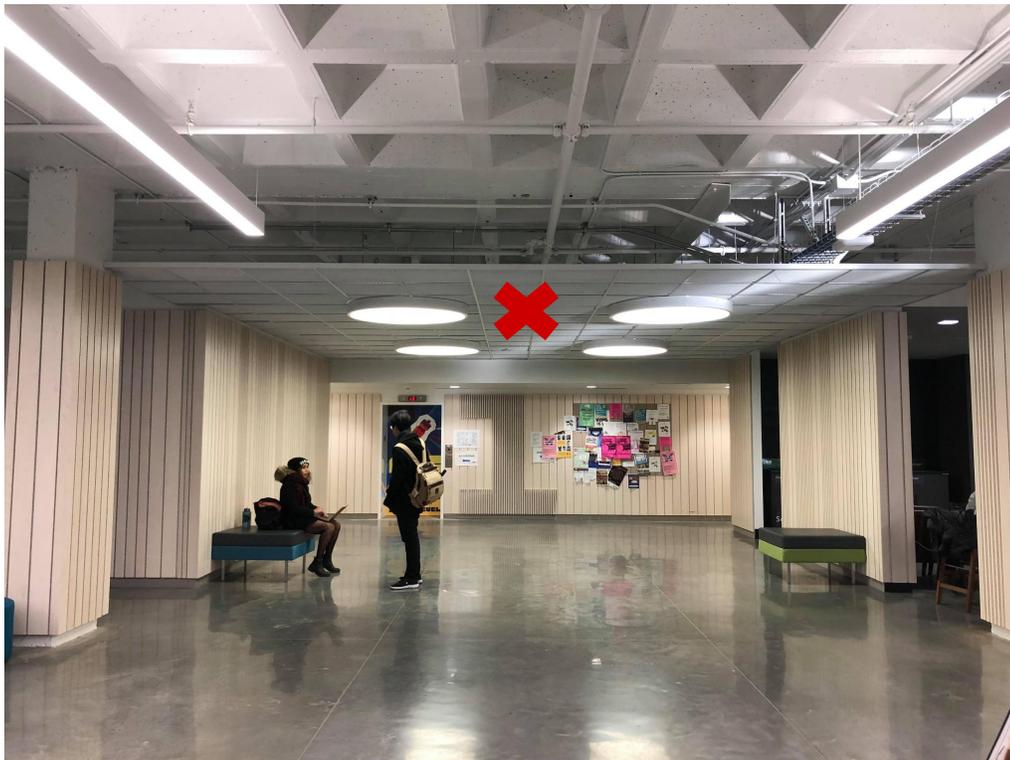
Figure 3 – LIFE building, floor 1, area left of Starbucks (on this photo) – proposed sign location 3 (photo facing the elevator)

Figure 4: Drinking fountain #2 in LIFE

Location: In the right side hallway within the universal washroom

Recommendation:

- Wall sign under the black 'Washrooms' sign on the right entrance, with a left-pointing arrow to precise drinking fountain
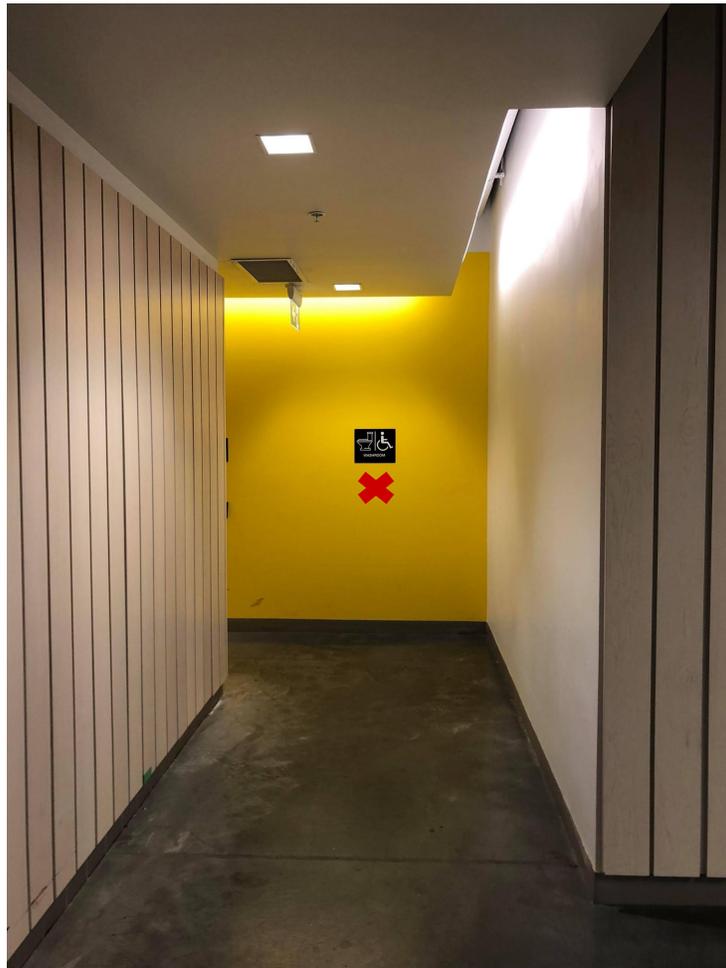
Figure 4 – LIFE building, floor 1, right entrance to the washrooms – proposed sign location 4 (photo facing the right entrance, to the right of the elevator)

Figure 5: Drinking Fountain #2 in LIFE

Picture of drinking fountains within universal washroom at the right-hand entrance

Figure 5 – LIFE building, floor 1, water fountains located in the washrooms behind the elevator (past Starbucks) – photo taken in the washrooms

NEST

- Signage location: Each of the four entrances on the main-floor (floor 1) of the building
- Recommendation: A map displaying the location of the drinking fountains on each floor of the building

Figure 6: Drinking Fountain #1 in NEST

Main floor

Location: Floor 1, between men's washroom and Blue Chip Cafe (Uppercase)

Recommendation:

