



The children, climate changes and the fairytale... without the fairies: children's perception¹

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Abstract: Climate change caused by anthropogenic actions plays a significant role in escalating the frequency and intensity of extreme environmental. Climate change threatens ecosystems, biodiversity, livelihoods, health, and well-being of future generations. The perception of young people and children about the climate crisis and its effects on the planet must be known to develop attractive educational practices and materials. For this purpose, qualitative research was carried out through the application of a questionnaire, with elementary school students from a public school in the city of Jundiaí in the state of São Paulo (Brazil). The research results indicate that, although elementary school students have a certain awareness of climate problems, they have generalized misconceptions about pollution and the environment. Therefore, it is increasingly necessary to invest in Environmental Education and teacher training.

Keywords: Environmental education. Climate change. Children's perception. Environmental awareness. Basic education.

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As crianças, as mudanças climáticas e o conto de fadas... sem as fadas: a percepção infantil

Resumo: As mudanças climáticas causadas por ações antropogênicas desempenham um papel significativo na escalada da frequência e intensidade dos eventos ambientais extremos. As mudanças climáticas ameaçam os ecossistemas, a biodiversidade, os meios de subsistência, a saúde e o bem-estar das gerações futuras. A percepção de jovens e crianças sobre a crise climática e seus efeitos no planeta deve ser conhecida para o desenvolvimento de práticas e materiais educacionais atrativos. Para tanto, foi realizada uma pesquisa qualitativa por meio da aplicação de um questionário, com alunos do ensino fundamental de uma escola pública da cidade de Jundiaí, no estado de São Paulo (Brasil). Os resultados da pesquisa indicam que, embora os alunos do ensino fundamental tenham certa consciência dos problemas climáticos, eles têm concepções errôneas generalizadas sobre poluição e meio ambiente. Portanto, torna-se cada vez mais necessário investir em Educação Ambiental e na formação de professores.

Palavras-chave: Educação ambiental. Mudanças climáticas. Percepção das crianças. Percepção ambiental. Educação básica.

Los niños, el cambio climático y el cuento de hadas... sin las hadas: la percepción infantil

Resumen: El cambio climático causado por acciones antropogénicas juega un papel importante en el aumento de la frecuencia e intensidad de los eventos ambientales extremos. El cambio climático amenaza los ecosistemas, la biodiversidad, los medios de vida, la salud y el bienestar de las generaciones futuras. Se debe conocer la percepción de jóvenes y niños sobre la crisis climática y sus efectos en el planeta para desarrollar prácticas y materiales educativos atractivos. Para ello, se realizó una investigación cualitativa mediante la aplicación de un cuestionario, con estudiantes de educación primaria de una escuela pública de la ciudad de Jundiaí, en el estado de São Paulo (Brasil). Los resultados de la encuesta indican que, aunque los estudiantes de primaria tienen cierta conciencia sobre las cuestiones climáticas, tienen conceptos erróneos generalizados sobre la contaminación y el medio ambiente. Por ello, es cada vez más necesario invertir en Educación Ambiental y en la formación del profesorado.

Palabras clave: Educación ambiental. Cambio climático. Percepción de los niños. Conciencia ambiental. Educación básica.

INTRODUCTION

Human activities due to the search for an increase in the quality of life have brought environmental difficulties. These issues include overpopulation, increased pollution, death and destruction caused by toxin spills and dumping, use of fossil fuels to generate energy, massive deforestation of forests, and destruction of wildlife habitats for human development, among other problems (Erhabor; Dom, 2016). Such anthropogenic (human) actions have led to global warming, with serious climate change (Evseeva *et al.*, 2021), impacting the planet's biodiversity. Damage to the environment is already observed in several regions of the planet, putting our very existence at risk (Kabir *et al.*, 2023). As a result, concerns about climate change are the focus of debates worldwide, entering the global political agenda. Due to the importance of the topic and the strong scientific evidence for the acceleration of impacts related to global warming,

with close limits predicted for global warming thresholds to be reached, considerable interest has been generated in the scientific literature, the political community, and public discourse (Diffenbaugh; Barnes, 2023).

Promoting environmental awareness is essential to mitigate climate problems. This involves educating people about the consequences of excessive consumption, encouraging sustainable practices, promoting recycling, reducing waste, and adopting the use of cleaner technologies. Environmental awareness can be promoted through Environmental Education (EE). Environmental Education is one of the means to advance in the formation of citizenship, consisting of the acquisition of knowledge aimed at the intelligent use of environmental resources at both individual and collective levels. EE offers the opportunity to acquire essential skills, attitudes, and knowledge in the ecological area. Thus, teaching materials focused on the topic can play an important role in building knowledge about climate change for teachers and (but not limited to young) students (Nyika; Mwema, 2021). Furthermore, it should be highlighted that the interplay between natural Earth systems and human actions has profound social consequences. The study and modelling of socio-economic sustainability therefore require an intrinsically interdisciplinary approach not always present in the school environment (Kakungulu, 2024).

In this sense, it is possible to promote environmental awareness through various educational practices, such as including ecological themes in curricula, developing projects and practical activities, creating sustainable educational spaces, and promoting values such as responsibility, respect for the environment, and collaboration. By integrating environmental education holistically, students not only gain theoretical knowledge about environmental issues but also develop a deeper understanding of the interconnections between their actions and the environment. This empowers young people to make informed decisions and adopt more sustainable practices in their daily lives, contributing to building a society that values and preserves the environment (Souza *et al.*, 2016; Dhara, 2022).

Climate change harms and weakens the rights of children and adolescents in all areas (UNICEF, 2023) and will exert devastating pressure on future generations globally (Lusz, Zaneti; Rodrigues Filho, 2021). However, the engagement of children, adolescents, and young people in the Brazilian environmental agenda is timid. It is therefore urgent to mobilize adolescents and young people to reflect, discuss, and

propose actions and projects in the context of socio-environmental issues, their challenges, and alternatives, within the schools, municipalities, states, and the country (UNICEF, 2023). Environmental Education, as a theoretical-pedagogical perspective, promotes the integral development of children, stimulates critical thinking, strengthens attitudes of socio-environmental responsibility, and encourages conscious consumption practices. By articulating academic knowledge with ethical and civic education, Environmental Education contributes to personal development and the formation of active subjects committed to protecting the planet (Nyika; Mwema, 2021). In this context, understanding how Environmental Education developed in the school environment influences children's perception of climate change becomes a central element for the analysis and interpretation of the results presented in the study entertained herein.

