

From Control to Compassion: Ecohumanism as a Framework for Teaching about Invasive Species

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Abstract

This study explores the effect of the ecohumanistic approach on environmental education students' perceptions of invasive species in Israel. The research draws on ecohumanism, a framework emphasizing the ethical responsibility humans hold toward nature, to challenge the traditional binary perspectives on invasive species. During the course of more than six years, 105 undergraduate and 127 graduate students participated in a biodiversity course, including a lecture on invasive species taught through the lens of ecohumanism. The study employed qualitative methods, using drawings, reflections, and interviews to capture students' evolving perceptions. A thematic analysis revealed three key shifts: a) initial negative emotions and simplistic views of invasive species, b) a deeper understanding of the complexity of ecological interactions, and c) reflections on the students' roles as future educators. Findings highlight the importance of integrating ethical and ecological perspectives in environmental education. The study concludes that an ecohumanistic framework fosters critical thinking, empathy, and responsibility, equipping future educators to address complex environmental challenges.

Keywords: *Ecohumanism, Invasive Species, Higher Education, Case Study.*

Introduction

Invasive species represent one of the most pressing ecological challenges of the modern era (Ballar et al., 2024; Colombari & Battisti, 2023; Haley et al., 2023; Hemming et al., 2021; McClendon et al., 2024; Pimentel et al., 2000). They are defined broadly as species that are introduced to new environments by humans, where they establish, proliferate, and cause harm to native ecosystems and pose significant threats to biodiversity, ecosystem stability, and even human economies (Banha et al., 2022; Cruz & Reynolds, 2019; Haley et al., 2023; McClendon et al., 2024; Stigall, 2012). The ability of these species to spread rapidly and outcompete native flora and fauna disrupts the delicate balance of local ecosystems, often leading to irreversible ecological damage (Banha et al., 2022; Bartz & Kowarik, 2019; Haley et al., 2023; Sullivan, 2017). Invasive species have become a global issue, with countless examples across continents highlighting the profound impact they can have on environmental health (Ballar et al., 2024; Banha et al., 2022; Colombari & Battisti, 2023; Haley et al., 2023; Ram, 2019).

The rise of invasive species is intricately linked to human activity, such as global trade, transportation, and urbanization, which have facilitated the movement of organisms across geographic boundaries (Colombari & Battisti, 2023; Haley et al., 2023). From plants and insects to mammals and birds, invasive species can thrive in new environments, often free from the predators and diseases that kept their populations in check in their native habitats. As a result, they can establish dominance in new regions, frequently at the expense of native species and ecosystems. This ecological disruption can lead to cascading effects throughout the food chain and fundamentally alter ecosystem functions (Ballar et al., 2024; Banha et al., 2022; Colombari & Battisti, 2023; Tabe-Ojong, 2023).

The phenomenon of invasive species has not passed over Israel. From a biological perspective, Israel is positioned at a critical global crossroads, with close proximity to both Europe and Africa and has a rich and diverse range of ecosystems. (Orchan et al., 2013; Spanier & Zviely, 2023). However, its unique geographical characteristics also makes it particularly vulnerable to the introduction and spread of invasive species (Galil et al., 2021; Orchan et al., 2013; Spanier & Zviely, 2023). Over the years, numerous species

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of plants, animals, and microorganisms have been introduced, either intentionally or accidentally, and many have established themselves as invasive species. (Orchan et al., 2013; Shani, 2024).

Currently, the primary approach to managing invasive species focuses predominantly on ecological aspects. However, ecological research underscores the necessity for a broader, multidimensional perspective in addressing this issue. Researchers argue that it is insufficient to view invasive species solely through a pure ecological lens, as the complexities involved cannot be reduced to a simple dichotomy of good versus bad. Therefore, education (has the potential to play a crucial role in tackling the phenomenon of invasive species. It is essential to cultivate a holistic approach among students that integrates ecological knowledge, critical thinking, and ethical considerations. Environmental education in general, should foster a deep understanding of the human role in disrupting ecosystems and equip students with the tools for critical thinking and personal responsibility (Goulder & Wong, 2024; Torres et al., 2024; S. Yin et al., 2024).

The ecohumanistic approach, which emphasizes a holistic perspective on human- environment relationships while highlighting ethical considerations (Aloni & Veugelers, 2024; Zapf, 2022), offers a valuable framework for addressing the challenges posed by invasive species. By integrating ecological insights with ethical reflections, this approach encourages a deeper understanding of the interconnectedness of all life forms and the responsibilities humans hold in these dynamics. It moves beyond a purely ecological focus, advocating for a comprehensive view that considers social, cultural, and ethical dimensions. This multifaceted perspective can enhance our strategies for managing invasive species, fostering a more responsible and sustainable interaction with our ecosystems. Therefore, this study aims to explore how an ecohumanistic approach influences the perceptions of environmental education students - both undergraduate and graduate - regarding invasive species. Specifically, the research will investigate: How does exposure to ecohumanism shape the attitudes of college students of environmental education in Israel toward invasive species?

