Effects of a training programme aimed at improving the pro-environmental competency of school children

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ABSTRACT

Bearing in mind the need to understand and analyze the psychological processes involved in pro-environmental behaviour, in order to mitigate the negative effects of the current global ecological crisis, the aim of the research presented here is to analyze the effects of a pro-environmental competency (PEC) training programme on Colombian children. To this end, a quasi-experimental design was applied to a non-probabilistic sample of 102 subjects, evenly distributed between the experimental and control groups (M_{age} = 8.13; SD_{age} = 0.496; 43.1% female and 56.9% male), applying the ECOPRO-N scale and structured quantitative observation to measure pro-environmental competency. The results showed an increase in the pro-environmental competency of the experimental group with respect to the control group, specifically in the dimensions Beliefs (d = 0.75), Knowledge (d = 0.91) and Motives (d = 0.32), with the greatest effect observed in the Knowledge dimension. This verifies the effectiveness of the intervention programme in terms of fostering pro-environmental behaviours among Colombian children.

KEYWORDS

Pro-environmental Competency, Effects, Children, Environment, Intervention Programme.

Humanity's current models of growth in its economic and social dimensions are characterized mainly by the unchecked exploitation of natural resources to meet our own needs, altering the true cycles of nature with devastating consequences (Leff, 2010).

In Colombia specifically, 92% of the country's glacier area has been lost in the last 50 years, i.e., glaciers are estimated to be losing 3% to 5% of their frozen area per year (Institute of Hydrology, Meteorology, and Environmental Studies-IDEAM, 2018). There has also been a visible increase in deforestation compared to other years (IDEAM, 2018) and problems with solid waste management. In fact, the country's vision for 2019 was focused on reducing pollution problems and environmental risks associated with solid waste generation and disposal (National Administrative Department of Statistics-DANE, 2011).

Taking into account the overall environmental panorama, the 1990s saw the first contributions made from within the field of Psychology towards the resolution of environmental problems. These contributions stem specifically from the reflection made by Corraleiza (1997), raising the following questions: Is it appropriate to label the current crisis affecting nature an "environmental problem"? Or, is it actually a "problem of humanity"? Different scenarios of discussion, research and intervention have been raised, which have generated important challenges at a local, national, and international level.

Some studies have focused on the explanation and prediction of pro-environmental behaviours using various theoretical models. Cognitive behavioural postulates, for example, also tackle intervening variables (Ajzen, 1991), analyze the effect of affective variables (Sevillano, Corraleiza & Lorenzo, 2017), the value-belief-

norm model of Stern, Dietz, Abel, Guagnano & Kalof (1999), and the influence of values on environmental conservation (Suárez, Salazar, Hernández and Martín, 2007). The research presented here takes into account the model of pro-environmental competency proposed by Corral-Verdugo (2002), set out below.

Pro-Environmental Competency (PEC) Model

"Competency is a special type of dispositional variable that combines the ability to act (skills) with other types of variables such as beliefs, knowledge, attitudes, and motives, among others" (Fraijo, Tapia, Corral-Verdugo, 2001, p.4). Pro-Environmental Competency (PEC) is included within this line, defined as the ability to respond effectively to the requirements of environmental conservation. For Corral-Verdugo (2002), possessing ability is not enough for the subject to actually engage in a certain conduct. In addition to possessing the ability to act correctly, there must be certain conservationist requirements at work and a context conducive to engagement in the behaviour (Figure 1).

Figure 1.

Conservationist requirements

In PEC theory, a requirement implies a demand or attribution, either internal or external, which operates at a dispositional level within the individual-environment relationship. In this context, there may be requirements that foster negative behaviour or

requirements that encourage positive behaviour, also known as conservationist requirements.

Corral (2002) explains that requirements are constructed through social information, such as beliefs and pro-environmental norms; they can also be acquired individually as is the case with motives, attitudes, knowledge, and perceptions.

