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Water literacy status of primary school 4th-grade students

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Abstract

The study aims to determine the water literacy status of 10-year-old students in the Western Black Sea Region of Turkey. When critical thinking skills develop, water literacy can be acquired, especially in the 4th grade of primary school. For this reason, a study group was created with the voluntary participation of 358 students and the cognitive, affective, and behavioral dimensions of water literacy of 10-year-old students. "Attitude scale towards water" and "verbal and visual expression form" were used to collect data. The data obtained from the scale were analyzed with an Independent Sample T-Test One-Way ANOVA test via IBM SPSS Statistics 23. The data obtained from the form were organized into categories and concepts/visuals. Direct quotes and pictures were included to show the verbal and visual expressions of the students in detail. The research results show that students' attitudes towards Water are affected by factors such as where they live, their drinking water usage, the number of siblings, and their parents' education levels. When the verbal and visual expressions of the students express the concepts related to water literacy correctly verbally and visually. The research results will develop young students' positive attitudes towards water.

Keywords: Water literacy, Primary school students, Mixed research, Türkiye.

Introduction

Water is vital for a sustainable future as a human, industrial, and ecological resource (McCarroll & Hamann, 2020). When people go to their taps to access this ingredient, few think about where the Water comes from and what processes it must go through before it reaches their glasses (Johnson & Courter, 2020). Although three-quarters of the world is covered with Water, 36% of the world's existing water resources are in Asia, 25% in South America, 15% in North America, 11% in Africa, 8% in Europe, and 5% in Oceania (Sözcü & Türker, 2020a). In particular, despite being surrounded by seas, Turkey is in a region where usable water resources are insufficient. This situation necessitates Turkey to take an essential role in the international arena, both economically and politically, in water-related problems (Yazıcı Doğan & Koca, 2023: 20). Therefore, understanding the natural and human dimensions of water resources is essential in supporting the current and future decision-making process regarding water management

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(Mostacedo et al., 2023). The Sustainable Development Agenda published by the United Nations emphasizes that the decrease in safe drinking water resources and "Clean water and sanitation," one of the sustainable development goals 2030, will affect all continents. The situation of Water has become a target and a challenge to be encountered in the coming years (United Nations, 2015). Therefore, it is necessary to obtain information about Water to protect, preserve, and manage it.

Water knowledge emerges from experiences and interactions with Water throughout childhood and adulthood. Therefore, raising individuals with water knowledge primarily involves parents who act as role models to shape positive attitudes and behaviors, and then educational institutions play an essential role. A disconnect in water education provided in families and schools leads to significant gaps in water knowledge and the transformation of water knowledge into actions that support sustainability (McCarroll & Hamann, 2020). This situation gives rise to the concept of "water literacy," as the importance of water knowledge is increasingly understood due to environmental problems (drought, potable Water, global warming, etc.).

Although Water is a universal substance both physically and chemically, water literacy is needed. This is because the value of Water and what it should be is determined by the consciousness (knowledge dimension) of individuals and the relationship between them and Water. Therefore, Water also exists socially (Otaki et al., 2015). When the definitions made regarding water literacy are examined, it is seen that water literacy is expressed as the level of knowledge that includes learning about water resources and understanding the importance of continuous consumption of Water in reflecting on life (Wood, 2014); a combination of necessary water knowledge, scientific water attitude and normative water behavior (He, 2018); the culmination of knowledge, attitude and behavior towards Water (McCarroll & Hamann, 2020); awareness and responsibility that enable individuals who have knowledge about Water to know in which situations water will be harmed (Dinc, 2018); individuals understanding how the Water they use daily is delivered and purified, knowing the quality and safety of Water, how much Water they use daily and for what (Otaki et al., 2015); including water knowledge, attitude and action by integrating critical thinking and decision-making understanding towards water resources, water management and water security problems (Saraswaty et al., 2022). Water literacy is a new concept that has been added to the literature, and a limited number of studies have it, so it is seen that it does not have a standard definition. In this context, from the meanings of water literacy, it is understood that the essence of the concept is a conscious use of Water that will allow us to reflect our knowledge, values, and skills in a balanced way to exist, sustain our daily lives, and live together.

