frontiers | Frontiers in Education

TYPE Original Research
PUBLISHED 17 April 2025
DOI 10.3389/feduc.2025.1552082

OPEN ACCESS

EDITED BY
Gavin T. L. Brown,
The University of Auckland, New Zealand

REVIEWED BY
Özlem Bal,
Hittite University, Türkiye
Halil Karadaş,
Mardin Artuklu University, Türkiye

*CORRESPONDENCE
Fatih Aydoğdu
✉ faydogdu@erzincan.edu.tr;
✉ faydogdu1985@gmail.com

RECEIVED 27 December 2024
ACCEPTED 04 April 2025
PUBLISHED 17 April 2025

CITATION
Aysu B, Aral N, Aydoğdu F and Gürsoy F (2025) Children's attitudes towards water: a scale development study.
Front. Educ. 10:1552082.
doi: 10.3389/feduc.2025.1552082

Children's attitudes towards water: a scale development study

Burçin Aysu[1], Neriman Aral[2], Fatih Aydoğdu[3]* and Figen Gürsoy[2]

[1]Department of Child Development, Faculty of Health Sciences, Ankara Yıldırım Beyazıt University, Ankara, Türkiye, [2]Department of Child Development, Faculty of Health Sciences, Ankara University, Ankara, Türkiye, [3]Department of Chid Department, Health Services Vocational School, Erzincan Binali Yıldırım University, Erzincan, Türkiye

Introduction: In this study, it was aimed to develop a scale to determine children's attitudes towards water.

Methods: The study included 865 children studying in the fourth to eighth grades. The items of the scale were formed based on the theoretical structure, a comprehensive review of existing scales related to attitudes towards water and expert evaluations. Content validity, exploratory factor analysis, confirmatory factor analysis and reliability analyses were performed from psychometric analyses to determine the validity and reliability features.

Results: As a result of the study, a scale consisting of three factors (water cycle, importance of water, water saving) and 24 items with acceptable validity and reliability values was obtained.

Discussion: The scale has reliable psychometric properties and can be used as an important assessment tool in evaluating children's attitudes towards water.

KEYWORDS

child, scale development, attitudes towards water, water cycle, importance of water, water saving

Introduction

The environment is a set of universal values with natural and artificial elements that shape human life (Keleş and Hamamci, 2009). Looking at the environment as a set of values, it is thought that having a healthy environment is the right of every living thing born. Factors such as climate change, global warming, increasing drought, pollution, desertification, the greenhouse effect, mass hunger and poverty have started to destroy this fundamental right of living things (Eren, 2016). As a result, environmental problems have emerged and turned from a national problem into an international problem affecting the whole world. One of these problems is water-related issues/problems and has a vital importance (Ertürk, 2018). Water, which is necessary for humans to maintain vital activities such as nutrition, respiration, circulation, excretion and reproduction, greatly affects public health and living standards (Akın and Akın, 2007; Ezell et al., 2023; Kılıç, 2020). In addition to being one of the basic substances in the formation of living space for living things (Kılıç, 2020), water is the environment in which all living processes occur (Cunningham and Cunningham, 2017). Water is vital not only for humans but also for the health and productivity of both plants and animals (Akın and Akın, 2007).

Water pollution occurs when organic, inorganic, biological and radioactive pollutants that restrict or prevent the use of water due to changes in the environment that disrupt the balance of the environment are mixed into water resources. This situation occurs when

water exceeds its self-renewal capacity as a result of human intervention in the hydraulic cycle (Ertürk, 2018). In addition, water is unevenly distributed around the world, and some countries face water shortages and drought (Kılıç, 2020). Drought occurs when the amount of precipitation is less than the average value of precipitation over many years (Polat, 2023). Drought is among the natural disasters both in terms of the damages it will cause and the lack of awareness on this issue. Drought is also closely related to human activities, and in some cases, it is seasonal and short-term, while in other cases it can continue for years and affect very large areas (Turan, 2018).

Every decision to be made and every step to be taken regarding water is vital for the continuation of life (Kılıç, 2020). It is emphasized that the only way to avoid water shortage is to control water use and water saving (Çiçek and Ataol, 2009). The ever-increasing threats to natural resources and public health require an urgent intervention for conscious environmental citizenship (Palmer, 1998; Schaefer, 1978; Wójcik, 2004). When the perspectives on when this intervention should start are examined, it is emphasized that children's mental sensitivity toward the environment develops mostly at the age of 9–10 (Demirkaya, 2006). Liefländer (2015) suggested focusing on developing connectedness to nature and pro-environmental attitudes for children under the age of 11. Praveena and Themudu (2022) found that 43% of school children in Malaysia had a good attitudes towards water-saving awareness, while Küçük (2022) underlined that experiences related to water reuse at home and outside are very valuable for children. Khiri et al. (2023) found that the inclusion of criteria and standards related to water education in school curricula at primary, secondary and high school levels in Morocco is weak. Further, Tegegne and Kelkay (2023) concluded that different teaching models are more effective in developing children's conceptual understanding of water concepts (water hardness, water softening, water pollution) than traditional methods.

Reddy et al. (2023) emphasize that attitudes towards water conservation will become a priority in the coming years. Problems related to water are largely due to the inadequacy of environmental education. Environmental education is a process in which attitudes are developed for the protection of the environment, behaviors that are not harmful to the environment are acquired, and the results of these behaviors are evaluated (Erten, 2004). Amahmid et al. (2019) reveal that attitudes and behaviors should be developed in the light of scientific knowledge for school-based water education programmes to be successful. At this point, it comes to the forefront that for effective environmental education on water, attitudes towards water should be determined from the early years. Attitudes, which are expressed as an acquired internal state and affect people's choice of individual activities toward any object, individual, event and various situations, also constitute the precondition of behaviors (Senemoğlu, 2010).

