Exploring how an experiential learning program shapes students' knowledge and awareness about water conservation

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Abstract:

The aim is to explore how an innovative pedagogical initiative - the Water Walk - shapes students' knowledge and attitudinal predispositions toward water and its consumption. Drawing on a three-stage research design, including pre- and post-program interviews as well as reflective journals, data were analyzed through thematic content analysis. Findings suggest that while participants retained sensory and emotional aspects of the experience more strongly than technical knowledge, their overall perception of water shifted toward greater awareness of its scarcity and importance. Some students also reported early behavioral adjustments, adopting more responsible water practices after completing the program. This study extends theoretical understanding of experiential learning in the context of sustainability education and highlights its potential to raise awareness and influence behavior. Practical implications are offered for educators and policymakers seeking to design impactful programs that foster long-term engagement with water conservation.

Keywords:

Water conservation; Experiential learning; Educational program; Transactional Distance; Site Visits; Meetings with Experts

1. Introduction

Climate change and the growing pressure on natural resources have made water conservation one of the most urgent sustainability challenges of the 21st century. Despite its essential role in human and ecological systems, freshwater remains a scarce resource, often perceived as abundant but increasingly threatened by population growth, intensive consumption patterns, and climate impacts (UNESCO, 2024, 2022). Preserving this resource will require not only technological innovations but also considerable changes in how individuals perceive and consume water (Haeffner et al., 2023). In this respect, the United Nations Development Programme (UNDP) highlights the importance of awareness-raising and education to foster sustainable practices[1].

Water awareness and conservation campaigns are frequently implemented (Li and Roy, 2021; Martínez-Espiñeira et al., 2014; Pérez-Urdiales and García-Valiñas, 2016), based on the assumption that increasing awareness of water scarcity issues can foster more positive attitudes toward its preservation (Koop et al., 2019). In parallel, several recent studies have examined the effectiveness of educational initiatives that address climate change and encourage environmentally responsible behaviors (Galeotti et al., 2024; Manna et al., 2022). A wide variety of pedagogical tools have been developed for this purpose, ranging from digital learning resources and educational videos (Rosenberg Goldstein et al., 2024) to serious games and board game–based activities (Bascoul et al., 2013), as well as case studies and project-based learning (Beitelspacher and Rodgers, 2018; Wiese and Sherman, 2011). All of these aims to improve young people's environmental knowledge and awareness.

However, despite the abundant literature on public-oriented water conservation campaigns on one side, and on climate change education integrated into school curricula on the other, only the study by Bilancini et al. (2023) appears to bridge these two approaches. Their research evaluated the effects of a board game designed to promote sustainable water use among elementary school children. Findings showed that the program not only encouraged more sustainable practices among the children themselves but also influenced their families' behaviors. This pioneering study opens promising avenues and highlights the need for further research. In particular, little is known about the impact of such programs on older audiences, especially young adults who make consumption decisions more independently. Moreover, alternative pedagogical formats—such as experiential learning, field-based activities, or active learning approaches—have yet to be widely explored as means of encouraging sustainable water use. In this context, the present study seeks to address this gap by asking the following research question: "*How does an experiential educational program influence students' knowledge and other attitudinal predispositions to adopt water conservation behaviors?*"

To answer this question, we designed a study based on an innovative educational program (i.e., the Water Walk) and a three-phase methodological approach: semi-structured interviews conducted before and after students' participation, combined with the use of reflective journals during the walk. A thematic content analysis of the collected data suggests that the program's flexible design and variety of interactions facilitated knowledge transmission, even though students mainly retained sensory and emotional impressions. Nonetheless, their perceptions of water evolved toward greater awareness of its conservation. Overall, this study offers valuable insights for policymakers, educators, and water sector stakeholders, encouraging collaboration to develop educational initiatives aimed at increasing awareness of water-related challenges and conservation efforts.

2. Theoretical background

2.1. Water awareness campaigns

[1] https://www.undp.org/fr/sustainable-development-goals

In response to increasing water scarcity, public authorities have implemented both regulatory measures (e.g., restrictions during droughts) and awareness campaigns designed to encourage responsible water behaviors (Lam et al., 2016; Survis and Root, 2012). These campaigns are based on the assumption that better knowledge of water issues fosters more positive attitudes toward conservation (Martínez-Espiñeira et al., 2014). Empirical studies confirm that awareness can shape pro-environmental habits (Brown and Pena, 2016; Su et al., 2021). Fielding et al. (2013) claimed that campaigns focusing on direct and/or specific targets are more likely to promote sustainable practices. While some research has shown the value of educational videos for students (Rosenberg Goldstein et al., 2024), only a limited number of studies, such as Bilancini et al. (2023), have examined the impact of immersive pedagogical programs on water behaviors.

