



Article

Testing the Effectiveness of an Ecomedia Literacy Environmental Education Lesson

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Abstract: The growing environmental crisis requires innovative educational strategies to promote pro-environmental attitudes and behaviors. In this context, ecomedia literacy, which combines ecological education and media to enhance pro-environmental attitudes and behaviors, stimulate sustainable actions, and foster critical thinking, represents a promising approach. In this research, we evaluated the effectiveness of an ecomedia literacy-based lesson. Participants (N = 106) were randomly assigned to either an ecomedia literacy group or a control group. Those in the ecomedia literacy group first attended the lesson and then completed a questionnaire to assess pro-environmental attitudes and behavioral intentions, while those in the control group completed the questionnaire before the lesson. The lesson focused on the use of plastic water bottles, and attitudes and intentions were assessed both in general toward the environment and specifically regarding the consumption of plastic bottles. The intervention was not successful in changing intentions or attitudes toward plastic bottles, but some facets of pro-environmental attitudes were better in the ecomedia literacy group than in the control group. The limited effectiveness of the lesson indicates the need for significant changes in content and future strategies to better achieve sustainability goals.

Keywords: sustainability; ecomedia; pro-environmental behaviors; pro-environmental attitudes



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1. Introduction

According to the scientific community, one of the primary causes of the environmental crisis is human behavior (e.g., Vicedo-Cabrera et al. 2021). Consequently, a major factor which could contribute to the reduction of environmental issues is individuals' pro-environmental behavior (PEB), which is defined as conduct that either preserves the environment or does not harm it (Stern 2000; Lange and Dewitte 2019). For this reason, a great deal of research has been conducted to identify factors which might motivate individuals to act—or not—to protect the environment. Such research also helps develop policies and programs that effectively promote PEBs. Given that environmental issues are becoming more and more severe (IPCC 2023), more research on this topic is required.

To foster PEBs, especially among children and young adults, several environmental education programs have been proposed. Environmental education interventions may vary according to educational goals, context, and available resources (e.g., Świątkowski et al. 2024). Integrating environmental education into school curricula is a common practice, encompassing lessons on environmental issues, science projects, and interdisciplinary activities that link environmental science with other subjects (e.g., Anggraini et al. 2018). For example, problem-based learning projects, i.e., a student-centered pedagogical approach that involves students working on authentic, real-world problems to develop their knowledge and skills (Mao and Yuan 2017), encourage students to tackle real-world environmental problems, fostering critical thinking and collaboration (e.g., Nurhidayati et al. 2024). Outdoor learning experiences, such as hikes, visits to nature reserves, and school

gardening, allow students to connect with nature (e.g., [Yanniris et al. 2023](#)). Community service projects, also known as service-learning, combine academic learning with community service, engaging students in sustainability and conservation initiatives (e.g., [Knackmuhs et al. 2017](#)). The use of educational technologies is increasing, with digital tools, educational applications, and online platforms offering simulations, educational videos, and interactive materials to enhance environmental education (e.g., [Liu and Zhang 2024](#)). Additionally, informal environmental education programs extend learning beyond traditional school settings through workshops, summer camps, and community outreach programs (e.g., [Cousineau et al. 2018](#)).

Educational spaces function as catalysts for promoting social change by raising awareness of environmental issues and teaching environmental content that leads to changes in behavior necessary for sustainable development ([Pérez Peláez et al. 2019](#)). Several studies have examined the effects of environmental education on students' pro-environmental behavior. For example, according to [Díaz Grijalva et al. \(2019\)](#), there is a significant effect of environmental education practices in Mexico on pro-environmental skills of students like practicing appropriate water care, proper garbage disposal, and energy conservation. Researchers in Hungary discovered an effect of environmental regulations put in place in educational institutions on pro-environmental attitudes and behaviors among secondary school pupils ([Mónus 2022](#)). In the Peruvian Amazon, it has been found that environmental education increases the pro-environmental behavior of students ([Estrada-Araoz et al. 2023](#)).

