

Ecological Intelligence at the Heart of Ecoliteracy: A Conceptual Framework and Scale Development Study

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Abstract

Ecological intelligence, a subdimension of ecoliteracy, encourages sustainable living by rethinking purchasing behaviors and understanding their environmental impacts. This paper develops the Ecological Intelligence Scale (EIS) to measure this concept, integrating insights from economics, psychology, sociology, neuroscience, and education. It highlights the role of ecological intelligence in fostering communities that share knowledge, take responsibility, and promote conscious consumption. The study was conducted with prospective teachers at a state university in eastern Turkey. Through exploratory and confirmatory factor analyses, a 24-item scale with four factors – collective consciousness, sustainable consumption, environmental activism, and empathy – was developed and validated. The EIS is a reliable tool, with Cronbach's alpha coefficients of 0.898 and 0.917, to assess ecological intelligence. This paper fills a gap in the literature by offering a concrete, multidisciplinary approach to understanding and measuring ecological intelligence, thereby providing a valuable resource for educators.

Keywords: Ecoliteracy, ecological intelligence, ecological self, environmental education, holistic education, prospective teachers, scale development.

Introduction

Environmental problems have become one of the few global issues that unite humanity in shared concern. Once localized, these problems now manifest as global catastrophes, exacerbated by increasing population and consumption patterns. The rapid pace of societal and cultural change has dramatically accelerated environmental degradation, with consequences that once took millennia now appearing within decades. For the first time since the extinction of the dinosaurs, Earth faces a mass extinction event

driven by human behavior (Des Jardins, 2006). Despite widespread discourse around environmental crises, global economic challenges often overshadow these concerns, fostering widespread apathy. As Macy and Johnstone (2013, p. 17) noted, perhaps the greatest threat we face is not environmental collapse itself but humanity's indifference to it.

A growing body of research suggests that unconscious consumption behaviors significantly contribute to ecological degradation (Goleman, 2009; Spaargaren & Van Vliet, 2000). These problems are symptomatic of a deeper crisis rooted in maladaptive individual and collective behaviors. When individuals make purchasing decisions without awareness of the broader impacts, they contribute to harm across the entire product lifecycle, i.e., from production to waste. Addressing these problems requires systemic change, supported by public education that fosters environmental awareness (Gökçen-Özgün & Yalçın, 2017).

Why, then, is it so difficult to change our consumption habits, even when the stakes are so high? What underlies our apathy and resistance to sustainable living? These questions lie at the heart of ecological intelligence – a framework that links personal awareness, environmental knowledge, and social responsibility. A persistent challenge in addressing environmental problems lies in the discrepancy between environmental awareness and environmentally responsible behavior. Although many individuals possess knowledge about environmental issues, this awareness does not consistently translate into sustainable actions, a phenomenon widely discussed as the environmental awareness–behavior gap (Gifford, 2011; Kollmuss & Agyeman, 2002). This gap often arises not only from a lack of information but also from limited emotional engagement, insufficient sense of responsibility, and the absence of systems thinking that connects individual actions to broader ecological consequences (Goleman, 2009; Sterling, 2001). As a result, individuals may express concern for the environment while continuing consumption patterns that contribute to ecological degradation. This is the biggest problem today: the gap between environmental awareness and environmentally conscious behavior. Addressing this gap requires educational approaches that move beyond cognitive awareness and foster responsibility, empathy, and conscious action, which are core components of ecological intelligence.

Theoretical Background: Connection with Nature and the Ecological Self

Human–Nature Connection and Biophilia

Wilson's (1984) Biophilia Hypothesis suggests that humans possess an innate tendency to connect with nature – a view supported by environmental psychology, which explores how natural settings influence well-being (Steg et al, 2015). Research shows that time spent in nature enhances physical health, creativity, emotional regulation, and environmental responsibility (Chawla, 2006; Dean et al., 2019; Nisbet et al., 2011).

The concept of nature relatedness or connectedness has gained attention for its role in promoting pro-environmental behaviors (Mayer & Frantz, 2004; Zelenski & Nisbet, 2014).

Studies consistently show that stronger human–nature bonds correlate with increased ecological concern and activism (Barbaro & Pickett, 2016; Forstmann & Sagioglou, 2017). These findings highlight that developing ecological awareness begins with fostering affective and relational ties to the natural world.

Ecological Self and Deep Ecology

Philosophical and psychological frameworks such as Deep Ecology, Gaia theory, and Buddhist eco-philosophy emphasize that environmental consciousness emerges from dissolving the illusion of separation between self and nature (Macy & Johnstone, 2013; Naess, 1989). The concept of the *ecological self* proposes that acting for the environment is not altruistic but integral to one’s identity. When individuals feel embedded in the web of life, environmental action becomes intrinsic rather than moralistic.

Education plays a pivotal role in cultivating this awareness. Bigari (2017) and Bai (2017) argue that contemplative and experiential learning practices foster ecological identity by integrating emotional and relational dimensions of the self. This shift from individualistic to relational selfhood enables deeper engagement in sustainability. Kretz (2014) adds that promoting ecological identity in education encourages a move from competition to cooperation, emphasizing empathy, ethical reasoning, and systems thinking. These qualities are also essential components of ecological intelligence.

Holistic and Neurobiological Perspectives

Recent interdisciplinary work in Interpersonal Neurobiology supports this relational paradigm. Siegel and Drulis (2023) described how a fragmented self, fostered by modern culture, leads to isolation, social disconnection, and ecological harm. Their concept of “MWe” (a fusion of self and other) echoes indigenous and holistic worldviews that situate identity within community and planet. Gibbs (2023) and Miseliunaite et al. (2022) advocated for holistic education frameworks that reconnect individuals to self, society, and the environment. These models emphasize the development of empathy, responsibility, and critical awareness, which are attributes foundational to ecological intelligence.

Zohar and Marshall’s (2019) theory of the quantum self also supported this view, describing identity as inherently relational and dynamic. Similarly, Maslow’s (1968) notion of self-actualization situated the self within a broader ecological and ethical context, aligning personal fulfillment with environmental stewardship. Bowers (2010) discussed how many university professors and classroom teachers are educated with an understanding of intelligence that primarily values individual autonomy, overlooking the importance of relationships and interdependence in ecological thinking. In a fragmented world, restoring a sense of connectedness is essential. As Emerson (1990) noted, disunity within the self leads to disunity in the world – a truth that holistic education seeks to heal.

Environmental Education within a Holistic Education Framework: From Environmental Literacy to Eco-literacy

Goleman (2009) defined ecological intelligence as the capacity to understand the impact of human actions across interconnected systems. Drawing from both Western and Eastern thought, he highlights the importance of life cycle analysis (LCA) and mindfulness. In referencing a Buddhist parable about the illusion of a “carriage” as a sum of parts, Goleman illustrates how fragmented self-perception mirrors our disconnection from the environment.

This idea is echoed in the framework of ecoliteracy, which integrates knowledge, values, and behaviors to foster sustainable living (McBride et al., 2013). More comprehensive than environmental literacy, ecoliteracy encourages systems thinking, ethical reasoning, and environmental responsibility (Capra, 1996; Orr, 1992; Sterling, 2001). It aligns closely with holistic education, which promotes the integration of mind, body, spirit, and nature.

