Refill, Reuse, Repeat: How Water Bottle Filling Stations Enhance Low-waste Drinking Water Consumption Through Nudging

by

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ABSTRACT

Design for sustainability and design to change habits are two areas that have been explored separately. Design for sustainable behavior has started to be researched for different purposes. This research focuses on how we interact with objects to reinforce sustainable actions, focused on low-waste drinking water consumption using Water Bottle Filling Stations. Things do not work the same in different contexts, even if they are targeted at a similar group of people in two different countries. In consequence, the habits around particular objects change as well. This research is part of a bi-cultural study on the relationship between users and Water Bottle Filling Stations in universities, sites where these devices have been installed to promote healthy habits and encourage sustainable practices in their population. This is to evaluate the use of current nudges attached to the design attributes on the artifact.

Using mixed methods, this research explored the possibility of using Water Bottle Filling Stations to create and reinforce habits in the user's routine and the consequences with the aid of nudges. To understand these behaviors, populations from a college in Mexico and a college in the United States were subjects of study to understand the implications of using Water Bottle Filling Stations as a device that, by design, promotes reusability as a circular economy strategy. The following research did not aim to redesign the entire system but evaluate the impact of current nudges and design attributes on the artifact, how habits have affected culture, and supply a list of findings and recommendations.

DEDICATION

To God, who makes everything possible.

To my mom, dad, Luz and Felipin for their patience, encouragement, and understanding even in the distance.

To the Ryan family for their support these years and for opening the doors of their home.

To Angelinita Vega.

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CHAPTER 1

INTRODUCTION

How often are actions executed in auto mode? A routine that includes waking up, taking a shower, preparing breakfast, and commuting. It has become a routine, a habit to which we will not have a clear answer if we ask how we executed the previously described actions. It is just as it is. Could this happen with those habits that not only make us healthier but improve the quality of life on our planet? Actions like composting, using the car only when it is essential, recycling, and avoiding single-use plastics, among others. Is it possible to turn them into ingrained habits where it is impossible to tell when they became part of our automatic routine? These actions are part of a more complex system, where context and objects play a significant role, and it does not depend solely on one's will to change.

Sustainability is a topic that now concerns everyone, from those in the industry to the user of product systems. More sectors of the global economy are getting involved, looking for an economic, industrial, and business system transition to approach sustainability by changing from a wasteful linear to a more circular economy (MacArthur, 2013). This has also translated into an individual effort to make this change. This research aims to reach these individual-to-collective efforts by understanding motivations and current behavioral economics techniques such as nudges, applied to product design, to evaluate users' automatic behaviors in consumers that favor low-waste habits, which can later turn into circular economy actions, and finally behaviors that promote sustainability; specifically evaluating use, performance, and functionality of water bottle filling stations for this purpose. Objects have meaning, purpose, and ways to influence our decisions and behaviors. Living in a linear economy where products are taken, made, purchased, used, and disposed of perpetuates wasteful habits that could change with product design intervention, supported by behavioral studies (Lehner et al., 2016). Products can familiarize and guide their users towards less environmentally harmful behaviors that help themselves and the planet as a link to a complex system where environmentally friendly habits occur.

We, as human beings, are continuously making decisions. Choosing what to do, where to go, and which product is better to buy and consume. Some decisions are well-thought-out, usually those with significant relevance, such as buying a house, while others are ingrained habits and behaviors with little or no awareness. In our society, behaviors that support the traditional linear economy (take-make-dispose) are now automatic habits. The disposable culture is gaining control, and society is buying and discarding for fashion, technological or comfort reasons without using products to their maximum before they reach the end of their useful life. Design as creation with intention stands for the first part of the chain.

A circular economy is “an industrial system that is environmentally restorative or regenerative by intention and design” (MacArthur, 2013). The circular economy can use design to make better products and communicate its goals combined with ecology, society, politics, and industry. However, design as a discipline still needs to appropriate these strategies in product development and product usage. Automating sustainable behavior choices - through low-waste habits such as reusing and refilling - products could help to get out of the disposable culture. The objective of this research is to support understanding of how products, specifically Water Bottle Filling Stations and the elements in this system, could communicate and introduce users to sustainable behavior, guided by low-waste habits by its use, creating newly adopted practices through nudges, since these are already being used for environmental purposes in a larger scale for sustainability sake’s purpose (Thaler and Sunstein, 2009). Design has applied various strategies to introduce users to sustainable practices with or without their knowledge, like increasing the durability of products. These approaches, eventually, are not enough to solve the psychological, emotional, or social benefits that the convenience culture stands for. The way we interact with the objects surrounding us, from why we choose them to customization, speaks about self-image and our belonging to society. Purchasing new goods is associated with a problem-free lifestyle and elevated social status. It is easier to replace than repair; wealth means having access to goods and consuming in massive quantities for self-realization.

Justification

According to the Global Footprint Network 2020 report, that year's Earth Overshoot Day was on August 22nd. The Overshoot Day is when humanity's demand on nature exceeds the Earth's capacity to regenerate this need over the entire year. Of course, this represents an ecological crisis indicator globally, which is why efforts are being made locally and internationally. The United Nations has set 17 Sustainable Development Goals (SDGs), a call to action to heal social and environmental issues, as shown in Figure 1. The circular economy holds promise for achieving multiple SDGs, including number 6 on energy, eight on economic growth, 11 on sustainable cities, 12 on sustainable consumption and production, 13 on climate change, 14 on oceans, and 15 on life on land, according to the UN General Assembly and the UN Economic and Social Council (2018).

Figure 1: The United Nations' Sustainable Development Goals

This research supports the study and future creation of products that automate low-waste leading to circular consumption by educating users on environment-centered habits. Minor changes in behavior and impact reduction do not matter when measured by their individual impact. Still, they create a joint treaty if the impact reductions are summed up for all users. How can a global issue be tackled locally? Formation and education are fundamental. According to Uehara and Ynacay-Nye (2018), “Universities have a social responsibility to address environmental issues, and they play a unique role in a sustainable society.” Several universities have used resources such as policies to ban the consumption of particular products from favoring a behavioral change in their population. From 2014 to 2015, Washington University in St. Louis avoided 567,000 single-use plastic bottles by banning them and installing hydration stations. It was the first university in the United States to implement a ban on these products (Keaggy, 2016). For example, Arizona State University (ASU) has incorporated sustainable-oriented efforts through its University Sustainability Practices and their Zero Waste department, communicating the benefits of adopting these habits and introducing the community to these concepts. As of April 2018, ASU claimed that “drinking fountains and water filling stations are available in all buildings,” but this was to encourage students to choose water over soda, not to decrease the usage of disposable water bottles (ASU Alumni, 2018).

These accommodations are not limited to universities in the United States. In Aguascalientes, Mexico, Universidad Autónoma de Aguascalientes (UAA) has its own “Sistema de Gestión Ambiental” (Environmental Management System) and through it, the university “commits to contribute to taking care of the environment, in the search of sustainability through the efficient management of its infrastructure” (Universidad Autónoma de Aguascalientes, n.d.). UAA is starting to implement sustainable actions through students’ efforts by mounting water fountains and filling stations to stop bottled water consumption and improve their waste management program ("UAA coloca nuevas Fuentes de Hidratación en sus Campus,” 2018), which according to an interview by Tlapalamatl (2018) to the Waste Management Department of the university, the institution still needs improvement and a change in the mentality of students. These two institutions advocate for sustainability and have installed Water Bottle Filling Stations.

People look for information to shift their behaviors to those less environmentally harmful. Environmental sustainability can be achieved “through new consumer behaviors who use lower impacting products than the status quo” (Petersen and Brockhaus, 2017). Creating products that guide while they are being used, analyzing how they are doing it, and potentially improving that function is the reason for this research to automate circular behavior through low-waste habits. Using nudges has been prolific. Public policies have been created, bringing economic changes, and they have increasingly been applied to objects and environments (Thaler and Sunstein, 2009). They are an opportunity to improve this decision-making and the resulting behavior. Even though circular behavior focuses mainly on an ecological impact, by incorporating education and low-waste habit adoption through nudges for product design, the results affect social relationships and thus also have implications for sustainability. This research could support the beginning of a more conscious lifestyle. Users could identify their actions and recognize the consequences of their behavior as they adopt habits that mean good for themselves and the planet.

Scope & Limitations

This research names the physical attributes of current Water Bottle Filling Stations design and how the features translate into motivations to use these devices. It also analyzes the application of existing nudges to improve low-waste water consumption in systems such as Water Bottle Filling Stations.

The President’s Council on Sustainable Development (1993) is a document by President Clinton, where ten goals are set up to create "bold, new approaches to achieve our economic, environmental, and equity goals." Goal number ten defends that all Americans should have access to education and how education is a fundamental step in the “understanding of the concepts involved in sustainable development.” Higher education represents a micro-universe, where people of diverse cultures, languages, backgrounds, ages, and education levels meet. Chudwick et al. (2013) said that a “student is not much different than the standard American, who is more likely to pick up a disposable bottle over a reusable water bottle.” In the United States, Duke University avoided 400,000 disposable water bottles in 2014 by installing refill stations and

refilling their reusable containers (Roth, 2015). Campuses aim to be sustainable and sometimes apply policies with nudges included. There is evidence of different strategies like plastic bottle bans (Keaggy, 2016). Arizona State University presents a unique scenario due to its commitment to environmental issues. ASU's Zero Waste department aims to “create and implement programs to reach the university's circular resources goals of strengthening its overall institutional sustainability by designing lasting, universal models that support ASU as a global leader in sustainable solid-waste management” (Arizona State University, n.d.). This research is limited to comparing the use of water bottle refill stations at two campuses of state universities: Arizona State University (ASU) in Tempe, Arizona, in the United States and the other in Aguascalientes, Mexico: Universidad Autónoma de Aguascalientes (UAA). Both are on the main campus, where most of the enrolled students attend classes, and in consequence, more staff and faculty work. For this reason, this study limits itself to the campus population at both universities.

The research does not address water accessibility, a relevant but separate issue related to sustainability, and the states of the countries where this study was conducted. Both locations are struggling with drought and public access to water for their population (Wang Whitman, 2021; Fondo para la Comunicación y la Educación Ambiental, 2021). It also excludes water fountains since the research evaluated the impact of reusable and refillable containers and not drinking water consumption directly from the source. Another reason not to include regular water fountains as part of the study is due to the reason that as this research is taking place in the years 2021 and 2022, still during the COVID-19 pandemic, it was recommended by authorities all over the globe to avoid drinking water directly from water fountains to prevent contamination and dispersal of the virus (The Associated Press, 2020). During the surge of COVID-19, not only water fountains were affected and closed, but general attendance to public spaces and in-person events, which represented a limitation while applying the methods for this research.

It is also important to highlight that this investigation does not involve the circular manufacture of Water Bottle Filling Stations but the effects of the interaction between users and the station to supply insights on how to introduce improvements in the aesthetics and functionality of the system. The present document does not propose new locations for Water Bottle Filling

Stations. Still, it looks forward to concluding why users prefer or not to refill their bottles over buying a disposable one and if the refilling system, along with the context it is placed on, delivers the message of promoting low-waste habits correctly. For this reason, it is pertinent to operationalize some key terms:

- **Circular Economy: "**An industrial system that is restorative or regenerative by intention and design. It replaces the 'end-of-life' concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse, and aims for the elimination of waste through the superior design of materials, products, systems, and, within this, business models" (Ellen MacArthur Foundation, 2012). Or in other words, explained by Sauvé et al. (2021), "The circular economy seeks to conserve material goods within closed loops and thus prevent or at least minimize the linear process of resource extraction, transformation, and disposal."
- **Low-waste Habits:** Zero Waste is defined by the Zero Waste International Alliance (2018) as "The conservation of all resources by means of responsible production, consumption, reuse, and recovery of products, packaging, and materials without burning and with no discharges to land, water, or air that threaten the environment or human health." And since "every resident, organization, and human activity (...) generates some type of waste." (US EPA, 2017). Porter (2018) also mentions this "Zero waste is not actually about arriving at zero, since living in our society means making some amount of waste. It means striving to lower our waste, which is an excellent goal." Low-waste habits are those regular practices that look for the conservation of resources by the responsible production, use, reuse, recovery, and disposal of goods and materials.
- **Nudge: "**Any aspect of the choice architecture that alters people's behavior in a predictable way without forbidding any options or significantly changing their

economic incentives. To count as a mere nudge, the intervention must be easy and cheap to avoid. Nudges are not mandates" (Thaler and Sunstein, 2009).

- **Water Bottle Filling Station: "**Device designed to provide drinkable tap water to users with a refillable water bottle." (Uehara & Ynacay-Nye, 2018) Hydration Station can also be referred to as its direct translation from Spanish to English. Some stations have water fountains integrated, but what makes them different is a "special water spigot that is designed for reusable bottles to fit underneath and easily refill" (Chudwick et al., 2013).

Research topics

For the previously explained points, this research study reviewed the following topics to understand how we interact with objects to reinforce sustainable actions, focused on low-waste drinking water consumption using Water Bottle Filling Stations thoroughly. The key research questions and questions are organized in the following categories:

Water Bottle Refill Systems:

1. Does the current design of water bottle filling stations introduce users to low-waste habits?
2. What do current water bottle filling stations communicate?
3. How are water bottle filling stations attractive to the user?
4. What is the role of hygiene in water bottle filling systems?

Low-waste Drinking Water Consumption Behavior:

1. How are water bottle filling stations communicating to users to continuously refill bottles instead of buying disposable plastic bottles?
2. Which nudges and prompts are being applied to water bottle filling stations to promote circular water consumption?
3. What are the motivations to support or not the use of water bottle filling systems?
4. How can water bottle filling stations enhance low-waste drinking water consumption through nudging?

CHAPTER 2

LITERATURE REVIEW

Introduction

To begin the research, a literature review was conducted to understand the current state of the topics that concern this study, using different references such as journal articles, conferences, books, manuals, reports, and other online resources. The review started with the circular economy, its definition, and implications, then the circular strategies and reuse models to be more specific, leading to the smaller scale adoption of sustainable behavior: low-waste habits. This sets the context of what environmentally friendly behavior represents.

The review then followed to describe habit creation and the tool this research evaluated for this purpose: nudges. Nudges are explored more profoundly, presenting studies, examples, and results on their application in design and sustainability, either through product implementation or policymaking. Understanding nudges and their theory allowed the research to focus on their impact, use, and limitations.

These previously mentioned topics should be addressed before narrowing their impact on the critical device this study covers, Water Bottle Filling Stations. This literature review aims to see this product as a system, not only analyzing the device but its implications in the context it was studied, the behavior around them, and the elements that compose the system it belongs to. The review also goes through the counterpart and its impact, bottled water.

Conceptual Framework

The conceptual framework illustrated in Figure 2 for this research includes three main spheres that relate to each other inside the sustainable behavior: Nudges as a transition to sustainability (Lehner et al., 2016) and low-waste habits applied to Water Bottle Filling Stations.

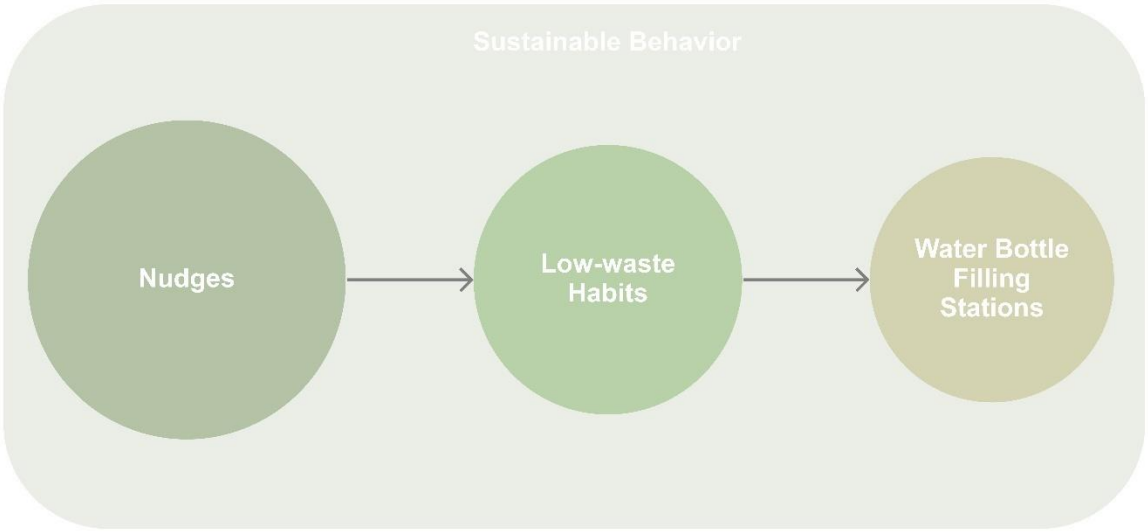


Figure 2: Conceptual Framework

Product design goes beyond proposing solutions through a sole product; now, the discipline clusters devices with services, experiences, and other objects surrounding the main object, creating modules or systems (Salvador, 2007). At the same time, these product-service systems are a way to reduce consumption (Beuren et al., 2013). Water Bottle Filling Stations belong to those systems where a service is provided by an institution that installed water fountains and refill stations. Users who may or not carry a reusable container to consume drinking water access the system through the WBFS device. Some institutions chose to acquire these water dispensers to promote health and sustainability on campus. They are moving towards more environmentally friendly goals by adapting their facilities through concrete actions, such as placing WBFS.

Sustainability, seen as a whole, requires actions from an environmentally friendly perspective and must also be socially responsible and economically accurate (Hawken et al., 2013); strategies such as the Circular Economy have been proposed as a solution. Circular Economy can be applied mainly from an industrial level but can also be replicated at low-scale individual actions. A low-waste lifestyle is an approach to reaching environmental sustainability from an individualized perspective. For their design, WBFSs are installed not only to supply water but to give access to a community to alternatives for more sustainable behavior. How can tools

such as nudges change behaviors and influence decisions, and if they can be used to enhance low-waste habits (and, in consequence, more sustainable practices) through objects that already exist in the user's context and have the objective to be an instrument for habit creation, which is the case of the use of Water Bottle Filling Stations.

Literature Review

Circular Economy

"Circularity has been ubiquitous and omnipresent throughout the history of planet Earth, in two distinctively different forms: Nature and Mankind" (Stahel, 2019). In his book "The Circular Economy: The User's Guide," Stahel mentions the objectives of the circular economy, which strives to maintain values and manage assets "from natural, cultural, human, manufactured to financial stocks, not only to keep waste out of the stream but to emulate how nature works in cycles, making itself different from the linear economy ('take, make, sell, consume and dispose'). Yet, he also mentions other "green" business models like Industrial Ecology and Industrial Symbioses (Saikku et al., 2015).

McDonough and Braungart (2010) describe the possibility of creating product systems thinking of the end of life of these products cyclically, minimizing waste, and using resources as much as possible. They mention that people are used to thinking of the industry and the environment as two separate entities just because "conventional methods of extraction, manufacture and disposal are destructive to the natural world." Both authors agree that "design is a signal of intention" and that it is difficult to apply universal solutions to local situations. "Industrial designers began to embrace recycled or sustainable materials; they still deal with surfaces - what looks good, what was easy to get, what they could afford." And that keeps the linear industrial infrastructure working, providing products to the consumer quickly and cheaply. This "cradle-to-grave" perspective is "not the result of corporations doing something morally wrong. They are a consequence of outdated and unintelligent design."

Specialists suggest ways consumers must take the lead and reduce their impact on the environment, as Lilienfeld and Rathje (1998) indicate in "Use less stuff: Environmental solutions

for who we really are" as a remedy to this century's waste problem. Businesses comply because they feel obligated to. After World War II, cheap materials and new synthetics entered the market; it became more accessible for the industry to ship rather than build local facilities to collect, transport, clean, and process for reuse than pass down or repair. McDonough and Braungart mention how this phenomenon happens with packaging, as it "may last longer than the product it protected." With the Cradle-to-cradle perspective, the authors intend to imitate nature's closed-loops flow, where the concept of waste is non-existent and resources continually circulate. This reduces consumption to local instances, evaluating not only how products are made but how it is used and by whom. The authors support that it is necessary to look for nature's patterns, such as circularity, to cut waste for a sustainable future.

When it comes to water, the situation changes. The circular economy applied to water and its life cycle assessment are unique compared to manufactured goods. Sauvé et al. (2021) acknowledge the circularity of water as part of a natural cycle at a planet scale; at a local scale, consumption and dispersal change. "Water footprint estimation methods (...) do not yet fully encompass circular economy concepts," which is understanding how water is being used, its origin, where it ends, and how the quality of water changes throughout the cycle. "Circular economy integrates normative concepts to prevent pollution and indirect impacts that go beyond evaluations of water consumptions in liters" it also considers energy consumption for extraction, transportation, use, and disposal, for example, as well as the consumables during water treatment to make it worthwhile to drink, not forgetting indirect water usage throughout the supply chain that involves the processes described above. "The first step to defining the circularity of water is for society to make choices for what environmental goals are to be achieved." Circularity in water consumption is a much more wicked problem than drinking water consumption and includes circular economy concepts in that activity.

Eriksen (2017) exposes, "Current waste volumes should be contained and remediated while long-term (circular economy/zero waste) strategies are implemented." The author showed how citizens had worked hard to promote solutions with public education and local waste collection in Chile and Taiwan. The author also addresses how design gives better alternatives,

“Design for longevity and fixability, leasing over ownership, reuse before recycling, and make things easy to dismantle, that’s good design.”

Circular Economy Strategies

Stahel (1982) was one of the first authors to expose how expanding the life of products to create a sustainable society was a good start, keeping objects in use by reusing, repairing, reconditioning, or recycling them. His approach focused on providing other revenue sources to businesses as service providers. The author mentions that the industry taking the first steps is easier since it has the resources and skills, so society can go next and be adopters. Stahel presents reuse as the first loop or alternative, followed by repair, reconditioning, and recycling as the last, shown in Figure 3. Each strategy aims for something different, reuse as product-life extension checks the quality and cleans. Most of the strategies focus on keeping products running in optimal conditions; this includes rebuilding, restoring and reconverting.

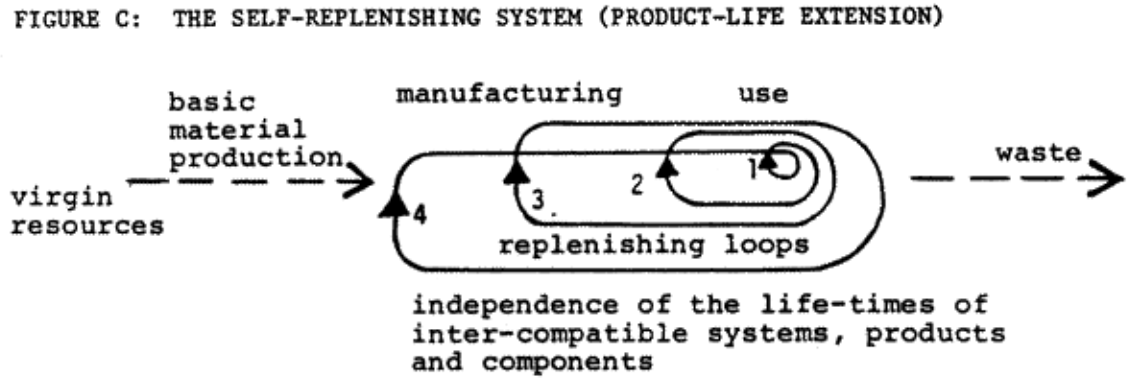


Figure 3: Stahel’s (1986) self-replenishing system

In 2016, The Ellen MacArthur Foundation released its report “The New Plastics Economy,” where it proposed the implementation of an after-use economy for plastic packaging. The report addresses the industry’s transition from the current business model to others that work differently along the value chain, such as leasing products instead of owning them. Other proposed strategies include product upgrades, product repairs, and the adoption of reusable or compostable plastic. All this to “rethink packaging and capture opportunities” as a process and transition. The report promotes recycling as one of the main strategies to change plastic waste

generation and enable the use of other materials to make the new economy not dependent on fossil feedstocks, focusing primarily on plastic's afterlife. Reuse is mentioned on a smaller scale. "Reuse plays an important role as an 'inner loop' to enhance material productivity in a circular economy." According to the foundation's circular economy scheme, it is a loop closer to the consumer's responsibility.

"Reuse is more challenging for many applications but could, however, be pursued for targeted applications." Reuse is a lever to reduce the quantity of plastic on the market. Since the report is directed to the industry and business, it supports the idea that "Innovative business models can capture value by capitalizing on the willingness of users to reuse in the home," including now regular consumers, copying models that are in use, like glass bottle reutilization and collection, or attending refilling necessities. Measures for reusing beverages containers in a business-to-consumer layout are exposed. For example, in San Francisco, selling and distributing drinking water in disposable bottles of 21 ounces or less is prohibited. At the same time, hydration stations were installed across the city; to the date of the report's publication, one hundred ninety-five towns and university campuses have copied the model.

Reuse Models

"Reduce, reuse, recycle" is a famous phrase useful not only to remind the public how to manage waste, but it is a hierarchy of indications. Porter (2018) agrees on having recycling as the last alternative for generating less waste or at least keeping the one generated out of the landfill or incinerators. The author defines reuse as a subcategory of reducing, "reusing old items reduces the need to purchase new ones." Porter presents examples applied to clothes and houseware and strategies for businesses such as making a discount for those customers who bring their containers to reuse. Reusing focuses on the creative use of what is already available, including repairing and refurbishment.