When the literature is examined, it is seen that there are various measurement tools for water for adults and children abroad (Collado et al., 2020; Meilinda et al., 2023; Praveena and Themudu, 2022; Reddy et al., 2023; Watkins, 1974), but the measurement tools developed for water in Türkiye are generally for adults (Cappellaro et al., 2011; Çankaya and Filik-İşçen, 2014), and there is no measurement tool for children. Therefore, children's attitudes towards water are not known in Türkiye. It is thought that there is a need for measurement tools with proven validity and reliability regarding children's attitudes towards water to take steps for the protection of water and water saving and to create intervention programmes. Determining children's attitudes towards water is important in terms of revealing their misbehaviours toward water, and it can form the basis for future initiatives and guide policymakers. Understanding children's attitudes towards water can guide studies on environmental education and sustainability. Attitudes towards water can be an important factor in understanding children's water consumption habits. Furthermore, developing the scale can form the basis for multidisciplinary studies by opening up new areas of research for educators, psychologists, environmental scientists and policy makers. Based on these considerations, in this study, it is aimed to develop a measurement tool to determine children's attitudes towards water.

Research problem

The answer was sought for the question "Does the "Attitude Towards Water Scale" to be developed measure the attitudes towards water of children studying in the fourth-eighth grades?"

Research aim and research questions

In this study, it was aimed to develop a scale to determine children's attitudes towards water.

Research methodology

General background

This study is a scale development study to determine the validity and reliability of the Attitude Towards Water Scale.

Participants

The population of the study consisted of children studying in the fourth-eighth grades of public schools affiliated to the Erzincan Provincial Directorate of National Education in the spring semester of the 2022–2023 academic year. The sample of the study consisted of 865 children who were randomly selected and studied in the fourth-eighth grades of schools. Information regarding the demographic characteristics of the children is given in Table 1.

As seen in Table 1, 57.8% of the children were girls, more than half of them were aged 12 and over, and they had a similar number of grade levels. In addition, it was determined that there were more children with one and two siblings. It was found that there were more children whose mother's education level was primary school and high school, whereas there were more children whose father's education level was high school and university and higher.

TABLE 1 Information regarding the demographic characteristics of children.

Gender	*n*	%	Number of siblings	*n*	%
Girl	500	57,8	None	58	6,7
Boy	365	42,2	One	349	40,3
Age			Two	267	30,9
9	57	6,6	Three	124	14,3
10	185	21,4	Four and more	67	7,7
11	171	19,8	**Mother's level of education**		
12	166	19,2	Primary school	246	28,4
13	193	22,3	Secondary school	168	19,4
14	93	10,8	High school	271	31,3
Grade level			University and higher	180	20,8
4th grade	180	20,8	**Father's level of education**		
5th grade	169	19,5	Primary school	108	12,5
6th grade	178	20,6	Secondary school	141	16,3
7th grade	160	18,5	High school	315	36,4
8th grade	178	20,6	University and higher	301	34,8
Gender	***n***	**%**	**Number of siblings**	***n***	**%**
Girl	500	57,8	None	58	6,7
Boy	365	42,2	One	349	40,3
Age			Two	267	30,9
9	57	6,6	Three	124	14,3
10	185	21,4	Four and more	67	7,7
11	171	19,8	**Mother's level of education**		
12	166	19,2	Primary school	246	28,4
13	193	22,3	Secondary school	168	19,4
14	93	10,8	High school	271	31,3
Grade level			University and higher	180	20,8
4th grade	180	20,8	**Father's level of education**		
5th grade	169	19,5	Primary school	108	12,5
6th grade	178	20,6	Secondary school	141	16,3
7th grade	160	18,5	High school	315	36,4
8th grade	178	20,6	University and higher	301	34,8

Instrument and procedures

General information form

The General Information Form was developed by the researchers and consisted of questions about children's gender, age, grade level, number of siblings, and mother and father's education level.

Attitude Towards Water Scale

Development process of Attitude Towards Water Scale

First, the theoretical basis was formed by reviewing the literature to reveal the structure of children's attitude towards water. At this point, environmental education approaches (education about the environment, education through the environment, education for the environment) were examined and "Education for the Environment Approach" was adopted (Büyüktaşkapu et al., 2011; Chatzifotiou, 2005; Palmer, 1998). Each of these approaches deals with environmental problems and environmental degradation from a different perspective, thus emphasizing a specific part of environmental education. "Education for the Environment Approach" advocates people to live in harmony with all living things around them (Büyüktaşkapu et al., 2011; Özdemir, 2016). At the same time, this approach aims to raise sensitive, conscious, and sociable citizens based on the fact that the individual is a whole with his/her environment. It is also indicated in this approach that human beings, who form, shape, affect and use the environment as well as being an element of the environment,

should receive education about the environment, be aware of it, and live in harmony with nature (Büyüktaşkapu et al., 2011; Chatzifotiou, 2005; Özdemir, 2016). Accordingly, it is necessary to measure children's attitudes towards water to determine whether this approach has achieved its purpose. For this reason, while determining the purpose of the study, it was aimed to determine the attitudes of children toward water as the target group.

In the formation of the scale items, the achievements of the Science Curriculum and similar scales were taken as basis. An item pool was created in line with the data obtained, and the process of determining the measurement format was carried out simultaneously with the creation of the item pool (Erkuş, 2014).

