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Research Article

Students' perspectives on water literacy: The case of 8th grade students

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This study aims to explore the perspectives of 8th-grade students on water literacy. A qualitative research design was employed with 15 students from four public middle schools located in the western part of Türkiye. Data were collected through a researcher-designed semi-structured interview form and analyzed using thematic analysis. The findings revealed that students were personally aware of the importance of water conservation, emphasizing the need to avoid waste and prevent pollution. However, they lacked sufficient knowledge of key concepts such as *water literacy* and *World Water Day*. In addition, students stated that most of their knowledge about water-related issues was gained in science classes, with limited emphasis in social studies courses. These results indicate a gap between students' environmental awareness and their conceptual understanding of water literacy. It is recommended that the social studies curriculum include systematic content and skills related to water literacy to help students develop both awareness and conceptual understanding of water as a vital resource for a sustainable and eco-friendly life.

Keywords: Basic qualitative research; Environmental awareness; Social studies education; Students' perspectives; Water conservation; Water literacy

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1. Introduction

Recognized as the source of life, water is one of the most essential natural resources sustaining human existence. Although Earth is often referred to as the "blue planet," its freshwater resources are limited, making their conservation crucial for future generations (Türker et al., 2022). In regions such as the Middle East, water is considered even more valuable than oil and is often called "blue gold" (Kapan, 2007). Rising global temperatures, which have increased by more than 1°C over the past century, further highlight the growing importance of water security (Intergovernmental Panel on Climate Change [IPCC], 2014).

Although water covers about two-thirds of Earth's surface, the amount of directly usable freshwater is extremely limited. Approximately 97% of the planet's water is saltwater, while the remaining 3% is stored in glaciers and underground sources—of which only a small portion is available in rivers, lakes, and wetlands (Shiklomanov & Rodda, 2003). This scarcity underscores the growing significance of water resources amid rapid population growth.

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Water makes up about 60% of the adult human body and up to 70% in children, emphasizing its fundamental role in sustaining life (Guyton & Hall, 2021; Popkin et al., 2010). In an era when water holds such vital importance, mere knowledge is not enough. What truly matters is the ability to translate this knowledge into attitudes and behaviors. Water is not just a consumable resource—it is a value deeply intertwined with life and must be protected. Societies evolve meaningfully when individuals understand water, use it wisely, and make conservation a natural part of daily life. In recent years, this conscious approach has been described in the literature as water literacy (Cole et al., 2024; McCarroll & Hamann, 2020). As water becomes increasingly scarce, water literacy is gaining importance every day and is now recognized as one of the key conditions for sustainable living.

1.1. Water Literacy and Social Studies Education

Water literacy encompasses not only understanding the water cycle and pollution but also recognizing the significance of water, learning how to protect it, and exploring sustainable usage methods (Haddout et al., 2021). A water-literate individual understands that water is essential for life, maintains ecological balance, contributes to societal development, and enhances quality of life (Bekele et al., 2021). Therefore, fostering this awareness among children from an early age is critical for environmental sustainability and for nurturing future generations who are more conscious of water-related issues.

As highlighted in the United Nations [UN] (2023) report, approximately 26% of the global population lacks access to safe drinking water, while 46% lack access to safe sanitation. Furthermore, two to three billion people experience water scarcity for at least one month each year (UN, 2023). The European Environment Agency [EEA] (2025) also notes that although water withdrawals in the European Union decreased between 2000 and 2022, conditions in water-scarce regions have deteriorated since 2010. Sustainable water use, therefore, requires intensified efforts, as shortages are not expected to improve before 2030 due to the impacts of climate change.

Türkiye uses between 40% and 80% of its renewable freshwater resources and is among the countries facing "high water stress" (Falkenmark et al., 1989). According to data from the General Directorate of State Hydraulic Works (2020), the annual per capita water supply decreased from 1,652 m^3 in 2000 to 1,346 m^3 in 2020, and this figure is expected to decline further with population growth (Türker et al., 2022). Given these trends, Türkiye must urgently implement effective water resource management strategies and sustainable water policies.

According to McBride et al. (2013), water literacy involves understanding the hydrological cycle, water quality indicators, human impacts on water resources, conservation methods, water purification technologies, and relevant legislation. This knowledge is increasingly important as water resources face greater threats worldwide. Per capita water use is declining, while its distribution patterns are simultaneously changing (Erbaş et al., 2023). The UN (2021) warns that by 2040, global water demand will increase by 50%, and by 2050, 5.7 billion people will live in water-scarce regions. The primary cause is a lack of awareness of water's value and importance (Karslı & Güçlü, 2023). This study therefore aims to examine water literacy and management amid these urgent global challenges.

Ensuring the proper use, conservation, and sustainable transfer of water—which is increasingly vital for life—to future generations requires individuals and societies equipped with fundamental knowledge about water, positive attitudes toward it, and behaviors that reflect these attitudes (McCarroll & Hamann, 2020; Sözcü & Türker, 2020). Education is the most critical element in protecting the world's water resources and passing them on to future generations (Brody, 1993). According to the European Environment Agency (2018), effective water management requires sustainable use, reduced sectoral pressures, and strengthened public policy, with water literacy strategies closely aligned with these principles. Developing awareness and positive attitudes toward water should begin within the family and continue throughout life, while a curriculum

designed to foster water-literate individuals can significantly enhance this process (Türker et al., 2022; UNICEF, 2020).

A comprehensive understanding of water and its resources—including its structure, properties, purification methods, and related challenges—is fundamental to water literacy. Raising awareness in this area can help prevent or mitigate potential problems (Cole et al., 2024; Türker et al., 2022). In this context, expanding the inclusion of water-related topics in social studies education and formally integrating water literacy as a key competency within the curriculum are essential steps toward developing water-literate individuals.