Combining teacher-directed learning with inquiry-based learning, i.e., an educational approach where students actively explore questions, problems, or scenarios to construct knowledge and deepen understanding, is an important strategy. According to Lee, both inquiry-based and teacher-supported scientific education are associated with students' understanding of environmental issues. This suggests that a blended approach, i.e., a mixed educational strategy, might increase students' environmental awareness ([Lee 2023](#)). This result is consistent with research by [Jack et al. \(2014\)](#), who claim that attention to emotional elements—such as students' interests and motivations—is necessary to develop competence in scientific and environmental education. Engaging teaching approaches can help to cultivate these characteristics ([Jack et al. 2014](#)). Therefore, the development of responsible citizens who are involved in environmental concerns depends heavily on the emotional and cognitive aspects of education.

Among such approaches, there are interventions based on ecomedia literacy, a methodology that bridges media education and education for sustainability ([López 2022](#)). In this research, we planned and conducted an ecomedia literacy-based environmental lesson on disposable plastic water bottles and tested its effectiveness in improving attitudes and behavioral intentions targeting both the environment in general and the consumption of plastic water bottles specifically.

By placing this intervention in the larger framework of science didactics and interdisciplinary teaching approaches, we aim at showing how encouraging critical thinking may increase the effectiveness of environmental education initiatives.

1.1. Ecomedia Literacy

Ecomedia is a concept that recognizes the effects of media on the environment, both in terms of content (narratives, news, policy awareness, etc.) and their physical impacts on the environment (such as the use of fossil fuel energy and water to maintain server farms for our data). Indeed, the media frequently shape our opinions on the environment and serve as an input for specific climate change actions. Importantly, the media are educational: they teach us how to act and live within the world's ecological systems ([López 2022](#)) and they are an ever-evolving continuum of promoters of skills, knowledge, attitude, and actions ([Scheibe and Rogow 2011](#)). Ecomedia literacy is a method that encompasses the ability to critically analyze and understand media messages related to environmental issues, promoting ecological awareness and sustainable behaviors ([Rosyid 2020](#)). Interventions based on ecomedia literacy aim to enhance individuals' understanding of ecological concepts and

encourage pro-environmental actions (Gustian et al. 2022). By utilizing various educational tools such as storytelling, digital learning, and interactive teaching materials, ecomedia literacy interventions can effectively cultivate empathy, community engagement, and observation skills related to environmental conservation (Ninsiana et al. 2024; Pursitasari et al. 2022).

Incorporating ecomedia literacy into educational settings through innovative learning media like web-based modules, virtual reality, and mobile learning can play a crucial role in fostering eco-literacy skills among students. These approaches not only provide thematic materials and real-world problem representations but also offer engaging and interactive platforms for enhancing eco-literacy (Wulandari et al. 2024; Aguayo and Eames 2017; Habibah and Putra 2023). Ecomedia literacy's pedagogy is inspired by Freire's educational principles. Freire's method, based on the idea that dialog can be a means of promoting understanding between people and changing society, can be an effective model for teachers who wish to enable their pupils to interpret the world critically. According to Freire, authentic dialogue between students and teachers is crucial to foster critical awareness and social transformation (Freire 1998; Jemal 2017). This pedagogical approach, known as critical pedagogy, aims to liberate from systemic inequity through education that promotes critical awareness and social action (Zanchetta et al. 2023).

The ecomedia literacy intervention for this research is based on media literacy curricula developed by Project Look Sharp (Scheibe 2004). Using a constructivist pedagogy based on the Freire dialogical method and the vast repertoire of media literacy curricula, Project Look Sharp's approach to media literacy is that it can be a catalyst for critical thinking and engagement with a range of social issues, including race, gender, violence, and sustainability. A community of co-learners dedicated to media literacy and sustainability is fostered by Project Look Sharp through collaborative curriculum creation and place-based learning. While the potential of ecomedia literacy interventions is promising, there is a scarcity of empirical studies evaluating their effectiveness. Despite the theoretical underpinnings and the diverse range of approaches used in ecomedia literacy initiatives, there is a need for more rigorous research to assess the impact of these interventions on individuals' eco-literacy levels and behavioral changes toward sustainability (Campbell et al. 2021).

For this research project, we adapted Project Look Sharp's lesson plan for fifth-grade students that focuses on evaluating media messages on bottled water. The activity was translated into Italian and updated with relevant examples from Italian media. Using Lopez's framework as a guide, the lesson helps students develop their critical thinking abilities by having them participate in reflective discussions and media document decoding. Students examine the social and environmental effects of drinking bottled water via a series of guided activities that end with the expression of well-informed opinions and recommendations for action.