- Text to be added to the "Vending machines/ATM" sign already present next to the men's washrooms, to identify drinking fountain
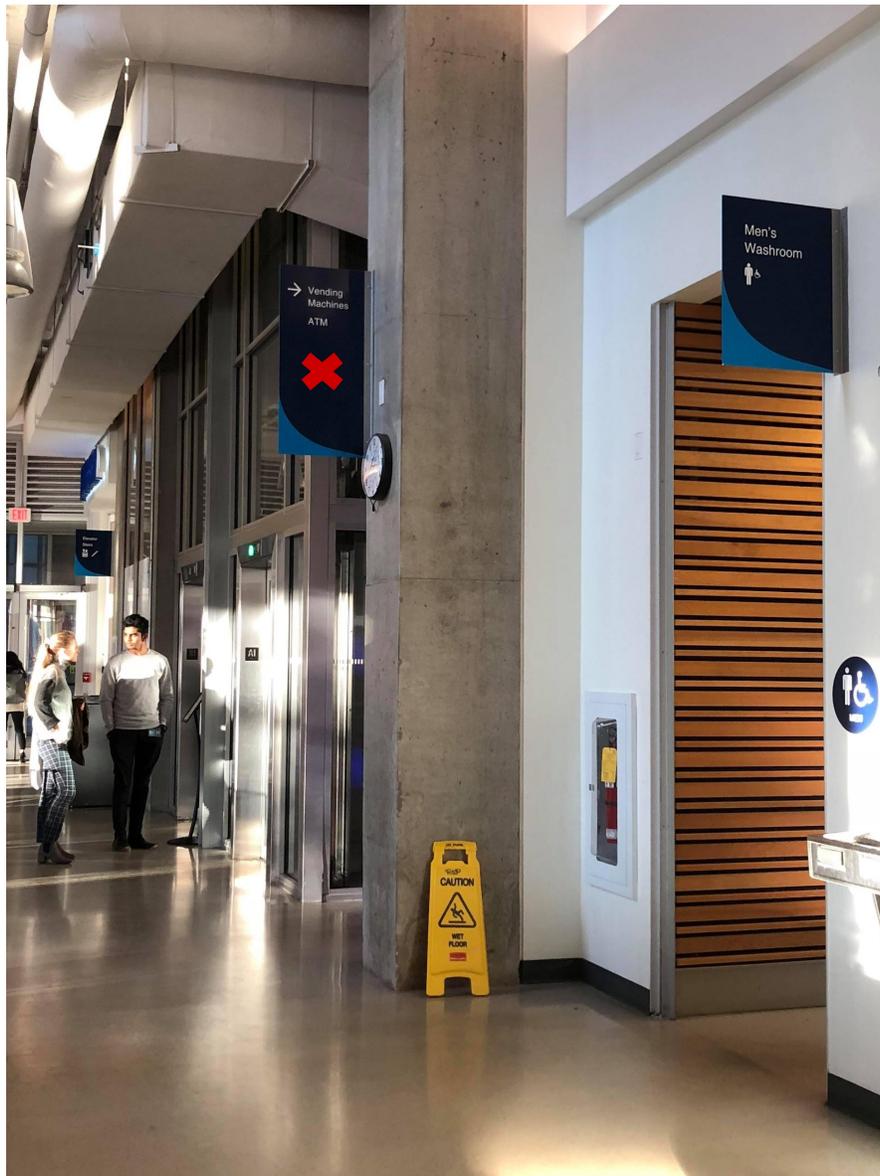
Figure 6 – Nest, floor 1, area between the elevators and Uppercase – proposed sign location 1 (photo facing the Men's washrooms)

Figure 7: Drinking Fountain #2 in NEST

Basement

Location: Lower level, between the elevators and the International News Market

Recommendations:

- A blade sign sticking out (double-sided) of the grey wall
- A blade sign around the corner by the TV (facing underground entrance into the LIFE building)
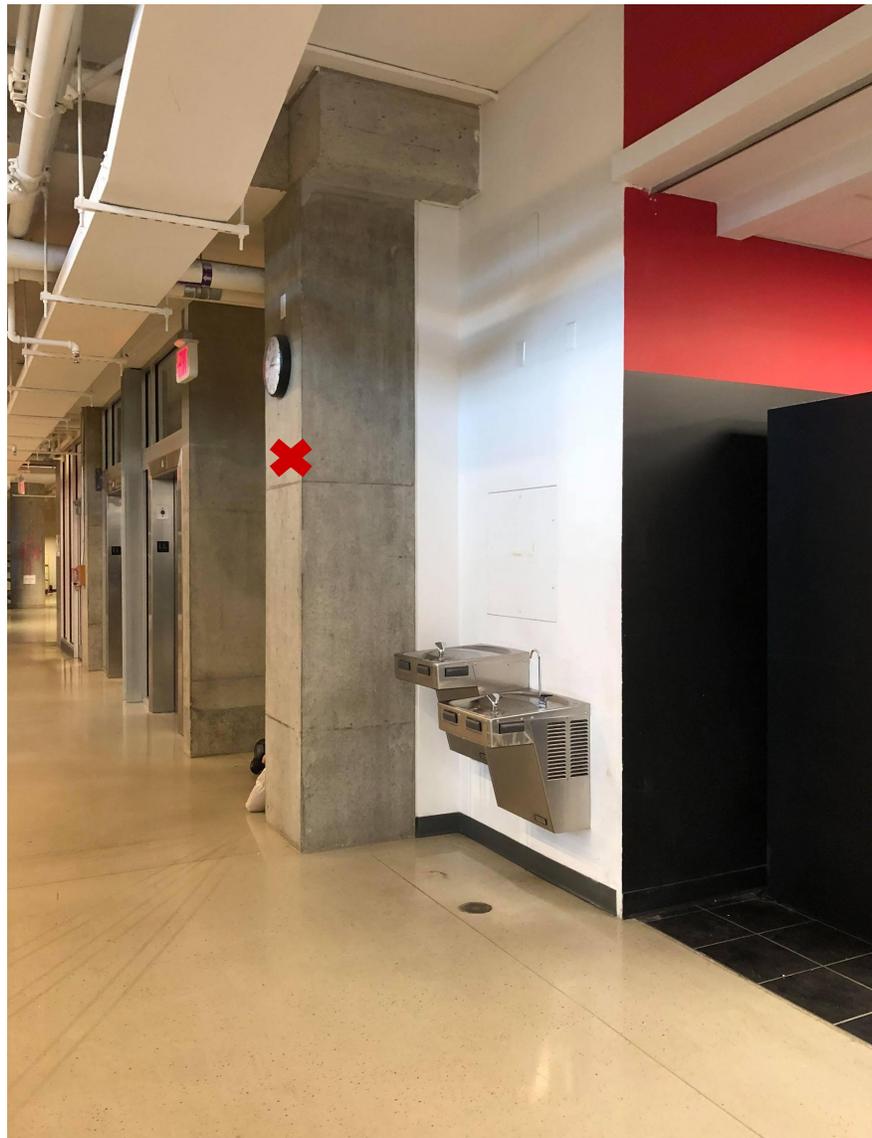
Figure 7 – Nest, basement floor, area between the INS market (as shown here on the right-hand side of the photo) and the elevators – proposed sign location 2

