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Socio-Environmental Problems and Environmental Education. Climate Change from the Perspective of Future Elementary School Teachers

Problemas socioambientales y educación ambiental. El cambio climático desde la perspectiva de los futuros maestros de educación primaria

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Abstract

Climate change has become very important worldwide in recent years. This socio-environmental problem has reactivated environmental policy in the wake of the "Friday for the Future" movement, led by activist Greta Thunberg, and highlighted the importance of the issue. The aim of this research was to find out the conceptions of future elementary school teachers about climate change and the need to address it in schools. A descriptive-exploratory study was carried out in which 261 teachers in initial training in the Elementary Education Degree at the University of Seville (Spain) participated. The data were collected through a structured questionnaire containing 11 questions. The results highlight that the notion of climate change is associated with extinction and destruction, as well a majority of participants recognizing human causality in the origin of the problem and an imminent need to address it in educational terms in school classrooms.

Keywords: climate change, environmental education, elementary education, socio-environmental problems, teachers in initial training.

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Resumen

El cambio climático ha cobrado gran relevancia en los últimos años a nivel mundial. Esta problemática socioambiental ha reactivado la política ambiental tras el movimiento "Viernes para el futuro", liderado por la activista Greta Thunberg y puso de manifiesto la relevancia que tiene la temática. El objetivo de esta investigación fue conocer las concepciones de los futuros maestros de educación primaria acerca del cambio climático y la necesidad de su tratamiento en las escuelas. Se realizó un estudio descriptivo-exploratorio en el que participaron 261 maestros y maestras en formación inicial del Grado de Educación Primaria de la Universidad de Sevilla (España). Los datos se recogieron a través de un cuestionario estructurado de 11 preguntas. Los resultados destacan que la noción de cambio climático se asocia con extinción y destrucción, así como también se evidencia un reconocimiento mayoritario de la causalidad humana en el origen del problema y una necesidad inminente de abordarlo educativamente desde las aulas escolares.

Palabras clave: cambio climático, educación ambiental, educación primaria, maestros en formación inicial, problemas socioambientales.

Introduction

Climate change has taken on great prominence worldwide in recent years, reactivating environmental policies in the wake of the "Friday for the Future" movement, led by activist Greta Thunberg, which highlights the importance of environmental education. Climate change is, without doubt, one of the greatest socio-environmental problems currently faced by humanity, not only because of the diversity of factors that cause it and the consequences it generates, but because of its planetary scale, which makes it an issue of great complexity (Bangay & Blum, 2010; González-Gaudiano & Meira-Cartea, 2020; Reis & Ballinger, 2020). Indeed, it is a problem that not only endangers life as we know it, but is also at the center of serious social, environmental, and economic problems at present, which affect all human activities (Schewe et al., 2019). Given its complexity, in order to combat it, society will have to work on multiple responses that come from a range of sectors, including the educational field.

State of the matter

At international level, the 1992 United Nations Framework Convention on Climate Change provided a basis for action, with its article 6 emphasizing the need for the international community to focus its efforts on socio-environmental education, training, empowerment, and commitment for our world. Subsequently, article 12 of the Paris Agreement encouraged nations to "enhance climate change education, training, public awareness, public participation and public access to information" (United Nations Framework Convention on Climate Change). Action for Climate Empowerment (ACE) supports these initiatives by working to raise awareness about climate change and Education for Sustainable Development (ESD) at international level, promoting the acquisition of appropriate knowledge, skills, and attitudes to empower communities and which contribute to the battle against the socio-environmental problems that we face, addressing Sustainable Development Goals 4.7 and 13.3 in the 2030 Agenda for Sustainable Development (United Nations, UN, 2015). From this perspective, we view environmental education as it was outlined by Moreno-Fernández and Navarro-Díaz (2015), that is, as a

> process through which the public should be provided with the necessary mechanisms for raising awareness and sensitization about the socio-environmental problems that surround us, in such a way that the individual-society-environment relationship is transformed, reinvented as the appropriate relationship of mutual respect and habitability, the latter being understood in qualitative parameters, as quality of life (p. 38).

