Unveiling Legends: A Journey through Cultural Folklore

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Abstract. *This paper presents "Caturama," a serious game prototype crafted for educators, students and proponents of cultural heritage preservation. Designed to immerse players in the rich folklore of the Brazilian Amazon's indigenous tribes, its conception was guided by twin goals: authenticity in visual and narrative representation and engaging user experience. Drawing inspiration from three iconic legends of the region, Caturama seeks to bridge the gap between the modern world and ancient traditions. Detailed within are the design principles, developmental methodologies, and user feedback analytics. With a favourable Net Promoter Score of +70, it underscores the game's appeal and its potential as an educational medium for fostering cultural understanding and preservation.*

Keywords— serious game, folklore legends, cultural heritage

1. Introduction

Digital serious games uniquely combine the captivating traits of computer and video games with an educational aim: they offer enjoyment, engagement, and structure through playful rules and goals while providing action, flow, and learning through interactivity, adaptiveness, and feedback [Schell 2008], [Rodrigues et al. 2022]. Furthermore, they motivate through win states, provoke creativity with problem-solving, encourage social interaction, and stir emotions via storytelling, all while maintaining a core learning objective through entertainment [Prensky 2001], [Junior et al. 2021].

In an increasingly digital age, there's substantial untapped potential in leveraging serious games to promote and understand cultural heritage, an aspect often overlooked despite the widespread acceptance of gaming for leisure. This form of engagement presents an intriguing possibility to transform how we appreciate and learn about our diverse cultural narratives, pioneering a new era of interactive education. The work of Anderson et al. [Anderson et al. 2010] is a step towards realising this vision. Their initiative uses innovative gaming technology, incorporating advancements in graphics and sound (such as visual lighting and shadow effects and artificial intelligence for simulating characters' behaviours and decision-making). This is to enhance the exposure to depict Brazilian folkloric tales [Cascudo 2015].

This work presents "Caturama" (Figure 1), which means in Tupi Guarani "Good luck", a serious game prototype where players embark on a journey to explore the cultural heritage of Brazil filled with fascinating folklore legends. The protagonist encounters various characters along the way, including the enchanting Iara, the mischievous Curupira, and the mysterious

Pink Dolphin. The protagonist is a young character called Caturama from a Brazilian Amazon forest indigenous tribe who, unlike their peers, is skeptical about the existence of these legendary beings. As the player progresses through the game, the protagonist must overcome challenges and complete missions, ultimately unravelling the truth behind these folklore legends and gaining an appreciation for their cultural significance. The game boasts 3D graphics that feature visual lighting and shading effects on select objects, collision mechanics between entities [Serpa and Rodrigues 2020], and Artificial Intelligence solutions for simulating character behaviour, motion control [Serpa et al. 2020], navigation [Barbosa and Rodrigues 2006], and decision-making [Rodrigues et al. 2022], along with some AI-generated sound effects. By completing this journey, Caturama realizes that the stories and significance of these legends within the Brazilian Amazon forest indigenous tribe hold immense cultural importance. The game's conclusion highlights the importance of respecting and preserving these legends as a vital part of the tribe's traditions, customs, and beliefs. By understanding and appreciating these folklore legends, players can develop a deeper connection to the cultural heritage and learn the value of preserving and promoting such unique and diverse cultural treasures for future generations.

Figure 1. Opening scene of the game.

2. Background and Related Work

Initial endeavours into incorporating elements of folklore legends into games featured basic mechanics in simple 2D formats such as roulette, memory, and card games.