Holistic education builds on these philosophies by aiming to nurture individuals emotionally, spiritually, socially, and intellectually (Miller, 2010; Preston, 2012). It fosters deep connections: between individuals and nature, between intuition and reason, and between personal well-being and global justice. As Mahmoudi et al. (2012) and Sampath (2015) note, such an approach is essential to addressing global crises like climate change, inequality, and ecological degradation. The United Nations Educational, Scientific and Cultural Organization ([UNESCO]’s 2016) Education for Sustainable Development (2030) report also calls for a transformative and inclusive educational vision that supports personal and planetary well-being. The 1989 Chicago Declaration further emphasized holistic education as a counterforce to reductionist paradigms, describing it as ecological, spiritual, postmodern, and transformative.

Holistic education extends beyond academic achievement to foster personal awareness, empathy, creativity, and a sense of social and environmental responsibility. It seeks to develop the person intellectually, emotionally, spiritually, and socially by cultivating deep connections with self, others, and the natural world (Gultekin et al., 2013; Miller, 2010). Unlike reductionist models grounded in objectivist science, holistic education adopts a person-centered, ecological, and spiritual paradigm (Fox, 1995; Orr, 1992; Shiva & Mies, 2014).

Goleman’s (2009) ecological intelligence echoes this approach by integrating systems thinking with mindfulness. He argues that both scientific tools – life cycle analysis and reflective, relational worldviews – are necessary to develop sustainable behaviors. Similarly, ecoliteracy, which encompasses knowledge, skills, values, and ethical awareness, emerges as a vital component of holistic education for sustainability (Capra, 1996; McBride et al., 2013; Sterling, 2001).

Recent literature emphasizes the urgent need for holistic education to address global crises such as climate change and inequality. Miseliunaite et al. (2022) highlight that effective ecological transformation requires students to develop not only knowledge but also compassion, critical consciousness, and global citizenship. Teachers play a central role; they must model holistic living through practices that integrate mind, body, and

spirit (Miller, 2019).

Taggart (2010) added a philosophical dimension, contrasting Dewey's pragmatic learning with Hegel's metaphysical wholeness. He suggests that holistic education balances scientific reasoning with experiential and spiritual wisdom to foster dynamic personal and societal transformation. Holistic education is practiced globally – from Finland and Canada to New Zealand and Taiwan – though its implementation remains inconsistent (Lee et al., 2014; Hedges & Cooper, 2014). In Turkey, however, it has yet to be meaningfully adopted in mainstream education, despite its potential to meet ecological and psychological needs (Ozgun, 2020).

Holistic approach enables learners to develop critical awareness of environmental and social issues while fostering responsible and action-oriented engagement. This approach is also deeply influenced by critical pedagogy, which connects social justice and environmental awareness. Chalaune (2021) and Freire (1970) argue that empowering students through critical thinking and ecopedagogy fosters resistance to exploitative systems and encourages agency in addressing environmental injustice. Ecopedagogy, as an evolution of critical pedagogy, emphasizes the interlinking of environmental, cultural, and political awareness and contributes directly to shaping ecological intelligence (Misiaszek, 2019; Yasida, 2020).

In sum, holistic education provides an ideal foundation for cultivating ecological intelligence. By integrating emotional intelligence, ethical reflection, global thinking, and critical pedagogy, it empowers learners to respond to environmental challenges not only intellectually but also relationally and responsibly.

From Naturalistic to Ecological Intelligence and Ecoliteracy

In response to contemporary environmental crises, the concepts of ecological intelligence and ecoliteracy have emerged as complementary and interconnected frameworks that extend beyond traditional environmental education. Both concepts emphasize that addressing environmental problems requires not only scientific knowledge but also emotional engagement, ethical responsibility, and conscious action. Ecological intelligence, as articulated by Goleman (2009), refers to the capacity to understand the environmental and social consequences of human actions and to apply this understanding to develop more sustainable ways of living. Similar to ecoliteracy, ecological intelligence integrates cognitive awareness with emotional sensitivity and moral responsibility. Drawing from the literature, ecological intelligence can be defined through the following core components:

- *Recognition of environmental and social impacts:* The ability to perceive both visible and hidden consequences of human activities, particularly consumption practices, across the full life cycle of products and services (Goleman, 2009; McCallum, 2008);
- *Translation of awareness into action:* The capacity to transform environmental knowledge into responsible decision-making and sustainable behavior in daily life (Goleman et al., 2010; Sterling, 2001);
- *Empathy and systems thinking:* An expanded form of empathy that includes

all living systems, enabling individuals to understand interdependence within complex ecological and social systems (Capra, 1996; Goleman et al., 2012);

- *Radical transparency and ethical responsibility*: The need for transparent information regarding environmental and social costs, allowing individuals and communities to make informed and ethically grounded choices (Goleman, 2009).

Parallel to ecological intelligence, ecoliteracy has been conceptualized as a holistic educational framework that integrates ecological knowledge with values, skills, and ethical action. Orr (1992) defined ecoliteracy as the ability to understand the principles of ecological systems and to live accordingly, emphasizing responsibility, care, and respect for the natural world. Capra (1996) further framed ecoliteracy within systems thinking, highlighting the importance of understanding relationships, patterns, and interconnectedness in sustaining life. Sterling (2001) expanded this view by positioning ecoliteracy as a transformative learning process that fosters critical thinking, ethical awareness, and sustainable action.

Building on these foundations, McBride et al. (2013) described ecoliteracy as a multidimensional construct encompassing cognitive, affective, and behavioral components. From this perspective, ecoliteracy includes: (1) *ecological understanding*, i.e., knowledge of ecological principles, natural systems, and human–environment interactions (Capra, 1996; Orr, 1992); (2) *values and ethical orientation* – the development of care, responsibility, and respect for nature, grounded in cultural, moral, and spiritual dimensions (Sterling, 2001; Wooltorton, 2006); (3) *skills for sustainable living* – the ability to apply ecological knowledge through critical thinking, problem-solving, and responsible action in personal and collective contexts (McBride et al., 2013); (4) *active environmental citizenship*, i.e., engagement in behaviors and practices that support sustainability, social justice, and long-term ecological well-being (Orr, 1992; Sterling, 2001).

While ecoliteracy provides a comprehensive educational framework for understanding and engaging with ecological systems, ecological intelligence emphasizes the psychological, emotional, and ethical capacities that enable individuals to act on this understanding. In this sense, ecological intelligence can be viewed as the internalized, affective, and behavioral expression of ecoliteracy. Both concepts converge on the idea that sustainable living requires an integrated development of knowledge, empathy, responsibility, and action.

Accordingly, ecological intelligence should be conceptualized and assessed in a manner consistent with ecoliteracy, reflecting its multidimensional nature and its grounding in holistic education. This alignment provides a strong theoretical foundation for the development of measurement tools that capture not only environmental knowledge but also empathy, ethical awareness, and environmentally responsible behavior. This perspective aligns with recent scholarship on ecojustice in prospective teacher education, which emphasizes the integration of ecological understanding, social responsibility, and ethical action as inseparable dimensions of sustainability-oriented education (Ozgun, 2025).