Figure 8: Drinking Fountain #3 in NEST

<u>Second floor</u>

Location: Floor 2, between the elevators and the climbing wall/lounge area

Recommendation:

- Outside, to the right the 2 elevators, add the water fountain logo/text to the existing sign pointing towards the Climbing Wall and The Ubyssey

*Figure 8 – Nest, floor 2, area between the elevators and the climbing wall/lounge area – proposed sign location 3
(photo taken facing the right, outside of the elevators)*

Figure 9: Drinking Fountain #3 in NEST

Picture of the fountain on the second floor next to the elevators

Figure 9 – Water fountain located on the 2nd floor, in close proximity to The Ubyssey and the Climbing Wall

Figure 10: Drinking Fountain #3 in NEST

Location: At the top of the stairs on the second floor

Recommendation:

- Add a flat fountain sign with an arrow pointing to the left, on the white wall that is describing the locations of various rooms and clubs

Figure 5 – Nest, floor 2, area to the right on top of the stairs, to the left of room 2311 – proposed sign location 4 (photo taken facing the wall when coming up from the stairs

Figure 11: Drinking Fountain #3 in NEST

Location: In front of the elevators facing the entrance to the Great Hall

Recommendation:

- Add a fountain sign across from the elevator: a blade sign, flat on the white wall, pointing to the left towards the water fountains that are located at the end of the hallway
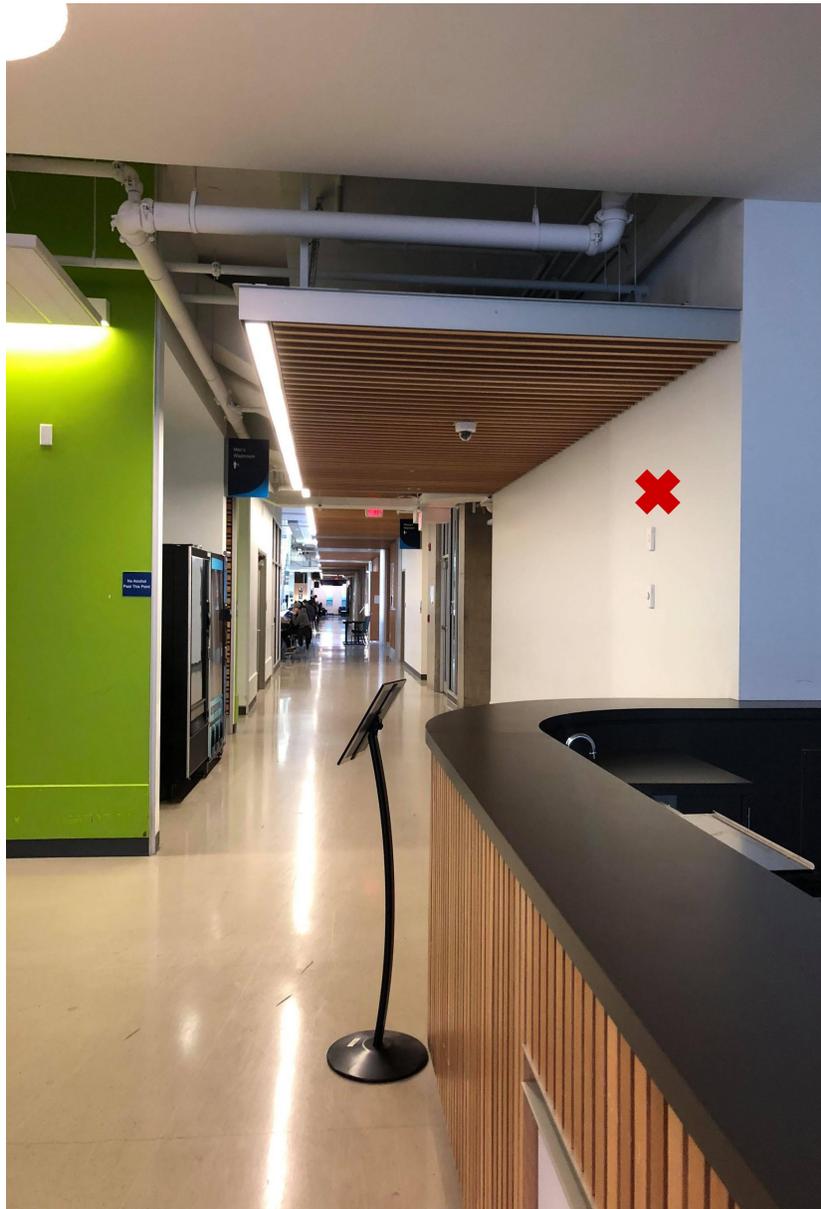
Figure 6 – Nest, floor 2, area between the Great Hall and the elevators – proposed sign location 5 (photo taken at the end of the hallway, back towards the windows, facing the main corridor, to the right of the elevators)

6. Significance of the proposed research

Our project tackles the issue of water fountain inaccessibility around the UBC campus. Indeed, our collaboration with SEEDS allows us to promote access and usage of the tap water stations in the university's various buildings, in an attempt to promote environmentally-friendly and healthier behaviours, by emphasising the use of reusable bottles and avoiding sugary drinks. Currently, drinking fountains are not located through signage in buildings or on the official UBC Wayfinding site, which may lead to reduced use, and consequently, increased plastic bottle beverage purchases and consumption. This lack of access and usage of water fountains is extremely important in a more global context, firstly for health reasons, but also because, in the context of plastic over-consumption, it encourages and underlines the importance of individual action to prevent contributions to environmental degradation, even at the university level. As such, our research projects addresses the issue of single-use plastic bottle waste, the consumption of unhealthy beverages by students, as well as attempts to promote a supportive, health-based and environmentally-aware learning space at UBC, where water is easily accessible. Besides, our investigation will provide SEEDS with data on student beverage choices and fountain use, as well as identify prime locations for drinking fountain signage. Additionally, our empirical evidence will help us define the specific criteria to consider in order to establish fountain signs.