In order to do this, it is essential to reflect on the attitudes and values that comprise environmental education, promoting learning experiences that encourage active participation in the search for comprehensive solutions to current problems, since these are changing and may vary over the years. Environmental education should, therefore, not only provide values and skills, but also develop "skills to act with criteria of sustainability; that is, with the ability to use knowledge and skills in other contexts, both individually and collectively" (Álvarez & Vega, 2009, p. 254), without neglecting to examine the emotional dimensions of environmental education (Russell, 2016).

Therefore, we can state that education plays an essential role where, without doubt, and as Bangay and Blum (2010) note,

> the integration of quality environmental learning into existing education systems represents both immediate and longer term challenges for responding to climate change. The immediate challenge is to climate proof education systems (adaptation), while the longer and more challenging task is to develop education systems that equip learners with the requisite skills, knowledge and attributes to deal with future challenges (p. 364).

In this respect, the role of higher education institutions in light of climate change is of great importance to address the challenges that we face, since it is in universities where, in addition to many other professionals, future teachers are trained who will work with the new generations in school classrooms (Karatzoglou, 2013; Leal-Filho, 2010; Leal-Filho et al., 2018; Molthan-Hill, Worsfold, Nagy, Leal-Filho, & Mifsud, 2019). However, and despite the importance of working on issues related to environmental education at the university level, the research carried out in this area shows that a large proportion of university teaching staff have not yet incorporated these issues into their teaching practice (Azcárate, Navarrete, & García, 2012; Aznar, Martínez-Agut, Palacios, Piñero, & Ull, 2011), with it being essential for the university community to include environmental education as a central priority in the basic literacy of teachers at all educational levels (Solís-Espallargas, & Valderrama-Hernández, 2015). In order to achieve this, it is necessary for content related to the world's socio-environmental problems to be included in university subjects, addressing these matters in an interdisciplinary manner to overcome the classic duality between the social and the natural. Teachers should likewise be made aware of the importance and responsibility of working on such content in conceptual, procedural, and attitudinal terms, creating spaces for reflection and collaboration in which to think critically, both individually and collectively, regarding the relevance of responsible educational practice.

In this respect, one of the obstacles identified in the university environment is the lack of attention to these problems, which leads to them being treated in a biased and reductionist manner (Barrón, Navarrete, & Ferrer-Balas, 2010; García-Díaz, 2004); It is therefore urgently needed to create "an education that helps individuals to interpret, understand and be aware of the complexity and globality of the problems that occur in the world and teach attitudes, knowledge, values, behaviors, etc." (Álvarez & Vega, 2009, p. 246).

University institutions, therefore, being responsible for training future teachers, must support the commitment to close this gap between the social and the natural and "seek new educational approaches that place us in a reality where environmental issues are, to a large extent, social issues" (Solís-Espallargas & Valderrama-Hernández, 2015, p. 169), being peremptory to regenerate the ways in which we live in this world (McKenzie, Hart, Bai, & Jickling, 2009).

According to various research (Escoz-Roldán, Gutiérrez-Pérez, Arto-Blanco, & Meira-Cartea, 2017; Meira-Cartea, Gutiérrez-Pérez, Arto-Blanco, & Escoz-Rodán, 2018), despite the fact that experiences in education regarding climate change have not been entirely satisfactory as a mechanism for adaptation, mitigation, raising

awareness, and citizen participation, there is no doubt that education plays a fundamental role in addressing this complex issue, so we have to continue working towards the objective to train citizens who are aware, informed, and involved with climate change (Bangay & Blum, 2010; Mochizuki & Bryan, 2015).

One of the biggest problems in teaching about the importance and urgency of the climate change problem is the level of abstraction of the phenomenon itself, an idea that was expressed very well by Giddens (2010) when he stated that "since the dangers posed by global warming aren't tangible, immediate or visible in the course of day to day life, however awesome they appear, many will sit on their hands and do nothing of a concrete nature about them" (p. 12). Overcoming the disconnect between concern for socio-environmental problems and incorporating sustainable behaviors into our daily lives remains one of the greatest challenges of environmental education. Although there are various issues responsible for this disconnect between what is thought and the way in which actions are taken, it should be acknowledged that any contributions—no matter how small—are never insignificant and always add value to solving the problem. We can therefore state that one of the main barriers to the failure to change habits is closely related to what we ourselves do, which may seem unrepresentative and insignificant, or will not lead to a significant enough change to be worth the effort, which, in the long term, leads to us distancing ourselves from the problem we are facing.

