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Motivators and Hindrances of Consuming Reusable Water Bottles: An Exploratory Case Study at Columbia University

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Abstract

This pilot study explores the factors that motivate and hinder tap water consumption and reusable water bottle usage among students at Columbia University. Despite Manhattan's tap water being among the highest quality globally, the prevalence of single-use plastic water bottles on campus remains significant. Choosing reusable water bottles over single-use plastics is a pro-environmental behavior that can reduce plastic production and waste. This research investigates the underlying reasons behind students' choices regarding tap water consumption and reusable bottle usage. The data were collected from 58 students selected through convenience sampling utilizing questionnaires and participant observation. The questionnaire responses were thematically coded, and descriptive statistics, including percentages and frequencies, were used to analyze the data. Findings indicate that, while a relatively high percentage of students consume tap water compared to other universities, hygiene concerns related to water quality are the main hindrances. In terms of bottle usage, the primary motivation for carrying a reusable water bottle was to increase water intake. The major barrier was the inconvenience and lack of portability of reusable bottles. Notably, students overestimated the positive environmental impact of using reusable water bottles, which could potentially lead to greater environmental harm due to misconceptions. This pilot study underscores the need for further in-depth research to identify and address the misconceptions and barriers affecting students' pro-environmental behaviors.

Author's Note

As someone who loves drinking water—I consume about a gallon of bottled water every day—I was taken aback one day when I noticed that my apartment's recycling bin was overflowing with plastic bottles. It struck me that this substantial amount of water had been bottled and transported all the way from France and Belgium to Korea. This realization prompted me to look into the carbon footprint associated with transporting bottled water and the challenges of recycling plastic bottles. Through this exploration, I discovered that using reusable water bottles is a far more environmentally friendly way to stay hydrated. This insight inspired me to learn how others perceive reusable water bottles and what motivates people to use them. My hope is that this research will help

future policymakers promote sustainable behavior and reduce the environmental impact of single-use plastics.

Keywords: Reusable water bottles; Single-use plastic; Pro-environmental behavior; Environmental sustainability; Student perceptions; Water consumption habits; Plastic waste reduction.

Introduction

Water is an essential resource for human survival and development. The establishment of reliable water supply systems has been pivotal in supporting population growth and urbanization. In the mid-19th century, New York City developed its water supply system, leading to a dramatic increase in population due to the availability of clean water resources (NYC Environmental Protection, 2020). Today, New York City is renowned for its high-quality tap water, sourced directly from the Catskill/Delaware Watersheds and maintained to rigorous standards (NYC Environmental Protection, 2020). Despite the superior quality of New York City's tap water, there is a prevalent use of disposable plastic water bottles among residents. Interestingly, studies have found that the percentage of people consuming bottled water tends to be high even in areas where tap water quality is excellent (Fedi et al., 2021). This paradox highlights a disconnect between the availability of clean tap water and the public's preference for bottled water.

The environmental impact of bottled water consumption is significantly greater than that of tap water. (Garfí et al., 2016; Makov et al., 2019; Nessi et al., 2012). Gleick and Cooley (2009) estimate that bottled water production requires up to 2,000 times more energy than tap water systems (as cited in Chudwick et al., 2013). Further, the widespread use of single-use plastic bottles contributes to environmental degradation through increased plastic waste and greenhouse gas emissions.

To better understand this discrepancy and promote environmentally sustainable behaviors, this study examines the motivators and barriers influencing tap water consumption and reusable water bottle usage among students at Columbia University. This population is particularly relevant for exploratory research due to their youth, high level of education, and urban setting, which may influence their environmental awareness and behaviors. By identifying the factors that encourage or discourage the use of tap water and reusable water bottles, this research aims to bridge the gap between the availability of clean water and consumer preferences. Understanding these factors is crucial for developing strategies and policies that promote pro-environmental behaviors and reduce reliance on single-use plastics.

I. Reusable Water Bottles and Bottled Water.

In this research, reusable water bottles refer to any stainless steel, aluminum, glass, or plastic bottles that can be used multiple times and are purchased as standalone items. This includes reusable tumblers with lids used for other beverages, such as coffee or tea, because they can also function as water containers. Recently, some manufacturers have commodified water in aluminum containers designed for multiple uses. However, these are not considered reusable water bottles in this study due to their limited popularity and unclear environmental impact.

Conversely, bottled water refers to water packaged in relatively thin, single-use plastic bottles, where the commodity is the water itself rather than the container. In this paper, the terms "bottled water," "single-use bottles," and "disposable water bottles" are used interchangeably. Additionally, when addressing the term "water source," it refers to the methods of drinking water—either tap water consumed with a reusable bottle or bottled water.

II. Columbia Morningside Campus Students.

Columbia University in the City of New York has a few campuses around New York City, such as the Manhattanville, Irving Medical Center, and Morningside campuses. This research solely focuses on the Morningside campus and often refers to it generally as Columbia University. It is the main area most undergraduate and graduate students live, commute, and study.

Literature Review

Several studies have been conducted to identify individual motivations for drinking either tap water or bottled water. Factors such as water quality, hygiene concerns, economic benefits, convenience, and environmental concerns, among others, have been identified (Doria, 2006, 2010; Etale et al., 2018; Gleick, 2010; Kang et al., 2017; Mukherji J. & Mukherji A., 2020; O'Donnell & Rice, 2012; Van der Linden, 2015).