Refilling can be understood as a variant of reusing, and it makes up an effort mostly from businesses and companies to evolve into a circular economy. "Investigating customer perceptions of refillable packaging and assessing business drivers and barriers to their use" by

Lofthouse et al. (2009) investigates the potential of refillable systems to both the consumer and the environment. There are diverse types of refills, and the use of this attribute on packaging has been seen as a possible solution to the waste problem. The researchers' study evaluates the prejudices and advantages refillable packaging systems confront, interpreting the customer's perception of performance and effects. Five main attributes of this type of reuse are highlighted from the supply chain perspective, which could make refilling not work on a large scale: 1) Health, 2) safety and hygiene regulations, 3) logistical complexities, 4) price of the system, and 5) customer behavior. For this research, relevant findings by the authors are perspectives on self-dispense refill models. The study participants described refilling as easy, reduced waste and price. The negative side was the inconvenience of cleaning, planning, and forgetting the container. Still, the price attribute "appeared to override any negative aspects," making price a "must-have" to incentivize the use of refill models. Participants named features from refillable containers as necessary: "quick and easy to use, lighter, easily transported." This research emphasized the need to make refill systems a positive experience to lead consumers to use them.

Low-waste Habits

Engaging in sustainable behavior has good benefits not only to the planet but to the life quality of the person that practices it. Tapia-Fonllem et al. (2017) describe sustainable behavior as "the set of deliberate and effective actions that result in the conservation of natural and social resources." This has led more people to be curious and try to practice actions that would then develop into habits. But thinking of Sustainable Behavior could be overwhelming for a person to conduct. Porter (2018) said, "The zero-waste movement has struck a chord, from individuals to companies to municipalities, who are all enthusiastically looking for ways to use less stuff, and in turn, discard less stuff; people are looking for diverse ways to make the transition and adoption easier to do.

Terry (2012), in the book "Plastic-Free: How I Kicked the Plastic Habit and How You Can Too," approaches the problem of letting go of certain habits such as plastic consumption. For a

whole chapter, the author proposes actions to generate less plastic waste when drinking water, as “The inconveniences created by our dependence on bottled water outweigh the conveniences it provides,” as in 2010, only 29% of all PET bottles from store shelves in the United States were collected for recycling, and this happens because they are mostly consumed away from home. Terry lists alternatives to carrying beverages other than plastic bottles and presents initiatives such as findafountain.org or wetap.org that support the idea of stopping bottled water consumption and enhancing the use of hydration stations. The author provides a consumer-friendly approach with a directory of recommendations that allows people to understand the process of generating less waste.

Problem awareness is key to understanding habit adoption. At an industrial level, firms have shown a good understanding of the circular economy, its values, and their willingness to operate it, but not an enthusiastic behavior (Liu & Bai, 2014). A gap exists between awareness and actual conduct, mainly for the uncertainty about the marketplace. Habits, norms, and situations can help predict consumer behavior regarding plastic. Heidbreder et al. (2019) reflect how effective political and psychological interventions are, but long-term permanence is still doubtful. Strategies such as recycling can apparently help save resources but take the consumer to buy more in the long run. The use of plastic (mainly coming from packaging like bottles and bags) and how humans behave about it is seen as a cause of pollution. In their review, the authors agree on the idea that consumers evaluate how environmentally friendly packaging waste is from what they know on how it is treated once discarded. Besides that, cultural background, education, gender, and age influence preference for plastic; for example, people with lower income tend to rely on reusing. Habits are essential for plastic consumption, the authors argue. Changing norms and conditions may lead to a change of habits. Sometimes users want to reduce their plastic consumption but fail because they cannot apply new practices. Other factors influencing plastic consumption behavior are convenience, diffusion of responsibility, social pressure, desirability, and identity. But plastic is not only about consumption; it covers how the waste is managed either by reusing, recycling, or throwing it away. To conclude, the researchers mention that behavior change does not happen automatically because of these obstacles:

convenience and practicality in the context, lack of knowledge and opportunities, solid habits, and shift of responsibility. These are the points that should be tackled when behavior change is planned to be introduced. By educating children, stakeholders, and the public, or intervening points of consumption “information activating authority endorsements was more effective than information activating social norms or monetary incentives.”

Giving the user information is critical for them to reflect on the sustainability of their products and choices. Meise et al. (2014) discuss how consumers are demanding sustainable options on retail shelves. Price/benefit trade-offs are made when consumers are provided with complete information on sustainability-related attributes. The result is the selection of more value differentiated products. As the nudge theory points out, consumers need the information to help them make good decisions.

Habit Creation

Habits are repetitive actions that can be learned consciously or without the user knowing. In his book “Hooked,” Nir Eyal (2014) explains what ingrained habits are “behaviors done with little or no conscious thought,” guiding designers of different products and services to “influence customers to use products on their own without calls to action” through a five-step process called The Hook Canvas: Internal Trigger, External Trigger, Action, Variable Reward, and Investment. As mentioned by Eyal, it is known that ingrained habits “guide nearly half of our daily actions.” Creating automatic responses is the way the human brain learns complex behaviors. The author also covers how users create a routine around products depending on varied factors from less sensitive to more impactful ones like the product’s price. Altering behavior is not only persuasion on how to act; it is to repeat behaviors for prolonged periods or the rest of the user’s life. According to Eyal, “The action that forms a habit starts with a trigger,” meaning that habits are not created; they are built upon.

Eyal points out the Fogg (2009) formula for behavior: B=MAT; Behavior equals Motivation, Ability to complete the action, and Trigger to activate. Ability is linked to the product’s usability, so it is necessary to simplify processes by removing steps. Also, the author mentions

how heuristics like the scarcity effect, framing effect, and anchoring effect, among others, are impactful in creating mental shortcuts; these are the base for nudge creation. “Products need to deliver on their promises, users depend on the product as a reliable solution for the problem.” This is reached through rewards that align with the user's interests to reinforce motivation. Decreasing friction is necessary by making “user experiences as easy and effortless as possible.” Effort should come after some rewards, as the user gets better in time, and with that, more effort is put into the product’s interaction and, in consequence, more benefits. If the product is not being used, it demands too much effort from the user. The content Eyal explains in his book is relevant as it presents the steps to follow when designing a product that encourages users to change behavior without them noticing.

It is crucial to understand how the consumer decides, to create habits around those choices, and know what they need and want. Luchs & Kumar (2017) explore how consumers evaluate products when they have to choose and hierarchize sustainability, hedonism, and utilitarianism. A relevant finding is that “users are more likely to trade-off aesthetics for sustainability than utilitarian value for sustainability.” Emotions like confidence and guilt are relevant when doing these trade-offs; those involving utilitarian and aesthetic attributes have different behavioral consequences. The authors emphasize the role of emotions in decision-making. “Behavior can be understood as goal pursuit and the individual’s desire to pursue gains or avoid pains.” According to this, Luchs & Kumar agree that utilitarian attributes belong to preventive actions and aesthetic qualities are more gain oriented. The authors' categories of objects allow us to understand choices and behaviors better.

Nudging

Nudging is known as an effective way to support behavior change. Thaler and Sunstein’s “Nudge” (2009) is about how nudging is a tool used in economics to influence users and the relevance of choice architecture in different areas of human development, in both public and private sectors. As humans, we are biased, and this affects decision-making. For example, Thaler and Sunstein mention different biases like status quo bias, default rule, availability bias,

inattention, optimism, and social norms. The authors define a nudge as “Any factor that significantly alters the behavior of Humans.” People respond to incentives but get influenced by nudges. For nudges to be impactful, the choice architect, called an architect because they decide how to move the user toward the desired behavior, handles organizing the context in which people make decisions. People will need nudges for complex choices when there is no assessment or feedback, and when they cannot interpret information into pieces they can understand.

“Small and apparently insignificant details can have major impacts on people’s behaviors,” which can focus people's attention on a specific direction, improve life quality, and solve problems, always seeking the freedom to choose. The book also argues that our cognitive system is divided into the Automatic System (instinctive) and Reflective System (self-conscious). The Automatic System can be trained with repetition, effort, and time. The interaction of both systems develops biases, which are generated by heuristics. Three heuristics can be used as nudges in the language of the authors: anchoring, availability, and representativeness. With anchoring, for example, nudges can guide the number a person would choose “by ever-so-subtly suggesting a starting point.” With availability, people evaluate how potential risk is in a particular situation by asking themselves for examples. If they bring up examples easily and fast, the concern decreases. With nudges, judgment can be guided into “true probabilities.” Representativeness is the “similarity heuristic;” it looks for patterns, which may not always be accurate, like stereotypes. Understanding heuristics and biases aids in realizing how the human mind fails so that nudges can be implemented. To know where to place nudges, choice architects must acknowledge when people are least likely to make a correct choice: when they get benefits now and costs later, difficult and infrequent situations, and lack of feedback.

Design groups and firms have explored nudging as a strategy. BresslerGroup, a firm based in Philadelphia, describes a nudge as “any aspect of the choice architecture that alters people’s behavior in a predictable way.” (Mitchell, 2019) In this case, a change in design, adding a nudge, can affect individual behavior; but nudging should always show the user the option to opt out. Four rules from nudging theory can be effectively applied to design: “Align incentives with desired behaviors. Supply clear, visible, and immediate feedback to reinforce desired actions. Simplify and structure choices when decision-making parameters are complex. Make goals and performance status clearly visible.”

Mejía (2021) reviews the impacts of the nudge theory on design and the design process. Nudges can be used as reference concepts to design, mostly during ideation. “Design products and systems are ordinarily created for people that are expected to reason when interacting with products; people are assumed to be effortful and rational,” and users tend to use products in “auto-mode,” therefore, the results of the use of specific design may not be what was expected at the beginning. This is the moment when prototyping is helpful during the design process, to note those automatic behaviors. The author revises how designers in different areas use nudges. When designing for retail, availability bias is used by placing the desired product closer to the customer, on apps and websites interfaces, or on traffic signs that give feedback when speeding. “The activity of a choice architect might be understood as a particular design activity,” but not all choice architects use design. Toolkits and frameworks have been developed to encourage behavior change through design: MINDSPACE (Messenger, Incentives, Norms, Defaults, Salience, Priming, Affect, Commitment, and Ego) by Dolan et al. (2010) or Design with Intent by Lockton (2010). As nudges are being applied in different disciplines, there is no concrete evidence that this tool can develop new habits, according to the author.

During the ideation stage in the design process, nudges come to be valid. Priming, as a nudge, had been used to guide designers, like She & MacDonald (2014) presented in “Priming designers to communicate sustainability.” Priming, as “a stimulation to cognitively access specific

mental content," helps designers to communicate sustainability at an early stage. Priming stimuli to develop design insights is proven effective, judged by experts and consumers.

Nudging for Sustainability

As Thaler and Sunstein (2009) presented in "Nudge," community and social interactions are behavioral influences. McKenzie-Mohr (2011) shows three reasons people do not engage in sustainable activities: People do not know the activity and its benefits, there are barriers, and the alternative is easier to do. Understanding the perceived internal and external barriers is what the authors suggest for promoting changes, analyzing the new behavior along with the competing behaviors and their perceived benefits. McKenzie-Mohr (2011) mentions that "Campaigns that rely solely on providing information often have little or no effect upon behavior" since his publication has a marketing perspective on the issue. One of the tools the author presents is the use of prompts to remind the user to act sustainably. A prompt is defined as "a visual or auditory aid which reminds us to carry out an activity that we might otherwise forget." It does not pretend to change attitudes or motivations, only to remind the user to engage. It could have a more significant impact if the prompt targets a specific behavior, such as repetitive actions. It should be delivered close in time and space to the desired action to have the desired effect. The prompt should be noticeable, self-explanatory with graphics or text, use positive language rather than inviting to avoid specific actions, and use commitment strategies. From the techniques shown by the author, the use of prompts is adapted by the discipline of design in a more practical way.

Rivers et al. (2017) describe the application of a tax on plastic bags in Canada as a nudge applied as a policy to favor sustainable behavior. Nudging is just one of the four different policy options used to confront issues of consumer waste. The other three are Prohibition, Change of behavioral norms by public education or persuasion, and Market-based mechanisms, such as subsidies. The authors highlight the idea that "Nudges need adequate temporal and geographic control, demographics and social norms." Applying the fee was effective for people using reusable bags but did not affect those who prefer plastic bags. These types of nudges tend

to affect users of lower socioeconomic status. This specific research agrees with the idea that not all nudges are economical; many are physical.

Persuasive communication is a tangible approach to nudge application. Behavioral barriers prevent the development of the Circular Economy (Muranko et al., 2019). According to research applied to refrigerated display cabinets, Persuasive Communication positively impacts behavioral attitudes, product perceptions, and behavioral intentions towards the purchase of remanufactured goods. The authors support the idea that “educating consumers about the merits of the Circular Economy is essential in attempting to change behaviours.”

Nudging for Sustainability in Design

Design can use nudges, on purpose or not. An example of a clear nudge is when Saatchi & Saatchi (2007) created a paper towel dispenser along with the WWF to create awareness of how the South American jungle is being destroyed. As the towels were dispensed, the container which had the continent cut out and was filled with green paper, showed the user how the area became less green. A more subtle nudge was the Paper Cube by Shigeru Ban (Ban et al., 2001). When pulled, a squared toilet paper roll created friction, and it was harder to use, so people “needed” less paper. Nudging can be fun, with strategies like gamification, like the decals installed in front of trash cans in Lucerne, Switzerland, to incite citizens to throw their residues in the correct place (Abfall: Luzern will den Spieltrieb wecken, 2011).

“It helps to think about the environment as the outcome of a global choice architecture system in which decisions are made by all kinds of actors, from consumers to large companies to governments. “Thaler and Sunstein (2009) in “Nudge” give examples of nudges using social influence to promote low-waste behavior. One of them is the finding that it is more probable that people will recycle if they learn other people are doing it, or when hotels want their guests to reuse towels, chains have seen results when they mention other guests are reusing their linens. The authors also cover incentives for economic matters, such as taxes and fees for those who pollute and the “cap-and-trade system,” where those who pollute get traded “rights” to do it in

certain amounts. These incentives allow freedom and do not impose changes. The authors suggest giving feedback “through better information and disclosure” at a consumer level.” This is less invasive and expensive, “But sometimes information is a surprisingly strong motivator.”

Thaler and Sunstein (2009) explained an example in “Nudge” is about energy conservation and physical products. They cite Clive Thompson with a project dated 2007, where people were given an Ambient Orb, a ball-like device that changed color when the person was using more energy and green when the consumption was modest. In weeks, the Orb reduced the energy use of those who owned one by 40%. They argue that people use energy aimlessly because they cannot see it. “If we can find ways to make energy use visible, we’ll nudge people toward reducing their energy use without mandating any such reductions.”

Water Bottle Filling Stations and Behavior

Willis et al. (2019), in their article “The success of water refill stations reducing single-use plastic bottle litter,” go deep on how behavioral change is possible to reduce waste that comes from disposable plastic water bottles in a study and application of strategies in Australia. They explain how commodity has meant expanding the use of disposable bottles, as they make water easy to carry, for example. Countries to cities legislate to benefit reusable water bottles at a government level, like policies that ban or tax disposable water bottles. Their study observed and analyzed areas around a river trail where groups go hiking to then place water dispensers in strategic places on the path. The authors concluded that consumers follow others’ behavior, and a behavioral change strategy, is helpful but not enough by only putting hydration stations in certain areas. This article supports the idea of how Water Bottle Filling Stations can be used to increase low-waste habits practices having in mind not only the strategies for behavioral change, “Considering the placement of stations and the intervention strategy to drive uptake and behavioral change will be key to achieving their maximum benefit as an additive strategy for reducing litter.”

Water Bottle Refill Stations have been studied to understand behavior that favors sustainable practices. Uehara & Ynacay-Nye (2018) present a case study in Japan that explores

the likelihood of installing WBFS on campus and how they contribute to encouraging sustainability when pro-environmental behaviors are promoted. The authors state that these devices can persuade students to prefer them over disposable plastic bottles. Their study proves that students would pay to have a Water Bottle Filling Station on campus. More than 50% showed a willingness to use them. Uehara & Ynacay-Nye also show how an information campaign is essential in this adoption process. In their study, the researchers defend that “Pro-environmental behavior often involves a conflict between hedonic or gain goals with normative goals;” therefore, strategies should be implemented to balance the goals. For this reason, they established attributes on Water Bottle Filling Stations and strategies to develop expected attitudes; for example, the bottle counter attribute was described as something fun, as the strategy it follows is to “make hedonic goals compatible with normative goals” expecting a favorable attitude that supports the use of hydration stations. Other attributes were not charging for the water, clean water, chilly water, and plastic waste. The authors observed that students were willing to change their habits if there were permanent locations on campus to find the WBFSs. For the participants of this study, the main reason not to use the hydration stations was the burden of carrying a container. Hence, the authors proposed using prompts, such as signs, to remind students to bring their water bottles. This study shows the willingness of students to change their current behaviors around WBFS, where there is no earlier presence of stations on campus.

In their report, “Implementing water refill stations across campus to promote reusable water bottle use,” Chudwick, Salvemini, & Welker (2013) describe the results of a survey done at Villanova University in Pennsylvania, United States. Questions asked to the participants involved current habits about their drinking water consumption, both from disposable water bottles and refilling stations. The survey results show that 91% out of the 235 subjects were willing to switch or try to use refill stations if it was convenient and easy. 52% indicated that the best locations to position water refill stations were familiar places on campus. This report shows an example of efforts from universities to promote the use of this infrastructure on campus by involving students in the decision.

It is also essential to understand the antithesis of hydration stations, the bottled water business. “Bottled and sold: The story behind our obsession with bottled water” (Gleick, 2010) sets the stage for how this business developed and has grown. Water fountains were public, trustable, and prolific; they became disused due to “private control and profit.” “In our health-conscious society, we’re afraid that public fountains and our tap water, in general, are sources of contamination and contagion.” Since the middle of the twentieth century, efforts had been made so the industrialized world could have access to “free fresh water” as people turned on a faucet. Gleick presents data that helps to foresee the magnitude of the business: In 2008, nearly 9 billion gallons (over 34 billion liters) of water were bottled and sold only in the United States, and worldwide it was five times this amount.

Bottled water is now so easy to find that it is difficult to remember it has not always been present. It has convinced consumers that it is better than tap water, an easier and more accessible alternative. This was by promoting through effective advertising and marketing the perceived advantages and emphasizing the competition’s flaws, selling “safety, style and convenience and playing on consumer’s fears.” At least in the US, public tap water is more regulated than bottled water, and it is not the only country where this happens. According to the author, Vietnam, the Netherlands, and Ireland are countries where bottled water is not heavily regulated. Through the book, Gleick describes the posture of CEOs and managers of big companies who benefit from selling bottled water, such as Kim E. Jeffery, CEO of Nestlé Waters North America, where she claims, “We are a 24/7 on-the-go society who wants convenience in our beverage choices”.

Material choice when bottling drinking water is essential. The author believes that bottled water sales would have never taken off if the containers available for water were exclusively made of glass or aluminum. Water portability has always been a problem due to the liquid being heavy. Aluminum is convenient for flavored drinks but not so much for plain water as it may slightly change its taste. On the other hand, Polyethylene Terephthalate or PET is resistant to

heat, oils, solvents, and acids, impermeable, strong, light, impact-resistant, naturally transparent, recyclable, and does not transfer taste to its contents. As the author reflects on the possibilities for empty bottles numbering 5: throw away, recycle, reduce the amount of packaging used, burn for energy, or make the bottle out of a more environmentally friendly material. Investment to recycle or create new materials is being done, but not on convenient public water.

Accessibility and perception of different water sources are crucial when choosing how to get drinking water. A survey done at Canadian universities found that a third noticed fewer water fountains, and half of them saw delays in repairs. In Australia, 9 out of 10 people said they did not know where to find a water fountain; 85% were worried about the stations' cleanliness and safety, and 80% thought there were not enough water fountains in their city. "The convenient availability of bottled water has reduced public demands for fountains," Gleick assures several reasons to fight bottled water, such as corporate control of public resources, economic costs to the poor, or the environmental implications. For this, groups and individuals have reduced or even dropped their consumption of bottled water and are influencing others to do so. Universities and colleges from various parts of the world are joining initiatives. Gleick concludes that "consumers will always seek a diversity of choices, including the choice to buy water in convenient, single-serve containers."

Second Level Framework

Figure 4 shows a more detailed conceptual framework, including citations from the literature review supporting this research. Cited pieces of work include articles and books from different authors that have explored sustainability in other areas, including behavioral economics (Thaler and Sunstein, 2009) and psychology (Tapia-Fonllem et al., 2017), to the direct application of the subject of this study which is Water Bottle Filling Stations (Willis et al., 2019) and low-waste habits (Eriksen, 2017; Porter, 2018). All the spheres of this research look forward to improving the planet's general state and society.

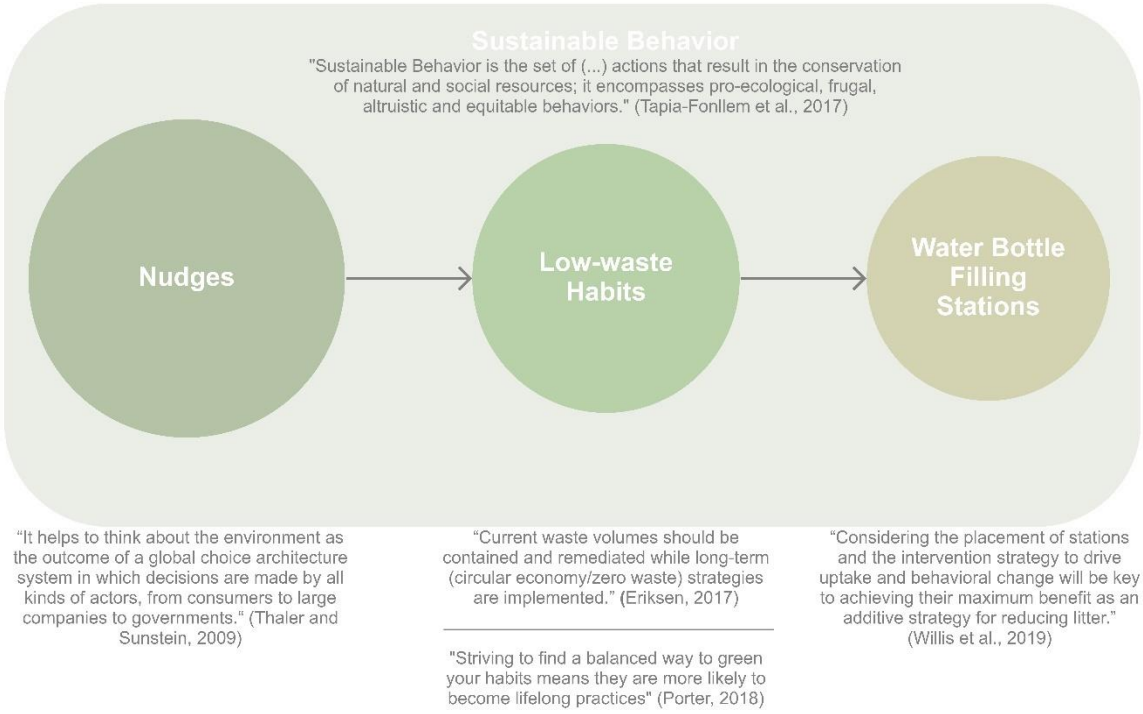


Figure 4: Second Level Framework

Beuren et al. (2013) expose the link between physical products and services to create systems. At the same time, this becomes a strategy used in business to create less waste but keep profiting. This is directly connected to the purpose of WBFSs. This device supplies a service and depending on its location and additional interventions. It could lead to behavioral change (Willis et al., 2019). Nudges are instruments to guide but not mandate a behavioral change in the freedom choice provides, and evidence shows they can be used in favor of environmental sustainability (Thaler and Sunstein, 2009). The behavior Water Bottle Filling Stations aim to change is the frequent consumption of bottled water, which generates waste. This is also the objective of the circular economy (Eriksen, 2017) and low-waste habits, being the latter a lifestyle that makes the strategies of the circular economy more concrete, modify the frequent consumption of goods that generate waste; aiming to adopt these practices can improve the probability of turning them into permanent habits (Porter, 2018). The circular economy supports the environmental part of sustainable behavior since this type of conduct also looks forward to improving society (Tapia-Fonllem et al., 2017).

CHAPTER 3

METHODOLOGY

Introduction

This research compared drinking water consumption at a college in the United States and a college in Mexico. By its nature, it was necessary to apply a mixed-methods approach, combining secondary (published) data collection, which was presented in the previous chapter, and primary (original) data collection. To understand current behaviors, priorities, habits, and the design of Filling Stations per se, it was necessary to use a qualitative approach. It was the best way to observe and analyze “experience, meaning and perspective” (Hammarberg et al., 2016). The chosen methods that delivered results for this research were examined and reviewed from a pool of options coming from books and similar previous studies. Each of the methods used is expected to provide the following: Fly-on-the-wall observation: Images and notes on context, activities, users, interactions, objects; surveys: Inputs with users' habits, motivations, and opinions of WBFS; follow-up semi-structured interviews: Extended and specific information from surveys.