From this perspective, it is necessary, as an urgent action, to seek to understand the perception of young people and children about the climate crisis and to develop attractive educational practices. As citizens and future actors in the preservation of the planet, young people and children need to be aware of the issues surrounding environmental problems. Thus, knowledge of their perspectives on environmental and climate problems, to provide subsidies for developing educational materials focused on environmental problems, can contribute to student awareness and sensitization regarding issues. From this perspective, the major goal of the research work undertaken was to gather information to understand the perception of elementary school students at a municipal school regarding climate change and to provide input for developing suitable educational material on the subject.

DEVELOPMENT

This study is grounded in a socio-environmental and critical perspective of Environmental Education, which understands environmental issues as inseparable from social, cultural, and economic processes. From this standpoint, Environmental Education goes beyond the transmission of information and aims to foster critical awareness, ethical responsibility, and active participation in addressing contemporary environmental challenges, such as climate change (Souza *et al.*, 2016).

The methodology used in the research work entertained herein has been qualitative-descriptive based on the analysis and interpretation of information gathered

from responses from public elementary school students (8-11 years old) to a questionnaire. The questionnaire had 14 questions about their perceptions linked to climate change and environmental pollution. The entire research process proposed, the procedures, and the use of information collection instruments were submitted for the approval of the Ethics Committee of the University of Sorocaba (CEP-UNISO). The research was approved and received the registration number 6.065.961.

Participants and sample size calculation

The research involved elementary school students at a Municipal Basic Education School (EMEB Aparecida Merino Elias) located in the city of Jundiaí (São Paulo, Brazil). From an eligible population of 169 individuals, the sample size was calculated for a 95% confidence interval (significance level $\alpha=0.05$) using the OpenEpi web-based tool (version 3.01) (Sullivan *et al.*, 2009), after which the students were drawn by simple randomization using Microsoft Excel (Microsoft, Redmond WA, USA).

Instruments

The questionnaire was prepared with illustrations and images, playfully, aiming at collecting information about children's knowledge of climate change. The instrument was designed to address three dimensions, viz. (i) understanding children's knowledge regarding the environment, nature, etc. (questions 1-3); (ii) understanding children's knowledge regarding waste and waste production, garbage disposal, and responsibility for pollution (questions 4-12); and (iii) proposals of actions that can minimize climate change (questions 13-14).

Procedure and data analysis

The questionnaire was administered in groups of 10 (ten) to 15 (fifteen) students, following guidance from the teacher. There was no time limit for the students to return the filled questionnaires. The results were statistically analyzed using the R software (R Core Team, 2023).

Results

The sample size of public elementary school students was calculated, for a 95% confidence interval (significance level $\alpha=0.05$), as 118, an equal number of questionnaires was applied randomly.

The responses of the 118 public elementary school students were then analyzed. All students (100.0%) stated that they care about the environment and the planet. A close inspection of the data in Table 1 allows to observe that 83.9% of the students responded that the environment is the place where all living beings (plants, insects, animals, and people) live. However, 11.0% of the students believe that the environment is the same as the forest. It is also worthy of note that 41.5% of the students responded that only rivers, forests, and soil are part of the environment, while 42.4% of the students responded that all the options indicated are part of the environment.

It can also be observed in Table 1 that 44.9% of the students believe that shortly they will be unable to play in open spaces, in contact with nature, because of pollution (11.0%, Figure 1), waste present (8.5%, Figure 1), and due to deforestation (7.6%, Figure 1) and fires (5.9%, Figure 1).

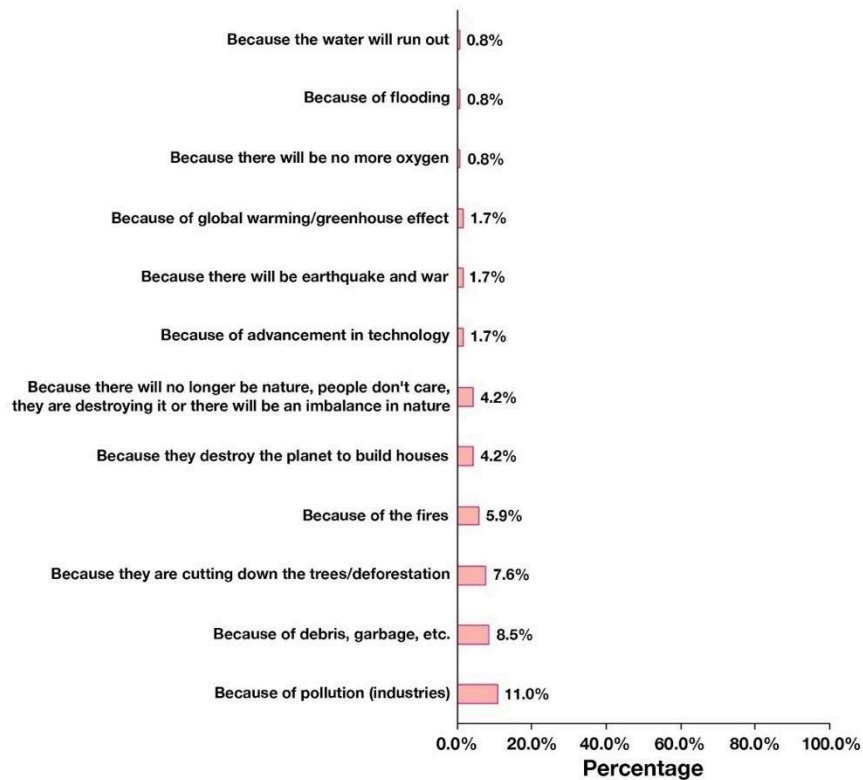
Table 1 - Descriptive analysis of variables related to the knowledge of public elementary school students about the environment (n=118).

Variable	Category	Frequency (%)
What do you consider the environment?	It's the same as a forest	13 (11.0%)
	It is a place that is very far from us	1 (0.8%)
	It's all animals	2 (1.7%)
	This is where humans live	3 (2.5%)
	It is the place where all living things (plants, insects, animals and people) live)	99 (83.9%)
What is part of the environment?	Rivers, forests, soil	49 (41.5%)
	The air, the mountains, the countryside	9 (7.9%)
	The streets, the animals, the insects, the house where you live	10 (8.5%)
	All of the options	50 (42.4%)
In the near future, do you think you can stop playing in open spaces, in contact with nature, because it may cease to exist?	No	65 (55.1%)
	Yes	53 (44.9%)

Fonte: Balcão, Liliane; Balcão, Victor; Vila, Marta, 2026.

Figure 1 displays the percentage of public elementary school students to answers why soon they think they can stop playing in open spaces and in contact with nature.

Figure 1 - Graph displaying the percentage of public elementary school students in relation to answers about why in the near future they think they will be unable to play in open spaces, in contact with nature (n=118).