Abilities

Corral-Verdugo, in the year 2000 (cited by Martimportugués, Canto and Hombrados, 2007), defined ability as "an instrumental action that solves a problem or reaches a definitive goal" (p.76). To be 'able' is not simply to possess an understanding of environmental problems and how they can be solved, but to take that understanding and know that you can act, then to act, and to act well.

For this reason, authors such as Corral-Verdugo and Pinheiro (2004), Ribes (2006), and Palacios and Bustos (2012) claim that abilities are one of the significant predictors of pro-environmental behaviours. Before engaging in environmental conservation, the person must have knowledge of which actions are to be taken and how to carry them out successfully, along with faster and more efficient modes of behaviour according to their skills: "If you have the capacity and ability that are essential to do this, the likelihood of initiating or maintaining behavioural patterns of environmental conservation will increase" (Palacios and Bustos, 2012, p.246), unlike someone who receives certain knowledge without instructions on how to put it into effect.

PEC research

In the case of behavioural analysis and the design of PEC promotion strategies, authors such as Morten and Grinstein (2016) state that behaviour is not only a relevant

emissions driver, but also an important agent of change regarding the consequences of such emissions, and that education plays a crucial role in the process of promoting behaviour (Tucker & Izadpanahi, 2017), mainly among children, whose attitudes are still being formed and shaped (Cornelisse & Sagasta, 2018).

Corral-Verdugo, Frias-Armenta and Corral-Verdugo (1996), using multiple regression analysis, found that the use of teaching strategies, the possession of pro-environmental competency and the obtaining of academic skills were significant determinants of the ability to critically differentiate between environmental facts and opinions among Mexican primary school students.

Fraijo-Sing, Corral-Verdugo, Tapia-Fonllem and González-Lomelí (2013), when studying PEC with regard to water conservation, designed an environmental education programme for children in Mexico, based on the theoretical model. According to the results, PEC significantly predicted water conservation behaviours and levels of ability, knowledge, motivation, and belief. Pro-environmental behaviours increased significantly as a result of the programme.

Meanwhile, Roczen, Kaiser, Bogner and Wilson (2013) measured the ecological behaviour, environmental knowledge, and attitude toward nature of 1,907 students from various schools in southern Germany, finding that environmental knowledge had a modest effect on behaviour, while attitude towards nature proved to be the strongest determinant of environmental behaviour.

Based on these previous studies, which demonstrate the effectiveness of intervention programmes in psychological aspects related to the promotion of pro-environmental behaviours in children, and on the need to continue generating research evidence in the Colombian population, the following question guided the research

hypothesis examined here: What are the effects of a pro-environmental competency training programme on children aged 6 to 11?

Method

To ascertain whether the pro-environmental competency training programme effected significant changes in the pro-environmental competency of children, a quasi-experimental design was established, applying pre- and post-test measurements to the control group and the experimental group.

Participants

The sample consisted of 102 school-age children (52 in the control group and 50 in the experimental group) from the city of Barranquilla-Colombia, aged between 6 and 11 years of age (*M*=8.13; *SD*=1-66), selected probabilistically and distributed according to the specifications in Table 1.

Table 1.

Materials

Two instruments were applied, analyzing the Measured Variable (CEP) before and after implementing the programme.

The first was a structured observation format designed to measure ability with regard to water consumption, solid waste management, and plant conservation. This instrument was completed pre- and post-test during break time in the classrooms by three previously trained researchers. To conduct these observations, the researchers

were stationed in the playground, by the drinking fountain, in the garden, and in the classrooms.

Inter-rater agreement between the three evaluators was measured using Fleiss' Kappa, yielding a value in excess of .68, which is considerable. However, items such as "carry a container for water" and "call out classmates if they damage plants" yielded Kappa values of .46 and .58, respectively, indicating moderate agreement between the reviewers. It should be noted that all the Kappa values recorded were statistically significant with P-values < .05. Table 2 shows the observed behaviours, with their respective inter-rater agreement scores, Z and P-values.