The significance of our research further pertains to the quantitative and qualitative data it provides on UBC student beverage consumption habits and drinking fountain use. Through our research, we identified prime locations for drinking fountain signage, especially for the trial placement of the first sign, which we suggested should be installed in the LIFE building cafeteria. In addition, our research provides insight into signage placement strategies, in terms of which forms of signage (hanging, blade sign etc.) would be appropriate for the locations we have identified in order to maximize access to the drinking fountains in the area.

Of the three UBC buildings we observed, there is a clear divide between traffic and drinking fountain use, especially for fountains that are tucked into walls or difficult to see from a profile view. Based on these observations and questionnaire responses, blade signs would be a viable mitigation technique to improve accessibility, visibility and usage of drinking fountains, in line

with UBC SEEDS' objectives ("UBC SEEDS Sustainability Program: Research Project Description Form," 2018).

In relation to previous scholarly literature on drinking fountain promotion through signage, our research complements existing literature on pre-tertiary students (Kenney et al., 2015; Patel and Hampton, 2011) by providing insight into the beverage consumption patterns and drinking fountain use of postsecondary students in a university setting. Further, our research provides an alternate mitigation strategy to Wiecha et al.'s study by demonstrating that improvements to drinking fountain accessibility may achieve the goal of reducing sweetened drink consumption in students, without interfering with vending machine product availability (2006). In this regard, our study has considered a number of variables that come with university buildings, which include fitness facilities, cafes and stores that provide alternate beverage choices. Additionally, our research relates to perceptions, however, it does not reflect the suggestions previous literature proposed. In our literature review, we discovered a study done by Turgeon et al. suggesting that public perception towards drinking water in some areas have not been improved and some still might consider drinking water as a risk perception (2004). However, according to our survey, we found out that most of our research participants do not perceive tap water as risky, which therefore undermines the significance of public perception.

7. Future research directions

Based on the results of our research project, we were able to identify that the majority of research participants used reusable water bottles, therefore drinking fountains should be retrofitted to include bottle fillers, and the prominent barrier that limits water fountain use is the lack of knowledge in its locations. This problem can be mitigated through signage and a more detailed wayfinding system as UBC. With this in mind, there are many avenues for further research in this matter.

Future research could investigate drinking fountain signage locations in other buildings on campus. Our research project was quite small-scale, focusing only on three campus buildings. However,

UBC has a vast amount of water fountains that are scattered across the campus, for which our methods could be applied to determine priority signage areas and assess where renovations for drinking fountains is needed. Other types of buildings to be studied could include faculty buildings, theatres, galleries and other UBC attractions, as students are not only compelled to visit study spaces but also to visit the attractions available on campus. With more information on water access in these types of buildings, UBC can come closer to its goal of increasing tap water intake in the campus community.

In addition, further research into other measures of drinking fountain promotion, such as through the provision of posters, could serve as a low-cost strategy to increase the UBC community's awareness of their actions and individual choices, as well as the impacts they have on the environment through their beverage consumption habits. Another strategy to encourage drinking fountain use could include a 'drinking water campaign' based on the example of the 'Drink Local' program initiated by Princeton University, in the US (Santos & Van der Linden, 2016). Incoming first year students would be given a reusable water bottle by UBC to encourage tap water consumption and discourage purchases of one-time use plastic bottles on campus. Measures to implement this campaign could be the subject of another research project in the future.

Further, future research could also investigate alternative methods to locating drinking water fountains, such as navigating space digitally. The use of technology has steadily risen in recent years and mobile services has also matured along with it (Wang, 2018). People have become accustomed to accessing navigation services online and if information on water fountains could be accessed online it could lead to many benefits. More people would be able to easily find water fountains and become more knowledgeable about water consumption benefits. An investigation into alternative online methods to locate water fountains could be helpful to UBC SEEDS and their Water Action Plan as it could provide a deeper understanding of how technology affects spatial practices with regards to water fountains at UBC.

Finally, future research could follow up on the study that we carried out, once signage has actually been installed, to determine if signage helped facilitate drinking fountain use for the campus community. Relatedly, during the course of our research, we considered the integer on the

automated drinking fountains that corresponds to the number of plastic bottles that were avoided by users that consumed the tap water from that fountain (i.e. 'helped eliminate waste from _____ disposable plastic bottles'). UBC SEEDS has expressed an interest in recording this number on automated drinking fountains every year. This would be an interesting avenue for an entirely new research project, to determine if fountains are being used more or less frequently over time, to define priority areas for signage, or as a potential measure to compare use of drinking fountains that have signage with those that do not.

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Appendix (I)
Questionnaire – UBC Survey Tool Qualtrics

 1. *Where do you obtain the majority of your beverages on campus?*
Choose all applicable

- Drinking water fountains
- Vending machines
- Campus restaurants/stores/coffee shops
- Residence dining rooms
- At home
- Other: please specify

2. (a) *What types of beverage do you most often drink throughout the day?*
Choose 1 or 2 of the following options, depending on your habits)

- Water
- Soft drinks
- Coffee/tea
- Juices
- Other (specify)

(b) If water was selected among the 2 options:
Do you generally drink tap or bottled water?

- Tap
- Bottled water
- Either

(b) If water was not selected among the 2 options: *continues questionnaire to (4)*

3. *Do you own a reusable water bottle?*

- Yes
- No

If 'Yes':

    (b) How often a week do you bring it and use it on campus?

- Never
- 1-2 times a week
- 3-4 times a week
- Everyday

If 'yes':

    (c) Why do you choose to bring a reusable water bottle with you to campus? (i.e. environmental reasons, because of habit, it is cheaper, ...)

