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The Success of Bottled Water: The Hidden Costs Hurt Us and the Environment

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Abstract

Bottled water is consumed worldwide as both a matter of necessity and preference. People who need bottled water live in areas with compromised water sanitation, such as developing countries. People who prefer bottled water despite its higher price tag tend to live in areas that already have ready access to clean water, such as developing countries. These preferences for bottled water stem partly from taste and convenience, but are largely driven by advertising efforts by bottled water companies. The preference for bottled water leads to increased sales as well as increased cost. Costs include damages to health and the environment. Since these effects are not taken into account by bottled water companies and must be borne by others, they are considered external costs. Lack of information outside of biased advertising influences consumers to act differently than if they had full knowledge of the indirect consequences from their purchases. Educational efforts can balance out the information asymmetry between bottled water companies and consumers. This can take the form of a blind taste test, which demonstrates how little taste actually influences water decisions. A practice taste test corroborated studies which state that consumers cannot accurately identify water based on taste. Framing this activity in the context of the personal cost of bottled and tap compared to their similar benefit will help shift consumer perspectives and behaviors, especially in children, before preferences are formed.

Keywords: bottled water, tap water, taste, consumer preferences, education, environment

Introduction

In the Western world, we are used to having clean water available to us straight out of the tap in our homes and offices. In regions lacking safe water, such as developing countries or regions where temporary contamination occurs, purchasing water or water filtration devices is necessary. In these regions, bottled water provides significant access to clean water and improves public health. Yet, the bottled water industry sells a large portion of its product to people in developed countries who already have access to clean water. In fact, people consume more bottled water in the U.S. than anywhere else in the world, at a rate of 8-9 billion gallons per year (Saylor et al., 2011). When the costs of bottling water are compared to the benefit this method of clean water provides, bottled water sales are higher than the efficient level. The costs go beyond the price of transportation and materials to include environmental damages from plastic litter, greenhouse gas emissions, and watershed depletion, and health risks. These costs form an externality, as they are not considered when bottled water companies weigh revenues and costs, making them external to the bottled water market. The external costs go ignored largely because consumers lack information about them. To reduce the amount of bottled water consumed to a sustainable level, educational efforts must make consumers aware of the external costs. Presenting children with educational water activities helps them form water preferences based on these costs and their own values so they can make informed decisions about water as adults.

People obtain drinking water through several access points. Surface water supply includes all sources above ground, like rivers and lakes (IMNH, n.d.). Groundwater includes all sources below ground, like aquifers (IMNH, n.d.). Spring water includes

sources that originate below ground and naturally rise to the surface (IMNH, n.d.). Municipal sources typically extract groundwater and pump it through the city for public use (IMNH, n.d., Gleick, 2010). Bottled water companies take advantage of a mixture of sources, including springs and wells (Gleick, 2010). Sometimes they simply take water from the tap, which a municipality has already pumped (Gleick, 2010). Dasani (Coca-Cola), Aquafina (PepsiCo), Nestle, and Smart Water all sell packaged tap water under the guise of "purified water" (Rega, 2016, Gleick, 2010). The label “purified water” describes tap water that has gone through a filtration process before bottling, and sounds more appealing to people who think tap water is bad (Gleick, 2010).

Bottled water removes water from local watersheds for export elsewhere. Any time water is extracted, it no longer contributes to the local ecosystem. In a municipality, water that the public uses typically undergoes treatment, and then the city returns it to a local body of water. The return of the treated water to the watershed counteracts the effects of its initial removal. With bottled water, however, companies ship the water across the country and the globe, with the local watershed experiencing a net loss in water content. The International Bottled Water Association (IBWA) states that bottled water uses "less than .004%" of the water supply in the US. A paper funded by the Drinking Water Research Foundation reported groundwater withdrawals for bottling commands .019% of the US water supply (Gleick, 2010). While these numbers are comparatively small and may represent an efficient amount when considering total water use, they do not take into account that extraction is localized around particular sources. Extraction sites are not spread evenly across the US, with several companies

concentrating in California and the northeast, so the impacts are also not felt equally (Gleick, 2010, Rega, 2016).