This question aims to bridge gaps in two interconnected aspects.

Despite the significant body of literature on environmental education which focus on teaching ecological concepts and sustainability, it often lacks the inclusion of the ethical, philosophical, and humanistic dimensions (Audley et al., 2024; Boynazarova, 2023; Colombari & Battisti, 2023; Masalimova et al., 2023; McClendon et al., 2024; Shaw & Stoll, 2021). Therefore there remains a notable gap in the integration of these aspects in educational frameworks toward both human and non-human life (Aloni et al., 2023).

There is a growing recognition within the scientific community of the urgent need to rethink how we address environmental challenges, particularly in the realm of invasive species management and broader ecological issues inside the education system (Avelo, 2023; Ballar et al., 2024; Colombari & Battisti, 2023; Masalimova et al., 2023; McClendon et al., 2024; Steele & Pienaar, 2023).. Furthermore, there is a literary requirement stating that educational engagement with the phenomenon of invasive species should include ethical aspects and awareness of the confidentiality of environmental justice and not just focus on scientific aspects (Goulder & Wong, 2024; Shani, 2024; S. Yin et al., 2024).

Hence, this article seeks to address these gaps by integrating environmental education with the principles of ecohumanism in the teaching of invasive species.

Ecohumanism as a Theoretical Framework

Ecohumanism provides a philosophical framework that integrates humanist values with environmental ethics, advocating for a balanced and interconnected relationship between humans and nature (Aloni & Veugelers, 2024; Zapf, 2022). This approach is particularly relevant in addressing the ecological challenges posed by invasive species, where human activities have disrupted ecosystems and led to significant environmental consequences. The rise of invasive species, often introduced or facilitated by human intervention, highlights the need for a more responsible and ethical approach to how humanity interacts with the natural world (Avelo, 2023; Ballar et al., 2024; Colombari & Battisti, 2023; McClendon et al., 2024; Orchan et al., 2013; Steele & Pienaar, 2023).

Ecohumanism emphasizes that humans are moral agents within the ecological system, bearing responsibility not only for the direct impact of their actions but also for the broader environmental consequences. In the context of invasive species, this approach promotes a more reflective and ethical stance, where humans are called to consider the long-term ecological balance and the well-being of both native and invasive species. It suggests that invasive species should not merely be seen as "enemies" of biodiversity but as part of a complex ecological web that has been altered by human actions. Thus, ecohumanism calls for a responsible approach that recognizes the moral obligations to manage invasive species in a way that seeks to restore ecological balance while minimizing unnecessary harm (Aloni & Veugelers, 2024; Zapf, 2022).

Ecohumanism, with its holistic approach to human-environment relationships, complements traditional environmental education by enriching its ethical dimensions. While conventional environmental education often focuses on ecological facts and conservation techniques, integrating ecohumanism encourages students to explore the moral implications of their interactions with nature. This perspective fosters a deeper sense of responsibility and empathy towards the environment, prompting learners to consider not just the ecological impact of invasive species, but also the social and ethical ramifications of their actions. By incorporating ecohumanism into environmental education, we can cultivate a generation of critical thinkers who appreciate the interconnectedness of all life and are motivated to engage in sustainable practices that reflect both ecological awareness and ethical responsibility (Aloni & Veugelers, 2024; Leite, 2024; Zapf, 2022).

In conclusion, ecohumanism provides a vital theoretical foundation for rethinking invasive-species management, moving beyond anthropocentric conservation strategies toward a more integrated approach that emphasizes the interconnectedness of human and ecological systems. By applying this approach, there is potential to address the complex ethical dilemmas posed by invasive species and to promote more sustainable and morally conscious environmental practices.

Methodology

Research Context

This research was conducted over a span of six years, focusing on the perceptions of undergraduate and graduate students regarding invasive species. Each year, 105 undergraduate students in the discipline of science education, took part in a second-year course called Biodiversity, which is part of the sustainability curriculum. Similarly, 127 graduate students in environmental education studied a comparable course. In both programs, the course was a one-semester class, and in each, one lecture was specifically dedicated to the topic of invasive species.

The lecture on invasive species was taught through the lens of ecohumanism, a framework emphasizing the ethical responsibility humans hold towards nature (Aloni et al., 2023; Zapf, 2022). Ecohumanism encourages the view that invasive species are not "culprits" but part of an ecological imbalance often caused by human intervention. This ethical perspective encourages students to consider the broader moral implications of invasive species management, aiming to foster empathy, responsibility, and a holistic understanding of environmental dynamics.

Prior to the lecture, students were asked to visually express their feelings about invasive species in Israel by creating a drawing and providing an explanation of their views. This exercise aimed to capture their initial perceptions of invasive species, often influenced by dominant ecological narratives that frame these species as destructive invaders. Following the ecohumanism-based lecture, students were asked to repeat the exercise—drawing their feelings and explaining their views again—now with the additional insight into the ethical dimensions of species invasion and human responsibility.

