A Magical Journey Through Brazilian Biomes with Customized Artificial Intelligence

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Abstract. Introduction: *Claws of Fate is a 2D adventure game for players with prior experience in reflex-based platformers, offering a guided and accessible experience. Set in Brazilian biomes such as the Amazon Rainforest and Caatinga, it follows a guardian whose cat escapes through magical portals. The journey to regain the animal's trust introduces themes like animal welfare, ethical pet care, and environmental conservation as aspects of collective health.* ***Objective:*** *This work presents a game designed to raise awareness of the connections between human behavior, animal well-being, and ecosystem preservation. Through a simple narrative and age-appropriate challenges, it supports health education and ethical reflection in early adolescence.* ***Methodology:*** *The game features an AI-based guide that provides real-time text and audio instructions, offering a safe and engaging experience tailored to players. Usability tests were conducted with young adults acting as proxies to assess interface clarity, narrative coherence, and technical performance, focusing on playability and responsiveness.* ***Results:*** *The game aims to contribute to health education by fostering empathy, responsible pet care, and environmental awareness. Its combination of accessible gameplay and AI guidance offers a developmentally appropriate way to explore human-animal relationships and collective health.*
Keywords *Serious game, AI, Brazilian biomes, Animal welfare, Environmental conservation.*

1. Introduction

Adventure games hold significant educational potential, particularly when addressing environmental conservation and biodiversity awareness. By incorporating playful, narrative-driven elements centered on fauna, flora, and ecosystem interactions, such games can promote ecological awareness and reinforce values such as respect for nature, habitat preservation, and responsible coexistence with wildlife [Hungerford and Volk 1990].

For many young people, the first connection with animal care begins through domestic pets. These experiences often serve as a foundation for building empathy and responsibility—key values that extend naturally to broader environmental contexts [Bone 2013]. Expanding this learning to the scale of national biomes, digital games emerge as powerful tools for communicating environmental concepts in a way that is

both engaging and cognitively stimulating for adolescents. Building on this foundation of environmental education, immersion becomes a key element in bridging the gap between virtual experiences and real-world awareness. A promising direction in this context is the integration of Artificial Intelligence (AI) as a personalized in-game assistant—capable not only of guiding players through diverse ecosystems, but also of engaging in dialogue, enriching the experience with contextual knowledge and a sense of presence [Gao et al. 2024].

This work presents *Claws of Fate*[1], a 2D adventure game for players with prior experience in reflex-based platformers, set in the Amazon Rainforest and Caatinga. This age group was selected for its capacity to engage with platform mechanics, narrative structures, and ethical-environmental themes. Gameplay is supported by an AI companion that provides personalized textual and audio feedback based on player interactions with animals, plants, and ecosystem elements. The game showcases native biodiversity and serves as a testbed for integrating generative AI in educational games. In addition to presenting the game's design and AI integration, this study reports initial user experience insights based on a multi-instrument evaluation, combining established UX models to assess usability, immersion, visual appeal, and emotional engagement. Findings support the overall approach while indicating the need to improve the accessibility of AI guidance during gameplay. Performance tests confirmed reliable real-time integration using GPT-4o and GPT-3.5 Turbo.

2. Related Work

Digital games offer interactive environments for education, allowing learners to explore content playfully while receiving immediate, personalized feedback. This section reviews commercial and academic games that address environmental conservation and education, as well as the growing role of generative AI in enhancing interactivity and learning.

2.1. Games Promoting Environmental Conservation

Numerous games promote environmental awareness through exploration, simulation, and narrative. *Eco* simulates the challenge of building sustainable societies, balancing development and ecology. *Planet Zoo* emphasizes animal welfare and habitat design, while *Animal Crossing: New Horizons* fosters harmonious living with nature. Games like *Fe*, *ABZÛ*, and *Never Alone* use visual storytelling to immerse players in terrestrial, aquatic, and folkloric ecosystems, raising ecological awareness. Other titles—*Rewilding*, *Sim Safari*, *Endling: Extinction is Forever*, *Beyond Blue*, *Terra Nil*, *Subnautica*, and *Flower*—span genres and platforms but share a focus on environmental education and conservation urgency.

