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The Role of P4C Practices in Sustainability and Environmental Awareness Among Middle School Students

P4C Uygulamalarının Ortaokul Öğrencilerinin Sürdürülebilirlik ve Çevre Bilinci Üzerindeki Rolü

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Abstract

This study investigates the impact of Philosophy for Children (P4C) practices on middle school students' environmental awareness in the context of sustainability. While the literature highlights the positive effects of P4C in areas such as democratic culture and moral reasoning, empirical studies examining its influence on environmental awareness remain scarce. A quasi-experimental design was employed in this study, involving 58 fifth-grade students from the Bursa province. Sustainability-themed P4C sessions were conducted over ***eight weeks***, and environmental awareness was measured using the Environmental Awareness Scale. The analysis utilized the Wilcoxon signed-rank test, the Mann-Whitney U test, and the Kruskal-Wallis H test. The findings revealed a significant increase in environmental awareness scores following the P4C intervention ($Z = -6.36$; $p < 0.001$; $r = 0.86$). The results suggest that P4C is associated with enhanced sustainability awareness, with a particularly notable impact observed among students whose mothers had lower educational attainment. Given the complexity of the environmental crisis, it is recommended that educational models based on philosophical inquiry be implemented from an early age.

Keywords: Philosophy for Children, Critical thinking, Sustainability, Environmental awareness, Environmental ethic.

Öz

Bu çalışma, sürdürülebilirlik bağlamında Çocuklar için Felsefe (P4C) uygulamalarının ortaokul öğrencilerinin çevre bilinci üzerindeki etkisini incelemektedir. Literatür, P4C'nin demokratik kültür ve ahlaki akıl yürütme gibi alanlardaki olumlu etkilerini vurgularken, çevre bilinci üzerindeki etkisini inceleyen ampirik çalışmalar oldukça sınırlıdır. Bu araştırmada, Bursa ilinden 58 beşinci sınıf öğrencisinin katılımıyla yarı deneysel bir desen kullanılmıştır. 8 Hafta boyunca sürdürülebilirlik temalı P4C oturumları gerçekleştirilmiş ve çevre bilinci, Çevre Bilinci Ölçeği ile ölçülmüştür. Analizde Wilcoxon işaretli sıralar testi, Mann-Whitney U testi ve Kruskal-Wallis H testi kullanılmıştır. Bulgular, P4C müdahalesi sonrasında çevre bilinci puanlarında anlamlı bir artış olduğunu ortaya koymuştur ($Z = -6,36$; $p < 0,001$; $r = 0,86$). Sonuçlar, P4C'nin sürdürülebilirlik bilincindeki artışla ilişkili olduğunu ve özellikle annelerinin eğitim düzeyi daha düşük olan öğrencilerde daha belirgin bir etki gözlemlendiğini göstermektedir. Çevre krizinin karmaşıklığı göz önünde bulundurulduğunda, felsefi sorgulamaya dayalı eğitim modellerinin erken yaşlardan itibaren uygulanması önerilmektedir.

Anahtar Kelimeler: Çocuklar için felsefe, Eleştirel Düşünme, Sürdürülebilirlik, Çevre farkındalığı, Çevre Etiği.

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Introduction

The escalating environmental crisis—encompassing climate change, biodiversity loss, pollution, and resource depletion—has intensified calls for educational models that move beyond the transmission of factual knowledge toward the cultivation of critical, reflective, and ethically engaged citizens (Stevenson, 2007; Sterling, 2010; Intergovernmental Panel on Climate Change, 2023). Since the early development of environmental education, scholars and international policy documents have emphasized that ecological problems require not only scientific understanding but also value-oriented, interdisciplinary, and action-oriented learning processes (Stapp, 1974; Childress, 1978; UNESCO, 1977; Elliott, 1999). Nevertheless, conventional environmental education has frequently been criticized for failing to bridge the gap between environmental knowledge and pro-environmental attitudes and behaviours (Kollmuss & Agyeman, 2002). This gap is particularly significant in relation to contemporary sustainability challenges, where students must evaluate evidence, recognize misinformation, consider ethical responsibilities, and make informed judgments about human–nature relations (Naess, 1973; Gardiner, 2011; Cook et al., 2017; Cook et al., 2020).

In response to these challenges, dialogic and inquiry-based pedagogies have gained attention for their capacity to develop the reasoning skills that meaningful engagement with sustainability requires. Philosophy for Children (P4C), developed by Matthew Lipman and Ann Margaret Sharp in the 1970s, is one such pedagogy. Now practised in diverse cultural and educational contexts, P4C aims to develop children's critical, creative, collaborative, and caring thinking within a "community of inquiry" (Oyler, 2016; Topping et al., 2020). P4C is not primarily concerned with teaching the history of philosophy or simplifying philosophers' ideas for children; rather, it uses philosophical questioning and dialogue to help children give reasons, listen to alternative perspectives, clarify concepts, and revise their judgments through shared inquiry (Lipman et al., 1980; Fisher, 1990; Matthews, 1980; Murris, 1997; Wartenberg, 2009). In this sense, the teacher's role shifts from transmitting fixed answers to facilitating reflective dialogue and collective meaning-making (Gregory & Brubaker, 2008).

