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Ecosystem Protection Curriculum Model with Passive Defense Approach

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A B S T R A C T

The aim of the study was to present a curriculum model for ecosystem protection with a passive defense approach. This research was conducted using a qualitative synthesis method, and the research environment included all Iranian articles (2009-2023) and international articles (2007-2023). A purposive sampling method was applied until data saturation was reached, resulting in the selection of 62 articles. The research instrument was the reading of article texts. Data analysis was carried out based on a classification system of open concepts, organizing concepts, and comprehensive concepts. The results showed that the curriculum model for ecosystem protection with a passive defense approach in the four areas of objectives, methods, content, and activities is as follows: in the dimension of objectives, it includes 6 components (cognitive, affective, psychomotor, metacognitive, meta-affective, and meta-psychomotor); in the dimension of content, it includes 4 components (content organization, content contextualization, content revision, and content integration); in the dimension of methods, it includes 6 components (self-directed learning, self-regulated learning, systemic learning, multiple learning, practical learning, and motivational learning); and in the dimension of activities, it includes 5 components (environmental-centered, exploratory, research-based, dialogic, and contingent).

Keywords: Curriculum, Ecosystem, Passive Defense

1. Introduction

The escalating environmental challenges faced globally have underscored the critical need for effective ecosystem protection strategies. Ecosystems are not only the foundation of biodiversity but also pivotal in sustaining human livelihoods and well-being (Goldstein et al., 2012). In recent years, the degradation of ecosystems due to anthropogenic activities has raised concerns about the sustainability of natural resources and the health of the environment (Ying et al., 2021). In this context, education plays a vital role in fostering environmental awareness and promoting sustainable practices.

Iran, with its diverse climatic regions and rich biodiversity, is no exception to these environmental challenges. The country encompasses a variety of ecosystems, from arid deserts to lush forests, each facing unique threats (Farashi & Shariati, 2017). The degradation of these ecosystems has been exacerbated by factors such as deforestation, overgrazing, and unsustainable agricultural practices (Mazloum et al., 2021). Additionally, the water crisis in Iran has highlighted the urgency of adopting sustainable environmental management practices (Mirzavand & Bagheri, 2020).

Protected areas in Iran, such as the Hyrcanian forests, have been established to conserve biodiversity and protect critical habitats (Sharifi et al., 2011). However, the effectiveness of these protected areas is often undermined by insufficient management strategies and a lack of public awareness (Kolahi et al., 2012). As Jowkar et al. (2016) note, the conservation of biodiversity in Iran faces numerous threats and challenges, but there are also hopes for improvement through enhanced education and policy reforms.

Environmental education is a crucial tool in addressing these challenges by equipping individuals with the knowledge, skills, and attitudes necessary for environmental stewardship (Amanat, 2016). By integrating environmental concepts into curricula, educational institutions can play a significant role in promoting ecosystem protection. As Madadizadeh (2023) emphasizes, fostering pro-environmental intentions requires a comprehensive approach that combines protection motivation and cultural theories within educational frameworks.

In light of this, developing a curriculum model that focuses on ecosystem protection with a passive defense approach becomes imperative. Passive defense, in this context, refers to strategies that minimize environmental damage and enhance resilience without active confrontation or significant intervention (Kolahi et al., 2012). Incorporating passive defense strategies into educational curricula can foster a generation that is more attuned to sustainable practices and environmental conservation.

Previous studies have highlighted the importance of environmental education in promoting sustainable practices. For instance, Sobhani et al. (2022) evaluated ecotourism sustainability indicators in Tehran's protected areas and emphasized the role of education in enhancing ecotourism practices. Similarly, Molaeinasab et al. (2018) assessed soil surface quality in rangeland ecosystems with different protection levels, underscoring the need for informed management practices that can be fostered through education.

Moreover, the integration of environmental education into curricula has been shown to have positive effects on students' environmental attitudes and behaviors. According to Amanat (2016), educating individuals about the cultural and environmental significance of their surroundings can lead to more sustainable behaviors. This is particularly relevant in regions where cultural ties to the environment are strong, such as in Iran.

The development of a curriculum model that emphasizes ecosystem protection also aligns with global efforts to achieve sustainable development goals (Ying et al., 2021). By fostering environmental literacy and stewardship among students, educational institutions contribute to broader conservation efforts and sustainable resource management.