I. Convenience as a Motivator.

People who drink tap water at home often consume bottled water due to the accessibility and convenience of bottled water (Etale et al., 2018). Studies at Purdue University (Saylor et al., 2011) and the University of Birmingham (Ward et al., 2009) found that convenience was the primary motivator for drinking bottled water. At the University of South Florida, Tampa campus, similar qualitative research identified "convenience" as one of the critical themes in responses (Graydon et al., 2019). Alternatively, 91% of students who consume bottled water at Villanova University indicated they would either use a reusable water bottle (50%) or "consider" using one (41%) if there were more water stations on campus (Chudwick, 2013). However, the inconvenience of using reusable water bottles comes from not only the location of water filling stations but also the necessity of carrying the bottle daily. In many cases, one of the main reasons for not using a reusable bottle, regardless of tap water quality, was the portability of the bottle and forgetting to bring it (Bartolotta & Hardy, 2018; Chang, 2010; Mukherji J. & Mukherji A., 2020).

II. The Perception of Water Quality as a Motivator.

The significance of water quality concerns related to tap water, such as health concerns and taste preference, varies among studies. Some have found it to be a less critical motivator (Bartolotta & Hardy, 2018; Ward et al., 2009), while others consider it a significant factor hindering tap water consumption (Espinosa-García et al., 2015; Gleick, 2010; Levêque & Burns, 2018; Saylor et al., 2011). In Germany, researchers tested whether students could distinguish between tap water and bottled water, as many believed that the taste of tap water was inferior. They conducted a blind test and found that students were unable to distinguish between tap water and bottled water (Debbeler et al., 2018).

III. The Environmental Impact as a Motivator.

Establishing a significant relationship between people's environmental values and their preference for reusable water bottles has been challenging. A study on Hispanic groups in the U.S. Southwest found no meaningful relationship between environmental views and the intention to buy bottled water or use reusable water bottles. However, the study revealed that "negative attitudes towards plastics" led to a decrease in bottled water consumption (Mukherji J. & Mukherji A., 2020).

This suggests that enforcing negative views on plastic usage is more effective than general concern for the environment at encouraging reduced consumption. Additionally, students' academic disciplines correlated with their attitudes and intentions. Students studying humanities and social sciences tended to use reusable water bottles for external reasons, such as community and environmental concerns (Fedi et al., 2021). STEM students tended to use reusable bottles for personal convenience or individual beliefs (Fedi et al., 2021).

IV. Ownership of Reusable Water Bottles as a Motivator.

Goucher-Lanbert and Cagan (2015) found that even when consumers are provided with environmental information, the importance of price remains constant, while the design of water bottles becomes less critical. In this context, to promote reusable water bottles and tap water, Princeton University distributed reusable water bottles to incoming students as part of the "Drink Local" campaign. They found that the distribution campaign successfully decreased the percentage of students drinking bottled water on campus (Santos et al., 2016). Since Columbia University has numerous water refilling stations on campus and distributes reusable water bottles to incoming students at the administrative and student organization levels, the proportion of students using reusable water bottles was expected to be high.

A Case Study on Columbia University Morningside Campus

This research is a pilot study focusing on students at Columbia University's Morningside Campus. This population serves as a representative case for this subject matter since the students are young individuals living in an urban setting, expected to become a significant economic demographic in the near future. In addition to its location, this population represents highly educated individuals with college-level education and exposure to sustainability education, as Columbia University offers climate-related courses. Studying the motivating factors among Columbia University students would be beneficial for policymakers encouraging pro-environmental behavior as using a reusable bottle can both harm and alleviate environmental impact, depending on usage patterns. However, the Columbia University population is unique regarding socio-economic status and other factors, making it challenging to claim external validity, though data may be applicable to similarly elite college campuses. In this regard, the findings from this study may provide exploratory opportunities for future research.

Methodology

I. Questionnaires

This study employed a convenience sampling method to recruit participants from Columbia University's Morningside Campus. The questionnaires were conducted entirely online and distributed through multiple channels, including online social networks and social media platforms exclusive to Columbia University students. Responses were collected anonymously via a Google Form without recording respondents' email addresses. The inclusion criteria were being a student at Columbia University's Morningside Campus. Participation was voluntary, and no incentives were provided.

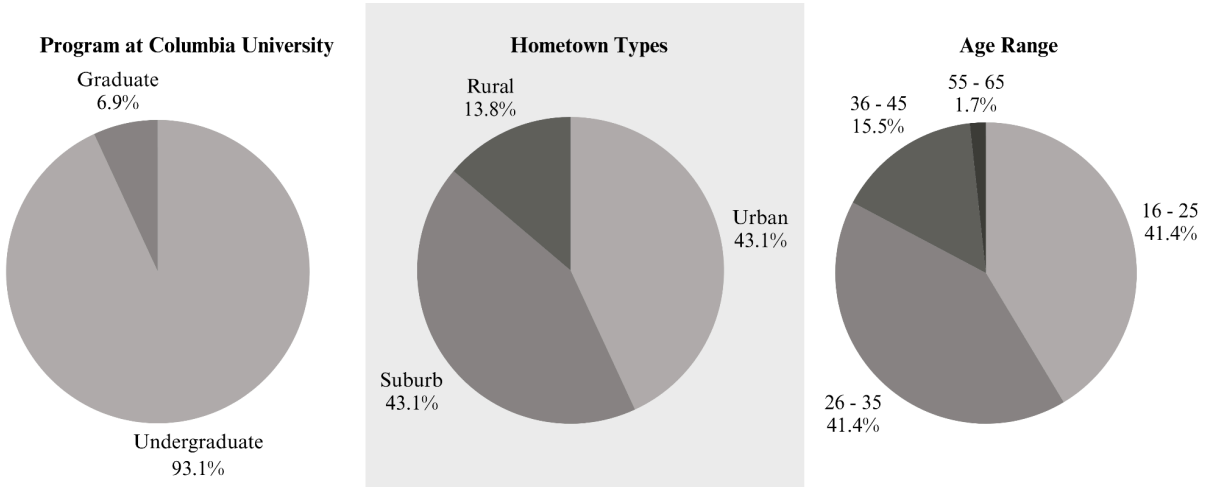
The questionnaire began with a section requesting Free Prior Informed Consent (FPIC) and included questions about participants' degree program at Columbia University, hometown type

(urban, suburban, or rural), and age group, provided as categorical choices to justify the representation of sample responses. Other demographic information was not collected.