There is, therefore, a departure from the problem, in which the educational sector has not been exempt and, in spite of the large number of studies that have looked at issues related to climate change—from the perspective of the curriculum, the students, and, to a lesser extent, the teaching staff, as well as at various education levels—they continue to demonstrate the existing lack of knowledge about this phenomenon (Barbosa, Lima, & Machado, 2012; Barros & Pinheiro, 2013; Escoz-Roldán et al., 2017; García-Rodeja & De Oliveira, 2012; Hess & Collins, 2018; Hess & Maki, 2019; Meira-Cartea et al., 2018; Molthan-Hill et al., 2019; Reis & Ballinger, 2020; Sternäng & Lundholm, 2011).

In this respect, it is essential to continue working on this in education, in both formal and non-formal teaching, and from early childhood education to higher education, since it plays an important role in addressing a change that is now more necessary than ever. This is because the purpose of education is to train students to develop the knowledge, attitudes, and capabilities that allow them to think critically, solve problems, and deal with uncertainty, so they need to have a holistic view of the problem.

Meanwhile, education systems face a variety of challenges, where the most immediate is to adapt to work on climate change and the longest and most difficult of them is to develop educational methodologies that provide students with the knowledge, skills, and capacities needed to address future challenges (Bangay & Blum, 2010).

This is, therefore, a scenario in which teachers certainly occupy an essential role, so it is necessary to examine how those of them who work in initial training and those who are still in training to prepare for working in classrooms in the short or medium term understand climate change and its various factors, in order to reorient their training towards one that is more adapted to current requirements and which, in their future teaching work, encourages their students to acquire the necessary tools to address important socio-environmental issues such as climate change.

These important questions therefore paved the way for the following research objectives for this study:

- Find out what teachers in initial training for elementary education understand about climate change.
- Explore the knowledge that teachers in initial training for elementary education have regarding the causes, consequences, and strategies that can be carried out to mitigate climate change.
- Determine the relevance of climate change as a socio-environmental problem to be addressed in elementary education, from the perspective of future teachers specialized in this educational level.

Methods and materials

We carried out a descriptive and interpretive study using instruments such as an open-ended questionnaire, combining the basic qualitative approach with quantitative support for data processing, as well as "content analysis" techniques (Cohen & Manion, 2002).

Participants

We conducted intentional and convenience sampling in which 261 teachers in initial training for elementary education took part, these being students of the Elementary Education Degree at the Universidad de Sevilla. Of those, 67.4% (n = 176) were women and 32.6% (n = 85) were men. The participants ranged from 19 to 22 years of age.

Instrument

We created an ad hoc questionnaire to explore the knowledge of the participants in the study. The initial instrument was based on that used by Meira-Cartea and Arto-Blanco (2014), while the final version was reviewed by two experts in climate change, so the questionnaire included 11 questions and 5 categories: Perception about climate change; Causes of climate change; Consequences of climate change; Strategies to mitigate climate change; and finally, Education and climate change (Table 1).

Table 1
Instrument's categories and questions.

Categories	Questions
Perception	1. What is the first thought or image that comes to mind when you hear talk about climate change?
Causes	2. What do you think is the main cause of climate change?
	3. Do you think that climate change is due to human intervention, purely natural phenomena, or a combination of both?
	4. Do you think that climate change is related to other socio-environmental problems? Which ones?
Consequences	5. What consequences do you think climate change has for the planet? How does it affect us?
Strategies	6. What strategies do you think can be carried out to mitigate climate change?
Education	7. Do you think it is necessary to address climate change in elementary school classrooms?
	8. If you answered yes to the previous question, in which subject or subjects would you address this? Indicate those that you consider to be appropriate.
	9. If we refer to current educational legislation, in which subject or subjects do you think that climate change is addressed?
	10. As a future elementary school teacher, do you think that you are capable of addressing this issue with students?
	11. Do you think you are sufficiently well-trained to address this topic?

Source: Prepared by the author based on the contributions of Meira-Cartea and Arto-Blanco (2014).

The questionnaire was applied in classrooms between September 2019 and February 2020, and we visited each of the classrooms in which the data was collected. The aim of the research was explained to the students and they were informed that their data would be anonymous and that their participation in the study would be entirely voluntary.

Results

Perception of climate change

For question 1, What is the first thought or image that comes to mind when you hear about climate change?, we followed the classification system of Meira-Cartea and Arto-Blanco (2014), grouping the answers into 12 categories (Table 2).