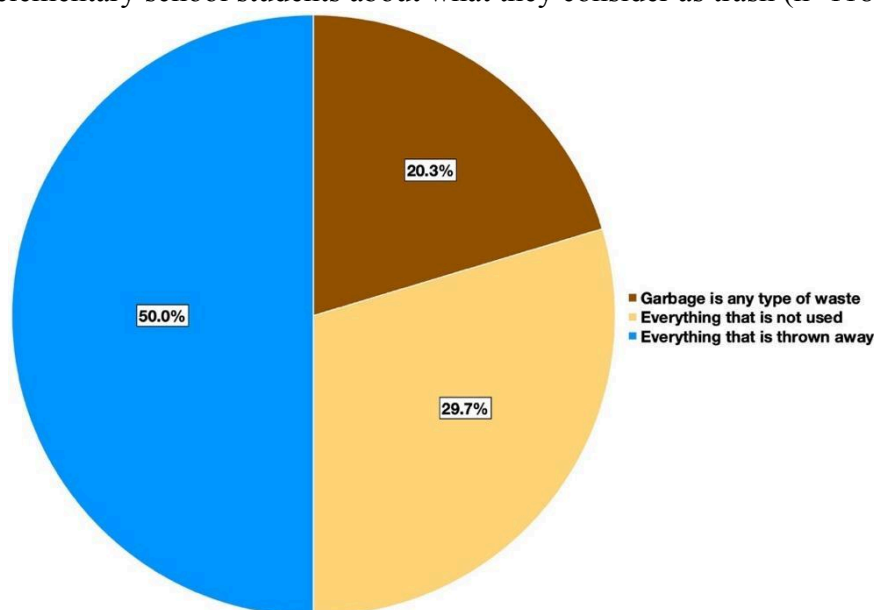


Fonte: Balcão, Liliane; Balcão, Victor; Vila, Marta, 2026.

Regarding the production of waste, most students consider trash everything that is thrown away (Figure 2). 36.4% of the students believe that they do not produce waste and 33.9% of them believe that their family does not produce any type of waste.

Figure 2 displays the frequency distribution of responses from public elementary school students about what they consider trash.

Figure 2 - Graph displaying the frequency distribution of responses from public elementary school students about what they consider as trash (n=118).



Fonte: Balcão, Liliane; Balcão, Victor; Vila, Marta, 2026.

Table 2 presents the frequencies of student responses regarding the types of waste they and their families produce. A close inspection of the data in Table 2 allows observing that the most cited terms were organic (according to 28.8% of the students, they and their families produce), plastics (according to 28.0% of the students, they produce themselves and according to 31.4% of the students, their families produce), paper (16.9% of the students produce themselves and 10.2% of the students say their families produce) and recyclables (13.6% of the students produce themselves and 11.0% of the students say their families produce).

Table 2 - Frequency distribution of answers of the public elementary school students regarding what types of waste they and their families produce (n=118).

Type of garbage	Frequency (%) (*)	
	The student	The family
Organic	34 (28.8%)	34 (28.8%)
Plastic	33 (28.0%)	37 (31.4%)
Paper	20 (16.9%)	12 (10.2%)
Recyclable	16 (13.6%)	13 (11.0%)
Pet	6 (5.1%)	2 (1.7%)
Glass	6 (5.1%)	4 (3.4%)
Cans	5 (4.2%)	5 (4.2%)

Boxes/Cardboard	7 (5.9%)	5 (4.2%)
Bottles	3 (2.5%)	3 (2.5%)
Bathroom trash	3 (2.5%)	1 (0.8%)
Metal	2 (1.7%)	2 (1.7%)
Another	3 (2.5%)	3 (2.5%)
Wood	0 (0.0%)	1 (0.8%)
Cigarette	0 (0.0%)	4 (3.4%)

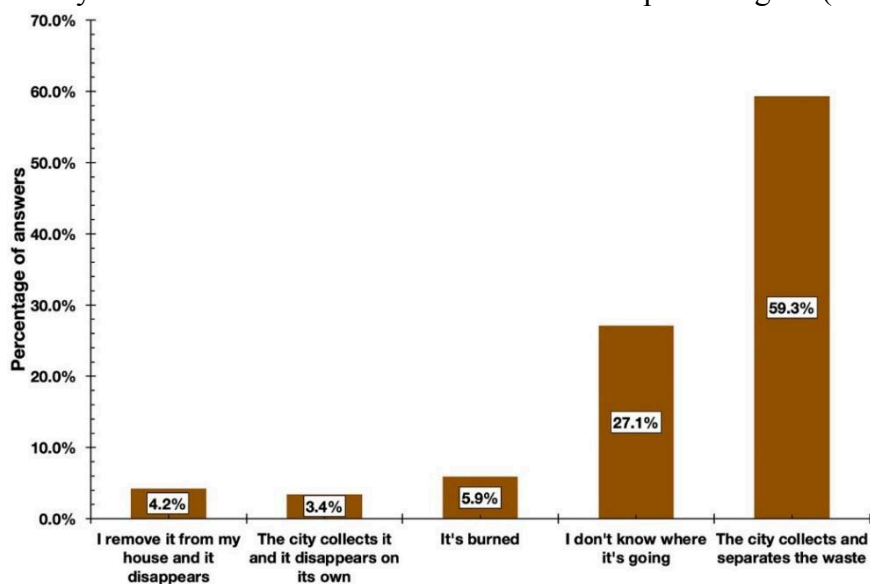
(*) The same student could answer more than one category.

Fonte: Balcão, Liliane; Balcão, Victor; Vila, Marta, 2026.

Regarding the destination of waste, a large percentage of the students (27.1%) responded that they do not know where the waste produced goes, in addition to 4.2% and 3.4% of the students who believe that they take it out of the house and it disappears or that the city collects it and it disappears on its own, respectively (Figure 3).

Figure 3 displays the frequency distribution of responses from public elementary school students about where the waste we produce goes.

Figure 3 - Graph displaying the frequency distribution of responses from public elementary school students about where the waste we produce goes (n=118).