As it respects to sustainability research, it is recommended to use quantitative methods to fix indicators or to combine both qualitative and quantitative data (Scerri & James, 2010); but current studies focused on design and behavior, along with sustainability, have shown the benefits and value of qualitative research (Lipman, 2020; Liao et al., 2020; She & MacDonald, 2014). Qualitative methods make the creation of theories possible to understand behavior and the current design of Water Bottle Filling Stations in a more profound way. The methodology explained throughout this chapter strived to answer the questions presented below.

Research Questions

The research questions for this study were derived from the research topics and literature review. The complete set of questions is relevant to the research because they explore how the

three axes of the study relate to each other through the exploration of Water Bottle Filling Stations. Table 1 shows the research questions and their rationale.

Research Question	**Rationale**
1. What is the level of information on water bottle refill stations regarding low-waste habits?	An example presented by Thaler and Sunstein (2009) showed how a device allowed citizens to notice their energy consumption. Is it possible to guide users into consuming less bottled water, as the Ambient Orb informed users to pay attention to their electricity use?
1.1 What do current water bottle filling stations communicate?	Bottled water is known for communicating a safe and healthy solution for water consumption (Gleick, 2010). This question aims to answer which are the design attributes and values of WBSFs and their interfaces that speak to the user.
1.2 How are water bottle filling stations attractive to the user?	Studies have shown that users make trade-offs when choosing between sustainability, practicality, and aesthetics; some attributes are more appealing than others (Luchs & Kumar, 2017). In which order do they apply to WBFS?
1.3 What is the role of hygiene in water bottle filling systems?	Bottled water is sold as the most hygienic alternative, and this aspect worries consumers when referring to WBFS; what is the reason? (Gleick, 2010)
2. How are water bottle filling stations communicating to users to continuously refill bottles instead of buying disposable plastic bottles?	Examine the current application of choice architecture as it promotes low-waste habits through product design on water bottle filling stations.
2.1 Which nudges and prompts are being applied to water bottle filling stations to promote low-waste water consumption?	Environments and products can guide people to adopt pro-environmental behaviors (Thaler and Sunstein, 2009). Find the current interventions on WBFS by design or adaptation, explicitly used for low-waste consumption.
2.2 What are the motivations to support or not the use of water bottle filling systems?	Research has been done to understand what would make people use water bottle filling stations or non-disposable water bottles (Uehara & Ynacay-Nye, 2018; Willis et al., 2019), but not at the same time. Motivation is necessary for habit creation (Fogg, 2009)
3. How can water bottle filling stations enhance low-waste drinking water consumption through nudging?	Explore the needs and preferences of the user to develop low-waste habit creation with choice architecture.

Table 1: Research questions rationale

Research Approach

For the purposes of this research, three primary data collection methods were applied. Depending on the nature of each question, a different approach was needed since every method delivered further insights and provided rich answers. Table 2 shows the justification for the chosen research method per question.

<table>
<tr><th>Research Question</th><th colspan="2">Research Method</th><th>Justification</th></tr>
<tr><td>2. How are water bottle filling stations communicating to users to continuously refill bottles instead of buying disposable plastic bottles?</td><td rowspan="2">Fly-on-the-wall observation</td><td></td><td rowspan="2">Non-intrusive observation of the users in the environment where the artifact is found and the artifact per se makes interaction and reactions as natural as possible, showing the reality.</td></tr>
<tr><td>1. What is the level of information on water bottle refill stations regarding low-waste habits?</td><td rowspan="5">Semi-structured Interview</td></tr>
<tr><td>1.1 What do current water bottle filling stations communicate?</td><td rowspan="2"></td><td rowspan="2">Detailed information and insights are provided during semi-structured interviews on current beliefs, motivations, and opinions on water bottle filling systems and their behavior around them.</td></tr>
<tr><td>2.1 Which nudges and prompts are being applied to water bottle filling stations to promote low-waste water consumption?</td></tr>
<tr><td>1.2 How are water bottle filling stations attractive to the user?</td><td rowspan="4">Survey</td><td rowspan="4">Surveys allow respondents to rank priorities and preferences on different water bottle filling systems attributes and develop their reasoning in short answers.</td></tr>
<tr><td>1.3 What is the role of hygiene in water bottle filling systems?</td></tr>
<tr><td>2.2 What are the motivations to support or not the use of water bottle filling systems?</td></tr>
<tr><td>3. How can water bottle filling stations enhance low-waste drinking water consumption through nudging?</td></tr>
</table>

Table 2: Research Method per Research Question

Questions 1 and 2 focus on the WBFS as a device in an environment and what can be noticed during active or passive use. An optimal way to answer these questions is through observation. According to O'Leary (2014), what people say they do and what they actually do may be different, and methods where direct interaction with the subject may lead to this result. Not all observations are the same. Candid observations could also deliver a similar scenario, where the behavior may change.

Questions 1.2, 1.3, 2.2, and 3 refer to points of view that could be answered generally, with not a lot of detail. Surveys collect data by asking the same questions to a sample related to their opinions, attributes, and characteristics. In this case, information on perception and widespread use of WBFSs is needed to answer the questions. A survey is a tool that adjusts to this purpose to gather this information. Observations would not allow the researcher to fully understand the behavior of users or measure the frequency of how many days a week a single person is using a station. It would take time to follow several users and would not be representative, whereas an explanatory survey is possible. Online surveys reach a large number of respondents, allow comparisons, and generate both qualitative and quantitative data that is standardized and empirical (O'Leary, 2014).

All the research questions may require in-depth data collection to have access to deeper reasoning and justification of specific actions that observation and surveys would not provide. Knowing if the current prompts and nudges are working correctly is hard to evaluate from observing or through a survey. A one-on-one semi-structured interview, where the participants can talk, develop, and show is a valuable tool to let users express their thoughts in detail. Focus groups could be another resource, but it goes around discussion rather than details or influence of other participants (O'Leary, 2014).

Fly-on-the-wall observation

It was crucial to collect as much information to contrast with reality and assemble checklists for behavior observation in the field. The first approach needed to be as close to reality as possible, so the Fly-on-the-Wall observation method was chosen for the first approach. During these observations, notes were taken on current nudges, prompts, and interventions around the user's environment and the water bottle filling stations. Fly-on-the-wall observation is "unobtrusive observation of people and behaviors, without direct participation or interference" (Hanington & Martin, 2017). This method reduces the influence on the users' behaviors in an uninterrupted way. It is ideal for public places, which is the case of this research. These first approaches through Fly-on-the-wall observation were to find and explore types of drinking fountains around both campuses, observe use, graphic and textual prompts present in the design and around the Water Bottle Refill Stations as well as adaptations, signage, describe the location, and emphasize in the importance of context, mapping proximity of stores, vending machines and other sources of disposable water bottles around the area of the Water Bottle Refill Stations. Other elements such as the type of container used while using the station, filling procedure, social interactions, weather conditions, and time of the day were considered.

The fly-on-the-wall observation was preferred over other observation approaches like control groups or participant observation. Since it remained unobtrusive, subjects did not know they were being seen. This gave freedom to the subject (Polaine et al., 2013); otherwise, the preferences and general behavior can change once it was mentioned they were part of a study.

Four sites on each main campus of both Universities were proposed to be observed due to the similarity of the building's use, as seen in Table 3.

Common Denomination	ASU	UAA	Rationale
Library	Hayden Library	Pedro de Alba (Access to Main Library) Building #65	A place often visited not only by students but by staff as well. It is not food-related but is a meeting point inside the campus.
Graduate-level facilities	Novus Innovation Center	Unidad de Estudios Avanzados (Graduate Studies Unit Building #220)	Graduate students tend to spend more time in the studio than undergraduate students, and they can be part of the staff crew simultaneously.
Cafeteria	Memorial Union	Building #9	A place with broad access to food and other drinks that are not tap water. Reference point to look for hydration.
Administrative building	Fulton Center	Edificio Académico Administrativo	They are frequented by staff and students. Represent reference points on campus and open the scope to other users besides students.

Table 3: Sites for Observation

The purpose of these observations was to understand the contexts and environment in which the activity of refilling containers with drinking water from the WBFSs takes place, how users interact with the device and prompts, and what actions are being executed by the consumers. From the list, only two were chosen for each university for being high-traffic areas: the libraries and cafeterias. Each location was visited at least three times at separate times of the day for at least 30 minutes each time to compare traffic and behavior. Notes were taken on the specific weather conditions from that day and the gender and other implicit information without interaction (Hanington & Martin, 2017), such as the material and approximate volume of the container the user carries, as the method shows. From what was seen, it was possible to design the questionnaires for the following research methods and determine the models to be analyzed.

Explanatory Survey

An online explanatory survey was designed to screen general perceptions on Water Bottle Filling Stations, preferences, and attitudes towards different water sources. Two questionnaires with the same set of questions were developed, the one for Universidad Autónoma de Aguascalientes in Spanish, and the survey applied to Arizona State University was in English. Both questionnaires had 23 questions conducted online using Google Forms, open from February 1st to February 28th, 2022. Questionnaires were formulated after observations and literature review, considering previous Water Bottle Filling Stations studies. Chudwick et al.'s (2013) questionnaire was used to get insights on the type of drinking water source preferred, daily consumption and use, awareness, and convenience of the location of the water bottle filling stations. For demographics, attitudes toward sustainability on campus, price, health, taste, convenience, environmental costs, reasons not to choose WBFS, and daily habits, i.e., frequency to campus, preference of drinking water, Uehara & Ynacay-Nye (2018) were referenced, as well as for describing reusable containers along with the one's mentioned by Terry (2012).

Data was collected through close-ended, Likert Scale questions and open-ended questions. Closed-ended questions included multiple-choice to describe difficulty in accessibility and use in different degrees (Always, sometimes, never), the taste of water, and safety factors (Not a factor, a small factor, a large factor). Checkboxes were used in questions where more than one answer applied to the participant, like moments to look for a hydration station or the material of their reusable container if they used one. Five-point Likert Scale questions ranging from "not convenient" to "very convenient" and "not interested at all" to "very interested" to rate their experience with the location of the water dispensers and interest in low-waste habits. In both cases, the subjects' answers were categorized as positive (Likert scale 4 and 5), neutral (Likert scale 3), and negative (1 and 2). Open questions were included when a further description was needed to explain why they chose a certain answer, for example so that participants could explain the rationale behind their answers. This provided insights into the qualitative nature of this research. A total of (n=74) participants was recorded, (n=36) from ASU and (n=38) from UAA.

Semi-structured Interview

The semi-structured interviews tool was optimal for understanding the impact of prompts and nudges on the filling stations. Participants from the surveys that volunteered to keep collaborating in the study were interviewed. Eyal (2014) suggests paying attention to “user narratives: clear descriptions of desires, emotions, context to understand how habits can develop.” Questions on the interviews aimed for participants to justify actions described in the surveys and gather comprehensive perspectives on the use and perception of the device. The interviews were conducted online, both in English and Spanish through Zoom. Participants were asked if they felt comfortable with video recording the session. Video recording allows to later review reactions, go over comments done during the interview, and create rapport with the participants instead of taking notes. A total of (n=10) interviews were executed. Semi-structured interviews allowed to guide the discussion depending on the experience and preference of the participants depending on how exposed to WBFS they were.

The interview started with an introduction question where the participants were asked about their typical day on campus and how they stay hydrated. At the same time, they attend their activities at the university. To have a broader scope on details like interaction, use, and preferences to figure out the influence of nudges, adaptations of other methods were included as interview questions.

Cognitive walkthroughs evaluate the current prompts on a system (Hanington & Martin, 2017). This method allows reflection on how people think and act during the task. It can be combined with Think-Aloud Protocol, in which the person says aloud the steps to follow as they execute a process. Interviewees were asked to describe how they refilled their bottle and their approach to staying hydrated on campus, step by step and aloud.

An adaptation of Triading (Hanington & Martin, 2017) was also used during the interview. This interviewing method reveals attitudes, perceptions, and feelings toward products. This method requires the participants to compare three images presented to them that belong to the same category, intending to point out similarities, differences, or changes among each other. Interviewees were shown photographs of the observed Water Bottle Filling Stations. They were

asked to compare physical characteristics, use, and familiarity as they found three attributes on each one that stood out and explained why.

Sampling

Two sets of samples were examined to understand if behavior and priorities that allow low-waste habits to increase are the same from country to country or vary because of cultural factors, economic possibilities, location, or other circumstances. The Institutional Review Board of Arizona State University approved data collection on January 31st, 2022. The criteria used to define who was included in the final sampling were current students, faculty, and staff working at ASU and UAA, 18 years or older, of any gender, that work or study in person at each college's facilities. The total sample size that was expected to recruit and enroll was n=90 anonymous volunteers per college, meaning n=180 in total for the surveys and n=28 for the interviews. Participants who wished to voluntarily continue with the study left their email addresses as contact information for the interviews.

The researcher did recruitment and consenting. Following the nature of the survey, volunteer sampling was adequate. It is a non-random sampling strategy, common for qualitative research, and hard to define populations (O'Leary, 2014). The intention was to gather both parts of the spectrum: whether they have used WBFS or not, whether that favors reusable containers or not. Two different recruitment methods for the surveys were applied: Posters with QR codes that took to the electronic surveys, posted near the areas where WBFSs can be found on campus. The same poster was distributed electronically through email social media. Posters in English were used in the United States (ASU Tempe campus), and posters in Spanish were used in Mexico (UAA Main Campus). Recruitment for interviews was done after the surveys through volunteering as well. An extra section at the end of the surveys functioned as a screen allowing the participant to enter data if they were interested in being part of the next part of the study.

Analysis Methods

Notes from in-field observations and the interviews were transcribed and categorized in tables according to the codes derived from each analysis method. Numeric data from the surveys were analyzed and graphed using Google Sheets. Observations allow to immerse the researcher into an experience through all the senses; those observations are full of detail (O'Leary, 2014). To analyze the information derived from this research method, Rothstein's (2003) A (x4) way is suitable to use as it evaluates user experience rebuilding scenarios, focusing on characters (Actors), events (Activities), products (Artifacts), and environments (Atmosphere), creating "detailed profiles as part of an analysis process."

Since the research contemplates how Water Bottle Filling Stations look, a broader analysis of them is needed. An artifact analysis (Hanington & Martin, 2017) is "a systematic examination of the material, aesthetic, and interactive qualities of objects". This analysis method focuses on what the object has to say about the context and user, rather than asking the user their perceptions of the object. For this research, three Water Bottle Filling Stations models are analyzed: Elkay EZH2O LZWSR_1B found at Arizona State University's Memorial Union, Elkay EZH2O LRPBD2_8WSC at Hayden Library, and Halsey Taylor HVRHTHB-NF_1B found at Universidad Autónoma de Aguascalientes at both locations observed. Hanington & Martin (2017) state that artifact analysis also goes through interactive aspects of operational use and behaviors around the device, such as complexity, identifying misuse, or adaptations. Artifact analysis was executed between observations and surveys to have a deeper understanding of the object the user is being exposed to.

The surveys and interviews were analyzed using coding and clustering, a technique that allows extracting meaning from words and building theory from the collected data (Milles & Huberman, 1994; Strauss & Corbin, 1990). This analysis method clusters ideas of similar types. The transcriptions were written down and translated if necessary. The texts were broken up by questions and terminology into sentences and paragraphs to prepare the data. This created macro-codes and then clusters. The coding was applied as specific topics were recurrent and

significant; recurrent to be defined as how often the term was mentioned and essential as a relevant input for the researcher, even if it was just mentioned by a single person and was not recurrent.

Each analysis method acknowledges different procedures to gather the insights which will translate into answers to the research questions aim to understand. Table 4 justifies the chosen analysis methods matching the research method it goes through.

<table>
<tr><th>Research Method</th><th>Data Analysis Method</th><th>Justification</th></tr>
<tr><td rowspan="2">Fly-on-the-wall observations</td><td>A (x4)</td><td>Allows fixing large quantities of information on observed phenomena from the environment, the WBFS, and users into four categories to create a scenario.</td></tr>
<tr><td>Artifact Analysis</td><td>Identifies physical attributes during the passive and active use of WBFSs, adaptations, and performance.</td></tr>
<tr><td>Explanatory surveys</td><td rowspan="2">Coding and clustering</td><td rowspan="2">Recognize and associate common themes to build theory from the participant’s input on their experiences, motivations, and behavior on WBFSs.</td></tr>
<tr><td>Semi-structured interviews</td></tr>
</table>

Table 4: Analysis Methods Justification

CHAPTER 4

RESULTS

The Fly-on-the-wall observation was executed from October to December 2021, with an average duration of 30 to 45 minutes. During the application of the method, it was possible to observe the artifacts in action with their adaptations and misuses. The analysis was complemented with information from the manufacturers' websites during March 2022. Although two different companies branded the WBFSs, both belong to the same manufacturer. Elkay Manufacturing Company bought Halsey Taylor in 1991 (Elkay Corporate, n.d.). They all are made from stainless steel and have the same description on their model's website "Delivers a clean quick water bottle fill and enhances sustainability by minimizing our dependency on disposable plastic bottles." (Halsey Taylor, n.d.; Elkay, n.d.).

Figure 5: WBFS at Hayden Library

Figure 6: WBFS at Memorial Union

Stations found at ASU were indoors, while those at UAA were placed outdoors, although they are also recommended for indoor locations. Out of the four locations, only three were seen in use. The one at Pedro de Alba (Figure 8) was never used during the observations but attracted subjects who stopped by to read the graphics and texted as they waited for someone. They are placed near restrooms and highly transited, except for the one at Building #9 in Mexico. Places that sold bottled water or other drinks in disposables were nearby. These places were

convenience stores, coffee shops, or vending machines supplying water of different brands and volumes. The three models included a chiller, but only the models at ASU had the filter built in the model, along with an LED filter status indicator. Depending on the model, the filter indicator changes color as it gets closer to the 19,200 or 38,400 20 ounces refills. In the case of UAA, the filters could be observed in a separate area not far from the refill station, as shown in Figure 7, and for that reason, they did not have an LED filter status indicator. The model found at the Memorial Union claimed it “can be used by persons with lack of experience” (Elkay, n.d.) on their website. The artifacts at Arizona are touchless and handsfree, so their refill system is through an activation sensor.

On the other hand, the model in Aguascalientes has a push button. All count with automatic activation and shut-off timers. It was possible to see the LED filter indicator at Hayden Library change colors during the observations. At the same time, only a few of the users stopped using it when it turned yellow, warning that the filter needed to be changed.

Figure 7: WBFS at Building #9

Figure 8: WBFS at Pedro de Alba

The three models count with iconographic instructions by default. Still, the Halsey Taylor models were adapted by adding text and symbols around them to explain how they work, to promote the stations as a healthy, hygienic, and ecologic option, as seen in Figures 7 and 8. The

only extra graphics added to the models at ASU were an A4-sized sign suggesting refilling instead of using the water fountain at Hayden Library and data on plastic bottles and water conservation at the Memorial Union. All observed stations had a bottle count screen, which counts every time 20 ounces of liquid is dispensed, yet the one at the Memorial Union never worked (Figure 9 and Figure 10). While observing, it was noticed that the counter skipped numbers. Other prompts and nudges for low-waste actions are bins and trash cans labeled to sort waste (Recycle and landfill). At building #9, there was a solar phone charger, and at the Memorial Union, there were containers for compost and other residues like used batteries.

Figure 9: Counter at MU Figure 10: Counter at MU

To use the WBFSs, observed subjects carried bottles from different volumes either in their hands or backpacks. Reusable containers, reused disposable bottles, disposable paper cups, or plastic cups were used. Materials were varied; containers were made of metal and plastic; in Mexico, it was common to see disposables being refilled more than reusable containers. Subjects not only carry their bottles, but at cafeterias, they were seen carrying food and drinks like coffee in disposable or reusable cups, skateboards, books, and materials.

Subjects were seen in groups or individually while they used the stations. On average, the number of people who used the stations varied at each site, with the Memorial Union the most visited, with 9.5 subjects using it every 30 minutes. Although regular water fountains were not suggested, in the US, they were used. The university canceled the fountains in Mexico, they had

no running water, and the same graphic surrounding the stations explained this was due to COVID-19. The procedure was standard for the four locations to refill the bottle using the filling station: open the bottle, place, wait, and leave the station. Users look to the front or at their phones while refilling, which causes an overflow in some cases. Some subjects held their bottles as they were being supplied. Stops are short; when the refill took longer, the subject took some sips out of their container to fill it out some more. It was also relevant to see how the stations are used for other purposes, like emptying bottles from their content or using the water to prepare different drinks on-site, such as protein shakes.

The afternoon was when the WBFSs were used the most, locations were more crowded, and at the Memorial Union, consumers were making a line to use it. At Hayden Library during that part of the day when water fountains were preferred. During the evening, it was possible to see the area getting untidy; the station at Hayden Library had toilet paper beneath it. In Mexico, areas were not well-lit, and users preferred not to use them.

The surveys provided interesting insights that justified behaviors seen during the observations. The surveys had a total of n=74 participants. n=36 from ASU, aged 18 to 70; 50% were women, 38.9% were men, and 11.1% preferred not to disclose their gender. All positions on campus were invited to take part, but no faculty members participated. 63.9% were undergraduate students, 22.2% were graduate students, and 13.9% were staff members of ASU. From UAA, the total number of participants was n=38. Thirty-nine responses were recorded, but one was from a participant younger than 18, so it was left out. Participants were ages 18 to 57, of which 59% were women and 41% were men, divided among undergraduate students (78.9%), graduate students (2.6%), faculty members (10.5%), and staff (7.9%).

Participants said sometimes it is hard to get drinking water on campus (ASU 52%, UAA 60.5%). Less than 10% specified it is always difficult, as almost 40% mentioned it is never hard to get water.

Participants from ASU mentioned that the preferred method to stay hydrated on campus is Water Bottle Filling Stations/Water Fountains and reusable bottles brought from home. In contrast, UAA participants prefer getting their containers from home. Participants were asked to

answer why they selected their chosen water source. It is important to note that some offices and cubicles at UAA have water coolers or dispensers different from the WBFSs placed around campus. Table 5 shows the water source preference by university, ordered by mention frequency.

Water source	**ASU**	**UAA**
Buy disposable water bottles on campus.	Convenient Easy Meal swipes (ASU's meal plan) offer bottled water. Not knowing where the WBFSs are.	Convenient Fast Easy
Bring disposable water bottles from home.	Convenience Preferences on the water source "I prefer to drink distilled water. So, I prefer to bring water from home to school."	Trusted source Practical Convenient Accessible Saves money Not knowing where the WBFSs are.
WBFS / Water Fountains	Environmentally friendly Convenient Free resource Cold water	Convenient location Cold water Free resource Environmentally friendly
Reusable bottle brought from home.	Environmentally friendly Filtered water from home is more sanitary Healthy Convenient Better taste Not knowing where the WBFSs are.	Saves money Environmentally friendly Full bottles are heavy and difficult to carry Saves time Prefer their bottle

Table 5: Water Source Preference by University

More than half of the respondents in the US showed that water safety to their health is a significant factor (57%), and in Mexico, it was even higher (65.8%). Less than 10% do not consider it a key factor. When asked which water source is the safest, the Mexican sample preferred bottled water over WBFSs, compared to the American sample, as seen in Figures 11 and 12. Referring to both sources as equally safe, both samples are consistent.

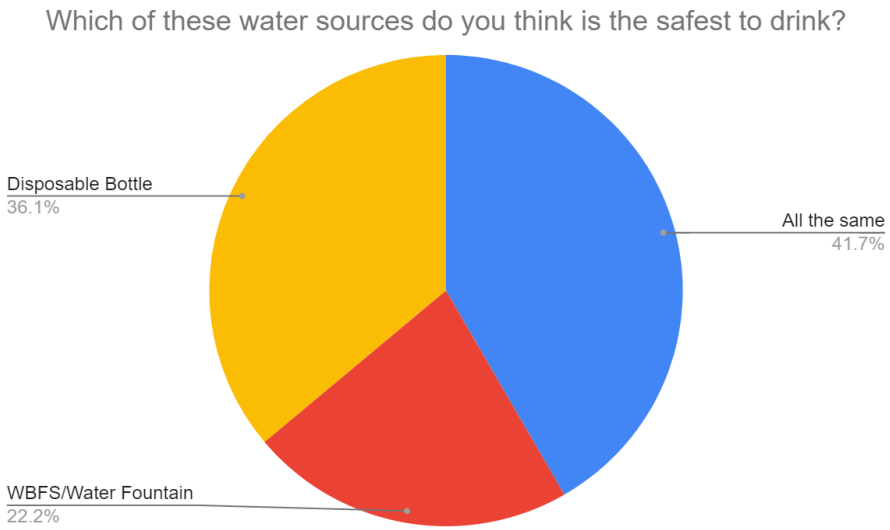


Figure 11: Safest water source at ASU

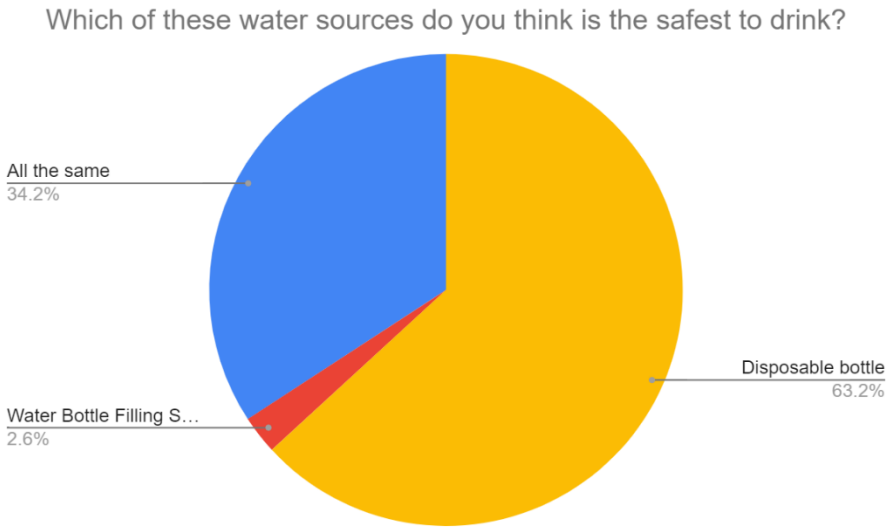


Figure 12: Safest water source at UAA

When they were asked why they preferred that source, respondents who prefer bottled water showed aversion to WBFSs, mentioning the supply source of the stations is uncertain as well as the quality of the filter, that the device is exposed to the open-air environment and public space, for the high COVID-19 exposure or even that they could be the target of jokes. Others explained bottled water has been through filters, tests, and protocols, as it is sold sealed. Those who think both sources are equally safe explained they trust the source is the same after all, did

not leave a justification at all, or showed themselves uneducated, although “Water Bottle Filling Stations may not always taste good.” Those who believe WBFSs are safer than other sources said authorities would not install something that harms users; they also referenced that when water is contained in plastic, it is not secure, and they trust water is being filtered. Another participant mentioned that all sources outside their home are risky.