Beyond the FPIC and demographic questions, the questionnaire had 16 items designed to understand students' perceptions of reusable water bottles and tap water. The questions included checklist items, rating scales, knowledge checks, and multiple open-ended questions to allow participants to provide more detailed and natural responses, enhancing data saturation. The open-ended questions encouraged longer responses to capture original thoughts and insights. The questionnaire was conducted from November 11th to 20th, 2021.

Figure 1

The Demographic Information of Samples



Note. All data is self-reported information, and they are collected as categorical options.

A total of 58 students responded to the questionnaire (see Fig 1). Of these, 54 respondents identified themselves as undergraduates (93.1%), and the remaining 4 identified themselves as graduate students (6.9%). The age distribution was as follows: 24 respondents were between 16 and 25 years old (41.4%), another 24 respondents were between 26 and 35 years old (41.4%), 9 respondents were between 36 and 45 years old (15.5%), and one respondent was between 56 and 65 years old (1.7%). The hometown types of respondents were well distributed among urban (43.1%), suburban (43.1%), and rural areas (13.8%). There is no available data on the hometown types of students at Columbia University for direct comparison.

The sample included a higher proportion of undergraduate students compared to the actual demographic distribution of Columbia University's Morningside Campus, where the graduate student population is about twice as large as the undergraduate population (Columbia University, n.d.). Therefore, the degree types of the sample do not accurately represent the actual population. Additionally, the use of convenience sampling may have introduced sampling bias, limiting the generalizability of the findings.

Despite these limitations, the purpose of this research is to focus on relatively young and highly educated individuals. Thus, having more undergraduate students in the sample aligns with the study's objectives. Furthermore, the age distribution of the samples is generally consistent with the actual student population (College Factual), although the sample includes slightly more students over

the age of 35. In this regard, the sample data is considered valid for the aims of this research.

II. Participant Observation

To complement the questionnaire data and gain a deeper understanding of students' behaviors with reusable water bottles, participant observation was conducted. This observational study took place covertly in Butler Library and Watson Library at Columbia University on November 30th, from 9:40 AM to 1:00 PM. The researcher assumed a non-participant role, observing students without interacting with them to avoid influencing their natural behaviors.

The observation was entirely opportunistic, focusing on randomly encountered individuals who were unaware of being observed. This approach ensured that the participants' behaviors were authentic and not affected by the researcher's presence. The primary focus was on how students used reusable water bottles in public spaces, including:

- Usage Patterns: Noting the frequency of reusable water bottle usage among students in the libraries.
- Methods of Use: Observing how students accessed water (e.g., using water fountains and filling stations) and how they interacted with their bottles.
- Design Features: Paying attention to the design of the water bottles, such as material (stainless steel, plastic, glass), size, color, presence of stickers or logos, and any ergonomic features that might affect portability and convenience.

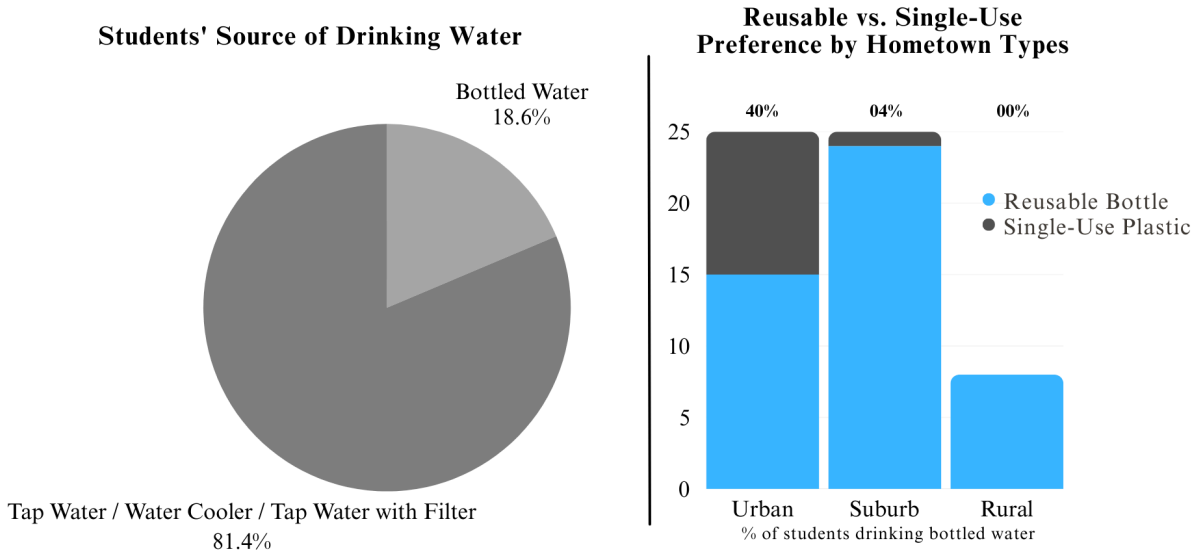
The data collected from this participant observation provided qualitative insights that enriched the quantitative findings from the questionnaires. By directly observing students in their natural environment, the study aimed to identify behaviors and contextual factors—such as convenience, social influences, and environmental awareness—that might not be fully captured through self-reported data alone. This method helped validate the questionnaire results and offered a more comprehensive understanding of the motivators and barriers influencing reusable water bottle usage among students.