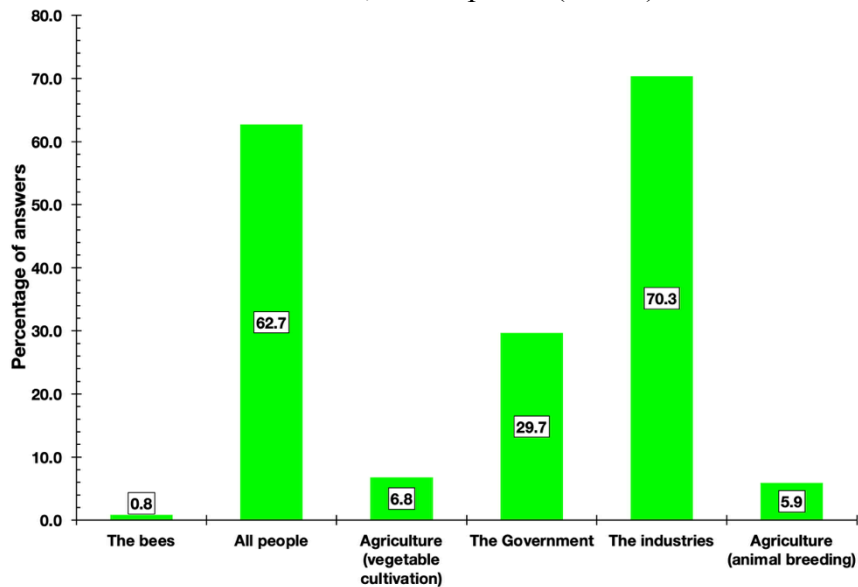


Fonte: Balcão, Liliane; Balcão, Victor; Vila, Marta, 2026.

As the main responsible for the environmental pollution, the majority of public elementary school students (69.5%) pointed all people (62.7%) and industries (70.3%) as the main causes of pollution in the environment (Figure 4).

Figure 4 displays the frequency distribution of responses from public elementary school students about what are the main causes of pollution in the environment, on the planet.

Figure 4 - Graph displaying the frequency distribution of responses from public elementary school students about what are the main causes of pollution in the environment, on the planet (n=118).

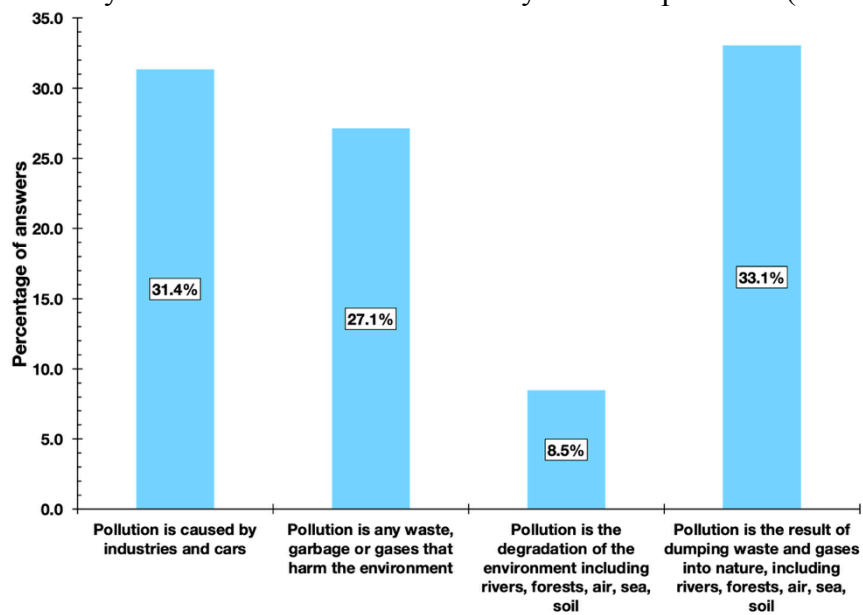


Fonte: Balcão, Liliane; Balcão, Victor; Vila, Marta, 2026.

It can also be observed that 33.1%, 31.4%, and 27.1% of the public elementary school students consider pollution as “the result of throwing garbage and gases into nature, including rivers, forests, air, sea, soil”, “caused by industries and cars” and “any waste, garbage or gases that harm the environment”, respectively, according to the data displayed in Figure 5.

Figure 5 displays the frequency distribution of responses from public elementary school students about what they consider pollution.

Figure 5 - Graph displaying the frequency distribution of responses from public elementary school students about what they consider pollution (n=118).

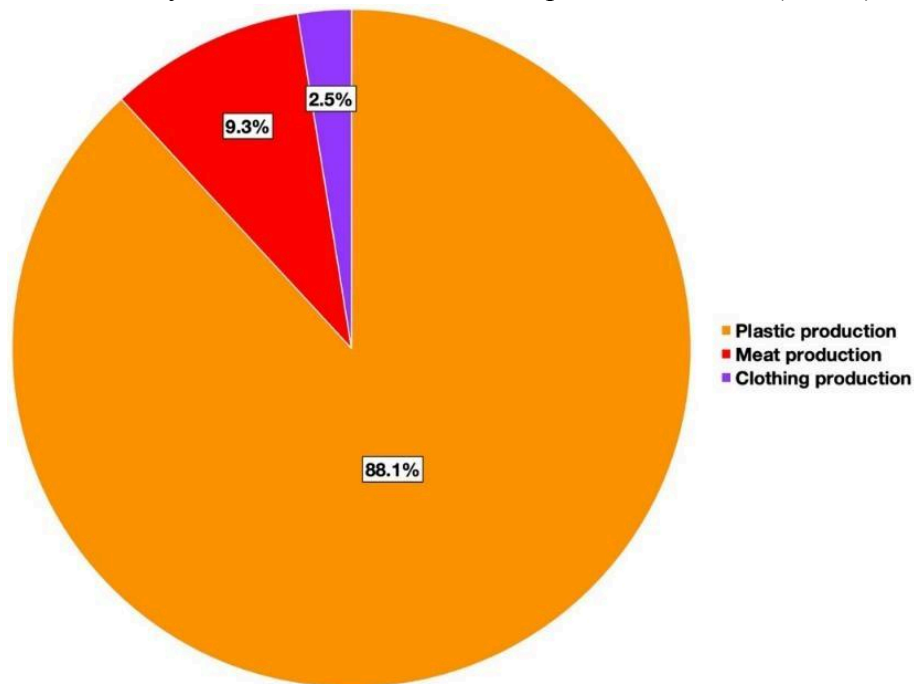


Fonte: Balcão, Liliane; Balcão, Victor; Vila, Marta, 2026.

Figure 6 displays the frequency distribution of responses from public elementary school students about what pollutes the most.

From inspection of the data in Figure 6, 88.1% of public elementary school students consider that plastic production pollutes more than meat and clothing production (Figure 6).

Figure 6 - Graph displaying the frequency distribution of responses from public elementary school students about what pollutes the most (n=118).