Table 2.

The second instrument was a scale to measure pro-environmental competency in children, ECOPRO-N (Herrera-Mendoza, Ramírez-Ordóñez and Orozco-Acosta, 2017, in press) made up of 27 items, which measure conservationist requirements: Motives, Knowledge and Beliefs regarding water consumption, solid waste management, and plant conservation, as shown in Table 3. It is a Likert-type scale with three degrees of measurement (disagree, neither agree nor disagree, and agree). It was validated by expert judges, and in the respective psychometric analyses, a general reliability of 0.82 was obtained using Cronbach's alpha scale (Motives: 0.75; Knowledge: 0.84; Beliefs: 0.89).

Table 3.

Copamb-Children: programme design

The Copamb-Children programme was designed with a view to promoting PEC among children aged 6 to 11, responding to the issues faced in their immediate context, in this case their school, and which could be useful for other spaces they frequent. It consists of twenty activities spread over three main modules: five water conservation activities, seven solid waste management activities, five plant conservation activities, two introduction to environmental issues activities, and one programme closure activity. These activities were carried out with the experimental group, twice a week, for 10 weeks, each lasting 90 minutes.

Based on the initial diagnosis, the aspects to be included in the programme were identified, allocating a greater number of activities to solid waste management, since, according to the scale and the practices observed, this item showed the lowest levels of pro-environmental behaviour.

The data collected in the quantitative phase of the diagnosis, as well as the effect tests carried out to determine the effectiveness of the programme implemented, were processed using the SPSS statistical software programme, version 24. The results of the pre-test (characterization of PEC) and post-test (evaluating the effect of the programme on the experimental group) phases are presented below, providing non-parametric statistical values, Mann Whitney's U and Wilcoxon's W.

Results

The pre-test and post-test results are presented below, respectively, in accordance with the research goals established.

Characterization of PEC indicators

In accordance with the Corral-Verdugo model, conservationist requirements and pro-environmental ability should be reviewed.

In terms of conservationist requirements, it was initially observed that the dimension of Beliefs obtained the lowest percentages in the pre-test measurements, with $\bar{X} = 1.82$, followed by Knowledge with $\bar{X} = 2.28$. Motives gained the highest scores or favourability in the items, with $\bar{X} = 2.84$.

Of all the practices evaluated, the lowest indicator was observed for solid waste management with $\bar{X} = 2.17$, followed by plant conservation $\bar{X} = 2.24$. Water conservation achieved a higher score with $\bar{X} = 2.49$.

Pro-environmental ability, on the other hand, was measured by means of structured observation. It was initially found that, with regard to water consumption, the behaviours of the children in the control group and the experimental group were not, on the whole, environmentally friendly. When observations were made of water consumption, 70% of the children observed unnecessarily turned on a tap in the school playground, even failing to turn it off fully, playing with the water and splashing their classmates, whilst others looked on without saying a word.

Likewise, it was observed that while drinking from the school water fountain, the children took on average 1 minute to take a drink, whilst fellow classmates waited in line. During that time, 80% of the children chatted to their classmates while the water fountain was turned on full. They also splashed water over their heads and face. Only 30% of them carried flasks or bottles to hold their drinking water.

As for plant conservation, 40% of the children observed played among the plants during break time, stepping on or mistreating them when running between them, some without noticing the damage they were causing and others turning back when they saw

they had been damaged, but continuing to play regardless. Of the children who were looking on, 5% of them called out their classmates for running between the plants, largely claiming they would be scolded by the teacher or the school coordinator.

The third observation scenario looked at how the children managed solid waste or litter. These observations were conducted in the classroom and at break time. A waste paper basket was located in each classroom, but 30% of the children threw their rubbish down by the side of their desk at the end of an activity. Rubbish was picked up when a teacher called them out about the state of the classroom.