2.2. Experiential learning

Experiential learning models emphasize the role of direct engagement in knowledge acquisition. Kolb's (1984) framework describes learning as a cyclical process involving concrete experience, reflection, conceptualization, and experimentation. Research suggests that site visits and interactions with professionals can foster deeper understanding and motivation by exposing students to real-world applications (Behrendt and Franklin, 2014; Van Doren and Corrigan, 2008). Immersive learning contexts, such as sustainability-focused field trips (Markley Rountree and Koernig, 2015; Mooney and Cockburn, 2024), have been shown to stimulate critical thinking and increase commitment to sustainable practices.

2.3. Transactional distance

Moore's (2013) theory of transactional distance conceptualizes learning environments in terms of the structure of educational programs and the quality of dialogue between instructors and learners. High levels of flexibility and rich opportunities for interaction tend to reduce pedagogical distance and enhance learning outcomes (Ivancevich et al., 2009; Netanda et al., 2019). In this perspective, experiential initiatives that combine structured site visits with informal exchanges provide an especially favorable context for reducing transactional distance and facilitating the transmission of knowledge and values.

Together, these perspectives highlight both the potential and the limits of existing educational approaches to water conservation. This study builds on them by analyzing how an experiential program such as the *Water Walk* may influence students' knowledge, attitudes, and behaviors regarding water use.

3. Methodology

3.1. The educational program: The Water Walk

The Water Walk is an engaged walk that led participants to study, in the field, the following theme: "*The challenges of ecological transition in 2024 in civic and economic life: the case of water*". Supervised by five individuals (including a lead professor, pedagogical coordinators, and logistics staff), thirteen students from a French business school (Appendix 1) walked over 600 kilometers in 36 days. Replacing the students' traditional end-of-year internship, the Water Walk is not part of a formal module on transversal skills or sustainability. Rather, it stands as a unique educational experience aligned with the school's recent curriculum redesign, which seeks to address ecological and social transitions through the lens of water while promoting reflective and experiential learning.

The theme of water was continuously expanded throughout the walk via a series of encounters, site visits, and testimonials (Appendix 2). A typical Water Walk day combined physical effort, field-based exploration, and reflective practice. For instance, during the visit to the Elis industrial laundry facility, students engaged with sustainability managers and operational staff to understand how water is consumed, treated, and recycled within

cleanroom garment cleaning processes. They toured the site, discovered water-saving technologies, and discussed the company's environmental strategy. The afternoon was dedicated to walking, offering time for students to process and reflect on what they had learned. Each day ended with a collective debriefing session and time for individual journal writing, which fostered personal reflection and helped consolidate the knowledge gained.

3.2. Data collection

Data was gathered through a three-stage process. First, students were interviewed prior to the *Water Walk* using the semi-structured interview method. Our interview guide (Appendix 3) first invited students to describe how they perceive water and what values they associate with this resource. Students were then asked to describe in detail how they consume water and whether they engage in responsible behaviors regarding it. The fourth and fifth themes focused on students' knowledge about water and other attitudinal predispositions toward water consumption. Finally, the guide explored students' perceptions of the future of water resources and consumption. Second, during the program, participants maintained reflective journals to document their feelings about the pedagogical day, the knowledge conveyed, and their awareness of water-related issues and conservation. Finally, six months after the program, students were interviewed again through semi-structured interviews. This methodological choice aimed to observe how the knowledge transmitted about water issues and conservation was retained, and whether this knowledge and other attitudinal predispositions influenced students' water consumption behaviors.

3.3. Data analysis

All interviews and journals were transcribed and analyzed using thematic content analysis with NVivo software (Flick, 2022). An inductive coding process allowed categories to emerge from the data. In the first step, words, lines, phrases, or paragraphs were coded and grouped into ideas (themes). These themes were then merged into higher-level themes with a conceptual role that goes beyond description to build a progressive categorization. Through iterative processes, comparing emerging themes with the data and linking themes to one another, a final multi-level coding framework was established (1st-level themes, 2nd-level themes, etc.). This framework enabled identification and conceptualization of students' knowledge and attitudinal predispositions toward water consumption, as well as their behaviors (Appendix 4). In the second step, the entire dataset was re-coded using this final framework. This full re-coding was necessary to observe changes across the two time periods by comparing the content of students' discourse before and after participating in the *Water Walk*.