Table 2
First thought or image that comes to mind about climate change

First thought or image	Frequency	Percentage
Thawing of the poles, glaciers	39	14.9%
Pollution	32	12.3%
Increase in temperatures	29	11.1%
Destruction	27	10.3%
Natural disasters	25	9.6%
Greenhouse effect	23	8.8%
Loss of biodiversity	21	8.0%
Human extinction	19	7.3%
Lack of awareness /irresponsibility	16	6.1%
Meteorological phenomena	11	4.2%
Natural phenomena	9	3.4%
Future (raising awareness/effort)	7	2.7%
Others	3	1.1%

Source: Prepared by the author.

As we can see, when teachers in initial training for elementary education think about climate change, they mainly relate it to melting glaciers and, therefore, of the poles (14.9%), pollution (12.3%), and increased temperatures (11.1%). The consequences are mentioned most frequently by teachers in initial training when they consider climate change (74.2%), while the causes are only mentioned in 18.4% of the cases. The data is consistent with

previous national and international studies (Leiserowitz, 2004; 2007; Meira-Cartea, 2013; Meira-Cartea & Arto-Blanco, 2014). Only 3.4% of the participants suggested there were natural causes of the phenomenon and 4.2% related it to meteorological phenomena, while 1.1% mentioned other issues.

Causes of climate change

The teachers in initial training who took part in the study believed that the main cause of climate change was the influence of human beings on the planet, which has repercussions on issues related to pollution, waste, or the misuse of natural resources, as exemplified in the following information units:

- **C17:** Harmful residues produced by man, factories, waste, etc. that affect the ozone layer.
- **C61:** Excessive consumption and the exploitation of resources by humans, especially by factories.
- **C136:** Bad actions by mankind, poor use of new industrial and technological developments, it is clear that we have to evolve, but always taking care of what enables us to live, nature.

Regarding whether climate change is due to human intervention, purely natural issues, or a combination of both, 62.8% of teachers in initial training (n = 164) stated that it was due exclusively to human intervention, while 37.2% (n = 97) said was due to a combination of natural factors and human activity, although the latter would have greater influence, as shown in the following information units:

- **C27:** Combination of both, but the acceleration is due to humans.
- **C83:** A combination of both, although due much more to human intervention.
- **C101:** Mainly human intervention, although nature has an influence. I would say it is a combination of both.

Similarly, 93.5% (n = 244) of teachers in initial training believed that climate change was related to other socio-environmental problems and 6.5% (n = 17) stated that this was not the case. Participants who answered affirmatively were asked to mention specific problems that they associated with climate change. Some 43.7% (n = 114) referred to various issues that were grouped into the category of *biophysical processes*, associated situations of environmental deterioration mainly related to polluting human activities, with this category accounting for the most responses. On the other hand, 24.5% (n = 64) mentioned *socio-environmental problems*, while 19.5% (n = 51) linked it to issues related to the *lack of education*, and 5% (n = 13) to *catastrophic phenomena*. Another 5% (n = 13) was included in the *others* category and, lastly, the category with the lowest proportion of responses was *terrestrial phenomena*, with 2.4% (n = 6) of the answers collected.

When comparing the results for this question and the type of causes of climate change stated by the participants, the data is consistent in the prevalence of origins related to the influence of human activity on the environment. This is in line with other studies, where, as Meira-Cartea and Arto-Blanco (2014) point out:

> the explanatory logics that appear in the category of *terrestrial phenomena* are not linked with cases that allude to natural causes of climate change, but with those that acknowledge a relatively important, but minority, influence of natural causes (p. 24).

Consequences of climate change

With regard to the consequences of climate change, all of the study participants mentioned that the ramifications of the problem were negative. Similarly, since this was asked as an open question, the participants were able to state one or more consequences, so the responses were grouped into a total of 10 items with 806 responses (Table 3).

Table 3
Consequences of climate change

Consequences of climate change	Frequency	Percentage
Increase in temperatures/more intense heat waves	196	75.0%
Impact on people's lives as we know it	102	39.0%
Increase in sea level	96	36.7%
Changes in ecosystems	82	31.4%
Loss of biodiversity	80	30.6%
Greater intensity of natural disasters (hurricanes, tsunamis, stronger storms, floods, droughts)	66	25.2%
Propagation of diseases	65	24.9%
Melting of glaciers/thawing of poles	55	21.0%
Pollution (increase in atmospheric CO_2)	49	18.7%
More expensive food	16	6.1%

Source: Prepared by the author.