The item pool consists of 62 items. After the items of the scale were formed, expert opinions were consulted for content validity in line with the validity study. The expert group consisted of two faculty members in the field of science, one science teacher, one classroom teacher, one Turkish teacher, two faculty members in the field of child development and two experts in the field of measurement and evaluation. After the experts' feedback on the scale items, the items were corrected and finalized.

A pilot study was conducted with a classroom teacher and 10 children attending primary and secondary school to determine the situation regarding the understand ability of the items and to reorganize them in case of a lack of understanding (Büyüköztürk, 2014), and it was decided that the items were understandable as a result of the pilot study.

The questions in the scale are answered as "strongly disagree," "disagree," "undecided," "agree" and "strongly agree." After the application, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were performed to determine the construct validity of the measurement tool and Cronbach Alpha and two-half reliability analyses were performed to determine its reliability. The reliability coefficients were also calculated.

Data collection

In the study, the necessary permissions were obtained from the Ethics Committee (Date: 22/03/2023, Protocol No: 01/01) and Erzincan Provincial Directorate of National Education. After the permission process was completed, the schools where the children were studying were visited, school administrators were interviewed and information about the study was given. In the study, a consent form was requested from the families before the forms were applied to the children. Then, the forms were applied face-to-face in free time periods in order not to disrupt the children's education and training processes and the data were collected.

Data analysis

Data analysis was performed using SPSS 25 and AMOS 21 package programs. The data analysis process was carried out in stages. In the first stage, after the collected data were arranged in the computer environment, missing data, extreme value, normality, linearity, and multicollinearity analyses were performed (Seçer, 2017; Pallant, 2013). Seven data with outliers that would affect the normality of the data set were identified and removed from the data set. The latent structure of the scale was analysed by EFA, and model fit was examined by CFA (Seçer, 2015). The following criteria were taken as criteria in EFA; the eigenvalue of each factor should be at least 1, the factor loading should be at least 0.30 for the factor loading value of an item in order for an item to be shown in a factor, and the difference between the loadings should be greater than 0.10 in order for the items in more than one factor not to be overlapping items (Seçer, 2017). In addition, the maximum likelihood technique and Promax rotation method were used in EFA. Multiple fit indices (X^2 /df, RMSEA, CFI, TLI, IFI, NFI) were used in CFA. In CFA, $>$ 0.90 for NFI, TLI, IFI and CFI, $<$ 0.08 for RMSEA and SRMR, and $<$ 3 for x^2/df were taken as criteria. The reliability results of the scale were reported with Cronbach Alpha and two-half reliability tests.

Research results

The findings obtained from the study conducted to develop a scale to determine children's attitudes towards water are presented below.

Construct validity

Two-factor analyses, EFA and CFA, are generally used to test the construct validity of a scale (Seçer, 2015; Seçer, 2017). While EFA is used as a technique to determine how many dimensions the items in a scale are included in and which item is grouped under which dimension; CFA is used to confirm the determined latent structure (Seçer, 2015). In this context, the construct validity of the Attitude Towards Water Scale was tested with EFA and CFA.

Exploratory factor analysis (EFA)

The results related to the exploratory factor analysis are given in Table 2. Kaiser-Meyer-Olkin (KMO) and Barlett tests were performed to determine whether the data were suitable for factor analysis. In exploratory factor analysis, KMO and Barlett tests were performed to test the suitability of the data collected from the study group for factor analysis and KMO was found to be 0.928 and Barlett test $\chi 2$ value was found to be 7,655,206 ($p < 0.001$). The fact that KMO was higher than 0.60 and Barlett's test was significant indicated that the data were suitable for factor analysis (Pallant, 2013; Seçer, 2015). In the analyses, the common factor variance of the factors on each variable, factor loadings of the items and ratios of variance explained were examined. In determining the factor structures, factor structures with values of 0.30 and above were taken into consideration (Seçer, 2017).

As a result of EFA, 30 items with low factor loadings and eight items determined to be overlapping were removed from the scale. In the remaining 24 items, a scale with a three-factor structure explaining 43.498% of the total variance was obtained and the scale was found to be adequate (Başol, 2020; Büyüköztürk, 2014; Scherer et al., 1988; Tavşancıl, 2010). The first of these factors is the "water cycle" sub-dimension, which consists of 10 items and explains 27,686% of the total variance. The second is the "importance of water" sub-dimension consisting of nine items and explaining

TABLE 2 Variances explained by the Attitude Towards Water Scale and item analyses.

Items	1st factor	2nd factor	3rd factor	Item total correlation
Item 8	0.725	–	–	0.515
Item 7	0.723	–	–	0.529
Item 10	0.689	–	–	0.466
Item 3	0.648	–	–	0.481
Item 6	0.647	–	–	0.555
Item 9	0.639	–	–	0.602
Item 1	0.633	–	–	0.485
Item 2	0.575	–	–	0.409
Item 4	0.572	–	–	0.500
Item 5	0.512	–	–	0.574
Item 12	–	0.764	–	0.557
Item 15	–	0.748	–	0.462
Item 13	–	0.716	–	0.572
Item 14	–	0.684	–	0.507
Item 17	–	0.677	–	0.459
Item 16	–	0.577	–	0.457
Item 18	–	0.556	–	0.520
Item 11	–	0.547	–	0.438
Item 19	–	0.467	–	0.477
Item 20	–	–	0.794	0.379
Item 21	–	–	0.790	0.448
Item 24	–	–	0.640	0.467
Item 22	–	–	0.553	0.397
Item 23	–	–	0.552	0.344
Eigen value	6.646	2.470	1.351	–
Variance explained	27.686	10.256	5.556	–
Total variance explained	–	–	–	%43, 0.498
KMO/ X^2	–	–	–	0.928/7655,206 ($p < 0.001$)

10,256% of the total variance. The third is the "water saving" sub-dimension, which consists of five items and explains 5,256% of the total variance. Further, it was found that the factor loadings for each item of the scale vary between 0.46 and 0.79 and meet the criterion of being at least 0.40 (Seçer, 2017). In addition, it is suggested that each dimension should explain at least 5% variance. It is also seen that the variance explained by each of the three factors in question is above 5%.