In the Social Studies Curriculum developed by the Ministry of National Education [MoNE] in 2018, there are 27 core skill areas intended to be cultivated throughout students' social studies education. These include various literacy domains such as environmental literacy, digital literacy, financial literacy, map literacy, legal literacy, media literacy, and political literacy (MoNE, 2018, p. 9). The recently published Social Sciences Curriculum under the *Century of Türkiye Education Model* includes digital, financial, and visual literacy, as well as literacy in information, culture, citizenship, data, sustainability, and art (MoNE, 2024, p. 4). However, neither curriculum includes a specific literacy domain dedicated to water—one of the most pressing global issues. It is particularly noteworthy that the *environmental literacy* component, which was present in the 2018 curriculum and closely linked to water topics, has been removed from the new curriculum.

Based on these considerations, acquiring water literacy at an early age is crucial. Although the social studies curriculum has certain limitations, it is flexible enough to incorporate water-related topics within relevant learning areas and outcomes, supporting the development of water literacy (McCarroll & Hamann, 2020; Ursavaş & Baki Pala, 2021). Furthermore, the formal inclusion of water literacy as a specific competency within the curriculum is expected to enhance students' understanding and awareness of water's importance as a vital natural resource.

1.2. Theoretical Framework

The theoretical framework of this study thoroughly explores the concept of water literacy, its relationship to other literacy domains, and its pedagogical foundation as discussed in the international academic literature. Water literacy has become increasingly important for achieving sustainable water management and social water equity, although its definition varies across different sources.

Water literacy can be defined as the accumulation of knowledge, attitudes, and behaviors related to water (McCarroll & Hamann, 2020). Sözcü and Türker (2020) emphasize that it encompasses not only knowledge of water resources but also the development of positive attitudes and behaviors that promote sustainable living. Project WET's (Water Education for Teachers) seven core principles provide a foundational framework for water literacy, covering topics such as the structure of the water molecule, water as the basis of all life, its interconnectedness with Earth's systems, and its management as a natural resource (Project WET, 2011).

Functional water literacy, however, is not limited to individuals' understanding of hydrological concepts underlying socio-hydrological issues (SHI). It also requires considering the social, cultural, and behavioral dimensions of these issues simultaneously (Owens et al., 2020).

Water literacy is situated within broader literacy frameworks such as Environmental Literacy (EL), Sustainability Literacy (SL), and Education for Sustainable Development (ESD) (Demir & Ulukaya Öteleş, 2023). Environmental literacy is particularly significant as the planet's ecological health continues to decline; it aims to develop environmental awareness, critical thinking, curiosity, and analytical skills for addressing environmental problems (Hollweg et al., 2011). Similarly, Karatekin (2013) provides a theoretical basis for positioning water literacy as a subdimension of environmental literacy, describing it as a complex construct that integrates knowledge, skills, attitudes, and values.

In today's educational context—where multiple literacies such as political, financial, media, and digital literacy are emphasized—the inclusion of water literacy strengthens the vision of preparing

students with the competencies required for the 21st century. Moreover, adopting a comprehensive approach to water literacy within the framework of climate change can be achieved through a "blue" and interdisciplinary curriculum, enabling students to understand the broader dimensions of the hydrosocial cycle (Boon, 2024).

According to the MoNE (2018), the multiliteracies approach in current curricula includes political, financial, media, and digital literacy. However, the absence of water literacy among these categories reveals a gap within the social studies curriculum. Positioning water literacy within the multiliteracies model underscores the importance of equipping students with the cognitive and social skills necessary for success in the twenty-first century.

Furthermore, UNESCO's (2023) *Education for Sustainable Development* (ESD) framework highlights the importance of education that fosters awareness, responsibility, and sustainable behaviors to address global challenges such as water scarcity. As a vital component of building sustainable societies, water literacy is thus inherently connected to ESD.

The pedagogical foundation of this study is grounded in constructivist and experiential learning theories (e.g., Kolb, 1984; McLeod, 2019), which emphasize that learners construct knowledge through social interaction and lived experience. Water literacy, which involves knowledge, skills, and attitudes, should therefore be cultivated from an early age to foster sustainable awareness and behaviors. Among the pedagogical approaches recommended for developing water literacy are the use of visual tools, place-based learning, and interdisciplinary curriculum design (McCarroll & Hamann, 2020; Mostacedo-Marasovic et al., 2022). These approaches help bridge abstract hydrological concepts with real-world contexts, promoting civic engagement and responsible water use.

1.3. The Purpose of the Study

This study aims to examine the perspectives of 8th-grade students who have taken the social studies course regarding water literacy. In light of these perspectives, it also seeks to evaluate their knowledge, attitudes, and awareness. While the main goal is to understand students' attitudes toward water through their own expressions, the study additionally investigates how they approach water conservation, perceive related challenges, and evaluate the extent to which their educational experiences have enhanced their understanding of these issues.

Accordingly, the study addresses the following research questions:

RQ 1) How do students define the concept of water literacy, and what meanings do they attribute to it, including their interpretation of the saying "*Drop by drop, it disappears*"?

RQ 2) What behaviors do students demonstrate in their daily lives regarding water conservation, and how do they respond to situations involving unconscious or wasteful water use?

RQ 3) How do students perceive current and future water-related problems in Türkiye, and which issues do they consider to be priorities?

RQ 4) What solutions do students propose for addressing water-related challenges?

RQ 5) What contribution does the social studies course make to the development of students' knowledge and awareness of water-related issues?

2. Method

2.1. Research Design

This study aims to thoroughly explore the perspectives of 8th-grade students regarding water literacy. To achieve this purpose, a basic qualitative research design was employed. Basic qualitative research focuses on uncovering individuals' meaning-making processes, perceptions, and experiences related to a particular phenomenon (Merriam, 2013). In this context, the study sought to reveal students' thoughts, attitudes, and interpretations concerning water literacy.

