

AI-BASED GAMIFICATION METHODS IN ENVIRONMENTAL PROTECTION EDUCATION

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Annotation: this article explores the integration of artificial intelligence (AI) and gamification in environmental protection education. It highlights how digital technologies can enhance ecological literacy, motivate learners, and develop responsible environmental behavior. The research introduces a new AI-based educational game, “Green Leaf,” designed to help students make eco-friendly decisions through interactive learning. The study emphasizes the pedagogical potential of gamified AI systems to personalize learning experiences and connect theoretical ecological concepts with real-life actions. This innovative approach aims to strengthen sustainability-oriented education and prepare environmentally conscious future generations.

Keywords: artificial intelligence, gamification, “green leaf” game, environmental education, pedagogical innovation, digital learning, environmental awareness.

Introduction. In the modern world, environmental education plays a crucial role in promoting sustainable development and ecological awareness[1]. However, traditional teaching methods are often insufficient to engage today’s digitally active learners. The combination of artificial intelligence and gamification offers new opportunities to make learning about environmental protection more interactive, personalized, and emotionally engaging. AI technologies allow teachers to analyze student behavior, adapt learning materials to their needs, and provide real-time feedback[2][3]. Gamification, on the other hand, uses competition, rewards, and storytelling to increase motivation and retention. When combined, these two methods can create a powerful digital learning environment that develops ecological values and practical habits.

Main Body. Artificial intelligence can analyze how students learn and provide personalized recommendations. For example, an AI system can identify students who need more support with topics such as recycling or energy conservation and adjust the level of difficulty accordingly[4]. Gamification elements like points, badges, and challenges transform the learning process into an active and engaging experience. Together, these technologies create a dynamic, feedback-driven learning cycle where students learn not only through reading but through action and reflection[5].

Innovative Educational Game: “Green Leaf”

To make environmental learning more interactive, a simple AI-based game called “Green Leaf” was created. The game helps students understand how everyday decisions affect the environment. It combines gamified scenarios with AI feedback to strengthen environmental thinking and awareness.

Game Idea:

Students are presented with short, real-life situations where they must choose the most environmentally friendly option. For every correct choice, they earn points; for harmful actions, AI shows how it negatively affects nature through short animations or messages.

Example Questions:

1. You finish drinking water. What do you do with the plastic bottle?

a) Throw it in the trash

b) Recycle it

→ Correct answer: b) – AI explains how recycling saves energy and reduces pollution.

2. You are leaving your classroom. What do you do?

a) Leave the lights on

b) Turn off the lights

→ Correct answer: b) – AI visualizes reduced CO₂ emissions.

3. You are shopping. Which bag do you choose?

a) Plastic bag

b) Reusable cloth bag

→ Correct answer: b) – AI shows how cloth bags help protect oceans from plastic waste.

How It Works:

- The game can be played on phones or computers.
- AI records correct answers and gives personalized feedback.
- At the end, players receive a “Green Level” (Starter-Who they are:

Starters are players who are just starting to learn about environmental protection. They often make incorrect choices or fail to fully understand the environmental impact of their daily actions. → Eco Leaf-Who they are: Eco Leaf already have a basic understanding of environmental issues. They usually make good choices but still occasionally overlook the most eco-friendly option. → Eco Tree-Who they are: Eco Trees are players who consistently make the right environmental choices. They demonstrate high awareness, responsible behavior, and a strong commitment to protecting nature. They act not only for personal gain but also for the well-being of the planet and their community.).

- Teachers can access performance reports and discuss decisions with students.

Educational Benefits:

- Builds environmental habits through fun decision-making.
- Easy to use and accessible to all learners.
- Promotes critical thinking and real-world problem-solving.
- Encourages teamwork when played in groups.
- Connects digital learning with ecological responsibility.

Unique Features:

1. AI-Powered Feedback: Explains environmental consequences of each decision.
2. Local Context Integration: Adapts to regional ecological issues.
3. Eco Diary: Provides students with personalized sustainability reports.
4. Collaborative Mode: Promotes teamwork and shared responsibility.

Research Value:

The “Green Leaf” model represents an innovative pedagogical tool that transforms environmental education into an active, technology-supported process. It helps students not only understand ecological issues but also take meaningful action toward sustainability.

Conclusion. AI-based gamification has the potential to revolutionize environmental education by turning abstract concepts into real experiences. The “Green Leaf” game demonstrates how simple digital tools can inspire ecological thinking, promote responsible behavior, and make learning both engaging and educational. By integrating artificial intelligence with environmental lessons, teachers can motivate students to develop lifelong eco-friendly habits. This approach proves that innovation and sustainability can coexist effectively in the modern classroom, leading to a more conscious and responsible future generation[6].

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