Additionally, from each class, two students were randomly selected to participate in short interviews regarding their evolving attitudes towards invasive species. These interviews provided deeper qualitative insights into how the ecohumanistic approach influenced their understanding and whether it shifted their initial perspectives.

Research Approach

This study employed a qualitative research approach, utilizing case study methodology to explore the perceptions of environmental education students toward invasive species and the impact of ecohumanism. Case study methodology is particularly effective in providing an in-depth analysis of a specific context, allowing for a detailed examination of participants' experiences and reflections (Yin, 2006). The central idea of the case study was to analyze students' understanding and attitudes through multiple data collection tools, which included the analysis of drawings, reflections, and short interviews. These diverse methods offered a holistic view of the participants' cognitive and emotional responses to the topic.

Case Study Design

The case study design was centered around understanding how ecohumanism, as an educational framework, shaped students' attitudes toward invasive species. This involved exploring their engagement with ecological concepts and moral reasoning through different expressive modalities. The use of multiple data sources allowed for triangulation, ensuring that the findings were comprehensive and reflected the complexity of the students' perspectives.

Analysis

The overall analysis was conducted using an inductive approach, which is characterized by allowing themes and patterns to emerge from the data without imposing preconceived frameworks. This method was appropriate for exploring the new and complex ideas related to ecohumanism and invasive species, allowing the students' voices and perspectives to lead the analysis.

Drawings

One of the research tools employed in this study was the analysis of drawings produced by the students. Drawing analysis is a valuable method in qualitative research, as it allows participants to express emotions, thoughts, and ideas that may not be easily articulated through verbal or written communication. The drawings were analyzed with a specific focus on the emotional content conveyed in them, particularly how the students represented their feelings toward invasive species and the environment. Emphasis was placed on recurring themes such as empathy, conflict, or detachment toward non-native species, providing insight into the emotional dimensions of their perceptions.

Reflections

In addition to drawings, students were asked to write reflections after participating in lecture on invasive species and ecohumanism. These reflections were analyzed following Saldaña's (2009) coding method, which involves both first-cycle and second-cycle coding. In the first cycle, open coding was used to identify initial themes and patterns related to students' views on invasive species. The second cycle involved axial coding, where the initial codes were organized into larger categories that connected students' reflections on invasive species and ecohumanistic themes. This inductive analysis helped to uncover how students internalized and processed the concepts presented to them (Saldaña, 2009).

Short Interviews

The final research tool involved conducting short, semi-structured interviews with students. These interviews provided a space for participants to elaborate on their views and expand on ideas expressed in their drawings and reflections. The interviews were transcribed and analyzed using the same coding approach as the reflections, with an emphasis on identifying patterns related to ecohumanism and invasive species. The use of Saldaña's (2009) coding methods allowed for a structured yet flexible analysis that was responsive to the emergent themes in the data. The inductive approach ensured that the findings were grounded in the students' real-time experiences and spontaneous reactions to the subject matter.

Findings

In analyzing the perceptions of undergraduate and graduate students toward invasive species before and after the lecture on ecohumanism, three main themes emerged: 1) initial negative feelings and binary thinking about invasive species, 2) a shift toward understanding the complexity of invasive species, and 3) reflections on the role of educators in shaping students' views on nature and environmental responsibility. Each theme represents a significant shift in the students' approach thinking, influenced by the ecohumanistic framework presented in the lecture.

Theme 1: Initial Negative Feelings and Binary Approach about Invasive Species

Before the lecture on ecohumanism, many students expressed strong negative feelings toward invasive species (Figure 1 and figure 2). Their perspectives often reflected a simplistic, "black-and-white" view, where invasive species were seen as inherently harmful and destructive, with little room for nuance. The students' initial drawings often depicted invasive species as dangerous or threatening to native ecosystems.

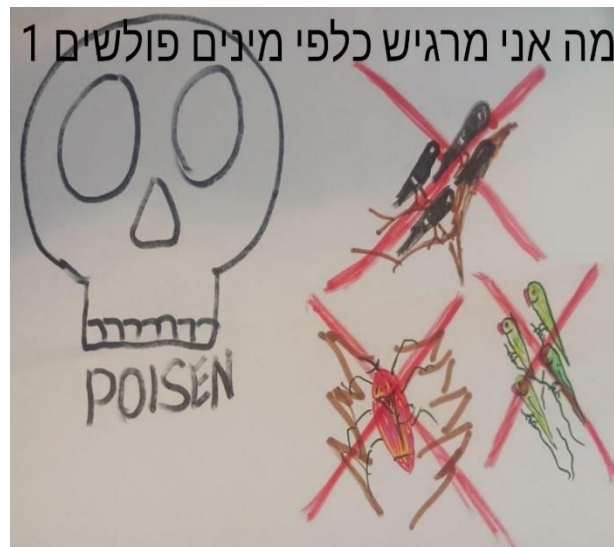


Figure 1. A Graduate Student Drawing of His Feelings Toward Invasive Species at The Beginning of The Lecture on Invasive Species.