2.2. Participants

The study group consisted of 15 eighth-grade students selected from four public middle schools located in the western part of Türkiye—two schools from the town center and two from rural areas. In total, 164 students were initially reached within the study scope. During the first phase of data collection, two instruments were administered: the Water Literacy Questionnaire developed by Sözcü and Türker (2020), and the Water Attitude Scale developed by Ülger (2011). Based on the results obtained from both tools, students were classified into three categories according to their water literacy levels: low, medium, and high. In total, 33 students were identified as having low water literacy, 68 as medium, and 63 as high. This classification served as the foundation for selecting participants for the qualitative interviews, allowing for a deeper examination of students' knowledge, attitudes, and behaviors across varying levels of water literacy. Furthermore, the scale scores provided a framework for comparing students' quantitative results with their qualitative views expressed during interviews.

Approximately 10% of students from each category were selected for interviews: three from the low group, six from the medium group, and six from the high group—yielding a total of 15 participants. In-depth, semi-structured interviews were conducted with these students using an interview form developed by the researchers. Prior to data collection, the necessary ethical committee approval and legal permissions for using the interview form and scales were obtained.

For participant selection, the study employed maximum variation sampling, a purposeful sampling technique commonly used in qualitative research. This method was chosen to capture both commonalities and differences among students with diverse characteristics, thereby providing a comprehensive understanding of the phenomenon under study. Each participant was assigned a code (e.g., S1, S2, S3 … S15) to ensure confidentiality.

Demographic information about the participants is presented in Table 1.

Table 1
Demographic information of the participants

Alias	*Gender*	*Age*	*Settlement Type*	*Interview Durations*	*Water Literacy Levels*
S1	Male	14	Town	4.53 min	76
S2	Female	14	Rural area	3.22 min	83
S3	Male	13	Rural area	4.13 min	85
S4	Female	14	Town	4.25 min	98
S5	Female	14	Rural area	6.11 min	101
S6	Female	13	Rural area	4.22 min	103
S7	Female	14	Town	3.46 min	103
S8	Male	14	Rural area	5.34 min	104
S9	Male	14	Rural area	3.52 min	106
S10	Male	14	Town	4.46 min	114
S11	Male	14	Town	5.21 min	112
S12	Female	14	Rural area	5.14 min	115
S13	Male	14	Rural area	5.20 min	121
S14	Male	14	Rural area	4.29 min	122
S15	Female	14	Town	4.51 min	150

The participants were eighth-grade students aged 13–14 from both village and district center schools. The gender distribution was balanced, consisting of eight male and seven female students. The interviews lasted between three and six minutes, a duration considered appropriate given the participants' age, attention span, and verbal expression skills at this developmental stage. Previous research indicates that shorter interviews with children can still be effective in obtaining rich qualitative data (Hill, 2006; Irwin & Johnson, 2005; Punch, 2002).

Water literacy levels were determined based on the following score ranges: 54–85 for *low*, 86–108 for *medium*, and 109–150 for *high*. Most participants fell within the medium and high

categories, with only one student in the low range. This distribution suggests that students generally possess a high level of awareness about water, which was reflected in their interview responses.

2.3. Data Collection Tools

In the first phase of the study, two measurement tools were used to assess students' knowledge, attitudes, and sensitivity toward water. The first was the Water Literacy Scale developed by Sözcü and Türker (2020), and the second was the Water Attitude Scale developed by Ülger (2011). The Water Literacy Scale consists of three subdimensions: water conservation, water awareness, and water sensitivity. It includes 30 items in total—items 1–13 focus on water conservation, items 14–25 on water awareness, and the final five items on water sensitivity. The scale employs a five-point Likert format, ranging from strongly agree (5) to strongly disagree (1). The Water Attitude Scale, on the other hand, comprises three factors: Water-Related Problems, Importance and Efficient Use of Water, and Love of Water. The factor loading values range from .65 to .97 for the first dimension, .50 to .80 for the second, and .42 to .74 for the third. The scale contains 32 items in total, including 18 positive and 14 negative statements. Positive items are scored from 5 to 1, while negative items are reverse-scored from 1 to 5. The minimum possible score is 32, and the maximum is 160. Higher scores indicate more positive attitudes toward water, whereas lower scores reflect more negative attitudes.

For both scales used in this study, permission was obtained from the original developers, and the necessary legal authorizations were secured. Documentation of this correspondence is included in the appendix section of the study. The scores derived from the two scales were used to categorize students into low, medium, and high water literacy levels. This classification facilitated a comparative analysis of students' perspectives on water literacy across groups. The quantitative results from the scales were used solely for participant selection and not for statistical analysis.

Based on this classification, a semi-structured interview form developed by the researchers was administered to the selected students. To ensure the content validity of the interview form, feedback was obtained from two subject-matter experts and one language expert. The final version of the form included ten questions. Qualitative data collected through this instrument enabled an in-depth exploration of students' perceptions and experiences related to water literacy. Participation in the study was entirely voluntary, and written consent was obtained from the parents of all participating students.

2.4. Data Analysis

The qualitative data collected in the study were analyzed using thematic analysis. Thematic analysis, as defined by Braun and Clarke (2006), is a method for identifying, analyzing, and reporting patterns or themes within qualitative data. It enables researchers to uncover meanings across participants' experiences and interpret the underlying ideas represented in the dataset.

An inductive approach was adopted, allowing themes to emerge directly from the data rather than being guided by predetermined categories (Braun & Clarke, 2006, 2019). The analysis process followed six main phases: (i) Becoming familiar with the data, (ii) Generating initial codes, (iii) Searching for themes, (iv) Reviewing themes, (v) Defining and naming themes, and (vi) Producing the report.