Educational games designed for younger audiences include *Resgate Selvagem*, a 2D puzzle-platformer teaching Brazilian biomes, and Aventuras na Amazônia, a 3D RPG exploring Amazonian biodiversity. *Life Green* blends point-and-click mechanics with environmental decision-making, while *SimSustentabilidade* invites players to build sustainable societies through strategic planning and citizen science. Games like *Endless Ocean* and *Claws of Fate* build interactive species databases as players explore

[1]A short teaser video of our game is available at
https://www.youtube.com/watch?v=dSKkHBuR148&ab_channel=ClawsOfDestiny

ecosystems. *Assassin's Creed: Discovery Tour* takes a similar approach with historical landmarks, offering contextual learning in a museum-like experience. *Eco, Planet Zoo,* and *Animal Crossing: New Horizons* share *Claws of Fate*'s focus on sustainability and environmental awareness. *Claws of Fate* differs by combining narrative and player action with AI that simulates real-time environmental responses. This approach supports environmental education for a variety of audiences, through personalized and guided interactions.

2.2. Artificial Intelligence in Games

AI-powered games are redefining interactivity. *AI Dungeon* uses generative language models to co-create narratives with players in real time, similar to how *Claws of Fate* leverages ChatGPT for contextual storytelling and player interaction.

In education, *Minecraft Education Edition* integrates generative AI (e.g., Azure OpenAI) with NPCs that answer questions and guide learning. Like *Claws of Fate*, these games use text-based AI agents to foster engagement and reinforce educational outcomes. *Akinator*, using decision trees and reinforcement learning, shows how AI can infer player intent and adapt responses dynamically, another parallel with *Claws of Fate*'s adaptive gameplay. Another game, *Osmo – Reading Adventure*, employs AI for adaptive early literacy education. It uses speech recognition and computer vision to provide real-time feedback, mirroring *Claws of Fate*'s AI-driven personalization for educational goals. Recent work has explored the use of deep learning to automate game art creation, enabling the generation of production-ready assets from sketches with minimal human input [Serpa and Rodrigues 2019, Serpa and Rodrigues 2022].

The rise of generative models like ChatGPT is transforming game development [Huang and Huang 2023]. Platforms such as *Inworld, MindOS, Promethean AI,* and *Ludo.ai* enable dynamic NPC behavior, automated 3D environment creation, and gameplay adaptation based on player input. ChatGPT also powers in-game assistants, offering real-time, personalized support—especially valuable in managing parental controls and content moderation. These advances raise concerns around copyright, data privacy, and the need for human oversight. Emerging frameworks promote transparency and accountability. Some examples of generative AI tools include ChatGPT-3.5 Turbo, GPT-4, GPT-4o, and Azure Speech Studio support text and voice-based AI [Carvalho and Rodrigues 2023] integration. Some works explore the use of AI with Retrieval Augmented Generation (RAG) to generate adaptive facial expressions in 3D game characters [Junior et al. 2025].

3. Game Overview

Developed in Unity, *Claws of Fate* follows 15-year-old Peter and his cat, Violet, on a journey through Brazil's Amazon Rainforest and Caatinga. Designed to blend education and entertainment, the game features an AI companion that provides accessible textual guidance to support engagement and learning. The story begins as Peter neglects Violet, damaging their bond. When a portal appears, Violet disappears into it, and Peter follows—arriving in the Amazon rainforest. This marks the start of his quest to find Violet and restore their relationship, exploring Brazilian biomes along the way (Figure 1).

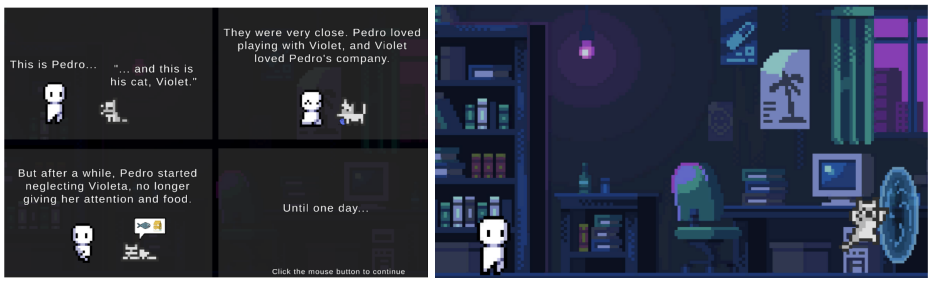

Figure 1. Story introduction (left) and Violet entering the magical portal (right)