Despite the recognized importance of environmental education, there remains a gap in implementing comprehensive curricula that effectively address ecosystem protection with a passive defense approach. This gap is evident in the limited incorporation of environmental concepts into existing educational programs and the lack of a structured framework to guide curriculum development (Kolahi et al., 2012).

Therefore, this study aims to address this gap by presenting a curriculum model for ecosystem protection with a passive defense approach. The model focuses on four key dimensions: objectives, content, teaching methods, and activities. Each dimension is carefully designed to incorporate cognitive, affective, psychomotor, metacognitive, meta-affective, and meta-psychomotor components, ensuring a holistic educational experience.

Methodology

The research method employed in this study was applied in terms of its objective and qualitative-synthesis in terms of

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its approach. The seven-step meta-synthesis method of Sandelowski and Barroso (2007) was utilized.

The research environment comprised all articles related to the curriculum of ecosystem protection with a passive defense approach, including Iranian articles published between 2009 and 2023 and international articles published between 2007 and 2023. The purposive sampling method was used until data saturation, with 62 articles selected from an initial screening of 91 articles.

The inclusion criteria were as follows: articles indexed in reputable databases, published within the last 20 years, containing sufficient data for extraction, and structured. The research instrument was the reading of selected article texts, which were gathered from valid domestic and international databases for analysis and review. Validity and reliability were assessed based on four methods: credibility, transferability, confirmability, and dependability. Data analysis was conducted using a classification system of open concepts, organizing concepts, and comprehensive concepts. Concepts were classified based on their similarities.

Findings and Results

The first research question was: What are the characteristics of the objective element in the curriculum for ecosystem protection with a passive defense approach?

Table 1. Curriculum Model for Ecosystem Protection with a Passive Defense Approach in the Dimension of Learning Objectives

Organizing Concepts	Open Concepts
Cognitive Objective	Transmission of environmental concepts and their components through textbooks (Code 1), enhancing students' understanding of environmental issues (Code 1), improving the quality of concept transmission based on analysis (Code 1), familiarizing students with the consequences of ecosystem protection (Code 7), raising environmental knowledge levels among students (Code 10), familiarizing students with current environmental conditions and challenges (Code 24), familiarizing students with the goals of environmental protection (Code 12), addressing limitations in environmental knowledge and its protection (Codes 22, 28), familiarizing students with environmental knowledge (Code 5), familiarizing students with cognitive environmental goals based on the Fundamental Transformation Document (Code 6), familiarizing students with reasons for environmental protection (Codes 7, 16), familiarizing students with ecosystem protection phenomena (Code 7)
Affective Objective	**Familiarizing students with affective environmental goals based on the Fundamental Transformation Document (Code 6), value orientation towards ecosystem protection (Code 11)**
Psychomotor Objective	Familiarizing students with psychomotor environmental goals based on the Fundamental Transformation Document (Code 6), addressing psychomotor limitations related to environmental protection (Code 22)
Metacognitive Objective	Familiarizing students with environmental protection laws (Code 5), addressing air pollution (Code 5), fostering environmental mindfulness (Code 11), familiarizing students with laws and rights associated with environmental protection (Code 19), familiarizing students with public responsibilities related to environmental protection (Code 19), familiarizing students with environmental crisis factors (Code 21), familiarizing students with the role of nature in society's survival (Code 21), familiarizing students with factors that disrupt the environmental system (Code 25)
Meta-affective Objective	Addressing limitations in environmental attitudes and protection (Code 22), expressing the importance of national parks in environmental life (Codes 25, 29), familiarizing students with environmental protection obstacles (Code 7), familiarizing students with factors influencing environmental protection (Code 20)
Meta-psychomotor Objective	Achieving the intended ecosystem curriculum (Code 1), developing intrapersonal skills (Code 42), developing interpersonal skills (Code 42)

Based on the findings from Table 1, the curriculum model for ecosystem protection with a passive defense approach in the dimension of learning objectives included six organizing concepts: cognitive objective, affective objective, psychomotor objective, metacognitive objective, meta-affective objective, and meta-psychomotor objective.

The second research question was: What are the characteristics of the content element in the curriculum for ecosystem protection with a passive defense approach?