At break time, 75% of the children threw rubbish on the floor, and by the end of break the playground was very dirty. 25% of these children put their rubbish in their pockets or took it directly to the rubbish bin to dispose of it. During the initial week of observation, no child was seen calling out a classmate for having thrown litter on the ground. The school had two large rubbish bins in the playground, but no eco areas or different coloured bins for recycling.

Evaluating the effect of the Copamb-Children programme

Based on the results of the pre-test phase, analyses were performed to evaluate the programme's effect using non-parametric tests, Mann Whitney's U and Wilcoxon's W. Initially and in general, comparisons were made between the scores of both groups in the pre-test and post-test measurements, and it was evident in the control group that most of the items did not obtain significant changes between the pre-test and post-test. However, there were some important cases to highlight. For example, rainwater collections to reuse at home went from 23.50% in the pre-test to 58.80% in the post-test, and the number of children who stated that a plant could be damaged if you stepped on it went from 9.80% to 74.50% in the post-test.

In the experimental group, who took part in the programme, significant changes were found in most scores, increasing the favourability of all of them in the post-test. This is most noticeable in items about whether plants clean polluted air, which went from 37.30% to 100% agreement; collecting rainwater for reuse at home, with 27.50% initially and 100% in the post-test; and whether plants protect the soil, with 23.50% initially compared to the final agreement value of 98%.

Subsequently, a detailed analysis was conducted to examine effect of the programme on the Knowledge, Beliefs, Motives and Abilities of children belonging to the experimental group. In 21 of the 27 items included on the ECOPRO-N scale, the results showed a statistically significant difference with 95% confidence in conservationist requirements. However, some of the items were statistically equal ($p > .05$). In the Beliefs dimension, these include: “I believe that plants do not have to be planted, they just grow by themselves” ($d = 0.07$; $U = 1249.50$; $W = 2575.50$) and “I think I should throw rubbish on the ground when I can’t find somewhere to throw it away” ($d = 0.11$; $U = 1191.00$; $W = 2517.00$). In the dimension Motives, items such as: “Without water there would be no life in the world” ($d = 0.13$; $U = 1224.50$; $W = 2550.50$), “piles of rubbish attract insects and other animals” ($d = 0.10$; $U = 1249.50$; $W = 2575.50$) and “throwing rubbish on the ground is rude” ($d = 0.10$; $U = 1275.00$; $W = 2601.00$), yielded no major differences. In the Knowledge dimension, this only occurred with the item “Plants need water, sun, and care to live” ($d = 0.00$; $U = 1300.50$; $W = 2626.50$). It should be noted that these items also have the smallest effects of the group of items, with Cohen’s $d < 0.20$, as shown in Table 4.

Table 4.

The effect per dimension was then analyzed, finding significant differences in all three dimensions of the conservationist requirements of pro-environmental competency: Beliefs ($d = 0.75$; $p = .00$), Knowledge ($d = 0.91$; $p = .00$) and Motives ($d = 0.32$; $p = .00$), all with $p \leq .05$. The dimension that showed the highest effect between pre and post-test measurements in the experimental group was Knowledge (Table 5), and Motives displayed the smallest effect in the measurements.

Table 5.

Discussion and conclusions

Considering that PEC is defined as the ability to respond effectively to environmental requirements, the research considered plant conservation, water conservation, and solid waste management as effective responses. Beliefs, Motives, and Knowledge constituted the requirements measured for environmental conservation.

Based on the pre and post-test measurements in the control and experimental groups, the effect of the Copamb-Children programme on pro-environmental competency was identified.

In the post-test measurements of the control group, conservationist requirements and abilities achieved similar scores in the pre-test and post-test measurements, with the exception of specific items on the ECOPRO-N scale, for example with regard to collecting rainwater and reusing it at home, and the understanding that a plant could be damaged if trodden on, which achieved positive percentage changes. This change is

attributed to a strange variable that could not be controlled but which was assumed: the knowledge developed through the school subjects of natural sciences and social sciences during the intervention programme. In the experimental group, the difference in these items was even greater, obtaining close to 100% favourability in the post-test measures.