Synergy of Emotional, Social, and Ecological Intelligence

Emotional intelligence, as defined by Salovey and Mayer (1990), is the capacity to understand, manage, and use emotions effectively. It plays a critical role in personal well-being, relationships, and decision-making. Consumers with low emotional intelligence are often more susceptible to marketing strategies and unconscious consumption (Ahn et al., 2016; Goleman, 2009). Social intelligence, i.e., the ability to navigate complex interpersonal environments, complements this by enabling individuals to participate effectively in collective action. Ecological intelligence extends these ideas into the environmental domain. Goleman (2009) described it as the awareness of how human behaviors, especially consumption, impacted ecological, economic, and social systems. Drawing on the metaphor of insect colonies, he highlighted the power of collective intelligence – diverse perspectives working toward shared sustainability goals.

Emotional and ecological intelligence are also neurologically connected. The amygdala, which processes fear and empathy, is activated during purchasing decisions when consumers are aware of the potential harm their choices might cause to people or the planet (Goleman, 2009). LCA, a tool from industrial ecology, helps visualize these invisible impacts – from resource extraction to disposal – shaping more conscious choices.

The psychological foundations of ecological intelligence align with humanistic and ecological psychology. Maslow's (1968) vision of self-actualization includes service to a greater good, and Naess's (1989) concept of the ecological self sees humans as embedded in an interdependent web of life. Humanistic psychology's holistic stance also suggests that personal fulfillment is inseparable from empathy, community, and planetary care (Robbins, 2016; Schneider et al., 2014).

Educationally, this synergy supported transformative learning. Goleman et al. (2010, 2012) advocated for cultivating all three intelligences through school initiatives. Their "Re-Thinkers" program, for instance, empowered students to redesign cafeteria systems by considering emotional wellness (nutrition), social dynamics (equity), and environmental concerns (local sourcing). This triple-focus yielded not only practical improvements but also a deeper sense of agency and community. The Center for Ecoliteracy (2013) exemplified this holistic approach by promoting systems thinking in education. Its framework integrated emotional and social learning with ecological values, advocating for empathy, anticipation of unintended consequences, and alignment with nature's principles. Ultimately, fostering ecological intelligence required more than scientific understanding; it involved emotional attunement, social participation, and ethical reflection. When learners were encouraged to empathize, collaborate, and critically evaluate the impacts of their choices, they developed not only environmental awareness but also a meaningful sense of belonging and responsibility. By integrating emotional, social, and ecological intelligence, education could empower communities to address sustainability challenges holistically and effectively.

A Typical Morning Routine to Illustrate Ecological Intelligence and Daily Consumption Habits

Every morning, you stop by the same coffee shop on your way to work. You wait in line, get your latte, drink it, toss the cup, and continue your day. It feels like a simple habit, yet the broader ecological and social impacts often go unnoticed. Now, imagine yourself as a consumer with emotional, social, and ecological intelligence. As you walk into the café, you begin to notice the plastic cups, lids, and stirrers. You start thinking beyond your immediate needs, recognizing the environmental consequences of your choices. You acknowledge your caffeine craving, but also the environmental harm caused by disposable plastics – how they accumulate in oceans, endanger marine life, and contribute to microplastic pollution affecting ecosystems and human health.

This awareness leads you to reassess your habits. You realize that using a reusable thermos can significantly reduce your footprint. You enjoy your coffee more mindfully and clean your thermos for future use. You may even question your daily need for coffee – wondering whether it is a true personal choice or a cultural habit shaped by modern routines.

Social intelligence becomes vital at this point. Through shared knowledge tools like life cycle analysis, you gain insight into environmental impacts of a product from raw material extraction to disposal. This holistic view helps you understand the true cost of your coffee – not just in monetary units, but in environmental and social terms.

Technology can support this awareness. Apps like GoodGuide provide quick access to a product's environmental, health, and ethical ratings. Before buying your coffee, you can check the sustainability of different brands to ensure your choice aligns with your values.

In the bigger picture, these small, intentional changes matter. You begin to see how millions of similar daily habits create massive global waste. Understanding this empowers you to make more conscious decisions. Your habits are no longer isolated actions but part of a larger system. By observing yourself and your environment more carefully, and sharing this awareness with others, you contribute to collective efforts for a more sustainable and just world.

Rationale of the Study

In line with the results obtained from literature, it has been determined that there is not yet a consensus on the dimensions of ecological intelligence. It has been concluded that the scales developed are generally focused on purchasing behaviors and economics. Based on Goleman's studies, they do not completely encompass social and emotional intelligence skills. It has been identified that the existing scales are insufficient to fully explain ecological intelligence. Therefore, the present study aims to develop a valid and reliable Ecological Intelligence Scale (EIS) to determine the ecological intelligence levels of prospective teachers.

The Methodology of Research

Research Design

As the research aims at developing a scale that is a tool for obtaining quantitative measurements in social research, a correlational research design has been used with a factor analysis technique. The Ecological Intelligence Scale has been developed using three different groups of prospective teachers to perform the *exploratory factor analysis* (EFA), *confirmatory factor analysis* (CFA) and *test-retest correlation* of the scale.

Research Samples

Validity and reliability studies have been conducted on different samples described below.

For Exploratory Factor Analysis: A sample of 469 prospective teachers studying at the Faculty of Education (2nd and 3rd grades) of a state university in the east of Turkey in 2017–2018 participated in the study. The sample consisted of 20.4% (n=96) prospective science teachers, 31.3% (n=147) prospective classroom teachers, 35.8% (n=168) prospective preschool teachers and 12.3% (n=58) prospective social studies teachers.

For Confirmatory Factor Analysis: A sample of 304 prospective teachers studying at the Faculty of Education (3rd and 4th grades) of a state university in the east of Turkey in 2017–2018 participated in the study. In this study group, 20.1% (n=61) were prospective science teachers, 31.6% (n=96) were prospective classroom teachers, 35.9% (n=109) – prospective preschool teachers, and 12.5% (n=38) were prospective social studies teachers.

For Test-Retest Reliability: To determine the consistency of the scale over time, 28 prospective teachers randomly selected from the sample used in the confirmatory factor analysis were re-tested at 2-week intervals.

The Scale Development Process

The scale development process comprised the following stages: literature review, pilot scale preparation, review of field experts, pilot application, and data analysis of the items.

Literature Review

Various scale development studies on ecological intelligence provide insights into the scope of this concept. The Ecological Literacy Scale developed by Nayal and Bhatt (2014) encompasses dimensions such as ecological sensitive behavior, ecological awareness, ecological impact, communication with nature, ecologically sustainable living, and ecological knowledge sharing. Akkuzu (2016) refined the ecological intelligence scale, identifying its factors as environmentally conscious product purchasing behavior, hidden ecological impacts of products, ecological sensitivity, and ecological knowledge sharing.

