Analysis and assessment of the environmental awareness of primary school pupils on the management and sustainable use of water

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Water care and aquatic ecosystems play a fundamental role in the health and sustainable development of our society. From this perspective, education and water culture are key elements for increasing environmental awareness of the socio-environmental problems and risks associated with the sustainable use and management of water resources. The aim of this study is ascertain the level of environmental awareness that primary school students have about the management and uses of water. A mixed sequential exploratory design is proposed, which is developed in two research phases. An initial phase of qualitative data collection and analysis; and a subsequent complementary phase of quantitative data gathering and analysis. The results of this research show the low levels of environmental awareness on the part of students regarding the uses, management and socio-environmental problems related to water. In addition, they tend to conceive of water uses from a direct and proximate perspective, based on food, health and hygiene. The conclusions of this study suggest the need to approach the contents of water from a broader perspective, considering the causes and consequences of the problems arising from poor water use and management

Keywords: environmental awareness; primary education; science education; sustainable management; water; disposition.

Introduction

The COVID-19 pandemic has provided evidence of the fragility of our planet and the global challenges we face. It is evident to state that humans are totally dependent on nature and the avoidance of this connection leads to significant negative consequences that threaten the survival of the species, and even of the Earth itself. In this sense, the scientific community and other experts have for years been warning of the need to transform and break with the processes that are destroying our biodiversity and natural ecosystems.

Thus, in order to halt this environmental deterioration, on the one hand, it is proposed to act by promoting collective awareness and an attitude of respect for nature and, on the other, by promoting responsible consumption, a key aspect of environmental education (Martínez, 2010). In other words, environmental education is necessary, the main objective of which is not the learning of concepts, but the search for the awareness of the individual in order to subsequently go into detail on the forms of intervention (Velázquez, 2016).

From this perspective, education is key to raising environmental awareness of some of the socio-environmental problems and risks present today, as for example those that are associated with the responsible use of water resources. UNESCO (2019) maintains that the care of this resource and aquatic ecosystems play a fundamental role in the health, sustainable development and well-being of our society, and it is therefore necessary to carry out adequate, sustainable and equitable management of its consumption in order to avoid the depletion of this resource.

From this standpoint, the importance of changing the collective mentality and educating in humility and respect for nature is highlighted, in order, as Sutoris (2021) argues, to rebuild the relationship with our planet. According to Benarroch et al. (2021), formal educational processes can be the foundations of community cultural changes, and therefore, in the case of water, it is necessary for the educational system to reflect on customs, attitudes and values, both individual and socially shared. In this sense, students should become aware of their previous ideas about water, and analyse whether their beliefs include considering water as a vital and natural resource in itself, and not only consider it from a utilitarian point of view. These approaches seem to have begun to be considered in Spain, and the new Primary Education curriculum published in March 2022 points in this direction. Thus, it is possible to verify how the responsible and sustainable use of water is included as one of the key contents during the three stages that make up this educational level.

For all of the above, the purpose of this study is to find out the level of environmental awareness of pupils in the third cycle of Primary Education in relation to the use and sustainable management of water resources, and what knowledge could be key to improving this level.

Theoretical background

The need to raise environmental awareness about water

Water scarcity is one of the main problems we face in the 21st century. Population growth, socio-economic development and changing consumption patterns, coupled with the effects of climate change, mean that water scarcity levels are becoming increasingly acute (Abbott et al., 2019). Data suggest that, if current consumption rates continue, by 2050, there will be an increase above today's consumption level of around 30% (UNESCO, 2019).

The consequence of all this is that millions of people around the world are being affected by the water crisis and are experiencing problems of drought and flooding, groundwater depletion, ecological degradation, poor sanitation, water pollution and thus a negative impact on human health (Srinivasan et al., 2012). In short, it is becoming clear that human water use, climate change and land conversion have created and are creating a water crisis for billions of people and for many ecosystems around the world (Abbott et al., 2019).