Findings

According to the self-reported questionnaire, 47 out of 58 students (81.0%) reported drinking tap water, with or without a filter, whereas 11 students (19.0%) reported drinking bottled water (see Fig. 2). Analysis of the data showed similar preferences between undergraduate and graduate students regarding tap water consumption, indicating consistent behaviors across degree programs, although the sample size is too small to make a conclusion. However, notable variations emerged when examining the students' hometown types. Among students from urban settings (n = 25), 10 students (40.0%) reported drinking bottled water. In contrast, only 1 student (4.0%) from suburban areas (n = 25) reported drinking bottled water, and all respondents from rural areas (n = 8) reported drinking tap water with reusable water bottles (see Fig. 2). Moreover, the majority of students who preferred bottled water (10 out of 11 students, or 90.9%) were from urban backgrounds, suggesting that students' hometown environments may influence their water consumption preferences.

Figure 2

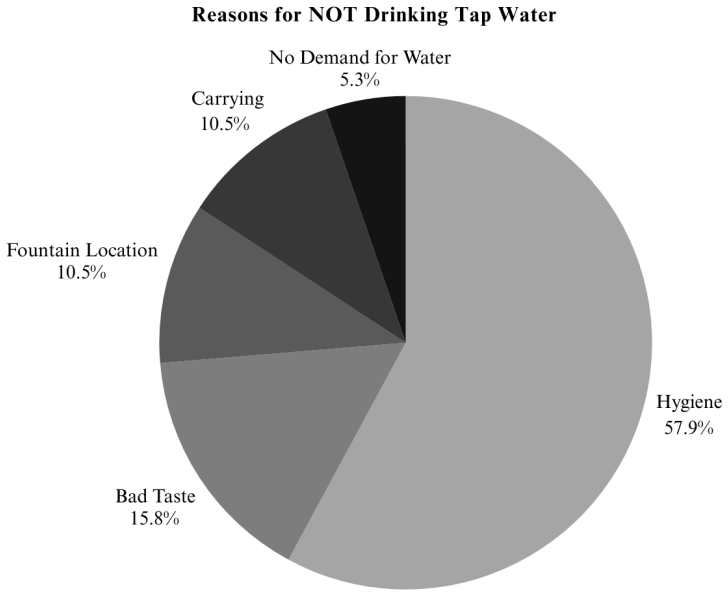
Sources of Drinking Water Preference and the Preference by Hometown Types



Note. Tap water, water cooler, and tap water with a filter were given as separate options.

Figure 3

Reasons for Not Drinking Tap Water



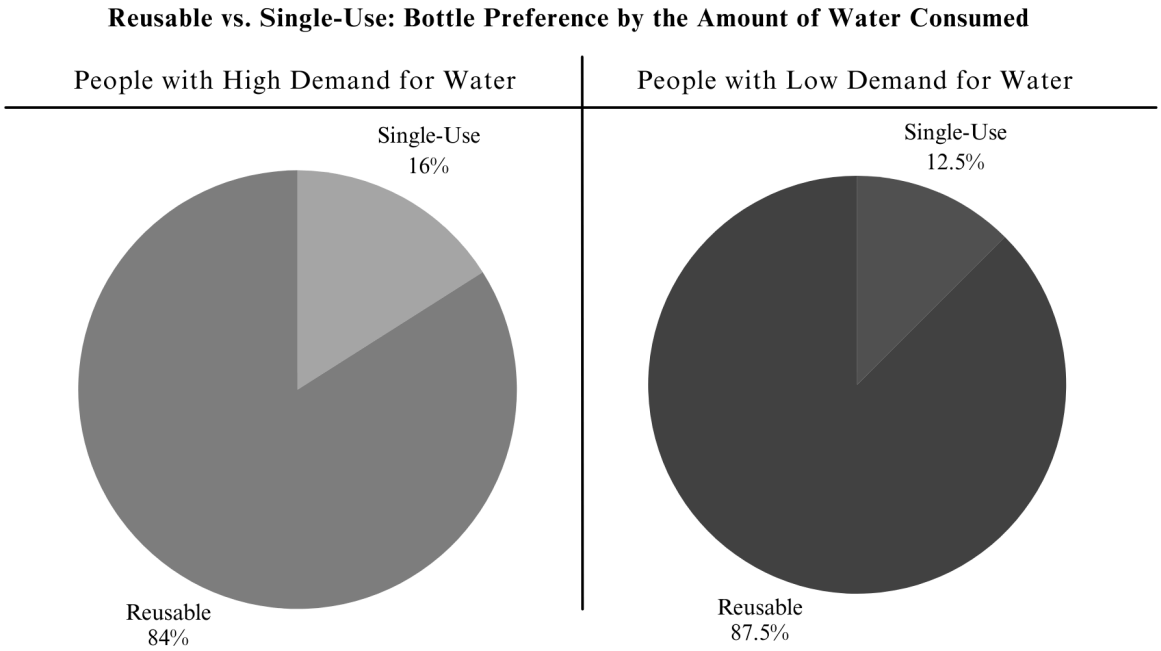
Note. Since many students drink tap water, the sample size is 19 respondents.