Najmuddeen and Areekkuzhiyil (2017) utilized the Ecological Intelligence Inventory developed in 2013, categorizing its sections as personal data form, awareness, application, and teaching. Mainaki et al. (2018) employed observation, surveys, interviews, field literature studies, and documentation to measure students' ecological intelligence. Okur-Berberoglu (2018) developed an ecoliteracy scale, delineating its sub-dimensions as ecological intelligence, social intelligence, emotional intelligence, economics, and green consumer behavior. The researcher confirmed the relationship of ecological intelligence with social intelligence, emotional intelligence, and economics using structural equation modeling. Okur-Berberoglu (2020) developed an ecological intelligence scale targeting adults, dimensioning it comprehensively as social intelligence and economics. Wulan et al. (2023) developed a three-dimensional ecological intelligence scale encompassing cognitive, behavioral, and technological dimensions.

Preparation of Pilot Scale

While creating the scale, firstly, a literature review was conducted on the keyword "ecological intelligence", and then Goleman's (2009) book "Ecological Intelligence: How Knowing the Hidden Impacts of What We Buy Can Change Everything" was examined in depth and information about the theoretical infrastructure of the concept was obtained. As a result of the examinations, an item pool consisting of 87 statements about the theoretical substructure of ecological intelligence and an expert opinion form were prepared.

Review of Field Experts

To determine the content validity and linguistic comprehensibility of the 87-item item pool, it was submitted to the opinions of 1 expert in educational sciences, 2 field experts, 1 expert in ecological intelligence research and 1 science teacher. In line with the recommendations of the experts, 8 items were removed from the scale and a pilot scale of 79 items was formed. Of the scale items, 62 were positive and 17 were negative. The items use a five-point Likert scale, with responses graded as Never (1), Rarely (2), Occasionally (3), Frequently (4), Always (5).

Pilot Application and Data Analysis of the Items

The pilot Ecological Intelligence Scale was applied to 469 teacher candidates. After the necessary corrections were made in terms of scope and appearance in line with expert opinion, the scale was finalized, and exploratory and confirmatory factor analyses were performed for construct validity. Cronbach's alpha coefficient and item-total correlations were calculated to determine the reliability of the scale, and the test-retest correlation was calculated for consistency over time.

Results of the Research

After the pilot study, construct validity was examined to determine the extent to which questions in the scale items accurately measure the specified characteristics.

Exploratory factor analysis was chosen because it is a statistical method in which the researcher attempts to obtain information about the nature of the factors measured by the measurement tool instead of testing a certain hypothesis in the early stages of research when the researcher has no information about the number of factors identified by the measurement tool. Confirmatory factor analysis, on the other hand, was used because it provided a high-level and complex type of statistics to test a hypothesis or theory developed in line with a theory (Pallant, 2011; Tabachnick & Fidell, 2007; Tavsancil, 2014).

Results of the Exploratory Factor Analysis

Before conducting the factor analysis of the Ecological Intelligence Scale, the suitability of the data was assessed. The correlation matrix showed that many item correlations were above 0.30, indicating appropriateness for factor analysis (Tabachnick & Fidell, 2007). The raw data set ($n = 469$) was standardized using z-scores, and 18 participants with extreme values (outside -3 to +3 range) were excluded. Missing values were handled by series mean imputation. Although 300 is cited as an ideal sample size (Tabachnick & Fidell, 2007), the sample size of 451 was deemed sufficient based on the KMO value of .920 and the Bartlett's Test of Sphericity ($X^2 = 4273.595$; $df = 300$; $p < 0.001$), indicating sampling adequacy. Skewness and kurtosis values confirmed that the data approximated a normal distribution after removing outliers.

Exploratory Factor Analysis was conducted using Principal Components Analysis with varimax rotation. Factor retention was guided by the Kaiser Criterion (eigenvalues ≥ 1), scree plot, explained variance, and item loadings (Buyukozturk, 2017; Cokluk et al., 2010). Initially, 19 factors had eigenvalues above 1, explaining 60.87% of the total variance. However, based on the scree plot and variance distribution, the scale was finalized with four factors (Figure 1). Items retained in the analysis met criteria such as: factor loadings ≥ 0.30 , at least 0.10 difference between cross-loadings, meaningful item grouping, each factor's eigenvalue ≥ 1 , and item communalities and explained variance ≥ 0.30 (Buyukozturk, 2017).

After determining the number of factors, the EFA was repeated. Items with factor loadings below 0.40 were removed, and items with high loadings on multiple factors were excluded if the difference between loadings was less than 0.10 (Can, 2014). As a result, the scale was reduced to 24 items. The eigenvalues of each factor were calculated, and the conceptual coherence of items within each factor was examined based on the rotated factor analysis.

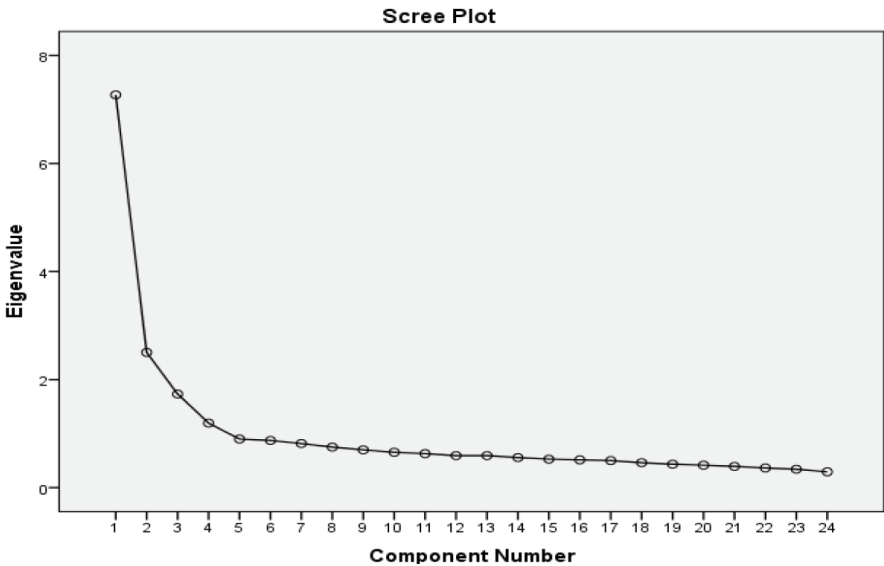
According to the findings obtained (Table 1), it is seen that the first of the factors determined as important explains 16.63% of the total variance of the scale, the second explains 15.05%, the third clarifies 11.95%, and the fourth – 9.26%. The variance explained by all four factors is 52.91%. Buyukozturk (2017) and Tavsancil (2014) state

that it is sufficient for the variance explained in multifactor designs to be between 40% and 60%, and Kline (2014) argues that the level of explaining total variance above 30% is one of the important indicators for construct validity. In this framework, it can be stated that the contribution of the identified factors to the total variance is sufficient. According to the data obtained from the scree plot, the 4-factor structure of the scale was confirmed.