If 'No':

    (b) – Would you consider buying bringing one?

- Yes, I am planning on it in the near future
- Maybe, but not in the near future
- No, not at this time

    (c) – <u>If 'Yes' chosen:</u>   *Why?*

    <u>If 'Maybe' or 'No' chosen:</u> *Why not?*

6. *(a) Are you aware of any net environmental benefits of using a reusable water bottle and refilling it on campus' water fountains? (Environmental benefits)*

- Yes
- No

If 'Yes':

    (b): Give 1 example of a net environmental benefit of using a reusable water bottle.

If 'No':

> *(b):* Would you be more inclined to use a reusable water bottle if you were aware of the net environmental benefits it entails?

- Yes
- No

9. *Among the following buildings, do you find it easy to access the water fountains?*

- Irving K. Barber Learning Center (IKB) – Yes/No/I'm not sure
- Nest – Yes/No/I'm not sure
- LIFE building – Yes/No/I'm not sure

New Question: Do you usually use bottle fillers, take a quick sip, neither, both

7. *What are the different barriers of accessing and using drinking water fountains/bottle fillers at UBC?*
   Choose all applicable options and use "N/A" = if the option does not apply to you.

- Difficult to locate them and difficult to access
- I do not own a reusable water bottle
- Bottled water is my preferred option
- I forget to bring my reusable water bottle
- Because many fountains are not adapted to refill water bottles
- Busy schedule and therefore I forget or do not have time to use them
- I am not sure about the cleanliness of tap water

8. *(a) Would effective, eye-catching signs locating water fountains on campus encourage you to use them more?*

- Yes
- No

If 'Yes':

> *(b)* Where do you think a sign pointing towards the location of water fountains would be eye-catching?

Choose all applicable

- At the entrance of the building
- Close to the washrooms
- Next to a food shop
- Close proximity to the fountain itself
- Along the hallways
- Other: *open-ended question*

If 'No':

(b) What other options would be effective to encourage students to use water fountains more?

Appendix (II)
Questionnaire – sample responses

Q1 - Where do you obtain the majority of your beverages on campus? Choose 1 of the following option
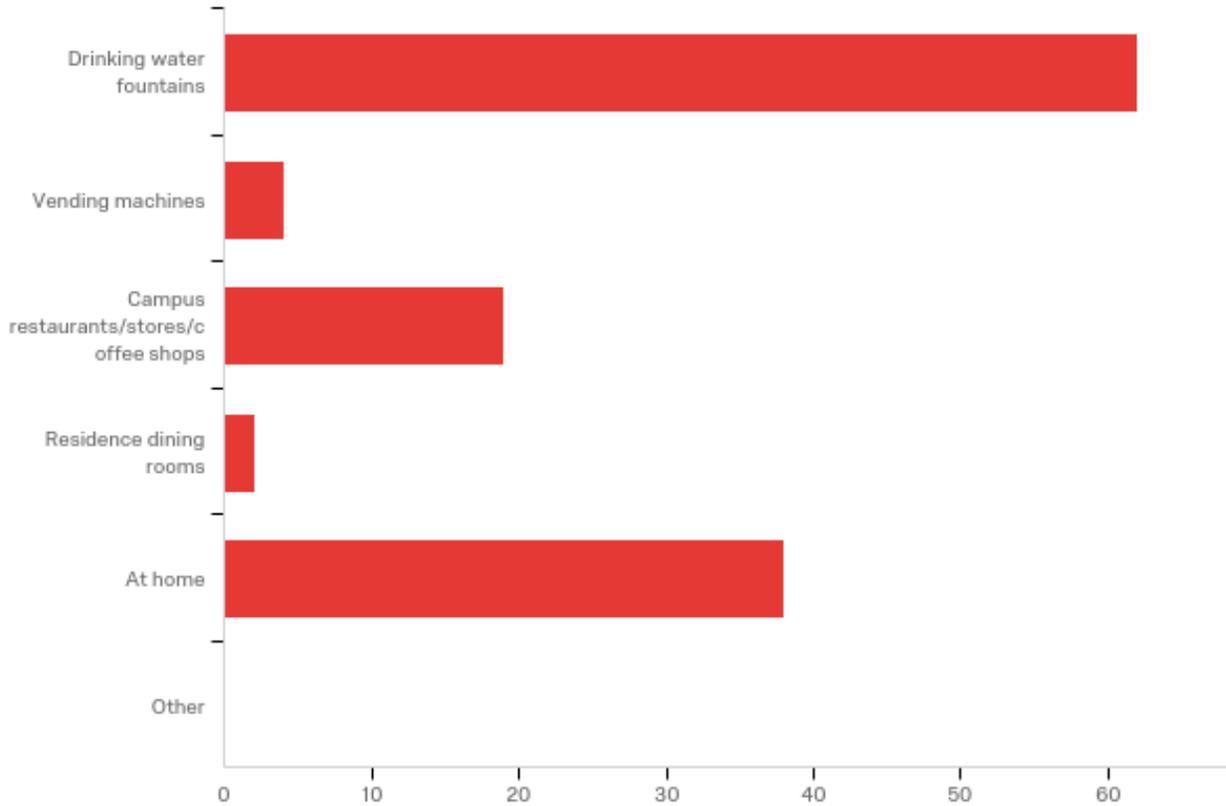
| #	Answer	%	Count
1	Drinking water fountains	49.60%	62
2	Vending machines	3.20%	4
3	Campus restaurants/stores/coffee shops	15.20%	19
4	Residence dining rooms	1.60%	2
5	At home	30.40%	38
6	Other	0.00%	0
	Total	100%	125