We are facing a problem that, according to experts, is the result of a lack of environmental awareness that provides broader economic, environmental and socio-cultural perspectives on the part of citizens in general, and scientists, policy makers and water resource managers in particular (Di Baldassarre, 2019). This is creating a clear threat to the well-being of people, societies and the environment. Confronting this and other problems of this nature requires awareness, decisions and action, but this demands understanding (Reis, 2014). In this sense, Jensen (2002) considers that there are three levels of knowledge necessary to achieve an active disposition in citizens in the face of these types of issues: (1) knowledge about the social, political and environmental aspects of the problem and how they contribute to the creation of social and environmental problems, (2) knowledge of what to do through direct or indirect action, and (3) knowledge of the results by the direct or indirect action and the need for getting such results. In other words, it is necessary to have deeper prior knowledge of the water problem that must include its origin, its impact and possible solutions from all perspectives (social, economic and environmental). Along the same lines as stated by Kang and Hong (2021), it seems necessary to understand environmental problems within a framework that considers environment, society and economy as integrated aspects of our lives. This will help people learn about and recognise the need to become involved in the management and care of their environment (Hodson, 2014), thereby acquiring a sense of individual responsibility and environmental awareness of the issues.

Therefore, there is an urgent need to educate citizens to become aware of problems in general, and of water issues in particular, and to acquire the skills to deal with them (Marques & Reis, 2017). Jensen (2002) argues that science education has a decisive role to play in this task, and must ensure that citizens see themselves as capable of contributing to the solution of these problems. On this path, and focusing on the problem of water in particular, we must begin by approaching its knowledge from a social, environmental and economic perspective, so that, as Castelltort and Sanmartí (2016) argue, we can adopt new actions both in the sphere of public management and in the everyday sphere, which guarantee the conservation of natural water reserves. From this approach, Ramírez-Segado et al. (2021) point out the importance of approaching water as a natural resource, which promotes economic growth and social development of communities, beyond its relationship with the physical environment. Environmental awareness of the relationships that humans establish with water is essential in order to understand that the distribution of this asset among the various regions is still very unequal, the demand for water is growing and its pollution is alarming.

Educational perspective on environmental water awareness

Environmental awareness can be defined as a system of experiences and knowledge that individuals actively use in their relationships with the environment, and which involves understanding the impact caused by human action thereon, and understanding the influence and repercussion of one's own actions in the present and in the future (Febles, 2004; Prada, 2013). In this sense, López and Santiago (2011) state that environmental awareness seeks to apply knowledge in order to understand the situation in which we find ourselves, to determine and observe the way to reach such a circumstance, and to seek alternatives to change the models that are failing and, as such, are deteriorating the environment.

For Simsekli (2015), promoting environmental awareness among students, particularly in primary education, represents a great investment for the environment and the future. In the same vein, Ablak and Yeşiltaş (2020) indicate that acquiring a good level of environmental awareness enables students to identify environmental problems and find various alternative solutions. Put another way, developing a high degree of environmental awareness empowers students' sensitivity by influencing attitudes, behaviours and willingness to act on environmental issues (Susilawati et al., 2021). Along the same line, Littledyke (2008) highlights the importance of integrating the cognitive-rational and the emotional to foster reflective awareness of environmental knowledge and care. Thus, she points out that conceptions, feelings and behaviours are highly interconnected and are involved in shaping the attitudes, beliefs and values that sustain relationships with our environment. Likewise, Gomera et al. (2012), based on different previous theoretical models (Chuliá, 1995; Febles, 2004), also consider environmental awareness to be a multidimensional concept, constituted taking into account four dimensions: cognitive (information, knowledge), affective (beliefs, perceptions, values), conative (attitudes, feelings of responsibility) and active (individual and collective behaviours).