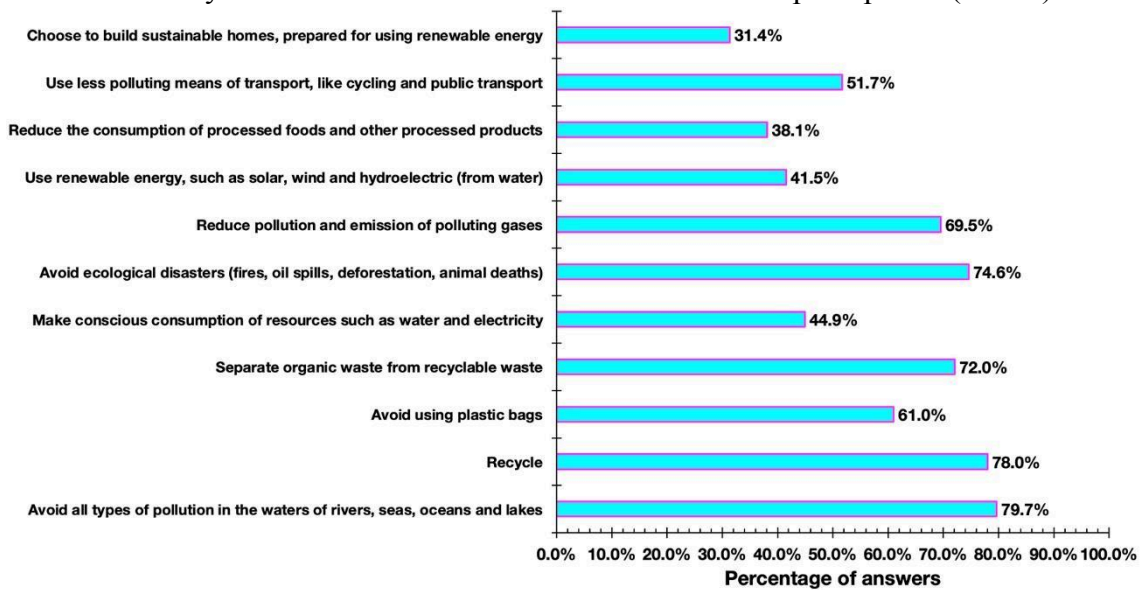


Fonte: Balcão, Liliane; Balcão, Victor; Vila, Marta, 2026.

Figure 7 displays the frequency distribution of responses from public elementary school students about what we can do to help the planet.

The majority of the students also responded that to help the planet we can avoid all types of pollution in the waters of rivers, seas, oceans, and lakes (79.7%), recycle (78.0%), avoid ecological disasters, such as fires, and spills of oil in the water, deforestation, and death of animals (74.6%), separating organic waste from recyclable waste (72.0%), reducing pollution and the emission of polluting gases (69.5%), avoiding using plastic bags (61.0%) and use alternatives and less polluting means of transport, such as cycling and public transport (51.7%), as shown in Figure 7.

Figure 7 - Graph displaying the frequency distribution of responses from public elementary school students about what we can do to help the planet (n=118).



Fonte: Balcão, Liliane; Balcão, Victor; Vila, Marta, 2026.

Discussion

All students showed concern for the planet. This perception is probably a reflection of the concerns and experiences of adults that reverberate in children. According to Dutra and Higuch (2018), such perceptions reflect feelings that children experience from the world they receive from adults. It is noteworthy that the subject “climate change” has been recurrent in the social communication media in Brazil and around the world. Mass communication media outlets create a forum for popular discourse, which is important for public understanding of climate change, including threats and risks, as well as future projections and coping possibilities (Rodas; Giulio, 2017). Regarding the meaning of “environment”, young students do not fully understand the meaning of the concept of environment, with age being an important variable for this understanding. Results of a study conducted on children aged between 8 and 10 years indicated, through drawings, that students understand the environment as elements such as forests, streams, animals, etc., where they find their vital needs met (water and nutrition, for example) (Duzenli, Alpak; Yilmaz, 2019). The results obtained in the research work undertaken and entertained herein were similar. It is noteworthy that 83.9% of the students responded that environment is the place where all living beings (plants, insects, animals, and people) live (Table 1). However, a significant

percentage (11.0%) of the students believe that environment is the same as the forest. The results obtained in this work may indicate a possible influence of the teaching materials available in Brazil and used in public elementary schools, which may not comprehensively address all components of the environment.

Students were also asked why they think they may shortly stop playing in open spaces, in contact with the nature. Children expressed a unanimous concern for the environment, however, many of them seem to believe that their playing activities will continue unchanged in the future as if they will not be affected by environmental impacts and changes around them. The most frequent responses involved a reduced contact with nature due to pollution (11.0% of the students), the presence of garbage and rubble (8.5% of the students), to deforestation (7.6% of the students) and fires (5.9% of the students). Children have no idea that environmental pollution is the result of an interconnected process, with multiple causes. This can be explained by the tendency for social media coverage of climate change to be more focused on specific events (Rodas; Giulio, 2017). In this sense, the need for Environmental Education in (but not limited to elementary) schools to be presented in an inter- and multidisciplinary approach is reinforced.

Some children do not see themselves as producers of waste. It was observed that 36.44% of students believe that they do not produce waste and 33.90% of them believe that their family does not produce any type of waste. It was observed that 36.44% of students believe that they do not produce waste and 33.90% of them believe that their family does not produce any type of waste. Discussion in the school environment about garbage and the correct disposal of solid wastes must be widespread since children are influenced by their parents and the school (Herdiansyah *et al.*, 2021). However, in review papers found in the specialty literature, it was concluded that teachers in general have poor training in dealing with this subject (Debrah *et al.*, 2021). Waste sustainability or environmental sustainability could be achieved in developing countries when environmental attitude, environmental awareness, and environmental knowledge are connected or communicated from teachers to students through formal education (Debrah *et al.*, 2021).

Regarding the type of waste generated, around 29% of the inquired public school elementary students indicated that the waste is so-called organic whereas around 28% of the students indicated that it is plastic (Table 2). This result was expected, since food, as

well as plastic packaging/wrapping linked to food, are the closest to the children's universe. These results are in close agreement with results published by Sulistyawati *et al.* (2020), who assessed the knowledge of children between 11 and 12 years old about the types of waste and waste management. However, in the research work described herein, although public school elementary students are aware of the types of waste generated, there is no discernment, among most of the participating students (40.7%), about how waste disposal and management occur. It is observed that a large percentage of the inquired students (27.1%) responded that they do not know where the waste they produce goes. In addition, 4.2% and 3.4% of the inquired students believe that they take it out of the house and it disappears, or that the city council collects it and it disappears on its own, respectively.