1.2. The Current Research

Ecomedia literacy is a recent development in the field of media literacy that has emerged over the past 15 years, so there is limited empirical research testing its effectiveness. Therefore, this experiment aims at testing the effectiveness of an environmental education lesson based on ecomedia literacy on plastic bottled water. Specifically, we tested whether the lesson was effective at improving pro-environmental attitudes and behaviors, which were assessed by targeting both the environment in general and plastic bottled water consumption specifically.

Participants were undergraduate students at an Italian university. The focus on university students is substantiated by research indicating that universities are pivotal in encouraging PEBs (Torres et al. 2023). Universities are recognized as crucial institutions for environmental education and have a significant influence on students' attitudes and actions toward sustainability (Torres et al. 2023). Furthermore, targeting university students for interventions aimed at promoting more eco-friendly behaviors is supported by research

indicating that this demographic group is open to adopting sustainable practices and to changing their behavior (Dewi and Sawitri 2018).

The goal of this study was to determine if the ecomedia literacy lesson could improve pro-environmental attitudes and behavioral intentions, particularly regarding plastic bottled water consumption. This objective is in line with prior research that has investigated factors influencing bottled water consumption, such as a preference for bottled water despite the availability of treated tap water (Aslani et al. 2021). Understanding the reasons behind bottled water consumption is essential for developing effective interventions to encourage more sustainable alternatives (Aslani et al. 2021).

Additionally, the focus on plastic bottled water is important due to the environmental issues linked to plastic pollution. Research has highlighted the necessity of reducing single-use plastic consumption, including plastic bottled water, to alleviate environmental impacts (Bruchmann et al. 2021). By specifically addressing plastic bottled water consumption, this study tackles a critical environmental concern and contributes to endeavors aimed at decreasing plastic waste (Bruchmann et al. 2021).

Finally, this study is in line with the objectives of the Italian Ministry of Education, which states the importance of the development of thematic components to address environmental issues, reinforce the use of best practices in the context of climate change, and encourage a critical mindset and the practice of responsible environmental citizenship.

2. Materials and Methods

The participants were 106 university students ($M_{\text{age}} = 22.84$, $SD = 7.03$, ranging from 19 to 61; 83% female, 16% male, 1% non-binary) attending the University of Ferrara. They were randomly assigned to either the experimental or the control group using an online random number generator. Specifically, each participant was asked to use the generator, and those who obtained an even number were assigned to the environmental education group, while those with an odd number were assigned to the control group. Subsequently, the two groups were directed to separate classrooms. Those in the environmental education group first participated in the environmental education lesson and then completed a questionnaire aimed at assessing pro-environmental attitudes and behavioral intentions. As we aimed to involve all participants in the lesson, those in the control group first completed the questionnaire and then participated in the environmental education lesson. The topic of the lesson was the consumption of plastic water bottles. Attitudes and behavioral intentions were assessed both specifically targeting the consumption of plastic water bottles and also related to the environment in general. This research received approval from the ethics committee of the Department of Humanities, University of Ferrara (2024#005).

2.1. Ecomedia Literacy Lesson

The lesson was based on two activities. In the first activity, two videos were shown: one depicting the journey of a plastic bottle in a United Nations Environment Program documentary and another portraying Norman, an ordinary man living an ordinary life until a group of people convince his city council to ban the sale of bottled water. While the first video was designed to raise awareness about the environmental impacts of plastic bottled water, the second one is about the controversy between preserving individual freedom versus implementing strict policies aimed at protecting the environment. After each video, participants were asked to reflect on questions such as “What messages about bottled water are conveyed in the video?” and “Who might benefit or be harmed by this video and why?” These questions encouraged critical thinking about the implications of bottled water consumption and the power of visual storytelling in shaping perceptions.

Moving on to the second activity, participants were invited to watch five Italian TV advertisements for bottled water and to analyze their persuasion techniques and underlying messages. Participants were instructed to analyze the strategies employed in each video and reflect on the significance of understanding these techniques. Then, in pairs, they reflected on possible actions based on their new knowledge. This activity

aimed to promote awareness of the marketing tactics used to promote bottled water and to encourage proactive responses to this issue.

2.2. Measures in the Questionnaire

For all the measures in the questionnaire, the response scale ranged from 1 (completely disagree) to 5 (completely agree).