Significant water extraction from a region damages the ecosystem that relies on its watershed. In 2004, bottling company USA Springs wanted to extract up to 300,000 gallons per day from a watershed that supports the cities of Barrington, Nottingham, and several others in New Hampshire (Gleick, 2010). Local officials of Barrington required USA Springs to conduct a ten-day test on the spring from which they wanted to draw water (Glieck 2010). During test, sections of a local wetland critical to the area dried up, indicating that 300,000 gallons per day was unsustainable and clearly detrimental to the ecosystem and the cities' water supply (Gleick, 2010). A similar case in Arizona involved the Sedona Springs Bottled Water Company (Gleick, 2010). In this case, extraction diminished surface water so significantly in Seven Springs Wash and Spur Cross Ranch Conservation Area that the ecosystem saw deaths of native fish, leopard frogs, Mexican black hawks, sycamore and ash trees, and deer grass. Precipitation can replenish surface sources relatively quickly, but aquifers can take years or decades to recover (CWSC, 2017). Even though bottling can harm local ecosystems, consumers do not think about them as effects of purchasing bottled water. Saylor et al. (2011) noted that most of their survey respondents did not consider environmental impacts when choosing between bottled and tap water, indicating that consumers also leave environmental considerations external to their decision of how much bottled water to buy.

Areas experiencing drought already have watershed stress, yet several large bottled water companies source their water from such areas. Arrowhead, Crystal Geyser, Aquafina (PepsiCo), Nestle, and Dasani (CocaCola) all have operations in California

(Rega, 2016, Gleick, 2010), a state that experienced a long-term drought between 2011 and 2017 (CWSC, 2017). The California Water Science Center (2017) explains that while recent precipitation and snowpack levels have officially ended the drought emergency, groundwater was depleted by over-reliance during the drought and lack of replenishment. Continuing to bottle water in regions such as California exacerbates the water shortage for use by the California public.

Other environmental damages occur as a result of the use of fossil fuels at various stages of the bottling process. Gleick (2010) notes that one of his studies found that global production and use of bottled water required 100-160 million barrels of oil in 2007. Oil is a non-renewable resource, which makes its use unsustainable. Bottled water containers are made of plastic, a product of oil, because of its malleability and durability (Gleick, 2010). However, most bottles are not created at the bottling plant which fills them (Gleick, 2010). Bottled water companies instead purchase ready-made bottles from plastic companies and have them shipped to their plants, consuming significant portions of fossil fuels and emitting air pollution in the transport process (Gleick, 2010). Fossil fuels also provide energy for the machines that shape bottles and filter water (Gleick, 2010).

People often think recycling eliminates environmental impacts, but there are several problems with the relevancy of recycling. Consumers trying to be responsible explain that they recycle bottles after use, which assuages their guilt about potential environmental damages without changing their purchase behavior (Saylor et al., 2011, Gleick, 2010). But this does not cancel out all of the energy requirements that go into making the bottle and melting it down for recycling into new bottles. Recycling entails

additional energy costs when materials are processed internationally, as was 40% of recycled PET in 2004 (Saylor et al., 2011). Bottling companies also tout that their bottles are 100% recyclable (Gleick, 2010). However, just because a bottle *can* be recycled does not mean consumers *do* recycle significantly. In 2007, over 5.6 billion pounds of PET plastic was available for recycling; only 1.4 billion pounds were recycled (Gleick, 2010). That's less than a 25% recycling rate, with other estimates suggesting an even lower rate of 20% (Saylor et al., 2011). Bottled water companies have no obligation to pay for recycling of the bottles, or for mitigation of environmental damage when bottles end up in landfills (Parag & Roberts, 2009). Even if consumers recycled, companies do not source their substantial amounts of plastic from recycling plants. PepsiCo and Coca Cola, two major companies, routinely use less than 10% recycled plastic in their products (Gleick, 2010). Talking about the merits of recycling is useless if companies continue to use materials from non-renewable resources. Recycling reduces the amount of plastic litter, but adds to the usage of fossil fuels. The capacity recycling does have to make plastic water bottles more sustainable is severely under-utilized.