A significant change was found with regard to the observed PEC of the experimental group, confirming the hypothesis that a significant change in children's environmental competency could be achieved through the implementation of the training programme. Following completion of the programme, the children in the experimental group were even seen to call out their classmates and teachers when they threw litter on the ground because they could pollute the environment; when they stepped on a plant because they were damaging it, or when they wasted water, arguing that water can run out.

The dimension that reflected the smallest final effect was Motives, since it initially obtained the highest mean ($\bar{X}$ =2.84). Although there were positive changes in its scores, no major changes were observed following implementation of the programme. When applying a programme to develop water conservation competency among primary school children, Fraijo, Tapia, Corral-Verdugo (2003) also stated that, because of the initial scores gained, Motives were the only variable that was not significantly different before and after the programme. The motivations expressed by the children to take care of the environment included the conservation of plants, stating that if they cut down plants there would be less oxygen on the planet (86.3%), that throwing litter on the street is rude (97.1%) and that drinking dirty water could make people ill (97.1%).

The dimensions that obtained the most significant changes were Knowledge followed by Beliefs. It is important to note that both variables obtained a lower initial

favourability score compared to Motives. These results are similar to those obtained by authors such as Dimopoulos, Paraskevopoulos and Pantis (2008), who applied a programme of 15 activities, achieving a greater effect on knowledge and concern about the well-being of sea turtles, an aspect that did not occur equally with attitudes.

Corral-Verdugo (2010) states that knowledge appears to play an important role in pro-environmental behaviour, as a lack of knowledge or the possession of contradictory information could limit pro-environmental behaviour. However, knowledge alone is not enough; it must be taken to the behavioural plane through ability.

Roczen et al. (2013) found that the direct and indirect behavioural relevance of knowledge about the environment was weaker than expected, stating in turn that a person's appreciation of nature was seen to be a relevant variable to motivate the search for more information about nature, i.e. to acquire more knowledge. This may provide a response to the findings of this research, where Motives were established as the dimension with the highest initial mean and with significant increases above all in the dimensions of Knowledge (d=0.91) and Beliefs (d= 0.75) in the post-programme measurements. Suárez et al., (2007) also noted in their research the existence of a significant relationship between motivation to act pro-environmentally and environmental attitudes.

Although interesting and equally positive results were achieved, it is suggested that in order for the effects of the programme to be long-lasting, it would be important to include other members of the education community such as teachers, parents, and students since, according to Collado, Evans and Sorrel (2017), Major, Namestovski, Horák, Bagány and Krekic (2017), close social actors contribute to the formation and

duration of children's pro-environmentalism, arguing that a collectively supported strategy could extend the effects of environmental education programmes.

Finally, in view of these interesting results, one might wonder whether the effects would be present to the same extent in other samples of children. The extrapolation of results is one of the limitations of this research on account of the characterization of the participants, and this could be a future line of research.