In contrast, the research conducted by Firmino Junior et al. [Junior et al. 2020] represents a more sophisticated approach, situating itself within the landscape of digital games that champion Brazilian cultural heritage. Using the Unity3D engine and RETAIN methodology [Gunter et al. 2008], they developed a prototype game teaching the Brazilian legend of Japuaçu, a fascinating Amazonian narrative on indigenous people's access to the fire. Although further game development is needed to comprehensively understand the legend, including refining checkpoint systems, the prototype showed promising results. Its potential was underscored by an initial testing score of 54.2 out of 63, highlighting its capacity to foster cultural knowledge. Likewise, Carvalho et al.'s research [Carvalho et al. 2015] employs a prototype game to impart Brazilian folklore to students. This approach enriches cultural awareness by incorporating authentic Brazilian geography and folklore. The study evaluates the effectiveness of traditional teaching versus game-based learning via a controlled case study. Keller's Instructional Materials Motivational Survey [Cook et al. 2009] is utilized to evaluate student motivation, intending to enhance technology integration in classrooms and cultural learning. Furthering this endeavour is the game "Seres do Folclore Brasileiro" [Domingues 2022], which aims to facilitate elementary history education by encouraging the discovery and identification of Brazilian folklore characters hidden within the game's scenario.

"Aritana and the Harpy's Feather" [Duaik et al. 2014], a 2D platform game, weaves indigenous culture and mythology into an engaging casual gaming experience. The gameplay mechanics focus on skill and timing, integrating traditional platform elements with a unique ability

system inspired by indigenous artefacts, creating a deep connection with Brazilian cultural heritage with striking visuals and immersive storytelling. The action RPG "Guerreiros Folclóricos" [Unique 2018] underscores a significant milestone in encapsulating Brazilian cultural heritage. Featuring Kambaí, an indigenous warrior set on a quest to reclaim his lost powers, this game parallels Brazil's quest for better representation in the gaming industry. The plot navigates the contest between nature preservers and disruptors, encapsulated in Kambaí's battles against folkloric adversaries, in an engaging narrative imbued with rich aesthetics. "Tropicália," [Franqueira 2023] inspired by 16-bit era RPGs and Super Nintendo classics, adds another layer of Brazilian culture into gaming. Kaique, a small Guarani warrior, embarks on a journey to rescue his kidnapped girlfriend from the deity Tau, resulting in an immersive and interactive gaming experience. Lastly, the recent launch of "Lendas" [KaioGx 2023], a 3D survival and exploration game, showcases the gaming community's increased focus on preserving Brazilian cultural heritage. Filled with special visual effects, the game's living ecosystems are the stage for confrontations with creatures drawn from Brazilian folklore.

Unlike previously mentioned related works that employ 2D graphics, "Caturama" is a serious 3D game that dives into Brazilian folklore by incorporating advanced 3D graphics and AI mechanics. In addition, it explores various legends through a singular narrative.

In summary, these games collectively emphasize the significance of preserving and interpreting Brazilian heritage via gaming, demonstrating their potential to represent folklore and shape future research endeavours.

3. Game Design and Development

In developing our serious game, we aimed to highlight the significance of cultural heritage, particularly Brazilian folklore. The game narrative centers around the legends of Iara, Curupira, and the Pink Dolphin. In our game, they represent the resilience, strength, and adaptability of the Amazonian tribes, symbolized by three sacred gems. The design and gameplay mechanics were deliberately crafted to emphasize these themes, fostering an understanding and appreciation of our rich cultural heritage.

To create an inspiring and healthy game environment, we have consciously avoided incorporating combat or destructive behaviour among characters. Thus, this game focuses on promoting positive interactions and problem-solving, emphasising curiosity [Spielberger and Starr 2012], courage [Vogler 1985], and the thrill of the journey [Malone 1981], [Prensky 2001], rather than conflict and aggression. Our game centers on the adventurous spirit of Caturama, a young member of an indigenous tribe from the Brazilian Amazon forest, driven by his thirst for proof that folkloric legends do not exist and his inherent bravery to confront any consequence. His age fuels this audacity, leading him into uncharted territories to pursue knowledge and understanding. Embarking on this hero's journey [Vogler 1985], [de Oliveira et al. 2022], he demonstrates the fundamental essence of interest and the joy of exploration. This way, our game aims to engage players through a narrative that celebrates curiosity, courage, and the thrill of the journey.