P4C's theoretical foundations lie in the pragmatist tradition, particularly the work of John Dewey and Charles Sanders Peirce. Dewey's notion of "reflective thinking"—the "active, persistent, and careful consideration of any belief or supposed form of knowledge" (Dewey, 1933, p. 9)—anticipated contemporary conceptions of critical thinking and shaped Lipman's emphasis on reasoning, democratic community, and learning through experience (Peirce, 1955; Cam, 2023). Building on this foundation, Lipman argued that thinking skills should be cultivated deliberately from an early age rather than left to chance, and that education should encourage students to think for themselves rather than passively accept authority or learn by rote (Lipman, 1982, 1984, 1988, 2003; Chance, 1986; Fisher, 1990). Later scholarship has similarly emphasized P4C's potential to promote democratic participation, moral reasoning, dialogic agency, and counter-cultural forms of education that challenge purely transmission-based schooling (Hannam & Echeverria, 2010; Lewis & Chandley, 2012; Kizel, 2016; O'Riordan, 2016; Splitter, 2020; Law, 2024).

A growing body of empirical research has examined the measurable effects of P4C on student outcomes. In a systematic review of controlled studies, Trickey and Topping (2004) concluded that P4C produces consistent, moderate gains in cognitive ability, reasoning, and self-esteem across different educational settings. In a quasi-experimental study conducted in Scotland, Topping and Trickey (2007) reported significant gains in cognitive ability among 10- to 12-year-old students after one year of weekly philosophical inquiry, with these gains persisting over time. Longitudinal evidence from Spain likewise indicated that sustained participation in P4C was associated with improvements in cognitive and reasoning measures over several years (Colom et al., 2014). More recently, a large-scale randomized controlled trial in England involving more than 3,000 primary school pupils found that P4C produced small but positive effects on reading and mathematics attainment, particularly among disadvantaged pupils (Gorard et al., 2017). Similar positive results have also been reported among younger learners, where structured philosophical dialogue improved children's reasoning skills relative to control groups (Säre et al., 2016).

Despite this expanding evidence base, empirical research on P4C has focused predominantly on general cognitive, linguistic, academic, and democratic outcomes rather than environmental awareness

or sustainability-related thinking. The connection between P4C and environmental education is theoretically promising because sustainability problems are complex, value-laden, and often contested. Issues such as climate change, biodiversity loss, pollution, and resource depletion require students not only to acquire environmental knowledge but also to deliberate about responsibility, interdependence, uncertainty, justice, and the moral status of non-human beings and future generations (Naess, 1973; Gardiner, 2011; Stevenson, 2007; Sterling, 2010). Although some studies and theoretical discussions have begun to link philosophical inquiry with nature, environmental values, and pollution, direct intervention-based studies examining the effect of P4C on students' environmental awareness remain limited (Turgeon, 2015; Kim et al., 2022).

The present study addresses this empirical gap by investigating the impact of a sustainability-themed P4C intervention on fifth-grade students' environmental awareness. By employing a quasi-experimental design, the study aims to determine whether integrating P4C into sustainability-oriented learning can produce measurable gains in middle school students' environmental awareness. The research was conducted within the framework of the EU-funded Erasmus+ KA220-SCH project titled "Sustainable Environmental Education by Integrating P4C Education into STEAM Courses."

1. Lipman's Idea on Critical Thinking

Lipman (2003) conceptualizes critical thinking not merely as a set of isolated logical abilities, but as a comprehensive process of acquiring autonomous thinking through engagement in a collaborative community of inquiry. He defines authentic critical thinking as "judgment that relies on criteria, is self-correcting, and is sensitive to context" (Lipman, 1988, p. 39). Among the skills he identifies, "formulating concepts precisely" (Fisher, 1990, p. 156) is particularly relevant to environmental education, as it enables students to articulate and examine sustainability-related concepts—such as ecological footprint, biodiversity, and intergenerational justice—with clarity and precision.