Q2 (b) - Do you generally drink tap or bottled water?
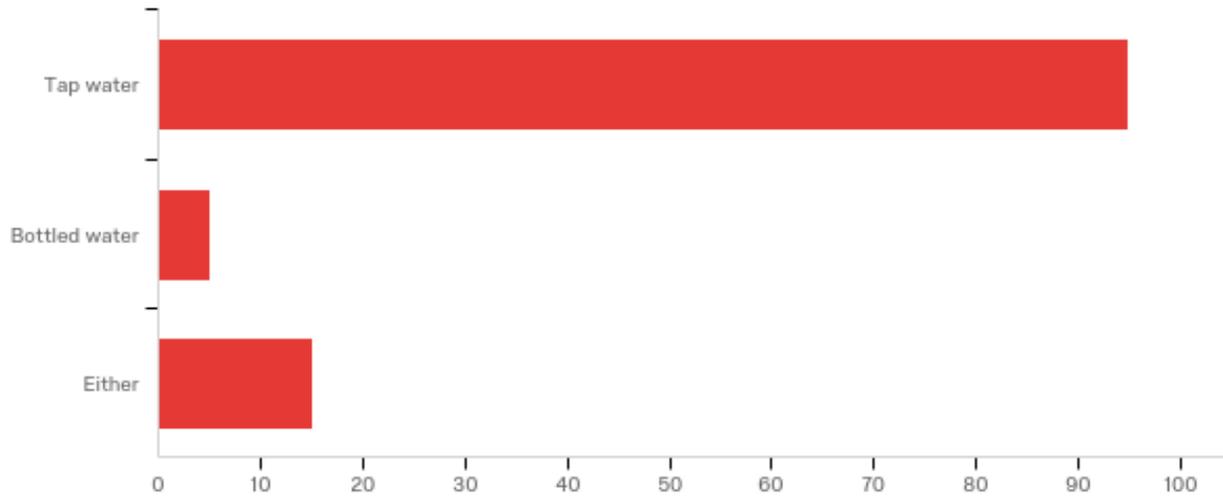
#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Do you generally drink tap or bottled water?	1.00	3.00	1.30	0.69	0.47	115

#	Answer	%	Count
1	Tap water	82.61%	95
2	Bottled water	4.35%	5
3	Either	13.04%	15
	Total	100%	115

Q3 (a) - Do you own a reusable water bottle?
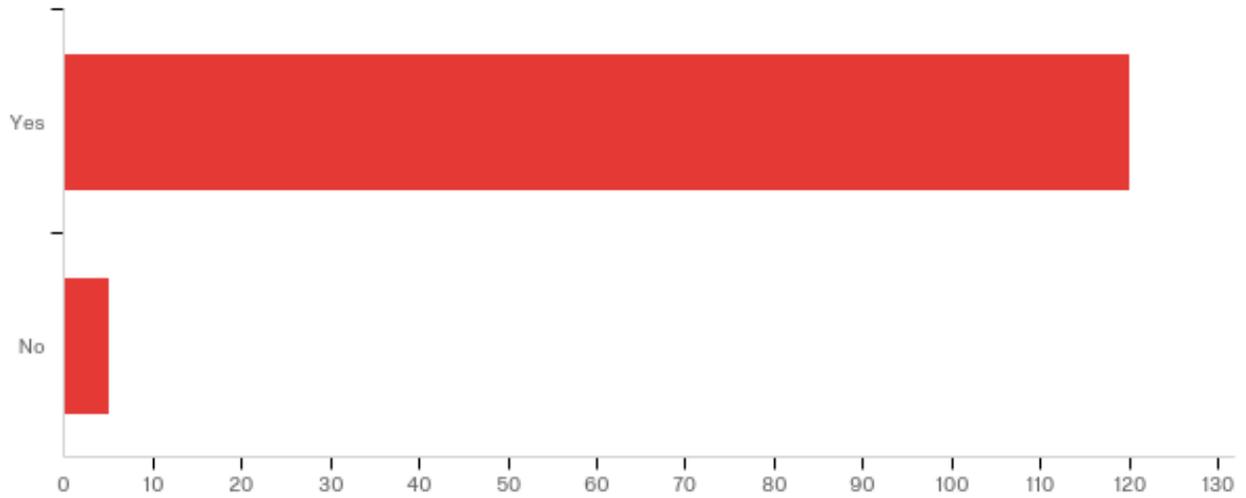
#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Do you own a reusable water bottle?	1.00	2.00	1.04	0.20	0.04	125