4. Results

4.1. Transactional Distance Reduced by the Originality of the Educational Program

The Water Walk relies on a relatively flexible pedagogical framework, shaped by the diversity of interactions it involves. Although the route and site visits were planned in advance, the educational content largely emerged from spontaneous encounters and real-life situations, fostering a discovery-based learning approach: "*We met someone from the Deux-Sèvres Chamber of Agriculture who explained the whole story about the mega-basins, highlighting not only environmental aspects but also social and financial ones*" (Manon). Discussions with public authorities, water management operators, and even everyday consumers offered numerous opportunities for students to ask questions and expand their understanding of water-related ecological challenges: "*I learned that France is the second most nuclearized country in the world and that EDF operates 18 power plants. Each of those plants requires a large amount of water for the cooling system*" (Sarah). These exchanges unfolded on two levels: with external experts, but also within the student group itself and with the pedagogical

supervisors, forming a dense network of interactions: "*We talked about it again after the brewery visit, when we were at the bar having a beer and saying, 'wow, look at your water consumption.' Even if it was kind of teasing, it still stuck with us*" (Walter). This richness and intensity of dialogue helped reduce the transactional distance, which in turn supported more effective knowledge transmission.

4.2. Influence on Students' Knowledge About Water

Although the program promoted the transmission of diverse knowledge about water management, students' assimilation of this content appeared more uneven. Their recollections were mainly anchored in the tangible elements they had encountered, such as desalination plants, hydraulic dams, and community gardens. Many of them only partly remembered technical or theoretical aspects: "*I forgot the technical terms, but I remember we had some kind of device to see how full the groundwater tables were*" (Walter). Interactions with experts seemed to leave a lasting impression less because of the factual information shared than because of the individuals themselves and their dedication to water conservation: "*What struck me about that visit was mainly the person herself. She told us the history of the town of Richelieu and the environmental damage caused by the Cardinal's developments. It really touched me how invested she was*" (Mathieu). While detailed explanations of industrial processes, technical mechanisms, or management strategies often faded into the background, the emotions experienced during and after the visits – such as surprise, joy, or fear – remained vivid: "*It was impressive to see the political side, to realize how water management is politicized. To see that some people can privatize water. It's scary. Realizing that sometimes decisions are more about politics and economics than about social good*" (Eric). The itinerant format of the walk, combined with its physical demands, likely made it more difficult for students to fully absorb theoretical and technical knowledge.

4.3. Influence on Attitudes and Perceptions

Although the program may have resulted in somewhat fragmented knowledge retention, the Water Walk appears to have positively shaped students' attitudes toward water preservation. One of the most immediate changes concerned how they perceived water. Once considered an endlessly available resource, it came to be seen as fragile and vulnerable to human influence: "*We tend to think water is an infinite resource. But it's not. Thanks to the visits, we realized that. If I take the example of the visit to the Marais Poitevin, we saw how climate change had degraded water quality and uprooted trees, affecting both fauna and flora*" (Olivia). This cognitive shift was accompanied by a stronger awareness of water-related challenges: "*About the mega-basins, even if I didn't know much about them, I used to side with the farmers because I understood the benefits for their crops. But I had no idea about the damage to biodiversity, the fauna, the flora. So it really opened my mind*" (Olivia). Throughout the walk, students were confronted with concrete realities such as water scarcity, waterway pollution, and the ecological consequences of human-built infrastructures. These direct experiences sparked growing concern among many participants: "*I think if environmental disruption keeps getting worse in the years ahead – like the hurricanes already hitting the U.S. and even France – it's really something to worry about. We need to act, because in the end, we're the ones responsible*" (Marc).