As for water’s taste, 50% of ASU’s participants considered it a minor factor when choosing their water source, while with UAA, that same percentage considers it a significant factor. A third of the ASU sample considers it an essential element. Taste is not a crucial factor for 16% of both samples. When asked to choose the source that delivers the best taste in water, most of both groups considered bottled water gives better flavor, based their rationale on earlier experiences and comparing them with WBFSs, arguing it feels fresher than the ones provided by the stations. ASU (38.9%) and UAA (42.1%) participants that answered both sources taste the same said, “All water tastes the same,” “water has no taste,” and they do not care or have any preference. Those who chose hydration stations described, “A water fountain tastes different, but it tastes natural. When I drink from a sealed water bottle, it tastes clean but not natural.” Taste from WBFS was classified as fresh, standard, or tasteless.

Another difference between both populations is the amount of bottled water consumed on campus in a week. Figures 13 and 14 show ASU’s and UAA’s consumption, respectively. In the survey, the participants that got more bottled water showed preference over this water source, as they related it to better taste and health safety.

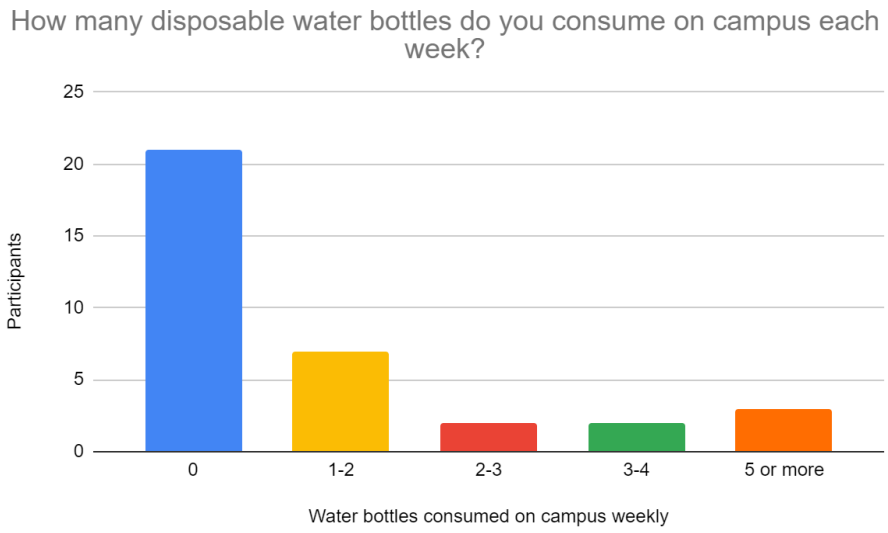


Figure 13: Disposable Bottles Consumed a Week at ASU

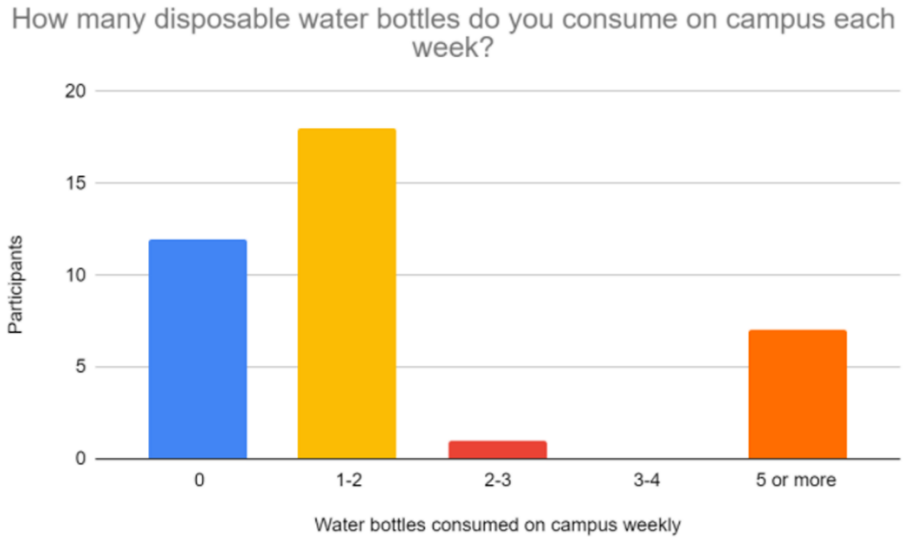


Figure 14: Disposable Bottles Consumed a Week at UAA

At both campuses, most of the participants (more than 80%) have had an experience with the Water Bottle Filling Stations on campus. When they were asked how to find hydration stations on campus, answers were varied; some mentioned it was a mere coincidence that participants spotted these areas by walking around. Another way to locate them, cited by the participants, is by looking for them in buildings or places where they have seen one before, like

offices, facilities, cafeterias, libraries, or restrooms. A minority would ask someone. Four subjects from ASU said they were unsure how to locate the stations. In contrast, eight from UAA said the graphics around the stations are a reference, two wondered if there were maps that displayed that information, and two others said there was no way to know the location of the stations. Not all participants have a favorite hydration station, and those who do refer primarily to location convenience (Being close to places where they frequently take classes, eat or study or work, such as ECA 3rd floor, USE, Hayden Library, Memorial Union, Adelphi I, Barrett Dining Hall, Best Halls, Pavilions at ASU) and water quality from that particular device (water is cold, fresh and good-tasting, the device is not exposed to the sun, looks clean, it is not crowded). Figures 15 and 16 show that most of the participants do not find the locations of Water Bottle Filling Stations completely convenient on either campus. On a scale from 1 to 5, where one was not suitable and five was completely convenient, most subjects rated location more towards the lack of convenience.

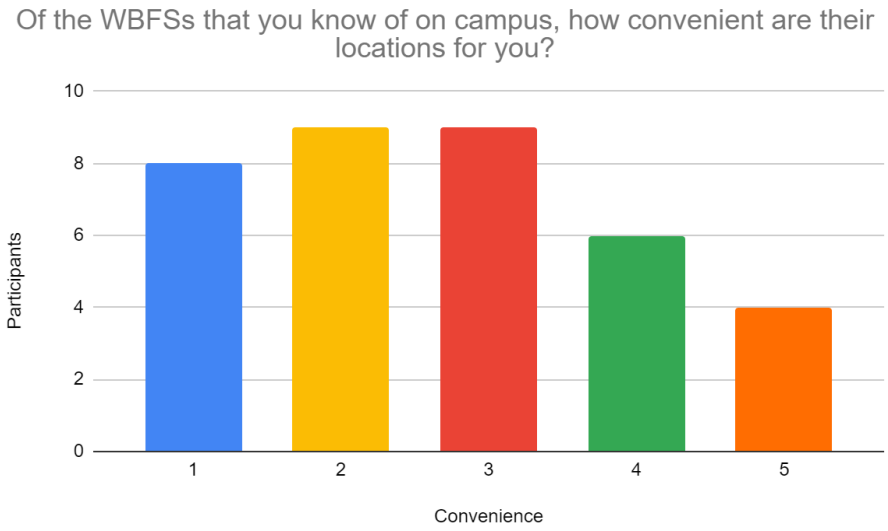


Figure 15: Location Convenience of WBFS at ASU

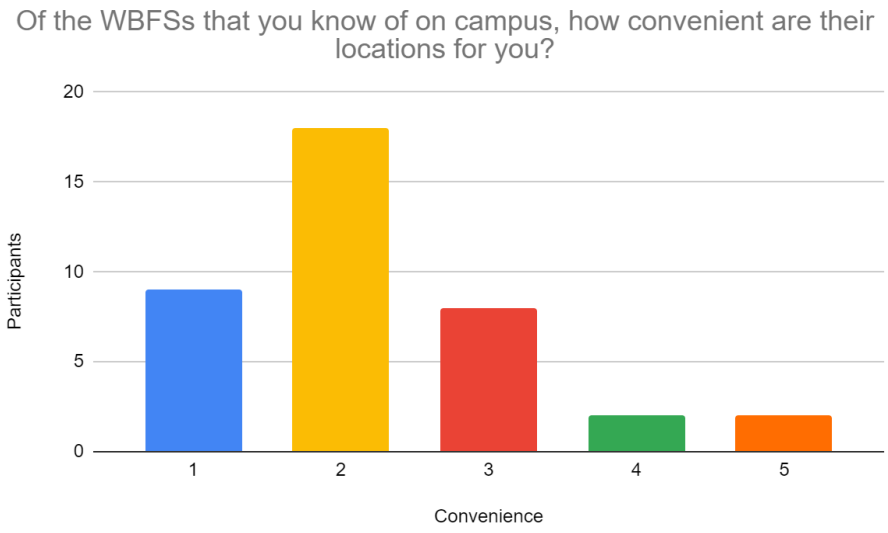


Figure 16: Location Convenience of WBFS at UAA

The moment to look for WBSFs on-campus changes from participant to participant, most of them chose more than one of the options. The usual reason to look for a station to refill a bottle is to have some water available. The second motivation is when they feel thirsty, and the last is before and after physical activity.

On carrying a reusable water bottle to campus, 69 out of 74 participants answered they take one to campus. This number is consistent with the number of participants that have used hydration stations. In the Mexican sample, the number of people that carry a bottle is more than the one that has used a Water Bottle Filling Station on campus, yet this is consistent with the number of subjects that take a reusable water bottle from home to campus and the times the bottle gets refilled. The materials those bottles taken to campus are made of vary. In the US, the dominant is stainless steel (25). This is consistent with the fly-on-the-wall observations, where Hydroflask was the most observed brand. In Mexico, participants did not limit themselves to giving a single answer; they used different containers and did not stick to one type. The most popular material is reusable plastic (29), followed by reusing disposable bottles (12). Only 10 prefer stainless steel.

Refill is an activity in which 29 American and 33 Mexican participants who carry their reusable containers practice at least once a day on campus. Refilling more than twice is not a usual activity. This is observed in Figures 17 and 18.

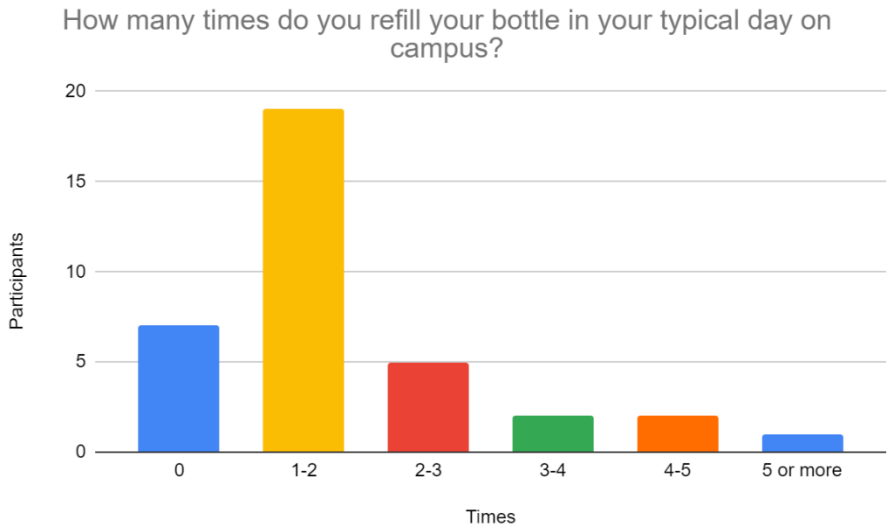


Figure 17: Refill Times a Day at ASU

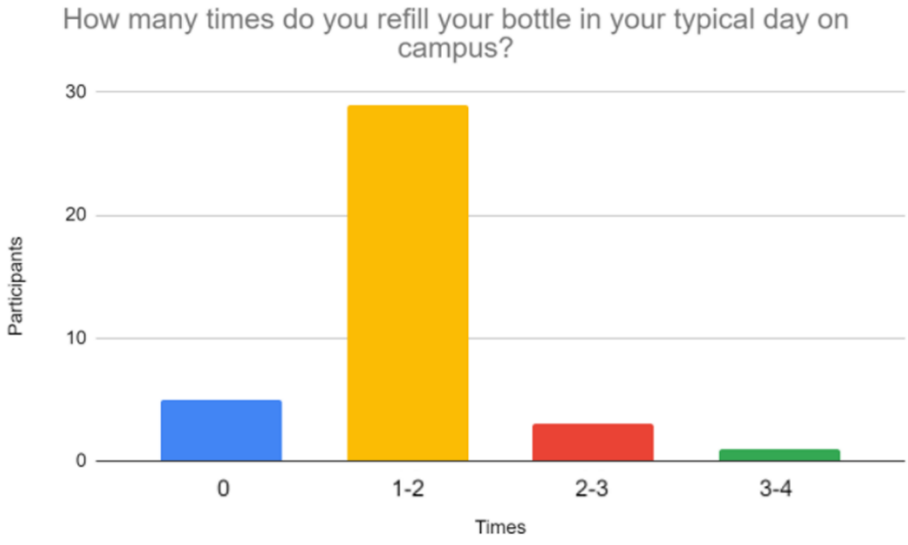


Figure 18: Refill Times a Day at UAA

Participants were also asked what they would do if they forgot their reusable water bottles. Most of them buy water bottles or a drink from a restaurant or store. The second most mentioned choice was drinking water directly from the fountains or not drinking water all day.

Other respondents said they have backup bottles at their offices and cars; they would go back home, look for a cup to use instead, or ask a friend to share with them.

The last question on the survey covered the participant's interest in low-waste habits, where 1 was not interested and 5 were completely interested. Results are congruent with the number of participants who carry reusable water bottles and continuously refill their containers, as seen in Figures 19 and 20.

Figure 19: Interest in Low-waste Habits at ASU

Figure 20: Interest in Low-waste Habits at UAA

Complimentary interviews were conducted from February 14th to March 11th, 2022. The total number of interviewees was n=10. N=5 were conducted in Spanish for participants from UAA and n=5 in English for participants from ASU, with an average length of 30 to 45 minutes. The interviews were set as a follow-up on the survey and detailed explanations of use and habits around Water Bottle Filling Stations.

The interviewees described staying at least 4 hours on campus three days a week. They are staff, faculty, or students from both universities. All except for one, take a reusable container refilled at home. It was learned that faculty in Mexico have different accommodations, like a water cooler at their office. Some of the participants indicated that they refill at stations that are familiar to them. They do not trust tap water and often use filtered water like Brita or buy purified water.

The participants favor refilling and not buying disposable water bottles but do not necessarily prefer Water Bottle Filling Stations. They consider refilling because they dislike the taste of plastic, for economic reasons (water is less expensive or free if they refill), because it is comfortable, convenient, environmentally friendly, and trust the institution. An interviewee who does not like filling on campus mentioned that WBFSs are “not a popular device; it makes me think not many people like them either.”

Participants were asked to describe their process of staying hydrated on campus. They start the process from home by refilling their bottle before leaving. A few mentioned cleaning the container. They take breaks to drink water and refill if necessary; this usually happens at midday, depending on the weather that day or if they are walking long distances. “The trick is never to leave the bottle empty,” an interviewee mentioned. Sometimes they refill as they walk to other parts of campus. Most of the participants indicated that usually, their container lasts all day, and water ingestion is combined at times with coffee or another hot drink throughout the day. The water the participants consumed during their last day on campus before the interview was mostly from home.

The things that were attractive about the Mexican location were the red sign near the water dispenser, the graphics, instructions, and colors around the station, and the general dimensions of the device. A few noticed the lack of the LED filter status indicator and did not

mention the bottle counter. From the American location, the filter lights, the bottle counter, the size of the fountains, the icons that show how to use the refill station and how visually clean it is, were attractive. When they were asked to compare both stations, the bottle counter was described as something fun to incorporate and asked how they work. Participants considered the addition of graphics and instructions relevant but they “do not like reading,” they believe adding them is “a good idea, but I do not really pay attention to them,” or that the refilling time is not enough to go through all the information displayed. A participant reminisced how when the fountains were first installed in Mexico. The stations were a novelty until people stopped using them. The refilling stations were promoted over the fountain functionality.

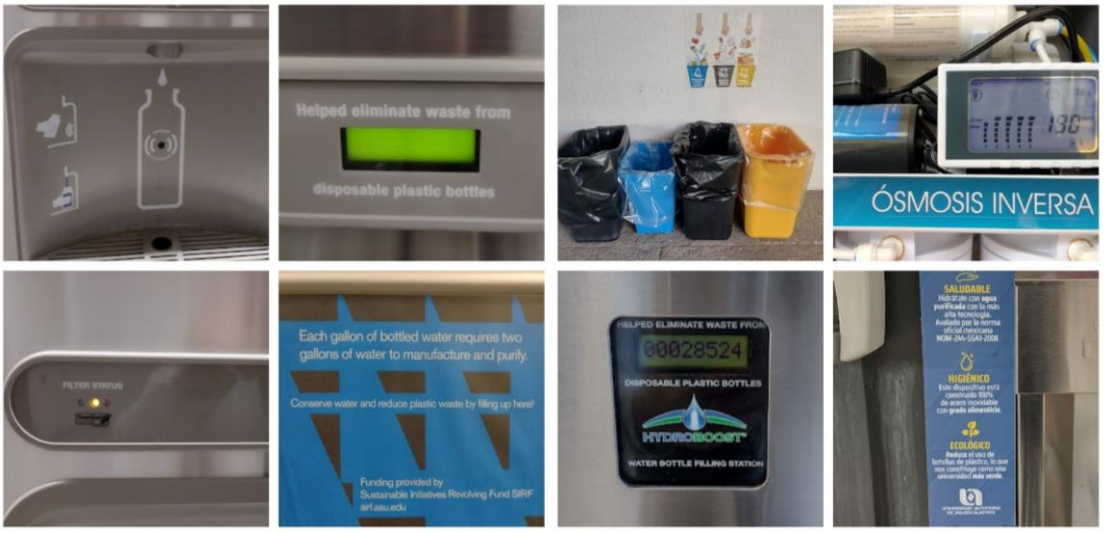


Figure 21: Prompts and Nudges Observed

The characteristics of the ideal Water Bottle Filling Station for the participants are as follows:

- Not be located on the outside “far from dirt,” private, an area to “chill and incorporate this activity to daily life.”
- The slightest contact possible, favoring motion sensors, capacity to refill bottles from assorted sizes, water tank at plain sight, improve the taste.
- Filter indicators that point out the meaning of lights, when was the last date when the filter was replaced, and contact information to report when it needs to be changed.

- Clear instructions and communication about the advantages of using refill stations.

On location, the participants agreed the stations should not be placed in outdoor areas where they can quickly get hot and preferably far from places with a non-pleasant smell. Cleanness is a relevant factor; participants have noticed that sometimes the fountains are not used for the purpose these were installed for, sometimes finding toothpaste residue. The places to install WBFSs should be easy to spot, convenient, and accessible in areas where water is needed, like gyms, halls, and cafeterias. Participants also suggested that at least one is located by every building with classrooms. Hence, it fits in their schedule, and they do not waste time looking for one or walking long distances to get water, avoiding large crowds, which are not necessarily large traffic areas. “People do not know where the stations are unless they look for them actively, and if you are actively looking, it’s already past the point where you should be drinking water.” In consequence, it would be easier to get water through the filling stations than to buy a disposable water bottle. Participants also suggested adding a map, wayfinding, or an app to find closer stations.

Interviewees use different refillable containers, mostly from large volumes varying from 16 to 40 ounces. They chose their bottles consciously and even customized them. Participants have used their bottles for at least more than a year now. The characteristics that they look at in a bottle are that it is easy to carry either in a backpack or with a “finger hook,” a way to see how much water they are drinking, that it does not spill, and easy to wash, and keeps water fresh. When asked about motivations to always carry a refillable container, participants proposed that their institutions should implement mandates and mention health or economic motivations. Two interviewees proposed institutions should invest and provide their population with quality water bottles when they start attending the campus.

When asked about the process of refilling a container using any of the stations previously shown in the pictures, the steps were described in a homogenous way: Open the container, place it under the dispenser, push the button or wait for the sensor to work, “keep an eye” on the container, remove from the device and cover the container. They also described the process of not carrying a container, where some of them may use the regular fountain or their hands as a

receptacle, or if the refilling stations do not work, how they would tilt their container. Three of the participants mentioned looking for the instructions depending on the model. During the interviews, most participants said the filter was an essential factor to use or not a WBFS, but verifying it was working correctly was not part of the participants' instructions. Interviewees suggested various actions to improve the refill process, such as a system that stops refilling so water will not spill out of the container, clearer instructions on buttons and displays, and a temperature switch so they do not carry two containers. Another suggestion was to include something that allows people to rest backpacks or other objects the user may be taking while using the stations. As they refill "on the go," sometimes it is hard to open and place the container safely.

In general terms, participants are concerned with how sustainability is tackled at each university. They believe actions to tackle small things are happening, but there are a lot of aspects yet to improve. A participant mentioned how the institution should advocate through their infrastructure and personnel; professors can invite students to use WBFSs. An interviewee from the US remembered when they used to be first-year students and how difficult it was to get water from their dorms. They did not have a closer option than the gym, paying for the service or buying water bottles, "People will develop habits in their college career."

As the interviewees mentioned their commitments to take care of the environment, several low-waste habits were mentioned, and recycling is one of the most popular. These habits were adopted before using Water Bottle Filling Stations. Using the stations as a low-waste habit "Reinforces a personal decision, I feel fully supported," "Using a water bottle is correlated, but not a consequence" of the presence of filling stations around campus.

What is the level of information on water bottle refill stations regarding low-waste habits?

From the origin, the main prompts with which WBFSs communicate relevant information to the user can be separated into three aspects: Functional, health-oriented, and ecology-oriented. The observed models were consistent with showing the instructions (functional prompt) and the bottle counter (ecology-oriented prompt), aligned with the manufacturer's description of the stations as a tool for sustainability and easy to use even for first-time users. The three

observed models hold a prompt to communicate to the user the “low-waste consequence” of using the station, the bottle count screen. This counter flicks every time the station dispenses 20 ounces of water through the refill area, not the water fountain. Users do not seem to be paying attention to the counter since refilling a bottle has become an automatic series of steps: while they fill, they are often distracted. Users are aware of the counter and consider it an exciting feature, gamification to keep them entertained yet informed. Others think it is confusing since they see the number change, but they do not know what makes it move to the following number, confusing them on what the number means. Information is incomplete, and the fact of what makes the counter flick is not directly told to the user is not disclosed unless they look for it on the webpage or manual; that is the only direct invitation the observed refill stations have regarding low-waste habits.

Adaptations have been made on different scales to work out those black spaces. The institutions have decided to complement institutional messages to promote the use of their equipment. The amount of information added depends on how familiar the user is with the device. In the case of ASU, just a small sign was placed above the WBFS of a highly transited area, but it does not appear to be insightful for the user. The approach was different in Mexico, where the devices were recently installed (2019). The graphics added to the refill stations were placed during 2020, after the surge of COVID-19, not since the stations were installed because they explain the recommendations of use during the pandemic. Information about the environment was added to one corner of the accessory, mentioning the hydration station “Reduces the use of plastic bottles, which makes us a greener university.” The action of refilling a bottle happens in a maximum of 20 seconds, not enough time to read all the information, as expressed by the interviewees. Yes, it is attractive for the colors and visuals it presents, but users lose interest quickly.

To be attractive to the user, a WBFS should communicate hygiene and safety first. This is accomplished through the health-oriented prompt, which is also a maintenance prompt. The LED filter indicator remains relevant to users as it is also an invitation to use or not the filling station. Many users consider it an essential part of a filling station, as it communicates hygiene

and safety. Still, it appears to be not as relevant as they said when using the station. Only one person decided not to use the station when the filter was already in the warning phase during the observations. Paying attention to the filters was not mentioned as a relevant step for refilling a bottle using a WBFS, so even though the elements are there, the user does not consider it appropriate. Information is there, users are getting it, but they do not see it or pay enough attention.