The game Caturama was developed using the Unity3D engine, implementing established best practices in game design and development [de Macedo and Rodrigues 2011]. Technical intricacies were considered to ensure a grounded gaming experience. Supporting tools such as VisualStudio, Blender (a free 3D creation suite for modelling, rigging, and rendering), and Mixamo (an online database for character customization and motion capture animations) were employed. Sound design and effects were sourced from publicly available files on Freesound.

3.1. Narrative

Caturama game is rooted in an original narrative we crafted, centering around three sacred gems of a Brazilian Amazon forest indigenous tribe. These gems, symbolizing Brazilian indigenous beliefs and traditions, guide players through our cultural heritage, creating an educational and immersive experience within the gaming environment.

   "In the past, in the heart of the Amazon region, there lived an indigenous tribe known for their deep connection to the forest and the spirits that resided there. At the center of their village stood an ornate altar dedicated to these spirits. Legend spoke of three sacred gems - the **Sapphire of Strength**, the **Emerald of Endurance**, and the **Ruby of Resilience**, that adorned this altar. It was said that these gems were gifted to the tribe by the sea, forest, and fire spirits, connecting to the Iara, Curupira, and Pink Dolphin creatures, respectively. The **Sapphire of Strength** embodied the tribe's fierce strength and, while glowing, assured their resilience against threats, symbolizing their protective duty. The **Emerald of Endurance** symbolized the tribe's symbiotic rainforest relationship, ensuring life essentials as it shone. Lastly, glowing amidst change, the **Ruby of Resilience** signified their adaptability and continuous prosperity, representing their evolutionary capability. These three gems became the heart of the tribe, central to their culture and belief system. However, the younger generations started to doubt the ancient legends over time. Skeptical of the tales and the mystical powers of these three legends, their faith in the sacred gems waned. Feeling their importance forgotten, the legendary creatures decided to reclaim the gems, vowing not to return them until true belief was restored. Upon sensing the waning faith, Iara, the enchanting siren of the waters, took back the **Sapphire of Strength**. Curupira, the forest guardian, reclaimed the **Emerald of Endurance**, and the Pink Dolphin, the shape-shifting spirit of transformation, spirited away the **Ruby of Resilience**."

3.2. Characters

In the game design, careful adaptations were made to the characters sourced from reputable 3D model repositories[1]. These adaptations involved modifying a female character to represent pregnancy through Blender's modelling capabilities, rigging and animations for characters that lacked them, and adjusting the colouration of objects like the dolphin to achieve the desired visual aesthetics. These modifications were undertaken to enhance the overall immersion and fidelity of the gaming experience.

Caturama: Serving as the protagonist, this character provides players with a firsthand experience of the indigenous tribe's culture and lifestyle (Figure 2).

Indigenous Tribal Chief: This character holds an important pivotal role in the tribe, offering guidance, wisdom, and crucial tasks to the protagonist (Figure 2).

Other Indigenous Tribe Members: These characters contribute to the social and cultural richness of the tribe, aiding in tasks, sharing knowledge, and adding to the narrative progression (Figure 2).
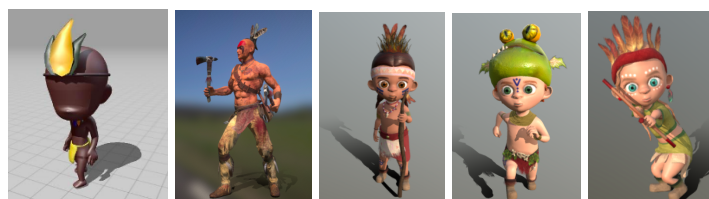

Figure 2. From left to right: young Indian, tribal Chief, and other tribe members.

Iara, Curupira, and Pink Dolphin: These mythical beings from Brazilian folklore play significant roles as supernatural entities in the game, each tied to a sacred gem reflecting their essence, enriching the mystical ambient of the game world (Figure 3).

Figure 3. The mythical beings, from left to right: Iara, Curupira, and Pink Dolphin.