Perceived benefits of bottled water consumption. We adapted the measure by [Xu and Lin \(2018\)](#). Respondents were asked to rate their agreement with 4 statements assessing perceived benefits of plastic bottled water (e.g., “Plastic bottled water is convenient”). Answers were averaged to create a reliable (Cronbach’s $\alpha = 0.69$) composite score, with higher scores representing more perceived benefits.

Affective attitude toward bottled water consumption. We adapted the measure by [Xu and Lin \(2018\)](#). Respondents were asked to rate their agreement with 3 statements (e.g., “I like the shape/design of the bottle”). Answers were averaged to create a composite score (Cronbach’s $\alpha = 0.56$), with higher scores representing a more positive attitude.

Bottled water purchase intentions. We adapted the measure by [Xu and Lin \(2018\)](#). Respondents were asked to rate their agreement with 3 statements (e.g., “I intend to purchase single use bottled water in the future”). Two items were reverse-coded. Answers were averaged to create a reliable (Cronbach’s $\alpha = 0.86$) composite score, with higher scores representing higher intentions to purchase plastic bottled water.

Pro-environmental attitudes. We used the Italian version ([Prati et al. 2015](#)) of the New Environmental Paradigm scale ([Dunlap et al. 2000](#)). The original version includes 15 items but, due to a technical error, only 14 items were administered. Six items were reverse-coded. Answers can be used to create an overall score of attitudes toward the environment (Cronbach’s $\alpha = 0.63$), but it is also possible to look at five sub-dimensions: limits of growth, i.e., the belief that there should be limits to economic growth and that the environment has a limited capacity to withstand human activity (sample item: “We are approaching the limit of the number of people the earth can support”); eco-crisis possibility, i.e., attention and concern for environmental issues (sample item: “If things continue on their present course, we will soon experience a major ecological catastrophe”); anti-anthropocentrism, i.e., opposition to the idea that nature exists primarily for human use (sample item: “Humans have the right to modify the natural environment to suit their needs”); anti-exceptionalism, i.e., beliefs and attitudes that support an ecological approach to life (sample item: “Despite our special abilities humans are still subject to the laws of nature”), balance of nature, i.e., importance of maintaining the natural balance and biodiversity (sample item: “The balance of nature is very delicate and easily upset”). Therefore, we created an overall score of attitudes toward the environment and five scores, one for each subdimension.

Pro-environmental behavioral intentions. We adapted the pro-environmental behavioral intentions scale by [Bosone et al. \(2022\)](#). Respondents were asked to report to what extent they intend to adopt four pro-environmental behaviors (e.g., “I intend to increase the accuracy of my recycling”). The measure was reliable (Cronbach’s $\alpha = 0.62$), and answers were averaged to create a composite score, with higher values representing a greater intention to behave pro-environmentally.

3. Results

Differences in attitudes and behavioral intentions between the environmental education and the control groups were assessed by running *t*-tests on each dependent variable. The results are reported in Table 1. We did not find any significant differences between the environmental education and the control groups on perceived benefits of bottled water consumption, on affective attitudes toward bottled water, and on bottled water purchase intentions. Pro-environmental behavioral intentions did not differ between the environmental education and the control groups either. Pro-environmental attitudes measured by the NEP scale were higher in the environmental education group than in the control

group, but this difference did not reach conventional levels of significance ($p = 0.116$). When looking at sub-dimensions separately, anti-anthropocentric attitudes were higher in the environmental education group than in the control group ($p = 0.004$). The same pattern was observed for balance with nature, with scores higher in the environmental education group than in the control group, although the difference did not reach conventional levels of significance ($p = 0.076$). All the other sub-dimensions did not differ between the environmental education and the control groups.

Table 1. Mean (and standard deviation) of each variable by experimental conditions.