Based on the definitions of water literacy, it is seen that water management suitable for the local environment is essential for water sustainability. Therefore, water literacy is examined in three categories. "Practical water literacy" ensures that water is usable. This means knowing how to ensure water is of significant quantity and quality. For example, it includes topics such as learning how to drink healthy Water and understanding the importance of hand washing. "Living water literacy" is the ability to use Water wisely in the places where a person lives. It is necessary to ensure an adequate quality water supply. For example, people use collected rainwater. Finally, "Social water literacy" is the willingness to act responsibly and make practical decisions on behalf of society regarding water use. For example, they should take precautions regarding water purification, distribution, and wastewater treatment. Appropriate behaviors for each dimension

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of water literacy are not universally determined. They should vary according to local lifestyles and traditions (Otaki et al., 2015). Considering the categories of water literacy, individuals and society who are Water literate, who can exhibit a positive attitude towards Water, and who have transformed this into a lifestyle are needed to transfer Water to future generations sustainably (Karabulut et al., 2023). Due to this need, it is aimed to raise environmentally sensitive students who do not harm nature, use Water consciously and economically, and are productive, creative, and responsible at all levels of education (Işıtan, 2023). In addition, cognitive and affective domains are critical in developing students' science-based understanding of concepts and skills that help them develop responsible attitudes and behaviors toward Water (Mostacedo-Marasovic et al., 2023). Therefore, it is suggested that water literacy should be imparted to students at all levels within the curriculum (Su et al., 2011). At the same time, during the teaching and learning processes, information should be conveyed to students to create awareness about water problems and enable them to understand and solve local and global water problems. In Turkey, especially at primary school levels, efforts are made to provide knowledge, skills, and awareness about water literacy through various courses (life studies, science, etc.) (Moreno-Guerrero et al., 2020; Sözcü & Türkler, 2020a). As a matter of fact, with the increasing adverse effects of water problems, today's children will try to cope with these problems in the future. Therefore, children should know water's importance, use, and management. In particular, a conscious individual who learns water literacy and water literacy categories and acquires effective water use early can continue this habit at later ages and contribute to their environment.

Different researchers have conducted various studies to increase the number of water-literate individuals. The studies were carried out to develop a water literacy scale (Aytaç, 2023, Karslı & Tunca Güçlü, 2023; Sözcü & Türker, 2020b), to determine the water literacy levels of students (Çakır, 2016; Ekinci et al., 2022; Işıtan, 2023; Karabulut et al., 2023; Sözcü & Türker, 2020a), to examine the opinions of sixth-grade middle school students about water footprint, water literacy, and water awareness (Özerdinç & Hamalosmanoğlu, 2021), to present the necessity of water literacy education (Dinc, 2018), to develop water awareness and water literacy in students (Özdemir, 2023; Ursavaş & Aytar, 2018), to evaluate the water literacy levels of prospective teachers (Çakır, 2016; Ekinci et al., 2022; Işıtan, 2023; Karabulut et al., 2023; Sözcü & Türker, 2020a), to evaluate the water literacy levels of students (Özerdinç & Hamalosmanoğlu, 2021), to present the necessity of water literacy education (Dinc, 2018), to develop water awareness and water literacy in students (Muslu, 2023; Özdemir, 2023; Ursavaş & Aytar, 2018), to evaluate the water literacy levels of prospective teachers (Özerdinç & Hamalosmanoğlu, 2021). It is seen that the aim is to determine and develop water literacy levels, examine their opinions (Doğrayıcı, 2023; Yazıcı Doğan & Koca, 2023), and analyze the curriculum in the context of water literacy (Demir & Ulukaya Öteleş, 2023). Research on water literacy is generally designed with quantitative methods and is aimed at determining the water literacy levels of different study groups. Research shows that water sustainability should be based on explicit knowledge and understanding of our water resources and their relationships with people and global systems (McCarroll & Hamann, 2020). However, as seen in the literature, there is no comprehensive study examining the attitudes of primary school students towards Water in the context of various variables and their thoughts on the concepts related to water literacy. It can be said that it is essential to raise awareness about Water, which is the only indispensable and irreplaceable element of today and the future, at an early age and to build a Water literate society. For these reasons, it aimed to

determine the water literacy levels of primary school 4th-grade students and their perceptions of water-related concepts to create awareness and increase the level of consciousness in students about Water and water literacy. It can be said that the research is an original study because it is presented understandably and appropriately for the level of primary school 4th-grade students (age 10) within the framework of the purpose determined within the scope of sustainable development goals. In addition, this research has unique values in creating awareness about Water in primary school students about sustainability, contributing to the literature and researchers due to the limited number of studies on the subject, and providing ideas to environmental organizations. The questions that guide the research in this context are as follows:

- What are the students' attitudes towards water?
- Is there a relationship between students' attitudes towards water and various variables (gender, place of residence, type of water used for drinking water, number of siblings, and education levels of mother and father)?
- What are the students' opinions on verbal and visual expressions of concepts related to water literacy (water literacy, water detective, water footprint)?