Both the students who prefer bottled water (n=11) and a small fraction of those who drink tap water provided reasons for their reluctance to consume tap water (see Fig. 3). Analysis of their responses revealed that the primary reason for not drinking tap water was "hygiene," encompassing

concerns about water quality and health. This reason was cited by the majority of these respondents. The second most frequently mentioned reason was "bad taste," which is also related to perceptions of water quality. Due to the small sample size of this subgroup, other reasons were not statistically significant. These findings indicate that concerns about water quality are the main hindrance to tap water consumption among the participants.

Figure 4

Drinking Water Preference by the Degrees of Water



Note. The groups are divided based on the levels of self-reported water consumption: High Demand (=>7), and Low Demand (=< 4).

Regarding the reasons for using a reusable water bottle, the most common response among students was to drink more water (hydration), cited by 79.3% of respondents. This was followed by environmental concerns (60.3%) and the design of water bottles (22.4%). Through thematic coding of the open-ended responses, "design" was found to include factors such as the volume, brand, weight, insulation capability, and durability of the water bottles. For students not using a reusable water bottle, the primary reason was inconvenience (55.2%). Other reasons included having lost a reusable water bottle in the past (24.1%) and forgetting to bring it (6.8%).

Although hydration was the most popular reason for using a reusable water bottle, the data did not show a significant difference in water bottle preference between students with high water consumption needs and those with lower needs (see Fig. 4). Due to the exploratory nature of the study and the sample size, formal statistical analyses were not conducted to assess this difference.

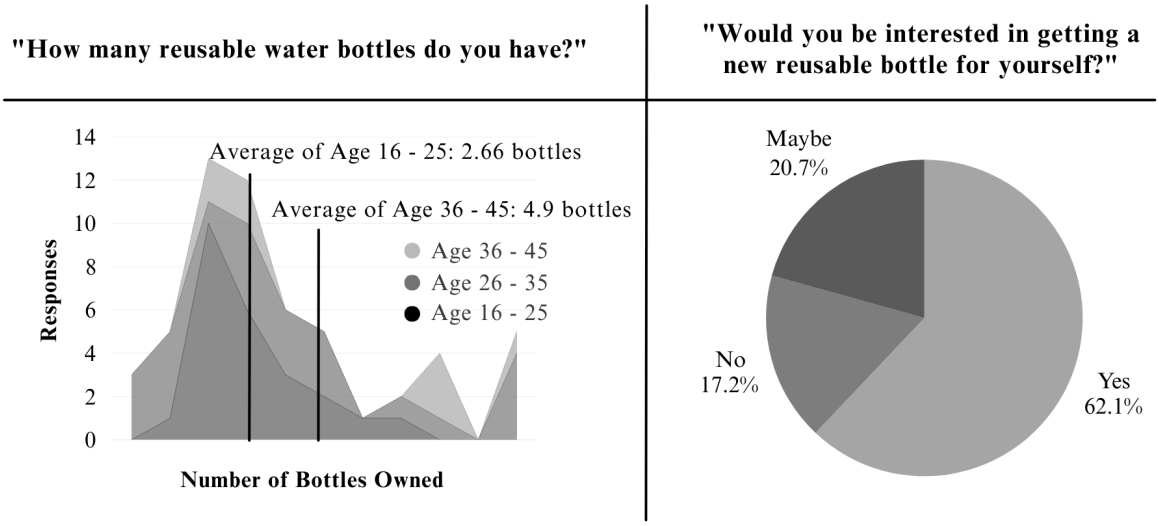
The questionnaire also inquired about the number of reusable water bottles owned by respondents. On average, students reported owning 3.08 reusable bottles. Breaking it down by age groups, students aged 16 to 25 owned an average of 2.66 bottles, while those aged 36 to 45 owned an average of 4.9 bottles (see Fig. 5). This difference suggests that individuals tend to accumulate

more reusable water bottles as they age. Despite most students owning more than one reusable bottle, the majority indicated they would accept a new water bottle if offered for free.

Additionally, the questionnaire asked participants how many times a stainless steel reusable water bottle must be reused to be environmentally more beneficial than using single-use plastic water bottles (see Fig. 6). Over half of the respondents (58.9%) predicted it would require fewer than 10 uses, and approximately 20% estimated the number to be between 20 and 50 uses. A small fraction of participants believed it would take more than 500 uses.

Figure 5

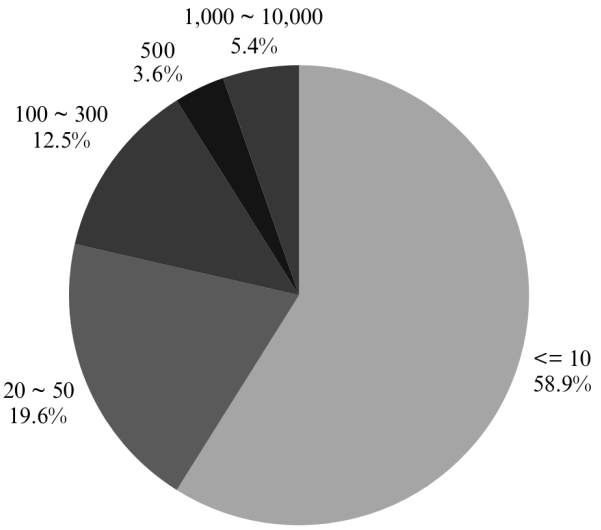
The Number of Reusable Water Bottles Owned by Students and the Willingness to Get More Reusable Water Bottles



Note. The question on the right side of the figure was framed with the condition that there is a "free" distribution station on campus

Figure 6

Assumptions on the Environmental Impact of Reusable Water Bottles (Equivalent to Disposable Bottles)



Note. The unit is the number of single-use plastic bottles.