Regarding the main agents causing environmental pollution, 62.7% of the students pointed out that all people are responsible for the pollution in the environment, as well as industries (70.3% of the students). It is observed that, when children mostly identify industries and people as the main causes of pollution, they often limit themselves to what they hear or observe directly. This prevents them from considering factors that have a significant impact, such as farming and agriculture, along with their ramifications, such as the use of pesticides and herbicides, soil exploitation, the production of animal feed and meat, and the consumption of water and energy associated with these activities (Parihar, 2020). This perception is a point that must be observed within a socio-political and cultural context. It is known that a few dozen food and consumer goods companies are the source of almost all the waste produced on the planet. The plastic resin production industry and manufacturers of polymers that transform into plastics are even fewer in number and are rarely held accountable for the environmental contamination they produce. The consumer still ends up being the main culprit in environmental pollution. Policies focused on recycling and consumer behavior (i.e., “avoiding waste”), ignoring the need to reduce plastic production, should be reconsidered (Stiftung, 2020). Furthermore, consumers are often identified as key contributors to environmental pollution. Public policies focusing on recycling and consumer behavior (i.e. “avoiding waste”) must be rethought (Stiftung, 2019). More specifically, 31.4% of the inquired students believe that pollution is predominantly caused by industries and cars. This group of students directly associates industrial activity and automotive transport with environmental issues.

Notably, though, 27.1% of the students inquired about understanding pollution more globally, as any waste, garbage, or gases that harm the environment (Figure 5). Finally, 33.1% of the students define pollution as the direct result of the disposal of (solid/liquid) waste and gases in nature (Figure 5). This perspective considers individual action as a factor in environmental pollution. Formation of individuals with critical thinking and a reflexive look at life must be encouraged, especially in schools. Students must therefore be educated to become competent in decision-making and act as active participants and agents of change, with a focus on sustainable production (Iliopoulou, 2018).

Furthermore, 88.1% of the students inquired believe that the production of plastic pollutes more than the production of meat and clothing (Figure 6). Plastic pollution represents a growing threat to the environment, impacting natural habitats and ecosystems, with dramatic consequences for sustainable economic growth and human well-being (OECD, 2023). However, children's perception of plastic as a polluting agent can be attributed to the emphasis that plastic receives in social media and teaching materials, whether in recycling campaigns or in the discussion of the time it takes for plastic to decompose in nature. However, it is important to note that the production of meat and clothing (Djekic, 2015; Niinimäk *et al.*, 2020), along with the activities related to their manufacture, are rarely addressed (although they are quite polluting activities), creating a kind of "unknown world" for children, which is why their perception of pollution is limited to plastic production and use.

The questions related to actions to minimize or avoid environmental pollution, comprehensively, indicated that public school elementary students were able to identify actions and attitudes beneficial to the environment (Figure 7). These results are in close agreement with results reported by Spiteri (2022), who inquired even younger children (3 to 7 years old). The information from the students' answers to these questions, poured into Figure 7, was quite positive, indicating that Environmental Education is an instrument that should be encouraged and improved, and teacher's formation and knowledge should be constantly updated.

Several studies encountered in the specialty literature reported that climate "alarmism" is leading to increased anxiety and depression, especially among children (Ward, 2019; Clayton *et al.*, 2019) While back in 2017 the American Psychological

Association diagnosed a rising ecological-based anxiety and nicknamed it “a chronic fear of environmental doom” (Clayton *et al.*, 2019).

Environmental education aims to foster individuals who are aware of environmental challenges and committed to the pursuit of a sustainable society (Oliveira, 2023). The development of values plays a central role in this process, particularly in the context of Environmental education. However, environmental themes are often addressed in a fragmented manner within basic education, with limited integration as a core area of knowledge (Gama; Bridi, 2021; Barbosa; Oliveira, 2020). Environmental education should therefore adopt an interdisciplinary approach, drawing on the specific contributions of different subjects to promote a comprehensive understanding of the relationship between environmental processes and human actions (Conde, 2016). The gradual and contextual introduction of environmental topics can support learning, yet the observed results indicate a lack of an integrated perspective on environmental contamination processes (Santos *et al.*, 2020).

While children in other countries are being emotionally impacted by such “apocalyptic” (real) discussions on climate change, an inescapable reality, in Brazil the evidence points in the other direction with the children being spared from such “environmental doom” discussions, literally like a fairytale without the fairies. In this context, the children's perception resembles living in a “fairytale”, where the harsh reality is hidden; however, it is a narrative “without fairies”, because there will be no magical solutions to save them from future consequences if critical awareness does not occur now.

Doing like an ostrich and sticking the head in the sand is no longer an option. The young children's knowledge about climate change and its causes can lead to real improvements in environmental awareness and future behavioral changes.

CONCLUSIONS

This research sought to investigate the perception of elementary school students regarding climate change, and, at the end of this process, the results revealed a worrying, yet fertile, scenario for pedagogical intervention. It was found that children's understanding of the environmental crisis is still fragmented and often superficial. Although students demonstrate sensitivity to visible and immediate problems (such as improper waste disposal and river pollution), there is a significant difficulty in

connecting these local events to global and systemic phenomena, such as global warming and the greenhouse effect. The predominance of alternative conceptions and conceptual confusion indicate that the Environmental Education (EE) practiced has sometimes failed to overcome the barrier of common sense.

In this context, the “fairytale” metaphor used in the title of this work is justified and concludes here as a warning. The data gathered suggests that the Brazilian children investigated live in a kind of bubble: unlike young people in other contexts who suffer from “eco-anxiety”, this group seems “protected” from the catastrophic reality of climate change, maintaining an idealized view of nature. However, this is a “fairytale”, as this alienation will not save them from future consequences. The lack of critical understanding of the gravity of the climate crisis leaves these children unequipped to act as agents of transformation in a world that will increasingly demand resilience and adaptation.

Therefore, it is concluded that it is imperative to reformulate EE practices in schools. It is not enough to simply teach how to separate waste or celebrate commemorative dates; it is necessary to promote a critical, interdisciplinary, and continuous environmental education that addresses the anthropogenic causes of climate change and its complex social and biological consequences. The school needs to be the space where the “fairytale” gives way to scientific thinking and active citizenship, preparing students to face reality without illusions, but with knowledge and the capacity for action.

Finally, this study points to the urgent need for investment in continued teacher training, so that teachers feel confident when addressing controversial and complex topics such as the climate emergency. It is hoped that the results presented here will serve as a basis for the development of new teaching strategies that, instead of masking reality, empower children to be protagonists in building a sustainable future.

Institutional Review Board Statement: The study was conducted according to Resolutions 466/12 and/or 510/16 of the National Health Council (Brazil) and was approved by the Ethics Committee of the University of Sorocaba (Sorocaba/SP, Brazil) (protocol code 6.065.961, date of approval: May 11th, 2023).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study, in the form of a TCLE (Free and Informed Consent Term) and a TALE (Free and Informed Assent Term).