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Table 2. Curriculum Model for Ecosystem Protection with a Passive Defense Approach in the Dimension of Learning Content

Organizing Concepts	Open Concepts
Content Organization	Organizing environmental learning content (Code 4), environmental knowledge relevant to location (Code 33), environmental knowledge relevant to ecotourism (Code 33), integrating ecological knowledge into curricula (Code 53)
Content Contextualization	Contextualizing environmental learning content (Code 53), contextual content for ecosystem protection (Code 7), familiarizing students with environmental protection content (Code 12)
Content Revision	**Revising environmental learning content (Code 9), diversifying educational content to improve environmental protection understanding (Code 3), developing environmental protection knowledge (Code 36)**
Content Integration	Integrating environmental knowledge (Code 38), new environmental protection laws (Code 56)

Based on the findings from Table 2, the curriculum model for ecosystem protection with a passive defense approach in the dimension of learning content included four organizing concepts: content organization, content contextualization, content revision, and content integration.

The third research question was: What are the characteristics of the teaching-learning methods in the curriculum for ecosystem protection with a passive defense approach?

Table 3. Curriculum Model for Ecosystem Protection with a Passive Defense Approach in the Dimension of Teaching-Learning Methods

Organizing Concepts	Open Concepts
Self-directed Learning	Personal development through technical skills (Code 8), personal development through human skills (Code 8), personal development through social skills (Code 8), personal development through physical skills (Code 8), personal development based on critical thinking (Code 44), fostering environmental political thinking (Code 22), fostering environmental economic thinking (Code 22), fostering environmental ecological thinking (Code 22), personal development with a systemic thinking approach (Code 37), personal development through self-directed learning (Code 37)
Self-regulated Learning	Strategy for vision change based on environmental protection (Code 14), strategy for attitude change based on environmental protection (Code 14), strategy for competence change based on environmental protection (Code 14), revising environmental teaching methods (Code 9), personal development through self-regulated learning (Code 37), employing scientific production strategies by students (Code 33), improving knowledge enhancement processes (Code 51), making changes in educational policies (Code 51), explaining the human role in the environmental ecosystem (Codes 2, 28), familiarizing students with strategies for preventing environmental crises (Codes 26, 28), developing geographical environmental perception (Code 30)
Multiple Learning	Focused group discussion (Code 44), spiral interaction with different resources (Code 44), utilizing multiple teaching-learning strategies (Code 16), employing active teaching methods (Code 17), familiarizing students with environmental protection teaching-learning strategies (Code 12), using exploratory learning methods to analyze environmental protection (Code 2), using group collaboration teaching methods (Code 4), employing cultural teaching strategies (Code 7), using environmental management teaching strategies (Code 7)
Systemic Learning	Appropriate teaching methods (Code 1), strategy for learning citizenship behavior with an environmental protection approach (Codes 14, 29), strategy for learning nature-oriented behavior with an environmental protection approach (Code 14), strategy for learning tourism behavior with an environmental protection approach (Code 14), strategy for learning ecotourism behavior with an environmental protection approach (Code 14)
Motivational Learning	Using exploratory learning methods (Code 4), peer-assisted learning (Code 1), reverse learning strategies to improve environmental protection (Code 3), using research-based teaching methods (Code 4), employing practical learning strategies (Code 4), using inquiry-based learning methods inside the school (Code 48), using inquiry-based learning methods outside the school (Code 48), utilizing excellence-oriented learning strategies (Code 11), demonstrating initiative in teaching-learning activities (Code 55), adopting new thinking styles (Code 54), stimulating student interest in environmental topics after education (Code 62), stimulating student interest in environmental topics during education (Code 62), employing motivational learning strategies (Code 52)
Practical Learning	**Practical teaching methods (Code 32), practical requirements for environmental protection (Code 60), environmental safety strategies (Code 39), engaging students in environmental sciences (Code 44), mentally engaging students in environmental phenomena (Code 62), using non-technical approaches in teaching-learning processes (Code 23)**

Based on the findings from Table 3, the curriculum model for ecosystem protection with a passive defense approach in the dimension of teaching-learning methods included six organizing concepts: self-directed learning, self-regulated learning, systemic learning, multiple learning, practical learning, and motivational learning.

The fourth research question was: What are the characteristics of the teaching-learning activities in the curriculum for ecosystem protection with a passive defense approach?