Drawing on the observation that young children naturally ask philosophical questions out of curiosity (Lipman, Sharp, & Oscanyan, 1980, p. 34; Matthews, 1980), Lipman designed the P4C approach to encourage children to critically examine what they hear and see. Central to this approach is the practice of engaging students in meaningful discussions on topics that are not conventionally considered suitable for young learners (Murris, 1997). As Fisher (1990, p. 12) summarizes, Lipman's objective was to encourage children to think for themselves rather than learning by rote or passively accepting the authority of the teacher. Philip Cam (2023, p. 8) presents Lipman's work as a direct practical application of Dewey's inquiry, wherein the classroom is transformed into a space for collaborative thinking through philosophical novels and guided discussions.

Lipman's first philosophical novel, Harry Stottlemeier's Discovery (1970), demonstrated that fifth-grade students could engage in meaningful philosophical dialogue about logic, ethics, and nature through narrative (Oyler, 2016, p. 2). By exploring conflicting perspectives on various topics, children develop better reasons and justifications for their own views while also understanding how an argument is constructed. Reflecting on the disconnect he observed between philosophical education and actual behavior, Lipman concluded that thinking skills needed to be cultivated much earlier in life, so that skillful and independent thinking would become habitual by the time students completed high school (Chance, 1986, p. 41). As O'Riordan (2016, p. 648) describes, "Philosophy for Children (P4C), rooted in the Socratic Method and constructivist and pragmatic assumptions, is a dialogic and democratic

pedagogy that teaches pupils to philosophize; to develop multi-dimensional modes of thinking through discussion of questions that connect with all human experience."

1.1. What Is The P4C Method?

P4C is defined as a "structured pedagogical method that invites and enables children to search for rational and justified answers to important questions that have no simple answers" (Topping, Trickey & Cleghorn, 2020, p. 16). A key feature of P4C is its flexibility, which manifests in two primary ways. Firstly, its applications can vary across different cultural contexts, allowing educators to adapt the method according to local cultural codes. Secondly, P4C can be integrated with other pedagogical approaches, as exemplified by initiatives like the project Sustainable Environmental Education by Integrating P4C Education into STEAM Courses, which this article also addresses.

Practitioners and facilitators of P4C frequently encounter misunderstandings, such as the misconception that P4C involves simplifying and explaining academic philosophy. Instead, it explores practical ways to develop critical and creative thinking. P4C encourages children's natural curiosity, engaging them in philosophical dialogue where different perspectives can be developed, explained, and justified (Lewis & Chandley, 2012, p. 24). In a classroom setting, all children can participate in discussions about basic concepts or important issues. The teacher's role is to facilitate this process for the students. The most important rule for students seeking logical reasons for their own thoughts is to listen carefully to different ideas and try to understand them.

The development of critical skills such as analytical reasoning and problem-solving is lagging in many countries, often due to traditional, transmission-based teaching methods. As Hannam and Echeverria (2010, p. 7) argue, students must learn to think critically, creatively, and compassionately, to inquire cooperatively, and to make better judgments that contribute to the creation of a better globalized world—competencies that are essential for addressing the environmental crisis. A typical philosophy session consists of five stages: (1) presentation of a stimulus (story, video, or image); (2) formulation of philosophical questions by students; (3) collaborative dialogue within a community of inquiry; (4) group self-assessment; and (5) facilitator-guided philosophical exercises (Gregory & Brubaker, 2008, p. 45).

1.2. Critical Thinking and Environment

At this point, the P4C program's goal of teaching children critical thinking skills cannot be considered independently of preparing them to become future democratic citizens who will be able to do the right thing even under difficult circumstances. Stephen Law (2024, p. 65) raises a fundamental question in this regard: why is raising autonomous critical thinkers—prepared to rely on their own intellects rather than on authority and tradition—a desirable educational goal? Law argues that traditional, authority-based education encourages obedient attitudes and uncritical acceptance, effectively creating what he terms "moral sheep." While a society of moral sheep may function smoothly under a benevolent authority, it becomes vulnerable when a less benevolent authority figure emerges, as such individuals may follow without question (Law, 2024). This highlights the critical role of P4C in fostering autonomous thinking as a safeguard against unexamined obedience.

The long-term aim of cultivating critical thinking through P4C is to foster a democratic culture in which citizens reason collectively about shared challenges. Among the most pressing of these challenges are climate change, sustainability, and environmental degradation—issues that demand precisely the capacities for logical analysis, evidence evaluation, and responsible decision-making that P4C seeks to develop. Although P4C's contributions to democratic culture, moral reasoning, and reasoning skills are well established (Gregory, 2002), its specific application to environmental ethics and sustainability awareness remains underexplored empirically (Turgeon, 2015).

The type of education system in place is of vital importance in this regard. An education system that produces individuals equipped with knowledge but who do not know how to use it is insufficient—particularly when addressing complex global challenges such as the environmental crisis. For a more optimistic future, both for our own species and for other species, we need not only knowledgeable

individuals, but also individuals who are as inquisitive as they are knowledgeable, collaborative, environmentally conscious, and who have internalized a culture of democracy.