Measure	Ecomedia Literacy Lesson ($n = 53$)	Control ($n = 53$)	<i>t</i> -Test and Significance
Perceived benefits of bottled water	2.67 (0.81)	2.71 (0.83)	$t = 0.24, p = 0.813$
Affective attitudes toward bottled water	2.33 (0.77)	2.37 (0.78)	$t = 0.27, p = 0.786$
Bottled water purchase intentions	2.14 (1.18)	2.22 (1.07)	$t = 0.37, p = 0.710$
Pro-environmental behavioral intentions	4.49 (0.50)	4.41 (0.50)	$t = 0.87, p = 0.388$
Pro-environmental attitudes (NEP scale)	4.02 (0.33)	3.91 (0.40)	$t = 1.59, p = 0.116$
Balance of nature	4.37 (0.46)	4.19 (0.57)	$t = 1.79, p = 0.076$
Ecocrisis	4.61 (0.53)	4.61 (0.52)	$t = 0.00, p = 1.000$
Anti-exceptionalism	3.84 (0.66)	3.66 (0.71)	$t = 1.32, p = 0.190$
Limits of growth	2.99 (0.63)	3.14 (0.58)	$t = 1.29, p = 0.201$
Anti-anthropocentrism	4.50 (0.50)	4.19 (0.60)	$t = 2.92, p = 0.004$

For all *t*-tests, degrees of freedom were 104.

4. Discussion

We conducted an environmental education intervention based on ecomedia literacy, i.e., the use of media education and media related to ecology with the aim of promoting critical thinking and triggering attitudes and behaviors related to change toward sustainability (López 2014; Sperry 2020), and we tested the effectiveness of such intervention in decreasing positive attitudes toward plastic bottled water and behavioral intentions to buy them, and in improving pro-environmental attitudes and behaviors. Even though the intervention was designed based on relevant ecomedia literacy literature, we found that it did not significantly decrease positive attitudes or behavioral intentions toward plastic bottled water. Additionally, our ecomedia literacy intervention did not significantly increase pro-environmental behavioral intentions. While the intervention showed some improvement in attitudes toward the environment, particularly in terms of anti-anthropocentrism and balance with nature, these attitudinal changes did not translate into behavioral intentions. This discrepancy highlights the difficulty of converting environmental awareness and concern into concrete pro-environmental actions.

The finding that anti-anthropocentric views were significantly higher in the environmental education group compared to the control group suggests that the environmental education intervention led participants to rethink their relationship with nature, reducing the belief that humans are at the center of the world or that nature exists primarily to fulfill human needs. This implies a shift in values and attitudes toward a more ecocentric worldview, where the balance of the ecosystem and respect for all forms of life are recognized as fundamental. Regarding the “balance with nature” dimension, the (marginally significant) higher score in the environmental education group compared to the control group suggests that participants in the ecomedia literacy lesson developed awareness of the importance of living in harmony with the natural environment and recognition that human well-being depends on ecological balance rather than dominance over nature. This could be reflected in ideas such as the need to reduce the exploitation of natural resources and to adopt more sustainable lifestyles. However, the fact that these more ecocentric views do not translate into concrete behaviors, such as reducing the use of plastic water bottles, highlights the difficulty of changing deeply ingrained habits. Social norms, daily consumption patterns, and the convenience associated with certain practices represent significant barriers that require more intense and long-term interventions. During the ecomedia literacy lesson,

participants were shown advertisement videos for plastic bottled water. Even though the purpose was to critically evaluate these advertisements, the exposure itself might have inadvertently reinforced positive attitudes toward plastic bottled water. This suggests that the persuasive nature of advertisements could overwhelm critical thinking, leading to the opposite effect to that intended, which has been observed in some studies of media literacy interventions. In some cases, interventions can produce a “boomerang effect” when participants become more attracted to, rather than critical of, the media they are studying. Research suggests that this tends to occur when interventions are overly didactic and lack the engagement of cognitive skills encouraged by active participation (Banerjee and Kubey 2012). Media Smarts (2024), Canada’s leading resource for digital media literacy, warns that media literacy interventions can backfire if not implemented effectively, leading to increased resistance, overconfidence, cynicism, or backlash among students. In this respect, one possible reason for the differing outcomes could be the level of maturity and receptiveness of participants. Children and adolescents may be more open and adaptable to new concepts and learning experiences compared to university students who already have established beliefs and attitudes.

Another critical factor could be the design of the intervention itself. While showing videos can raise awareness, the lack of interactive dialogue and collective inquiry might limit participants’ ability to deeply engage with the content. Encouraging participants to actively debate and reflect on their values, rather than passively viewing materials, could foster deeper cognitive processing and a stronger connection to pro-environmental behaviors. Indeed, in the context of environmental education, fostering critical thinking is crucial for empowering students to analyze environmental challenges and devise sustainable solutions. However, challenges remain. For instance, research from Japanese primary schools indicates that many science teachers struggle to incorporate critical thinking into lessons due to time constraints and a lack of resources (Kinoshita 2022). To address this, professional development programs that equip teachers with effective pedagogical strategies are essential. Similarly, the development of teaching materials that utilize collaborative learning models has been proposed as a means to enhance critical thinking and decision-making skills among students (Saputra et al. 2023). Including real-world applications, such as community projects or experiential learning activities, might also help bridge the gap between attitudes and actions.