Supplementary to these main characters, our game also features various non-playable characters (NPCs) that represent:

The Villagers: These characters add depth to the tribal community, each with their distinctive roles, personalities, and dialogues, including a pregnant woman, giving life to the village and emphasizing cultural diversity (Figure 4).

The Deforestation Workers: As antagonistic figures, these characters bring conflict into the game, symbolizing the threat to the indigenous lands and biodiversity, serving as catalysts for the protagonist's journey (Figure 4).

Figure 4. Villagers (on the left) and deforestation workers (on the right). All 3D models animated.

These characters have been conceived as agents in each moment of the game narrative. They collectively contribute to creating an engaging, culturally rich, and challenging gaming environment that draws players into the indigenous world and its struggles.

3.3. Legends' Encounters

Three special encounters and challenges add excitement to the game while encouraging players to learn more about the unique folklore legends and their cultural significance within the native Amazon forest tribe. These encounters enrich the game by providing diverse challenges and engaging players, emphasizing the importance of respecting and preserving cultural heritage.

Iara Encounter: Caturama meets the Iara [Cascudo 2015], a mermaid-like creature with a rich backstory, near a river (left of Figure 5). A former warrior betrayed by her siblings, she was transformed by gods into her current form and now seeks revenge. Known for her enchanting beauty and hypnotic singing, she lures prey to their doom. The player assists the protagonist in resisting Iara's song through a rhythm-based mini-game (right of Figure 5), aiming to understand and possibly help her find peace. This encounter, testing problem-solving skills and cultural understanding, emphasizes empathy and knowledge preservation of Amazonian tribal heritage. Upon triumphing in the visual and auditory memory challenge, the protagonist is rewarded with the **Sapphire of Strength** in recognition of his courage and respect for the Iara.

Figure 5. Iara encounter.

Curupira Encounter: Navigating the disorienting forest where Curupira [Cascudo 2015] lives, a mythical creature with backward feet known as a forest guardian (right of Figure 6), Caturama faces environmental tests. Witnessing illegal deforestation (left of Figure 6), Caturama's mission shifts towards forest protection. He gathers tools used for deforestation without confronting workers, proving his understanding of the ecosystem. The elusive Curupira, identified by echoing laughter, appears once these tools are confiscated. Caturama's courage and empathy for the forest earn him the **Emerald of Endurance** upon giving the tools to Curupira for destruction.
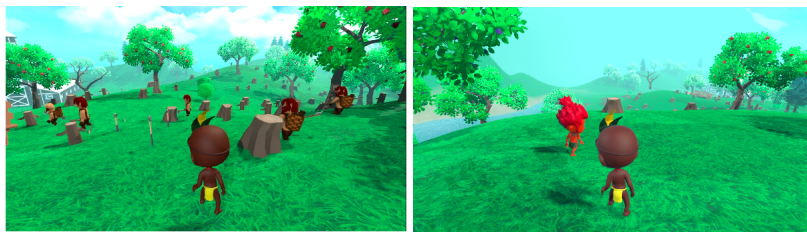

Figure 6. Curupira encounter.

Pink Dolphin Encounter: In this game encounter, Caturama unravels the mystery of the shapeshifting Pink Dolphin [Cascudo 2015], a creature from riverside village folklore. Known for transforming into a human man and seducing locals (left of Figure 7), the Pink Dolphin's story is pieced together through reluctant villagers, each holding a piece of the puzzle. The pregnant woman's story and hat discovery - a cover for the dolphin's blowhole - provide critical clues. Gathering these clues and personal items scattered across the village, Caturama exposes the Pink Dolphin's true nature and hiding place, confronting the entity (middle of Figure 7). He persuades the creature to reevaluate its risky seductions due to the threat of extinction. Successfully persuading the Pink Dolphin of its misconduct, Caturama is awarded the **Ruby of Resilience** and convinces the creature to revert back to its aquatic form (right of Figure 7).

Figure 7. Pink Dolphin encounter.