In relation to environmental awareness of water, Seelen et al. (2019) define it as the knowledge of the amount of water used daily through direct use (e.g. drinking, washing, showering, etc.) and indirect use (e.g. production of food, clothing, packaging, etc.), and the threats that affect the quality and loss of water, valuing it as a scarce and limited asset. For Fisman (2010), this awareness should be addressed in the classroom from an urban perspective, analysing both the natural elements involved (flora, fauna, soil, water resources, rocks, etc.) and the artificial ones (playgrounds, buildings, etc.). Other authors such as Hernández (2014) point out the importance of working on awareness of this resource in the classroom by considering two types of content: "water in nature" (distribution of water in the hydrosphere, the water cycle and its role as a geodynamic agent that shapes the landscape); and "water as a resource" (uses of water from different sectors, the urban cycle and its environmental impact). Based on all these approaches, Gutiérrez and Pozo (2006) also state the need to study the environment, moving from a dominant anthropocentric vision (focused on the human being) to an ecocentric one (focused on the ecosystem) where the whole set of physical, environmental and chemical components that determine the environment must be taken into account.

Nevertheless, several studies reveal the difficulty that students in education in general, and Primary Education (PE) in particular, have in developing all these perspectives on water and, therefore, in creating environmental awareness about it. Specifically, studies such as that of Basterretxea, et al. (2019) and Durkan, et al. (2016) point out that students are unaware of the multiple uses of water and do not relate its use to economic sectors, with the most common reference being that of direct individual consumption. Díez (2017) and Sari, Karkkainen and Tuula (2018) also show results in this sense and establish that students have difficulties in linking water with environmental care and the reasons for problems related to water scarcity and pollution.

These difficulties seem to have their origin in the perspective through which this subject is being addressed in the classroom. Thus, Ramírez-Segado et al. (2021), in a systematic review of water as a curricular content area, reveal that the natural water cycle is the subject matter most worked on in the classroom, although it is often disconnected from aspects related to the use, management and socio-environmental problems of water resources. In this sense, Martínez-Borreguero et al. (2020), in a review of the importance given to water concepts in the Spanish PE curriculum, shows that water-related content is approached from a theoretical perspective, compared to the perspective of acquiring pro-environmental attitudes, values and behaviour, in terms of consumption and rational use of water. In the same vein, Amahmid et al. (2019) show that education plans in Morocco focus more on the acquisition of scientific knowledge about water than on the development of skills, attitudes and behaviours to protect and respect the environment. It is therefore necessary to approach the subject of water from a more systemic point of view, linking different dimensions of environmental awareness, allowing students to have a global perspective on the management, uses and problems relating to this precious resource.

Methodology

Participants

Due to the characteristics of the study, purposive sampling was applied (Tójar, 2006). 95 PE students aged between 10 and 12 years were selected, of whom 44.2% were girls and 55.8% boys. They were in the last cycle of PE (in the Spanish education system there are 3 cycles in PE, each with a duration of 2 years), specifically 47 students (49.5% of the total sample) were in the 5th year of PE and the remaining 48 (50.5% of the total sample) were in the 6th year. All students belong to the same public educational centre, located in a coastal neighbourhood of Malaga of the city of Malaga (Spain). This educational centre was selected because the coastal neighbourhood usually has problems with the purification and sanitation system, especially in the summer season. In addition, the age of the students has also been considered relevant criterion due to the important curricular implications it has in the understanding of natural phenomena and socio-scientific problems related to water.

Methodological design

The study was conducted using a mixed sequential exploratory approach developed in two research phases (Creswell & Plano Clark, 2011). A first initial phase of qualitative data collection and analysis where interpretative methods were applied (ethnographic-narrative design); and a subsequent complementary phase of quantitative data collection and analysis, with the aim of supporting and prioritising the interpretation of the qualitative findings (Ardoin et al., 2018).