WBFSs are also communicating accessibility. Current designs give options to stay hydrated, placing fountains at different heights to use if the user does not bring a bottle. Extra information invites the user not to do it to prevent the expansion of COVID-19- Still, until the spigot is not physically blocked, it will keep communicating its performance as usual. By design, the filling stations are not communicating cleanness and hygiene. The manufacturer's intention of using a non-porous, easy-to-clean material like stainless steel is not enough. Added prompts provide information on how it is safe to drink from it, but many users, mainly from Mexico, do not trust it as they do not see where the water is coming from, although there is a filter. Communication that favors bottled water is more substantial and remains as ingrained information.

Another point that does not support the communication of cleanness and hygiene is when the stations are used for other purposes, like brushing one's teeth. It communicates that clean water comes out, but not enough to drink it. When stations are placed in distant places or not very well-lit areas, they do not communicate safety. This was confirmed in the Pedro de Alba location at UAA, where no one was observed using the stations.

WBFSs are placed near high-transited areas, appealing to be more accessible to the users. As they remain close to them, it is more attractive to use them over getting bottled water, confirmed by several interviewees. The natural color of the devices blends in with an institution's facilities. Added elements were more attractive than the ones the station's design has by default. Graphics with bright colors and warnings turned out to be the most appealing aspects to the participants, even when the information was not in their native language. When filling stations were a novelty at UAA, they became attractive, as told by an interview participant.

The previous questions show that hygiene is critical for choosing WBFS over bottled water. Bottled water is still perceived as a more hygienic alternative to get drinking water, as branding has presented it. Hygiene of both the station and dispensed water equals the safety of the final product. Exposure to the environmental factors, i.e., sun, dirt, and air, makes it less appealing to the users, as it is related to the water's cleanness to be dispensed. Health is the biggest motivator to have a regular water consumption, so anything that affects the user's health in getting water is seen as not favorable.

How are water bottle filling stations communicating to users to continuously refill bottles instead of buying disposable plastic bottles?

It is seen that refilling is favored over buying a disposable bottle every time, although that does not necessarily mean the refill is done at WBFSs. Bringing water from home to campus, or at least an empty container, is something that already happens. Finding refill stations is seen as a reinforcement of their choices; users feel their decisions are supported by the institution that installed the water dispensers, which makes them attractive. None of the participants indicated they started carrying a reusable bottle once they noticed WBFSs on campus; they had been using reusable bottles for years. Related to the attractiveness of the stations, the location appears to be the aspect that convinces people the most to use refilling stations over getting bottled water. Availability can also be understood as a convenience for users. Not having to walk long distances under the sun, wasting time on a tight schedule, or being uncertain about where to find a station are details users pay attention to when deciding on a water source. Those who favor reusable containers would not drink any water before buying a disposable bottle, placing the environment (or perhaps their commodity) over their physical needs. The stations are available but are not convincing enough for non-users. They do not trust the source; they place their physical needs and take care of their health over environmentally friendly motivations. The lack of information does not allow non-users to consider refilling stations as an alternative; data on bottled water has been spread more quickly. It is hard to compete against bottled water; users need the information to make conscious decisions.

The way WBFSs were designed was not to be convincing; it was to provide good quality water and make it accessible. Therefore, sustainability came by adding the bottle counter, which appears not to be enough as it does not fully disclose what it is counting. Institutions have altered stations and their surroundings to communicate the benefits of using them, going against the bottled water ingrained habit. The amount of information depends on how familiarized the public is with the device, which can be contrasted in the ASU and UAA cases. ASU stations have been available for years, while the ones in Aguascalientes have barely three years and counting. Institutions aim to be convincing enough, speaking to those aspects that may make users distrust the device. Still, the device is not communicating it is hygienic, safe, and ecological. And if sustainability came consequently, it is the least important aspect of those three to be communicated.

Graphics, either by the manufacturer or the institution which installed the stations, are supportive. The clear instructions on different models show that the stations are not being used, not because they are difficult to use. All participants were able to explain clearly how to refill a bottle, either with an automatic refill using a sensor or by pushing a button. The procedure to use a station is ingrained, but the choice is not. The bottle counter prompts the user to understand the positive consequence of refilling a bottle on that station. Still, it becomes irrelevant once the user gets familiar with the counter, it stops being an exciting factor.

The stations' environment counts with other nudges and prompts to promote recycling, mostly trash cans, and bins. Those are pointed out around both campuses and seen close to the WBFSs. Once in front of them, if the user still doubts where to put their waste, the object has reminders to guide them into placing trash in the correct bin. The environment drives people first to the bins and then correctly uses them. Guiding users to the stations looks tricky. For nudges to work correctly, in this case, the environment requires modification to guide users to prefer the stations over bottled water on campus. Some universities decided to ban bottled water, but that eliminates alternatives for water accessibility instead of shifting the preference order of the consumer. The studied campuses have not banned bottles, but the choice architecture does not favor the stations. Yes, they are in places where water is needed, like gyms, cafeterias, and

important buildings, but not located where they are required. The environment is not designed to walk the campus population to WBFSs; it is not easy to get to them, and they are not memorable unless used frequently. For that reason, interviewees suggested wayfinding or maps.

To create habits is necessary to identify motivations that will lead to the creation of triggers. Those triggers could be reinforced with nudges. The health control motivator has been identified as the main reason to drink water and decide which water source to choose. Some have decided to prefer refills because of the known dangers of containing water in plastic; that way, they have control over their water quality. Some users have an aversion to water fountains and refill stations, but that does not mean they favor bottled water. Participants still think bottled water is safer than drinking from a fountain on campus because the best source is the one from which they have control, and this is usually water they get from home. Water that comes from their home has been bought or filtered by them.

Another motivation when a preference has been made is taste. In the US, a big part of the participants said bottled water and filtered water from the fountains taste the same, but in Mexico, people prefer bottled water. During the interviews, some participants disclosed that they do not like the taste of the water the fountains deliver. The manuals of the three models indicated that the way the electric circuits are connected to the ground might change the taste of the water, causing it to taste like metal. Bad taste can be avoided from installation.

The motivators to choose WBFSs over bottled water on campus are price and the environment. Most survey participants showed interest in low-waste habits, but the amount is not consistent with those who favor refilling using WBFSs. The price is not a decisive factor in the US as in Mexico. Getting free water on campus at UAA was a reason to prefer the stations rather than buying a bottle. This can also be observed in how it is usual to reuse disposable bottles in Mexico. The most popular material for reusable containers is plastic, the cheapest option. There may be the will to not invest in another bottle, which could mean the economic motivator is essential. Those motivated by a sustainable lifestyle to use WBFS were informed subjects practicing different low-waste habits. They are conscious of the effort made to change: “the

amount of waste that I'd be producing is just not, it's not comparable to the small amount of effort." (Interviewee 3).

After all, the different motivators are distinguished for being convenient to the user: convenient to get water, convenient to use, convenient amount of effort, convenient for one's health, etc.

How can water bottle filling stations enhance low-waste drinking water consumption through nudging?

Nudges are about gently guiding people to the desired action. People tend to choose what sounds convenient for them in that instant because they lack information. It is evident that those missing pieces of information still put in doubt how safe is drinking water that comes from a refill station. The low-waste intention in WBFSs from design is clear, users know they are saving plastic bottles from landfills as they use refill stations with the help of the bottle counter, they know how to use the station safely, and they get notified of the state of the filter which supports the water safety necessities. Identifying the principal motivators makes it possible to appeal to the user and create different nudges. Motivations vary from economic preferences, health, the effort involved, the taste of the water dispensed, or not generating plastic waste. Nudges from the product can focus on the previously mentioned motivations and link them to low-waste habits. For a nudge to work, the choice architect must decide the user's desired behavior and when the user should take action. The whole environment should be modeled to lead consumers to prefer WBFSs without removing the other drinking water options, like convenience stores or vending machines. Wayfinding or maps could guide consumers to the source, as the study's participants proposed. By experience, they are also able to remember where to find them.

WBFSs are reusable systems by design; they require a container to be used. Using and carrying a container did not mean an obstacle to using the stations; users already carry objects to campus every day. On the device itself, interventions can be done. At least with the models from this study, the interface has enough space to add information for the users, either by the manufacturer or the institution that acquires it. As commented during the interviews, users would

like to see more tangible consequences of the benefits of using the refill stations, like to visualize the number of bottles the counter is communicating, to see the effects of the trash if the WBFSs are not used or the volume it occupies. A prompt can not only be visual but audible. Sounds while or after refilling, as a celebration every time a bottle gets filled could be added. The intention of nudges should be to reinforce positive actions instead of helping to avoid the negative ones.

Nudges can also cover the needs of water hygiene and safety, and by doing so, it could be more inviting to those who do not favor the stations because of those reasons. Hygiene and safety needs should be tackled before environmental requirements for some consumers. To make WBFSs evident to cover those necessities, they could make them more appealing so the appliance can start being considered a trustable option to get water.

Out of the device's design itself, institutions can apply particular nudges. Interviewees mentioned that providing a quality water bottle when students first attend campus and showing them the stations could allow them to adopt low-waste habits. Interviewees also recognized how habits are formed in the first years of life or college, talking from their own experiences. Another resource suggested was a simple reminder from faculty to students that the stations are available for them to use.

It is possible to add nudges and reinforce low-waste behavior rather than create them. A single nudge cannot cover all the missing information and create a trigger to use the stations; it depends on the specific action the choice architect wants the consumer to execute. The system appeals to reusability, and by covering those voids of information more people can get convinced to use the stations and set them as their default choice for water consumption. Trusting the water source requires one nudge, communicating the taste of water dispensed by the stations has no bad taste requires another, reminding consumers of the location of the stations, to reuse a container, and so on, bu. Still, all should go beyond displaying information; stations should involve the user and be a call to action.

CHAPTER 5

CONCLUSION

Introduction

Habits are hard to learn, even more if that means relearning. When it comes to making trade-offs that favor the environment, it could feel overwhelming to use the word sustainability. Turning a habit change into low-waste makes the process more “doable” action, rather than keeping it only on sustainable or zero-waste. “We all have countless opportunities to insert more responsible habits into our lives, and we can begin by acknowledging the ways we can do with less and stick to it” (Porter, 2018). Having an environment that supports the consumer’s decision to generate as little waste as possible works for those that have decided to live under those norms. But not everyone values sustainability the same. At least, this is evident when choosing a drinking water source. By design, Water Bottle Filling Stations have the intention to be a product that favors sustainability. At the same time, they give space to apply one of the circular economy strategies, reuse through refilling, and avoid generating waste coming from disposable water bottles. This study compared two samples, one in Mexico and the other in the United States, in similar contexts, university campuses. As in various answers, there is a common trend, like why some people favor disposable water bottles over filling stations or the reasons to be aversive with WBFS. The adoption process is still ongoing in the Mexican university chosen for the study. The three models analyzed were similar in the constituency, providing a valid comparison between the two populations. The reasons to favor filling stations also change from country to country. In the United States, consumers feel in control of their consumption and look for more environmentally friendly actions (they also consume less bottled water on campus a week). In contrast, the Mexican consumer looks to save money as much as possible.

“Convenience” is commonly related to single-use packaging and disposable items. Still, the term “convenient” was used by both samples when they were asked which water source they preferred: disposable water bottles bought on campus or brought from home, reusable water bottles brought from home, or WBFS. Convenience happens to have a different meaning to every consumer; it does not necessarily mean the ease of getting something. For some users, it is the

fact that the source they like is not that expensive or allows them to control what they are consuming, or the source is safe enough. The point is not to say that water bottles are wrong; they are when they are used without control. They are also convenient in some cases.

Human beings form habits around what they know and work best. Not having enough information may block that process and build habits where not all the alternatives are pondered the same. For these situations, shortcuts like nudges can provide insights as they remind users of all the other options, evaluate them, and probably change the choice preference. Current WBFSs rely on a couple of visual nudges to make the user feel comfortable and validated. Still, those efforts are not enough to appeal to a sector of the population that would instead buy bottled water because they are uncertain of the origin of the water or have had a bad experience with the taste of it. It is possible to nudge using water bottle filling stations, “If choice architects want to shift behavior and to do so with a nudge, they might simply inform people about what other people are doing.” (Thaler and Sunstein, 2009) Not only show how many bottles are being saved but how many individuals are using the stations every day, week, month, or what is happening with the bottles saved from landfill.

On Water Bottle Filling Station Communication

Currently, WBFSs are a reference for sustainable behavior. They reinforce a habit several consumers adopt to carry a reusable container to stay hydrated. The stations communicate that ease of use and accessibility, but not enough hygiene to be at least on the same level as bottled water. An aspect to be modified in that communication is to provide users with enough information, mostly on making a difference between tap water and filtered water coming out of a WBFS. To show the water source should be the main priority of WBFSs design. It should not remain covered, making the user feel less confident. Consumers that refill feel validated by institutions that make WBFS an accommodation. “To find a way to green (your) habits means they are more likely to become lifelong practices” (Porter, 2018).

Prompts are used to remind consumers of the attributes of WBFS and can make it more eye-catching but adding too much information or graphics does not work; as shown in the

Mexican adaptation of a WBFS, it could be overwhelming. Nudge theory mentions they are necessary because people do not know what to do with large quantities of information. Users need to know what the prompts mean. Prompt positioning and nudge application should be made considering human perception, not at extreme levels. McKenzie-Mohr (2011) set an example using litter receptacles: “Litter receptacles serve as a visual prompt for the proper disposal of garbage. Simply making a litter receptacle more visually interesting was found to double the amount of litter deposited in one study and increase it by 61% in another”

On Water Bottle Filling Station and Low-waste Habit Adoption

This research proved that WBFSs do not create new habits but reinforce existing ones, either carrying a reusable container or preferring to buy bottled water. If Eyal’s (2014) process of creating habits is reviewed, using a WBFS lacks a fair reward for all consumers. Which are the incentives it promotes? “Products need to deliver on their promises, users depend on the product as a reliable solution for the problem.” Those who value sustainability know the motivation is not generating more waste, but consumers that get a bottle of water every day do not get satisfaction from using the stations. Before making a WBFS a valuable alternative to get water, something is missing for the users. Habit creation requires incentives, along with motivations.

Institutions that install these devices have a particular reputation and have shown results on sustainable goals. Hence, they are credible for their population, based on the water safety questions on the survey. Trust institutions could be essential for habit adoption since they provide filtered and dispensed water, this aspect goes beyond product design.

On Nudging as a Tool to Enhance Low-waste Habits

People will need nudges for complex choices when there is no assessment or feedback (Thaler and Sunstein, 2009). In this case, the tough choice is deciding on a water source with preconceptions and not enough information on which source is better and why. Applying nudges for behavioral change in design should be done by someone who understands the implications

and consequences. Not all prompts and functions on a device act as a nudge, and not all nudges are part of the tangible parts of the device. Designers can approach nudges as a tool, not a mandate. The intention with WBFSs and nudging should be to make the stations the default option for any consumer while they are not home.

The types of nudges the WBFS presented intend to be priming nudges. These nudges prime people into specific forms of behavior by offering simple and apparently irrelevant cues. But they turned out to be too irrelevant. A prompt acts as a nudge since Thaler and Sunstein define it as anything that can change behavior. Those reminders can produce changes in the long term, making life as easy as possible, sending reminders, and minimizing efforts.

In 2009, students in a K-12 in Los Angeles, California, started a project not to generate more waste from water bottles in their school. The school installed five WBFS, stopped providing bottled water, and designed a reusable water bottle that the kids gave for free. In a year, the program saved more than 65,000 bottles from landfill. (Terry, 2012). A program like this could work. In interviews, participants mentioned that if the institution provided more tools (like providing a good-quality water bottle) for the campus population to use the water stations, they could be more popular. That is a nudge that does not rely on product design but on service design by the institutions. If consumers do not prevent and take a reusable container, if they don't know where to find a place to refill, how can they reinforce the behavior?

Design Implications

All designed products, at some point, aim to change behavior. Objects intended to satisfy a necessity can improve life quality, changing behavior patterns for a positive outcome. Design has adopted premises to conserve the environment, from design thinking with a life-centered approach to biomimicry with feedback loops. The circular economy provides tools at a business and industry scale but can be adopted individually. Systemic changes are not individual, but personal progress is something. In this case, the product analyzed may not be manufactured under circular economy premises. Still, it aims to promote behaviors sustained on circular

economy strategies, as it presents prompts that appeal to reusability and maintenance. The next step could be to analyze the possible circular manufacturing of WBFSs.

The industry and governments need to be pointed out as the greatest actors to provide change for planet conservation, but individual actions have been practical as well through social influence. A personal step multiplied by the number of humans in a country is strong enough to promote change for the next generation. Design should be seen as a tool for conservation, not for failure. The products designed should inspire better behavior, and for that reason, consciousness begins with the design team. If the design team is not centered on the attributes they want to communicate; the product will not be able to sustain sustainable behavior.

Behavior change should not rely on a single object that advocates for change. Design can mold behaviors while assessed by other disciplines, like behavioral economics. Nudges are valued as information when designing, as the use of other fields such as psychology and marketing (Alwazzan et al., 2020). Nudges have been applied consciously and unconsciously for product design, having different outcomes. As designers, fighting programmed obsolescence by designing to extend the life cycle of products has not been enough, but to design for life transcendence. How can designers promote better habits through products? Not teaching the culture of convenience in designs but a more responsible and conscious consumption of goods. Along with support services like maintenance, offering a product and an experience. For WBFSs, the experience they deliver is crucial for consumers to decide whether to keep using them or not. What they communicate on their interface and how they work have shown to be highly relevant for consumers when deciding on a drinking water source.

It is also essential to consider how context molds necessities and use. Mexico and the United States have similarities in certain behaviors, but economic factors are relevant for Mexican consumers. Studies in India (Biswas & Roy, 2014) and Brazil (de Medeiros & Ribeiro, 2017) explore the relationship between environmental concerns and consumer choice behavior in purchasing green products. Price sensitivity is high, but social value parameters influence sustainable consumption and behavior adoption. This is replicated in Mexico, where users look for the most affordable option. Not all one size fits all countries. Circular economy and nudging

appeal to solutions adapted to context, “Nudges need adequate temporal and geographic control, demographics and social norms” (Rivers et al., 2017). The price attribute “appeared to override any negative aspects,” according to Lofthouse et al. (2009), so that becomes an aspect of cultural background for nudge use.

The correct use of graphics to display information lacking on WBFS is something to improve on their design. The studied stations' ecological and water safety prompts and nudges can be modified. For example, the LED filter status indicator could be substituted by a countdown or a status bar. The current indicator imitating traffic lights is confusing; the filter is still good even when the light is yellow. Some users find it disgusting; others do not pay attention to it because it is not communicating anything relevant. Changing the way the filter status is displayed matters not only to the maintenance team but to the user too. For this reason, the indicator has room for improvement. Another slight change in the current design could be to the bottle counter. The counter does not indicate it flicks every 20 ounces. The counter makes it hard for the user to visualize the number of bottles saved from landfills. They are adding text to make that information clearer could work. Materials influence quality, sustainability, and aesthetic perceptions. Designing more sustainable products is an opportunity to deal with wasteful consumption practices. Sustainability is achieved through changes in consumer behavior and accessible products at the development stage. Sustainability evaluations are entirely based on first impressions and information provided through visuals. (Petersen & Brockhaus, 2017). So, should nudges be applied to avoid bottled water or reinforce the refillable habit?

Previous research argues that only presenting information helps the user make better choices, but evidence shows it does not; just McKenzie-Mohr suggests, it is not enough. They do not know what to do with that information when nudges come into action. They are necessary to help organize thoughts and make better decisions. When product design starts to be developed by the team, it is beneficial to look at nudges. Research on other areas that aim for behavioral change focused on sustainability could help the team comprehend different approaches. The use of buttons, visuals, and indicators can slightly mold preferences and help develop the habit. For

this, experimenting is a crucial factor. As a designer, it is crucial to remember that the intention of changing behavior exists, but it is not guaranteed the user will act as imagined. Experimentation allows seeing what works better for the user and the designer's intention.

For companies who manufacture WBFSs, the design implications change. Minor alterations on already existent devices can help to re-design future models. These new devices could walk away from the engineering image they hold today, actively incorporating design features. The current design of WBFSs effortlessly merges with the environment, but interventions made by users add another layer of design. If a conscious product design is applied, aspects such as hygiene and water safety could be communicated without adding textual information.

Future research

Future research in this field would have a deeper approach, analyzing other models of WBFSs to understand how different prompts, or the lack of them, work. It would also consider other times of the year when more water is consumed, which is a factor that could make some consumers consider using a refill station more. This includes summer in Arizona, where water consumption increases. More consumption could lead to a change of motivations for the users, changing the sense of urgency to get water, for example. To understand those motivations and incentives deeply, asking the participants how they feel before, during, and after using WBFS could be added to the surveys and interviews.

Observation locations could be amplified to have more contrast, rather than just focusing on high-traffic zones. As the fly-on-the-wall observation method suggests, people may not do what they say they do. This was tested and proved in this research. The surveys indicated WBFSs are being used in Mexico, but one of the locations was never seen in use. An interesting question would be which preferred stations are and what makes them that way.

"An important problem here is "pluralistic ignorance"—that is, ignorance, on the part of all or most, about what other people think. Many social practices persist for this reason, and a small shock, or nudge, can dislodge them." (Thaler and Sunstein, 2009) It is shown how that pluralistic

ignorance goes beyond countries regarding the water source, taste, and location of water stations. This research allowed the researcher to define a timeline for the habit adoption related to WBFS. UAA is in an early adoption stage, where consumers still doubt the product the stations deliver. To look at the US and understand what happened for it to consume fewer bottles of water a week could help create a path for faster habit adoption and see the trends of other places.

Nudges are a tool for design, not a set of rules. The designer should first understand product functionality and then accessorize with nudges. For further design research, experimentation with nudges would be ideal. The location for this specific research and how the models are similar could allow the experimentation. Minor changes to the current interface, adding and adapting to see results may enrich the results, testing the nudge theory. The research could provide quantitative results as well. The nudging for this study focuses on the consumer, but the designer could be nudged and primed for re-design.

Another improvement in this study could have been the way to apply interviews. Instead of being online, they could happen in front of the stations. Interviews right in the location allow seeing a live perspective on use and interaction. Although, this may limit the results to those who favor using the stations.

The prompts and nudges could be analyzed according to Mitchel's (2019) four rules from nudging applied to design to see how they can be improved. Also, compare aspects like heuristics and biases. Heuristics influence decisions and represent an excellent tool for choice architects. Understanding how the bias is attached to the observed nudge or prompt allows for enhancing the effect.

This same analysis could be applied to other artifacts, from those that promote low-waste habits, i.e., trash bins, to those which do not have the intention to reduce environmental impact, i.e., cars or electronics, as a push to help people to do the right thing and product designers to have more accessible environmental responsible behavior. Thaler and Sunstein (2009) said, "The best way to help Humans improve their performance is to provide feedback. Well-designed systems tell people when they are doing well and when they are making mistakes."

REFERENCES

Abfall: Luzern will den Spieltrieb wecken. (2011, May 11). Luzerner Zeitung AG. https://www.luzernerzeitung.ch/zentralschweiz/luzern/abfall-luzern-will-den-spieltrieb-wecken-ld.20585

Alwazzan, A., Mejía, G. M., Xie, Y., & Fischer, D. (2020, September). Incorporating behavioral theory in design ideation for changing sustainability behaviors. In *Synergy-Design Research Society International Conference 2020*.

Arizona State University. (n.d.). *Zero Waste*. Business and Finance. Retrieved October 2021, from https://cfo.asu.edu/zerowaste

ASU Alumni. (2018, April 8). *ASU helps Sun Devils live better through participation in Healthier Campus initiative | ASU Alumni*. Alumni.asu.edu. https://alumni.asu.edu/20180703-asu-helps-sun-devils-live-healthier-lifestyles-through-participation-nationwide-initiative

Ban, S., Ambasz, E., & Bell, E. (2001). *Shigeru Ban*. Princeton Architectural Press.

Beuren, F. H., Ferreira, M. G. G., & Miguel, P. A. C. (2013). Product-service systems: a literature review on integrated products and services. *Journal of cleaner production*, *47*, 222-231.

Biswas, A., & Roy, M. (2014). Green products: an exploratory study on the consumer behaviour in emerging economies of the East. *Journal of Cleaner Production*, *87*, 463-468.

Chudwick, E., Salvemini, M., & Welker, A. (2013). Implementing water refill stations across campus to promote reusable water bottle use. *Dept. of Geography and the Environment, Villanova University*.

Clinton, W. J. (1993). President's Council on Sustainable Development. *Executive Order*, *12852*, 58.

de Medeiros, J. F., & Ribeiro, J. L. D. (2017). Environmentally sustainable innovation: Expected attributes in the purchase of green products. *Journal of Cleaner Production*, *142*, 240-248.

Dolan, P., Hallsworth, M., Halpern, D., King, D., & Vlaev, I. (2010). MINDSPACE: influencing behaviour for public policy.

Economic, U. N., & Council, S. (2018). Circular Economy for the SDGs: From Concept to Practice.