The responses to the open-ended questions were thematically coded. Four main themes were identified: economic, environmental, pessimistic, and design. Under the economic theme, students considered reusable water bottles as either "too expensive" or "a good investment." For the environmental theme, "waste" emerged as the major sub-theme, reflecting concerns about plastic waste and its impact on the environment. Under the pessimistic theme, respondents often claimed that the leading cause of climate change is pollution by "corporations," suggesting that individuals have little to no responsibility for climate change. The design theme encompassed factors such as aesthetics, branding, and personalization that influence the appeal of reusable water bottles.

Some respondents mentioned that they use disposable cups and single-use plastic bottles for other beverages (e.g., juice or carbonated drinks) and then refill them with tap water for the rest of the day. This behavior was corroborated through participant observation; in the afternoons, many students were observed bringing their non-water beverage containers to water fountains and filling them with tap water. Regarding the design theme, it was observed that more than half of the students using reusable water bottles had bottles featuring brand logos, such as Columbia University SIPA, Columbia University G.S., YouTube, Bain & Company, and Google. A small fraction of students had water bottles adorned with multiple decorative stickers. These observations support the idea that non-functional factors, such as branding and personalization, contribute to the appeal and usage of reusable bottles.

Discussion

Compared to studies conducted at other universities (Saylor et al., 2011; Ward et al., 2009; Graydon et al., 2019; Chudwick, 2013), Columbia University showed a higher percentage of tap water consumption among students. This may be attributed to the large number of water stations on campus (Uehara & Ynacay-Nye, 2018; Willis et al., 2019), the free distribution of reusable water bottles by the university, and active promotional campaigns by both New York City and Columbia University emphasizing the cleanliness of tap water and its environmental benefits. Additionally, the

progressive attitudes of students at Columbia University, coupled with exposure to climate-related information and sustainability issues, may contribute to a preference for environmentally friendly options such as drinking tap water.

For those who do not drink tap water, concerns about water quality are the primary issue, as many studies have found. However, focusing solely on the hindrances to tap water consumption may not be sufficient, because the use of reusable water bottles often influences consumer preferences. The consumption of tap water and the use of reusable bottles are interconnected, as the bottle serves as the means of consuming tap water.

Although this research was exploratory and did not test specific hypotheses regarding reusable bottle usage, it was initially assumed that environmental concerns would be the primary reason for using reusable water bottles. Contrary to this assumption, the primary motivator identified was "to drink more water." While "environmental concerns" was the second most popular response, included by more than half of the respondents, this suggests that personal health and hydration are more immediate motivators. Participants tended to hold strong opinions against the use of plastic materials and were concerned about plastic waste, as identified through thematic coding. Interestingly, there was little mention of the production of plastic bottles and associated CO_2 emissions; instead, concerns focused on waste management and the negative impact on oceans, specifically harm to "turtles." This indicates that specific environmental narratives may influence behavior more than general environmental concerns.

To further understand the environmental aspect of using reusable water bottles, the questionnaire assessed participants' knowledge of the environmental impact of reusable bottles compared to bottled water. Measuring the environmental effects in absolute terms is challenging due to variables such as the weight and size of bottles, transportation distances, and washing frequency of reusable bottles (Dettore, 2009). Technological advancements have also reduced the plastic content in single-use bottles; for example, the average weight of 500 ml polyethylene terephthalate (PET) bottles has decreased by 48% (as cited in Graydon et al., 2019).

Previous studies have indicated that producing an aluminum reusable bottle results in carbon emissions equivalent to those from producing 50 disposable plastic bottles (Goleman & Norris, 2009). More recent research suggests that CO_2 emissions from producing one aluminum water bottle are equivalent to about 88 single-use plastic bottles and that in terms of eutrophication—a process where excess nutrients lead to algal blooms and oxygen depletion in water bodies—an aluminum bottle must be reused more than 483 times to offset its impact compared to single-use plastic bottles (Tamburini et al., 2021).

In this context, participants' assumptions about the environmental impact of reusable water bottles were found to be lower than reality. Students tended to overestimate the positive environmental impact of using reusable bottles and the pollution caused by disposable bottles. This knowledge gap may lead to behaviors that are counterproductive to environmental goals, such as owning multiple reusable bottles and being willing to acquire more when offered for free, which contradicts their environmental intentions.

While providing accurate environmental information can encourage sustainable consumption, emphasizing the need to reuse a bottle more than 88 to 500 times to offset its environmental impact may discourage use due to the perceived difficulty in achieving such numbers.

Therefore, further research is needed to find effective ways to educate consumers about the importance of consistently using the same reusable bottle without causing discouragement.

In practice, reusing a bottle more than 88 or even 500 times can be achieved within a few months by refilling it several times a day, and Columbia University's numerous water refilling stations facilitate this behavior. However, inconvenience remains a major hindrance to using reusable bottles. Through thematic coding, "inconvenience" was identified with issues such as carrying the bottle due to its weight, cleaning the bottle, and locating refilling stations. Additionally, reasons such as "forgetting to bring [a reusable bottle]" and "having lost [a reusable bottle]" align with the theme of inconvenience. Some participants intentionally avoided bringing their reusable bottles when they had evening plans to prevent losing them, as they had in the past.