From the qualitative approach, an analysis of the content of the students' productions (95 narratives) was carried out, through procedures of data reduction, arrangement and transformation, obtaining and verifying conclusions (Miles et al., 2014):

A. Reduction of the information. This consisted of defragmenting the units of information analysis (narratives) through a process of categorisation and coding. To this end, a mixed model of categorisation was established that allowed the information to be classified into predefined (deductive) categories, derived from the review of specialised literature (Gomera et al. 2012), and ad hoc (inductive) categories constructed from the observation of the texts selected for the sample. The category system was configured on the basis of the following structure:
   - Macrocategory 1. Affective dimension.
   - Macrocategory 2. Cognitive dimension.
   - Macrocategory 3. Conative dimension.
   - Macrocategory 4. Active dimension.
B. Arrangement and transformation of the data. Descriptive matrices were elaborated to order, structure and observe the relationships between the data.
C. Obtaining and verifying conclusions. All the information was assembled through the identification of regularities and common patterns, ending in the construction of certain generalisations, typologies and models. Atlas.ti v7.0 (2012) was used to support the qualitative analysis.

Based on the elaboration of the system of categories, the content of the student production was analysed and the data obtained were classified in order to carry out a quantitative treatment thereof. The quantitative analysis techniques were descriptive analysis of the distribution of frequencies and percentages, the preparation of contingency tables and the study of relationships (associations or nominal correlations). This test made it possible to determine in which cases the variables were related on the basis of the independence test.

Instruments for collecting information

The data collection was carried out on the basis of different creative productions made by the students. These productions consisted of the elaboration of narratives in which students were asked to reflect their previous knowledge of certain contents related to water (water properties, hydrological cycle, water uses, environmental problems associated with water, etc.). To this end, students were presented with a simulated situation in which they were required to explain to extraterrestrial beings, through a written message, the importance of water for life on the planet. With the aim of promoting reflection and creative thinking among the students, they were asked a series of questions: What is water, for whom is it of vital importance, what is it for, where can we find it, where does the water circulate, what it is the water cycle, could we drink any kind of water, how we treat water to make it fit for human consumption, how we contaminate water, how contamination affects water, how can we take care of the water? These types of learning strategies based on the development of the narrative become a great educational resource for learning about the evolution of students in the construction of scientific knowledge, the modifications produced in their initial mental representations and learning gaps (Gómez & Gavidia, 2015; Grilli et al., 2015).

Category system

The categorisation system developed for the collection and analysis of the data contained in the students' productions is presented below, taking into account the four dimensions (macrocategories) of environmental awareness established by Gomera et al. (2012).

Macrocategory 1. Affective dimension

The affective dimension includes the students' beliefs regarding the interdependent relationship between living beings and water, and their perceptions of the importance of water for living beings. Within this macrocategory, two categories have been defined to analyse whether they consider and value water to be an essential resource for living beings (ecocentric awareness), and whether it is a necessary resource in all contexts in which human beings develop (anthropocentric awareness). For the perceptions of ecocentric awareness, 2 answers type have been defined: A (values water as a resource for the survival of humans and other animals) and B (values water as a resource for humans and plants). An example of the ecocentric approach is presented below: "*Water feeds animals and plants for photosynthesis*".

Regarding perceptions of anthropocentric awareness, 2 answers type have also been defined: A (values water as a nearby or direct resource for food, hygiene, leisure, ...), and B (values water as a distant or indirect resource for industry, commerce, ...). An example of the anthropocentric approach can be seen below: *"There are companies that make money by bottling water"*.

For each category of this dimension, in turn, 4 levels of performance have been constructed: Level 0 (no answers related appear), Level 1 (only answers type A appears), Level 2 (only answers type B appears), Level 3 (all answers type appear: A-B). Table 1 shows the relationship between the answers type and levels of this dimension.

Table 1. Relationship between the answers type and levels of the affective dimension

Level 0	Level 1	Level 2	Level 3
No answers type are shown	Type A	Type B	Type A-B

Macrocategory 2. Cognitive dimension

The cognitive dimension includes knowledge related to the natural and urban water cycle. Knowledge about the natural water cycle has been classified in 3 answers type: A (knows the physical and electrical properties of water, and its surface distribution), B (knows the changes of state of water, and its underground distribution) and C (knows the origin of the phases of the water cycle, and the processes and dynamism of these phases). An example of the natural cycle can be found in this quote: *"Groundwater is found underground. It can only be accessed by digging and laying a well"*.