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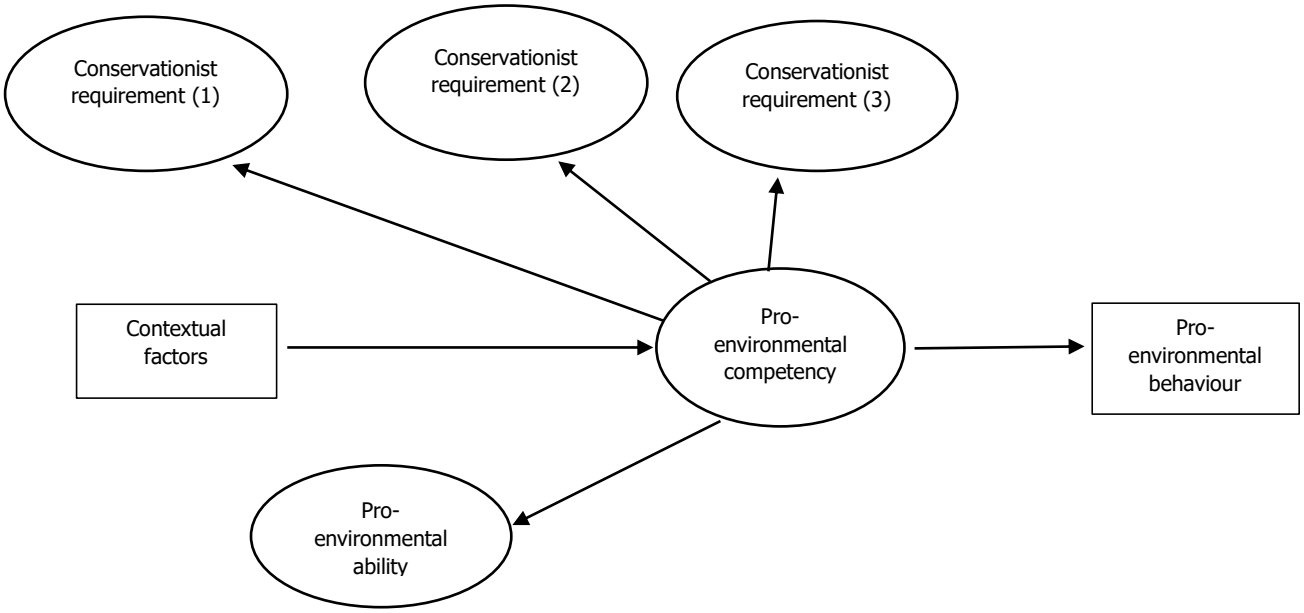

Figure 1. The theoretical model of pro-environmental competency. Adapted from Corral-Verdugo (2002).

Table 1.
Study sample distribution.

Gender	Female: 43.14% Male: 56.86%
Age	6 years old 19.38% 7 years old 26.52% 8 years old 16.32% 9 years old 19.38% 10 years old 13.26% 11 years old 7.14% 12 years old 2.9%
School year	2nd grade 32.3% 3rd grade 33.6% 4th grade 34.7%

Table 2.
Inter-rater agreement for observations.

	Kappa	Z Statistic	P-value
1. Turn on the tap unnecessarily	.83	4.54	.0000
2. Turn on the tap to play with classmates	.86	4.69	.0000
3. Fail to turn off the tap fully	.73	3.99	.0001
4. Turn the tap fully on	1.00	5.48	.0000
5. Call out classmates if they leave the tap on	1.00	5.48	.0000
6. Bring a water container	.46	2.54	.0110
7. Call out classmates if they waste water from the fountain	.71	3.90	.0001
8. Time taken drinking water (in seconds)	.68	3.74	.0002
10. Play among the plants	1.00	5.48	.0000
11. Damage or mistreat plants	1.00	5.48	.0000
12. Call out classmates if they damage plants	.58	3.20	.0014
13. Throw litter on the ground instead of in the bin.	.68	3.74	.0002
14. There are rubbish bins placed around the school	.87	4.74	.0000
15. There are waste paper bins in the classroom	.83	4.54	.0000
16. Litter is thrown on the floor during class	1.00	5.48	.0000
17. They buy several plastic bottles a day.	.70	3.83	.0001
18. They use plastic straws.	1.00	5.48	.0000
19. They call out classmates if they throw litter on the floor	.89	6.63	.0000

Table 3.