4.4. Influence on Water Consumption and Conservation Behaviors

Before taking part in the Water Walk, students were already engaged in several water-saving habits in their daily routines. They reported shortening their showers, paying attention to water use during tasks such as washing dishes or cleaning, and avoiding certain practices like car washing or taking baths. Beyond these long-established habits often learned in childhood, the Water Walk encouraged them to adopt additional responsible behaviors. Through site visits and exchanges with experts, participants became more aware of the vast amounts of

water consumed indirectly for the production and transport of everyday goods—particularly food, clothing, and electronics: "*We think we know what water consumption is, because it's all around us. But actually, there's all this invisible water […] Like the water used to make this computer—it's invisible, and we don't realize how huge it is compared to the water we directly use and see. The numbers are crazy*" (Robin). This awareness led some students to reassess their consumption choices, particularly regarding food: "*We know things are bad, but everyone has to do their part. We absolutely need to become vegetarians. I still eat meat, but I've cut down. And when I do eat it, I know where it was produced, for example*" (Manon). Others reconsidered their fashion consumption: "*The water footprint—that's something I learned about during the walk. […] I'll be less into excessive shopping or impulse buying, especially clothes. I'll keep what I already have because now I feel committed*" (Sarah).

5. Discussion and conclusion

This study examined how an experiential educational program, the *Water Walk*, influenced students' knowledge, attitudes, and water-related behaviors. The findings highlight both the potential and the limitations of such initiatives.

From a theoretical perspective, three contributions emerge:

- First, according to Moore's theory of transactional distance (2013), learning is optimized when the distance between teacher and learner is reduced through rich dialogue and a flexible pedagogical structure. Our findings nuance this assumption. While the Water Walk enabled diverse forms of knowledge transmission through decentralized exchanges, the second wave of interviews, conducted six months later, shows that while students-consumers retained rich sensory and emotional memories, their retention of technical or theoretical knowledge was more limited. This type of program appears to offer fewer opportunities for clearly consolidating acquired information.
- Second, the program proved effective in shaping attitudinal predispositions. Although knowledge assimilation may be partial, our findings suggest that experiential educational programs provide fertile ground for raising awareness of water consumption and preservation issues (Koop et al., 2019). Site visits (e.g., water treatment plants, dams, research centres) combined with expert meetings offer students direct exposure to societal and environmental challenges, including those relating to water management and preservation, fostering more eco-friendly attitudes and behaviors.
- Third, in a context where water preservation is becoming increasingly urgent – particularly due to the effects of climate change (Abbott et al., 2019), this study highlights the importance of raising students' awareness of water-related challenges (Bilancini et al., 2023) as well as broader sustainability issues (Mooney and Cockburn, 2024). The findings support the idea that lived experiences can trigger broader reflections on indirect consumption (food, textiles, energy), extending beyond immediate water-saving actions.

Managerial and pedagogical implications also arise. Educational institutions should integrate experiential components, such as site visits, expert meetings, or field immersions, into their curricula to complement traditional teaching. These initiatives foster critical thinking, emotional engagement, and civic responsibility, equipping future professionals with the mindset needed to address ecological transitions. Partnerships with water-related organizations can further strengthen these programs, creating mutual benefits for students, institutions, and practitioners.

Several limitations temper these insights. The *Water Walk* was an exceptional initiative with a small, homogeneous sample, which limits generalizability. The qualitative design, though rich in depth, cannot fully capture behavioral changes over time. Future research could replicate the program in shorter, more scalable formats, include larger and more diverse populations, and combine qualitative insights with quantitative measures.

In conclusion, while experiential programs may not guarantee the retention of technical knowledge, they appear highly effective in reshaping perceptions and encouraging more responsible practices. As water scarcity intensifies, such approaches represent promising avenues for educating the next generation of consumers and decision-makers.