The capacity for critical thinking has implications that extend beyond environmental issues. In an interview with The Guardian, philosopher Jonathan Glover noted that individuals who risked their lives to protect others under oppressive regimes shared a common trait: they were educated in a way that encouraged them to think for themselves, to feel empathy for others, and to discuss rather than simply follow orders. Glover added, "I think that teaching people to think rationally and critically can actually make a difference to people's susceptibility to false ideologies" (Law, 2024, p. 67). This observation is equally relevant to environmental education: the same critical autonomy that protects against ideological manipulation also enables citizens to critically evaluate environmental claims, resist misinformation about climate change, and make ethically informed decisions about sustainability. In order to prepare young people for the complex challenges of the future, the most effective defense is not to prescribe what to think, but rather to provide each individual with the cognitive tools to think independently.

This is precisely where the P4C approach offers a valuable contribution: by fostering critical thinking, ethical reasoning, and collaborative dialogue, it equips students with the dispositions needed to engage meaningfully with sustainability issues and to make informed, responsible decisions.

The long-term objective of nurturing critical thinking alongside other forms of thinking in P4C is to foster a robust democratic culture. P4C enables us to explore universal and controversial concepts such as truth, justice, and freedom in depth and in various forms. It provides a thinking education that enables children to become better thinkers—including critical, creative, and careful thinking—and offers opportunities for dialogue that develop better judgment skills. However, thanks to democracy, a society composed of responsible citizens can engage in critical thinking about critical issues that concern all societies, such as climate change, sustainability, and environmental problems, and make joint decisions aimed at finding solutions in a peaceful environment of debate. It is unreasonable to expect societies composed of individuals lacking critical thinking skills to resolve the environmental crises they face. This is because critical thinking is a fundamental skill that strengthens environmental sustainability efforts and deepens environmental awareness by promoting logical analysis, conscious decision-making, and responsible behaviour.

As Stevenson (2007, p. 1) points out, "A number of authors have observed a pronounced discrepancy between the problem-solving and action-oriented goals associated with the contemporary philosophy of environmental education and an emphasis on the acquisition of environmental knowledge and awareness in school programs." Historically, environmental education evolved from nature study and conservation movements toward a broader concern with knowledge, skills, and awareness of natural resources—yet school curricula have persistently struggled to translate this rhetorical commitment into action-oriented practice (Stapp, 1974; UNESCO, 1977; Childress, 1978; Stevenson, 2007). One limitation of traditional curricula is that environmental awareness often remains at a conceptual level, without necessarily translating into practical engagement. The P4C approach, by contrast, emphasizes critical-thinking and problem-solving skills through structured dialogue, encouraging students to recognize their role in sustainability challenges. While the present study did not directly measure behavioral change, the significant increase in environmental awareness scores following the P4C intervention suggests that this approach may help bridge the gap between theoretical understanding and practical disposition—an area that warrants further investigation.

Turgeon emphasizes that direct experience of nature is essential for our personal and societal development. Turgeon also mentions two approaches to applying P4C to ecological education:

- “A focus on children's direct experience of nature so as to generate a phenomenological encounter between child self and world.

An indirect approach to nature through narratives and an ensuing philosophical discussion” (Turgeon, 2015, p. 3).

These two approaches can help children achieve the goals of questioning and better understanding our relationship with the natural world, as well as committing to ecological action.

Despite its widespread implementation, the P4C curriculum has traditionally paid little attention to environmental ethics, as it tends to focus on the conventional branches of Western philosophy: metaphysics, logic, ethics, social and political philosophy, and, to a lesser extent, aesthetics (Turgeon, 2015). Some notable exceptions exist, however. Kristina Calvert and Anna Hausberg's handbook, PhiNa: Philosophieren mit Kindern über die Natur (Philosophizing with Children about Nature), offers a structured approach divided into three areas—epistemology, ethics, and metaphysics—each providing teachers with narrative guides for exploring questions about nature (Turgeon, 2015). While many children's stories address ecological issues, these often adopt a didactic tone and require critical problematization to function effectively within the P4C inquiry model, which emphasizes genuine questioning rather than the uncritical acceptance of politically correct positions. This gap between existing P4C implementations and the need for empirically grounded environmental ethics education underscores the relevance of the present study, which examines whether a sustainability-themed P4C intervention can produce measurable gains in environmental awareness among middle school students.

The question of what can be said about children's motivation to discuss environmental issues is an essential one. The environment is a broad subject that interests children and directly affects their living conditions. While this is not the sole topic about which children want to, could, and should philosophize, it is certainly one they do think about. "Children are generally more willing than adults to think about big questions concerning our nature, partly out of curiosity and partly because, compared to many adults, they do not have a fixed worldview" (Matthews, 1980; Kizel, 2016, p. 7; Kim et al., 2022). In this respect, it is possible to discuss fundamental issues related to nature, such as the consequences of climate change, in classrooms using the P4C method.