Considering both the environmental impact and the inconvenience associated with reusable water bottles, policies and campaigns may need to shift focus. Instead of solely promoting the use of reusable bottles, efforts should encourage individuals to consistently use the bottles they already own for extended periods. While distributing reusable bottles can reduce the consumption of bottled water and plastic waste (Santos et al., 2016), it may inadvertently increase other environmental impacts, such as CO_2 emissions, eutrophication, photochemical oxidation (the formation of reactive compounds in the atmosphere due to sunlight), acidification, fossil fuel depletion, water depletion, human toxicity, and ecotoxicity (Tamburini et al., 2021).

A strong relationship was also observed between students' hometown environments—urban, suburban, and rural—and their preferred water source, whether tap water with a reusable bottle or bottled water. Although this relationship was apparent, the research could not further investigate this variable within the scope of the study. This hometown variable could be associated with factors such as exposure to nature, access to markets, perceived cleanliness of tap water, and parental preferences regarding water sources. It is worth exploring these aspects in more depth in future research.

Limitations

This study has several limitations that should be acknowledged. Firstly, a significant portion of the research relies on self-reported data collected through questionnaires. Although the survey was entirely anonymous and conducted online—which can reduce social desirability bias—there remains the possibility that respondents may have overreported pro-environmental behaviors or provided answers they perceived as socially desirable rather than reflecting their actual practices. This potential bias could affect the validity of the findings related to tap water consumption and reusable water bottle usage.

Secondly, the research was conducted in November, a period when water demand often decreases due to cooler temperatures. Seasonal variations in water consumption behaviors may have influenced the results, as individuals might be less inclined to carry reusable water bottles during colder months and might opt for bottled water if needed. Although the study did not find a significant relationship between water source preference and water demand, seasonality could still be a confounding variable that was not fully accounted for in this case study.

Furthermore, this study was conducted within a specific and unique setting—a population of young, highly educated students at Columbia University's Morningside Campus, characterized by high socio-economic status and politically progressive attitudes. These factors may limit the

generalizability of the findings to other populations with different demographic and socio-economic characteristics. The use of convenience sampling and the overrepresentation of undergraduate students compared to graduate students may also affect the external validity of the study.

Given these limitations, this research serves as a pilot study and provides exploratory insights into the factors influencing tap water consumption and reusable water bottle usage among university students. Future research should include a more diverse and representative sample, consider longitudinal designs to account for seasonal variations, and employ methods that mitigate self-reporting biases. Such efforts would enhance the external validity of the findings and contribute to a more comprehensive understanding of pro-environmental behaviors in different contexts.

References

Bartolotta, J. F., & Hardy, S. D. (2018). Barriers and benefits to desired behaviors for single use plastic items in northeast Ohio's Lake Erie Basin. *Marine Pollution Bulletin*, *127*, 576–585. https://doi.org/10.1016/j.marpolbul.2017.12.037

Chang, C. (2010). A study on the social and the environmental impacts of bottled water & A design solution to improve the user experience of reusable water bottles. *ProQuest Dissertations & Theses Global*. Retrieved from http://ezproxy.cul.columbia.edu/login?url=https://www.proquest.com/dissertations-theses/study-on-social-environmental-impacts-bottled/docview/1707335938/se-2?accountid=10226.

Chudwick, E., Salvemini,, M., & Welker, A. (2013). Implementing water refill stations ... - villanova university. Villanova University. Retrieved December 1, 2021, from https://www1.villanova.edu/content/dam/villanova/sustainability/Student%20Research/HydrationStation2013.pdf.

CollegeFactual.com. (n.d.). *Columbia University in the City of New York Student age diversity*. Columbia University in the City of New York Student Age Diversity - College Factual. Retrieved December 8, 2021, from https://www.collegefactual.com/colleges/columbia-university-in-the-city-of-new-york/student-life/diversity/chart-age-diversity.html.

Columbia University. (n.d.). *Statistics and facts*. Statistics and Facts | Columbia University in the City of New York. Retrieved December 8, 2021, from https://www.columbia.edu/content/statistics-and-facts.

Debbeler, L. J., Gamp, M., Blumenschein, M., Keim, D., & Renner, B. (2018, July 4). Polarized but illusory beliefs about tap and bottled water: A product- and consumer-oriented survey and Blind Tasting Experiment. *Science of The Total Environment*. Retrieved December 8, 2021, from https://www.sciencedirect.com/science/article/pii/S0048969718322666?via%3Dihub.

Dettore, C. (2009, December 1). Comparative life-cycle assessment of bottled versus TAP Water Systems. *Deep Blue Repositories*. Retrieved December 8, 2021, from https://deepblue.lib.umich.edu/handle/2027.42/64482.

Doria, M. F. (2006). Bottled water versus tap water: understanding consumers' preferences. *Journal of Water and Health*, *4*(2). Retrieved December 8, 2021, from https://www.proquest.com/docview/1943085848?pq-origsite=summon.