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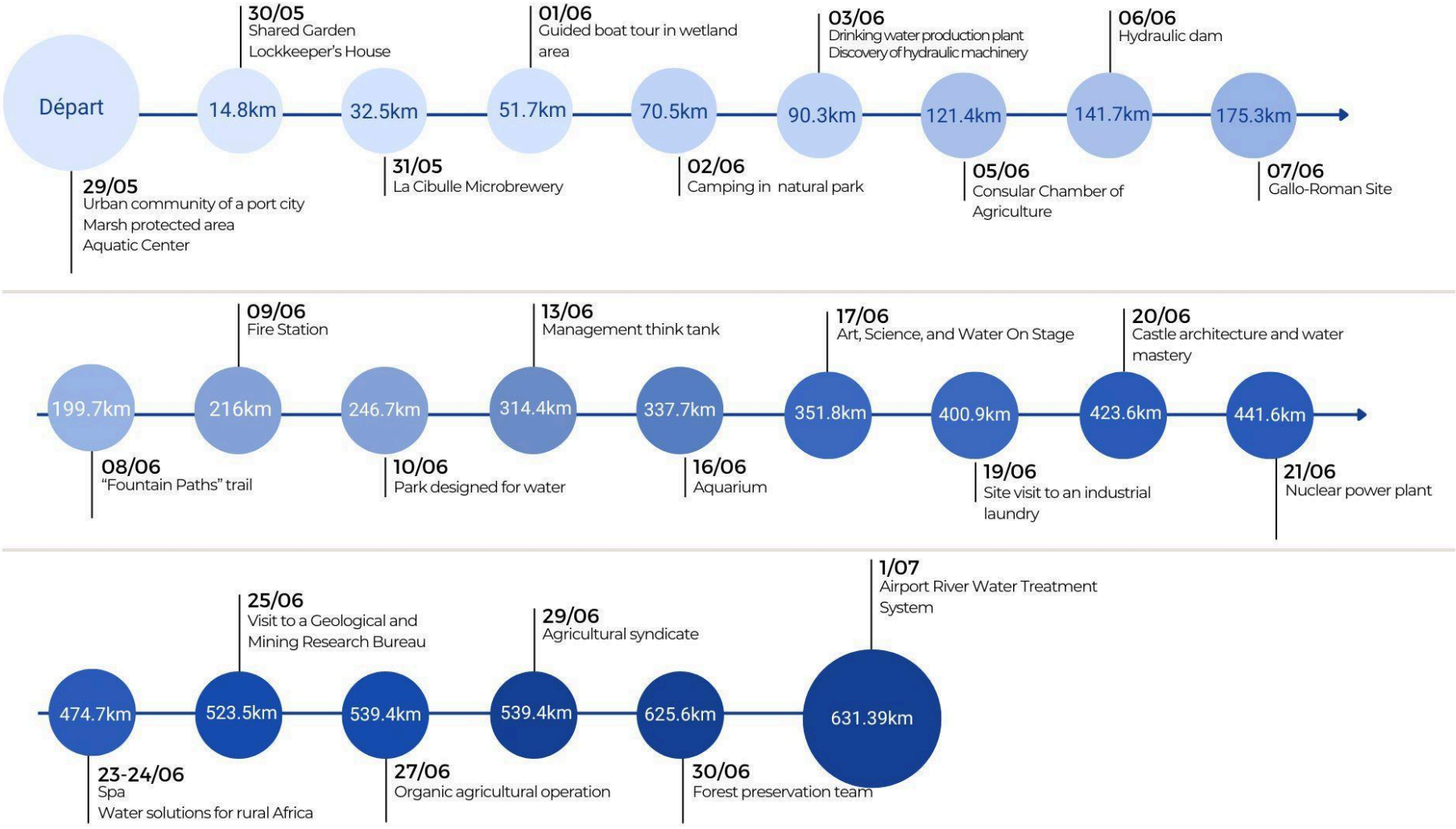
Appendices

Appendix 1. Sample

Pseudonym	**Age**	**Gender**	**Year of Study**	**Program**
Sarah	18	Female	1st Year	Bachelor Business
Mathieu	20	Male	3rd Year	Master in Management
Dylan	25	Male	4th Year	Master in Management
Hugo	20	Male	3rd Year	Master in Management
Manon	19	Female	1st Year	Bachelor Business
Olivia	20	Female	3rd Year	Master in Management
Marc	19	Male	2nd Year	Bachelor Business
Cindy	19	Female	2nd Year	Bachelor Business
Walter	19	Male	2nd Year	Bachelor Business
Eric	18	Male	1st Year	Bachelor Business
Pierre	22	Male	3rd Year	Master in Management
Robin	18	Male	1st Year	Bachelor Business
Jules	22	Male	4th Year	Master in Management