Sustainability challenges—such as climate change, pollution, and biodiversity loss—require logical, evidence-based assessments grounded in critical thinking. By applying critical reasoning, we can distinguish causes from effects, interpret scientific data accurately, and move beyond biases and oversimplifications (Kollmuss & Agyeman, 2002). Even well-intentioned environmental actions risk failure if they ignore root causes. For example, the IPCC (2023) underscores that effective climate solutions demand systemic analysis of anthropogenic drivers, not just symptomatic fixes. Philosophy for Children (P4C) cultivates the skills needed for this analysis. As Lipman (1988) argues, P4C teaches children to question assumptions, weigh evidence, and collaborate on ethical solutions—a foundation for sustainable decision-making. Topping et al. (2020) highlights how P4C classrooms foster "holistic thinking" by connecting seemingly unrelated issues (e.g., fast fashion's ecological toll and renewable energy investments). Without such skills, society may fall for pseudo-solutions, such as corporate greenwashing or politically expedient policies (Gardiner, 2011).

Critical thinking also counters misinformation, a barrier to environmental action. Cook et al. (2017) show how myths like "individual actions don't matter" breed apathy. P4C addresses this by teaching students to evaluate sources—a skill underscored in Cook et al.'s (2020) Debunking Handbook. For instance, children learn to scrutinize claims like "climate change isn't real" by examining peer-reviewed science (IPCC, 2023). Environmental ethics further strengthen this process. Naess's (1973) concept of deep ecology rejects short-term solutions and calls on societies to prioritize long-term interdependence. As documented by Splitter (2020), schools implementing P4C enable students to confront ethical dilemmas (e.g., animal welfare and food production) through dialogue. This is consistent with Sterling's (2010) call for education that "replaces linear thinking with systemic resilience."

This study examined the relationship between P4C and sustainability and environmental awareness, focusing on both the theoretical framework and P4C's role in fostering this awareness among middle school students. Emphasizing critical thinking—one of the fundamental benefits of P4C—the study highlighted its importance in developing meaningful sustainability and environmental awareness. Critical thinking transforms passive concern into conscious action, ensuring that solutions are effective, ethical, and sustainable. In this context, the integration of theory and action is crucial. Without critical thinking, environmental efforts may become superficial, misguided, or easily undermined. Sustainability and environmental awareness cannot be considered separately from our consumption habits and lifestyles, both individually and collectively. Furthermore, we must take responsibility for the consequences of our actions and seek solutions that protect the future of all species in the ecosystem,

not just the well-being of our own. As we confront the irreversible consequences of climate change, which is occurring much faster than anticipated, it is our responsibility to raise future generations capable of critical thinking, creativity, and sound decision-making.

2. Methods

2.1. Design and Setting

This study employed a one-group pretest–posttest quasi-experimental design to examine changes in fifth-grade students' environmental awareness regarding sustainable development following a P4C intervention. To gain a deeper understanding, we also examined whether these changes varied by school type (public vs. private), maternal and paternal education levels, and gender.

2.2. Participants

Participants were recruited through convenience sampling after obtaining parental consent and approval from the school board. During the 2024–2025 academic year, the initial sample consisted of 58 fifth-grade students (30 boys and 28 girls) from two schools—one public and one private middle school—located in Bursa, Turkey. Three participants (n = 3) provided only demographic information and had missing data on the study measures; therefore, they were excluded from analyses, resulting in a final sample of 55 students. Among the included participants (n = 55), most were 11 years old (85.5%, n = 47), while 14.5% were 12 years old (n = 8).

Regarding maternal education, the largest proportion of mothers (29.1%) held a university degree. Regarding fathers' education, the largest proportion (29.1%) were university graduates, followed by high school graduates (25.5%). The participant profile is presented in Table 1.

Table 1. Demographic Characteristics of the Participants

	Category	*n*	*%*
School	Public School	25	45.5%
	Private School	30	54.5%
Gender	Male	25	45.5%
	Female	30	54.5%
Mother's Educational Level	Primary School	10	18.2%
	Secondary School	11	20.0%
	High School	10	18.2%
	Undergraduate	16	29.1%
	Graduate	8	14.5%
Father's Educational Level	Primary School	7	12.7%
	Secondary School	11	20.0%
	High School	14	25.5%
	Undergraduate	16	29.1%
	Graduate	7	12.7%

2.3. Intervention

The intervention was implemented over a period of 8 weeks, running from February 3 to April 3, 2025, with participants attending one 40-minute session per week. The program was situated within

the fifth-grade environmental awareness curriculum and delivered as part of an extracurricular social club. Participation was voluntary, with students recruited into the club following parental consent protocols. All sessions were led by trained facilitators who had completed a specialized Philosophy for Children (P4C) practitioner training program. The adoption of the P4C methodology was informed by the extant literature emphasizing the efficacy of dialogical pedagogies in cultivating both environmental awareness and higher-order critical thinking skills (Stevenson, 2007).