Plastic container aside, the contents of water bottles raise health concerns. Water quality is generally subject to the standards outlined in the Clean Water Act of 1972 and the Safe Drinking Water Act of 1974 (Gleick, 2010). Bottled water and tap water should exhibit equally safe levels of contaminants (Gleick, 2010). "Drinking water" as covered and regulated by federal agencies such as the EPA does not include bottled water (Gleick, 2010). Bottled water instead falls under the jurisdiction of the FDA, as it is defined as a food product (Gleick, 2010). This explains the unhelpful "nutrition label" on water bottles, which display 0% for carbs, fiber, fats, and everything else one expects to find in

actual food (Gleick, 2010). Since the FDA regulations only apply to "interstate commerce," 60 to 70% of bottled water falls outside of regulation simply because it never crosses state lines (Gleick, 2010). This leaves consumers uninformed about the actual contents of what they are drinking.

The specific standards for each regulatory agency do not always overlap or inspire confidence. The EPA has stricter guidelines for organismal levels than the FDA (Gleick, 2010). According to 2008 guidelines, municipalities must test their tap water 60 to 420 times per month and provide same-day notice to citizens if any coliforms are found (Gleick, 2010). If coliforms are found, municipalities must test for the presence of a particularly dangerous coliform: E. coli. The FDA only requires weekly tests for coliforms, and permits a small amount of coliforms to remain in water regardless of type (Gleick, 2010). In addition to the possibility of the presence of E. coli in our bottled water, the FDA does not require bottled water companies to notify the public or recall bottles with low but potentially dangerous levels of contamination (Gleick, 2010). When recalls do occur, it is months after the contaminated bottles have been disseminated to the market, and long since bought and consumed (Gleick, 2010). On the other hand, the FDA limits lead content to 5 parts per billion, much below the EPA's limit of 15 parts per billion (Gleick, 2010). Whenever the EPA has an update to drinking water standards, which already occurs infrequently, the FDA has 6 months to update their own regulations or prove that the update is non-applicable to bottled water (Gleick, 2010). "Nonapplicable" seems to mean that the FDA does not believe the contaminant to be present in bottled water, and therefore should not have to test for it at all (Gleick, 2010).

This flawed logic leaves consumers at risk of illness at the whim of bottled water companies, who have the power to test water quality more frequently than required.

Bottled water companies get away with these externalities because they lack incentives to pay for the costs of mitigation. The negative impacts to health and the environment do not directly affect bottled water companies, so they would have to voluntarily consider them. Companies are not interested in incurring extra costs since costs reduce overall profit. Partly this is due to poor or nonexistent regulatory standards such as those regarding health and watershed impacts. Companies have power and incentive to keep regulations weak, as lack of proper regulation means no one can force extra costs onto the companies. They can prevent regulations from passing by lobbying against proposed measures, as they did multiple times against bottle-deposit bills that consumers and city organizations supported (Gleick, 2010). Enforcement of existing regulations is weak as well. The FDA performs few inspections of bottled water, even though 35% of inspections performed between 2000 and 2008 revealed problems (Gleick, 2010). Thus, bottled water companies can and do choose to sell their water without paying for quality tests, environmental impact tests, or responsible bottle disposal, in order to maximize profit at the expense of consumer health and the environment.

A key factor in this market failure is information asymmetry. Information asymmetry refers to an information imbalance: one side of the market, supply or demand, knows more than the other. Consumers could express distaste for the environmentally harmful practices of bottled water companies by refusing to buy the product, which would cut into profit margins. The reduced profitability of bottled water would incentivize companies to reduce production overall, or adjust the ethical ramifications of

production to regain their consumer base. Such an adjustment would put the bottled water market back on track to economic equilibrium, with the costs to society and the companies balancing the benefit consumers reap. We do not see this occur because consumers are simply not aware. Some bottled water users admit they do not even know where water comes from or how the treatment process works (Saylor et al., 2011). Lack of basic knowledge about water supply leaves consumers vulnerable to manipulation.

Lack of consumer awareness stems largely from misconceptions about the quality and healthiness of tap compared to bottled water (Hu et al., 2011, Saylor et al., 2011, Gleick, 2010). Since tap water problems must be immediately reported, consumers hear about tainted tap water more often than bottled water (Gleick, 2010). These reports significantly reduce consumer trust in tap water, and contribute to the false assumption that bottled water must be subject to stricter federal regulations (Saylor et al., 2011). Operating under the philosophy of "no news is good news," consumers are more likely to reach for the option they do not hear bad news about, regardless of actual risk (Saylor et al., 2011, Gleick, 2010). In this case, people are 4.8 times more likely to reach for bottled water when they do not trust their tap water (Hu et al., 2011). Saylor et al. (2011) also report that the higher price leads consumers to believe bottled water is of higher quality. This assumption comes from the fact that people expect price to convey the amount of benefit they should receive from a product. Since bottled at tap water are often of equivalent quality in developed countries, the price actually reflects packaging, transportation costs, and the company's profit motive.