Data Availability Statement: The data presented in this study will be made available upon request from the corresponding authors, in a way that does not identify the subjects inquired for the study due to privacy and ethical restrictions.

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REFERENCES

BARBOSA, Giovani; OLIVEIRA, Caroline Terra. Educação Ambiental na Base Nacional Comum Curricular. **Revista Eletrônica do Mestrado em Educação Ambiental** v. 37, n. 1. Seção especial: XI EDEA - Encontro e Diálogos com a Educação Ambiental. p. 323-335. jan/abr. 2020. E-ISSN 1517-1256. Available at: <https://periodicos.furg.br/remea/article/view/11000> (accessed on 28/01/2026).

CONDE, Ivo Batista. **Ciências biológicas: Educação Ambiental na escola**. Fortaleza/CE: EdUEC, 2016. Available at: https://educapes.capes.gov.br/bitstream/capes/431714/2/Livro_Educacao%20Ambiental%20na%20Escola.pdf (accessed on 28/01/2026).

CLAYTON, Susan; MANNING, Christie; SPEISER, Meighen; HILL, Alisom N. **Mental Health and Our Changing Climate: Impacts, Implications, and Guidance**, 2017. Washington, D.C.: American Psychological Association, and ecoAmerica, Available at: <https://www.apa.org/news/press/releases/2017/03/mental-health-climate.pdf> (accessed on 27/04/2024).

DEBRAH, Justice K.; VIDAL, Diogo G.; Dinis, Maria Alzira P. Raising awareness on solid waste management through formal education for sustainability: A developing countries evidence review. **Recycling**, v.6, n. p.1-31, 2021. Available at: <https://doi.org/10.3390/recycling6010006> (accessed on 28/01/2026).

DHARA, Haripada. Education and environment. **International Journal of Creative Research Thoughts**, v.10, n.4, p.1-6, 2022. Available at: <https://www.bing.com/ck/a?!&&p=0e20e6b181345371474a446a2c23bc6de7666b7198c817894a021640578aef08JmltdHM9MTc2OTU1ODQwMA&ptn=3&ver=2&hsh=4&fclid=3ca5dce-1722-6da3-06f3-c8a816286c49&psq=DHARA%2c+Haripada.+Education+and+environment.+&u=a1aHR0cHM6Ly9pamNydC5vcmcvZG93bmxvYWQxLnBocD9maWxlPUIKQ1JUMjIwNDI0NS5wZGY&ntb=1> (accessed on 28/01/2026).

DIFFENBAUGH, Noah. S.; BARNES, Elizabeth. A. Data-driven predictions of the time remaining until critical global warming thresholds are reached. **Earth, Atmospheric, and Planetary Sciences**, v.120, e2207183120, 2023. Available at: <https://www.pnas.org/doi/10.1073/pnas.2207183120> (accessed on 28/01/2026).

DJEKIC, Ilija. Environmental impact of meat industry: Current status and future perspectives. **Procedia Food Science**, v.5, p.61- 64, 2015. Available at: https://www.researchgate.net/publication/282325498_Environmental_Impact_of_Meat_Industry_-_Current_Status_and_Future_Perspectives (accessed on 28/01/2026).

DUTRA, Grace, M.; HIGUCHI, Maria Inês, G. Environmental perceptions of children who live in degraded spaces in the Amazon. **Ambiente & Sociedade**, v.21, e00871, p.1-18, 2018. doi: 10.1590/1809-4422asoc0097r1vu18L3AO. Available at: <https://www.scielo.br/j/asoc/a/W4ZYFqWK6yXghpNkhjZjCzv/?format=html&lang=en> (accessed on 28/01/2026).

DUZENLI, Tugba.; ALPAK, Elif. M.; YILMAZ, Serap. Children's imaginations about environment and their perceptions on environmental problems. **Fresenius Environmental Bulletin**, v. 28, p.9798-9808, 2019. Available at: https://www.researchgate.net/publication/336983132_CHILDREN'S_IMAGINATIONS_ABOUT_ENVIRONMENT_AND_THEIR_PERCEPTIONS_ON_ENVIRONMENTAL_PROBLEMS (accessed on 28/01/2026).

ERHABOR, Norris. I.; DOM, Juliet, U. Impact of environmental education on the knowledge and attitude of students towards the environment. **International Journal of Environmental & Science Education**, n.11, p.5367-5375, 2016. Available at: https://www.researchgate.net/publication/382899921_Education_for_a_Sustainable_Future_The_Impact_of_Environmental_Education_on_Shaping_Sustainable_Values_and_Attitudes_among_Students (accessed on 28/01/2026).

EVSEEVA, Oksana.; EVSEEVA, Svetlana; DUDARENKO, Tamara. The impact of human activity on the global warming. **E3S Web of Conferences, Section: Environmental Policy and Law**, v. 284, p.11017, 2021. Available at: https://www.researchgate.net/publication/353184303_The_impact_of_human_activity_on_the_global_warming (accessed on 28/01/2026).

GAMA, Suzani Evelin de Souza S.; BRIDI, Veronica Loureiro Educação Ambiental no Ensino Fundamental: Dificuldades, desafios, recursos didáticos e percepções. **Revista Educação Pública**, v. 21, nº 27, 2021. Available at: <https://educacaopublica.cecierj.edu.br/artigos/21/27/educacao-ambiental-no-ensino-fund>

amental-dificuldades-desafios-recursos-didaticos-e-percepcoes (accessed on 28/01/2026).

HERDIANSYAH, Herdis.; BRODOSUSILO, Agus.; NEGORO, Habibulloh, A., SARI, Ravita; ZAKIANIS, Zakianis. Parental education and good child habits to encourage sustainable littering behavior. **Sustainability**, v.13, p 8645, 2021. Available at: <https://www.mdpi.com/2071-1050/13/15/8645> (accessed on 28/01/2026).

ILIOPOULOU, Ifigenia Children's thinking about environmental issues. **Education Research**, v.60, p. 1-14, 2018. Available at: <https://www.mdpi.com/2071-1050/13/15/8645> (accessed on 28/01/2026).

KABIR, Muhammad.; HABIBA, Ume.; IQBAL, M.Z.; SHAFIQ, Muhammad; FAROOQ, Zia, R.; SHAH, Amin.; KHAN, Wali. Impacts of anthropogenic activities & climate change resulting from increasing concentration of Carbon dioxide on environment in 21st Century: A critical review. **IOP Conference Series: Earth and Environmental Science**, n.1194, p.012010, 2023. Available at: https://www.researchgate.net/publication/372359689_Impacts_of_anthropogenic_activities_climate_change_resulting_from_increasing_concentration_of_Carbon_dioxide_on_environment_in_21_st_Century_A_Critical_Review https://www.researchgate.net/publication/372359689_Impacts_of_anthropogenic_activities_climate_change_resulting_from_increasing_concentration_of_Carbon_dioxide_on_environment_in_21_st_Century_A_Critical_Review (accessed on 28/01/2026).