Doria, M. F. (2009). Factors influencing public perception of drinking water quality. *Water Policy*, *12*(1), 1–19. https://doi.org/10.2166/wp.2009.051

Espinosa-García, A. C., Díaz-Ávalos, C., González-Villarreal, F. J., Val-Segura, R., Malvaez-Orozco, V., & Mazari-Hiriart, M. (2015). Drinking water quality in a Mexico City University community: Perception and preferences. *EcoHealth*, *12*(1), 88–97. https://doi.org/10.1007/s10393-014-0978-z

Etale, A., Jobin, M., & Siegrist, M. (2018). Tap versus bottled water consumption: The influence of social norms, affect and image on consumer choice. *Appetite*, *121*, 138–146. https://doi.org/10.1016/j.appet.2017.11.090

Fedi, A., La Barbera, F., De Jong, A., & Rollero, C. (2021). Intention to adopt pro-environmental behaviors among university students of hard and Soft Sciences: The case of drinking by reusable bottles. *International Journal of Sustainability in Higher Education*, *ahead-of-print*(ahead-of-print). https://doi.org/10.1108/ijshe-08-2020-0320

Garfí, M., Cadena, E., Sanchez-Ramos, D., & Ferrera, I. (2016). Life cycle assessment of drinking water: Comparing conventional water treatment, reverse osmosis and mineral water in glass and plastic bottles. *Journal of Cleaner Production*.

https://doi.org/https://doi.org/10.1016/j.jclepro.2016.07.218
Gleick, P. H. (2010). *Bottled and sold: The story behind our obsession with bottled water*. Island Press.
Goleman, D., & Norris, G. (2009). *How Green Is My Bottle?* The New York Times. Retrieved from https://archive.nytimes.com/www.nytimes.com/interactive/2009/04/19/opinion/20090419bottle.html?scp=1&sq=earthster&st=cse.
Goucher-Lambert, K., & Cagan, J. (2015). The impact of sustainability on consumer preference judgments of product attributes. *Journal of Mechanical Design*, *137*(8). https://doi.org/10.1115/1.4030271
Graydon, R. C., Gonzalez, P. A., Laureano-Rosario, A. E., & Pradieu, G. R. (2019). Bottled water versus tap water. *International Journal of Sustainability in Higher Education*, *20*(4), 654–674. https://doi.org/10.1108/ijshe-01-2019-0003
Kang, J., Grable, K., Hustvedt, G., & Ahn, M. (2017). Sustainable water consumption: The perspective of Hispanic consumers. *Journal of Environmental Psychology*, *50*, 94–103. https://doi.org/10.1016/j.jenvp.2017.02.005
Levêque, J. G., & Burns, R. C. (2018). Drinking water in West Virginia (USA): Tap water or bottled water – what is the right choice for college students? *Journal of Water and Health*, *16*(5), 827–838. https://doi.org/10.2166/wh.2018.129
Makov, T., Meylan, G., Powell, J. T., & Shepon, A. (2016, November 25). Better than bottled water?-energy and climate change impacts of on-the-go drinking water stations. *Resources, Conservation and Recycling*. Retrieved December 1, 2021, from https://www.sciencedirect.com/science/article/pii/S0921344916303263?via%3Dihub.
Mukherji, J., & Mukherji, A. (2020). Making sustainable consumption choices: A planned behavior approach. *Competition Forum*, *18*(1), 111–119. Retrieved from http://ezproxy.cul.columbia.edu/login?url=https://www.proquest.com/scholarly-journals/making-sustainable-consumption-choices-planned/docview/2516295438/se-2?accountid=10226.
Nessi, S., Rigamonti, L., & Grosso, M. (2012). LCA of Waste Prevention Activities: A case study for drinking water in Italy. *Journal of Environmental Management*, *108*, 73–83. https://doi.org/10.1016/j.jenvman.2012.04.025
NYC Environmental Protection, History of New York City Drinking Water (n.d.). Retrieved November 17, 2021, from https://www1.nyc.gov/site/dep/water/history-of-new-york-citys-drinking-water.page.
NYC Environmental Protection, The 2020 Drinking Water Supply & Quality Report (2020). Retrieved November 17, 2021, from https://www1.nyc.gov/assets/dep/downloads/pdf/water/drinking-water/drinking-water-supply-quality-report/2020-drinking-water-supply-quality-report.pdf.
O'Donnell, C., & Rice, R. E. (2012). A communication approach to campus bottled water campaigns. *Social Marketing Quarterly*, *18*(4), 255–273. https://doi.org/10.1177/1524500412466075
Saylor, A., Prokopy, L. S., & Amberg, S. (2011). What's wrong with the tap? examining perceptions of tap water and bottled water at Purdue University. *Environmental Management*, *48*(3), 588–601. https://doi.org/10.1007/s00267-011-9692-6
Tamburini, E., Costa, S., Summa, D., Battistella, L., Fano, E. A., & Castaldelli, G. (2021). Plastic (PET) vs Bioplastic (PLA) or refillable aluminium bottles – what is the most sustainable choice for drinking water? A life-cycle (LCA) analysis. *Environmental Research*, *196*, 110974. https://doi.org/10.1016/j.envres.2021.110974
Uehara, T., & Ynacay-Nye, A. (2018). How water bottle refill stations contribute to campus sustainability: A case study in Japan. *Sustainability*, *10*(9), 3074.

https://doi.org/10.3390/su10093074
Van der Linden, S. (2013). Exploring beliefs about bottled water and intentions to reduce consumption. *Environment and Behavior*, *47*(5), 526–550. https://doi.org/10.1177/0013916513515239
Ward, L. A., Cain, O. L., Mullally, R. A., Holliday, K. S., Wernham, A. G. H., Baillie, P. D., & Greenfield, S. M. (2009). Health beliefs about bottled water: A qualitative study. *BMC Public Health*, *9*(1). https://doi.org/10.1186/1471-2458-9-196
Willis, K., Wilcox, C., Vince, J., & Hardesty, B. D. (2019). The success of water refill stations reducing single-use plastic bottle litter. *Sustainability*, *11*(19), 5232. https://doi.org/10.3390/su11195232