Figure 1 illustration expresses a highly negative attitude toward invasive species, reflected in several key elements:

- **Red Xes:** The red Xes symbolize rejection or complete elimination of the depicted species. This indicates that the student perceives invasive species as a threat that must be eradicated, without recognizing any positive aspects or complexities.
- **Skull:** The skull universally represents danger, death, or destruction, reinforcing the perception that invasive species pose a serious threat to the ecosystem.

- The word "poisen" (misspelling of "poison"): The spelling error (using "Poisen" instead of "Poison") may suggest that the student is responding emotionally and intuitively to the topic, rather than through a well-informed or nuanced approach. The use of the word implies that invasive species are perceived as toxic or dangerous, something that needs to be removed at all costs.

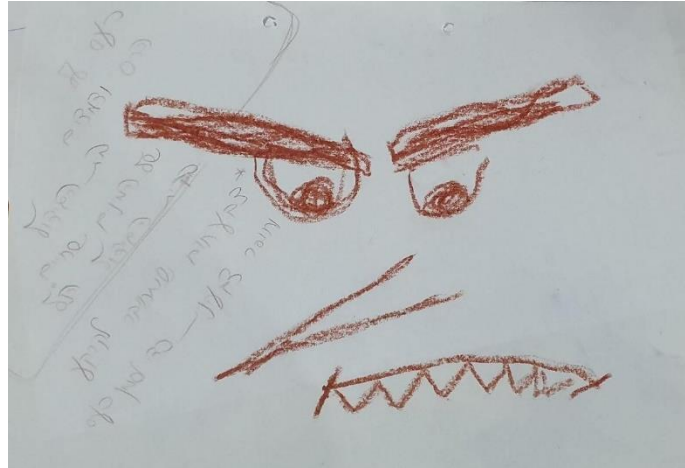


Figure 2. Undergraduate Student's Drawing of Their Feelings Toward Invasive Species at The Beginning of The Lecture on Invasive Species.

Figure 2 illustration depicts angry, threatening facial features, expressing frustration and resentment toward invasive species. The use of the color brown, along with the clear expression of anger, symbolizes the student's negative emotions toward invasive species and reflects a perception of destruction and habitat reduction caused by these species.

- Strong expression of anger: The angry eyes and jagged mouth illustrate deep frustration on the part of the student toward invasive species. This likely reflects the perception of these species as a threat that causes anger due to their impact on local ecosystems and biodiversity reduction.
- The student's statement: The accompanying text on the side of the drawing indicates that the anger and negative emotions stem from an awareness of the damage caused by invasive species: "Destruction of habitat, reduction of opportunities for native species." This reinforces the perception that the student views invasive species as enemies disrupting the natural balance.
- Lack of color: The absence of additional colors reflects an emotional state dominated by a single, clear feeling—anger and frustration. This expresses a one-dimensional perspective toward invasive species, leaving no room for empathy or understanding of the complexity of the issue.

These figures highlight the simplistic, binary perspective toward invasive species, where they are viewed as a problem to be solved. It reflects a "black-and-white" mindset, consistent with findings from various studies showing that people often label invasive species as inherently harmful. However, this approach overlooks the complexity of invasive species issues and humanity's role in creating ecological challenges, i.e., how to reverse their presence harmlessly, how to alter their presence from being completely negative or harmful to the ecosystem, to partially positive or contributory, if possible, and how to change people's attitudes towards their existence.

The example reflected in the drawings was also supported by the students' statements. One student, for example, described their perspective before the lecture:

I used to think of invasive species as evil intruders. They come into our environment, destroy native plants

and animals, and cause a lot of damage. I couldn't see anything positive about them, and honestly, I felt that they should just be eliminated.

This sentiment of "invasive species as enemies" was common among many students, reflecting the dominant narrative of invasive species management, which emphasizes eradication and control. Another student stated:

I felt like invasive species were like criminals—breaking into a country that doesn't belong to them and ruining it for everyone else. They were a problem that needed to be solved.

Another student stated:

Invasive species were always the 'bad guys' in my mind. We talked about them as if they were some kind of villain in a movie, where the only way to fix the situation was to get rid of them.

These responses demonstrate that, prior to exposure to ecohumanism, many students viewed the issue of invasive species in purely negative terms, without acknowledging the broader ecological or ethical context.

Another student expressed similarly strong negative views, describing their frustration and anger toward invasive species:

When I thought about invasive species, I only saw them as destructive forces. They come in, take over, and there's nothing positive about them. I felt they were a clear problem that we needed to get rid of as fast as possible.

A final example of this binary thinking came from a student who noted: "It always felt like these species were ruining everything for the native plants and animals. I was angry that they were allowed to spread and didn't see any reason to feel bad about getting rid of them."

This response illustrates the emotional intensity behind the students' pre-lecture views, where invasive species were framed as inherently negative, leading to feelings of anger and frustration.

Theme 2: Understanding the Complexity of Invasive Species

After the lecture on ecohumanism, there was a noticeable shift in the students' perceptions. The lecture, which emphasized the ethical responsibility humans have toward all species and highlighted that invasive species are not inherently "evil," helped students develop a more nuanced understanding of the issue. Many students began to realize that invasive species are often a result of human actions, and that blaming the species themselves is not productive (Figure 3, Figure 4 and Figure 5).