Table 1
Total Variance Explained for the Ecological Intelligence Scale

Factors	Initial Eigenvalues			Recommended Eigenvalues			Rotated Eigenvalues		
	Total	Percentage of Variance %	Cumulative Percentage %	Total	Percentage of Variance %	Cumulative Percentage %	Total	Percentage of Variance %	Cumulative Percentage %
1	7.270	30.292	30.292	7.270	30.292	30.292	3.991	16.631	16.631
2	2.502	10.426	40.718	2.502	10.426	40.718	3.614	15.057	31.688
3	1.732	7.215	47.933	1.732	7.215	47.933	2.870	11.957	43.644
4	1.195	4.979	52.912	1.195	4.979	52.912	2.224	9.268	52.912

Figure 1
Scree Plot for Factor Solution of Items in the Ecological Intelligence Scale



The factors were named by considering the contents of the items that came together for the Ecological Intelligence Scale and by examining the studies in the literature (Table 2). The first factor was named Collective Consciousness (CC) due to the mutual sharing of information about ecological products and the items expressing that this information affects the actions of manufacturers and environmentalist organizations. The second factor was named Sustainable Consumption (SC) because it included the statements about individuals' choices made by evaluating the ecological effects of products when purchasing them. The third factor was named Environmental Activism (EA) because of the statements indicating that individuals take actions to encourage other people to be conscious consumers. The fourth factor was named Empathy (E) because it included statements about individuals' choice made by considering others (people, nature and other living things in nature) when purchasing products.

With regard to Collective Consciousness, it measures an individual's tendency not only to access environmental information but also to share, disseminate, and transform this information into collective awareness. Goleman's (2009) definition of ecological intelligence emphasizes "radical transparency," which requires making visible the hidden ecological and social impacts of products. CC items represent an individual's role as an active carrier of this transparency. Ecological intelligence is not individual cognition; it is a consciousness shared, multiplied, and transformed into behavior within a community (Goleman, 2009). The circulation of information through social networks enables individual awareness to evolve into societal transformation.

Collective consciousness can be understood through the following conceptual correspondences:

- Ecological intelligence → *Making the invisible visible*. Through the lens of collective consciousness, ecological intelligence means becoming aware of connections that are not immediately obvious and bringing them into common awareness.
- Social intelligence → *Collective intelligence*. Social intelligence concerns the ability of a group or community to think, respond, solve problems, and act wisely together through shared understanding and collaboration.
- Ecoliteracy → *Systems awareness and shared responsibility*. From the prism of collective consciousness, it reflects a shared awareness that humans are part of larger social and natural systems.

Example items included in the CC dimension are the following:

- When I read scientific information about a product's negative environmental impacts, I share it with my friends.
- If sufficient evidence is presented that a particular brand of product is truly environmentally friendly, I become a loyal consumer of that product.

The example items above demonstrate the relationships with others. Observed through collective consciousness, individual interpersonal skills are expanded to become collective intelligence. It can be stated that collective consciousness transforms individual awareness into shared understanding and mutual responsibility.

In terms of Sustainable Consumption, this factor measures an individual's evaluation of products not only at the "use" stage but also across the entire production-transportation-consumption-disposal process. This approach is central to the concepts of systems thinking and ecoliteracy as defined by Capra (1996) and Orr (1992). According to Goleman (2009), one of the fundamental components of ecological intelligence is the capacity to predict the harm a product causes to nature throughout its life cycle. SC items demonstrate that the individual carries this cognition to the pre-behavioral research and inquiry stage.

Sustainable consumption can be viewed using the following conceptual correspondences:

- Ecological intelligence → *Life Cycle Analysis awareness*;
- Ecoliteracy → *Understanding how nature sustains life*;
- Cognitive dimension → *Anticipating unintended consequences*.

Some example items of the SC dimension are the following:

- I pay attention to the decomposition times of the products I buy in nature after use.
- I make sure that all the environmental impacts of the product I buy are clearly and understandably stated on the label.

The example items reveal that an individual, through an understanding of LCA of the products, makes informed decisions, focusing on the long-term ecological consequences of products and the importance of transparent environmental information.

Environmental Activism measures an individual's willingness to translate their ecological awareness into active civic behavior. Ecological intelligence means not only "knowing," but also taking responsibility through ethical and political action (Misiaszek, 2019; Sterling, 2009). The items in the Ecological Intelligence section also align with Freire's (1970) understanding of critical pedagogy: awareness → critical consciousness → social transformation. Actions such as signature campaigns, reporting to authorities, and social media groups demonstrate that the individual has taken on the role of an advocate for ecological justice.

Environmental activism incorporates the following conceptual correspondences:

- Ecological intelligence → *Ethical responsibility and action*;
- Ecoliteracy → *Sustainability as a community practice*;
- Social intelligence → *Civic participation and advocacy*.

Example items of the EA dimension demonstrate the following ideas:

- I create groups on social media to reach more people with information about the environmental impact of products.
- When I notice a product's harmful effects on the environment, I report it to the authorities so that it can be banned.

These items suggest that the environmental activism dimension is related to proactive environmental advocacy, involving both collective dissemination of information and civic engagement, which aim to reduce/minimize the environmental harm caused by products.

Empathy, in turn, represents the emotional and ethical core of ecological intelligence. According to Goleman et al. (2012), ecological intelligence does not limit empathy to interpersonal relationships; it extends it to all living things and ecosystems. This dimension is directly related to the concept of “ecological self” as defined by Naess (1989). Sensitivity towards animals, child laborers, starving people, and worker health shows that the individuals perceive themselves not as separate from nature and humanity, but as integrated with them.

Empathy is viewed through the following conceptual correspondences:

- Emotional intelligence → *Empathy and moral emotion*;
- Ecological intelligence → *Empathy with all living systems*;
- Ecoliteracy → *Ethical relationship with life*.

Example items include:

- I do not buy products from companies proven to use child labor in their manufacturing.
- I do not buy products tested on animals because I find it unethical.

These items reflect ethical consumer responsibility, which is characterized by purchasing decisions that take into account human rights and animal welfare.

Table 2

Exploratory Factor Analysis Results for the Ecological Intelligence Scale

Items	Factor Loading			
	Factor 1	Factor 2	Factor 3	Factor 4
1	0.760			
2	0.738			
3	0.721			
4	0.711			
5	0.690			
6	0.642			
7	0.624			
8		0.766		
9		0.732		
10		0.714		
11		0.641		
12		0.636		

See next page for continuation of table

Continuation of Table 2

Items	Factor Loading			
	Factor 1	Factor 2	Factor 3	Factor 4
13		0.570		
14		0.502		
15			0.783	
16			0.733	
17			0.703	
18			0.670	
19			0.567	
20				0.722
21				0.663
22				0.566
23				0.507
24				0.486
Eigenvalue	3.91	3.61	2.87	2.22

Results of the Confirmatory Factor Analysis

The confirmatory factor analysis was conducted to evaluate the model-data fit for the constructs obtained from the exploratory factor analysis. For this purpose, Lisrel software was used and the final version of the scale was applied to a group of 389 people different from the data set that was subjected to the exploratory factor analysis. The data set was transferred to the program, the covariance matrix was prepared, and the 4-factor structure of the scale was tested using CFA. Path diagrams and goodness of fit values were produced for the model. It was found that the t-values related to the explanatory status of the latent variables for the observed variables were significant at the 0.01 level, and the error variances of the observed variables were not very high. It was also checked that the standardized parameter values defined from the latent variables to the observed variables were below 1 (Simsek, 2007).

The goodness of fit values obtained from the initial and final analysis are provided in Table 3. The values presented in the table regarding goodness of fit are characterized as “excellent” and “acceptable” by adhering to the criteria generally accepted in the relevant literature (Cokluk et al., 2010; Simsek, 2007; Tabachnick & Fidell, 2007).