| #	Answer	%	Count
1	Yes	96.00%	120
2	No	4.00%	5
	Total	100%	125

Q7 - What gets in the way of you accessing and using drinking water fountains/bottle fillers at UBC? Choose all applicable options.
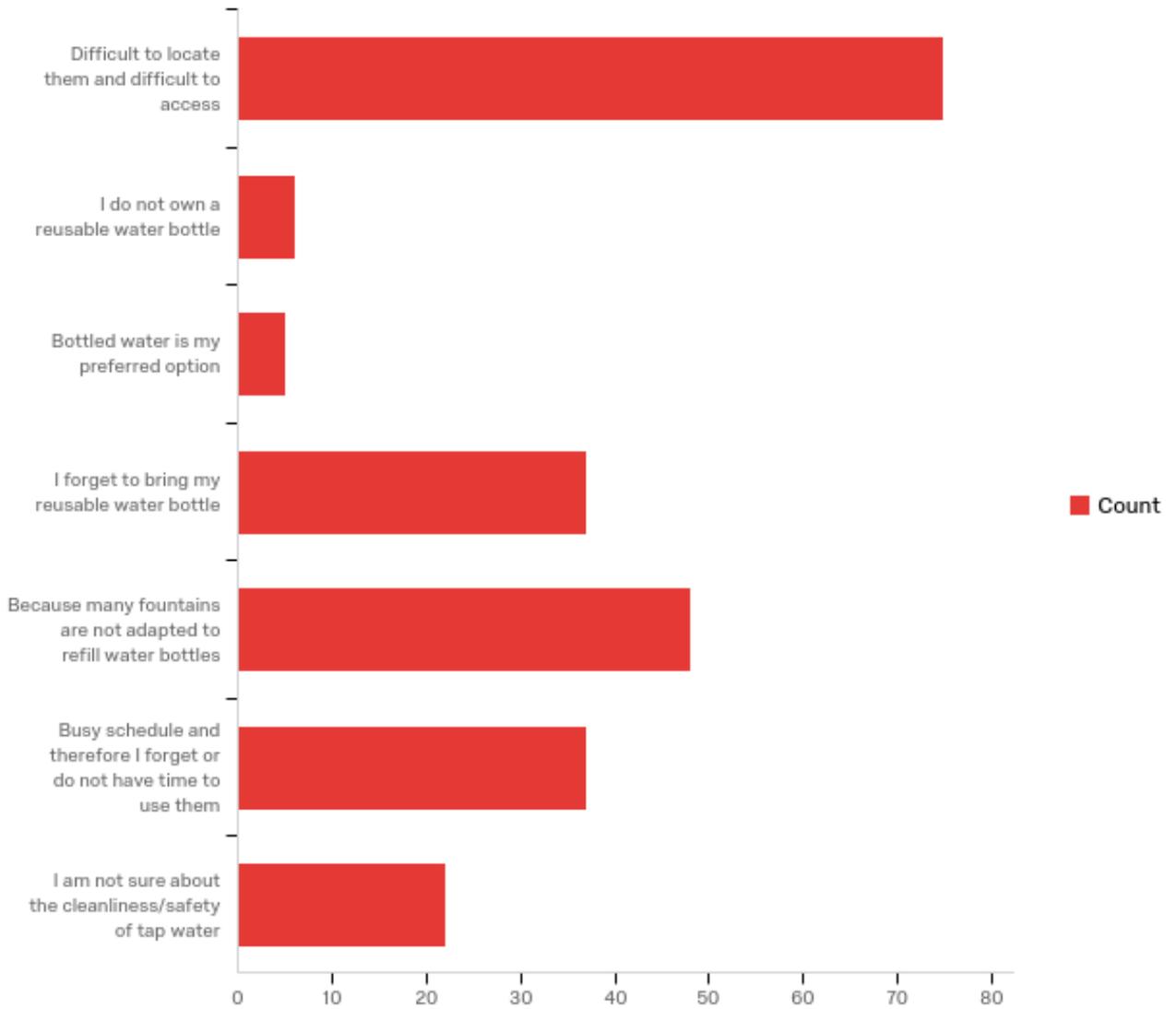
Q8 (a) - Would signs locating water fountains on campus help you use them more?
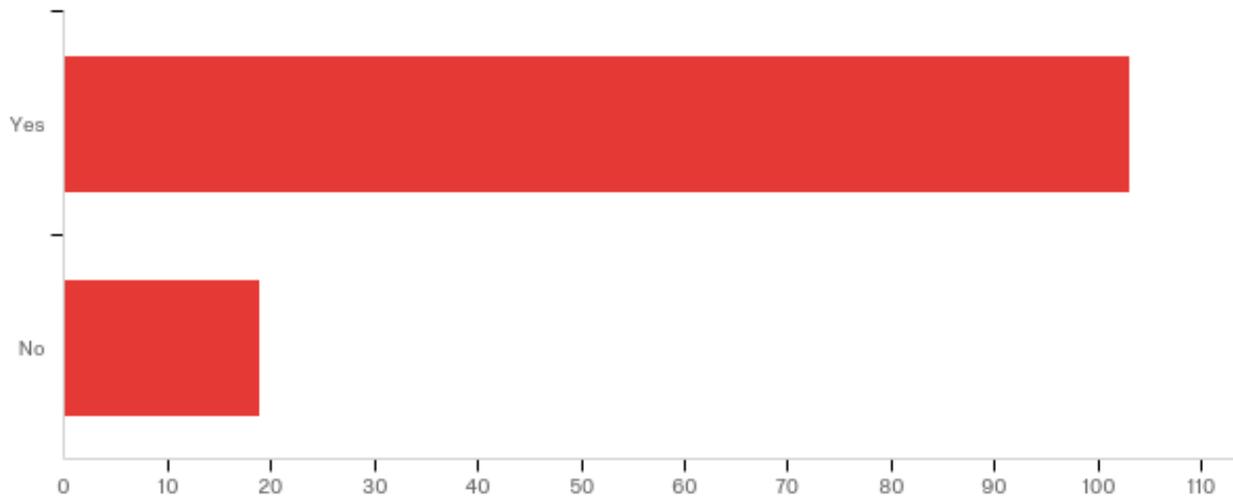
#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Would signs locating water fountains on campus help you use them more?	1.00	2.00	1.16	0.36	0.13	122

#	Answer	%	Count
1	Yes	84.43%	103
2	No	15.57%	19
	Total	100%	122

Q8 (b) - Where do you think a sign pointing towards the location of water fountains would be eye-catching?
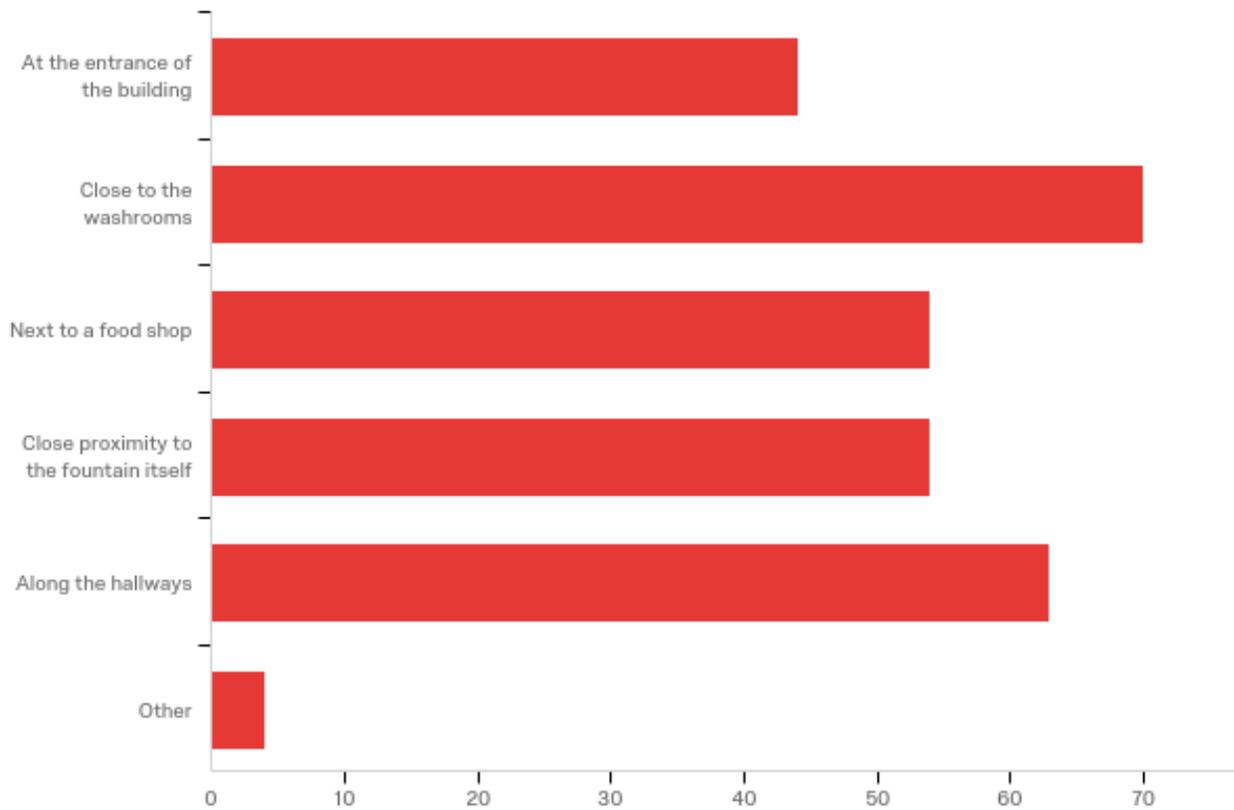
#	Answer	%	Count
1	At the entrance of the building	15.22%	44
2	Close to the washrooms	24.22%	70
3	Next to a food shop	18.69%	54
4	Close proximity to the fountain itself	18.69%	54
5	Along the hallways	21.80%	63
6	Other	1.38%	4
	Total	100%	289