The qualitative data were obtained through semi-structured interviews with 15 students. All interviews were audio-recorded after participants were informed that the recordings would be used solely for transcription purposes, would remain confidential, and would not be shared outside the research context. The recordings were then transcribed verbatim into digital format. During the coding process, meaningful expressions reflecting students' perspectives on water literacy were identified and labeled. These codes were subsequently organized into themes that represented shared patterns and interpretations across participants' responses. To enhance the clarity and visual presentation of the findings, color tones were used in tables to improve readability and thematic distinction.

2.5. Data Analysis

To ensure the validity and reliability of the study, several qualitative research strategies were employed, including expert review, detailed description, and purposive sampling (Creswell, 2013). In selecting the study group, purposive sampling was used to identify participants most capable of providing in-depth insights and relevant responses to the research questions. The collected data were analyzed using a detailed descriptive approach, and participants' statements were supported with direct quotations to enhance data transparency and strengthen the validity of interpretations. Additionally, participant confirmation was obtained from students for the interview transcripts to further ensure reliability.

Following the completion of the coding process, expert opinions were sought to evaluate the validity of the identified codes and themes. As a result of this process, 20 themes were established. A minor disagreement occurred regarding one code within the theme of recycling, while full consensus was achieved on all other codes. To assess the consistency of the coding, the reliability formula proposed by Miles and Huberman (1994) was applied:

$$\text{Reliability} = \frac{\text{Consensus}}{\text{Consensus} + \text{Disagreements}}$$

The reliability coefficient for the study was calculated as 0.95, indicating a high level of agreement among the coders and strong consistency in the thematic analysis (Patton, 2015).

3. Findings

This section presents the findings derived from the students' responses to the semi-structured interview form developed by the researcher. The form consisted of open-ended questions designed to explore students' perspectives on water literacy.

3.1. Findings Related to the First Research Question

In accordance with the first research question, this section presents findings on how students define water literacy and what meanings they attribute to it, including their interpretation of the saying "*Drop by drop, it disappears*." The results obtained from the data analysis are summarized in Table 2**.**

Table 2
Students' perceptions of water literacy and their interpretations of the saying "Drop by drop, it disappears"

Themes and codes	*Students' Responses*	*Students*
Water Literacy		
Personal knowledge acquisition	Being knowledgeable about water	S5, S6, S8, S12, S14
	Conducting research related to water	S1, S13
	Understanding the importance of water	S15
Social Awareness	Informative texts about water	S7, S10
	Raising public awareness about water	S4, S14
	People educated about water	S3
	Being environmentally conscious about water use	S1
Proverb		
Conservation	Even small amounts of waste lead to loss	S1, S3, S5, S9, S10, S11, S12, S15
	If faucets are left running, it disappears	S3, S6, S10, S13, S14, S15
	It means wasting water	S1, S3, S14
Protection	It cannot be recovered	S4
	Even a single drop is valuable	S7
	We should store water	S8
No Response	I have no idea	S2

As shown in Table 2, students' definitions of water literacy primarily focus on understanding the importance of water and raising awareness about its use and conservation. This indicates that students perceive water literacy as both a form of personal knowledge and a dimension of social responsibility. For example, S5 (medium group) described individuals with water literacy as "people who have more knowledge about water than the average person, acquire more information, and are aware of this information." Similarly, S12 (high group) emphasized the importance of sharing such knowledge with others, stating that "those who have more knowledge about water than the average person, who know what needs to be done, and share this with others." To provide an overview of students' perceptions of water literacy, a word cloud was created and presented in Figure 1.

Figure 1
Word cloud illustrating students' perceptions of water literacy

Figure 1 illustrates the concepts most frequently used by students when defining water literacy—such as knowledge, awareness, conservation, protection, and consciousness—highlighting their multidimensional understanding of water literacy, which encompasses both cognitive and behavioral or responsibility-based aspects. The distribution of concepts in the word cloud suggests that students not only acquire knowledge but also develop a sense of social responsibility toward water conservation. Moreover, the prominence of terms related to everyday life, such as water conservation and valuing water, indicates that students actively translate their understanding of water literacy into daily practices.

Building on the word cloud findings, students' interpretations of the proverb "Drop by drop, it disappears" further demonstrate how knowledge can be transformed into concrete behaviors. For example, S6 (medium group) emphasized the danger of ignoring small acts of waste, stating, "Even if a tap is left open somewhere, even if it's just a drop, it disappears drop by drop." Similarly, S10 (high group) highlighted the magnitude of potential loss, explaining, "Even if the tap only drips a little and is left open until evening, liters of water could be wasted." In contrast, S1 (low group) associated the proverb directly with waste, stating, "They usually say that drop by drop forms a lake, but I don't think so—it forms a desert."

When these responses are considered together, the students' definitions highlight the cognitive and awareness-based aspects of water literacy, whereas their comments on the proverb reflect a more behavioral and action-oriented dimension. This indicates that culturally embedded proverbs

can help translate abstract knowledge into practical attitudes and behaviors. At the same time, some students' limited interpretations reveal varying levels of understanding, underscoring the need for more comprehensive and systematic water literacy education.

3.2. Findings Related to the Second Sub-Problem

The second research question addressed was: "How do students behave in terms of water conservation in their daily lives, and how do they respond to situations where water is used unconsciously?" To explore this question, students were asked: "Do you conserve water? If so, where and in what ways?" The findings obtained from the data analysis are presented in Table 3.