Bottled water companies do not attempt to clear up misconceptions, but further contribute to confusing consumers. The confusion occurs because the bottled water

market is a monopolistic competition. In monopolistic competition, producers must differentiate their product, either through content or marketing, to make it seem better than other similar products. This allows the producer to put a higher price on the product and make a positive profit. Since water is a relatively homogenous product, in order to increase sales and profits, each company must make their product *appear* better than all the other options. As Gleick (2010) puts it: "bottled water advertisers don't try to sell water: They sell youth, health, beauty, romance, status, image, and of course, the old standbys, sex and fear." Many of these lifestyle pitches are reflected in the attractive design of the packaging (Doria, 2006), which often bears pictures of glacier-covered mountains regardless of the true source (Gleick, 2010). Fearmongering campaigns center on the dangers of tap, with bottled water the obvious "safe" alternative (Gleick, 2010). Setting possible contamination aside, Doria (2006) notes that bottled water sales tend to follow along with "health food" trends, as if consumers think bottled water is somehow inherently healthier than tap water. For consumers more concerned with image or status, marketers play up the other aspects – youth, beauty, etc. – to distinguish their water from the rest. Marketing is required to convince consumers that one brand or product is better than another so they will buy it, but when marketing contains lies, or refrains from addressing misinformation, consumers lose money.

Despite slamming tap water, bottled water companies claim that the market for bottled water doesn't compete with tap, because the water sources are not substitutes. A substitute, economically speaking, is a good whose consumption rivals that of another good. Drinking bottled water doesn't reduce tap consumption, they say, but reduces consumption of other bottled beverages, like soda and tea (Gleick, 2010). "40% percent

of all water servings are bottled water", the IBWA (2017) boasts in a video on their website, so "bottled water helps people drink more water." Assuming other beverages are the true substitute, we would see people "by switching from soft drinks to bottled water" (IBWA, 2017). Increased bottled water sales would correlate with decreased soft drink sales, and the claim would hold water, so to speak. In reality, many bottled water companies are owned by brands which also produce soft drinks. It's unlikely for Coca Cola to promote Dasani at the expense of Coke, or for PepsiCo to promote Aquafina at the expense of Pepsi, as this would cut into overall sales for the company. While it is true that tap water is used for many purposes bottled water is not, both are in the market when it comes to drinking water (Parag & Roberts, 2009). Regardless of whether companies consider tap and bottled water to be substitutes, consumers do (Hu et al., 2011). This makes sense, as people who choose bottled water over soft drinks may also choose water of any type over soft drinks. A high percentage of bottled water consumption does not mean people consume more water overall, and increased bottled water consumption more likely reduces tap water consumption.

When consumers defend their preference for bottled water over tap water, taste often comes up as a reason (Teillet et al., 2010, Gleick, 2010). We cannot dismiss claims about taste, as people do not actually like the taste of water which has been completely purified (Teillet et al., 2010). Knowledge of the unpleasantness of truly pure water leads bottled water companies to leave or add in minerals to their product (Gleick, 2010). Dasani even formulated a special ratio of minerals to keep taste consistent across their product, which comes from many sources (Gleick, 2010). Tap water gets its taste from whatever minerals are present in the aquifer the water is drawn from, as well as a chlorine

flavor when chemical treatments are used (G. Merriam, personal communication, October 26, 2017). Since many bottled waters are literally bottled tap water, there should be little taste difference between the two. But what about spring or glacier water? Based on several blind taste assessments by the media, it turns out that most people prefer tap water over bottled water (Doria, 2006, Ronnow, 2010). A study in France by Teillet et al. (2010) found that people could discern and group water samples according to taste and whether or not the taste was pleasant. When tap was allowed to dechlorinate, participants often created taste categories which contained both tap and bottled water samples (Teillet et al., 2010). Most of the participants, 63.8%, were unable to properly identify a sample, and seemed to like bottled and tap water equally (Teillet et al., 2010). This suggests that a broad variety of tastes exist within both tap and bottled water samples, so taste is an unreliable characteristic for making decisions about all tap or all bottled waters.