Strategies to mitigate climate change

Of the strategies that teachers in initial training believed could be carried out to mitigate climate change included, the most common proposal was the need to change our current lifestyles to shift towards less consumerist models that are more responsible with resources, which was mentioned in 23.4% (n = 61) of the cases. In second place, 16.8% (n = 44) proposed moving towards renewable energy and reducing the use of fossil fuels, a view that is reflected in the reports of the Intergovernmental Group of Experts on Climate Change (IPCC) (2013; 2018). The third option was mentioned by 16.2% (n = 42) of the participants, who agreed on the importance of reflecting, becoming aware of, and promoting education of these issues. The fourth most popular option was stated by 13.4% (n = 35) of the sample, who indicated the need to reduce emissions to decrease air pollution, followed by 10% (n = 26) who referred to industry. Recycling, reusing, and reducing waste, and the proposal to draft laws and international agreements were both stated by 6.5% (n = 17) of the participants. Only 3.4% (n = 9) of the sample believed that there was no solution to halt climate change, arguing that it is too late. Finally, 3.8% (n = 10) answered other questions (Table 4). These strategies coincide with those proposed by future professionals in the education sector, although not in the same order of importance (Meira-Cartea, 2013; Meira-Cartea & Arto-Blanco, 2014).

Table 4
Strategies to mitigate climate change

Strategies	Frequency	Percentage
Change in lifestyles (new, less consumerist production model). Consumption that is more responsible with recourses.	61	23.4%
Change to renewable energies and lower use of fossil fuels.	44	16.8%
Reflect,w become aware. Education.	42	16.2%
Not polluting, lower emissions. Air pollution.	35	13.4%
Industry (reduce pollution, apply taxes, close centers).	26	10.0%
Recycle, reuse, reduce waste.	17	6.5%
Laws. International agreements.	17	6.5%
Too late to combat climate change.	9	3.4%
Others.	10	3.8%

Source: Prepared by the author.

Climate change and education

With regard to the question, Do you think it is necessary to address climate change in elementary school classrooms?, 100% of the participants answered in the affirmative. In order to look more closely at the responses obtained, we opted to categorize them following a hypothesis of progression, that is, putting the answers in order from the simplest to the most complex (Table 5).

Table 5
Need to address climate change in elementary school classrooms

Level	Description of level	Frequency	Percentage
Syncretic worldview (basic level)	The participants limit themselves to stating that it is necessary or essential to discuss this issue with elementary school students, but without going into detail.	130	49.9%
Analytical worldview (intermediate level)	The participants, in addition to agreeing that it is an issue that should be addressed in elementary education, state the need to provide students with tools that allow them to understand climate change, as well as its causes and consequences.	33	12.6%
Approach to a systemic worldview (approach to desirable knowledge)	The participants not only consider that it is necessary and important to provide appropriate tools to students, but they go further by mentioning the importance of working on these contents in training future citizens and the need for them to be aware of environmentally sensitive issues such as climate change.	98	37.5%

Source: Prepared by the author.

Some 49.9% (n = 130) of the participants answered simply with statements like C1: "Yes, very necessary" or C16: "Of course, very necessary, essential". Meanwhile, 12.6% (n = 33), while also agreeing that this is a issue necessary to address in elementary education, mentioned the importance of going beyond what is usually included in textbooks, providing students with tools to understand climate change, its causes, and consequences. One example of this can be extracted from information units such as C125: "Yes, and it should be taken into reality, that is, it shouldn't be merely stated in books" or C238: "Yes, we should give them the tools to be able to understand and combat it". Finally, 37.5% (n = 98) mentioned the importance of working on these contents in training future citizens and the need for them to be aware of the subject. This is extracted from information units such as the following:

- **C10:** Of course, but not in a rapid manner, but giving it emphasis because of its importance. The students should be aware of the repercussions and the future that awaits them, they can be the most powerful weapon against this unfavorable situation.
- **C112:** Yes, because they are the future of our world; if we educate students correctly in caring for the environment, they will be aware of most of the aspects needed to protect it.
- **C260:** Yes, because in elementary school we train future citizens, and if they are aware of and understand the importance of it from a young age, it will be easier to consolidate those thoughts and help them in an active way.