3.1. Game Phases and Gameplay

Players control Peter using event-based mechanics that support movement, jumping, dashing, and, later, double jumping. The game is divided into two phases, set in the Amazon Rainforest and the Caatinga, connected by a central Hub where Violet occasionally appears. To regain her trust, players must collect three favorite items—yarn, fish, and milk—some of which require abilities unlocked in the other biome, encouraging cross-phase exploration. In the Amazon, Peter interacts with native species and gains a frog-inspired *power-up* for double jumping; and in the Caatinga, a snake-inspired ability for quick movement through narrow spaces. Each phase begins with a brief guide who grants the biome-specific ability. Violet's items reflect emotional ties: yarn recalls play, fish her favorite food, and milk symbolizes home. Collecting all three unlocks the final Hub encounter to restore the bond with Violet. Each biome features supportive and hazardous elements. In the rainforest, Peter meets capybaras, birds, macaws, and jaguars, while avoiding piranhas and navigating water lilies. In the Caatinga, obstacles include cacti, lizards, and scorpions, reinforcing its dry, rugged setting. Collecting all items is essential to completing the journey.

3.2. Biome-Modeled Scenes

Players enter each biome through blue oval portals, like the one that appeared in Peter's home. The journey begins in the Amazon Rainforest (Figure 2), where Peter explores an environment filled with native flora and fauna. A humanoid NPC introduces key species and warns about dangers such as piranhas, carnivorous plants, thorns, and venomous creatures. Players navigate rivers by jumping across lily pads while avoiding hazards. Background animals like frogs and macaws enhance immersion. A special blue frog grants Peter a double-jump ability, unlocking access to higher areas.

Players must also collect scattered trash to activate the portal at the end of this phase (Figure 2). This segment builds on the double-jump mechanic and introduces a snake challenge. A brief cutscene adds humor as Peter mistakes a macaw for Violet. Once the trash is collected, Peter rides a jaguar across thorny terrain and receives a frog medallion, officially unlocking the double-jump. Peter then visits the Caatinga biome (Figure 3), marked by warm yellow-red tones contrasting the Amazon's green. Cacti obstruct, snakes and macaws cause damage, and scorpions raise difficulty. Players collect trash, use double jump and a new "fast forward" ability, and gather items to regain Violet's trust.

Back in the Hub (Figure 4), players can revisit biomes, complete missed objectives, and interact with the AI for deeper learning about environmental themes. Once

Figure 2. Amazon biome (fauna and flora), and frog medallion reward (last image)

Figure 3. The Caatinga biome featuring examples of its fauna and flora

all trash and key items are collected, a final portal appears, allowing Peter and Violet to return home. The Hub serves as a central space for managing progress, reflecting on key messages, and reinforcing themes of empathy, care, and coexistence.

4. BiomesAI: Integrating AI Technologies into Game Biomes

BiomesAI is an integrated system that provides players with contextual, on-demand educational content about the fauna and flora of each biome in the game. By interacting with biome-specific elements, players receive personalized explanations in real time, delivered via text or audio. To support this feature, we used OpenAI's ChatGPT for generating textual content and Azure's Speech Studio for converting text to audio. The system was embedded directly into the Unity engine through a custom API client, allowing real-time responses without the need for external tools or manual input.

4.1. BiomesAI Architecture

BiomesAI uses a modular architecture designed for flexibility and responsiveness during gameplay. It consists of four main components: (1) AI Manager, which coordinates

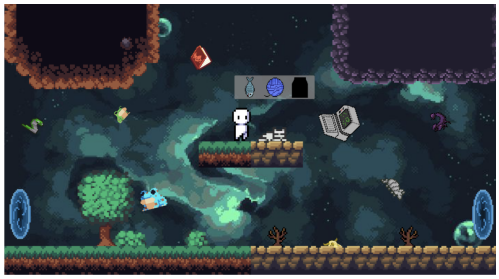

Figure 4. Central Hub where the game ends with success or failure

communication between the game and AI services; (2) Content Generator, which sends prompts to ChatGPT to generate educational descriptions of biomes and species; (3) Local Cache, which stores responses to reduce latency and API calls; and (4) Resource Handler, which manages content saving and loading across sessions for continuity. Two supporting modules handle data structure: OpenAIResponse, which formats ChatGPT outputs for clarity and consistency, and BiomesData, which defines how content is stored and shared across components. To simplify future integration with cloud-based AI tools, we also developed a support library, `Nuvia`, which manages backend connections to ChatGPT. This allows developers to focus on game content rather than implementation details.