3.4. Mechanics and Resources Management

The game uses keyboard arrow keys or "W, A, S, D" for movement and the spacebar for jumping. The player starts with a score of zero, reflecting uncollected gems. Items, including gems and

tools, are stored in an inventory accessed with the "X" key. This inventory adjusts based on collected items, and each item can be used once. Interaction with game objects is automatic upon close proximity; collecting them requires pressing the "E" key. The camera's point of view control is handled via mouse movements. The camera consistently faces the camera focal point, with an automatic recentering feature ensuring it always points forward. A degree of lateral mobility is implemented, permitting side glances while maintaining the main focus direction of the player.

3.5. Animations and Special Effects

All humanoid characters have bones, are rigged, and have associated animations. They have been rigged using Blender and animated with Mixamo. Other game objects, such as river water, tree leaves, village bonfires, and the Pink Dolphin as an aquatic mammal, are also animated. These animations and visual effects using the particle system activated in Unity3D create a more vivid experience, offering a more engaging and interactive visual to the user.

3.6. Game Over

The game's ending scene either portrays Caturama's triumphant retrieval and return of the three sacred gems (the **Emerald of Endurance**, the **Saphire of Strength**, and the **Ruby of Resilience**) to the tribe's primary altar, concretely corroborating the three legends and rejuvenating cultural heritage values via regional folklore appreciation (left of Figure 5) or illustrates the player's tribulation in gathering together and returning the sacred gems to their original altar, featuring motivational sentiments for the protagonist to persist and potentially revisit the game until the mission's completion (right of Figure 5).

Figure 8. Game over scenes.

4. User Experience Assessment Testings

Initially, we performed functional tests to pinpoint inconsistencies and failures, identified areas for enhancement and then refined the implementation to mitigate execution risk and optimize the gaming experience. Upon agreeing and signing an informed consent form, we initiated User Experience (UX) evaluations with ten participants, aged 18-32, from the University of Fortaleza. The assessments, conducted in a notebook, commenced post a succinct briefing on the game's purpose and controls. Upon completion of the game, each participant was asked to fill out a questionnaire seasoned by a UX specialist. This questionnaire, hosted on Google Forms, employed a 5-point Likert scale based on the sentiment of the feedback (1-Strongly Disagree, 5-Strongly Agree) and two subjective questions regarding the game recommendation and potential improvements. Our UX questionnaire, designed for simplicity, aimed to offer a comprehensive evaluation of various aspects of the game with straightforward questions that required minimal time and effort from the participants.

In the Thematic Analysis, participant responses were divided into **Audio**, **Graphics**, and **Animations**, each individually evaluated and averaged. These metrics shed light on user perception and each theme's gameplay influence. **Usability** gauged player navigational ease and game