Table 3
Students' behaviours in daily life about water conservation and their responses to unconscious water use

Themes and codes	*Students' Responses*	*Students*
Water Conservation Behaviors		
Conserving Water	I do	S4, S5, S6, S7, S8, S10, S11, S13, S14, S15
	I try to do	S1, S9, S12
	Occasionally	S2, S3
In Daily Life	While brushing teeth	S1, S2, S3, S4, S5, S6, S9, S12, S13, S14, S15
	While watering plants	S8, S9, S11
	While washing the car	S13
	Doing the dishes	S2, S5, S9, S12, S15
At Home	In the bathroom	S1, S7, S10, S13
	In the kitchen	S6, S7, S14
	Doing the laundry	S5, S12
	Fixing leaky taps	S11, S14
At School	Turning off running taps	S4, S8, S10
Reactions to Unconscious Water Use		
Warning	I would warn them regardless	S4, S6, S8, S9, S10, S12, S13, S14
	If it's someone close to me	S1, S7
	If the person is younger than me	S1
Responsibility	I would turn off the tap myself	S2, S6, S8
	I would do nothing	S3
Critical Thinking	I would ask why they did it	S5, S11
	I would explain that what they did was wrong	S5, S15

Upon examining Table 3, it becomes evident that most students reported adopting water-saving behaviors in their daily lives. Their practices generally centered on simple and immediate actions, such as turning off the tap while brushing their teeth, which they described as the easiest way to save water. However, some students extended these behaviors into more deliberate strategies within their household routines. For instance, S9 (medium group) stated:

> In my daily life, I do not leave the tap running while brushing my teeth. Additionally, I try to use the dishwasher more often when washing dishes and take care not to pre-rinse them. I do not leave the water running while watering the garden. I try to turn it off immediately.

Such statements demonstrate awareness that goes beyond basic habits and reflect an effort to align everyday practices with water-conservation principles. Similarly, S11 (high group) expressed a stronger sense of responsibility:

> In agriculture, for example, at home too. In agriculture, we use rainwater. We store it in a tank and use it when needed. At home, for example, if there is a leaking tap, I tell my father that we need to fix it so it doesn't drip.

This illustrates that some students view water conservation not merely as an individual act but as a collective responsibility involving family and community members. The findings also reveal how students responded to others' unconscious water use. Most indicated that they would issue verbal warnings, though the extent of these interventions varied. Some were willing to warn anyone, while others restricted their responses to peers or younger individuals. A few students preferred explanation and dialogue as a corrective approach. For example, S15 (high group) stated, "I would explain that what they are doing is wrong," whereas S5 (medium group) said, "I would ask why they are doing it." These responses reflect an emerging tendency toward critical engagement, suggesting a transition from passive observation to active intervention. In contrast, one student (S3, low group) admitted, "I would do nothing," revealing that indifference persists for a minority of participants—approximately 20%—whose awareness has yet to evolve into responsible behavior.

Overall, students' approaches to water conservation and their reactions to unconscious water use represent different levels of engagement with water literacy. At the most basic level, students engage in individual, low-effort actions such as turning off taps. At an intermediate level, they incorporate water-saving behaviors into household routines or take corrective measures. At the advanced level, a smaller group attempts to influence others through dialogue and advocacy. These layered behaviors indicate that awareness of water conservation is generally present among students, although its consistency and depth vary.

This finding suggests that educational initiatives should not only provide knowledge but also cultivate proactive participation grounded in responsibility and social engagement. In conclusion, while students display promising awareness and behavioral tendencies, all learners would benefit from sustained education and structured opportunities to transform this awareness into lifelong, sustainable water practices.

3.3. Findings Related to the Third Sub-Problem

The third question in the interview form asked, "What do you think is the most important issue related to water?" In line with the revised sub-research question — "How do students perceive current and future water issues in Türkiye, and what issues do they consider to be priorities?" — the findings obtained from the data analysis are presented in Table 4.

When examining students' perceptions of current water issues, it was found that they primarily attribute these problems to human behavior, as shown in Table 4. Specifically, they frequently mentioned unconscious use and waste. One student described the situation as follows: "It's used unnecessarily or excessively. Actually, the amount of water that should be used is clear, but sometimes we use double or triple that, unnecessarily" (S5, medium group). Similarly, another student highlighted the general disregard for the possibility that water could run out: "People don't use it efficiently. They don't act as if it could run out. Most people are unaware of this… I don't think they really care" (S12, high group). These statements suggest that students perceive water issues through both an environmental and a social responsibility lens.

Students' opinions about Türkiye's water resources present a mixed picture. While some believed current resources are sufficient, others argued they are inadequate due to population growth and careless usage. For example, one student stated: "I don't think it's sufficient for our country. We already have a huge population, so it's not enough. Also, I don't think people are conserving water much either" (S6, medium group). In contrast, a few students believed that technological advances could offer solutions. One participant explained: "Actually, I don't think so, because the Chinese and others developed machines to convert seawater into freshwater. I think Türkiye could find or produce similar technologies" (S1, low group). These differing perspectives suggest that while students are aware of potential water stress in Türkiye, they may not fully grasp its scale or urgency. Some students, however, recognized the importance of responsible usage, as reflected in S12's (high group) remark: "If we manage to use it properly and correctly, its sufficiency will be in our own hands anyway."

Table 4
Students' perceptions of current and future water issues in Türkiye and the priorities they consider important

Themes and codes	*Students' Responses*	*Students*
Current Issues		
Pollution	Water being polluted	S9, S10
	Water pollution	S2, S4, S6, S7
	Waste thrown into the seas	S4, S10
	Water being wasted / water wastage	S3, S13, S8, S14
	Excessive and unnecessary use	S3, S5, S9, S12
Global Issues	Scarcity of freshwater resources /Depletion of water/ Evaporation of water/ Global warming/Water scarcity	S1/ S6/ S11/ S13
Türkiye's Water Resources		
Are Türkiye's water resources sufficient for our country?	Sufficient/ I think it is sufficient	S3, S5, S7, S9, S10, S12, S15/ S14
	Not sufficient /Freshwater is not sufficient	S1, S2, S4, S6, S11, S13/ S8
Do you think our country will face water shortages in the future?	Yes / I do	S2, S3, S4, S5, S6, S7, S8, S9, S10, S11, S12, S13, S14, S15
	No / I do not	S1
Future Problems		
Direct Water-Related Issues	Water scarcity	
	Water pollution	
	Depletion of water	
	Depletion of drinking water	
	Decline in freshwater availability / disappearance of water resources	
Indirect Water-Related Issues	Drought	S5, S7, S8, S9, S13, S14
	War over water / conflict	S3, S6/S10
	Desertification	S2, S9
	Inability to grow crops	S11, S13
	Suspension of agricultural activities / inability to maintain hygiene / health problems / death of living beings / global disorder / extinction of aquatic species	S11/ S12/ S14/ S10/ S4