Method

Research design

This research was conducted in an explanatory design, as quantitative and qualitative data collection tools were used to examine the attitudes of 10-year-old students towards water in the context of various variables and to determine their thoughts on verbal and visual expressions regarding concepts related to water literacy. The mixed method strengthens the credibility of the results obtained by supporting each other with the data obtained with both qualitative and quantitative methods. The explanatory design, one of the mixed method designs, is the first stage in which data is obtained with quantitative methods. Then, the qualitative data are collected, and the results obtained are integrated into the discussion section (Creswell, 2008; Yıldırım & Şimşek, 2021). This study explained water literacy, which corresponds to knowing water, the vital source of our life, using students' perceptions of this water literacy. An attitude scale and an expression form were applied to the students to obtain detailed information about their attitudes toward water and their perceptions of water literacy.

Research group

The research was conducted with 4th-grade students in the 2023-2024 academic year in Bartin province, located in the Western Black Sea Region of Turkey. The study used criterion sampling, one of the purposeful sampling methods, to select students. In criterion sampling, researchers choose a sample that meets the criteria they determined before the research (Patton, 2014; Yıldırım & Şimşek, 2021). In this context, when determining the study group of the research, the criterion was determined as the study group is in the 4th grade of primary school because determining attitudes towards water at an early age and making the necessary interventions is essential for sustainability. Three hundred fifty-eight students studying in state primary schools in Bartın participated in the study. One hundred sixty-three of the students participating in the study were female (%45.53), and 195 were male (%54.47). In addition, the qualitative part of the study was carried out with 30 students randomly selected from the students participating in the

quantitative part.

Data collection tools and data collection

Attitude Scale Towards water Karslı and Tunca Güçlü (2023) developed the "Attitude Scale towards Water" as an up-to-date, valid, and reliable measurement tool appropriate to the level of students to determine the attitude levels of primary school 4th-grade students towards water. The scale has three factors, namely "Attitude towards thirst" (items 1-8), "Attitude towards unconscious use" (items 9-15), and "Attitude towards water saving" (items 16-20), 20 items and a 3-point Likert type feature. The lowest total score that can be obtained from the scale is 20, and the highest total score is 60. Cronbach's Alpha reliability coefficients were determined to vary between .62 and .85 for the overall scale and sub-factors.

Verbal and visual expression form: In the research, a "verbal and visual expression form" adapted from Önlen (2022) was prepared to determine the students' thoughts on verbal and visual expressions regarding concepts related to water literacy. The researchers determined eight concepts related to water literacy categories by examining the relevant literature. Expert opinions were obtained regarding the suitability of the defined concepts, and the necessary arrangements were made after the preliminary application. The initial application process was not included in the research. There were three concepts in the final form. The students expressed their thoughts about these concepts by writing and drawing pictures. The students were asked the following questions in the form: "What comes to your mind when you think of water literacy?" "Can you draw a picture to express what comes to your mind about water literacy?" "What comes to your mind when you think of a water detective?" "What comes to your mind when you think of water you think of water footprint?" "Can you draw a picture to express what comes to express what comes to your mind when you think of water you think of a water detective?" "What comes to your mind when you think of water footprint?" "Can you draw a picture to express what comes to your mind when you think of a water detective?" "What comes to your mind when you think of water footprint?" "Can you draw a picture to express what comes to your mind when you think of water footprint?"

The research data were collected in the spring semester of the 2023-2024 academic year. First, the students were informed about the purpose of the research, and that participation was voluntary. The data collection tools were collected by the researchers from 4th-grade students in state primary schools in Bartin during a class hour under the guidance of the classroom teacher.

Data analysis

Analysis of quantitative data: Data obtained from the attitude scale were analyzed with SPSS 23.00. The normality of the students' total scores from the attitude scale was analyzed with the Kolmogorov-Smirnov test, and the significance value was determined to be p=.23 (p>.05). In this case, parametric tests (t-test, ANOVA) were performed in the study because the data obtained showed a normal distribution. For the reliability of the current research, the Cronbach Alpha reliability coefficient of the scale was calculated as $\alpha=.87$.