Appendix 2. Timeline of the Water Walk



Appendix 3. Interview Guide

Theme	Questions
Perceptions and Perceived Values of Water	**Could you tell me what images spontaneously come to mind when we talk about water?** Follow-up: – What symbols do you associate with water? – What value do you place on water? – How important is water to you? – How do you compare water to other goods? - – What role does water play in your daily life?
Water Consumption	**Could you tell me about the last time you consumed water?** Follow-up: – When was that? – Where were you? – Were you alone? – What were the circumstances? **Beyond that specific instance, could you describe your water consumption in daily life? Your everyday uses of water?** Follow-up: – Type of consumption? – Places of consumption? – When do you consume water during a typical day? – Are there periods of the year when you use more water? – Frequency of consumption? – Objects associated with types of consumption? – Infrastructure associated with types of consumption? – Practices linked to these types of consumption? – People involved in the consumption situations? **In your opinion, which usage represents the largest portion of water consumption in your home?** Follow-up: – What types of equipment in your home use water? Do you have an idea of how much water they consume? – Do you have any infrastructure that requires large amounts of water? Does it require special management? – On the contrary, do you have any infrastructure or systems designed to reduce or recover water consumption?

Responsible Behaviors Toward Water	**Could you tell me to what extent you pay attention to your water consumption?** Follow-up: – How does that manifest in practice? – What do you do to be mindful of water usage? – How concerned are you about your daily water consumption? – To what extent would you be willing to reduce your water usage if necessary? What uses would you prioritize? – What do you think about the quality of tap water?
Knowledge About Water	**Could you tell me whether and how you keep yourself informed about water?** Follow-up: – Why? – How? Through which media? – Can you recall any communication campaigns or messages about water? Of any kind? **Could you describe how you perceive water in nature?** Follow-up: – To what extent are you sensitive to aquatic environments? – What comes to mind if I say “water stress”? – Would you say that water can be a source of conflict? **Could you name any organizations or actors involved in water management?** Follow-up: – Do you know who your water provider is, for example? – What do you think about the water distribution system in France? – Do you drink tap water? And why? Do you drink bottled water? And why? – What do you think about the quality of tap water? – What do you think about the price of water? **Could you tell me if you know how much water you usually consume in a day?** Follow-up: – What quantity do you estimate?
Other Attitudinal Predispositions Toward Water Consumption	**Have you ever been affected by events related to water?** Follow-up: – Could you mention any climatic events linked to water? – How did you experience that event? – Have you ever lived through a period of drought or water restrictions? Are you afraid that might happen to you someday? – On the other hand, have you ever experienced flooding? Are you afraid that might happen to you someday?

	Beyond climatic events, have you ever participated in events related to water? Workshops? Training sessions? Seminars? Follow-up: – What did you get out of it? – What motivated you? When? Where? What did you experience? – What were your expectations? Any obstacles? – What did you learn? – To what extent did it make you want to attend other water-related events? **Do you engage in water-related recreational activities? Which ones?** **To what extent are you concerned about water issues?** Follow-up: – Do you believe access to water is under threat? – Do you think water quality is threatened? What about natural and aquatic environments? – Does that concern you?
Projective Theme	**If you had a magic wand, what would you do to improve water use and consumption?** **How do you imagine water consumption in 20 to 30 years?** **To conclude, for you, water is…**

Appendix 4. Content Analysis Grid

Level 1 Theme	**Level 2 Theme**	**Level 3 Theme**
Transactional distance of the educational program	Dialogue	Dialogues with external experts
		Dialogues within the group
	Structure	Diversity of interactions
Consequence of the reduced transactional distance of the educational program (in the moment)	Critical thinking	
	Introspection	
Students' knowledge about water	General knowledge about water and aquatic environments	
	Knowledge about distribution and water market stakeholders	
	Knowledge about reliability and accessibility of water	
	Knowledge about the measurement of direct water consumption	
	Knowledge about the measurement of indirect water consumption	
	Knowledge about water quality	
	Knowledge about the price of water	
Other determinants of water consumption	Attitude toward water preservation	
	Environmental concerns	Specific concerns related to water and aquatic environments
		Other environmental concerns
	Personal pro-environmental norms	
	Representations of water	Private good vs. common good
		Readily available and accessible resource vs. fragile resource
		Fundamental resource for ecosystems and human activity
Water consumption behaviors	Direct consumption	Drinking
		Hygiene
		Cooking and dishwashing
		Laundry
		Irrigation/watering
		Leisure (swimming pool, water games, etc.)
	Indirect consumption	Textiles
		Food
		Energy
Responsible behaviors regarding direct water consumption	Water-sparing behaviors	
	Use of storage or recycling systems	
	Use of water-efficient systems	
	Other responsible behaviors toward direct water consumption	
Responsible behaviors regarding indirect water consumption	Textiles	
	Food	
	Energy	