When discussing future water problems, students' predictions extended beyond issues of scarcity or pollution. They mentioned broader consequences such as drought, agricultural challenges, health risks, and even potential social conflicts. One student expressed this concern: "If people continue to use this much water at this rate, drought is going to happen, and I think drought will become one of the worst things in the world because it affects even the lives of animals and humans" (S5, medium group). Another focused on public health, stating: "We won't be able to maintain our hygiene. That would cause major problems for us... many health issues will emerge because water is something our body absolutely needs" (S12, high group). Conversely, some students viewed these issues as distant and believed technology would eventually offer solutions. For instance, S1 (low group) noted: "Freshwater will inevitably decrease... but people will find a solution."

Overall, students' views indicate that they regard human actions as the main cause of water-related problems and foresee a wide-ranging threat to the future. However, their tendency to downplay the current severity of these issues while deferring concern to the future reflects a partial and sometimes overly optimistic understanding. These findings suggest that students' water literacy remains inconsistent and, in some cases, shaped by idealized expectations of

technological solutions. Therefore, water education should move beyond simple knowledge transfer to foster critical awareness, realistic understanding, and proactive responsibility regarding current and future water challenges.

3.4. Findings Related to the Fourth Sub-Problem

The fourth set of questions in the interview form addressed the sub-research question: "What solutions do students propose for addressing water-related challenges?" The findings obtained from the data analysis are presented in Table 5.

Table 5
Students' proposed solutions for preventing water-related problems

Themes	*Students' Responses*	*Students*
Recycling	Desalination of seawater	S1
	Purification of polluted water	S12
Conservation	Water should be conserved	S2, S5, S10, S13
	Not leaving taps running	S15
	Prevention of waste	S8
Cleanliness	Not littering in the sea	S4, S10
	Not polluting water	S7, S15
	Avoiding pollution of water bodies	S15
	Placing trash bins on beaches	S4
Awareness	People should be informed	S3, S4, S6, S9, S14
	Use water carefully and consciously	S7, S9
	Students and parents should be informed	S5
	Posters should be hung	S6
	We should plant trees	S8
No Response	I don't know	S11

As shown in Table 5, students proposed a range of solutions for preventing water-related problems. However, their suggestions went beyond simple descriptions and provided valuable insights into their levels of water literacy. For example, S3 (low group) attributed water problems to a lack of education and stated that "free schools should be opened for the public," further explaining that "it would be helpful to set up schools for people who are uninformed or who haven't studied up to middle school, where they can attend for free and learn about these things." This response suggests that the student perceives water literacy primarily as a means to overcome the lack of knowledge.

Similarly, S5 (medium group) focused on everyday water-saving behaviors and emphasized that "the correct use of water should be taught within the family." They added:

> I think we must first understand how important water is to us to use it properly. After that, for instance, some people keep the tap running unnecessarily while washing or soaping their hands. I think they shouldn't do that. They should turn it off while brushing their teeth. Even a small chore uses too much water. We can do more work using the same amount of water by being more efficient. I believe students should be taught about this in schools so that they can pass it on to their families.

This statement indicates that students with intermediate water literacy tend to prioritize social learning and collective awareness over individual actions. In the same vein, S7 (medium group) drew attention to environmental and policy-related factors, remarking that "to prevent water problems, we need to be more careful. For example, since factories are often built near lakes and seas, the water gets polluted. I think factories shouldn't be built in those areas." This response is notable as it shows that the student's understanding of water literacy has expanded to include environmental and political dimensions. Conversely, S11 (high group) did not offer any concrete suggestions, implying that even students with higher academic performance may struggle to translate theoretical understanding into practical, solution-oriented thinking within the context of water literacy.

Overall, these findings reveal that students' proposed solutions reflect both their behavioral tendencies and their levels of water literacy. It is therefore crucial to teach water-saving behaviors systematically within education while also equipping students with the skills to address water issues from environmental, social, and political perspectives. Integrating these dimensions into the curriculum could help develop a more comprehensive and action-oriented understanding of water literacy among students.

3.5. Findings Related to the Fifth Sub-Problem

The fifth sub-research question of the study was: "What is the contribution of the social studies course to students' knowledge and awareness about water?" The findings obtained from the student interviews addressing this question are presented in Table 6.

Table 6
Contribution of the social studies course to water literacy and the knowledge acquired

Themes	*Students' Responses*	*Students*
Lack of Acquisition	I don't remember	S2, S3, S7, S8, S9, S11, S12, S13, S14
Values and Attitudes Gained	Conservation	S10, S15
	Awareness	S1, S4,
Geographical Information	Information about seas	S6
Historical Content	Wars at sea	S5

When Table 6 was analyzed, it was found that students perceived the contribution of the social studies course to their water literacy as limited. S1 (low group) stated that the course contained only a small amount of water-related content, explaining: "I think we usually cover environmental and climate cycles in science lessons. There was not much about water in social studies. I mean, there are some contents such as awareness in social studies."

Students in the medium group (S3 and S7) also noted that the course played only a partial role in developing water literacy and emphasized that this contribution was limited. S3 commented: "It helped a little bit at the beginning of secondary school," while S7 remarked: "It helped a little bit in previous years."