People also choose bottled water for perceived convenience. 71% of Canadian bottled water users cite convenience as an important factor in choosing bottled water (DuPont, 2005). As misleading ad campaigns increase demand for bottled water, supply increases to meet it. This makes bottled water easy to find in stores, and the bottle makes it portable, both important aspects of convenience. With the increase in preference for bottled water, preference for its substitute, tap, decreases, so water fountains fall into disrepair and become harder to find (Gleick, 2010). As fountains become harder to find, bottled water becomes even more convenient, perpetuating the cycle. This causes an inequitable distributional effect, as the cheaper option of equivalent or better quality is less available in public areas, forcing lower-income consumers to purchase their water.

Several methods exist for discouraging uses of bottled water. Requiring damage tests would force bottling companies to prove that their extraction would not negatively impact local ecosystems or water access, or set a limit on how much they can sustainably extract. This would reduce the incidence of bottling plants in sensitive regions. "Bottle bills" include a deposit in the price of bottled water, which the consumer only regains by recycling. This provides incentives for consumers to recycle, but such bills face much opposition from companies (Gleick, 2010). A 2013 program in Missoula, Montana called "Hit the Tap" aimed to increase the convenience of tap water by installing new water fountains and upgrading old fountains in high-trafficked or requested areas (Hit the Tap Missoula, 2013). The program also created a map which indicated the location and inspection status of all public fountains within the city to help citizens find access points (Google Maps, 2017).

Given the rampant misleading advertising for bottled water and consumers' lack of knowledge about where water comes from, educational efforts are most relevant for addressing the negative externalities of bottled water. Explanation of the environmental damages caused by bottled water will help consumers understand the costs of their actions beyond the price on the product. To illuminate the variability and inaccuracy of taste preferences, organizations can conduct blind taste tests. Informational campaigns like Hit the Tap's fountain map can help counteract issues of not knowing where to find free tap water, but additional personal experience with negative impacts may also be necessary to adjust people's behaviors (Takacs-Santa, 2007).

Methods

Given the difficulty that changing regulatory processes entails, along with the market power informed consumers have, education is the most effective way to shift the bottled water market to an efficient equilibrium quantity of sales. Pro-environmental behaviors are linked with education during childhood (Paloniemi & Vainio, 2011, IIED, 2007). Children also learn more easily than adults. Specifically I propose an educational activity aimed at children around 9-11 years old. These will be students in the 4th grade class at Florence-Carlton Elementary, which currently has no water curriculum and lies outside the reach of educational organizations in Missoula, such as the Watershed Education Network and the Missoula Natural History Museum.

The intention of this activity is to make students more aware of differences of value and cost between tap and bottled water. Although tap and bottled water are almost the same in terms of quality, bottled water costs several times more in terms of price and environmental damages. Some taste differences do exist, but it is hard to tell which tastes are associated with bottled or tap waters. Slightly better taste may not be worth the extra personal cost for bottled water. Knowing that choosing bottled water negatively impacts the environment may help some students include this consideration as a personal cost. Making this a hands-on activity will help make the experience more personal and less cerebral, which assists in altering environmental behaviors (Takacs-Santa, 2007).

Design

The activity is a blind taste test within the frame of a hypothetical purchase. Sample A will be Missoula tap water drawn from the local aquifer, which lends high mineral content to the water. Sample B will be bottled water from a spring source, which will also provide high mineral content. Sample C will be Missoula tap water that has been

filtered with a Brita pitcher. Sample C will approximate the taste of "purified drinking water," which is simply filtered and bottled tap water (Gleick, 2010). The inclusion of sample C could be easily identified as either tap or bottled water but must be categorized as "tap" (since this is the actual source) to be a correct guess.