When the estimation point and the parts with eigenvalues above one in the scree pilot table of the scale are analyzed, it is seen that it is a three-dimensional scale (Figure 1). Factors with eigenvalue statistics greater than one are accepted as significant (Kalaycı, 2010: p.322).

Pearson correlation analysis was performed and the relationships between the sub-dimensions of the Attitude Towards Water Scale were examined to evaluate the multicollinearity problem. The presence of a relationship of 0.90 and above between the sub-dimensions indicates that there is a multicollinearity problem. The results obtained accordingly are given in Table 3.

Table 3 shows the correlation values between the sub-dimensions of the Attitude Towards Water Scale. The data obtained show that there are significant relationships between the sub-dimensions of the scale and there is no multicollinearity problem since the pairwise correlation values are lower than 0.90 (Seçer, 2017).

Confirmatory factor analysis (CFA)

Confirmatory factor analysis was performed to test whether the factor structure resulting from EFA was a good fit (Figure 2).

When Figure 2 is analyzed, it is seen that the fit values of the Attitude Towards Water Scale, which consists of 24 items and three sub-factors, meet the desired criteria and the model is compatible as a result of CFA (x^2: 699.940, df = 249, p = 0.000, x^2/df = 2.811, RMSEA = 0.04, RFI = 0.900, TLI = 0.933, IFI = 940, NFI = 0.910, SRMR = 0.04) (Kline, 2005; Seçer, 2015; Seçer, 2017). It was determined in the analysis that the values obtained were

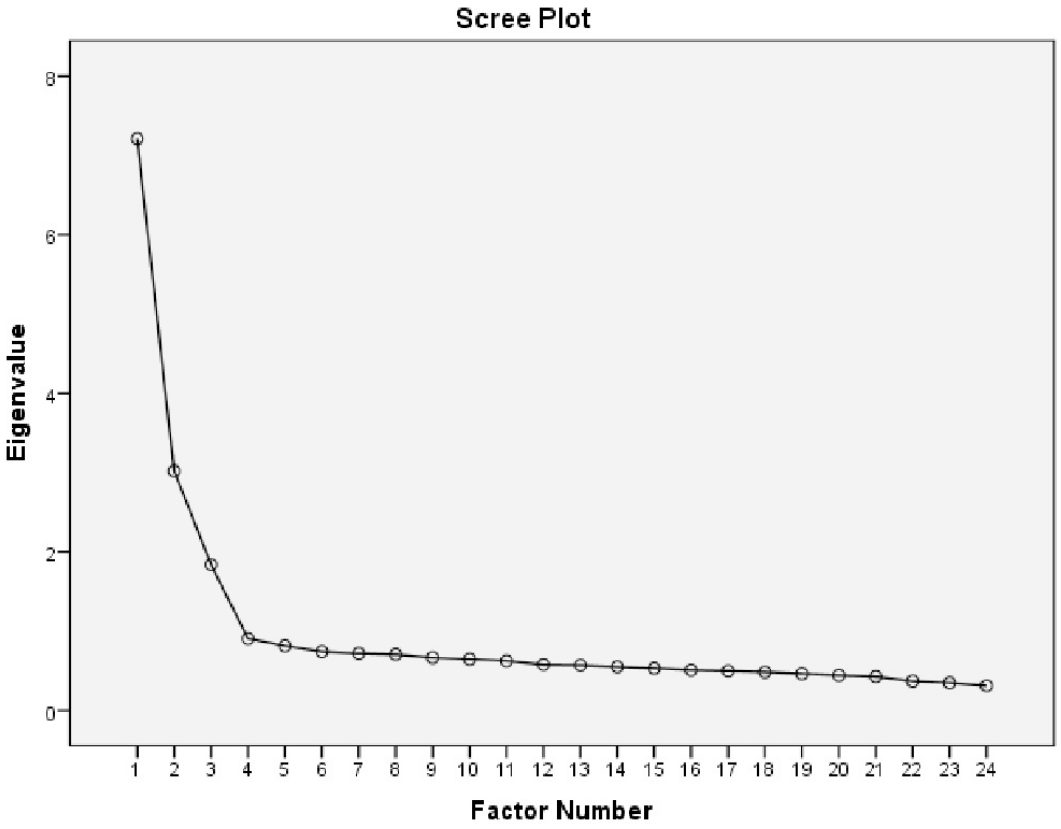

FIGURE 1
Scree plot graph.

TABLE 3 Correlation analysis result for the relationship between the sub-dimensions of the Attitude Towards Water Scale.

	Factor 1	Factor 2	Factor 3
Factor 1	1	0.464	0.273
Factor 2	–	1	0.503
Factor 3	–	–	1

generally an acceptable level of fit between the data and the factor structure of the scale.

Reliability analysis

At the end of the validity assessment, two half and Cronbach Alpha reliability methods were used for reliability analysis. Cronbach's Alpha coefficient was calculated to estimate the internal consistency of each sub-dimension. In addition, the equivalent halves method, which is based on a single application used to determine the reliability of a test, was employed. In this method, the scale was divided into two forms as odd-numbered items and even-numbered items to test the reliability and the relationship between these two forms was analyzed. The results obtained are given below (Table 4).