Analysis of qualitative data: Data obtained from verbal and visual expression forms were analyzed using content analysis. Content analysis is aimed at any attempt to reduce and make sense of qualitative data to determine the fundamental consistencies and meanings of qualitative data (Patton, 2014: 453). Before moving on to content analysis, students were coded as "SM1, SF2, SM3..." (Student, gender (Female/Male, serial number) by paying attention to ethical rules, then the answers of the students who filled in the concepts appropriately and entirely were written into Microsoft Word. The answers were read in-depth using the line-by-line reading technique,

categories were created, and frequency values were determined and ranked. In addition, direct quotes and pictures were included to better and more detailedly show the students' perceptions. Different researchers analyzed qualitative data at various times and places to ensure reliability. The reliability formula of Miles and Huberman (1994) was used to calculate 85%. This rate shows that the results are reliable. In addition, the validity of the research was ensured by including examples of students' verbal and visual expressions to support the research findings.

Findings and comments

In the findings section, the analysis of the data obtained within the framework of the questions determined in line with the purpose of the research is presented under the relevant headings as findings related to quantitative and qualitative data.

Findings and comments related to quantitative data

The students' attitude levels and attitudes towards water were examined in the context of various variables.

Findings related to the student's attitude levels towards water

Table 1 Students' attitude levels towards water

Attitude Scale Towards Water	Ν	X	S
Attitude towards thirst	358	2,31	,27
Attitude toward unconscious use	358	1,80	,21
Attitude toward water-saving	358	1,03	,10
Total	358	1,74	,45

When Table 1 is examined, the average score of the student's responses to the water attitude scale is \overline{X} =1,74. The attitude towards thirst is \overline{X} =2,31, the attitude towards unconscious use is \overline{X} =1,80, and the dimension of water saving is \overline{X} =1,03. When the total and average scores of the dimensions are examined, it can be said that the students' attitudes towards water are low.

Findings on variables affecting students' attitudes towards water

 Table 2 T-test and ANOVA results of the total scores of students' attitudes towards water according to their socio-demographic characteristics

Sex	п	Mean±SD	t	р	df	
Female	163	33,42±9,51	1,23	,21*	356	
Male	195	34,54±7,63				
Place of residence	п	Mean±SD	F	р	df	Difference
Province (a)	124	39,44±5,07				
Village (b)	99	32,34±8,90	50,609	,00*	2	a>b,c
District (c)	135	30,30±8,55				
Type of water used as drinking water	п	Mean±SD	F	р	df	Difference
Prepared water (a)	145	30,68±8,60				
Purified water (b)	136	37,59±7,36	26,173	,00*	2	b>a,c
Tap water (c)	77	34,05±8,55				
Number of siblings	п	Mean±SD	F	р	df	Difference
Only child (a)	38	29,27±8,20				
2 siblings (b)	161	33,50±8,99	8,426	,00*	4	c>a
3 siblings (c)	150	36,28±7,35				
4 siblings (d)	9	27,11±6,86				
Mother's education status	п	Mean±SD	F	р	df	Difference
Elementary School (a)	87	34,01±8,76				
Secondary school (b)	126	30,48±8,12				
High School (c)	92	34,84±8,35	3,249	,01*	4	b>c
Bachelor's Degree (d)	37	35,02±9,27				

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Master's Degree (e)	16	29,87±7,75				
Father's education status	п	Mean±SD	F	р	df	Difference
Elementary School (a)	52	34,80±8,79				
Secondary school (b)	131	34,39±8,24				
High School (c)	131	34,93±8,55	3,986	,00*	4	c>d,e
Bachelor's Degree (d)	17	28,64±8,85				
Master's Degree (e)	27	29,81±7,39				

*Statistically significant difference at p < .05.

According to the t-test results, it was determined that there was no statistically significant difference between the student's attitudes toward water and the gender variable t(356)=1,23; p>0.05. In addition, the analyses revealed that the students living in the province F(2-355)=50,60; p<0.05, the students using bottled water F(2-355)=26.173; p<0.05, the students with three siblings F(4-353)=8,426; p<0.05, the students whose mothers had a bachelor's degree F(4-353)=3,249; p<0.05, and the students whose fathers had a high school degree F(4-353)=3.98; p<0.05 had higher attitudes towards water (p<0.05) (Table 2).

Findings related to qualitative data

In Table 3, students verbally and visually expressed their perceptions about water literacy, detective, and footprint. Since the students were young, verbal expressions were generally in sentences. The information in the table below was created because each student expressed more than one opinion.