First, students will be presented with two cups of water. One will be clear and clean bottled water, the other will be polluted with dirt (or another such unappealing substance) which represents the unclean surface water in many developing countries. The facilitator should remind the students that dirty water could make them sick. The students will have to choose which they would prefer to drink, with the expectation that they will pick the clean water. Then the students will be presented with the three samples. The pouring of each sample will occur behind a screen (such as a cardboard box) to ensure they do not see the source. After each sample, the student will be asked to categorize the sample as "tap," "bottled," or "unsure." After tasting all three samples, they will be told which they got correct. It may also be helpful to demonstrate that, while an individual may guess correctly, overall guesses vary wildly. This can be done by keeping a large tally visible to the students. Keeping a public track of students' guesses also involves social processing in decision-making, which van der Linden (2015) finds makes education more effective at altering behavior. With answers visible, it will be necessary to provide samples in a random order, so students who have already guessed cannot give the right answers to those who have not yet participated.

Since both bottled and tap are accepted forms of drinking water in the US, but bottled water costs significantly more, students will then be presented with two cups of clear clean water to choose between. The facilitator will explain that the bottled sample

costs a dollar and hurts the environment, but the tap sample only costs one cent. With only minor differences in taste, the students should understand that the almost-free tap water is more desirable than the bottled water.

I conducted a preliminary test of my activity with students at the University of Montana. The university students I recruited already manage their own budgets, so the frame activity of choosing between two cups of water was left out of the test. They were also asked to close their eyes instead of watching as water was poured behind a screen, as they were trusted to be mature enough to comply. Since Missoula's tap water has a high mineral content from the aquifer and is treated with chlorine, I expected participants to identify it fairly easily. Since both tap and bottled water can be filtered, I expected people to have trouble identifying the source of the filtered water. Since I tested this activity on university students, I expected the majority to rely on tap water because it is cheap and readily available in their homes. I also expected most of the participants to carry reusable water bottles, based on my observations of students attending University of Montana classes.

Results

Eleven university students participated in my activity. Only one preferred and relied on bottled water. The remaining 10 said they relied on tap water. Of the ten who relied on tap water, 6 claimed a preference for tap and 4 had no preference. Cost was the most frequently cited reason for reliance on tap, mentioned by 5 of the 10 tap users, as tap is either free or extremely cheap in comparison to bottled. Linked with low cost is convenience, cited by two tap users. One participant specifically mentioned the inconvenience of having to recycle plastic water bottles, indicating an implicit concern

for the environment. Taste was cited as a reason by 2 tap users and the bottled water user. One person also mentioned that tap water irritated their throat. Eight people said they carry a reusable water bottle, including the one bottled water user. The other three participants did not carry a reusable water bottle. Eight participants said the environment (in terms of impact from fossil fuels, plastic in landfills, etc.) factored into their use of tap, all except one of which also carried a reusable bottle. Of these 8, five explicitly mentioned the environment unprompted as a reason for their preference for tap, while the other three did not have a water preference.

Figure 1: Drinking Water Habits Survey Responses (N=11)

Water Source Preference Tap: 6 Bottled: 1 Neither: 4
Water Source Reliance Tap: 10 Bottled: 1
Considerations when Choosing Sources* Cost: 8 Taste: 3 Convenience: 2 Environment: 5 Physiological Reaction: 1
"Do You Consider the Environment when You Choose?" Yes: 8 No: 3
Reusable Water Bottle Usage Yes: 8 No: 3

*Participants gave these answers unprompted. In the next question they were directly asked about whether they consider the environmental impacts of their choice.

The very hard tap and spring water were identified correctly by 7 participants each. Three people mislabeled tap as bottled and two people mislabeled bottled as tap. Four people correctly identified all three samples, including the person who noted mild throat irritation from tap water. People were evenly split on whether the filtered water was tap or bottled – 5 thought it was tap and 5 thought it was bottled, with one person

saying "unsure." The confusion surrounding the filtered water matches the fact that both tap and bottled water may be filtered depending on the region and company. Only 2 people took advantage of using the “unsure” option: one said they were unsure what the tap sample was, and the other said they were unsure about all three samples.

Of the two participants that cited taste as a reason for their tap preference, one correctly identified all three samples. The other categorized both tap and bottled water as tap, and categorized the filtered water as bottled. The participant who preferred bottled water for its taste correctly identified all three samples.