4.2. The Prompts of BiomesAI

BiomesAI provides educational content using data preloaded into a local cache from a predefined file (`Predefined.json`). If a requested species or biome term is not found, and if enabled, BiomesAI can query ChatGPT to supplement its knowledge base. In this version, however, real-time queries are disabled to maintain content control and ensure that only pre-approved educational material is shown to players.

Each ChatGPT interaction is based on two prompts: 1. A system prompt that positions the AI as a specialist in Brazilian biomes, and 2. A user prompt that requests a concise, two-paragraph explanation of a specific term. Since the `term` values are strictly controlled within the game, the system prevents players from inputting arbitrary or inappropriate requests. This controlled prompt structure is summarized as follows:

Type of *prompt*	*Prompt*
system	You are an expert in Brazilian geography and biology. Specifically, you are knowledgeable about Brazilian biomes, their fauna, and flora.
user	Describe, in one to two paragraphs, **{term}**

4.3. Audio Output and Voice Design in BiomesAI

BiomesAI complements text responses with pre-generated audio, created using Azure's Speech Studio. Pre-generation was chosen over real-time synthesis to ensure content safety and control. Azure was selected for its high-quality Portuguese female voices, which align with research suggesting that such voices are perceived as more welcoming by young people [Kao et al. 2021]. This supports comfort and engagement, reinforcing caregiver-like associations during gameplay. All audio was integrated via standard Unity tools. Real-time voice synthesis is not used, reflecting a design choice prioritizing safety and consistent player experience.

4.4. Mode of Operation of BiomesAI

BiomesAI operates in three stages: 1. **Preparation:** BiomesAI is integrated into Unity (2022.3.x) via a manager component configured with two files: one for the OpenAI access key, and another with curated educational content on biomes, fauna, and flora, these ensure safe, age-appropriate responses; 2. **Content Generation:** A demonstration scene that allows developers to generate short explanatory texts using ChatGPT, based on biome-related keywords, all outputs are saved locally and pre-approved for in-game use, and 3. **In-Game Usage:** During gameplay, BiomesAI retrieves educational responses when players interact with environmental elements, with content coming from a local cache, ensuring safety and consistency, optional audio playback is supported. No live AI queries are made in the release version, maintaining full content control.

5. Optimizing AI Feedback for Flow and Engagement

To assess in-game AI viability, we tested GPT-3.5 Turbo, GPT-4, and GPT-4o for response time and token speed, calculated as the total number of tokens (input + output) divided by the response time. GPT-4 was slowest (>10s, 31 tokens/s), while GPT-3.5 Turbo and GPT-4o were faster ($\approx$70 and 89 tokens/s). Prioritizing responsiveness, especially in educational or therapeutic settings, we adopted GPT-4o and GPT-3.5 Turbo. All AI outputs were pre-generated to balance personalization, cost, and fluid gameplay. Real-time AI shows promise for health-focused use, with animations or audio cues maintaining immersion during short delays.

6. User Experience Evaluation

Twenty participants (aged 20–23, predominantly male, experienced players familiar with digital games) completed a full gameplay session and responded to a post-play UX questionnaire.