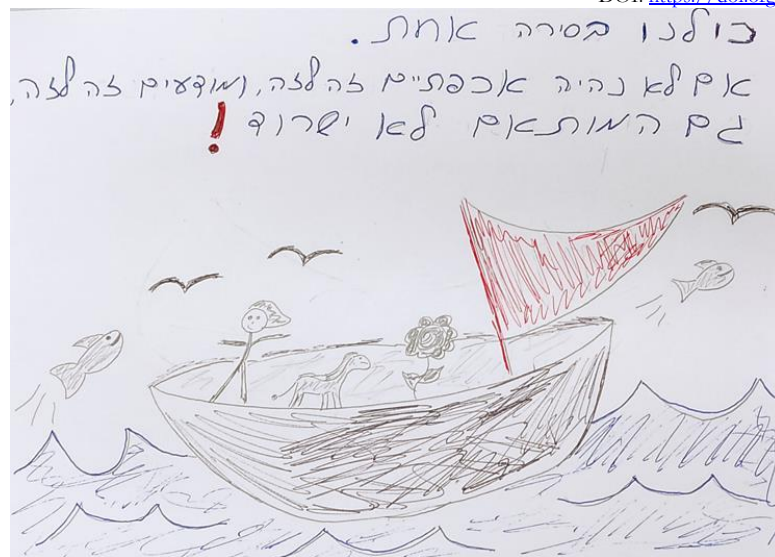


Figure 3. Undergraduate Student's Drawing of Feelings Toward Invasive Species at the End of the Lecture on Invasive Species.

Figure 3 represents a change in attitude and a broader and more inclusive perception towards invasive species following the lecture dealing with ecohumanism. The main message in the illustration is "we are all in the same boat", and illustrates the understanding that all creatures, regardless of their origin or ecological status, depend on each other. This approach reflects a non-dichotomous view, which opposes seeing invasive species as enemies that need to be excluded or destroyed.

- The meaning of "we are all in the same boat": The message expressed here - emphasizes the idea that all creatures in the ecosystem, including invasive species, share the same space of existence. If we are not caring and aware of each other, as the text indicates, we will cause damage not only to the invaders but also to the entire ecosystem, since every creature is connected to the complex system around it. The statement is an expression of the ecohumanist understanding that places the mutual relationship at the center.
- The illustration of the boat and the various creatures: In the boat various creatures are shown; some may represent local species and some foreign, but all of them are together in harmony. This symbolizes the importance of cooperation and mutual understanding among all species, without separation between "native" and "invader". The combination of living things (human, flora, fauna) in the same boat conveys a message of inclusion and equality between the species.
- Using nature and the sea as a symbol of an open ecosystem: The open sea around the boat can be used as a metaphor for an ecosystem that does not have defined boundaries. As in the sea, in ecosystems, too, there is a constant movement of creatures, and the question of whether a creature is "invasive" or "native" is not always clear-cut.
- A message of mutual responsibility: The text in the illustration emphasizes the importance of awareness and mutual care between all creatures. This is a message that corresponds with the principles of ecohumanism, which emphasize the need for mutual responsibility between humans and other creatures in nature, including the species that are considered "invaders"



Figure 4. Graduate Student's Drawing of His Feelings Toward Invasive Species at The End of The Lecture on Invasive Species.

Figure 4 reflects a significant shift in the student's attitude toward invasive species following exposure to the principles of ecohumanism. The use of color, the diversity of species, and the accompanying message indicate a new perspective based on inclusion, acceptance, and a more nuanced understanding of ecological processes.

- Use of color and species diversity: The variety of colors in the illustration conveys vitality and abundance, symbolizing a harmonious approach to the environment. The depicted species—such as the giraffe, horse, birds, and various plants— create a scene where all creatures coexist in balance. The colorful depiction emphasizes the complexity and beauty of an ecosystem that integrates both native and so-called “invasive” species.
- Absence of signs of extermination or eradication: In contrast to the previous approach, where invasive species were portrayed as problematic and needing to be excluded or eradicated, this illustration lacks symbols of violence or rejection. There are no red Xes, skulls, or elements of aggression, reflecting an internalization of ecohumanism's message that these species should not be blamed for their presence.
- The written message in the illustration: The accompanying text states: "There is no reason to harm invasive species because they are not to blame." This message reflects an attitude of inclusion and an understanding of ecological processes, emphasizing that humans bear part of the responsibility for the existence of invasive species. It aligns with ecohumanism's philosophy, which views invasive species as part of nature, deserving of empathy and understanding rather than blame.

These figures and the message conveyed in it reflect an ecohumanist approach, emphasizing inclusion and the search for solutions that include all species and are not based on dichotomous separation. The approach in the illustration seeks to convey the idea that invasive species are part of the complex system of nature, and that they should be treated out of understanding and awareness and not out of automatic rejection.