Categories	Concepts/visuals	Total (f)
Those who express the concept verbally correctly	Water Awareness	19
	Use of Water	13
	Quality of Water	12
	Water Information	11
	Water Saving	10
	Water Security	3
Those who express the concept visually correctly	Water Use	19
	Water Protection	13
	Value of Water	9
	Water Safety	7

Table 3 Concepts/visuals used in the verbal and visual expression of the concept of water literacy

When the concepts used by the students in their verbal expressions regarding the concept of water literacy are examined in Table 3, it is found that the students generally use the expressions water awareness (f:19) and water use (f: 13) more and water safety (f: 3) less. Among these expressions, SF17 responded regarding water awareness: "It may mean using water consciously.", while SF12 stated: "Learning about water means using water as much as necessary. Not wasting water." Regarding water saving, SF3 said, "We should not waste water." SF4 stated: "Using water economically." Regarding water researchers, SF18 stated: "It is someone who knows where and how water comes to people."

When the students' visuals related to the concept of water literacy were examined, it was determined that they generally used water use (f:19) more and the visual of water safety (f:7) less. Examples of these visuals belonging to SM12, SM5, and SF7 are given in Figure 1.



Visual belonging to SM12

Visual belonging to SF5

Visual belonging to SF7

Figure 1 Visuals related to water literacy

When the visual drawn by SM12 regarding the concept of water literacy is examined, it is seen that he is trying to depict people who unconsciously pour water and turn off the open tap. Based on this, it can be concluded that the student is trying to explain the difference between two water-conscious people and those who are not. In this context, it is seen that the student associates using water economically with water literacy awareness.

When the visual drawn by SF5 is examined, it is seen that he tried to depict the decrease in the water mass by drawing the source of an open tap in the shape of the world. Based on this, the student thinks that the taps left open will negatively affect the water mass of the world, causing water scarcity. The world will decrease, and therefore, water waste will be.

When the visual drawn by SF7 is examined, it is seen that, on the one hand, the individual he calls rich and bad deliberately wastes water unnecessarily. On the other hand, the individual he calls poor and good deliberately uses water sparingly and carefully. Based on this, it is seen that the student defines the rich as bad and the poor as good based on social class distinction and accordingly associates water use with the concept of water justice.

It is seen from the answers the students gave and the pictures they drew that they associate the concept of water literacy with water awareness. However, it has been noticed that water research is the least mentioned category. Although the students' views on the concept of water literacy are evaluated as correct, it can be said that their opinions on this concept are not sufficient. When the pictures are examined, it is seen that the students generally emphasize water saving and water use. Therefore, it can be said that the students are aware of water protection, preservation, and management.

Table 4 Concepts/images used in the verbal and visual expression of the water detective concept

Categories	Concepts/Images	Total (f)
Those who express the concept verbally correctly	Water Researcher	15
	Water Conservation	8
	Water Knowledge	7
	Water Finder	2
Those who express the concept visually correctly	Water Protector	11
	Water Evaluator	7
	Water Finder	6
	Water Teacher	4

When the concepts used by the students in their verbal expressions regarding the concept of water detective are examined in Table 4, it is determined that the students generally use the expression water researcher (f:15) more and the expression water finder (f:2) less. Among these examples of expressions, SM5 responded with the following regarding the water researcher: "A water detective is a person who searches for water and finds water in the mountains." SM6 responded: "A person who searches for water in places without water." Regarding the protection

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of water, SM3 responded with the following: "It should be required and taught about monitoring and protection of water." SM12 responded: "It means protecting and saving water."

Regarding the water observer, SF10 responded, "A person who monitors and evaluates water." SF15 responded: "A water detective is a person who investigates, examines, and observes water." In the water knowledge category, SF7 responded: "They need to teach what they know about being the protector of water, monitoring, and protecting water to their environment." SF7 responded with the following: "Information about water."

When the students' visuals related to the concept of water detective were examined, it was determined that the students generally used the visual of the water protector (f:11) more and the visual of the water teacher (f:4) less. Examples of these visuals belonging to SF3, SF15, and SF16 are given in Figure 2.



Visual belonging to SF3Visual belonging to SF15Visual belonging to SF16Figure 2 Visuals related to the water detective

When the visual drawn by SF3 is examined, it is seen that the individual is trying to depict a close examination of water drops on the ground with a magnifying glass in his hand. Based on this, it is seen that he drew the water researcher.

When the visual drawn by SF15 is examined, it is seen that he draws a female researcher and that this researcher visualizes water examination tools. Based on this, it is understood that he is trying to indicate that the student is a water researcher and that he examines and evaluates water with these tools and equipment.