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Table 4. Curriculum Model for Ecosystem Protection with a Passive Defense Approach in the Dimension of Teaching-Learning Activities

Organizing Concepts	Open Concepts
Contingent Activities	Growth of ecological and environmental knowledge (Code 61), growth of ecological and environmental attitudes (Code 61), using motivational learning activities (Code 42), utilizing interdisciplinary approaches in environmental education (Code 59)
Dialogic Activities	Using dialogue methods for environmental protection (Code 56), environmental discourses (Code 27), linking environment and education (Code 27), improving environmental education (Code 54), new collective environmental ethics (Code 54)
Environmental-centered Activities	Identifying environmental ecosystem threats (Code 5), identifying environmental ecosystem opportunities (Code 5), identifying environmental ecosystem threats (Code 5), designing environmental-centered learning activities (Code 23), designing human-centered learning activities (Code 23), constraints imposed by environmental crises (Code 35), integrating environmental protection education into curricula (Codes 38, 40)
Research-based Activities	Reporting environmental protection conferences and meetings (Code 24), familiarizing students with environmental capacities (Code 31), learning activities associated with the need for environmental survival (Code 32), research-oriented environmental protection activities (Code 57), presenting the multiple values of ecological knowledge (Code 53), familiarizing students with the life cycle (Code 28), energizing teaching-learning activities (Code 55)
Exploratory Activities	Reviewing environmental learning activities (Code 9), exploratory learning activities to understand the value of the environment (Code 15), problem-solving learning activities to understand the value of the environment (Code 15), processing learning activities to understand the value of the environment (Code 15)

Based on the findings from Table 4, the curriculum model for ecosystem protection with a passive defense approach in the dimension of teaching-learning activities included five organizing concepts: environmental-centered activities, exploratory activities, research-based activities, dialogic activities, and contingent activities.

Discussion and Conclusion

The present study aimed to develop a comprehensive curriculum model for ecosystem protection with a passive defense approach, focusing on four key dimensions: objectives, content, teaching methods, and activities. The analysis of 62 selected articles led to the identification of critical components within each dimension, emphasizing the multifaceted nature of environmental education.

The results revealed that the dimension of learning objectives encompasses six organizing concepts: cognitive, affective, psychomotor, metacognitive, meta-affective, and meta-psychomotor objectives. This holistic approach aligns with the educational frameworks proposed by Madadizadeh (2023), who emphasized the importance of integrating cognitive and affective elements to foster pro-environmental intentions toward sustainable rangeland management. By incorporating metacognitive and meta-affective objectives, the curriculum encourages students to engage in higher-order thinking and self-reflection regarding environmental issues, which is crucial for developing long-term sustainable behaviors (Amanat, 2016).

The emphasis on psychomotor objectives highlights the necessity of practical skills in environmental protection. Molaeinasab et al. (2018) demonstrated that hands-on activities in soil surface quality assessment significantly enhance students' understanding of ecosystem dynamics. Similarly, the inclusion of meta-psychomotor objectives suggests a need for students to internalize and continuously improve their practical skills, fostering a lifelong commitment to environmental stewardship.

In the dimension of content, four organizing concepts were identified: content organization, content contextualization, content revision, and content integration. This structured approach to content development ensures that educational materials are relevant, up-to-date, and interconnected. Kolahi et al. (2012) highlighted the challenges in Iran's protected areas due to outdated or fragmented educational content. By advocating for content revision and integration, the curriculum model addresses these gaps, promoting a more cohesive understanding of environmental issues.

Content contextualization is particularly significant in making learning relevant to students' local environments. Farashi and Shariati (2017) emphasized the importance of regional biodiversity hotspots in Iran, suggesting that localized content can enhance students' appreciation and commitment to ecosystem protection. Moreover, integrating ecological knowledge into curricula, as suggested by Liang et al. (2022), can improve ecological security and ecosystem quality by making education more place-based and context-specific.

The teaching-learning methods dimension includes six organizing concepts: self-directed learning, self-regulated learning, systemic learning, multiple learning, practical learning, and motivational learning. This diverse array of methods caters to different learning styles and promotes active engagement. Self-directed and self-regulated learning empower students to take ownership of their education, fostering autonomy and critical thinking skills (Amanat, 2016). Such approaches are supported by Khoshand (2021),

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who advocated for the application of artificial intelligence and innovative teaching methods in groundwater ecosystem protection education.

Systemic learning encourages students to understand the interconnectedness of environmental systems, which is essential for addressing complex ecological challenges. This method aligns with the findings of Wang et al. (2021), who stressed the need for integrated approaches in managing the water-food-energy-ecosystem nexus in the Asian alpine belt. Multiple learning strategies, including collaborative and interdisciplinary methods, enrich the educational experience and have been shown to enhance ecological literacy (Ying et al., 2021).