Figure 5. Graduate Student Drawing of Her Feelings Toward Invasive Species at The End of The Lecture on Invasive Species

Figure 5 reflects the student's conceptual shift following the ecohumanism-based lecture, using the metaphor of a Rubik's Cube to convey the complexity of the invasive species issue. The combination of colors, shapes, and the accompanying text suggests a nuanced understanding of the topic and highlights the idea that ecological issues cannot be viewed in simple black-and-white terms.

- **Use of the Rubik's Cube metaphor:** The Rubik's Cube symbolizes complexity, indicating that the invasive species issue, much like the cube, requires thoughtful analysis and problem-solving. Just as solving a Rubik's Cube demands looking at multiple facets simultaneously, understanding invasive species involves considering multiple ecological, social, and ethical perspectives.
- **Color diversity in the illustration:** The choice to use various colors represents the diversity inherent in ecological systems, including those impacted by invasive species. This colorful depiction reflects a recognition that invasive species are part of a dynamic and complex natural world. Each colored section suggests a different aspect of the issue, symbolizing that the topic involves numerous variables and cannot be solved with a simple or one-sided solution.
- **The text's message: Complexity of the Topic:** The student's statement highlights the realization that the invasive species issue is intricate: "The subject of invasive species is complex, and one must look at all sides." This reflects a key ecohumanistic principle—an openness to multiple viewpoints and the rejection of simple narratives that vilify invasive species. It emphasizes the importance of understanding these species as part of a larger ecological picture, rather than approaching them with blame or hostility.

The student's use of the Rubik's Cube as a metaphor indicates a profound shift toward a more balanced and thoughtful perspective, aligning with the principles of ecohumanism. The lecture fostered an understanding that the relationships between species—both native and invasive—are intricate, and that environmental challenges require multi-dimensional thinking. This aligns with ecohumanism's call for empathy and critical thinking, acknowledging that nature is not neatly divided into good and bad but is instead a complex interplay of factors.

The example reflected in the drawings was also supported by the students' statements. One student reflected on this shift in perception:

Learning about ecohumanism made me realize that invasive species are not the real problem. It's humans who are moving them around and creating these situations. We can't just blame the species for doing what they naturally do—survive.

This quote reveals the student's growing awareness that invasive species are not inherently harmful but are often victims of human-caused ecological disruption. It reflects a move away from blaming the species

toward a broader consideration of the ecological context.

Another student noted a significant change in a previous emotional response to invasive species, shifting from anger to understanding:

I used to be upset with invasive species, but now I see that it's not fair to blame them. They didn't choose to come here, and they're just adapting to the environment we created for them. It made me rethink how we should approach the problem.

This quote emphasizes the ethical implications of ecohumanism, where students begin to see invasive species as creatures merely adapting to their circumstances, leading to a shift from anger to empathy.

Another student highlighted how their perspective evolved:

The idea that invasive species are simply doing what they need to do to survive really changed my thinking. We shouldn't perceive them as enemies, but rather as part of a larger ecological problem that humans have contributed to.

This reflection presents how students moved from perceiving invasive species as a threat to understanding their place within a human-altered ecosystem, recognizing the broader systemic issues.

Additionally, one student shared:

The lecture really opened my eyes to how complex the issue is. It's easy to blame the species, but it's we who have created the conditions for them to thrive. We need to think about the role we play in the problem.

This statement reflects the growing awareness among students that humans bear responsibility for the spread of invasive species, which challenges their initial "black-and-white" thinking.

Finally, a student noted the importance of this shift in thinking:

It's not just about getting rid of invasive species anymore. It's about understanding why they're here in the first place and figuring out solutions that don't just focus on elimination.

This demonstrates how students began to move beyond simplistic solutions toward more thoughtful and ecologically aware approaches to managing invasive species.

Theme 3: Reflections on the Role of Educators

In reflecting on their future role as educators, one student emphasized the responsibility they feel in shaping young minds regarding environmental issues:

As a teacher, I realize now that I must be very careful about how I present these topics to my students. I can't just tell them that invasive species are 'bad.' I need to show them that it's a complex issue, and help them think about it from different angles.

This quote underscores the student's realization that education is not just about transmitting facts but about fostering critical thinking and encouraging students to understand the complexity of environmental issues.

Another student expressed the importance of presenting issues in a balanced and thoughtful way:

The lecture on invasive species made me think about how I'll talk to my students about the environment. I need to show them that it's not always about 'good' and 'bad,' but about understanding the bigger picture. I want to teach them that every issue has two sides.

This reflection illustrates the shift from viewing environmental education as purely informational to seeing it as a tool for developing students' ethical and critical thinking skills.

Several students also reflected on how the ecohumanism framework could reform their teaching practices, encouraging them to foster critical thinking and ethical reflection in their students. One student noted:

What I take from this for my future teaching is that we need to be careful with the messages we send. I want to help my students see that humans have a big impact on the environment, and that we need to be thoughtful about our actions. It's not about scaring them—it's about helping them think critically.