When the picture drawn by SF16 is examined, it is seen that she tried to draw a sunny day, houses, a fountain, and two girls in a square. There is a dialogue between the girls, and one of the girls says the sentence, "Don't leave the water running," at the fountain that is left open. It is thought that the student stated the importance of warning those who leave the water running and protecting water resources.

From the answers given by the students and the pictures they drew, it is seen that the students associate the concept of water detective with the water researcher. As can be seen from their views on the search and protection of water resources, it is understood that they associate it with the concept of water detective. As seen in the visuals, the students generally emphasize water saving and usage. In this context, the students see water detectives as people who monitor water resources and play an essential role in water protection and sustainable use. It is stated that these people take action to prevent waste of water and create awareness in society.

Table 5 Concepts/visuals used in the verbal and visual expression of the water footprint concept.

Categories	Concepts/visuals	Total (f)
Those who express the concept verbally correctly	Water Consumed	18
	Water Use	11

	Water Volume	6
	Water Polluted	3
Those who express the concept visually correctly	Water Use	8
	Water Waste	6
	Water Footprint Component	4

When the concepts used by students in their verbal expressions regarding the concept of water footprint are examined in Table 5, it is determined that students generally use the expression consumed water (f:18) more and polluted water (f:3) less. In the water amount category, SF10 responded: "It refers to the amount of water consumed from fresh water resources," SF15 stated: "In real life, it is the footprint that always shows the amount of wated water." Regarding water consumption, SF2 said: "It shows the water consumption of a consumer or producer and the pollution value related to water use." SM3 responded: "The water footprint is the amount consumed and polluted in production processes." Regarding water pollution, SF16 stated: "The amount of water produced and polluted in all production processes." SF1 stated: "Using water economically." Regarding searching for water, SF9 said: "Finding where water flows." Regarding the water indicator, SF12 responded: "It is a versatile indicator."

When the students' visuals related to the concept of water footprint were examined, it was determined that they generally used the water usage (f:8) visual more and the water footprint component (f:4) less. Examples of these visuals belonging to SF16, SF5, and SM7 are given in Figure 3.



Visual belonging to SF16

Visual belonging to SF5

Visual belonging to SM7

Figure 3 Visuals related to the water footprint

When the visual drawn by SF16 is examined, it is seen that he tried to depict an open tap. The fact that there is no one around the tap indicates that the tap is left open. It is seen that the student aimed to draw attention to the fact that taps should not be left open after using water and that water should not be wasted in this drawing.

When the visual drawn by SFK5 is examined, it is seen that he draws blue, green, and gray water footprints. It is understood that the student knows the components of the water footprint.

When the visual drawn by SM7 is examined, it is seen that he likens the water source to a whole bottle, that this bottle has a hole, and that water flows from there in vain. The student draws attention to the water being wasted in this drawing. The student emphasized that water should not be wasted and wasted in water consumption.

From the answers given by the students and the pictures they drew, it is seen that the students associate the concept of water footprint with the amount of water. Based on this, it is noticed that the students draw attention to the amount of water used in the concept of water footprint. The students emphasize how much water plays a role in every aspect of our lives by drawing attention to the total amount of water used in production and consumption. As seen in the visuals, the

students emphasize the water footprint of wasteful water use. In particular, the students drew the blue, green, and gray water footprints from the water footprint components but did not have enough information about them.

Discussion

Water literate means using water consciously and sensitively and ensuring it is managed correctly. In today's world, where global warming is increasing and water resources are decreasing, it is essential to make this awareness collective. It is thought that it is important to draw attention to this issue in students and create awareness from an early age. In the research, in addition to determining the water literacy status of 4th-grade primary school students, their verbal and visual expressions of the concept of water literacy are determined.

It was determined that the students' average scores on the attitude scale towards water were low. While the highest average of the student's attitude scale dimensions towards water was the attitude dimension towards thirst, the lowest average was the attitude dimension towards water saving. To create water-sensitive and participatory citizenship, an education that includes cognitive, affective, and behavioral areas should be provided (McCarroll & Hamann, 2020). Due to water scarcity in certain parts of the world, awareness of water use is also rapidly increasing in education systems worldwide. In particular, water conservation and care are emphasized in education policies and teaching and learning processes (Moreno-Guerrero et al., 2020). A society that saves water is concerned about the future of water and actively participates in activities that require a high level of water literacy (Hui-Shuang He, 2018). In addition, within the framework of the results obtained from the research, it has been determined that teaching based on experiential learning positively affects students' water literacy and water usage attitudes (Muslu, 2023). Therefore, water awareness can be achieved by developing positive attitudes towards water from an early age.