When Table 4 is analyzed, the Cronbach Alpha internal consistency coefficient of the Attitude Towards Water Scale was found to be 0.88. In addition, Cronbach Alpha internal consistency coefficient of Factor one sub-dimension of the scale was 0.87, Cronbach Alpha internal consistency coefficient of Factor two sub-dimension was 0.86, and Cronbach Alpha internal consistency coefficient of Factor three sub-dimension was 0.80. It was also concluded that the two-half reliability results were 0.91 and these results were 0.70 and above, which are accepted in scale development studies (Pallant, 2013; Seçer, 2017), as a result, it can be stated that the reliability coefficients of the scale are at an acceptable level.

Discussion

Reusing water and encouraging people to save it are important components of water management and water saving. It is thought that this should be taught from early years (Demirkaya, 2006; Liefländer, 2015). Further, it is believed that a positive attitude towards water and its conservation in the early years can be one of the first steps to solve the water crisis that our country, and on a large scale, the world will experience in the future.

Very little is known about children's attitude towards water in Türkiye (Cappellaro et al., 2011; Çankaya and Filik-İşçen, 2014). It is necessary to measure their attitudes to understand what can affect the change in these attitudes, which is a prerequisite for children's behaviors toward water. This can be achieved by developing a valid and reliable scale. Children's attitudes towards

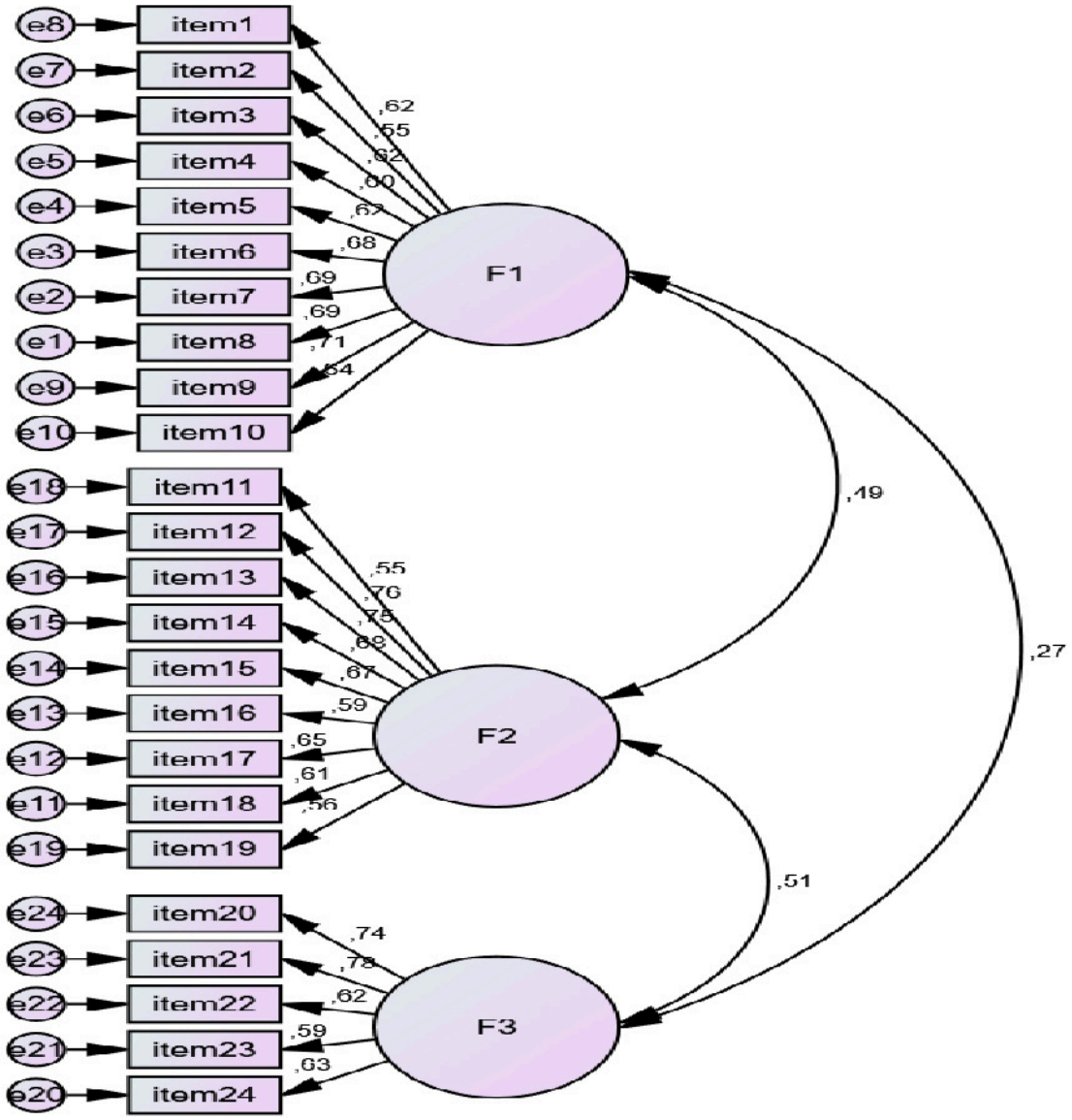

FIGURE 2
Confirmatory factor analysis (CFA) results.