Knowledge of the urban cycle has also been divided into 3 answers type: A (knows the processes of water catchment), B (knows the processes of transport, storage and distribution) and C (knows the processes of water treatment). An example of the urban cycle can be seen in this quote: *"Water can move through pipes that are located under the ground in the sewers"*.

Based on the difficulties relating to the learning of these contents reported in the literature (e.g. Amahmid et al., 2019; Havu-Nuutinen et al., 2018; Authors et al., 2021) 4 levels of performance have been described for each category of this dimension and are listed in Table 2: Level 0 (no answers type appear), Level 1 (one answer type appears: A or B or C), Level 2 (combined answers type appear: A-B or A-C or B-C), Level 3 (all answers type are shown: A, B and C).

Table 2. Relationship between the answers type and levels of the cognitive dimension

Level 0	Level 1			Level 2			Level 3
No answers type are shown	Type A	Type B	Type C	Type A-B	Type A-C	Type B-C	Type A-B-C

Macrocategory 3. Conative dimension

The conative dimension attempts to capture the level of individual environmental responsibility that students have for the care and conservation of water. An example of this dimension is the following: *"The water should not get dirty because it is a treasure. There are countries where there is no drinking water and they have a hard time"*.

For this category, 2 answers type have been proposed: A (they perceive that their daily activity does not affect the care and conservation of water) and B (they perceive that their daily activity affects the care and conservation of water). Moreover, in order to know the level of acquisition of this category, 3 levels of performance have been defined, as shown in table 3.

Table 3. Relationship between the answers type and levels of the conative dimension

Level 0	Level 1	Level 2
No answers type are shown	Type A	Type B

Macrocategory 4. Active dimension

The last of the macro-categories, the active dimension, aims to analyse the disposition of participants regarding water issues, assessing their capacity to identify their origin, repercussions and possible solutions. An example of this macro-category can be seen in the following quote: *"Water is very important, so we should not waste it and leave the tap open or throw things down the toilet*".

For this category, 3 answers type are proposed: A (very low capacity to identify water issues- passive disposition), B (identifies the origin of the problem and/or the causes at economic, social or environmental level - critical disposition) and C (identifies possible solutions to the problems - proactive disposition). In addition, in order to know the level of acquisition of this category, 4 levels of performance have been defined, as shown in table 4.

Table 4. Relationship between the answers type and levels of the active dimension

Level 0	Level 1	Level 2		Level 3
No answers type are shown	Type A	Type B	Type C	Type B-C

Data analysis

Quantitative analysis

This section presents the quantitative results obtained from the analysis of the student narratives. First, the results of the univariate analysis (category by category) are shown, followed by the results of the repeated measures multivariate analysis of variance (MANOVA). Furthermore, the results of the existing relationships between categories are shown through contingency tables by calculating Pearson's χ^2 coefficient, Fisher's exact probability and Pearson's Phi coefficient.

Univariate analysis

Table 5 shows the results on the affective dimension of environmental awareness, assessing the students' ecocentric and anthropocentric views. From an ecocentric perspective, the results show that students have a high level of awareness, considering water as an essential resource for all living beings on the planet (answer type A-B: 41.1%), and not only for humans and other animals (answer type A: 14.7%) or plants (answer type B: 8.4%). It should also be noted that a large proportion of students value water as a resource exclusively for humans, standing at level 0 (no answers type: 35.8%). From the anthropocentric perspective, it can be seen that they are highly aware of the direct or proximate uses of water (answer type A: 69.5%), such as food, hygiene or human leisure. On the other hand, there is a lack of awareness of indirect or distant water uses (answer type B: 1.1%), such as industrial water uses. It is striking to note the low percentage of students who consider direct and indirect water uses together (answer type A-B: 24.3%).