Figure 2: Taste Test Responses

		Samples		
	N=11	**TAP**	**BOTTLED**	**FILTERED**
Responses	**TAP**	7	2	5
	BOTTLED	3	7	5
	UNSURE	2	1	1

Conclusion

While this activity is not an experimental study, the findings do support the general literature. The test activity with university students supported that bottled water and tap are indistinguishable from each other. This is both a result of taste (some participants could not tell the difference) and identical processing (when filtered, people could not identify the source). A higher portion of participants expressed environmental

concerns than in other studies, but this is likely due to the small sample size and shared values among the group of students tested. Elementary students do not typically manage budgets on their own as university students do, so when working with children facilitators should illustrate the magnitude of the cost difference. Facilitators can explain that $1 is one thousand times more expensive than 1 cent. Including both the comparison between cups of dirty and clean water and the two clean cups of water will provide context for when benefits exceed costs, and that the socially desirable amount of bottled water sales is not zero, but should be lower.

References

California Water Science Center (CWSC). (2017). California Drought. *U.S. Geological Survey.* Retrieved from https://ca.water.usgs.gov/data/drought/.

Clerkin, K. (2012). Hit the tap, kick the bottle. *Drinking Water Fountains,* Retrieved from http://www.drinkingwaterfountains.com/2012/09/27/hit-the-tap-kick-the-bottle/.

Doria, M. F. (2006). Bottled water versus tap water: understanding consumers' preferences. *Journal of Water and Health,* 4(2), 271-276.

DuPont, D. P. (2005). Tapping into consumers' perceptions for drinking water quality in Canada: Capturing customer demand to assist in better management of water resources. *Canadian Water Resources Journal,* 30(1), 11-20.

Gleick, P. (2010). *Bottled and Sold: The Story Behind our Obsession with Bottled Water*. Washington, DC: Island Press.

Google Maps. (2017). Hit the tap: Map of Missoula's water fountains. Retrieved from https://www.google.com/maps/d/viewer?mid=12_KQbUODsKj8cq6levBLo418yvU&hl=en_US&ll=46.86873735910461%2C-114.025061&z=11.

Hit the Tap Missoula. (2013). Hit the tap Missoula. *Facebook.* Retrieved from https://www.facebook.com/Hit-the-Tap-Missoula-621952224533786/

Hu, Z., L. W. Morton, & R. L. Mahler. (2011). Bottled water: United States consumers and their perceptions of water quality. *International Journal of Environmental Research and Public Health*, 8, 565-578.

Idaho Museum of Natural History (IMNH). (n.d.). What is an aquifer? Retrieved from http://imnh.isu.edu/digitalatlas/hydr/concepts/gwater/aquifer.htm

International Bottled Water Association (IBWA). (2017). International bottled water association. Retrieved from http://www.bottledwater.org.

Rega, S. (2016). Animated map of where your bottled water actually comes from. *Business Insider.* Retrieved from http://www.businessinsider.com/animated-map-bottled-water-springs-dasani-aquafina-2016-10.

Ronnow, K. (2010). Take a sip and guess: Tap or bottled? *Bozeman Daily Chronicle*. Retreived from https://www.bozemandailychronicle.com/news/take-a-sip-and-guess-tap-or-bottled/article_33296fb4-d8b1-11df-8a98-001cc4c002e0.html.

Paloniemi, R., & A. Vainio (2011). Why do young people participate in environmental political action? *Environmental Values*, 20(3), 397-416.

Parag, Y. & J. T. Roberts. (2009). A battle against the bottles: Building, claiming, and regaining tap-water trustworthiness. *Society and Natural Resources*, 22(7), 625-636.

Saylor, A., L. S. Prokopy, & S. Amberg. (2011). What's wrong with the tap? Examining perceptions of tap water and bottled water at Purdue University. *Environmental Management*, 48, 588-601.

Takacs-Santa, A. (2007). Barriers to environmental concern. *Human Ecology Review*, 14(1), 26-38.

Teillet, E., C. Urbano, S. Cordelle, & P. Schlich. (2010). Consumer perception and preference of bottled and tap water. *Journal of Sensory Studies*, 25, 463-480.

Van der Linden, S. (2015). Exploring beliefs about bottled water and intentions to reduce consumption: The dual-effect of social norm activation and persuasive information. *Environment and Behavior*, 47(5), 526-550.

Appendix

Survey Questions

Do you currently prefer tap or bottled water?

Which do you usually drink?

What is the reason for your preference?

Do you carry a reusable bottle?

Do you think about the environment when choosing between tap and bottled water?