water will be determined through this scale and it will be a pioneer and a source for future intervention programmes. It is believed that with future intervention programmes preventive approaches can be developed beyond problem solving. Thus, the harmony of human beings with their environment can be ensured at the highest level. "Education for Environment Approach," one of the approaches related to the environment, has also been a basis for this study since it emphasizes the realization of this harmony by human beings (Büyüktaşkapu et al., 2011; Özdemir, 2016). Children with a positive attitude towards the environment can be sensitive, conscious, and sociable citizens in their environment (Büyüktaşkapu et al., 2011; Chatzifotiou, 2005; Özdemir, 2016). Children should be aware of the form, movement, and origin of water, that is, the water cycle in order for this approach to achieve its purpose. At the same time, children are expected to be aware of the importance of water and willing to save it. The presence of an individually positive attitude towards water in everyday life will not only make the child feel good but will also ensure that he/she has responsibility and awareness. Therefore, this scale, which was developed based on the Education for the Environment approach, will enable more people to save water in the future by knowing and measuring attitudes towards water with the sub-dimensions of the water cycle, the importance of water and water-saving.

As a result of exploratory factor analysis (EFA), confirmatory factor analysis (CFA) and Cronbach's Alpha reliability coefficients, it was determined that the "Attitude Towards Water Scale" is a valid and reliable measurement tool for measuring children's attitudes towards water. These results proved that the scale can be used in academic studies.

The scale is a five-point Likert-type scale including "strongly disagree," "disagree," "undecided," "agree," and "strongly agree." The scale consists of three sub-dimensions as water cycle (10 items),

TABLE 4 Findings on the reliability of the Attitude Towards Water Scale.

Reliability method	Sub-dimensions	Internal consistency
Cronbach's alpha	Factor 1	0.875
	Factor 2	0.864
	Factor 3	0.803
	Scale (total)	0.889
Two-half reliability	Spearman-Brown	0.919
	Guttman split-half	0.919

importance of water (nine items) and water saving (five items) and 24 items in total (Table 5). In the water cycle sub-dimension; 10–17 points were evaluated as very low, 18–25 as low, 26–33 as medium, 34–41 as high and 42–50 as very high. In the sub-dimension of the importance of water; 9–15 was scored as very low, 16–22 as low, 23–29 as medium, 30–36 as high and 37–45 as very high. In the water-saving sub-dimension, 5–8 was evaluated as very low, 9–12 as low, 13–16 as medium, 17–20 as high and 21–25 as very high. In the total scale, 24–42 was calculated as very low, 43–61 as low, 62–80 as medium, 81–99 as high and 100–120 as very high.

When the sub-dimensions were analyzed, it was seen that the first sub-dimension was related to the importance of water. Within the scope of education for the environment approach, it is necessary to raise awareness about the importance of water since worsening water scarcity causes worldwide concern. The availability of water, more than any other environmental factor, will determine where we live and what we do. Globally, analysts expect water scarcity to increasingly become the focus of wars and refugee crises. The fact that water is essential for life and our bodies will magnify this crisis because water dissolves nutrients and distributes them to cells, regulates body temperature, supports cells and removes waste products. In addition to the moving feature of water in our body, it constantly changes place and form in nature as it does in our body. Understanding how water resources are distributed and how the form of water changes can be one of the steps in finding strategies to protect this valuable resource (Cunningham and Cunningham, 2017). This step is explained by the water cycle, which is one of the sub-dimensions of the scale.

Another step and therefore sub-dimension is water saving. In terms of water saving, water use is increasing rapidly with population growth. The Food and Agriculture Organization of the United Nations estimates that by 2025, 1.8 billion people will live with severe water scarcity and two-thirds of all people will experience water shortages. Climate change is also expected to exacerbate water scarcity. One of the United Nations Millennium Development Goals has been to halve the proportion of people without reliable access to clean water and improved sanitation, but this target may be difficult to achieve if water resources come under further pressure. As with most environmental resource issues, better management of water, i.e., saving water, is often cheaper and more effective than dealing with the major problems of mismanagement. Water-saving practices can occur at any step of the water use process. Everyone can help save water (Table 5). Without making any major sacrifices or radical changes in lifestyle, probably half of the water currently used in homes or schools could be saved. Simple steps can go a long way in preventing water scarcity. It is better to adapt to more conservative uses while there is an option now, rather than being forced to do so in the future due to scarcity (Cunningham and Cunningham, 2017).

TABLE 5 Attitude Towards Water Scale.

Sub-dimensions	Items
water cycle	1. I am interested in the fact that water descends to the earth from the atmosphere/sky.
	2. It is interesting that water reaches the sea and lakes from rivers/streams.
	3. I would like to watch a documentary about the evaporation of water under the influence of the sun.
	4 I wonder how the snow falls.
	5. I would like to investigate underground water resources.
	6. I wonder where the water in dams comes from.
	7. I am interested in how the sun heats the water in seas, lakes and streams.
	8. I wonder where the rain/snow water goes.
	9. I would like to know where the groundwater goes.
	10. I am curious about the states of water in nature (solid, liquid, gas).
importance of water	11.Water is a vital resource for living things.
	12. The danger of water shortage in my country scares me.
	13. I would like to take precautions against water scarcity.
	14. I am worried about drought caused by water scarcity.
	15. It is important to protect water to prevent drought.
	16. I get worried if the water I drink is dirty.
	17. I would like the authorities to work to keep the water clean.
	18. It is important to know what pollutes water.
	19. I believe that dirty water can make people sick.
water saving	20. I find it difficult to save water.*
	21. I am lazy to save water at home.*
	22. It doesn't bother me if the taps are left running at school.*
	23. There is no need to wait for the dishwasher to be completely filled to start it.*
	24. It's boring to follow news about saving water.*

*Reverse scored items.