Table 5. Frequencies (*f*) and percentages (*%*) of the affective dimension

Affective Dimension	Level 0		Level 1		Level 2		Level 3	
	No answers type		Type A		Type B		Type A-B	
	f	*%*	*f*	*%*	*f*	*%*	*f*	*%*
Ecocentric	34	35.8	14	14.7	8	8.4	39	41.1
Anthropocentric	5	5.3	66	69.5	1	1.1	23	24.2

Table 6 presents the results on the cognitive dimension. Regarding this aspect, it is clear that students make special mention of elements related to the physical properties of water and its surface distribution, referring to the natural water cycle (answer type A: 27.4%). A decrease in frequency can be observed when considering the combination of the more complex answer type, as in the case of answer type B-C (3.2%). It is also worth noting the low percentage of students reaching level 3 knowledge (18.9%) in this category. In relation to the urban cycle, a high percentage of level 0 (56.85%), denotes a great lack of knowledge about the different phases of the urban cycle. There are also few references to water catchment processes (answer type A: 2.1%) and even a total decrease in frequency when the answer type are combined (answer type A-B: 0.0%). However, the number of references to other concepts or more complex processes related to water treatment such as drinking water treatment or purification is striking (answer type C: 24.2%).

Table 6. Frequencies (*f*) and percentages (*%*) for the cognitive dimension

Cognitive Dimension	Level 0		Level 1						Level 2						Level 3	
	No answer type		Type A		Type B		Type C		Type A-B		Type A-C		Type B-C		Type A-B-C	
	f	*%*	*f*	*%*	*f*	*%*	*f*	*%*	*f*	*%*	*f*	*%*	*f*	*%*	*f*	*%*
Natural Cycle	17	17,9	26	27.4	1	1.1	4	4.2	16	16.8	10	10.5	3	3.2	18	18.9
Urban Cycle	54	56.8	2	2.1	6	6.3	23	24.2	0	0.0	1	1.1	8	8.4	1	1.1

Table 7 shows the results on the conative dimension of environmental awareness. This aspect shows how students do not show many feelings, attitudes or patterns of behaviour respectful towards water care. Only one third of the students seem to have a high level of responsibility in terms of the impact of their daily activities on water management and care (answer type B: 14.7%). Furthermore, there is a notable absence of references to their responsibility as citizens to change their lifestyle and avoid water quality degradation (answer type A: 3.2%).

Table 7. Frequencies (*f*) and percentages (*%*) of the conative dimension.

Conative Dimension	Level 0		Level 1		Level 2	
	No answers type		Type A		Type B	
	f	*%*	*f*	*%*	*f*	*%*
Responsibility towards water care	78	82.1	3	3.2	14	14.7

Table 8 shows the results on the active dimension. In this aspect it can be seen that a significant number of students fail to mention anything about water-related issues (57.9%). In contrast, students with a somewhat more critical disposition towards water issues seem to possess some knowledge about the origin and/or the economic, social or environmental causes (answer type B: 29.5%). However, very few students show a more proactive disposition, being aware not only of the problems, but also of possible solutions (answer type B-C: 2.1%).

Table 8. Frequencies (*f*) and percentages (*%*) of the active dimension.

Active Dimension	Level 0		Level 1		Level 2				Level 3	
	No answers type		Type A		Type B		Type C		Type B-C	
	f	*%*	*f*	*%*	*f*	*%*	*f*	*%*	*f*	*%*
Disposition towards water issues	55	57.9	5	5.3	28	29.5	5	5.3	2	2.1

Multivariate analysis

The following is the multivariate analysis of variance (MANOVA) of repeated measures to study the differences between the 4 dimensions in which environmental awareness can be structured (cognitive, affective, conative and active).

Multivariate tests all show significant results (Table 9), with F=137.66 and p<0.0005. Effect size ($\eta 2$) with power being high (0.818 and 1 respectively). If the p-value associated with the Pillai's trace, Wilks' Lambda, Hotelling trace and Roy's largest root statistics are less than 0.05, the null hypothesis is rejected. That is, there are significant differences between the dimensions of environmental awareness.

Table 9. Multivariate repeated measures MANOVA contrasts.