Regarding the question about which subject or subjects would address climate change in elementary school classrooms, 62.5% (n = 163) mentioned the subject of Natural Sciences, followed by 31% (n = 81) who indicated Social Sciences. In third place, 6.1% (n = 16) chose Education in Values/Education for Citizenship. Only 0.4% (n = 1) stated that the topic had to be addressed transversally in all subjects at the elementary level[1].

The data collected highlights the duality between Natural Sciences and Social Sciences that has been made regularly and which loses all meaning if the aim is to explain and cover address problems in all their complexity. However, other studies with teachers in initial training, such as that by López-Fernández and Oller-Freixa (2019), point out that this type of socio-environmental problem is still being addressed from the perspective of Natural Sciences. This may be due to the fact that the curriculum for the elementary education level has traditionally divided this content between the subjects of Natural Sciences and Social Sciences. Only the Organic Education Law (LOE) (2006), in force in Spain between 2006 and 2013, managed to bring it together under umbrella of the subject called Knowledge of the Natural, Social, and Cultural Environment.

In this regard, one way of understanding socio-environmental problems in general and climate change in particular, is that we are talking about a complex process in which environmental factors and natural factors have an influence, so we believe it should be addressed jointly by both subjects.

That said, if we ask the teachers in initial training in which subject or subjects they believe that current educational legislation addresses climate change, the answers are even more polarized between Natural Sciences and Social Sciences. In this respect, 62.9% (n = 164) said that the curriculum addresses climate change in the subject of Natural Sciences, 34.5% (n = 90) said it was covered in Social Sciences, and 2.6% (n = 7) declared that they were not clear about it and could not decide. However, if we refer to the current curriculum, RD 126/2014 states that climate change is content to be addressed in the subject of Social Sciences, specifically in "Block 2. The world in which we live", in which it mentions sustainable development, pollution problems, the causes and

1. This would include the following subjects: Mathematics, Spanish Language and Spanish Literature, Foreign Language, Artistic and Plastic Education, Physical Education, or Religion.

consequences of climate change, and responsible consumption. So, from this perspective, this ignorance of the curriculum on the part of teachers in initial training may lead to the issue not being addressed from a complex perspective and in accordance with its characteristics.

Regarding the education that teachers in initial training have on the subject of climate change, 87.4% (n = 228) said they would be capable of addressing it once they were in the classroom. Only 12.6% (n = 12.6%) stated that they were not trained. If we look more closely at the responses obtained, the number of participants who reported having insufficient training to address climate change in elementary education classrooms is consistent with the 12.6% (n = 33) of participants who said they were not sufficiently trained to teach this topic. On the other hand, 37.5% (n = 98) said they thought they were sufficiently trained to cover it and the remaining 49.8% (n = 130%) stated that, although they were trained to teach the subject, they were not trained to address it in depth, as C72 points out: "I believe that I am trained to address the main topic, but not to address it in depth."

Training at university was a recurring theme in the responses collected, as a significant number of participants stated that climate change was addressed during their university training. An example of this can be drawn from the following information units:

- **C13:** Yes, because of all the hypothetical sessions that could be given in an elementary classroom that we have received in the education faculty, although you are never fully trained and you always have to undergo continuous training to improve.
- C109: This is one of the problems that is addressed most at university. However, we have to put it into practice, because there are currently a lot of educational centers that don't address this relevant and important issue. That is why we have to encourage, empower, and train future teachers so that they understand its importance and really put it into practice in the future.

Discussion and final reflections

The choice of elementary education teachers in initial training for this study was made due to the important work that these professionals will carry out throughout their careers in the classroom, as pointed out by Meira-Cartea and Arto-Blanco (2014).

On the other hand, university students have a greater affinity to scientific culture than other population groups, besides the importance of the university as a center of education and social innovation.

With regard to the first two objectives of the study—finding out what elementary education teachers in initial training understand by climate change and exploring their knowledge about the causes, consequences, and strategies that can be carried out to mitigate climate change—the results of the research showed that the treatment of socio-environmental problems continues to be one of the current challenges in school classrooms, for which it is essential to provide teachers with the tools that allow them to address this content.