Conclusion and implications

This scale developed in this context will allow quantitative data to be obtained on the attitude towards water of children attending 4^{th}, 5^{th}, 6^{th}, 7^{th}, and 8^{th} grades. This study will also provide a new perspective and research direction for water-based environmental education research and enrich the scope of water-related studies.

In line with the results obtained, the following can be suggested:

- The scale is related to attitudes towards water within the scope of environmental education and can be a source for the development of other scales for measuring attitudes towards water.
- After determining attitudes towards water at regional, national, and international dimensions by using this scale, it can be recommended to develop intervention programmes to improve attitudes towards water.
- The ability of the scale to determine children's attitudes towards water in a wide age range will pave the way for longitudinal studies and reveal the long-term effects of intervention programmes.
- The number of studies on water should be increased in Turkey.

Limitations

This study also has a few limitations. The scale was developed by adopting the "Education for the Environment Approach." Researchers can carry out scale development studies based on different approaches. Questionnaires were used to collect information in the study. The authors suggest that researchers should conduct in-depth interviews to support or strengthen the study. In the study, the authors included only children living in Turkey. The study takes into account Turkish cultural characteristics, so its findings cannot be generalized to other countries. The reliability and validity of the scale should be tested by taking samples from other countries. Future studies should validate this measurement tool in other countries so that the scale can be applied in different countries. In addition, future studies can be conducted with different age groups and sample sizes. Finally, in the reliability studies of the scale, Cronbach's alpha coefficient and two-half reliability values were examined, and the Coefficient H technique was not used. In addition, only eigenvalues and scree plot graphics were used in determining the dimension in the exploratory factor analysis. Although the techniques used in determining validity and reliability are still used by many researchers, more powerful techniques could have been used to prove the validity and reliability of the scale.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Erzincan Binali Yıldırım University. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin.

Author contributions

BA: Conceptualization, Methodology, Validation, Writing – original draft, Writing – review and editing. NA: Validation, Writing – review and editing. FA: Conceptualization, Methodology, Validation, Writing – original draft. FG: Validation, Writing – review and editing.

Funding

The author(s) declare that no financial support was received for the research and/or publication of this article.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The authors declare that no Generative AI was used in the creation of this manuscript.

Publisher's note

References

Akın, M., and Akın, G. (2007). Suyun önemi, Türkiye'de su potansiyeli, su havzaları ve su kirliliği. *Ankara Üniv. Dil ve Tarih-Coğrafya Fakültesi Dergisi* 47, 105–118.

Amahmid, O., Guamri, Y. E., Yazidi, M., Razoki, B., Rassou, K. K., Rakibi, Y., et al. (2019). Water education in school curricula: Impact on children knowledge, attitudes and behaviours towards water use. *Int. Res. Geograph. Environ. Educ.* 8, 178–193. doi: 10.1080/10382046.2018.1513446

Başol, G. (2020). *Araştırmacılar Için Istatistik (2. Baskı)*. Ankara: Pegem Akademi.

Büyüköztürk, Ş (2014). *Sosyal Bilimler Ýçin Veri Analizi El Kitabı Ýstatistik, Araştırma Deseni SPSS Uygulamaları ve Yorum. (19. Baskı)*. Ankara: Pegem Yayınları.

Büyüktaşkapu, S., Samur, A. Ö, Koçyiğit, S., and Kiremit, H. Ö (2011). *Çocuk ve Çevre*. Ankara: Vize Yayıncılık.

Çankaya, C., and Filik-İşçen, C. (2014). Fen bilgisi öğretmen adaylarına yönelik su davranış ölçeği: Geçerlik ve güvenirlik çalışması. *Educ. Sci.* 9, 341–352. doi: 10.12739/NWSA.2014.9.3.1C0622

Cappellaro, E., Ünal Çoban, G., Akpinar, E., Yildiz Feyzioğlu, E., and Ergin, Ö (2011). Yetişkinler için yapılan uygulamalı çevre eğitimine bir örnek: Su farkındalığı eğitimi. *J. Turk. Sci. Educ.* 8, 157–173.

Chatzifotiou, A. (2005). National policy, local awareness: Implementing environmental education in the primary schools of northern Greece. *Environ. Educ. Res.* 11, 503–523. doi: 10.1080/13504620500169650

Çiçek, İ, and Ataol, M. (2009). Türkiye'nin su potansiyelinin belirlenmesinde yeni bir yaklaşım. *Coğrafi Bilimler Dergisi* 7, 51–65. doi: 10.1501/Cogbil_0000000094

Collado, S., Rosa, C. D., and Corraliza, J. A. (2020). The effect of a nature-based environmental education program on children's environmental attitudes and behaviors: A randomized experiment with primary schools. *Sustainability* 12:6817. doi: 10.3390/su12176817

Cunningham, W. P., and Cunningham, M. A. (2017). *Principles of Environmental Science: Inquiry & Applications*, 8th Edn. New York, NY: McGraw-Hill Education.

Demirkaya, H. (2006). Çevre eğitiminin Türkiye'deki coğrafya programları içerisindeki yeri ve çevre eğitimine yönelik yeni yaklaşımlar. *Fırat Üniv. Sosyal Bilimler Dergisi* 16, 207–222.

Eren, Y. (2016). "Biyolojik çeşitlilik ve Türkiye'deki durum," in *Çevre ve Enerji içinde*, ed. K. Aysel Aydın (Ankara: Nobel Akademi).