Effect	Value	*F*	Df hip.	Df. Error	*P*	*η2*	Power
Pillai's trace	0.818	137.66	3	92	0.000	0.818	1
Wilks' Lambda	0.182	137.66	3	92	0.000	0.818	1
Hotelling trace	4.489	137.66	3	92	0.000	0.818	1
Roy's largest root	4.489	137.66	3	92	0.000	0.818	1

To test for homogeneity of variances, Mauchly's test for sphericity (W), which analyses whether the variance-covariance matrix is circular or spherical, was performed. Mauchly's W obtained a result of 0.210, implying a χ^2 statistic of 144.68 (p<0.005 with 5 df). As the sphericity hypothesis was rejected, the corresponding corrections were made to the degrees of freedom (Pardo & Ruiz, 2010). The results without assumed sphericity also all show significant values (Table 10), so it can be considered that the different dimensions have a different representation in the narratives. The effect size, with respect to the results in Table 10, has decreased somewhat ($\eta2$ = 0.528), but the power of the tests remains at 1.

Table 10. Tests of within-subjects effects.

Origin	F	Df hip.	Df. Error	P	$\eta2$	Power
Assumed sphericity	104.98	3	282	0.000	0.528	1
Greenhouse-Geisser	104.98	1.76	165.32	0.000	0.528	1
Huyn-Feldt	104.98	1.79	168.23	0.000	0.528	1
Lower limit	104.98	1	94	0.000	0.528	1

Table 11 shows the estimated marginal means of the 4 dimensions of environmental awareness. It shows that the cognitive dimension is the most represented ($\bar{x}$=3.32), followed by the affective dimension ($\bar{x}$=3.20). The two least represented dimensions are conative ($\bar{x}$=0.19) and active ($\bar{x}$=0.53).

Table 11. Estimated marginal means of the dimensions of environmental awareness.

Dimension	$\bar{x}$	Standar Error	95% Confidence interval	
			Lower limit	Upper limit
Affective	3.20	0.173	2.86	3.54
Cognitive	3.32	0.255	2.81	3.82
Conative	0.19	0.043	0.10	0.28
Active	0.53	0.073	0.38	0.67

Relationships between components of the dimensions.

Two-by-two comparisons were made between all the components of each of the categories. As the presence and absence of the components was considered for all of them, it was possible to obtain 2x2 contingency tables and thus study the possible association between components of the same or different categories. In each contingency table, Pearson's coefficient χ^2, Fisher's exact probability and, as these were tables with dichotomous variables, Pearson's Phi coefficient were calculated. Of the 630 possible comparisons (36 components taken 2 by 2), 61 significant contrasts were obtained (9.67%).

Thus, for example, the relationship between the components of answer type B of anthropocentric awareness and answer type B of disposition to problems components is shown (Pearson's χ^2 =0.028, Fisher's exact statistic=0.037, and Pearson's Phi coefficient=0.226). The results indicate that there is a direct correlation between the two components. This means that the presence or absence of a high level of anthropocentric awareness (indirect uses of water) is associated (correlates) with the presence or absence of knowledge about the origin and causes of problems (social, economic and environmental) arising from poor water management and uses.

The results also show that there is a direct correlation between answer type B of anthropocentric awareness and answer type C of the natural water cycle (Pearson's $\chi 2$=0.038, Fisher's exact statistic=0.067, and Pearson's Phi coefficient=0.213). This means that the presence or absence of a high level of anthropocentric awareness (indirect uses of water) is associated (correlates) with the presence or absence of a high level of knowledge about the natural water cycle (origin of the phases and dynamism of the cycle).

In addition, a direct correlation was found between answer type C of the urban cycle and answer type B of responsibility towards water care (Pearson's $\chi 2$=0.031, Fisher's exact statistic=0.054, and Pearson's Phi coefficient=-0.223). This means that the presence (or absence) of a high knowledge of the urban water cycle (water treatment) is associated (correlates) with the absence (or presence) of a high feeling of responsibility, being aware that everyday activity affects our relationship with water.