Practical learning is a cornerstone of effective environmental education, as it provides students with hands-on experience in ecosystem protection. Molaeinasab et al. (2018) demonstrated that practical activities in rangeland ecosystems significantly improve students' understanding of environmental protection measures. Motivational learning methods aim to inspire and engage students, fostering a positive attitude toward environmental stewardship. Sobhani et al. (2022) emphasized the role of motivational strategies in promoting sustainable ecotourism practices in Tehran's protected areas.

The dimension of teaching-learning activities comprises five organizing concepts: environmental-centered activities, exploratory activities, research-based activities, dialogic activities, and contingent activities. Environmental-centered activities focus on direct interaction with the environment, which enhances experiential learning and fosters a deeper connection to nature (Gholami et al., 2020). Exploratory and research-based activities encourage inquiry and critical analysis, aligning with the approaches suggested by Jowkar et al. (2016) for improving biodiversity conservation through informed decision-making.

Dialogic activities promote discussion and reflection, facilitating the exchange of ideas and perspectives. This method is supported by Amanat (2016), who highlighted the importance of cultural dialogue in environmental education. Contingent activities allow for adaptability in teaching, enabling educators to respond to emerging environmental issues or student interests. Such flexibility is crucial in dynamic ecosystems, as noted by Farrokhzadeh et al. (2020) in their study on sustainable water resources management in arid areas.

The comprehensive curriculum model developed in this study addresses the multifaceted nature of environmental education by integrating cognitive, affective, and psychomotor elements across all dimensions. This holistic approach ensures that students not only acquire knowledge but also develop the necessary skills and attitudes for effective ecosystem protection. The inclusion of passive defense strategies within the curriculum aligns with the need for sustainable and non-invasive environmental management practices (Kolahi et al., 2012).

Comparing these findings with previous studies highlights the consistency and relevance of the proposed curriculum model. For instance, the emphasis on self-directed and self-regulated learning mirrors the approaches recommended by Khoshand (2021) for enhancing ecosystem protection through innovative educational methods. The focus on content integration and contextualization corresponds with the suggestions of Liang et al. (2022) and Farashi and Shariati (2017) for improving ecological security through place-based education.

The incorporation of practical and motivational learning methods aligns with the findings of Molaeinasab et al. (2018) and Sobhani et al. (2022), who emphasized the effectiveness of hands-on and engaging educational strategies in promoting environmental stewardship. Moreover, the inclusion of dialogic and exploratory activities supports the arguments of Amanat (2016) and Jowkar et al. (2016) for fostering critical thinking and informed decision-making in environmental conservation.

Overall, the curriculum model presented in this study offers a structured and comprehensive framework for environmental education that is supported by contemporary research. By addressing the cognitive, affective, and practical aspects of learning, the model aims to cultivate environmentally conscious individuals equipped with the knowledge, skills, and attitudes necessary for sustainable ecosystem management.

Despite the comprehensive approach of this study, there are several limitations to consider. First, the reliance on literature from selected articles may introduce bias, as the findings are contingent on the scope and quality of the available research. The exclusion of unpublished studies or articles outside the specified time frame may have omitted relevant information. Second, the qualitative synthesis method, while thorough, is inherently subjective, and the interpretation of concepts may vary among researchers. Third, the curriculum model has not been empirically tested in educational settings, limiting the ability to assess its practical effectiveness and adaptability across different contexts.

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Future research should focus on empirically testing the proposed curriculum model in various educational settings to evaluate its effectiveness and adaptability. Longitudinal studies could assess the impact of the curriculum on students' environmental knowledge, attitudes, and behaviors over time. Additionally, expanding the research to include diverse cultural and ecological contexts would enhance the generalizability of the findings. Investigating the integration of technology and digital resources within the curriculum could also provide insights into innovative teaching methods for ecosystem protection.

Educators and curriculum developers are encouraged to adopt the proposed model to enhance environmental education programs. Emphasizing holistic learning objectives and incorporating diverse teaching methods can foster a more engaging and effective learning experience. Tailoring content to local environmental contexts and involving students in practical, hands-on activities can deepen their connection to the ecosystem and promote sustainable behaviors. Collaboration with environmental organizations and experts can enrich the curriculum and provide real-world relevance to the educational content.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethical Considerations

In this study, to observe ethical considerations, participants were informed about the goals and importance of the research before the start of the interview and participated in the research with informed consent.

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