Erkuş, A. (2014). *Psikolojide Ölçme ve Ölçek Geliştirme-I: Temel Kavramlar ve Işlemler (2. baskı)*. Ankara: Pegem Akademi Yayıncılık.

Erten, S. (2004). Çevre eğitimi ve çevre bilinci nedir, çevre eğitimi nasıl olmalıdır. *Çevre ve İnsan Dergisi* 65, 1–13.

Ertürk, H. (2018). *Çevre Bilimleri*. Bursa: Ekin Yayınları.

Ezell, J. M., Bhardwaj, S., and Chase, E. C. (2023). Child lead screening behaviors and health outcomes following the flint water crisis. *J. Racial Ethn. Health Disparities* 10, 418–426. doi: 10.1007/s40615-022-01233-6

Kalaycı, Ş (2010). "Faktör analizi," in *SPSS Uygulamalı Çok Değişkenli Istatistik Teknikleri (ss.321 335)*, ed. Ş Kalaycı (Ankara: Asil Yayın Dağıtım).

Keleş, R., and Hamamci, C. (2009). *Çevre Politikası*. Ankara: İmge Kitabevi.

Khiri, F., Benbrahim, M., Rassou, K. K., Amahmid, O., Rakibi, Y., El Guamri, Y., et al. (2023). Water education and water culture in curricula for primary, middle and upper secondary school levels. *Aus. J. Environ. Educ.* 39, 37–54. doi: 10.1017/aee.2022.9

Kılıç, Z. (2020). The importance of water and conscious use of water. *Int. J. Hydrol.* 4, 239–241. doi: 10.15406/ijh.2020.04.00250

Kline, R. B. (2005). *Principles and Practice of Structural Equation Modeling*. New York, NY: Guilford.

Küçük, A. (2022). Investigation of Turkish middle and high school students' water literacy as a factor predicting targets for sustainable development goals. *Educ. Q. Rev.* 5, 192–201. doi: 10.31014/aior.1993.05.02.480

Liefländer, A. K. (2015). Effectiveness of environmental education on water: Connectedness to nature, environmental attitudes and environmental knowledge. *Environ. Educ. Res.* 21, 145–146. doi: 10.1080/13504622.2014.927831

Meilinda, M., Khoiron, N., Riyanto, R., Anggraini, N., and Sukardi, R. R. (2023). Students water literacy in South Sumatera Indonesia, does indigenous culture had influence? *JETL* 8, 30–38.

Özdemir, O. (2016). "Çevre eğitiminin günümüzde değişen yüzü: sürdürülebilir yaşam eğitimi," in *Çevre ve Enerji içinde*, ed. K. Aysel Aydın (Ankara: Nobel), 1–18.

Pallant, J. (2013). *SPSS Survival Manual*. London: Open University Press.

Palmer, J. A. (1998). *Environmental education in the 21st century: Theory, Practice, Progress and Promise*. New York, NY: Routledge.

Polat, T. (2023). "Türkiye'de ve dünyada iklim krizi ve küresel eğilimler," in *İklim Krizi ve Küresel Eğlimler*, eds Ş Göçer ve and Y. Solak (Ankara: Nobel Akademik Yayıncılık), 13–36.

Praveena, S. M., and Themudu, S. (2022). Exploring water conservation awareness level among primary school children from melaka (Malaysia. *Malaysian J. Med. Health Sci.* 18(Suppl.5), 75–81.

Reddy, R. A., Sengupta, R., Jackson, B. M., and Lewis, C. (2023). Development of a new measure to check attitude towards water conservation?. *MethodsX* 10:101992. doi: 10.1016/j.mex.2022.101992

Schaefer, G. (1978). "Environmental education-a new word or a new philosophy of teaching?," in *Environmental Education Principles, Methods, and Applications*, eds T. S. Bakshi and Zev Naveh (New York, NY: Plenum Press).

Scherer, R. F., Luther, D. C., Wiebe, F. A., and Adams, J. S. (1988). Dimensionality of coping: Factor stability using the ways of coping questionnaire. *Psychol. Rep.* 62, 763–770. doi: 10.2466/pr0.1988.62.3.763

Seçer, I. (2015). *Psikolojik Test Geliştirme ve Uyarlama Süreci: SPSS ve LISREL Uygulamaları*. Ankara: Anı yayıncılık.

Seçer, I. (2017). *SPSS ve LISREL ile Pratik veri Analizi (3. Baskı)*. Ankara: Anı Yayıncılık.

Senemoğlu, N. (2010). *Gelişim Öğrenme ve Öğretim: Kuramdan Uygulamaya*. Ankara: Anı Yayıncılık.

Tavşancıl, T. (2010). *Tutumların Ölçülmesi ve SPSS ile Veri Analizi*. Ankara: Nobel Yayın Dağıtım.

Tegegne, T. A., and Kelkay, A. D. (2023). Comparative study of using 5E learning cycle and the traditional teaching method in chemistry to improve student understanding of water concept: The case of primary school. *Cogent Educ.* 10:2199634. doi: 10.1080/2331186X.2023.2199634

Turan, E. S. (2018). Türkiye'nin iklim değişikliğine bağlı kuraklık durumu. *Doğal Afetler ve Çevre Dergisi* 4, 63–69. doi: 10.213247/dacd.357384

Watkins, G. A. (1974). Developing A "Water Concern" scale. *J. Environ. Educ.* 5, 54–58. doi: 10.1080/00958964.1974.1080184

Wójcik, A. M. (2004). Informal environmental education in Poland. *Int. Res. Geograph. Environ. Educ.* 13, 291–298. doi: 10.1080/10382040408668525