Conclusions

This work shows the environmental awareness of primary school pupils in relation to the use and management of water resources from four knowledge perspectives: water as an essential resource for living beings; the natural and urban water cycle; attitudes and patterns of individual responsibility regarding water care; and existing socio-environmental problems associated with water.

The participants in this study show a greater knowledge in the affective dimension, mainly from an anthropocentric perspective, and in cognitive dimension, mainly respect to the natural water cycle. This situation could be generated due to the fact that in schools there is a greater tendency to teach physical-chemical contents (natural water cycle, basins, ...) as opposed to environmental contents (management, urban water cycle, purification, ...), even causing students difficulties in identifying the impact of human activities on the water cycle (Ramírez-Segado et al., 2021). Moreover, this perception is accentuated by an anthropocentric view, more focused on direct uses (hygiene, food, etc.) than indirect uses (e.g. industrial use), which makes it difficult for students to understand the concept of the water footprint, so necessary for adopting pro-environmental behaviour in this area (Benninghaus et al., 2018).

Furthermore, the results also show that the two areas where students show a lower level of environmental awareness are those related to the conative dimension (responsibility towards water management and care) and the active dimension (knowledge of water issues).

Regarding the conative dimension, the data suggest that this situation could be influenced, on the one hand, by the shortcomings detected in the participants' knowledge of the natural and urban water cycle (cognitive dimension), and on the other hand, by the lack of knowledge of some of them in relation to ecocentric awareness (water essential for all living beings). Authors such as Çoban, et al. (2011) point in the same direction and show that students with a better knowledge of concepts related to water have better attitudes towards its use and, therefore, greater environmental awareness. On the other hand, Abbott et al. (2019) also recognise that not considering living beings, and especially human beings, in the study of water can be problematic and lead to the idea that human actions do not influence this resource. However, one must also consider the caveats of authors such as Zhan et al. (2019) who recognise that an increase in knowledge alone does not lead to the adoption of pro-environmental behaviours, unless competence for action is properly developed.

In relation to the active dimension, among the aspects that could be contributing to the low disposition about this the lack of knowledge shown in the cognitive dimension (natural and urban cycle) once again stands out. In this sense, Ramírez-Segado et al. (2021) conclude on the need for students to have a high level of knowledge in water management, transport and purification contents so that they can understand the role of human beings in the availability of water resources, and advance their conceptions from a more local level to a more extensive one in space and time. In other words, alongside knowledge of the natural water cycle, it is necessary for students to have knowledge of aspects related to urban use and the economic and environmental issues associated, for example, with water treatment, so that they can come to understand the problem of water scarcity. In addition, gaining an understanding of the problems and their consequences can be the first step towards adopting active attitudes towards them since, as Del Rey et al. (2021) argue, students must identify and assume the social repercussions of their behaviour in order to achieve a real transfer of their learning and an involvement in real actions. In other words, we agree with the approach proposed by Sarkawi et al. (2017) who state that a population that does not know that its behaviour can contribute to damaging the environment will continue to behave in this way.

Therefore, given the interconnection shown in the different areas of knowledge necessary to achieve an adequate environmental awareness of water, the need arises to approach the teaching of this subject from an integrated approach that seeks to provide students with the skills to carry out pro-environmental actions in relation to water. For this reason, it is proposed to work on the contents based on socio-scientific problems related to the subject, close to the students' everyday environment and directly caused by human action. From here, the different areas of knowledge to be addressed include: the importance of the resource for the life of living beings in both direct and indirect contexts; the natural and urban water cycle; the repercussions of individualised actions in the conservation and care of the resource; and the causes of and solutions to socio-environmental problems associated with this resource. As an example, a teaching proposal is proposed based on trying to answer the question "What happens to the sanitary towels that are flushed down the toilet?" Answering this question in the classroom involves studying the cycle that the towel will follow, the repercussion it will have on the environment, the environmental, economic and social problems that exist today as a result of this action, and the possible solutions that could be adopted.

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