Table 3

Findings of CFA for Pre-modification and Post-modification (Final) Models of Ecological Intelligence Scale

Examined fit indices	Perfect fit criterion	Acceptable fit criterion	Pre-modification Scale values	Post-modification Scale values	Results
p*	> 0.01 or 0.05	< 0.01 or 0.05	0.000	0.000	Acceptable
X ² /sd	≤ 3	≤ 5	671.38/ 246= 2.7	539.39/ 244= 2.2	Perfect
RMSEA	0.00 ≤ RMSEA ≤ 0.05	0.05 ≤ RMSEA ≤ 0.10	0.06	0.05	Perfect
RMR	≤ 0.05	≤ 0.08	0.06	0.06	Acceptable
SRMR	0.00 ≤ SRMR ≤ 0.05	0.05 ≤ SRMR ≤ 0.08	0.05	0.05	Perfect
GFI	0.95 ≤ GFI ≤ 1.00	0.90 ≤ GFI ≤ 0.95	0.87	0.90	Acceptable
AGFI	0.90 ≤ AGFI ≤ 1.00	0.85 ≤ AGFI ≤ 0.90	0.85	0.87	Acceptable
CFI	0.95 ≤ CFI ≤ 1.00	0.90 ≤ CFI ≤ 0.95	0.97	0.98	Perfect
NFI	0.95 ≤ NFI ≤ 1.00	0.90 ≤ NFI ≤ 0.95	0.95	0.96	Perfect
NNFI	0.95 ≤ NNFI ≤ 1.00	0.90 ≤ NNFI ≤ 0.95	0.96	0.97	Perfect

** The fact that the p-value is not significant indicates that there is no difference between the observed and expected covariance matrices, i.e., the model is confirmed. If it is significant, other criteria are examined (Cokluk et al., 2010). (M: Excellent fit; K: Acceptable fit)*

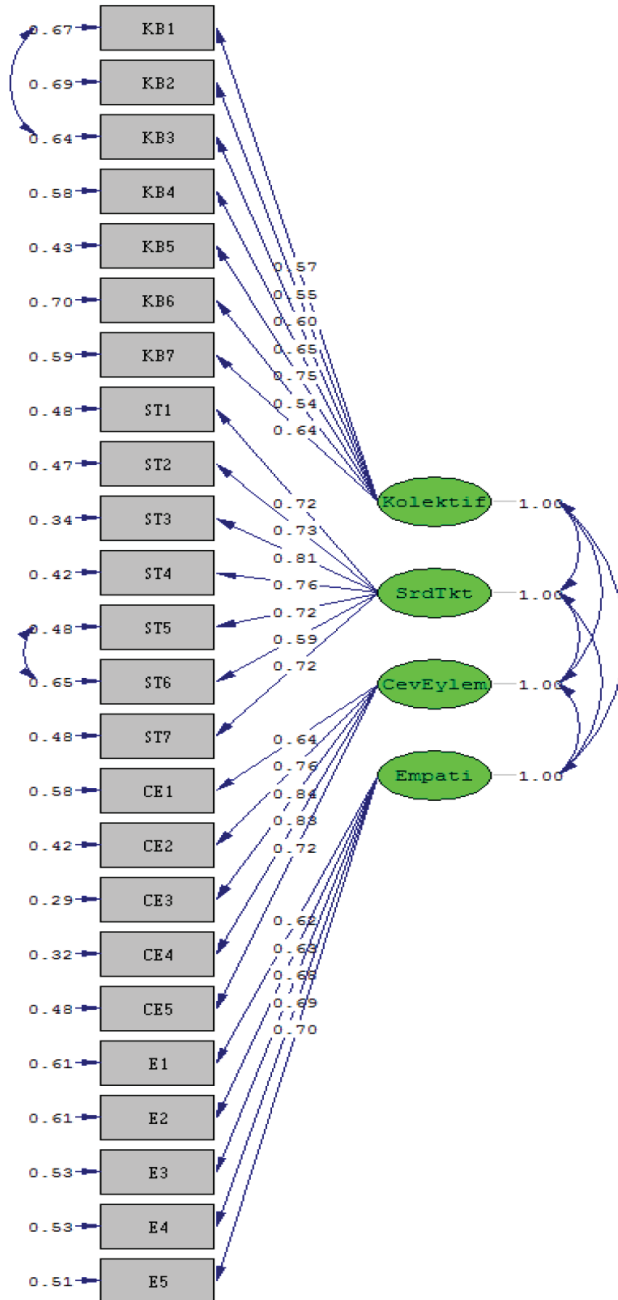
According to the results of the first and last CFA analysis provided in Table 3, it is seen that there is a significant difference between the expected and observed covariance matrix of the model. It is desirable that this value is not significant, but it is normal for this value to be significant in cases where the sample is large, and this situation is ignored in many studies (Cokluk et al., 2010). Therefore, other fit indices regarding the fit between the two matrices should also be evaluated.

Modification suggestions from the analysis results were examined. Modifications between KB1 and KB3 and between ST5 and ST6 will make a significant contribution to X². Thanks to these modifications, X² decreased to 539.39, causing critical changes in terms of the model. The path diagram of the confirmatory factor analysis results of the Ecological Intelligence Scale after the modifications mentioned is illustrated in Figure 2.

Figure 2

Path Diagram of Four-Dimensional Model Post-Modification

(Kolektif: Collective Consciousness; SrdTkt: Sustainable Consumption; CevEylem: Environmental Activism; Empati: Empathy)



$\chi^2=539.39$, $df=244$, $P\text{-value}=0.00000$, $RMSEA=0.056$

After examining the other fit indices of the Ecological Intelligence Scale after modification, $X^2=539.39$ and $sd= 244$, $X^2/sd= 2.2$. Since this ratio is below 3, it can be stated that the fit is excellent. When RMSEA, one of the fit indices, is examined, it can be stated that it shows an excellent fit by obtaining a fit index at the level of 0.05. According to the data obtained, it can be said that GFI and AGFI show good (acceptable) fit by giving fit indices at the level of 0.90 and 0.87, respectively. It can be stated that the RMR is 0.06 and shows good (acceptable) fit, and the fit index of the standardized RMR is 0.05, and the value shows excellent fit. Among the fit indices, it is seen that NFI is 0.96, NNFI is 0.97 and CFI is 0.98, so these values show excellent fit. In this framework, the structure of the Ecological Intelligence Scale consisting of 24 items and 4 factors was validated as a model.

Results of Reliability Analysis

Reliability is an indicator of the extent to which the measurement tool measures the characteristics consistently and free from errors (Tekin, 2000). Within the scope of the reliability studies of the EIS, Cronbach's alpha internal consistency coefficients, test-retest reliability, item-total correlations and item discrimination values were analyzed (Table 4).