Although students in the medium and high groups acknowledged that the course supported water literacy to some extent, they also stated that the knowledge gained was not long-lasting. S6 mentioned that the water-related content was inadequate, noting: "We learn about seas and oceans in this course, but this alone is not enough." Similarly, S14 (high group) accepted that the course had some contribution but described it as insufficient, adding: "I think it contributes, but it is not enough. It should be emphasized more. I don't remember what kind of information we learned about water in the lesson."

4. Discussion

Students were first asked to describe their understanding of the concept of water literacy. Most students explained this concept in terms of personal awareness, knowledge, and social responsibility. However, the fact that some students were completely unaware of the concept was a remarkable finding. The primary reason for these differences and conceptual limitations is believed to be the limited integration of water literacy skills within the curriculum. Indeed, in the study conducted by Özerdinç and Hamalosmanoğlu (2021) with secondary school students, it was observed that students defined water literacy as "knowing how to use it," "realizing that the future consumes water," "knowing that water is limited," and "having awareness about water." This result suggests that water literacy extends beyond cognitive knowledge to encompass attitudes and awareness (Pozo-Muñoz et al., 2023). Consistent with previous findings at the undergraduate level, many students struggle to accurately conceptualize groundwater flow and river-erosion processes (LaDue et al., 2021). In line with this, the present study indicates that middle-school students demonstrate a limited conceptual understanding of water literacy, despite showing awareness in their daily practices. Similarly, Cheng et al. (2019) emphasized that the

education system is inadequate in promoting students' water literacy and adaptation to water resources, highlighting the need for innovative, experience-based, and holistic approaches. In addition, students' interpretation of the proverb "A drop becomes a lake" shows that cultural elements in daily language are effective in fostering awareness of conservation. This finding underscores the importance of cultural context in awareness-raising activities.

When students' behaviors toward water use in daily life were examined, the majority displayed conscious and responsible attitudes. Practices such as collecting rainwater, turning off taps, and using water carefully demonstrate that students possess a high level of environmental awareness. This finding is consistent with Işıtan's (2023) study of high-school students, which revealed similar saving behaviors, including turning off the tap while brushing teeth, closing open taps, avoiding excessive water consumption during showers, using rainwater in gardens, and repairing leaky taps. When this study and similar research are evaluated together, it can be concluded that positive attitudes and behaviors toward water conservation begin to develop at an early age. Indeed, Fielding et al. (2012) showed that environmental knowledge and habits acquired early in life significantly influence long-term conservation behaviors. Likewise, Mullenbach and Green (2018) reported that knowledge gained through environmental education positively affects individuals' environmental attitudes and behaviors—findings that highlight the potential of water-literacy education to foster awareness and responsibility. However, as Mostacedo-Marasovic et al. (2022) point out, current educational standards largely prioritize the cognitive domain while neglecting affective dimensions such as responsibility, empathy, and emotional engagement. This imbalance may explain why students, despite demonstrating awareness, still struggle with deeper conceptual understanding. At the same time, the fact that students in this study directly or indirectly warned people who used water unconsciously can be considered additional evidence of their growing awareness and sensitivity. According to Xu et al. (2019), water knowledge, emotion, and responsibility significantly influence behavior, with emotion and responsibility mediating the relationship between knowledge and behavior. Similarly, Kang (2022) emphasizes that water literacy is a multifaceted construct shaped by the interaction of behaviors, attitudes, and knowledge, and their structural-equation model indicates that, although attitudes and general literacy are influenced by knowledge, water-related behaviors—such as caring for, conserving, and protecting water—most strongly predict overall water literacy.

Upon analyzing students' opinions on environmental issues, it was found that the most frequently mentioned topics were waste, pollution, and global warming. This finding indicates an increasing awareness among students of the negative impacts of human behavior on the environment. However, it was also noteworthy that many students lacked sufficient knowledge about Türkiye's water resources. Although the country faces the threat of water scarcity, most students believed that existing resources are sufficient. As Barbier (2019) points out, the perception that water is abundant shapes both societal behavior and related technologies and policies. Nonetheless, students also expressed concerns about the future. Indeed, drought and water scarcity were the most frequently cited problems for the coming years. These projections align with Mahler's (2009) findings regarding the availability of drinking water.

When examining students' proposed solutions to water-related problems, most emphasized the necessity of raising societal awareness first. This shows that students recognize a lack of social sensitivity toward water issues. Similarly, saving water was one of the most frequently mentioned strategies. These findings are consistent with those of Özerdinç and Hamalosmanoğlu (2021) and Işıtan (2023), in which students suggested both technical measures—such as installing filter systems, conducting inspections, imposing sanctions, and supporting treatment-recycling processes—and behavioral measures, such as promoting public awareness, frugality, avoiding littering, and providing education. Therefore, the rational and efficient use of existing resources, as well as the expansion of available ones, remain central strategies for preventing today's water crisis (Kapan, 2007).

When the function of the social studies course was assessed, some students highlighted its benefits, while others emphasized that the curriculum does not adequately address water-related issues. This finding indicates that a critical topic such as water literacy should be incorporated more comprehensively into the curriculum. The analyses also revealed that students generally viewed the social studies course's contribution to water literacy as limited. However, despite this, most students still believed that the course helped improve their water-literacy skills. One reason for this limitation is the insufficient inclusion of water-related content in the curriculum, which prevents students from gaining lasting knowledge and developing sustained literacy skills. The course mainly covers limited topics, such as awareness and conservation, which are not enough to fully support students' water-literacy development. This gap was clearly reflected in students' responses about World Water Day. When asked about this day, all students reported having no prior knowledge of it. Regardless of gender, school, or region, every participant stated that they had heard of it for the first time. Although World Water Day (March 22) is officially recognized as a special day by the Ministry of National Education (MoNE, 2023), the fact that none of the students were aware of it suggests that this topic is not sufficiently addressed in schools or the social-studies curriculum. This finding demonstrates that students are not receiving adequate support through extracurricular activities or school programs to acquire basic water-literacy knowledge and that any such awareness, when present, is likely gained through the social-studies course itself.