Another result of the research was that students' attitudes towards water did not change according to gender. In this case, creating a society that is highly sensitive to water, conscious about water, and supports steps towards water saving in all segments of society will provide significant advantages in the coming years (Sözcü & Türker, 2020a).

It has been determined that students' attitudes towards water vary depending on where they live. According to this result, it has been determined that students living in the city center have higher attitudes towards water than students living in districts and villages. The value of water and what it should be are socially determined by people's awareness of the relationship between people and water. Indeed, each region and city has its lifestyle (Otaki et al., 2015). Especially as the population increases and rapid urbanization occurs, the difficulties in managing water and its resources will continue to increase (Maniam et al., 2021). Therefore, there is expected to be awareness of water in densely populated city centers that do not have sufficient water resources and may experience water stress.

The study observed that the attitudes of students who use ready-made water as drinking water were higher than those who used purified water and tap water. To use water sustainably, it is essential to manage It with approaches appropriate to the local water environment (Otaki et al., 2015; Sözcü & Türker, 2020a).

The study shows that students' attitudes towards water change according to the number of

siblings. It is seen that students with three siblings especially have higher attitudes towards water. To sustain our daily lives and live together, we need water and use the existing water together. As the number of people using the existing water increases, the situation of using water effectively emerges (Maniam et al., 2021). Based on this, it is seen that students with siblings have habits towards using water consciously, as the sustainable use of water is essential both at the individual and social levels.

The study found that the educational background of students' parents affected their attitudes towards water. It was determined that students whose mothers had a bachelor's degree and whose fathers had a high school degree had higher attitudes toward water. The invisible obstacle to creating a participatory community that will develop water awareness is the lack of knowledge about water. Water knowledge and attitudes towards water emerge from experiences and interactions with water, especially in childhood. Based on the idea that education begins in the family, parents also have an essential role in achieving the goals of a water literate society (McCarroll & Hamann, 2020; Moreno-Guerrero et al., 2020). Parents who create these environments should also have sufficient water.

While students used the concept of water literacy as water awareness, water use, water quality, water knowledge, water saving, and water safety in their verbal expressions, they depicted water use, water protection, water value, and water safety in their visual expressions. While students often used the concept of water awareness in their verbal expressions of water literacy, they preferred images related to water use in their visual expressions. Therefore, it can be thought that students associate having water literacy skills with consuming water consciously. Özerdinc & Hamalosmanoğlu (2021) also emphasize in their study that students with water literacy awareness use water consciously, efficiently, and economically. Indeed, water literacy is essential in individuals' lives and affects them in every aspect. At this point, students emphasize that water literacy is the ability of individuals to use water wisely in the places they live in, which is the "living water literacy" category (Otaki et al., 2015). At this point, the protection of water resources depends on the education provided to a significant extent, along with public and private institutions (Gezer & Erdem, 2018). Especially when it is considered that individuals spend a significant part of their lives in schools, which are our educational institutions, it can be thought that raising awareness on this issue can be possible through educational institutions (Demir & Ulukaya-Öteleş, 2023; Ergin, 2008; Kılınç et al., 2016). In a study conducted by Akpınar et al. (2011), they emphasized that the education to be given in primary school is essential in creating awareness of water awareness in our country, water saving, and water resources.

In their verbal expressions, students used the expressions water researcher, water protection, water knowledge, and water finder for the concept of water detective. In contrast, their visual expressions depicted it as a water protector, water assessor, water finder, and water teacher. In their verbal expressions, students generally expressed the water detective concept with the water researcher concept. In contrast, in their visual expressions, they frequently preferred the visual aspect of a water protector. Therefore, students associated the research, discovery, and protection of water resources with the concept of water detective. Alaş et al. (2009) emphasize that environmental knowledge progresses in an integrated manner with water knowledge. Water resources are called "white oil," indicating the protection and beneficial use of water resources (Tutar et al., 2012).