Elkay. (n.d.). *Elkay ezH2O Bottle Filling Station with Single ADA Cooler, Filtered Refrigerated Light Gray*. Retrieved March 14, 2022, from https://www.elkay.com/products/details/lzs8wslk

Elkay Corporate. (n.d.). *Elkay Corporate | History*. Retrieved April 2, 2022, from https://corporate.elkay.com/en/about-elkay/history.html

Elkay. (2019). *INSTALLATION & USE MANUAL SWIRLFLO® Refrigerated fountains with FLEXI-GUARD® and ezH2O® Bottle Filler*. Elkay Files. https://www.elkayfiles.com/care-cleaning-install-warranty-sheets/0000001030.pdf.

Elkay. (2021). *EZ & LZ Series Bottle Filling Stations & Coolers.* Elkay Files. https://www.elkayfiles.com/care-cleaning-install-warranty-sheets/1000002207.pdf

Ellen MacArthur Foundation. (2012). *Towards the circular economy*. Ellen MacArthur Foundation.

Ellen MacArthur Foundation, Waughray, D., & Stuchtey, M. R. (2016, January). The new plastics economy, rethinking the future of plastics. In *World Economic Forum*.

Eriksen, M. (2017). Junk raft: An ocean voyage and a rising tide of activism to fight plastic pollution. Beacon Press.

Eyal, N. (2014). *Hooked: How to build habit-forming products*. Penguin.

Fogg, B. J. (2009, April). A behavior model for persuasive design. In *Proceedings of the 4th international Conference on Persuasive Technology* (pp. 1-7).

Fondo para la Comunicación y la Educación Ambiental. (2021). Aguascalientes – Agua.org.mx. Retrieved 23 March 2022, from https://agua.org.mx/tag/aguascalientes/

Gleick, P. H. (2010). *Bottled and sold: The story behind our obsession with bottled water*. Island Press.

Global Footprint Network, Lin, D., Wambersie, L., Wackernagel, M., & Hanscom, P. (2020, June). *CALCULATING EARTH OVERSHOOT DAY 2020: ESTIMATES POINT TO AUGUST 22ND*. overshootday.org. https://www.overshootday.org/content/uploads/2020/06/Earth-Overshoot-Day-2020-Calculation-Research-Report.pdf

Halsey Taylor. (n.d.). *Halsey Taylor HydroBoost Vandal-Resistant Bottle Filling Station & Bi-Level ADA Cooler Non-Filtered Non-Refrigerated Stainless*. Retrieved March 14, 2022, from https://www.halseytaylor.com/products/details/HTHBHVRBL-NF

Halsey Taylor. (2018). *Owners Manual Model HTHBHVR8, HTHBHVR8-25, HTHBHVR8-26 Factory Prep HydroBoost® Bottle Filling Station and Cooler*. Elkay Files. https://www.elkayfiles.com/care-cleaning-install-warranty-sheets/98986c.pdf

Hammarberg, K., Kirkman, M., & de Lacey, S. (2016). Qualitative research methods: when to use them and how to judge them. *Human reproduction*, *31*(3), 498-501.

Hanington, B., & Martin, B. (2017). *The Pocket Universal Methods of Design: 100 Ways to Research Complex Problems, Develop Innovative Ideas and Design Effective Solutions*. Rockport.

Hawken, P., Lovins, A. B., & Lovins, L. H. (2013). *Natural capitalism: The next industrial revolution*. Routledge.

Heidbreder, L. M., Bablok, I., Drews, S., & Menzel, C. (2019). Tackling the plastic problem: A review on perceptions, behaviors, and interventions. *Science of the total environment*, *668*, 1077-1093.

Keaggy, D. T. (2016, April 20). *Water bottle ban a success; bottled beverage sales have plummeted*. The Source Washington University in St. Louis. Retrieved March 15, 2022, from https://source.wustl.edu/2016/04/water-bottle-ban-success-bottled-beverage-sales-plummeted/?fbclid=IwAR3JpQ60jQKR0jx3UXSlg1eaATXbvXf9Z3H-6T3_nSr_03JkFirMdxd9Nl0

Lehner, M., Mont, O., & Heiskanen, E. (2016). Nudging–A promising tool for sustainable consumption behaviour? *Journal of Cleaner Production*, *134*, 166-177.

Lilienfeld, R. M., & Rathje, W. L. (1998). *Use less stuff: Environmental solutions for who we Really are*. Ballantine Books.

Liao, T., Tanner, K., & MacDonald, E. (2020). Revealing insights of users' perception: An approach to evaluate wearable products based on emotions. Design Science, 6, E14. doi:10.1017/dsj.2020.7

Lipman, S. (2020). One size fits all? Designing financial incentives tailored to individual economic preferences. Behavioural Public Policy, 1-15. doi:10.1017/bpp.2020.21

Liu, Y., & Bai, Y. (2014). An exploration of firms' awareness and behavior of developing circular economy: An empirical research in China. *Resources, Conservation and Recycling*, *87*, 145-152.

Lockton, D. (2010). *Design with intent: 101 patterns for influencing behaviour through design*. Dan Lockton.

Lofthouse, V. A., Bhamra, T. A., & Trimingham, R. L. (2009). Investigating customer perceptions of refillable packaging and assessing business drivers and barriers to their use. *Packaging Technology and Science: An International Journal*, *22*(6), 335-348.

Luchs, M. G., & Kumar, M. (2017). "Yes, but this other one looks better/works better": how do consumers respond to trade-offs between sustainability and other valued attributes? *Journal of Business Ethics*, *140*(3), 567-584.

McDonough, W., & Braungart, M. (2010). *Cradle to cradle: Remaking the way we make things*. North point press.

McKenzie-Mohr, D. (2011). *Fostering sustainable behavior: An introduction to community-based social marketing*. New society publishers.

Meise, J. N., Rudolph, T., Kenning, P., & Phillips, D. M. (2014). Feed them facts: Value perceptions and consumer use of sustainability-related product information. *Journal of Retailing and Consumer Services*, *21*(4), 510-519.

Mejía, G. M. (2021). Theory-Driven or Theory-Informed? A Review of Behavioural Economics in Design. *The Design Journal*, *24*(4), 567-587.

Milles, M. B., & Huberman, A. M. (1994). An expanded sourcebook: Qualitative data analysis. *London: Sage. Retrieved on July 12*, 2016.

Mitchell, E. (2019, January 29). *What's a "nudge" in product design?* BresslerGroup. https://www.bresslergroup.com/blog/design-defined-what-is-a-nudge-in-product-design/

Muranko, Z., Andrews, D., Chaer, I., & Newton, E. J. (2019). Circular economy and behaviour change: Using persuasive communication to encourage pro-circular behaviours towards the purchase of remanufactured refrigeration equipment. *Journal of cleaner production*, *222*, 499-510.

O'Leary, Z. (2014). *The essential guide to doing research*. Sage.

Petersen, M. & Brockhaus, S. (2017). Dancing in the dark: Challenges for product developers to improve and communicate product sustainability. *Journal of Cleaner Production*, 161, 345-354.

Polaine, A., Løvlie, L., & Reason, B. (2013). *Service design: From insight to implementation*. Rosenfeld media.

Porter, B. (2018). *Reduce, reuse, reimagine*. Rowman & Littlefield.

Rivers, N., Shenstone-Harris, S., & Young, N. (2017). Using nudges to reduce waste? The case of Toronto's plastic bag levy. *Journal of environmental management*, *188*, 153-162.

Roth, B. (2015, October 27). *Campus Water Stations Save 400,000 Plastic Bottles*. Duke Today. Retrieved March 15, 2022, from https://today.duke.edu/2015/10/hydrationstations

Rothstein, P. (2003). a (x4): A user-centered method for designing experience. *ADVANCES IN CONSUMER RESEARCH, VOL 30*, *30*, 354-354.

Salvador, F. (2007). Toward a product system modularity construct: literature review and reconceptualization. *IEEE Transactions on engineering management*, *54*(2), 219-240.

Saatchi, & Saatchi. (2007). *WWF paper dispenser*. Adsoftheworld.Com. https://www.adsoftheworld.com/media/ambient/paper_dispenser

Saikku, L., Antikainen, R., Droste, N., Pitkänen, K., Loiseau, E., Hansjürgens, B., ... & Thomsen, M. (2015). *Implementing the green economy in a European context: Lessons learned from theories, concepts and case studies* (Doctoral dissertation, irstea).

Sauvé, S., Lamontagne, S., Dupras, J., & Stahel, W. (2021). Circular economy of water: Tackling quantity, quality and footprint of water. *Environmental Development*, *39*, 100651.

Scerri, A., & James, P. (2010). Accounting for sustainability: combining qualitative and quantitative research in developing 'indicators' of sustainability. *International Journal of Social Research Methodology*, *13*(1), 41-53.

She, J., & MacDonald, E. (2014). Priming designers to communicate sustainability. *Journal of Mechanical Design*, *136*(1).

Stahel, W. (2020). Product-Life Factor. 1982.
Stahel, W. R., & MacArthur, E. (2019). *The circular economy: A user's guide*. Routledge.

Strauss, A., & Corbin, J. (1990). Basics of Qualitative Research: Grounded Theory Procedures and Techniques. London: Sage. 270.

Tapia-Fonllem, C., Corral-Verdugo, V., & Fraijo-Sing, B. (2017). Sustainable behavior and quality of life. In *Handbook of environmental psychology and quality of life research* (pp. 173-184). Springer, Cham.

Terry, B. (2012). *Plastic-Free: How I Kicked the Plastic Habit and How You Can Too*. Simon and Schuster.

Thaler, R. H., & Sunstein, C. R. (2009). *Nudge*. Penguin

The Associated Press. (2020, August 13). *Is it safe to drink from a fountain during the pandemic?* AP NEWS. https://apnews.com/article/virus-outbreak-ap-top-news-ap-fact-check-lifestyle-pandemics-6d2cad6b1bdaf04fb99702a8c47bab27

Tlapalamatl, J. J. (2018, October 31). *Falta consciencia en los estudiantes para separar residuos: Beatriz Campos*. Locus. https://comunicacion.uaa.mx/revista/index.php/2018/10/30/falta-consciencia-en-los-estudiantes-para-separar-residuos-beatriz-campos/

UAA coloca nuevas Fuentes de Hidratación en sus Campus. (2018). Retrieved 23 March 2022, from https://www.uaa.mx/portal/noticias/uaa-coloca-nuevas-fuentes-de-hidratacion-en-sus-campus/

Uehara, T., & Ynacay-Nye, A. (2018). How water bottle refill stations contribute to campus sustainability: A case study in Japan. *Sustainability*, *10*(9), 3074.

Universidad Autónoma de Aguascalientes. (n.d.). *POLÍTICA AMBIENTAL*. Sistema de Gestión Ambiental. Retrieved March 12, 2022, from https://www.uaa.mx/sga/index.php/politica-ambiental/

US EPA, O. (2017, November 2). *Wastes* [Reports and Assessments]. https://www.epa.gov/report-environment/wastes

Wang Whitman, E. (2021). Meet Arizona's water one-percenters. Retrieved 23 March 2022, from https://www.theguardian.com/us-news/2021/apr/05/arizona-water-one-percenters

Wharton, C., Rieman, J., Lewis, C.H., & Polson, P.G. (1994). The cognitive walkthrough method: a practitioner's guide.

Willis, K., Hardesty, B. D., Vince, J., & Wilcox, C. (2019). The success of water refill stations reducing single-use plastic bottle litter. Sustainability, 11(19), 5232.

Zero waste definition – Zero Waste International Alliance. (2018, December 20). https://zwia.org/zero-waste-definition/

APPENDIX A

RECRUITMENT POSTER ENGLISH

Join our study on low-waste habits and design

We are looking for ASU students on any level and any major, faculty and staff to participate on our survey and share their opinion on Water Bottle Filling Stations.

Participation is voluntary.

Any questions?
sabecerr@asu.edu

APPENDIX B

A (X4) AND ARTIFACT ANALYSIS

		ASU		UAA	
	Building	Hayden Library	Memorial Union	Pedro de Alba	Building #9
Atmosphere	**Location**	Indoors, in front of restrooms	Indoors, in front of restrooms	Outdoors, near restrooms. 2, one by each entrance.	Outdoors, next to the coffee shop
	Weather	57ºF-80ºF	59ºF-79ºF	59ºF-76ºF	58ºF-76ºF
	Traffic during observation	Medium, people were going to the restroom.	High, people going for food or to the toilet.	Low, people were going to the library or the restroom.	Medium, people are going for food or resting.
	Sounds	Cooling system	People talking, cooling system	No sounds	Cooling system, background music
	Other water sources	Food area nearby, where they sell bottled water and other drinks in disposables.	Food area, convenience store, and vending machines providing bottled water and other beverages. Assorted brands and volumes.	Not close to the observed area.	The coffee shop sells bottled water of one brand and a single size and other drinks.
Artifacts	**Brand and model**	Elkay EZH2O LRPBD2_8WSC	Elkay EZH2O LZWSR_1B	Halsey Taylor HVRHTHB-NF_1B	Halsey Taylor HVRHTHB-NF_1B
	Material	Stainless steel			
	Description on website	“Delivers a clean quick water bottle fill and enhances sustainability by minimizing our dependency on disposable plastic bottles.” (Halsey Taylor, n.d.; Elkay, n.d.).			
	Features claimed by the website.	Chiller and filter. Indoor use. Airflow is required. Touchless.	“Appliance can be used by persons with lack of experience.” Antimicrobial, handsfree. Indoor use. Cooler and filter.	Filter and filter monitor not included. Made for outdoor and indoor locations.	Filter and filter monitor not included. Made for outdoor and indoor areas.
	Refill system	Activation sensor. Activation with automatic 20-second shut-off timer.	Activation sensor. Activation with automatic 9-second shut-off timer.	Manual (Push button). Activation with automatic 20-second shut-off timer.	Manual (Push button). Activation with automatic 20-second shut-off timer.

		ASU		**UAA**	
	Building	Hayden Library	Memorial Union	Pedro de Alba	Building #9
	Instructions	Icons, no text	Icons, no text	Icons, text added by the institution	Icons, text added by the institution
	Graphics	Letter-sized poster suggesting refilling instead of using the water fountain	Letter-sized sign with data about plastic bottles and water conservation	Around the WBFS with instructions, suggestions, and data. Stickers as prompts. Poster of an independent artist.	Around the WBFS with instructions, tips, and data. Stickers as prompts.
	Filter change	After 19,200 or 38,400 20 oz refills, according to the manufacturer's website.			
	LED Filter status indicator	Working, during observations changed from green to yellow and finally red	Working. Stayed on green during observations.	Not present.	Not present.
	Bottle count screen	Not working correctly; it skips numbers. Informs quantity of 20 oz bottles saved from landfill.	Not working correctly, numbers do not show. Informs quantity of 20 oz bottles saved from landfill.	Present, working. Informs quantity of 20 oz bottles saved from landfill.	Not working correctly; it skips numbers. Informs amount of 20 oz bottles saved from landfill.
	Low-waste habits prompts	No graphics. Just two small bins approximately 5 meters away.	Besides the poster, different containers to separate organics, paper, landfill, and other residue collection are available	Small containers for paper, landfill, and face mask 5 meters away.	Bins to separate paper, plastic, metal, and organics. Solar phone charger.
	Bottles	Carried on hands or backpack. Metal containers, plastic bottles, cups, and disposables are being refilled. Small capacity.	Carried on hands or backpack. Different volume Hydroflask or other metal containers. With caps. Other containers are	Carried on hands, backpacks, or bicycles. Mostly disposables.	Carried on hands. Mostly plastic or disposable bottles are refilled.

			used, like paper cups.		
		ASU		**UAA**	
	Building	Hayden Library	Memorial Union	Pedro de Alba	Building #9
Actors	**Pairing**	Go in couples or by themselves.	Go in groups, couples or by themselves.	Couples, small groups, by themselves.	Go by themselves, in couples or large groups.
	Position on campus	Students, staff	Students, staff	Students, faculty, staff	Students, staff
	Staff cleaning	Only the area, not directly the device	Only the site, not directly the device	Cleaning device	Only the area, not directly the device
	Quantity observed (average)	Six subjects every 30 min	9.5 subjects every 30 minutes	0 every 30 minutes	1.6 subjects every 30 minutes
Activities	**Use of water fountains**	Yes, mostly males	Yes, mostly males	No, canceled by the university	No, canceled by the university
	Carrying food	No	Yes	No	Yes
	Refill	Open the bottle and look at the phone. Do not hold the bottle while refilling. Do not take much time. No overflow.	Open the bottle, look inside, wait, and look to the front. Sometimes it spills. Some of them hold their bottles; others do not. Look at the phone. Drink on-site and refill again	N/A	Open the bottle, may or may not hold it while pressing the button. Looking to the front.
	Other notes	A small quantity noticed that the filter was not useful anymore. The area is used for other activities, e.g., preparing protein shakes.	Curious about other low-waste habits enhancers, like charging stations. Users empty their bottles on site.	N/A	Users empty and refill/mix with other drinks containers on site. People carry more disposables.
	Morning	Coffee in disposables.	Not very crowded, carrying coffee more than water on disposables. Some have two reusables.	People with backpacks do not carry water, just coffee. Faculty and staff bring	Mostly staff and groups sit near the area to eat—coffee in disposables. Hands are available.

				coffee in reusables.	
		ASU		**UAA**	
	Building	Hayden Library	Memorial Union	Pedro de Alba	Building #9
	Afternoon	Regular water fountains are preferred over refills. Quick stops.	Crowded, lunchtime, larger groups but refill alone. People make a line to use WBFS.	WBFSs were cleaned in detail. The subject reads graphics while the partner is in the restroom but is not carrying a bottle.	Groups are having lunch and drinks in disposables. They have backpacks but not water bottles.
	Evening	Small groups gather close. The area is not clean; toilet paper is beneath—trips to the restrooms.	Not very crowded; people are taking out food and other drinks (not water). Carry skateboards and books.	Not a well-lit area. Water in disposables.	Students were eating and studying. Gets dark. Coffee in disposables.

APPENDIX C

SURVEY QUESTIONNAIRE ENGLISH

1. *

Check all that apply.

- [ ] I accept to be part of the study.
- [ ] I am an ASU's current student, staff member or faculty.

You have the right not to answer any question, and to stop participation at any time.

2. How often is it difficult for you to get drinking water on campus?

Mark only one oval.

- ◯ Always
- ◯ Sometimes
- ◯ Never

3. About what percent of all water that you drink on campus is from each source? It should add 100%

Check all that apply.

	100%	75%	50%	25%	0%
Disposable Bottle (Bought on campus)	☐	☐	☐	☐	☐
Disposable Bottle (Brought from home)	☐	☐	☐	☐	☐
Water Bottle Filling Station/Water Fountain	☐	☐	☐	☐	☐
Reusable Bottle (Brought from home)	☐	☐	☐	☐	☐

4. Describe why you chose the water source that you use the most.

5. How much is the safety of water to your health a factor in your water choice?

Mark only one oval.

- ◯ Not a factor
- ◯ A small factor
- ◯ A large factor

6. Which of these water sources do you think is the safest to drink?

Mark only one oval.

- ◯ Disposable Bottle
- ◯ Water Bottle Filling Station/Water Fountain
- ◯ All the same

7. Describe why you chose the water source that you think is the safest.

8. How much is the taste of water a factor in your water choice?

Mark only one oval.

- ◯ Not a factor
- ◯ A small factor
- ◯ A large factor

9. Which of these water sources do you think delivers the best tasting water?

Mark only one oval.

- ◯ Disposable Bottle
- ◯ Water Bottle Filling Station/Water Fountain
- ◯ All the same

10. Describe why you chose the water source that you think delivers the best tasting water.

_____

_____

_____

_____

_____

11. How many disposable water bottles do you consume on campus each week?

_____

12. Have you ever used a Water Bottle Filling Station (WBFS) on campus?

Mark only one oval.

- ◯ Yes
- ◯ No

13. How do you locate the WBFSs on campus?

14. Of the WBFSs that you know of on campus, how convenient are their locations for you?

Mark only one oval.

	1	2	3	4	5	
Very convenient	◯	◯	◯	◯	◯	Not convenient at all

15. When do you usually look for WBFSs on campus?

Check all that apply.

- ☐ When thirsty
- ☐ Before physical activity
- ☐ After physical activity
- ☐ To have water available

16. If you have a favorite WBFS, explain why it is your favorite.

17. Do you carry a reusable water bottle on campus?

Mark only one oval.

- ◯ Yes *Skip to question 18*
- ◯ No *Skip to question 21*

18. With what material(s) is your refillable bottle made? Select all that apply

Check all that apply.

- ☐ Glass
- ☐ Ceramic
- ☐ Stainless steel
- ☐ Aluminum
- ☐ Reusable plastic
- ☐ I refill disposable bottles
- Other: ☐ _____

19. How many times do you refill your bottle in your typical day on campus?

20. What you do when you forget your reusable water bottle?

You are almost done! Just a few more questions

21. How interested are you in low-waste habits?

Mark only one oval.

	1	2	3	4	5	
Not interested at all	◯	◯	◯	◯	◯	Very interested

22. Gender

Mark only one oval.

- ◯ Female
- ◯ Male
- ◯ Prefer not to say
- ◯ Other: _____

23. Age

24. Position on campus

Mark only one oval.

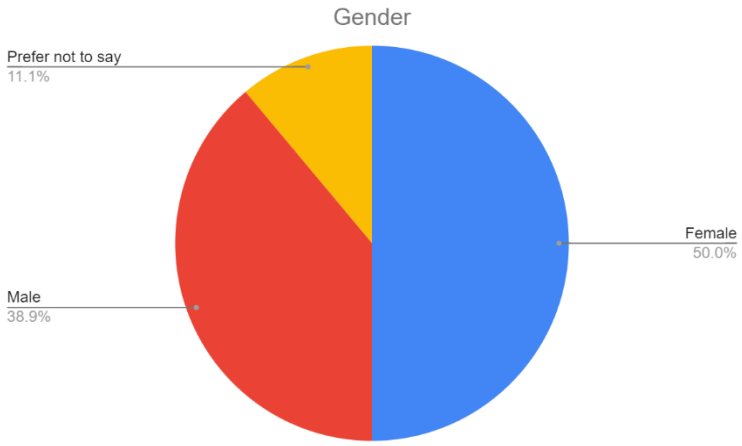
- ◯ Undergrad student
- ◯ Grad student
- ◯ Staff
- ◯ Faculty
- ◯ Other: _____

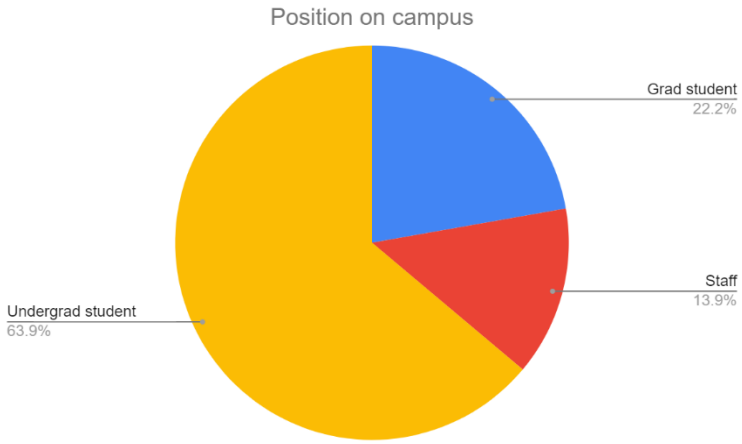
25. Would you be interested in participating in a follow up interview? A $25 dollar Amazon gift card will be given to one of the interview's participants. Please leave your email to contact you.