The curriculum was organized thematically around key sustainability challenges, including climate change, biodiversity, plastic waste, renewable energy, and water resources. Each session adhered to a structured inquiry process comprising four distinct stages. The opening stage involved the presentation of a carefully selected stimulus—such as a short illustrated story, a video, or an image—designed to ground abstract sustainability concepts in concrete, emotionally resonant scenarios. In the second stage, students worked in small groups to formulate their own philosophical questions stemming from the stimulus, subsequently selecting one question through a democratic voting process for whole-class deliberation. The third stage constituted the core of the intervention: a facilitated collaborative dialogue within a community of inquiry, during which the facilitator scaffolded the discussion by prompting students to provide reasoned justifications, examine underlying assumptions, entertain alternative perspectives, and build constructively on their peers' contributions. The final stage consisted of a closing reflection, in which students articulated shifts in their thinking or synthesized newly acquired insights.

To illustrate, the session on biodiversity opened with an illustrated narrative depicting a forest ecosystem under threat from deforestation. In response, students generated questions such as "Do humans have the right to cut down trees for their own needs?" and "What would happen to animals if all forests disappeared?" During the subsequent dialogue, the facilitator guided the discussion without imposing predetermined answers, instead encouraging students to interrogate assumptions and grapple with the ethical dimensions inherent in environmental decision-making. In a session dedicated to plastic waste, students viewed a short video on the impact of plastic pollution on marine life and proceeded to explore questions including "Whose responsibility is it to clean up the ocean?" and "Should single-use plastics be banned?" These representative cases demonstrate how the P4C framework served to connect philosophical inquiry with tangible, real-world environmental issues, thereby bridging the gap between theoretical knowledge and practical engagement central to effective environmental education.

2.4. Research Instrument

The study utilized the Environmental Awareness Scale in the Context of Sustainable Development (Atabek-Yiğit & Balkan Kıyıcı, 2022) to measure environmental awareness among secondary school students. This scale is based on solid theoretical frameworks and has a two-factor structure that effectively captures different dimensions of environmental awareness, including waste management, energy resources, biodiversity, and endangered species.

The research instrument is a 16-item scale comprising 9 positively coded and 7 negatively coded items. Responses were collected using a 4-point Likert format ranging from 1 (*strongly disagree*) to 4 (*strongly agree*), yielding a total possible score between 16 and 64, with higher scores indicating greater environmental awareness supportive of sustainable development. The scale consists of two factors. The first factor, labeled "Positive Environmental Awareness," reflects proactive environmental attitudes and behaviors. The second factor, termed "Negative Environmental Awareness," captures environmentally harmful attitudes or indifference toward sustainability concerns.

To establish construct validity, the scale developers first conducted Exploratory Factor Analysis (EFA) using data from 302 students. Prior to EFA, the suitability of the dataset was confirmed through the Kaiser-Meyer-Olkin (KMO) test ($KMO = .861$) and Bartlett's test of sphericity ($p < .05$), both indicating adequate sampling for factor analysis. The EFA confirmed a two-factor structure, with the two factors together explaining 40.74% of the total variance (Factor 1 eigenvalue = 4.965, variance = 21.55%; Factor 2 eigenvalue = 1.918, variance = 19.19%). Subsequently, Confirmatory Factor Analysis (CFA) was performed using data from 190 students. The second-order CFA yielded acceptable goodness-of-fit indices: $Cmin/df = 1.732$, GFI = .921, AGFI = .905, CFI = .935, IFI = .941, TLI = .908, RMSEA = .066, PNFI = .903, PCFI = .917 (Atabek-Yiğit & Balkan Kıyıcı, 2022). Discriminant validity

was established by demonstrating significant differences in scale scores between lower and upper 27% groups on each item. Regarding reliability, McDonald's Omega coefficients were calculated as ω = .803 for Positive Environmental Awareness, ω = .760 for Negative Environmental Awareness, and ω = .833 for the overall scale. These findings confirm the scale's effectiveness as a reliable and valid instrument for assessing environmental awareness in the context of sustainable development.

2.5. Data Collection

The intervention was implemented over a period of 8 weeks, running from February 3 to April 3, 2025, with participants attending one 40-minute session per week.