6.1. Multi-Instrument Evaluation Strategy

The evaluation followed a hybrid UX metrics strategy, applying multiple established models. Each question was mapped to a specific instrument aligned with the type of construct being measured—ranging from functional usability and cognitive load to emotional engagement and aesthetic appeal. The instruments used included *AttrakDiff* [Hassenzahl 2003], *Game Experience Questionnaire (GEQ)* [IJsselsteijn et al. 2013], *Post-Study System Usability Questionnaire (PSSUQ)* [Lewis 1995], *User Experience Questionnaire (UEQ)* [Schrepp et al. 2017], *Curve* [Battarbee 2004], *NASA-TLX* [Hart and Staveland 1988], and adapted methods from the *Microsoft Desirability Toolkit* [Benedek and Miner 2002] to capture emotional impressions. Open-ended responses based on the *Open-Ended Feedback* metric [Lazar et al. 2017] were also collected to complement the quantitative data with qualitative insights. This approach enabled a multidimensional understanding of the player experience, spanning from functional usability (e.g., interface clarity, navigation, task flow) to affective perception (e.g., immersion, emotional engagement, aesthetic appeal).

6.2. Questionnaire

The following questionnaire consists of 13 quantitative questions (Q1 to Q9 and Q11 to Q14), as well as descriptive adjectives (Q10) and open-ended suggestions (Q15). Each

item in the evaluation corresponds to a targeted aspect of the user experience, designed to gather both objective scores and subjective impressions.

Q1. Is the AI-generated information about fauna and flora (visual and textual) clear and consistent? (1 = Strongly disagree, 5 = Strongly agree)

1	2	3	4	5

Q2. In your opinion, does the game effectively promote a positive message about animal care? (1 = Strongly disagree, 5 = Strongly agree)

1	2	3	4	5

Q3. Did the game provide an immersive experience? (1 = Strongly disagree, 5 = Strongly agree)

1	2	3	4	5

Q4. Did you find the visual design of the game appealing? (1 = Not appealing, 5 = Very appealing)

1	2	3	4	5

Q5. Did you find the game interface intuitive and easy to use? (1 = Strongly disagree, 5 = Strongly agree)

1	2	3	4	5

Q6. Was navigation through the biomes clear and easy to understand? (1 = Strongly disagree, 5 = Strongly agree)

1	2	3	4	5

Q7. Was the interaction with game elements (NPCs, item collection, fauna, and flora) smooth and fluid? (1 = Strongly disagree, 5 = Strongly agree)

1	2	3	4	5

Q8. Did the game make you feel that your choices or actions influenced the progression of the narrative? (1 = Strongly disagree, 5 = Strongly agree)

1	2	3	4	5

Q9. Did the information about fauna and flora feel relevant to your experience in the game? (1 = Strongly disagree, 5 = Strongly agree)

1	2	3	4	5

Q10. Which adjectives best describe your perception of your overall experience with the game? Pick up to 5 adjectives from the list below.

☐ Exciting	☐ Stressful	☐ Empathetic
☐ Frustrating	☐ Surprising	☐ Environmental
☐ Challenging	☐ Engaging	☐ Narrative
☐ Fun	☐ Monotonous	☐ Meaningful
☐ Complex	☐ Accessible	☐ Appropriate for the target audience
☐ Rewarding	☐ Guided	
☐ Confusing	☐ Interactive	☐ Safe
☐ Interesting	☐ Playful	☐ Responsive
☐ Repetitive	☐ Educational	☐ Imaginative
☐ Immersive	☐ Ethical	☐ Contextualized

Q11. Did the soundtrack contribute to your immersion in the game? (1 = Strongly disagree, 5 = Strongly agree)

1	2	3	4	5

Q12. How would you rate the overall difficulty level of the game? (1 = Very easy, 5 = Very difficult)

1	2	3	4	5

Q13. Were the objectives of the missions or tasks clear during gameplay? (1 = Very unclear, 5 = Very clear)

1	2	3	4	5

Q14. Was the AI guide helpful in understanding and progressing through the game? (1 = Strongly disagree, 5 = Strongly agree)

1	2	3	4	5

Q15. Do you have any comments or suggestions for improvement?

6.3. Results

The average scores for each question revealed a generally positive perception, shown in shown in Figure 5. Notably, Q4, which assessed the visual design of the game,

received the highest average score of 4.21, indicating that participants found the aesthetics particularly appealing. On the other hand, some questions pointed to areas for improvement. Q14, which evaluated the usefulness of the in-game AI guide, received the lowest score (2.57), followed by Q8 (3.07), which measured the perceived influence of player choices on the narrative.