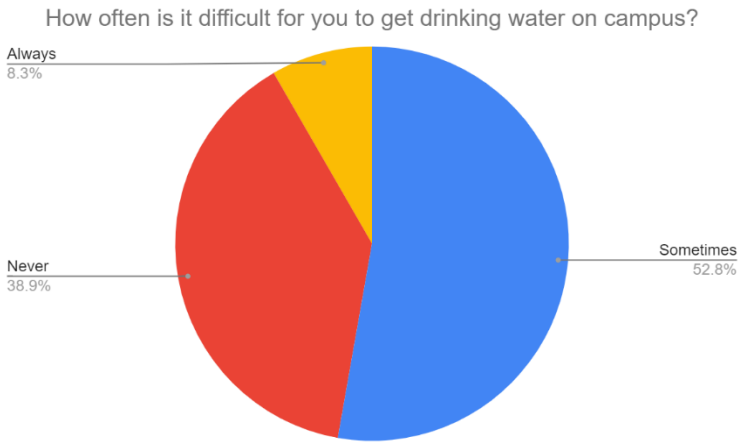
_____

APPENDIX D

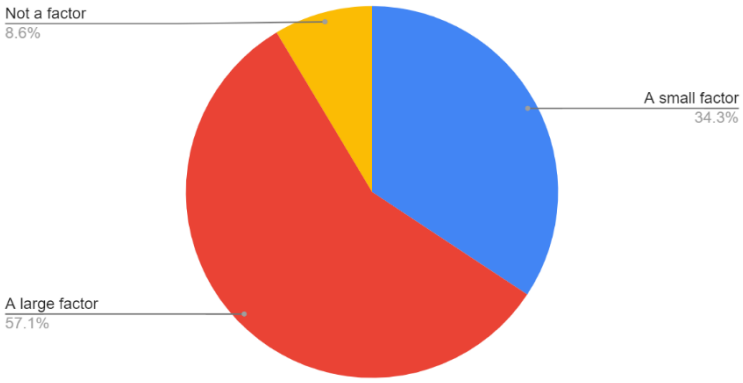
SURVEY RESULTS ASU


Gender
Prefer not to say
11.1%
Female
50.0%
Male
38.9%

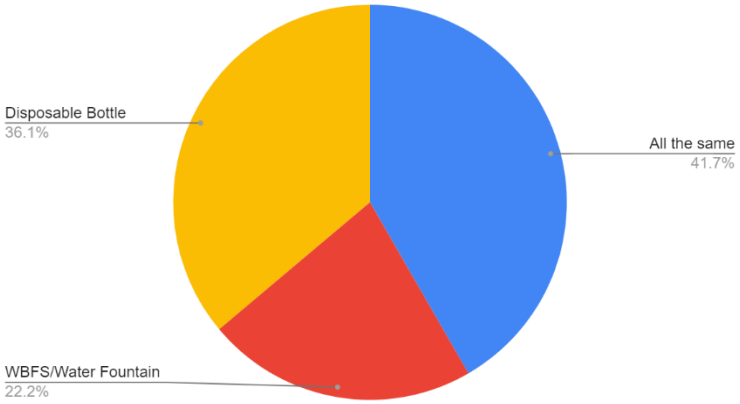

Position on campus
Grad student
22.2%
Staff
13.9%
Undergrad student
63.9%


How often is it difficult for you to get drinking water on campus?
Always
8.3%
Sometimes
52.8%
Never
38.9%

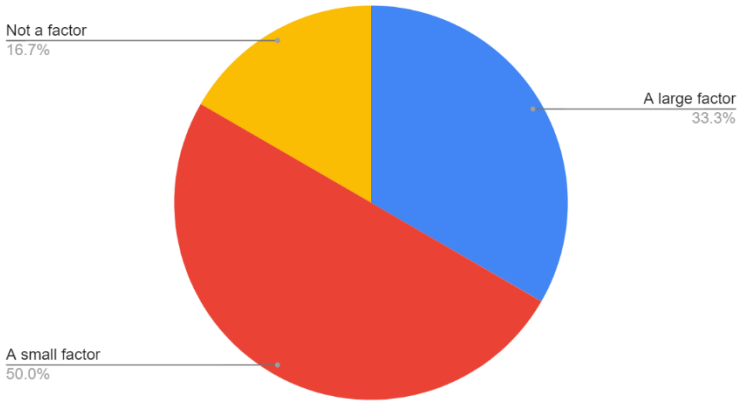
How much is the safety of water to your health a factor in your water choice?

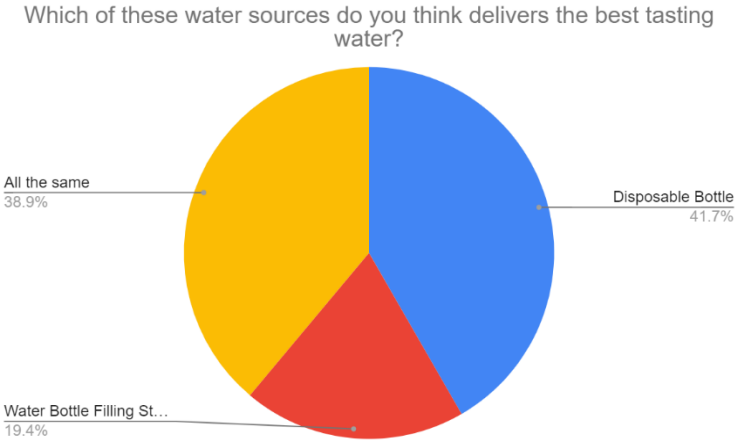


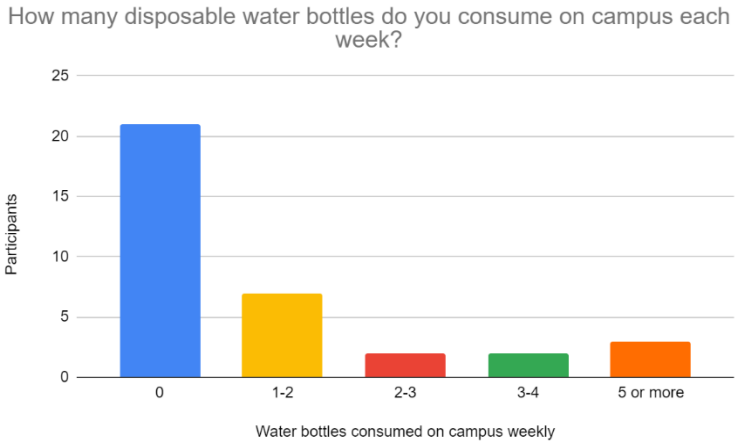
Which of these water sources do you think is the safest to drink?

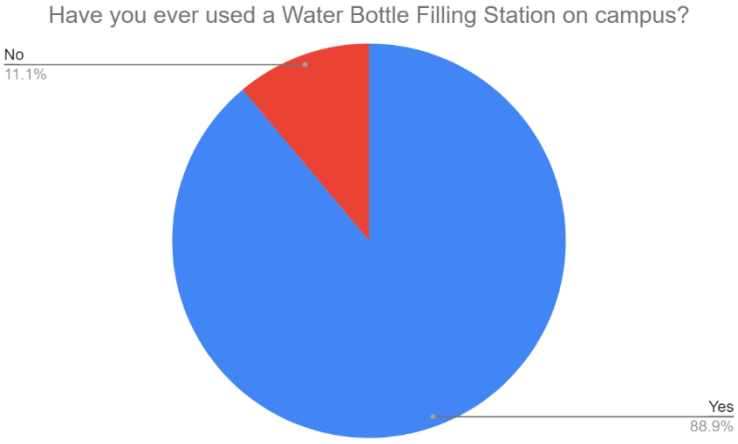


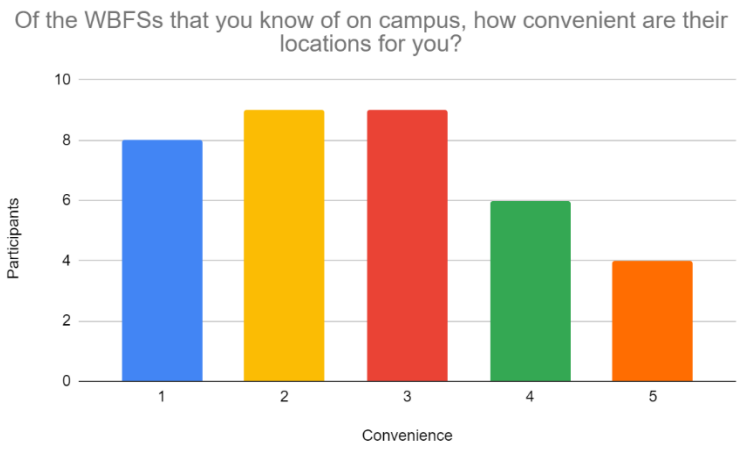
How much is the taste of water a factor in your water choice?

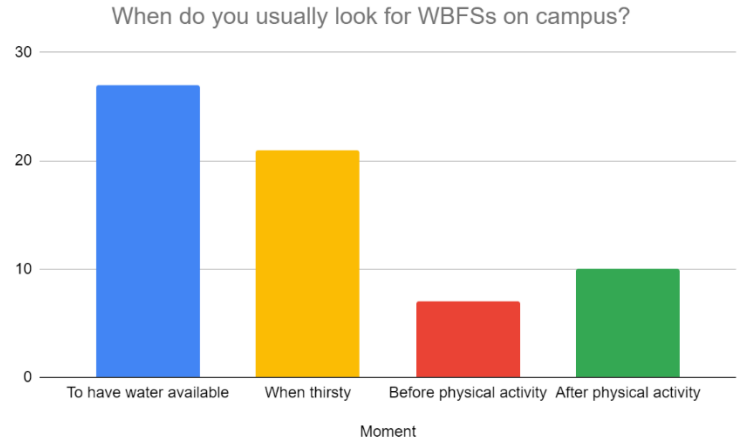


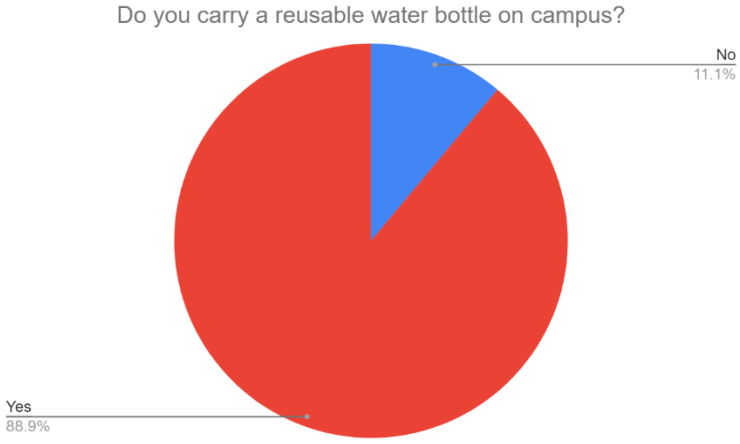

Which of these water sources do you think delivers the best tasting water?
All the same
38.9%
Disposable Bottle
41.7%
Water Bottle Filling St…
19.4%

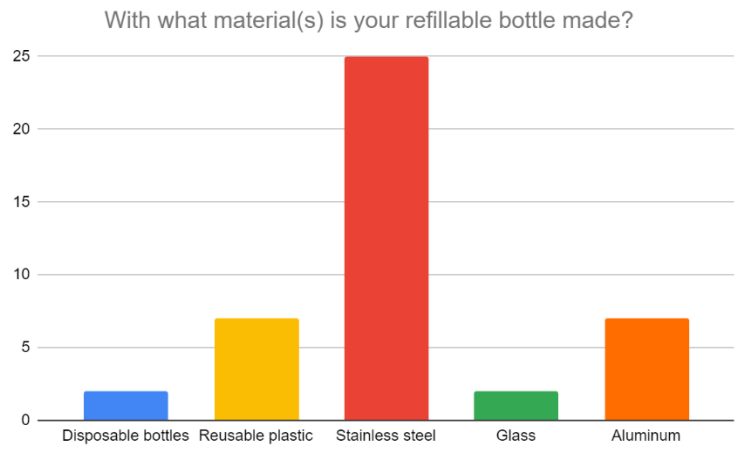

How many disposable water bottles do you consume on campus each week?
25
20
15
10
5
0
Participants
0
1-2
2-3
3-4
5 or more
Water bottles consumed on campus weekly

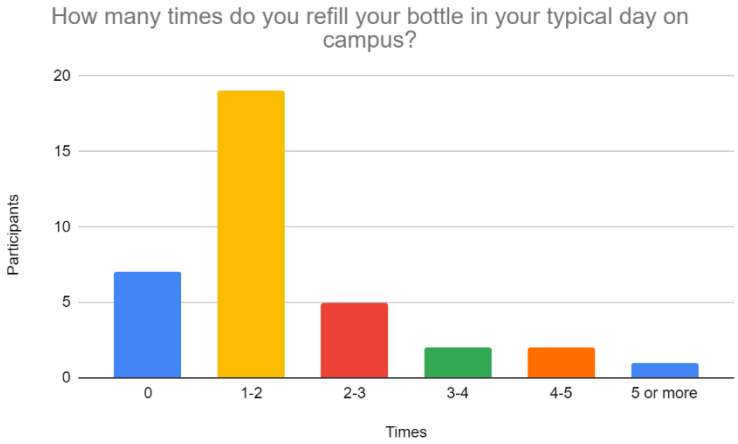

Have you ever used a Water Bottle Filling Station on campus?
No
11.1%
Yes
88.9%


Of the WBFSs that you know of on campus, how convenient are their locations for you?
Participants
10
8
6
4
2
0
1
2
3
4
5
Convenience


When do you usually look for WBFSs on campus?
30
20
10
0
To have water available
When thirsty
Before physical activity
After physical activity
Moment


Do you carry a reusable water bottle on campus?
No
11.1%
Yes
88.9%

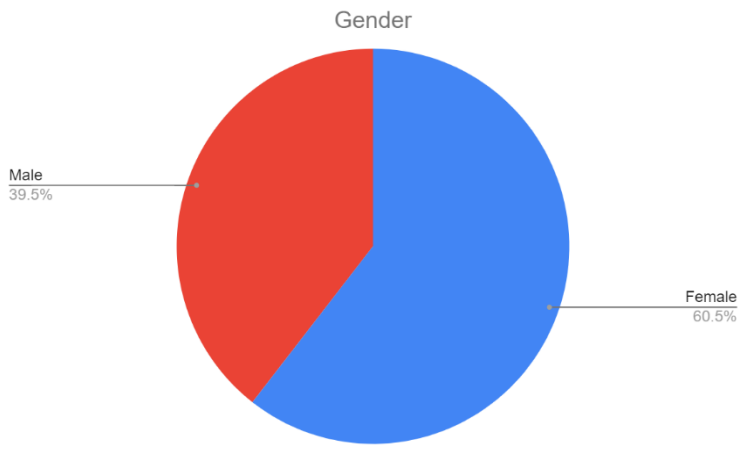

With what material(s) is your refillable bottle made?
25
20
15
10
5
0
Disposable bottles
Reusable plastic
Stainless steel
Glass
Aluminum

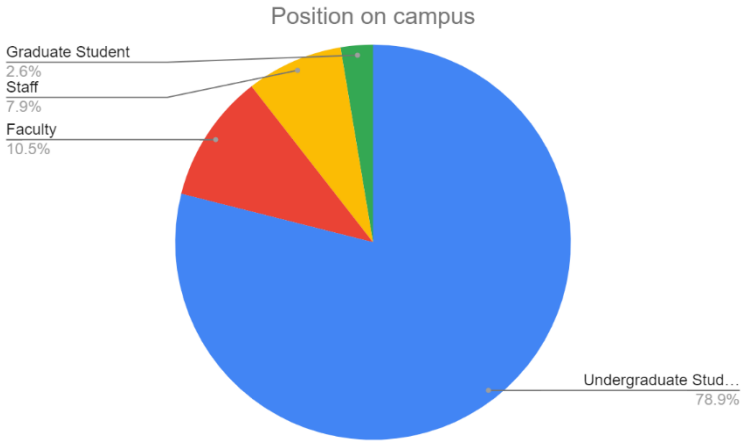

How many times do you refill your bottle in your typical day on campus?
Participants
20
15
10
5
0
0
1-2
2-3
3-4
4-5
5 or more
Times

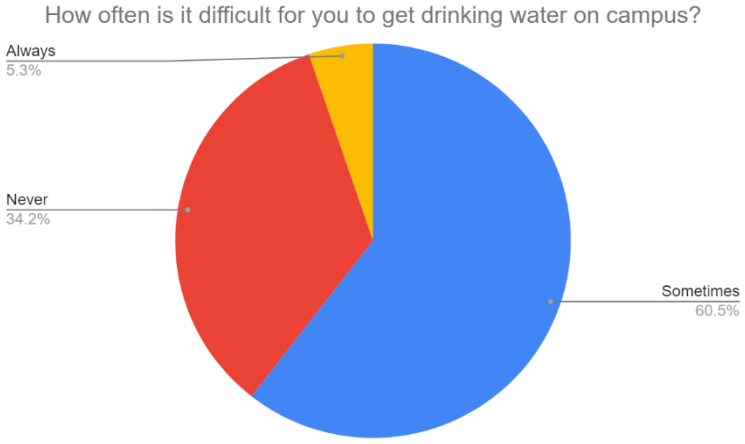

How interested are you in low-waste habits?
Participants
25
20
15
10
5
0
1
2
3
4
5
Interest

APPENDIX E

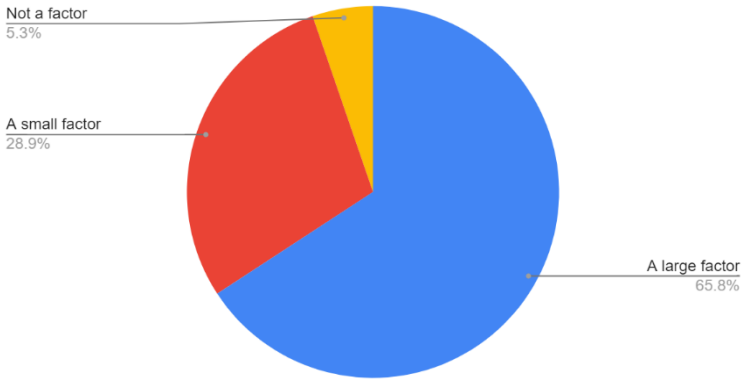
SURVEY RESULTS UAA


Gender
Male
39.5%
Female
60.5%

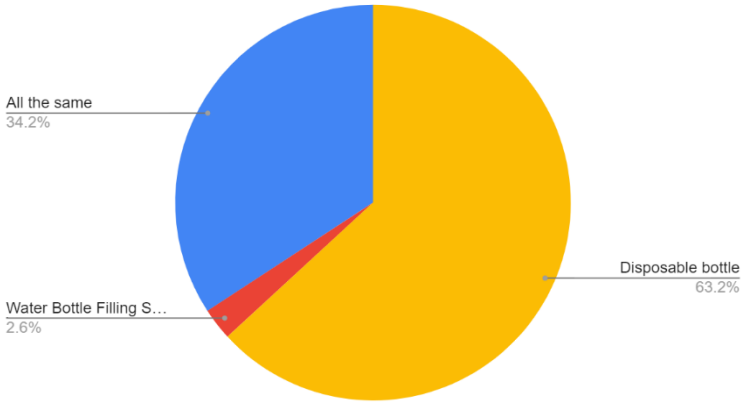

Position on campus
Graduate Student
2.6%
Staff
7.9%
Faculty
10.5%
Undergraduate Stud…
78.9%


How often is it difficult for you to get drinking water on campus?
Always
5.3%
Never
34.2%
Sometimes
60.5%

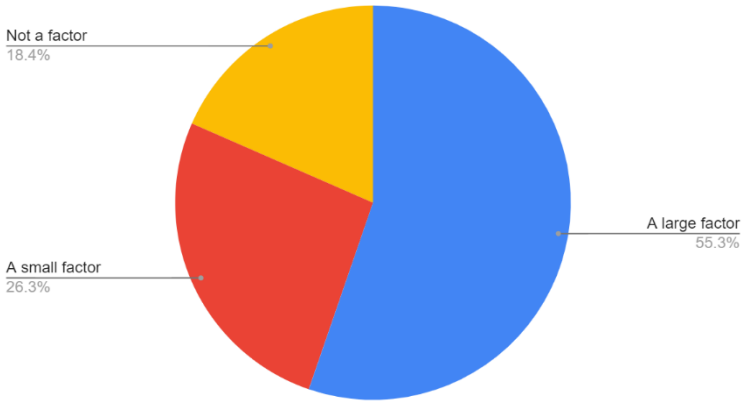
How much is the safety of water to your health a factor in your water choice?

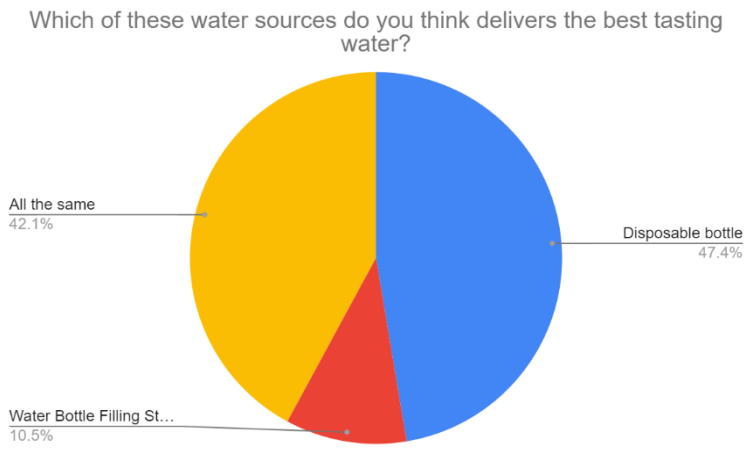


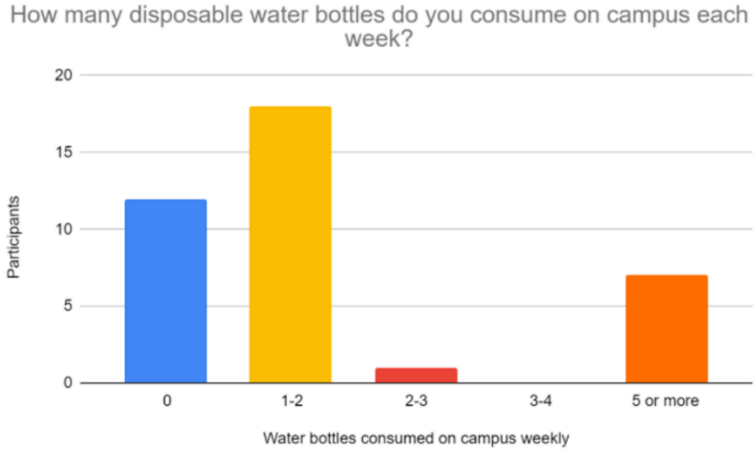
Which of these water sources do you think is the safest to drink?

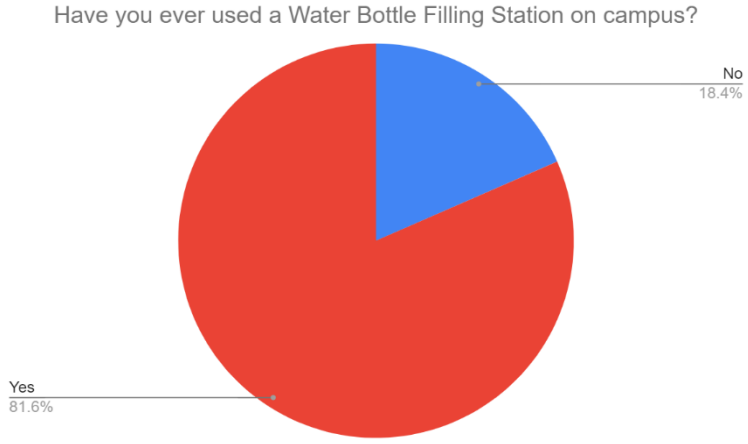


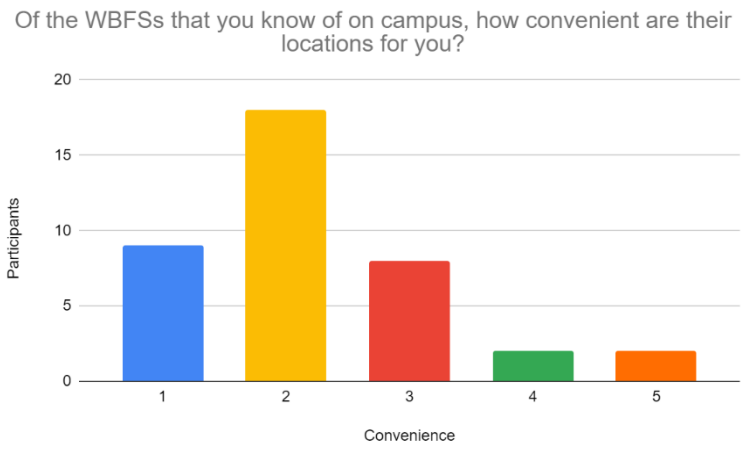
How much is the taste of water a factor in your water choice?