In Demir and Ulukaya Öteleş's (2023) study, it was similarly observed that water literacy is not directly structured within the curriculum and is mostly addressed indirectly through environmental education and climate-change topics. Işıtan (2023) also found that most students reported receiving no formal education about water. However, the development of awareness and sensitivity toward water is only possible through education (Levy & Moore Mensah, 2021; McCarroll & Hamann, 2020). As noted by Levy and Moore Mensah (2021), experiential and inquiry-based science instruction helps students identify and correct misconceptions, particularly about complex systems such as the water cycle. In this context, Ursavaş and Aytar (2018) emphasized that transforming attitudes toward water into lasting behaviors can be achieved only through consistent and early education. Furthermore, Ursavaş and Baki Pala (2021, p. 84) stress that addressing the right to water from a human-rights perspective and integrating it into the social-studies curriculum would be an important step in promoting water literacy. This recommendation aligns with global trends identified in bibliometric analyses, which highlight the necessity of comprehensive, curriculum-based water education to enhance conceptual understanding and sustainable behaviors (Imaduddin & Eilks, 2024). Therefore, adopting a human-rights-based approach to water literacy—one aligned with the Sustainable Development Goals—is essential for strengthening students' knowledge and competencies in this domain.

Finally, students' lack of knowledge about World Water Day was a striking finding. This suggests that a globally significant awareness day, such as March 22, is not sufficiently visible in educational practices. Ilgar (2020) also noted that water-literacy education in Türkiye largely remains theoretical and argued for a more applied, holistic, and sustainable approach capable of fostering behavioral change. Similarly, Çakır (2016) observed that World Water Day was not celebrated in any school. These findings indicate that students are not being adequately guided on such a vital issue as water awareness and that these themes should be made more visible in educational environments. Moreover, considering that future planning will be shaped by population growth, urbanization, land use, and climate change, water-resource management must prioritize the efficient use of existing natural resources (Işık Mercan, 2016).

Overall, the results indicate that students' water literacy is at a moderate level. While they demonstrate positive attitudes and behaviors, there remain notable gaps in their knowledge and understanding. It is encouraging that students can propose practical solutions, exhibit responsible behaviors in daily life, and show sensitivity toward unconscious water use. However, their limited knowledge of Türkiye's water resources and lack of awareness of World Water Day reveal

deficiencies in the education system. In conclusion, this study emphasizes the need for a structured, interdisciplinary, and sustainable water-literacy education model that integrates cognitive and affective dimensions. It also reveals that the role of the social studies course in developing long-term awareness and responsibility should be significantly strengthened.

5. Conclusion

This study has determined that the majority of eighth-grade students possess a moderate level of water literacy. However, notable differences exist within the same categories. For example, some pupils in the "low" category demonstrated higher environmental awareness than expected, while some in the "high" category provided limited and superficial responses. This demonstrates that water literacy is too complex and multidimensional to be fully assessed by quantitative criteria alone. Similarly, a study in Taiwan found that although people had high water awareness, their daily habits often limited behavior change (Yu et al., 2021). These discrepancies underscore the importance of incorporating qualitative perspectives that account for students' beliefs, values, and practical experiences. The survey results show that, while students demonstrate high water-saving behaviors and good water sensitivity, they rarely engage in activities such as reading about water protection, indicating limited independent water-related learning (Yentür et al., 2022). In parallel, Meilinda et al. (2023) in Indonesia demonstrated that students' water literacy levels are influenced by knowledge, their environment, cultural practices, and familial interactions. Consequently, water awareness emerges as an experience deeply embedded in daily life.

The findings indicate that a combination of knowledge, environmental factors, cultural elements, and family experiences shapes water literacy. Differences between urban and rural students suggest that contextual factors, such as access to education and awareness-raising activities, play a decisive role.

In light of these findings, it is concluded that developing comprehensive water literacy requires structured, interdisciplinary, and experience-based educational practices that address both cognitive and affective dimensions. Early family and community experiences play a crucial role in shaping lasting attitudes towards water conservation and ethical use (Demir Evcimen et al., 2025). Adopting a human rights-based approach aligned with the Sustainable Development Goals will help equip students with the knowledge, awareness, and competence needed to address future water challenges. This perspective aligns with the World Economic Forum's (2025) projection that without urgent and coordinated educational interventions, environmental risks—particularly resource shortages and pollution—will intensify by 2035. Therefore, water literacy is an indispensable competency for sustainable living and requires integration of science, social studies, and other disciplines through an interdisciplinary approach.

6. Recommendations

Based on the findings of this study, several recommendations can be made to enhance students' water literacy. First, an interdisciplinary approach should be adopted across social studies, science, life sciences, and environmental education courses to ensure that students develop both conceptual understanding and practical awareness of water-related issues. In addition, textbooks should incorporate practical activities and real-life examples focusing on water conservation, efficient use, and global water challenges to help students connect theoretical knowledge with everyday experiences. Furthermore, awareness events should be organized as part of World Water Day (March 22) to encourage students to learn about both local and global water concerns through active engagement. Finally, students should be encouraged to participate in community-based water awareness campaigns and cooperative decision-making activities, which can foster social water literacy by promoting responsible actions, collective problem-solving, and an appreciation of the broader social benefits of sustainable water management.

7. Limitations

Although this study employed a comprehensive approach, it still has certain limitations. This study involved 15 eighth-grade students from four state secondary schools in the Kaynarca district of Sakarya province. Since this is a qualitative study, the findings are specific to the context and do not seek to make statistical generalizations. However, they might offer valuable insights for similar educational settings. Additionally, the short length of the interviews may have affected the depth of some student responses. In addition, as with all qualitative studies, researcher bias and the limitations of self-report data should be considered, as these factors may have influenced the collection and interpretation of students' responses.

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