Participants reported demographic information, including age, gender, school type (public vs. private), and parents' education level, via an online survey administered through Google Forms. The survey was completed during regular class sessions under the supervision of the class teacher and a research team member, who provided no guidance on responses. Both the pre-test and post-test were administered using the same online format. The pre-test was completed on January 27, 2025, one week before the intervention began, and the post-test was completed on April 10, 2025, one week after the intervention concluded. Students were given approximately 20 minutes to complete the 16-item scale. Prior to beginning the survey, a brief oral explanation was provided to students clarifying that participation was voluntary and that they could withdraw at any time without consequence. To protect confidentiality, responses were collected anonymously via a secure online platform, and no identifying information was made available to third parties.

2.6. Data Analysis

All statistical analyses were conducted using the Statistical Package for the Social Sciences (SPSS, Version 28.0; IBM Corp., 2021). The data analysis process proceeded in several stages. First, descriptive statistics (means, standard deviations, medians, frequencies, and percentages) were calculated to summarize participants' demographic characteristics and overall trends in environmental awareness.

Next, tests of normality (skewness, kurtosis, and Shapiro–Wilk tests) were performed to determine whether the pre- and post-test data met the assumption of normal distribution. Since the results indicated non-normality, non-parametric methods were selected for subsequent analyses.

To evaluate changes in students' environmental awareness between the pre- and post-tests, the Wilcoxon signed-ranks test was employed. To examine whether demographic factors — namely gender, school type, and maternal and paternal education levels — were associated with differences in participants' scores, Mann–Whitney U tests (for two-group comparisons) and Kruskal–Wallis H tests (a non-parametric alternative to one-way ANOVA, for comparisons involving more than two groups) were conducted. Effect sizes were calculated using rank-biserial correlation (r) for Wilcoxon signed-ranks and Mann–Whitney U tests, and eta-squared (η^2) for Kruskal–Wallis H tests.

3. Results

3.1. Pre-post Awareness

Normality was assessed using skewness and kurtosis statistics and further examined with Shapiro–Wilk tests indicated non-normality for both pre-test and post-test scores (both $p < .001$). As the normality assumption was violated, the Wilcoxon signed-ranks test was employed to compare pre- and post-test scores. The results indicated a statistically significant increase in environmental awareness related to sustainable development ($Z = -6.36$, $p < .001$, $r = .86$), indicating a large effect size. The median score increased from 3.19 (pre-test) to 3.44 (post-test), suggesting a meaningful improvement in participants' environmental awareness following the intervention.

3.2. Pre-post awareness based on demographic characteristics

As shown in Table 2, the Mann-Whitney U Test indicated that there was no significant difference in environmental awareness in terms of sustainable development by gender or by school type.

Table 2. Mann-Whitney U Test Results for Gender and School Types

Comparison	Group	*N*	Mean	Rank	*U*	z	*p*
Gender	Male	25	26.96	674.00	349.00	-0.440	*p> .05*
	Female	30	28.87	866.00			
School	Public	25	31.30	782.50	292.50	-1.396	*p> .05*
	Private	30	25.25	757.50			

Note: A p-value less than the 0.05 significance level indicates a statistically significant difference between groups (i.e., the null hypothesis is rejected).

To further investigate differences in environmental awareness, a Kruskal–Wallis H test was conducted to examine whether gains in students' awareness scores differed across maternal and paternal education levels. The test revealed a statistically significant difference across maternal education levels (H (4) = 12.58, p <.01). Post-hoc pairwise comparisons were conducted using Mann–Whitney U tests with Bonferroni correction (adjusted α = .005). The post-hoc analysis revealed that students whose mothers had only primary school education showed significantly greater gains than those whose mothers held a master's degree (U = 2.50, p <.005); no other pairwise comparisons reached statistical significance. This pattern is consistent with the pre-test descriptive data: students whose mothers had completed a graduate degree already began with substantially higher baseline awareness (n = 8, M = 36.81) than those whose mothers had only completed primary school (n = 10, M = 17.50), suggesting a probable ceiling effect among the higher-baseline group. No statistically significant difference was observed across paternal education levels (H (5) = 6.06, p > .05).

Discussion

This study set out to empirically evaluate whether an 8-week P4C intervention would produce a measurable change in fifth-grade students' environmental awareness, and whether any such change was moderated by demographic variables. The findings provide direct answers to both research questions.

With respect to the first research question, the Wilcoxon signed-ranks test yielded a statistically significant increase in environmental awareness scores from pre-test to post-test (Z = −6.36, p < .001), with the median rising from ***3.19 to 3.44***. The effect size (r = .86) indicates a large practical effect, meaning that the observed change is not only statistically significant but also substantial in magnitude. Because the design was a one-group pretest–posttest quasi-experiment without a control group, this result should be interpreted as evidence that environmental awareness increased *following* the intervention, rather than as definitive proof that P4C is superior to alternative pedagogies. Nevertheless, the large effect size lends empirical support to the theoretical argument developed earlier—namely, that dialogic, inquiry-based pedagogy can strengthen students' engagement with sustainability issues.