control through its mechanics. **Learnability** measured the ease of game understanding and mastery, a key success indicator. Player **Engagement**, progress through the game, and **Enjoyment**, the game's entertainment and intellectual value, were also assessed. Lastly, **Satisfaction** considered the overall fulfilment of participant expectations, accounting for gameplay, aesthetics, user interface design, and their impacts on enjoyment and learnability. The game's metrics: **Usability**, **Learnability**, **Engagement**, **Enjoyment**, **Graphics**, **Animations**, **Audio**, and **Satisfaction**, garnered average scores and standard deviations of 4.5 (0.53), 4.7 (0.67), 4.6 (0.52), 5 (0), 5 (0), 5 (0), 5 (0), and 4.9 (0.32), respectively, as shown in Figure 9.
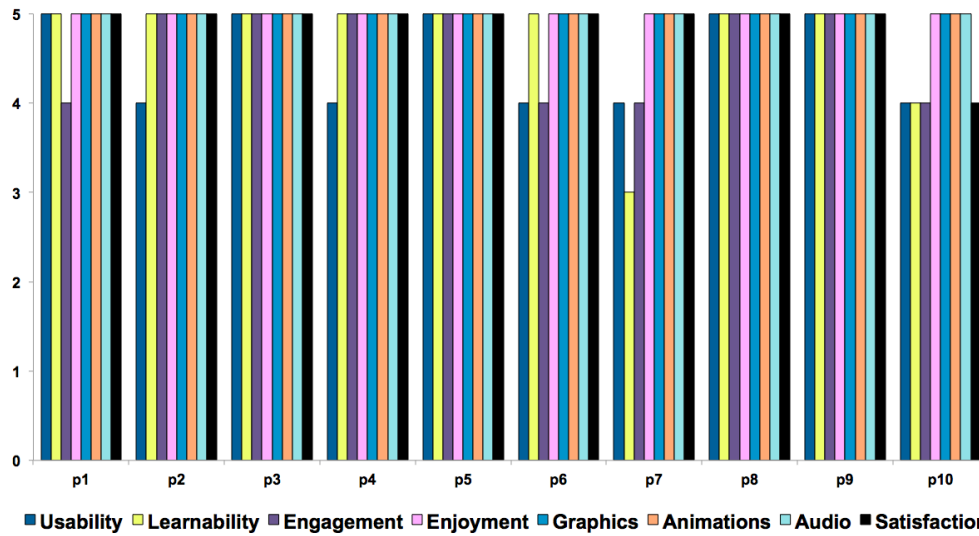

Figure 9. Summary of the UX results. In this graph, the x-axis represents the participants, while the y-axis corresponds to their respective scores.

We also adapted the concept of Net Promoter Score (NPS) from Reichheld [Reichheld 2006] and used it in our UX questionnaire. This is a metric for helping to find out how an audience feels about a product. While NPS is not the only method that measures audience satisfaction, it is a powerful one. In our UX form, participants answered the simple question "How likely are you to recommend this prototype game to your friends or colleagues?" Participants responded with a number from 0 (not likely) to 10 (very likely). We splitted the participants up into 3 groups, depending on where they fall on the scale: (1) **Promoters**: Scoring 9-10 these participants are likely to recommend your game to others; (2) **Passives**: Scoring 7-8, these participants think your game is alright and continue to use it, but would easily switch to another alternative; and (3) **Detractors**: Scoring 1-6, these participants either actively dislike or have some significant issues with your game and will probably tell others to avoid it. We used this feedback to gain insights into which areas need enhancement and which game elements should be added or removed. The NPS value was obtained through the application of the equation $NPS = (\% \ Promoters) - (\% \ Detractors)$, yielding a score of +70. This result was based on the distribution of participant scores: 8 respondents assigned the highest score of 10, 1 participant gave a score of 8, and 1 participant provided a score of 6. Ideally, the more participants, the more insights can be extracted with more certainty.

Player feedback indicates areas for game improvement. Participants appreciated the game's portrayal of Brazilian folklore and suggested adding a minimap for easier 3D navigation. They suggested enhanced interactivity like faster character movement and, while enjoying the game's immersion, recommended adding more legends. Finally, many suggested adapting the game for younger audiences to expand its reach and boost its educational and cultural impact.

5. Limitations

The current game version covers only three legends and includes three mini-games, which limits the narrative depth and gameplay variety. Despite its features, it lacks broader dialogue and could benefit from more magical effects. In addition, its single-player design restricts collaboration. Although it has been tested, more extensive playtesting could offer enhanced feedback.

6. Conclusions and Future Work

"Caturama" immerses players in Brazilian folklore, emphasizing the legends' cultural importance and the need for their preservation in indigenous heritage. The game's design enhances usability and learnability, offering an engaging cultural context. High scores across metrics such as **Usability**, **Learnability**, **Satisfaction**, and **Enjoyment**, along with a Net Promoter Score of +70, affirm its positive reception. Future iterations could add magical effects, more dialogue, and additional folklore creatures for a deeper narrative. Transitioning to multiplayer and emphasizing dialogue's role in development and conflict can enhance its educational aspect. Further playtesting with larger groups can enhance the game's cultural and educational impact and reach.

Acknowledgments

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