This quote highlights the student's commitment to fostering a more empathetic and nuanced approach in their future classroom, moving beyond simplistic judgments and encouraging a deeper understanding of ecological challenges.

Lastly, a student reflected on the broader impact of ecohumanism in shaping their future teaching philosophy:

As a future teacher, I feel it's important to teach students that nature is complex and that we must approach it with empathy and responsibility. We can't just think in terms of 'good' or 'bad' species—we need to help them see the bigger picture.

This reflection emphasizes the importance of developing a responsible and empathetic approach to environmental education, recognizing the role teachers play in shaping students' attitudes toward nature.

To sum up, each of these themes reflects a significant shift in the students' attitudes toward invasive species and their broader role as educators. Initially, students regarded invasive species in a simplistic, negative light. After engagement with the ecohumanism framework, they gained a deeper appreciation for the complexity of the issue and recognized their own responsibility as future educators to foster a more balanced and thoughtful approach to environmental challenges. Through this shift, students began to embrace a more holistic understanding of invasive species, moving beyond eradication and blame toward a more responsible and ethical engagement with the natural world.

Discussion

This study aimed to explore how the ecohumanistic framework influences environmental education students' perceptions of invasive species in higher education in Israel. Specifically, the research sought to answer the following central question: How does exposure to ecohumanism shape the attitudes of students of environmental education toward invasive species in Israel? Through the analysis of student reflections and visual representations, the study uncovered a profound transformation in students' perceptions, moving from simplistic, negative attitudes toward more complex, empathetic understandings of invasive species. This transformation highlights the impact of incorporating ecohumanism into environmental education, particularly in addressing ecological challenges like invasive species. Furthermore, and contrary to the literature's call for including dedicated courses on developing moral thinking (Shaw & Stoll, 2021), the findings of this study on invasive species demonstrate that ethical aspects can be integrated as an integral part of the regular curriculum.

One of the critical insights emerging from this study is the limitations of traditional environmental education frameworks, which ethical issues are not consistently integrated into educational programs, which tend to emphasize cognitive and behavioral aspects over ethical ones (Capoano et al., 2024; Masalimova et al., 2023; Panatsa & Malandrakis, 2024). Moreover, traditional environmental education frameworks often portray invasive species as external threats to be eradicated (Gal, 2023; Steele & Pienaar, 2023). This binary framing, which divides nature into "good" and "bad" species, perpetuates a narrative of control and dominance over the natural world (Omosulu & Inja, 2019; Tabe-Ojong, 2023).

Ecohumanism, by contrast, challenges this reductionist perspective by emphasizing inclusivity, empathy,

and ethical responsibility. It urges a holistic approach that accounts for the human-driven causes behind ecological disruptions, aligning closely with the findings of this study (Aloni & Veugelers, 2024; Zapf, 2022). The ecohumanistic approach emphasizes consideration for all components of the ecosystem, including invasive species, with the understanding that they are not "to blame" for their new status within the system. It advocates for avoiding hatred or hostility toward invasive species and instead promotes a nuanced understanding of the factors that led to their spread, thereby advancing a more ethical approach to environmental management and to environmental education (Audley et al., 2024; Capoano et al., 2024; Omosulu & Inja, 2019).

The students' initial artwork, dominated by angry faces, red Xes, and symbols of destruction (as seen in Figure 1 and 2 in the Findings), reflects the common narrative in which invasive species are vilified. However, the lecture on ecohumanism encouraged a shift away from these simplistic views toward more nuanced, compassionate perspectives. By engaging with ecohumanistic principles, students began to recognize the complexity of invasive species as part of broader ecological systems, often driven by human actions (Aivelo, 2023; Ballar et al., 2024; Colombari & Battisti, 2023; McClendon et al., 2024; Orchan et al., 2013; Steele & Pienaar, 2023). This shift reflects the integration of both ecological understanding and ethical reflection, and critical components of ecohumanism (Aloni & Veugelers, 2024; Zapf, 2022).

A significant contribution of this study lies in its exploration of the ethical implications of invasive species management. Students came to understand that invasive species are not inherently harmful but are often victims of human-caused disruptions. The shift in perception from blame to empathy highlights the value of ecohumanism in fostering responsible environmental attitudes. This approach aligns with the ethical call of ecohumanism to move beyond domination and control toward coexistence and mutual respect between humans and nature (Aloni & Veugelers, 2024; Zapf, 2022).

It has previously been found that attitudes toward invasive species can mirror social attitudes, such as the marginalization of migrant populations. Just as invasive species are often framed as threats to native ecosystems, migrant workers and marginalized communities may be viewed as threats to social stability (Atchison, 2019; Ram, 2019). There is an incumbent need to address the phenomenon of invasive species, its effects, and consequences in a different way educationally (Inglis, 2020; Willing, 2022). Moreover, an educational framework that normalizes the taking of lives and disregards the welfare of animals risks fostering cruelty toward both animals and humans (Morris, 2022). By prompting students to reflect on these parallels and recognize that the issue of invasive species is complex, extending beyond purely biological knowledge (Altmeyer & Dreesmann, 2021; Moon et al., 2015; Öhman & Östman, 2008), ecohumanism encourages an inclusive worldview. This perspective challenges discriminatory attitudes while fostering empathy and a sense of responsibility toward all forms of life, both human and non-human (Aloni & Veugelers, 2024; Zapf, 2022).