The Q14 score likely reflects player uncertainty about what elements were interactive. Many participants focused on progressing quickly to rescue Violet — the emotional core of the plot — and were therefore less inclined to explore or test biome elements, especially when animations and environmental effects were already visually rich and somewhat distracting. As a result, the AI system, although functional, may have felt backgrounded or underutilized in the players' experience. As for Q8 score, it suggests that players did not feel their actions significantly altered the story. Since the plot progression follows a relatively linear structure, player agency may have felt limited — especially for users expecting more branching paths or consequences tied to their choices. Other items below the 3.5 threshold included Q11 (3.36), related to soundtrack immersion, and Q12 (3.29), concerning the general difficulty level. These results suggest that while the game succeeds in visual and conceptual design, it lacks clarity in narrative dynamics and interactive feedback.

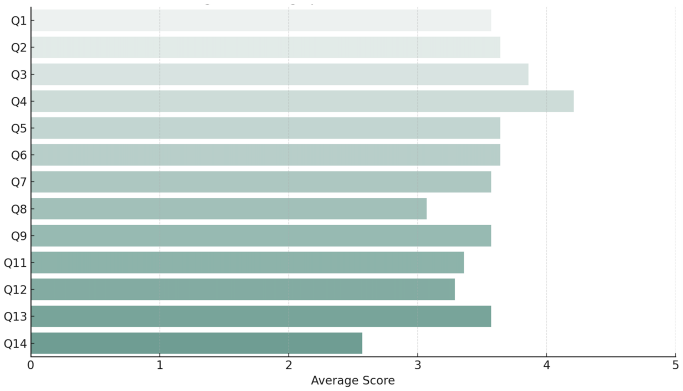

Figure 5. Average ratings per question (Q1 to Q9 and Q11 to Q14)

In addition to numerical ratings, participants selected adjectives to describe their overall experience, shown in Figure 6. The most frequent descriptors were Challenging (16 mentions), Frustrating (10), Fun (10), Interesting (10), Environmental (9), and Educational (8). This diverse range of terms illustrates a complex experience, combining engagement and thematic depth with occasional difficulty or tension. While many found the gameplay stimulating and meaningful, some responses reflected moments of frustration, often linked to gameplay support or interaction mechanics.

Figure 6. Word cloud of User Experience Adjectives (Q10)

Finally, participants shared open-ended suggestions that revealed key friction

points during gameplay. Driven by the urgency to rescue the kitten, many players overlooked which objects were interactive, limiting their engagement with the AI guide. The most frequent concern was the lack of checkpoints, which made failure especially frustrating, as it forced players to restart entire levels—an issue particularly challenging for less experienced users. Camera movement was another common critique; several noted it was abrupt or disorienting, affecting reaction time. Additional suggestions included more in-game hints and clearer cues for using the AI guide. It is also worth noting that some computers had inactive audio during the test session, which may have negatively impacted evaluations related to the soundtrack. Overall, the feedback highlights the need for greater clarity, fairness, and accessibility, particularly through better progression systems and user support.

7. Conclusion and Future Work

Claws of Fate integrates Unity and ChatGPT to immerse players in the Amazon Rainforest and Caatinga, using real-time AI to deliver interactive educational experiences via text and audio. Initial testing showed strong engagement and positive feedback on visuals, narrative, and educational content. Players appreciated the integration of environmental themes through AI-driven interactions and highlighted areas for improvement (narrative flexibility, AI guidance, difficulty balance, object collisions [Serpa and Rodrigues 2020], and camera transitions). Findings suggest that linear design, environmental richness, and narrative urgency may have unintentionally inhibited players from fully engaging with optional educational or AI-driven elements. Improvements could include clearer interaction cues, slower pacing during exploration, and subtle rewards for curiosity.

Future development will focus on refining BiomesAI to improve learning outcomes and player experience. This includes expanding in-game content, introducing real-time voice synthesis, and managing AI usage costs. Additional support features will be explored to better assist younger or less experienced players, including early readers. The game will also expand to include additional Brazilian biomes, further enhancing its environmental and educational value. To support broader reuse and extensibility, we plan to redesign the gameplay using the Need editor [Barbosa and Rodrigues 2025]. Finally, we plan to make it available on an app store.

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