Table 4
Reliability Analysis Results for the Ecological Intelligence Scale

	Cronbach' alpha for the first measurement	Cronbach' alpha for the second measurement	Guttman's Split-Half Coefficient	Test-retest reliability (r)
Factor 1 – Collective Con-sciousness	0.858	0.812	0.722	0.813
Factor 2 – Sustainable Consumption	0.820	0.887	0.822	0.830
Factor 3 – Environmental Activism	0.806	0.869	0.781	0.825
Factor 4 – Empathy	0.701	0.794	0.761	0.806
Total	0.898	0.917		

According to Sencan (2005), the Cronbach's alpha value of scales used in research should be calculated separately for different segments of the population, and both pilot and main study results should be reported. In this study, since the Ecological Intelligence Scale was administered to two different samples, reliability coefficients were reported separately, with Cronbach's alpha values found to be 0.898 and 0.917 for the overall scale. Kline (2023) suggests that a reliability coefficient around 0.90 is excellent, around 0.80 is very good, around 0.70 is adequate, and below 0.50 is inadequate. Accordingly, the reliability was excellent for the first three dimensions, adequate for the fourth, and excellent overall.

Sencan (2005) suggested that if there is more than one factor in the scale used, one of the test–retest, parallel forms reliability methods should be applied along with the alpha coefficient on factor basis. For this reason, in this study, the reliability of the scale was calculated using Cronbach’s alpha internal consistency coefficient, Guttman’s two-half reliability coefficient, test–retest stability coefficient, and item–total correlations.

A positive and high item–total correlation, which explains the relationship between the scores obtained from the test items and the total score of the test, indicates that the items measure similar behaviors, and the internal consistency of the test is high. In general, it is stated that items with a corrected item–total correlation coefficient of 0.40 and above are very good items, items between 0.30 and 0.39 are good items, items between 0.20 and 0.29 can be included in the measurement tool if necessary or after correction, and items below 0.19 should be removed from the measurement tool (Buyukozturk, 2017; Can, 2014; Kalayci, 2008). Accordingly, it can be stated that the item–total correlations for all items in the scale ranged between 0.337 and 0.627, and the items discriminated individuals well.

For test–retest reliability, the EIS was reapplied to 28 prospective teachers after two weeks (Buyukozturk, 2017). As a result of the analysis, the test–retest reliability coefficients of the scale were calculated as 0.813 for the collective consciousness dimension, 0.830 for the sustainable consumption dimension, 0.825 for the environmental activism dimension, and 0.806 for the empathy dimension. In general, it is stated that a reliability coefficient of 0.70 and above is sufficient to accept a psychological test as reliable (Buyukozturk, 2017; Tavsancil, 2014). The fact that the correlation coefficients calculated for test–retest reliability are above 0.70 for all four dimensions can be expressed as the scale provides stable measurements over time.

Interpretation of scores: The Ecological Intelligence Scale was designed as a 5-point Likert scale, graded as follows: 1 – Never, 2 – Rarely, 3 – Sometimes, 4 – Frequently, and 5 – Always. The scale has 24 items, 4 sub-dimensions, and no negative items. The lowest score that each participant can get from the **Ecological Consciousness** dimension of the scale is 7 and the highest score is 35; the lowest score that each participant can get from the **Sustainable Consumption** dimension is 7 and the highest score is 35; the lowest score that each participant can get from the **Environmental Activism** dimension is 5 and the highest score is 25; the lowest score that each participant can get from the **Empathy** dimension is 5 and the highest score is 25; the lowest score that each participant can get from the whole scale is 24 and the highest score is 120.

Discussion and Conclusion

Starting with educating people to make nature sustainable can help address and solve the root of the problem. Individuals and organizations need to develop their ecological intelligence for a sustainable planet, and educational institutions and educators, who have the responsibility to foster eco-literate individuals, bear a greater responsibility. Thus, the current study aimed to develop, validate, and make significant contributions to environmental education through the Ecological Intelligence Scale. This section discusses the implications of the findings, compares them with existing literature, and

offers suggestions for future research.

In recent years, increasing concerns about significant environmental issues have become a global discourse. The widespread nature of these problems, no longer confined to specific regions, has led to a growing sense of urgency in addressing them comprehensively. This urgency is further exacerbated by the rising human population and consumption patterns, which complicate efforts to resolve rapidly emerging environmental issues. This reality underscores the importance of developing ecological intelligence, which can guide sustainable behaviors and reduce environmental harm (Goleman, 2009; Spaargaren & Van Vliet, 2000; Ozgun, 2018).

Ecological intelligence, a subset of ecological literacy, represents a holistic understanding aimed at rethinking consumption behaviors and raising awareness about their impacts on ecosystems. It is an area that integrates environmental awareness with cognitive and emotional skills to support sustainable living. This multifaceted construct, which integrates insights from economics, psychology, sociology, neuroscience, and education, is crucial for promoting sustainable living practices. Therefore, developing a robust ecological intelligence scale can provide educators and policymakers with a valuable tool to encourage conscious consumption and environmental stewardship. The present study aligns with Goleman's (2009) earlier work, defining ecological intelligence as the ability to apply knowledge about environmental impact to change behaviors for sustainability.

The Ecological Intelligence Scale developed in this study complements Goleman's framework by providing a structured tool to measure this type of intelligence among educators. The EIS in this study revealed a four-factor structure: collective consciousness, sustainable consumption, environmental activism, and empathy. These factors highlight the multifaceted and holistic nature of ecological intelligence, encompassing awareness, attitude, and behavior towards environmental sustainability. The scale demonstrated good reliability and validity, proving to be a robust tool for measuring ecological intelligence among educators. The developed EIS offers significant advancements compared to previous ecological intelligence scales (Akkuzu, 2016; Mainaki et al., 2018; Najmuddeen & Areekkuzhiyil, 2017; Nayal & Bhatt, 2014; Okur-Berberoglu, 2020; Wulan et al., 2023). Therefore, the EIS provides a more comprehensive tool for educators and researchers to assess and promote ecological intelligence, expanding the scope of previous scales.

Akkuzu (2016) attempted to measure ecological intelligence using statistical methods, focusing on students' ecological behaviors and attitudes. While Akkuzu's work emphasized cognitive and behavioral dimensions, the present study expanded this by including empathy, consistent with Gardner's (1993) Theory of Multiple Intelligences and Goleman's (2019) concept of social intelligence. This addition underscores the importance of emotional aspects in developing holistic ecological consciousness.

Najmuddeen and Areekkuzhiyil (2017) conducted a study on ecological intelligence among teachers in Kerala, using the Ecological Intelligence Inventory, which included components such as awareness and practice. Their inventory encompassed "intentional practice" as a component, which was not explicitly measured in our scale. Our study focuses more on empathy and activism, extending the scope of ecological intelligence to include emotional and action-oriented components.

Okur-Berberoglu (2020) developed an ecological intelligence scale for adults, primarily focusing on the cognitive and behavioral aspects of ecological intelligence. The scale included items measuring environmental awareness, understanding of ecological principles, and eco-friendly behaviors. In comparison, our scale expands this framework by adding an emotional dimension, assessing individuals' emotional responses to environmental issues. This addition is significant as it recognizes the role of emotions in motivating eco-friendly behavior, aligning with theoretical perspectives that emphasize emotional engagement as a core component of ecological intelligence (Goleman et al., 2010). Both scales acknowledge the importance of a holistic approach, but our scale specifically addresses actionable dimensions of ecological intelligence, such as environmental activism and sustainable consumption, which are critical for promoting practical environmental stewardship in educational contexts.