A meta-analysis of 51 media literacy interventions to evaluate their effectiveness determined that interventions are more likely to have a greater impact if the outcome is focused on critical thinking about media but less likely to succeed if the goal is behavioral change. The same study also found that media literacy outcomes are more impactful when there are multiple sessions (Jeong et al. 2012). Additionally, some aspects of quantifying media literacy’s impact involve competencies that are challenging to measure, and it is uncertain when the effects of interventions become apparent. It is unclear whether these effects are immediate, temporary, or lifelong, like developing reading skills (Andersson and Danielsson 2021). Changing deep-seated attitudes and behaviors, especially those reinforced by pervasive advertising and habitual consumption, is inherently challenging and a process of lifelong learning. Because it is challenging to develop new habits and “undue” a lifetime of particular environmental attitudes, the duration and depth of the intervention likely plays a significant role. A single lesson may not have been sufficient to instill the necessary understanding and behavioral changes required for ecomedia literacy to take root effectively. A single session may only scratch the surface, while a series of lessons, integrated into a broader curriculum, could allow for incremental learning and reinforcement. Additionally, the readiness and prior exposure of students to ecomedia literacy could influence the outcomes. Habibah and Putra (2023) point out that improving students’ eco-literacy skills requires the implementation of eco-literacy modules and a focus on solving environmental problems. If students were not adequately prepared or motivated to engage with ecomedia literacy concepts, the effectiveness of a single lesson may have been compromised. Moreover, the approach and methodology used in delivering the lesson

are critical. [Wulandari et al. \(2024\)](#) highlight the importance of how eco-literacy is taught, involving not only formal education settings but also the role of the family, community, and government in promoting sustainable values. The lack of a comprehensive approach that involves multiple stakeholders and real-world applications could have limited the impact of the intervention. Interventions that combine critical media analysis with action-oriented tasks, such as designing counter-advertisements or implementing sustainability campaigns, may also be more effective. Expanding the use of participatory methods, such as co-creating content with participants or employing inquiry-based learning approaches, could enhance engagement toward pro-environmental attitudes and behaviors. Future research should focus on refining ecomedia literacy interventions to integrate these insights. Furthermore, testing interventions in diverse contexts and with varied audiences could also uncover contextual factors that influence outcomes.

5. Conclusions

As explained, the ecomedia literacy lesson did not significantly decrease positive attitudes or behavioral intentions toward plastic bottled water, nor did it significantly increase pro-environmental behavioral intentions. Future interventions could minimize the use of advertisements for plastic bottled water, even if the intent is to critique them. Instead, the focus could be on alternative educational materials that promote critical thinking without the risk of reinforcing the discouraged behavior. Extending the duration and intensity of the intervention could provide more sustained exposure to ecomedia literacy concepts, potentially leading to significant changes in attitudes and behaviors. This might include repeated sessions, ongoing activities, and follow-up assessments to reinforce learning and behavioral change ([Díez et al. 2018](#)). Moreover, a more holistic approach that addresses various aspects of consumption behavior, such as convenience, social influences, and perceived alternatives, might be necessary ([Lin and Xu 2021](#)). Providing practical solutions and alternatives to plastic bottled water, along with promoting a supportive environment for these choices, could enhance the intervention's impact. Finally, in future interventions, children or adolescents could be the participants. When working with younger students, according to [Andersson and Danielsson \(2021\)](#), media literacy interventions are more effective when children participate in the design of the curriculum.

In conclusion, while the ecomedia literacy intervention showed some promise in improving some facets of pro-environmental attitudes, particularly regarding anti-anthropocentrism and balance with nature, its failure to reduce positive attitudes and behavioral intentions toward plastic bottled water highlights the need for significant content and structural modifications in future iterations. By addressing the identified shortcomings and incorporating more effective behavior change strategies, future interventions can better achieve their sustainability goals.

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