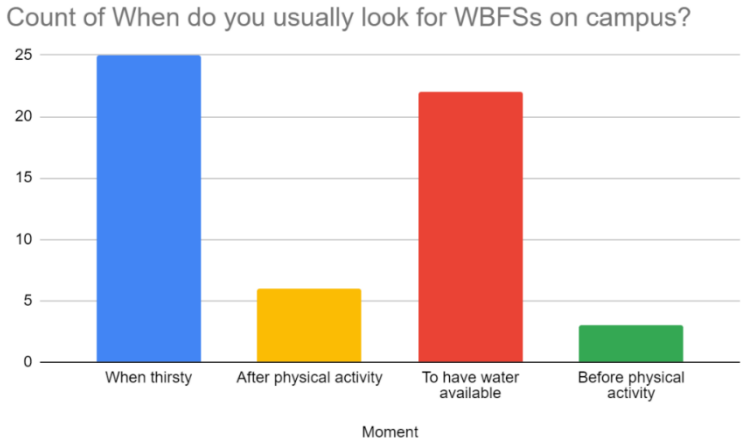


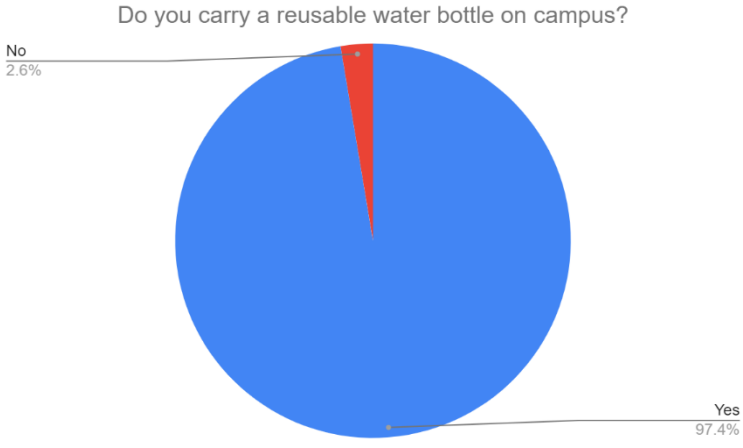

Which of these water sources do you think delivers the best tasting water?
All the same
42.1%
Disposable bottle
47.4%
Water Bottle Filling St…
10.5%

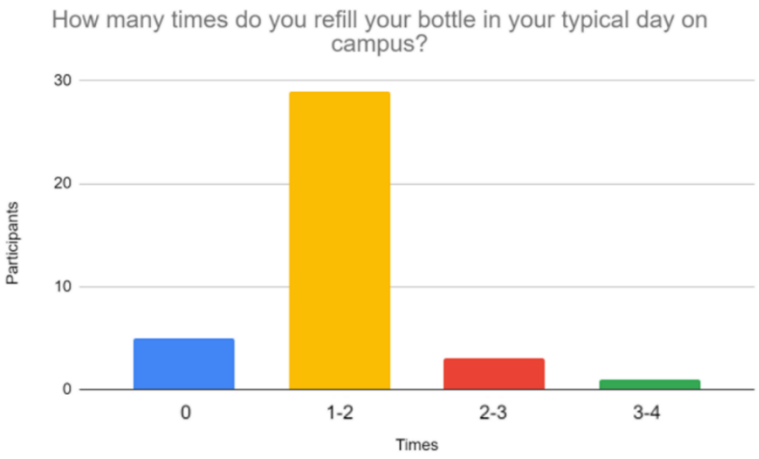

How many disposable water bottles do you consume on campus each week?
20
15
10
5
0
Participants
0
1-2
2-3
3-4
5 or more
Water bottles consumed on campus weekly

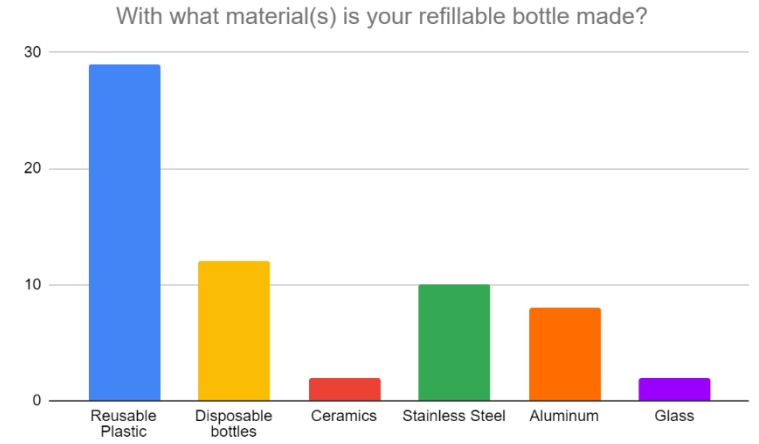

Have you ever used a Water Bottle Filling Station on campus?
No
18.4%
Yes
81.6%


Of the WBFSs that you know of on campus, how convenient are their locations for you?
20
15
10
5
0
Participants
1
2
3
4
5
Convenience


Count of When do you usually look for WBFSs on campus?
25
20
15
10
5
0
When thirsty
After physical activity
To have water available
Before physical activity
Moment


Do you carry a reusable water bottle on campus?
No
2.6%
Yes
97.4%


How many times do you refill your bottle in your typical day on campus?
30
20
10
0
Participants
0
1-2
2-3
3-4
Times


With what material(s) is your refillable bottle made?
30
20
10
0
Reusable Plastic
Disposable bottles
Ceramics
Stainless Steel
Aluminum
Glass


How interested are you in low-waste habits?
30
20
10
0
Participants
1
2
3
4
5
Interest

APPENDIX F

SEMI-STRUCTURED INTERVIEW QUESTIONS

1. Can you describe what is your normal day on campus?

2. How do you stay hydrated on campus?

3. Why do you prefer to refill rather than buying a disposable water bottle? / Why do you prefer to buy bottled water over refilling your bottle from the stations?

4. Please explain step by step your process to stay hydrated on campus.

5. Think about the last day you were on campus, what was the source of the water you consumed?

6. Show pictures of the models of WBFS on both campuses, please point out the three things that are the most attractive/appealing/interesting/eye-catching and explain why.

7. Proceed to compare the models

8. How would your ideal hydration station look like?

9. Do you think the current locations of the WBFSs are ideal? Why or why not?

10. Tell me about your relationship with your reusable container? Since when do you have it, why did you choose it?

11. What would motivate you to take your bottle everywhere?

12. How would your ideal refillable bottle look like?

13. Please explain step by step the process to refill your bottle using the WBFSs you have on campus.

14. How would you improve the process you just described?

15. How could you know how many disposable water bottles are being saved when you use WBFSs?

16. How concerned are you about sustainability on campus?

17. Which low-waste habits do you practice? Has anything changed since you started carrying your bottle?

18. Have WBFSs made you reflect on your consumption?

19. Do you have any questions for me? Or an anecdote, story related to WBFSs?

APPENDIX G

SAMPLE INTERVIEW TRANSCRIPT

Susana Becerra Galicia: Okay perfect Thank you so much so my first question is, I want you to describe what is your common day, your usual day on campus like what time do you get there, how many hours you stay there, if you go from Monday to Friday yeah so tell me about it.

Participant 9: um, so this is my final semester here, so I don't have a ton of classes left. But basically, I'll be on campus Monday through Friday. Specifically, Monday Wednesday and Friday I usually have to campus around like 11 I'll go to the gym I'll leave at MU and then I will go to the pavilions usually and do some work there until I have class which is usually in the evening around like 430.

SBG: Okay, so what is your process to stay hydrated on campus do you take a water bottle with you from home? do you buy water on campus the refill and a water bottle? What do you do to stay hydrated?

Participant 9: yeah. I always bring like a 40-ounce Hydroflask with me, and I just throw it in my backpack. Hope it doesn't leak all over my things. And that's pretty much, it usually doesn't quite get me through the day I tend to have to refill it somewhere, but if I'm lazy, then I won't. Yeah, that's that's pretty much it.

SBG: Okay. So, a usual day how many times have you would you say you refill your bottle if you're not lazy?

Participant 9: Probably one or two times a day.

SBG: um why, why do you prefer to feel over buying disposable water bottle.

Participant 9: um. Good question. I guess there's a great convenience to disposable but obviously they're not great, for the environment. It is difficult to get clean water here in Tempe, so I guess that is a benefit of going disposable but as far as just kind of the economics of it and the environment I've always just kind of you know, I, like my Hydroflask and I feel like it's easy enough that I can do it.

SBG: So, what can you tell me about the hydration stations or these systems that allow you to refill your your bottle like what what are your feelings towards it.

Participant 9: um I don't have particularly strong feelings, I guess, about them. They're just there. I feel like I usually have access to them when I when I need to refill. But also, I'm not feeling

super like frequently. But yeah, they they tend to work fairly well, like the they have the water fountain and then they have the spout that comes from kind of the ceiling quote-on-quote, which is very convenient. Yeah, I don't know if that answers.

SBG: yeah, sure there are no right or wrong answers so feel free to express whatever you want to say. Okay, so if you had to number like step one step two step three the process of staying hydrated on campus starting from home, can you introduce me to that process?

Participant 9: Yes. So, you know wake up go to the fridge go to the Brita filter, unload 40 ounces of water into my Hydroflask. You know sip on that until I had to campus sometimes, I'll refill it before if I want a very heavy backpack and sometimes I won't. And then, once I'm on campus I'll kind of continue drinking that and then usually around the afternoon I go somewhere to refill it and then I will go to class and then head home.

SBG: Okay, so you would say that this same process happened as you described the last day you were on campus.

Participant 9: (Nods)

SBG: yeah okay. Um so now, I am going to show you two pictures. The first one is a hydration station around Hayden library. What are we gonna do? You're gonna tell me the first three things that call your attention the things that look the most interesting most appealing at first glance, to you yeah so you don't have to think a lot. OK, and you want me to zoom in or like to move the picture, please let me know.

Participant 9: I guess it looks low, which is normal looks clean. Looks accessible and low.

SBG: Okay, and why, why were those three things interesting or appealing to you.

Participant 9: Um. I guess like when you have a backpack on or something it's nice to just be able to like have access to it also figure for you know potentially people in wheelchairs or with other disabilities being able to access the water. The kind of shine of the of the metal or whatever, that is, makes it look clean. And what was the other thing I said? Oh, and accessible it just kind of looks like it's you know, in the hallway somewhere that you can just kind of navigate to it into and fill your water.

SBG: Okay, good so now. The second picture that I'm going to show you is a station that is located in a college in Mexico and we're going to do the same exercise. You're gonna tell me the three things that are interesting that call your attention that you look up first.

Participant 9: It looks. More mechanical, I guess. I know it clearly does the same same thing. It has, I don't know if those are instructions or warnings. So, there's kind of like I guess some verbiage surrounding it. It looks fairly clean, I would say.

SBG: Okay.

Participant 9: yeah, it's more of a like a standard looking water fountain like those are the water fountains, I guess, I remember from like middle school or something along those lines.

SBG: Okay, and why were those three things as you notice first.

Participant 9: um I guess just trying to kind of point out the differences compared to kind of what we just saw. And I guess my my top priority when I'm filling in my water is you know, is the water clean and is, you know the station, you know cleanly enough to kind of be okay with using it. And then I don't I don't love reading.

Okay So how do you like, if you have to explain how this works, what would you say like, how do I refill my bottle using this?

Participant 9: Ah that's good question um so my guess, so if they work like as us then it's just kind of a sensor and you put it towards the back there. Potentially maybe that circle is a button I'm sure, maybe the instructions probably help with that. So yeah, put your water bottle click the button, or maybe it's automatic and then, if you're just going to drink water then click the button at the at the front and kind of drink from that spigot.

SBG: yeah, actually yeah here, it has an instruction.

Participant 9: Oh, there's literally yeah.

SBG: Um okay good Thank you so much, so now and actually that comparison was the next question. Because I wanted you to describe your preferences like if you get to have your own perfect worse bottle filling station, why would you look like a what features from one or the other, or even some from some other that you've seen it somewhere else would it have.

Participant 9: um. I guess the nice thing about the ASU was the was the two different levels. So maybe that's better for accessibility. The automatic system at ASU is. I guess ideal for just people not touching everything, however, I will say I've had times, where doesn't really work and then I have to pull my water out as it's still going and then that's my bottle all wet. Yeah so. Again, guess my ideal would probably be, you know, clean, accessible and just having it work I guess overall on the button I don't think is very ideal in my mind um.

SBG: Okay, how would you know it is clean like what lets you know from the physical part of it that it's clean?

Participant 9: um I'm gonna guess you never really know. But mostly just if it looks like there's anything on either the spout or just like on the metal. Really just visual. It's probably difficult to keep them clean, so you never really know but yeah as long as kind of where the water is coming out of is clever enough and I think that's.

SBG: Okay, and what keeps you a cue for that, how can you know the water is clean enough?

Participant 9: um. I guess you know based off of off of taste usually. But I know that's a great indication given you know if the water is colder than it will taste better. You know, you can see, I guess, like, little like. I don't know if something's really dirty, then you could see you know particles in the water, that was coming out I don't really think that's necessarily the case here, particularly. Yeah, there's no it's really trust. I don't think there's a great way for my eyes to perceive that. There's probably a lot of like bias involved as well you know, on my campus you know assume that I'm being taken care of and that the water will be fine so I'm not really thinking about it, but if I was you know in another country, or you know somewhere else. That would maybe be more on my mind.

SBG: Would you like an indicator for you to tell you that you can trust the water?

Participant 9: yeah, I think that's always Nice. Every once in a while, like the the filter button will go from like you know green to yellow and red. Which always you know does its job of either stressing you out or making you feel more comfortable.

SBG: yeah, that's a big deal like for a lot of people, once it turns orange not even like red stopped using them. What about your your feelings towards it?

Participant 9: Um I like it even our Britta filter has like a green. You know, led light or whatever that lights up when it's you know clean and then eventually over time it it goes red, and then we know to replace it so it's nice to have an indicator of when to replace it, and also, if you are going to be super particular than you know find another station or you're not going to be comfortable doing that.

SBG: Okay, very good Thank you oh. For example, what are your feelings or what do you think about the location of the stations on campus? Do you think they're in the good place? you think there should be more? Where would you place them to be accessible?

Participant 9: um. On campus I feel like they're in the right place is usually always kind of by a restroom or just kind of in like a you know, a hallway, which you know is out of the way. And I guess, I would say there's enough of them in the sense that, when I need to fill up there's you know never align or anything along those lines.

SBG: um so would you say that accessibility, will help people to use them more? do you consider it important or strong factor for people to use them more frequently in prefer them over buying disposable bottles?

Participant 9: yeah, for sure. I think, unfortunately, we live in a world where people are going to do whatever is the most convenient for them. And you know that is 100% dependent on on the person I think if there are stations available and you're seeing that as an option and it's easier than people are going to be more willing to do it, I'd say majority of people, I see on campus have water bottles with them. And so yeah, I feel like there if it's accessible then then we'll do it yeah.

SBG: Okay, so do you describe me a little bit your bottle. You say you're using other Hydroflask yeah Okay, you have it there with you great. Well, why would you say is your relationship with it, what makes you keep it what makes you take care of it and how they like what's the story behind your bottle how did you choose it.

Participant 9: I've had it for a long time actually. I used to work at a store that sold them and so. I was somewhat incentivized because I got a discount. And I wanted to drink more water in general, you know if you have a bottle with you, you'll drink more water. And you'll refill it more and then you can do the math of that's a 40-ounce bottle I need to drink, however, many of those

a day so it's a good way to kind of stay healthy. I was attracted to the color. I said, you know I wouldn't mind looking at that. And then I guess just the standpoint of it, keeping everything colds, which makes it feel fresh.

SBG: Okay, is there anything that you would change from your bottle to make it completely perfect?

Participant 9: I would buy a new cap with like a straw right now, I have to like rotate it and it's kind of model so that's super nitpicky obviously don't care too much because I haven't changed it, but straw would be nice.

SBG: Would you explain how to use the the station from from Mexico just by intuition, so now, can you give me a more detailed explanation on how to use the ones are, as you as you.

Participant 9: yeah. I would say it's pretty much the same thing, the only difference being. That, I guess, all the all the stages, see more automatic for filling up your bottle. But as far as drinking water, like right there they're pretty much identical other than. As us look sleeker and there's circular. So maybe that means there's less mechanics going on, maybe it's more efficient or, as you just better at hiding over the pumping the water into the into the fountain.

SBG: Okay. And how would you say this whole process of refilling your bottle in these stations can be improved? Is there anything that can be changed modified to make the experience I don't know easier, more pleasant? With less trouble.

Participant 9: Nothing really comes to mind. I guess it is there's always a trade off because I'm like having a 40-ounce bottle is great for the quantity, but it is kind of a pain to lug around and fill up. So maybe if they were more and I had a smaller bottle and was kind of it was way easier to kind of find a station, you know you're walking out of a classroom fill it up something like that. Then, maybe we'd all have straighter backs and be hydrated.

SBG: Okay, so it's like the whole process of actually carrying the water around.

Participant 9: yeah, and just I don't know it's a cylinder and there's a reason it's a cylinder, but you know the rolls around in your bag and water is heavy so it's like. Yeah, you know and and, as you as a big campus so I feel like on any given day I'm walking you know point eight to one mile just to get to class from my apartment, so I am kind of thinking about how to lighten my load.

SBG: How can you know how many bottles have like plastic bottles, have you saved from using hydration station?

Participant 9: um there is a oh that's a difference there's a there's a ticker on there um usually. That I'm guessing is just based on ounces poured but it goes up and tells you how many bottles have been saved.

SBG: Okay, do you think that's useful that motivates people like to know that information.

Participant 9: I think, so if you're curious. I you know I think it's kind of a nice statistic I don't I doubt majority of people are really looking at it. It probably adds some incentive, especially for people who are are kind of more aware and more like active in that regard, but yeah, I guess it just depends.

SBG: Okay, so in a scale from one to 10 where one is not at all and 10 is completely. How worried, or how concerned are you about sustainability on campus?

Participant 9: I'm just kind of as a broad term not just water. I don't know I feel like as you this far as tackled the small things. You know a lot of the straws and the MU, you went to went to paper, instead of plastic. I see kind of more and more trash cans and recycling cans popping up specific ones like in the millions, for electronic waste, which is another huge problem. So, I feel like they're doing they're doing some things. I think there's always more to be done. I think once again it's if they're incentivized in the proper way. So yeah, I guess it's a big campus I mean the number of buildings were powering. Just all of those things. You know I guess we're trying to make more more efficient buildings greener buildings. But I'm not super aware of what is us doing in that guard. COVID obviously helped when maybe they weren't powering as many buildings. Although they were charging the same tuition, so they were doing pretty well.

SBG: Okay. Um and how interested, are you on low-waste habits? which are the ones that you practice on a daily basis?

Participant 9: um I could be a lot better. I took a I took a course my freshman year and it's you know telling us that we're using you know however many times earth's that we have just because you know it's a consumer culture and we're all pretty wasteful and try to recycle when I can. I've definitely felt less inclined to do so just with. You know understanding that my you know little bit of

work to recycle doesn't actually mean it's getting recycled, because you know, someone has to pay for it, and maybe they don't want to so. A lot of times sustainability feels a little hopeless, and I think we're also a custom to our lives that no one's willing to change and. If this past, you know, a couple years is proven anything, then we're all a lot more selfish I think than we'd like to admit. Recycling try not to take too long showers. Trying to kind of eat cleaner things, carpool. Yeah, those those would be the main things.

SBG: Would you say that I don't know like if you make a timeline out of these different low waste habits and when you started to adopt them, has anything changed for the better or for the worse when you started carrying your your own bottle? I mean like were you a little bit more conscious about the different lowest habits you started incorporating a little? like some others are you ditch some, what can you tell me about it.

Participant 9: yeah, I think it, I think it helps I think the fact that the Hydroflask became kind of this brand, and it became you know cool or sleek to have one. That was kind of great I think for the younger generation, because I don't even think we all knew what we were doing. You know it's just Oh, I want the new hydro flask but was actually being you know pretty great for the environment. I have in the past, gone like those Costco water bottles so there's like 40 or 80 water bottles in there, and I mean it's you know its massive. And I think that sometimes puts things into perspective of wow if that's how much space just my waters taking up to be like package, then imagine everything else that's happening. So, the Hydroflask is nice it kind of reduces that.

SBG: So do you think that, at a certain point, it is possible for this spaces such as the hydration stations to influence people into other low-waste habits? or do you need something that you bring like from before and another point of your life and they like the station's just reinforce that kind of behavior.

Participant 9: I think a little bit of both. I think there's definitely way to incentivize this and other things, whatever they may be, I think a lot of it does come down to accessibility of number one we use the water, for example. But also if bottled water wasn't as accessible. And you know people are never going to be happy when they're inconvenienced but if that's kind of what needs to be

done to kind of shift everyone away from that then then that needs to be done. You know when ASU change their plastic straws to to the paper straws, no one knew that that was going to happen is like one day show to the M, you and your drink tastes a little different. So yeah, I think incentives are good, and I think. Big changes probably just need to be made on the other end as well.

SBG: Okay, so um well we're pretty much done, I just wanted to ask you if you have any questions for me if you have anything else you would like to comment on water bottle filling stations or getting water on campus if you can remember any unusual or I mean, like any anecdotal experience that you can remember, using the water bottle filling stations.

Participant 9: I'm actually yeah so, my freshman year I lived it took her house. And it's like this big beautiful new building. And you kind of get to Tempe and you realize that the tap water isn't safe to drink. So then, you have kind of two options either you tough it out and you keep going to the gym where there's one water filling station. And you like bring a bucket just to you know, have a gallon or two of water in your dorm at any time and then every every day or to go down there and refill it. Or you have to pay for like a service a water service, where they have like the big jug, and they put it in your dorm room. And I guess there's a third option, which is to buy water bottles and Obviously, going downstairs to the gym is the cheapest but it's painful and then the water service is expensive, and so I think a lot of people I wouldn't be surprised if they fall into the category of buying you know water bottles, especially in bulk we're just super unfortunate. And so, you know I guess between tuition and rent for those dormitories. I would like to see like clean water for students in their dorm rooms or like on their floors. I think that'd be a nice touch. Good for the brain good for the body.

SBG: That's important.

Participant 9: And that was freshman year, so people are going to develop habits in their college career and so, if you're a hydro flask or then you'll probably be a hydro flask or senior year and if you're a water plastic bottle person, then you might be that as well, so yeah that's true.

SBG: That that convenience factor is important. So, if you don't have anything else to add to mention, I would really like to thank your help and your collaboration for this study your input was really, really valuable for this research.

APPENDIX H

CONSENT FORMS ENGLISH

Water Bottle Filling Stations and Low-Waste Habits

I am a graduate student under the direction of Professor John Takamura and Michelle Fehler in the Design School of the Herberger Institute of the Design and the Arts at Arizona State University. I am conducting a research study to understand how the current design of Water Bottle Filling Stations introduces users to the circular economy. I am inviting your participation, which will involve answering a survey compiling multiple choice and open questions. It may take you from 15 to 20 minutes of your time. You have the right not to answer any question, and to stop participation at any time.

Your participation in this study is voluntary. If you choose not to participate or to withdraw from the study at any time, there will be no penalty. At the end of the survey, you will find a series of questions that serve as screen for an interview that is also part of the study. Your participation on the screen is also voluntary. You must be 18 or older to participate in the study.

Although there is no benefit to you, possible benefits of your participation are the creation of guidelines for products that involve the circular economy. There are no foreseeable risks or discomforts to your participation.

To protect your confidentiality, all data collected will be saved under passwords in a special platform where only the researchers will have access. Your responses will be anonymous and de-identified. The results of this study may be used in reports, presentations, or publications but your name will not be used. de-identified data collected as a part of current study will/will not be shared with others (e.g., investigators or industry partners) for future research purposes or other uses.

If you have any questions concerning the research study, please contact the research team at:
MSD John Takamura: John.Takamura@asu.edu
MS in Biomimicry Michelle Fehler: mfehler@asu.edu
Co-Investigator Susana Becerra: sabecerr@asu.edu

If you have any questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU Office of Research Integrity and Assurance, at (480) 965-6788.

By checking the box, you are agreeing to be part of the study.

* Required

I am a graduate student under the direction of Professor John Takamura and Professor Michelle Fehler in the Design School of the Herberger Institute of the Design and the Arts at Arizona State University. I am conducting a research study to understand how the current design of Water Bottle Filling Stations introduces users to the circular economy.

I am inviting your participation, which will involve sharing your points of view in an interview. It may take you from 45 to 60 minutes of your time. You have the right not to answer any question, and to stop participation at any time.

Your participation in this study is voluntary. If you choose not to participate or to withdraw from the study at any time, there will be no penalty. You must be 18 or older to participate in the study. Although there is no benefit to you, possible benefits of your participation are the creation of guidelines for products that involve the circular economy. There are no foreseeable risks or discomforts to your participation. A 25-dollar gift card will be given to one of the interview's participants. The winner will be chosen from the pool of the participants through a drawing a week after the last interview is completed. You will be notified via email if you result a winner.

To protect your confidentiality, all data collected will be saved under passwords in a special platform where only the researchers will have access. Your responses will be anonymous and de-identified. The results of this study may be used in reports, presentations, or publications but your name will not be used. De-identified data collected as a part of current study will/will not be shared with others (e.g., investigators or industry partners) for future research purposes or other uses

I would like to audio record (mention when in person) / video record (mention when online) this interview. The interview will not be recorded without your permission. Please let me know if you do not want the interview to be recorded; you also can change your mind after the interview starts, just let me know.

If you have any questions concerning the research study, please contact the research team at:

MSD John Takamura: John.Takamura@asu.edu

MS in Biomimicry Michelle Fehler: mfehler@asu.edu

Co-Investigator Susana Becerra: sabecerr@asu.edu

If you have any questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU Office of Research Integrity and Assurance, at (480) 965-6788. Please let me know if you wish to be part of the study.

By saying aloud “I agree” you are agreeing to be part of the study.

APPENDIX I

TRANSLATION CERTIFICATION FORM

For Office Use Only:
Date Received:

Translation Certification Form
Institutional Review Board (IRB)

PROTOCOL TITLE:	**WBFS and low-waste habits**
HS NUMBER:	**STUDY00015161**
PRINCIPAL INVESTIGATOR:	**Philip White**
LANGUAGE OF TRANSLATED DOCUMENTS:	**English to Spanish**

TYPE OF SUBMISSION	
☒	The initial submission of the following forms supportingdocuments 27-01-2022, Model Short Consent_survey, Model Short Consent_interview
☐	The modification of the following forms that have been approved.
☐	Other

CERTIFICATION OF TRANSLATION

I certify that I have performed the translation of the following documents: supportingdocuments 27-01-2022, Model Short Consent_survey, Model Short Consent_interview for the referenced project.

Printed Name of Translator: Susana Angelina Becerra Galicia

Signature of Translator: [signature] Date: 05/Feb/2022

CERTIFICATION OF BACK-TRANSLATION

I certify that I have performed the back-translation of the following documents: supportingdocuments 27-01-2022, Model Short Consent_survey, Model Short Consent_interview for the referenced project.

Printed Name of Back-Translator: Carlos Alberto López de Lira

Signature of Back-Translator: [signature] Date: 05/02/2022

IRB NOTE: The translation and back-translation should be done by two different people.