Wulan et al. (2023) proposed classifying ecological intelligence into three dimensions: cognitive, behavioral, and technological. Their theoretical framework highlights the importance of technological decision-making in promoting sustainability. While our scale does not explicitly include a technological dimension, it implicitly addresses this aspect through items related to sustainable practices and resource use. The inclusion of an emotional dimension in our scale offers a more holistic understanding of ecological intelligence, capturing the underlying emotional and ethical considerations in ecological decision-making. This alignment with existing frameworks not only validates the theoretical foundations of our scale but also underscores its relevance and applicability across different contexts and populations.

One of the main strengths of our ecological intelligence scale is its comprehensive structure. By integrating cognitive, behavioral, and emotional dimensions, the scale provides a detailed assessment of ecological intelligence. This multidimensional approach allows for a more accurate measurement of individuals' ecological competencies and can help identify specific areas for intervention and education. Holistic education, integrating cognitive, emotional, and spiritual dimensions, is essential to nurture this interconnectedness (Miller, 2019). The EIS can effectively evaluate the impact of holistic education programs in developing ecological intelligence.

The innovative aspect of our scale lies in its integration of emotional and social intelligence dynamics with ecological literacy. By emphasizing ecological self and fostering a sense of environmental responsibility through empathy and collective consciousness, our scale provides a nuanced approach to understanding and developing ecological intelligence. This approach is particularly important in educational settings, where fostering a deep connection with nature and promoting sustainable behaviors are essential for developing environmentally responsible citizens (Schultz, 2001; Mayer & Frantz, 2004; Wilson, 1984). Emotions play a significant role in shaping environmental attitudes and behaviors, as highlighted in previous research (Goleman et al., 2010; Shumba, 2011). By including items that assess emotional responses to environmental issues, our scale acknowledges the importance of emotional engagement in developing ecological intelligence and promoting sustainable behavior. Goleman (2009) argued that ecological intelligence enables individuals to make more sustainable choices by integrating emotional and social intelligence with environmental awareness. Our scale

aligns with previous studies emphasizing the importance of ecological intelligence in promoting sustainable behaviors.

Despite the strengths of our study, there are some limitations. The sample size and demographic diversity may limit the generalizability of our findings. Future research should aim to validate the scale with larger and more diverse populations to ensure its applicability across different cultural and socio-economic contexts. Additionally, the implementation results in the Turkish education system might have been influenced by the lack of a holistic education approach. Therefore, applying this developed scale in various countries around the world would yield more meaningful results. Furthermore, longitudinal studies are needed to evaluate the long-term impact of ecological intelligence education on behavior.

The development of this original ecological intelligence scale makes a significant contribution to the fields of environmental psychology and environmental education. By providing a multidimensional and comprehensive assessment tool, our ecological intelligence scale represents a significant advancement in measuring ecological intelligence. By comparing the developed EIS scale with existing literature, its unique contributions are highlighted, particularly the inclusion of the emotional dimension. This scale not only enhances an understanding of ecological intelligence but also provides educators and policymakers with a valuable tool to promote sustainable behaviors and attitudes. Future research should continue to refine and validate the scale to ensure its robustness and applicability in various contexts.

The insights of Bowers (2009), who emphasizes the importance of recognizing and addressing these obstacles to develop educational reforms that truly promote ecological intelligence and sustainability, are very important at this point. Integrating holistic educational approaches is vital for developing the ecological self, establishing a deeper connection with nature, and promoting sustainable living. Bowers (2009) stated that many university professors and classroom teachers are trained with an understanding that intelligence is primarily about individual autonomy, neglecting the importance of relationships and interdependence in ecological thinking. This paradigm gap is a significant barrier to the development of ecological intelligence among prospective and experienced teachers. At the same time, ecological intelligence can be taught and developed not only through formal education but also through non-formal education (Kusnoto et al., 2023).

Bowers (2009) highlighted the resistance within tenured faculty and educational institutions to accepting and integrating new ecological perspectives due to institutional rigidity and the strong structure of existing academic frameworks. Educational institutions that continue to teach with a purely reductionist understanding unfortunately lag in seeing the whole constituted by parts and developing a curriculum for it. This situation implies questioning the ecological leadership of academics.

Bowers (2009) also emphasizes the importance of oral cultures, which are crucial for developing ecological intelligence. According to him, education systems can better promote sustainable practices and ecological awareness by recognizing and learning from the ecological wisdom of oral cultures. Bowers (2009) argues that while UNESCO supports education for sustainable development, focusing solely on individual empowerment

and knowledge construction fails to address the deeper changes in consciousness and lifestyle needed for ecological sustainability. Lastly, Bowers (2009) also stressed that educational reforms often lack specificity and depth, resulting in superficial changes in teaching and learning practices that are insufficient for cultivating individuals with high ecological intelligence. Developing ecological intelligence seems possible through mindfulness practices that increase one's connection to nature. Attention spans, one of the most important psychological issues of our time, the complexity of systems supporting fast living, and the tendency to understand complex issues quickly and superficially undermine the potential for meaningful educational reform.

Ecological intelligence encompasses cognitive, behavioral, and emotional awareness of our connection with nature and supports sustainable living. This study, guided by Bowers (2009), emphasizes the role of holistic education and mindfulness in developing ecological intelligence. The validated scale offers a useful tool for educators and policymakers to assess and foster ecological awareness, contributing to a more sustainable future.

Practical Recommendations

The following recommendations are offered to guide the effective implementation of the findings in practice:

- Integrating ecological intelligence into the curriculum: Educational institutions should incorporate ecological intelligence into their curricula, emphasizing the interconnectedness of human and environmental systems;
- Professional development for educators: Providing educators with training and resources to enhance their understanding and teaching of ecological intelligence can lead to more effective environmental education;
- Promoting experiential learning: Engaging students in hands-on, experiential learning activities related to environmental sustainability can deepen their understanding and commitment to ecological principles;
- Conscious awareness/mindfulness practices: Recognizing the pressures of fast-paced living, holistic practices such as meditation can enhance focus and attention, fostering a deeper connection to nature.
- Building communities: Creating communities to discuss sustainability, question the status quo, share experiences and knowledge, and foster oral culture can support the development of ecological intelligence.

Based on the findings of the study, the following policy recommendations are proposed to support effective implementation:

- Supporting holistic education initiatives: Policymakers should recognize the importance of promoting ecological intelligence for sustainable development and support educational programs that integrate holistic approaches;
- Encouraging interdisciplinary collaboration: Interdisciplinary collaboration can enhance the development and implementation of educational strategies that support ecological intelligence;
- Monitoring and evaluation: Establishing mechanisms to monitor and evaluate the

effectiveness of ecological intelligence education programs can ensure continuous improvement and impact.

This article presented the Ecological Intelligence Scale as a robust framework for assessing and developing ecological intelligence. By integrating holistic educational approaches and supporting educators, it is possible to cultivate a generation equipped to resolve the urgent environmental challenges of our time. Future research should continue to explore and expand these findings, ensuring that ecological intelligence becomes a fundamental component of education worldwide.

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