Q6 - Among the following buildings, do you find it easy to access the water fountains?
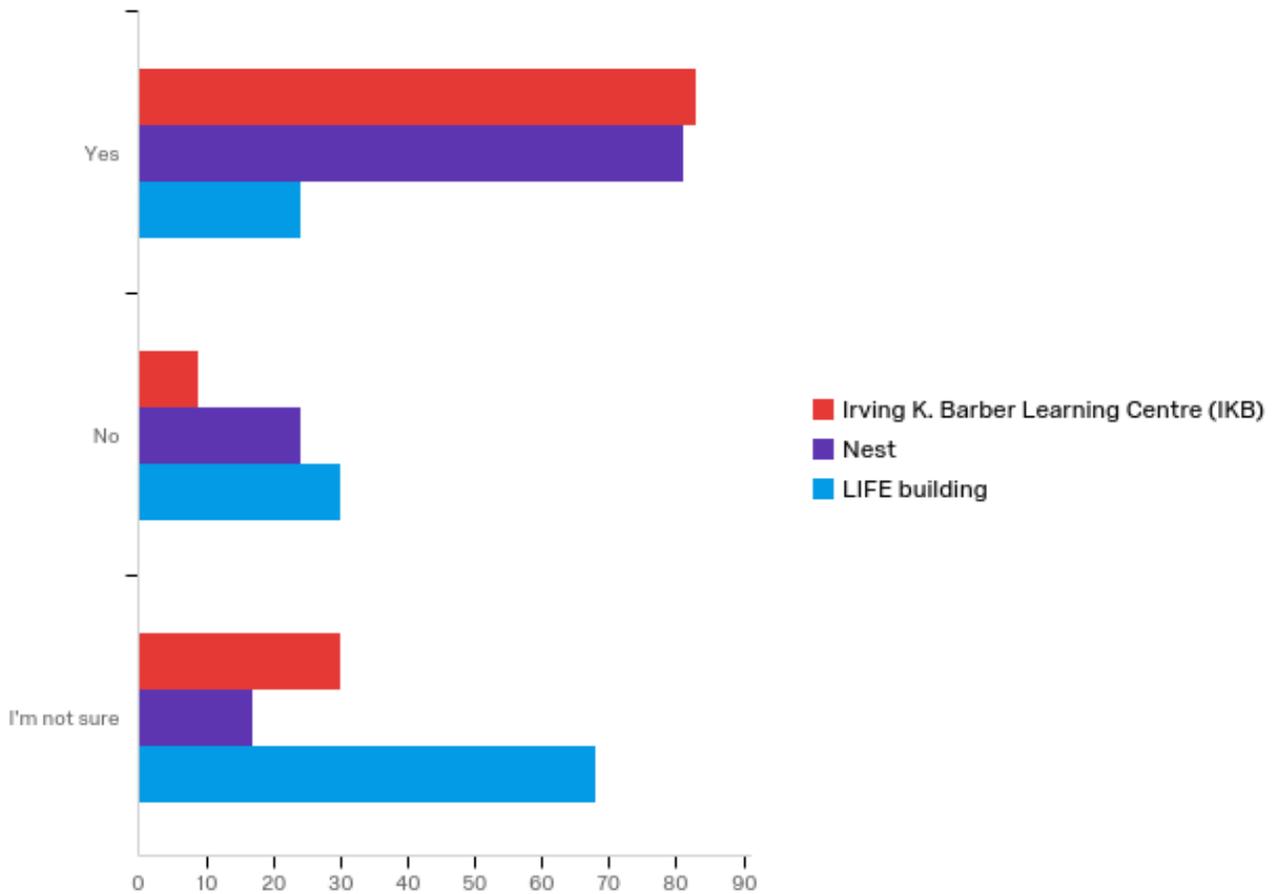
#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Irving K. Barber Learning Centre (IKB)	1.00	3.00	1.57	0.86	0.74	122
2	Nest	1.00	3.00	1.48	0.73	0.53	122
3	LIFE building	1.00	3.00	2.36	0.79	0.62	122

#	Question	Yes		No		I'm not sure		Total
1	Irving K. Barber Learning Centre (IKB)	68.03%	83	7.38%	9	24.59%	30	122
2	Nest	66.39%	81	19.67%	24	13.93%	17	122
3	LIFE building	19.67%	24	24.59%	30	55.74%	68	122

Appendix (III)
Proposed poster #1 – to be placed on top of campus water fountains

Appendix (IV)
Average Use of Bottle Filler and Spout in all 3 Locations