Students' reflections on their future roles as educators reveal an increased awareness of the need for balanced and thoughtful teaching (Dubois et al., 2017; Newman & Fernandes, 2016; Shaw & Stoll, 2021; Stein, 2019; Waliczek et al., 2018). Because, the management of invasive species, like most environmental issues, is not only a scientific matter but also a social one, as it involves understanding the attitudes and perceptions of local communities, as well as economic, political, and ecological aspects (Dubois et al., 2017; Lewis et al., 2019; Stein, 2019). Therefore, The students in environmental education must go beyond conveying information and include fostering critical thinking and ethical reflection (Dubois et al., 2017; Newman & Fernandes, 2016; Shaw & Stoll, 2021; Stein, 2019).

Integrating the ecohumanistic approach in education responds to the call in the literature to incorporate ethical perspectives in teaching, particularly on issues related to environmental justice and moral action in addressing environmental challenges (Beach, 2023). However, adopting such approaches requires educators to feel confident in navigating complex moral landscapes (Beach, 2023). Therefore, fostering this self-efficacy during teacher training is vital for equipping future educators with the tools needed to promote thoughtful, ethically informed environmental stewardship in the classroom (Aloni & Veugelers, 2024; Beach, 2023).

Conclusion

The ecohumanism can serve as an educational and ethical framework providing new tools to address environmental challenges, such as the phenomenon of invasive species. This underscores the need for a paradigm shift within the education system, including the recognition that nature and humanity are part of a single, integrated system. This approach can serve as a crucial tool in shaping meaningful environmental education that fosters not only knowledge but also ethical and emotional sensitivity toward the world around us. Therefore, this study highlights the importance of ecohumanism as a guiding framework for environmental education. By moving beyond simplistic narratives and fostering a deeper understanding of ecological and ethical complexities, ecohumanism offers a powerful tool for rethinking how we approach environmental challenges. The transformation in students' attitudes—from viewing invasive species as harmful intruders to understanding their role within a human-altered ecosystem—demonstrates the value of integrating ethical considerations into environmental education. As future educators, students must embrace this holistic approach to ensure that environmental education fosters not only ecological knowledge but also the moral and ethical tools needed to address the challenges of a rapidly changing world.

This discussion not only highlights the theoretical and practical contributions of the study but also emphasizes the necessary implementation of these insights within the education system. Education systems should incorporate the following elements into their curricula: 1) Development of systemic and transdisciplinary thinking; 2) Fostering an ethical and critical approach to addressing complex environmental issues; 3) Enhancing teachers' self-efficacy to integrate these principles effectively in their practice.

Contributions

This research contributes to the growing body of literature on environmental education by integrating ecological knowledge with ethical and critical perspectives. It extends current theories on invasive species management by emphasizing the importance of moving beyond ecological frameworks and adopting a more holistic, multidimensional understanding. The study highlights the role of ecohumanism in shifting perspectives from simplistic, dichotomous views to more nuanced reflections, thereby enriching the discourse on human-nature interactions. Furthermore, it offers new insights into the interplay between ecological concepts and education, proposing an innovative framework for fostering critical thinking and responsibility among students. At the practical level, this research demonstrates how ecohumanist education can be integrated as an essential part of environmental education to equip students with tools for critical and ethical thinking. The study also contributes to the theoretical body of knowledge on the integration of ethical and moral issues in the education system. Likewise, it provides a practical educational example by incorporating drawings as an assessment tool for students' environmental perceptions of complex topics, such as invasive species. An additional practical aspect is the demonstration of how a shift in mindset and empathy toward all living beings can be achieved. Similarly, this article emphasizes the need for critical, non-dichotomous thinking that recognizes interconnected relationships.

Limitations and Future Research

While this study offers important insights, it also has several limitations. First, the study was conducted within a relatively small sample of undergraduate and graduate students in Israel, which may limit the generalizability of the findings to other educational contexts or geographical regions. Additionally, the study relied on qualitative data, such as drawings and interviews, which, while rich in detail, may be subjective and open to interpretation. Future research could benefit from incorporating quantitative measures to assess shifts in attitudes more rigorously.

Another limitation is the focus on invasive species within a specific ecological and cultural context. While the findings provide insights into the students' changing attitudes toward invasive species, further research could explore how ecohumanism impacts perceptions of other environmental issues, such as climate change or biodiversity loss, across diverse educational settings.

Future studies should also investigate the long-term impact of ecohumanism on students' attitudes and behaviors. While this research captures a snapshot of their shifting views, it remains unclear whether these changes are sustained over time or influence their future actions as environmental educators. Longitudinal studies could provide deeper insights into the lasting effects of ecohumanistic education.

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