Distribution of ECOPRO-N scale items

Variable	Measurements	Items
Conservationist Requirements	**Environmental motivation**	**Plant conservation** If we cut down a tree, some animals would be without a place to live. Several of the foods that we eat come from plants. If we cut down plants we will have less oxygen on the planet. **Water consumption** People can get ill from drinking dirty water. Without water there would be no life in the world. Water is important for all nature. **Solid waste management** Piles of rubbish attract insects and other animals. Throwing litter on the ground is rude. Waste such as paper and cardboard can be reused.
	Environmental beliefs	**Plant conservation** If a place has plants, everything is cooler. Some plants do not have to be planted, they just grow by themselves. If I tread on a plant, I could damage it **Water consumption** One day there will be no water to drink in the world. When a tap is leaking, water is wasted Human beings do not need water to live. **Solid waste management** The litter I throw on the ground can end up in rivers I think that plastic straws pollute the environment. I throw litter on the ground when I can't find anywhere to throw it away.
	Environmental knowledge	**Plant conservation** Plants clean up polluted air. Plants need water, sun and care to live. Plants protect the soil. **Water consumption** We can collect rainwater and reuse it at home. The water I drink comes from the rivers. The water is disinfected before it reaches houses. **Solid waste management** Plastic bottles can be reused. There are different coloured bins for different types of rubbish. The paper we use is made of wood from trees.

Table 4.
Analysis of the effect of the programme on the experimental group

Item	Mann-Whitney U	Wilcoxon W	Z	P	d(Cohen)
One day there will be no water to drink in the world.	1010.50	2336.50	-2.12	.0339	0.21
The litter I throw on the ground can end up in rivers.	765.50	2091.50	-4.94	.0000	0.49
If a place has plants, everything is cooler.	1122.00	2448.00	-2.73	.0064	0.27
When a tap is leaking, water is wasted.	1147.50	2473.50	-2.51	.0120	0.25
Human beings do not need water to live.	892.50	2218.50	-3.53	.0004	0.35
I think that some plants do not have to be planted, they just grow by themselves.	1249.50	2575.50	-0.73	.4636	0.07
I think that plastic straws pollute the environment.	512.50	1838.50	-6.44	.0000	0.64
If I step on a plant, I could damage it.	76.50	1402.50	-9.48	.0000	0.94
I think I should throw litter on the ground when I can't find somewhere to throw it away.	1191.00	2517.00	-1.11	.2683	0.11
Plants clean up polluted air.	484.50	1810.50	-6.78	.0000	0.67
Plastic bottles can be reused.	867.00	2193.00	-4.49	.0000	0.45
We can collect rainwater and reuse it at home.	357.00	1683.00	-7.58	.0000	0.75
There are different coloured bins for different types of rubbish.	892.50	2218.50	-4.33	.0000	0.43
The water I drink comes from the rivers.	841.50	2167.50	-4.64	.0000	0.46
Plants need water, sun and care to live.	1300.50	2626.50	0.00	1.0000	0.00
Plants protect the soil.	333.00	1659.00	-7.59	.0000	0.75
The water is disinfected before it reaches houses.	971.00	2297.00	-3.1	.0006	0.34
The paper we use is made of wood from trees.	357.00	1683.00	-7.56	.0000	0.75
If we cut down a tree, some animals would be without a place to live.	1122.00	2448.00	-2.73	.0064	0.27
People can get ill from drinking dirty water.	790.50	2116.50	-4.79	.0000	0.47
Without water there would be no life in the world.	1224.50	2550.50	-1.36	.1739	0.13
Piles of rubbish attract insects and other animals.	1249.50	2575.50	-1.02	.3100	0.10
Several of the foods that we eat come from plants.	1045.50	2371.50	-3.31	.0009	0.33
Throwing litter on the ground is rude.	1275.00	2601.00	-1.00	.3173	0.10
Waste such as paper and cardboard can be reused.	918.00	2244.00	-4.16	.0000	0.41
If we cut down plants we will have less oxygen on the planet.	1096.50	2422.50	-2.93	.0034	0.29

Water is important for all nature	1071.00	2397.00	-3.13	.0018	0.31

Table 5.
Analysis of the effect of the programme on the dimensions.

	Mann-Whitney U	**Wilcoxon W**	**Z**	**p**	**d(Cohen)**
Beliefs	180.00	1506.00	-7.60	.0000	0.75
Knowledge	1.50	1327.50	-9.20	.0000	0.91
Motives	846.50	2172.50	-3.26	.0011	0.32