Teachers in initial training, meanwhile, pointed out the consequences most often covered by the media, such as the thawing of the poles or rising sea levels. However, they did not mention local consequences, such as the desertification taking place in Andalusia (the area where the study was carried out) and which directly affects agricultural productivity. This is significant because it shows that teachers do not fully understand how certain consequences of climate change can affect their daily lives, that is to say, they are unable to contextualize the problem.

In addition to this, the study participants mentioned alternative conceptions related to climate change, including referring to the ozone layer (C17: "Harmful residues produced by man, factories, waste, etc. that affect the ozone layer") or understanding the increase in CO_2 as a consequence of climate change, when it is actually a cause. That

said, we understand that they may refer to air pollution that affects health, but in that respect there is something very important that we must highlight: confusing air pollution with climate change is equally concerning, since they are two different environmental problems that share causes and are therefore often confused and, although they are interrelated (like almost all environmental problems), they are different issues.

With respect to pedagogical strategies to address the content related to climate change, the teachers did not refer to adaptation techniques, which include, for example, those aimed at changing lifestyles, but which are only focused on reducing consumption. Similarly, they say that life will change because of climate change and that it is essential to intervene, but their possible strategies do not include citizen resilience (How will it change for them? What will they be able to do and what not?), changes in diets (Will some foods disappear? Will insects be included in people's diets?), changes in the management of cities (creation of more shaded areas or more urban gardens to combat food shortages, etc.), or individual adaptation to learn to how cultivate plants, obtain water, etc., among other actions.

In terms of educational strategies, we propose that the approach to socio-environmental issues in the classroom could follow the constructivist model; that is, based on the specific selection of socio-environmental issues in the students' immediate surroundings, we can formulate a problem and identify its causes and consequences, the conditions to change, as well as the difficulties for a transformation to take place. Thanks to this proposal, it would be possible for the students to establish priorities for participation and sustainable actions (Álvarez & Vega, 2009; Ferreras-Listán, Moreno-Fernández, & Puig-Gutiérrez, 2019).

Similarly, another strategy that could be carried out would be participation in specific debates, that is, interaction with scientists (e.g., *cafés con ciencia*, or "coffee with science" in English) carried out at various university institutions at certain times of the academic year). This would allow misconceptions to be addressed, as well as execution of school and/or community projects that could be approached using a service-learning methodology (Caballero, Domínguez, Miranda, & Velo, 2018; Cebrián, Fernández, Fuertes, Moraleda, & Segalàs, 2019; Monroe, Plate, Oxarart, Bowers, & Chaves, 2019), or from a "glocal"[2] perspective (López-Fernández & Oller-Freixa, 2019; Moreno-Crespo & Moreno-Fernández, 2015; Morote, 2019).

Therefore, we believe that despite these deficiencies in training, elementary level teachers in initial training stated that climate change is a priority issue that should be addressed in school and, although the participants had a simplistic view of the problem by confusing the causes and consequences, in many cases this may be due to the fact that they did not have complex training on the subject, despite considering themselves adequately trained to cover with climate change, even at a basic level. This is an important step, as it demonstrates that these professionals are aware of the importance of working on the topic.

Finally, with regard to the objective of determining the importance of climate change as a socio-environmental problem to be addressed in elementary education from the perspective of future teachers, the results of the study show that the reductionist vision of the curriculum means that climate change is also understood partially, even though it has natural and social aspects, and that the best way to approach the issue would be from two joint perspectives, thus providing a more complex and holistic view of the problem, in accordance with the current requirements of the world in which we live. We therefore agree with Bustillo and Antón (2020) on "the need to include actions in the training of future teachers that allow them to be aware of their limitations when interpreting complex topics" (p. 207), as well as with García-Pérez and De Alba (2008), in that

> Working on relevant social and environmental problems within the framework of an integrated school curriculum promotes treatment of the serious problems of our time and therefore contributes to training students as citizens of our world (p. 9).

2. This refers to factors that have effects at both the global and local level, bringing together characteristics of both realities in the same dimension: "Thinking globally and acting locally".

It is along these lines that we believe that it is essential to continue working to gain greater insight into the conceptions of teachers in initial training or in permanent training in terms of socio-environmental problems and how they are addressed in education based on a perspective of planetary citizenship and with a commitment to their environment (Varela-Losada, Arias-Correa, & Vega-Marcote, 2019).

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