KAKUNGULU, S. The importance of environmental education: Teaching sustainability in the classroom. *Eurasian Experiment Journal of Humanities and Social Sciences*. v. 5, p.22-25, 2024. Available at: https://www.researchgate.net/publication/383549288_The_Importance_of_Environmental_Education_Teaching_Sustainability_in_the_Classroom. (accessed on 28/01/2026).

LUSZ, Pedro.; Zaneti, Isabel, C. B. B.; Rodrigues Filho, Saulo. Environmental education in rural education: youth, action research and climate change. In **SciELO Preprints**, 2021. Available at: <https://doi.org/10.1590/SciELOPreprints.2365> (Original work published 2021) (accessed on 19/04/2024).

NYIKA, Joan; MWEMA, Frederick M. **Environmental education and its effects on environmental sustainability**, 2021. Doi: 10.4018/978-1-7998-7512-3.ch009. Available at: https://www.researchgate.net/profile/Joan-Nyika/publication/349126299_Environmental-Education-and-Its-Effects-on-Environmental-Sustainability/links/60221e52299bf1cc26b254b7/Environmental-Education-and-Its-Effects-on-Environmental-Sustainability.pdf (accessed on 08/03/2023).

NIINIMÄK, Kirsi; PETERS, Greg; DAHLBO, Helena; PERRY, Patsy; RISSANEN, Timo; GWILT, Alison. The environmental price of fast fashion. **Nature Reviews**, v.1, p. 89-200, 2020. Available at: https://www.researchgate.net/publication/340635670_The_environmental_price_of_fast_fashion (accessed on 28/01/2026).

OLIVEIRA, Laeson Costa. A importância da educação ambiental na escola. *Revista FT. Ciências Biológicas*, v 17, 2023. Doi 10.5281/zenodo.8436182. Available at: <https://revistaft.com.br/a-importancia-da-educacao-ambiental-na-escola/> (accessed on 28/01/2026).

ORGANIZATION FOR ECONOMIC COOPERATION AND DEVELOPMENT (OECD). **Towards Eliminating Plastic Pollution by 2040: A policy scenario analysis**, 2023. Available at: <https://www.oecd.org/environment/plastics/Interim-Findings-Towards-Eliminating-Plastic-Pollution-by-2040-Policy-Scenario-Analysis.pdf> (accessed on 15/04/2024).

PARIHAR, Sanjay. Agricultural pollution. **International Journal of Education, Modern Management, Applied Science & Social Science**, v.2, p. 89-94, 2020. Available at: <https://www.inspirajournals.com/uploads/Issues/1251730783.pdf> (accessed on 28/01/2026).

R CORE TEAM. R: a language and environment for statistical computing. Viena: R Foundation for Statistical Computing, 2023.

RODAS, Caroline A.; DI GIULIO, Gabriela, M. Brazilian media and climate change: Analysis of media coverage trends, approaches and criteria of newsworthiness. **Desenvolvimento e Meio Ambiente**, v. 40, p. 101-124, 2017. Available at: https://www.researchgate.net/publication/316950167_Midia_brasileira_e_mudancas_climaticas_uma_analise_sobre_tendencias_da_cobertura_jornalistica_abordagens_e_criterios_de_noticiabilidade (accessed on 28/01/2026).

SANTOS, Francisco Arapiraca; SILVA LEITE, Elidinaldo, ROCHA AMORIM, R. Dinani; AMORIM, Ricardo Environmental education in Brazil: Socio-historical perspectives in formal teaching for sustainability. **Creative Education** v.11, p. 2053-2068, 2020. doi: 10.4236/ce.2020.1110150. Available at: https://www.researchgate.net/publication/346350634_Environmental_Education_in_Brazil_Socio-Historical_Perspectives_in_Formal_Teaching_for_Sustainability (accessed on 28/01/2026).

SOUZA, Maria Lucélia M.; PINTO, Adeon. C. The importance of environmental education in science education. **REVASF**, v.6, p.06-15, 2016. Available at: <https://www.periodicos.univasf.edu.br/index.php/revasf/article/view/34/41> (accessed on 28/01/2026).

SPITERI, Jane. How can environmental sustainability be achieved? The perceptions of young children as expressed through their drawings. **International Journal of Early Childhood**, v.54, p. 13–31, 2022. Available at: <https://link.springer.com/article/10.1007/s13158-021-00312-9> (accessed on 28/01/2026).

STIFTUNG, Heinrich B. **Plastic Atlas: Facts and figures about the world of synthetic polymers**, 2ed., 2019. Available at: <https://www.boell.de/sites/default/files/2020-01/Plastic%20Atlas%202019%202nd%20Edition.pdf> (accessed on 25/04/2024).

STIFTUNG, Heinrich. **Atlas do Plástico**. 1ª ed. Brasileira. Rio de Janeiro: Fundação Heinrich Böll, 2020. Available at: <https://br.boell.org/pt-br/atlas-do-plastico> (accessed on 28/01/2026).

SULISTYAWATI, Sulistyawahi.; SUKESI, Tri W.; MULASARI, Surahma. A; TENTAMA, Fatwa.; DJANNAH, Sitti. N. Knowledge, attitude and practice towards waste management among primary school children. **Asian Journal of Education and Social Studies**, v.8, p. 24-30, 2020. Available at: https://www.researchgate.net/publication/342365295_Knowledge_Attitude_and_Practice_towards_Waste_Management_among_Primary_School_Children (accessed on 28/01/2026).

SULLIVAN, Kevin M.; DEAN, Andrew; SOE, Minn, M. OpenEpi: a web-based epidemiologic and statistical calculator for public health. **Public Health Reports**, v.124, n. 3, p 471-474, 2009 doi: 10.1177/003335490912400320. Available at: <https://pmc.ncbi.nlm.nih.gov/articles/PMC2663701/> (accessed on 28/01/2026).

WARD, Mary. **Climate anxiety is real, and young people are feeling it**, 2019. Available at: <https://www.smh.com.au/lifestyle/health-and-wellness/climate-anxiety-is-real-and-young-people-are-feeling-it-20190918-p52soj.html> (accessed on 27/04/2024).

UNICEF. United Nations Children's Fund. The climate-changed child, 2023. Available at: <https://www.unicef.org/media/147931/file/Theclimate-changedchild-ReportinEnglish.pdf> (accessed on 19/04/2024).