Regarding the second research question, the quantitative results present a more nuanced picture. The Mann–Whitney U tests revealed no statistically significant differences in awareness gains across gender (p > .05) or school type (public vs. private; p > .05). This suggests that the intervention was similarly effective for boys and girls and across the two institutional settings examined. In contrast, the Kruskal–Wallis H test identified a statistically significant difference across maternal education levels (H(4) = 12.58, p < .01), whereas paternal education level showed no significant effect (H(5) = 6.06, p > .05). Notably, students whose mothers had only primary-level education exhibited the greatest gains, while those whose mothers held graduate degrees showed the smallest gains. The descriptive pre-test data help explain this pattern: students of graduate-educated mothers already began with substantially higher awareness (M = 36.81) than those of primary-educated mothers (M = 17.50), leaving less room for measurable improvement (a probable ceiling effect). This finding indicates that the intervention was

particularly beneficial for students entering with lower baseline awareness, a result with clear implications for educational equity.

Taken together, these experimental findings suggest that structured philosophical dialogue on sustainability themes can produce measurable gains in environmental awareness, and that these gains may be most pronounced among students from less educated family backgrounds. It is important, however, to delimit these conclusions to what was actually measured. The present study assessed environmental awareness as operationalized by the Environmental Awareness Scale; it did not directly measure critical thinking, ethical reasoning, or behavioural change. Claims regarding these broader competencies therefore remain theoretically motivated rather than empirically demonstrated in this study.

Limitations

Several limitations should be acknowledged. First, the one-group pretest–posttest design lacks a control group, which limits causal inference and leaves open the possibility that maturation, testing effects, or concurrent instruction contributed to the observed gains. Second, the sample was relatively small (N = 55) and drawn from two schools in a single province, constraining generalizability. Third, the study relied exclusively on a self-report quantitative instrument; no qualitative data (e.g., dialogue transcripts, classroom observations, or interviews) were collected, so the study cannot describe the mechanisms through which awareness changed. Finally, parental education was used as a proxy for socioeconomic status, which is an imperfect indicator.

Conclusion

This study examined the extent to which an 8-week P4C intervention enhanced environmental awareness among fifth-grade students. The experimental findings demonstrated a statistically significant and large increase in environmental awareness scores following the intervention ($Z = -6.36$, $p < .001$, $r = .86$), with no significant moderation by gender or school type, but a significant moderating effect of maternal education level. Based on these results, we cautiously suggest that P4C is a promising approach for fostering environmental awareness, particularly among students from less educated family backgrounds. Given the absence of a control group and qualitative data, we recommend that future research employ randomized controlled or quasi-experimental designs with comparison groups, incorporate mixed-methods approaches to capture the reasoning processes underlying awareness change, and include follow-up measures to assess the durability of the observed effects across diverse educational contexts.

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Değerlendirme/*Evaluation*:
Çift Taraflı Kör Hakemlik Sistemi / *Double Blind Refereeing System*

Etik Kurul İzni/ *Ethics Committee Approval Certificate:* Bursa Uludağ Üniversitesi Rektörlüğü Etik Kurulu'nun 29 Kasım 2024 tarih ve 7 sayılı yazısı ile etik açıdan uygun görülmüştür. / *It was deemed ethically appropriate with the letter dated 29 November 2024 and numbered 7 of bursa Uludag. University Rectorate Ethics Committee.*

Etik Beyanı/ *Ethical Statement:* Bu çalışmanın hazırlanma sürecinde bilimsel ve etik ilkelere uyulduğu ve yararlanılan tüm çalışmaların kaynakçada belirtildiği beyan olunur. / *It is hereby declared that scientific and ethical principles were adhered to during the preparation of this study and that all studies used as references are listed in the bibliography.*

Etik Bildirim/*Ethics Notification:* info@esosder.org

Araştırmacıların Katkı Oranı Beyanı/ *Declaration of the contribution rate of the researchers:* Birinci yazar % 40 ikinci yazar % 30, üçüncü yazar %30 oranında katkı sağlamıştır. */ The first author contributed 40%, the second author 30% and the third author %30.*

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Yapay Zekâ Kullanımı /*Use of Artificial Intelligence:* Bu çalışmanın hazırlanma sürecinde yapay zekâ tabanlı herhangi bir araç veya uygulama kullanılmamıştır. Çalışmanın tüm içeriği, yazar(lar) tarafından bilimsel araştırma yöntemleri ve akademik etik ilkelere uygun şekilde üretilmiştir. / *No artificial intelligence-based tools or applications were used in the preparation of this study. All*

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