While students used the terms water consumed, water use, water volume, and polluted water in their verbal expressions, they depicted the concept of water footprint as water use, water waste, and water footprint components in their visual expressions. While students generally expressed the concept of water footprint with the concept of water consumed in their verbal expressions, it is seen that they used the concept of water use in their visuals. Based on this, it is noticed that students draw attention to the importance of the amount of water in the concept of water footprint. Students are in the "practical water literacy" category, which means they know how to ensure that water has significant quantity and quality. In the studies, water footprint is associated with sustainable and responsible use of water (Gómez-Llanos et al., 2020). Temiz et al. (2022) found that third-grade primary school students encountered the concepts of water footprint and hidden water use for the first time. Therefore, if these concepts are taught concretely at a young age, awareness of water use can be achieved. In a similar study, the 6th-grade middle school students' water footprint concept is associated with calculating the water footprint and the measures that can be taken to reduce the water footprint (Özerdinç & Hamalosmanoğlu, 2021). In particular, it is determined that hearing about the water footprint is related to water consumption behavior (Bulut & Şahin, 2020). Indeed, Gómez-Llanos et al. (2020) emphasize that water footprint is directly or indirectly associated with individual water consumption.

Conclusion

Water literacy means knowing water and understanding and solving water-related problems. Individuals who have this skill at a young age, in addition to understanding the importance and value of water, actively contribute to the sustainability of water resources and act consciously about water use. Awareness of this issue is gained through experiences and interactions with water throughout childhood and adulthood. In particular, a conscious individual who learns water literacy and water literacy categories and acquires effective water use early can continue this habit at later ages and contribute to their environment.

It was determined that the student's attitudes toward water in the 10-year-old group participating in the study were low. Therefore, learning environments can be developed to make students aware of water's importance and increase their level of water literacy. Education that includes cognitive, affective, and behavioral areas can be provided to create water-sensitive and participatory citizenship.

It was observed that the factors determining their attitudes towards water were where the students lived, the type of drinking water they used, the number of siblings they had, and the education level of their parent's education level and that the attitudes of the students living in the city center towards water were positive compared to those living in other parts of the country. Therefore, more research can be conducted with students from different socioeconomic levels for various segments of society. It is seen that the attitudes of the students who use ready-made water as drinking water are higher. This situation can be explained by the fact that ready-made water is purchased in bottles, the consumption process is observed, and it requires sparing use. Now, as all societies, we must be sensitive to water resources. We can transfer clean water resources to future generations if we are sensitive. This is the most fundamental responsibility of a water-literate individual. It has been observed that students with more siblings have higher attitudes towards water. The use and distribution of water resources among people play an essential role. Therefore, it is crucial to protect and fairly share water resources that are open to

everyday use by all of us. Based on this result, more studies can be conducted on students with different family structures and socioeconomic levels. Student attitudes towards water vary according to the educational status of their parents. Because individuals adopt the lifestyles of the families in which they grow up. Therefore, it can be said that literate and conscious parents who provide their children with awareness about water at an early age are essential in building a water literate society. Parents should convey information and experiences to their children from a young age so that they can be part of a sustainable water society.

It is thought that revealing the students' existing perceptions of the concepts will help them realize the missing and developing aspects of the concepts and produce solutions. The students expressed their opinions verbally and visually about water literacy, detective, and footprint. They depicted them as water use, water saving, water quantity, and water researcher. Students can be made aware of the importance and protection of water by being taught the concepts of water literacy, provided training, and conducted awareness studies. Within the scope of all the results obtained, water literacy is essential for continuing all living things today and in the future. In this context, topics such as water awareness, water saving, water protection and sustainable use, water cycle, water pollution, water footprint, water stress, and water scarcity can be added to the content of the curriculum. In addition, it is essential to organize workshops and in-class and outof-class activities to raise awareness and consciousness on these issues from an early age.

Declarations

Statement Regarding Informed Consent

Participants participated in the study voluntarily by reading informed consent.

Statement Regarding Ethical Approval

Informed Consent Data collection tools and informed consents were approved by the Bartin University Research Ethics Committee with the date 30.05.2024, number 2024-SBB-0397, and meeting number.

Statement Regarding Research Involving Human Participants and/or Animals

Since the research was conducted with human participants, an ethics declaration was obtained from the relevant institution.

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Author's Contribution

1. Author Contribution: 40% (Corresponding Author, Implementation of the research idea/meaning, writer, data collection tools), 2. Author Contribution: 15% (Design, Implementation of the research, Implementation of the study), 3. Author Contribution: 15% (Analysis and commentary, study implementation), 4. Author Contribution: 15% (Literature review, Implementation of the research, data collection tools), 5. Author Contribution: 15% (Critical review, data organization).

Competing Interests

Competing Interests Not applicable.

Availability of data and materials

Although the verbal and visual expression form and the attitude scale towards water are data collection tools that other researchers can use in their studies, the answers given to these questions by students who participated in the researcher's other studies may differ from those in this study.

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