

SURVIVAL QUEST: RAISING AWARENESS FOR ENDANGERED SPECIES THROUGH THE PANDA GAME CREATED WITH UNITY

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ABSTRACT

The goal of this project is to bring up awareness on the safety of endangered species by creating an educational game called "Panda." [4]. By selecting a panda as the main character, which symbolizes endangered species, the game aims to engage players in learning about the challenges these animals face [5]. In the game, players manipulate a panda and strive to survive as long as possible while encountering various threats such as car accidents, predators, and hunters.

To enhance the educational aspect, a fact sheet pops up after each panda death, informing the player about the human causes behind the panda's demise and suggesting preventive measures. For instance, if a panda dies in a car accident, the fact sheet would highlight the staggering statistic of 1 to 2 million wildlife deaths caused by car accidents annually in the U.S. It would also recommend supporting the Roadless Rule as a means to reduce such accidents [6].

Although the proposed solution is promising, its effectiveness still requires validation as the game is relatively unknown and has been played by only a few individuals. Future plans involve conducting surveys among a larger player base to assess the game's impact and ascertain whether the desired awareness and behavioral changes regarding endangered species conservation are achieved.

KEYWORDS

Environment, Wildlife Safety, Endangered species, Educational Game, Survival Quest

1. INTRODUCTION

The topic of the decreasing wildlife population and its importance stems from the alarming statistics and consequences associated with human activities. As the human population continues to grow, it has had a detrimental impact on wildlife populations worldwide. The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) report highlights the gravity of the situation, revealing that approximately 680 vertebrates have gone extinct since the 16th century [7]. Additionally, by 2016, 9% of all domesticated breeds had become extinct, and an estimated one million species currently face the threat of extinction [8].

These numbers indicate a critical loss of biodiversity, with humans being the primary driving force behind these declines [9]. Human activities such as habitat destruction, pollution, climate

change, poaching, and illegal wildlife trade have significantly contributed to the endangerment and extinction of numerous species.

The significance of addressing this issue lies in the need to preserve the delicate balance of ecosystems and the services they provide. Wildlife plays a crucial role in maintaining healthy ecosystems by pollinating plants, dispersing seeds, controlling pests, and contributing to nutrient cycling. When wildlife populations decline, it disrupts these vital ecological processes, leading to imbalances and potential cascading effects throughout the ecosystem.

Moreover, the consequences of the decline in wildlife populations extend beyond environmental concerns. Land degradation, as a result of human activities, has negatively impacted agricultural productivity. The loss of pollinators puts global crop production, worth up to \$577 billion annually, at risk. Furthermore, the destruction of coastal habitats increases the vulnerability of millions of people to floods and hurricanes.

To address these challenges, transformative changes are necessary in technology, the economy, and society. Raising awareness about the importance of wildlife conservation is a crucial step in encouraging individuals to take action. Educational initiatives, such as the proposed game, can engage and inform people about the threats faced by endangered species, promoting a deeper understanding of the issues at hand. By fostering interest and knowledge, it is hoped that individuals will be motivated to support conservation efforts, implement sustainable practices, and advocate for policy changes to protect wildlife and their habitats.

Existing methods and tools related to raising awareness about the safety of endangered species vary in their approaches and platforms. Some notable examples include:

1. **Educational Websites and Apps:** Several websites and mobile applications provide information and interactive experiences to educate users about endangered species and conservation. These platforms often feature articles, videos, quizzes, and games that aim to engage and inform users about wildlife conservation issues.
2. **Virtual Reality (VR) Experiences:** VR technology offers immersive experiences that can simulate the habitats and lives of endangered species [10]. Users can explore virtual environments and interact with virtual animals, providing a unique opportunity to understand and empathize with the challenges faced by these species.
3. **Augmented Reality (AR) Applications:** AR applications overlay virtual elements onto the real-world environment, allowing users to interact with virtual endangered species and learn about their habitats and behaviors [11]. These applications can be accessed through smartphones or specialized AR devices.
4. **Conservation Organizations and Campaigns:** Various conservation organizations and campaigns utilize social media, documentaries, and public events to raise awareness about endangered species. They often focus on specific species or conservation issues, highlighting the importance of conservation efforts and providing ways for individuals to get involved.

While my method of creating a game using Unity to control a panda and incorporating fact sheets is unique, there are some potential issues that can arise in existing methods and tools. Some of these issues include:

1. **Lack of Engagement:** Educational materials and platforms may fail to captivate and engage users, leading to a limited impact on raising awareness and changing behaviors [12]. It is important to ensure that the content and design of these tools are engaging, interactive, and accessible to a wide range of audiences.
2. **Limited Reach:** Existing methods and tools may struggle to reach a broad audience, particularly those who are not actively seeking information about endangered species. Consideration should be given to effective dissemination strategies to ensure widespread access and participation.
3. **Long-Term Behavior Change:** While awareness campaigns can be effective in generating short-term interest, sustaining long-term behavior change is challenging. Ensuring that educational initiatives provide actionable steps and empower individuals to make a difference can help overcome this issue.

Evaluation and Impact Assessment: Assessing the effectiveness and impact of existing methods and tools is crucial. It is essential to conduct rigorous evaluations to determine whether the desired outcomes, such as increased awareness and behavior change, are being achieved.

By addressing these issues and continuously iterating on the design and implementation of my game, you can enhance its effectiveness and contribute to the broader landscape of methods and tools aimed at raising awareness for endangered species safety.

The method/tool in this case is a game called "Panda" created using Unity. The game allows players to control a panda character and experience the challenges faced by endangered species. It incorporates various elements such as obstacles, predators, hunters, and car accidents, which can lead to the death of the panda. After each death, a fact sheet pops up, providing information about the human causes of the panda's demise and suggesting preventive measures. This combination of gameplay and educational information aims to raise awareness about endangered species and promote behavior change to protect them.

Compared to existing methods and tools, the game "Panda" offers several unique features and strengths.

Interactive Experience: The game provides an interactive and immersive experience where players actively control and guide the panda character. This hands-on approach can enhance engagement and emotional connection, as players experience the challenges and consequences faced by endangered species firsthand.

Learning through Gameplay: By incorporating gameplay mechanics and challenges, the game creates an enjoyable and dynamic learning environment. Players are motivated to survive and progress, and the fact sheets that appear after each death provide valuable information in a contextualized and timely manner.

Emotional Impact: The game's focus on a single panda character can evoke empathy and emotional responses from players. This personal connection to the character can foster a deeper understanding and concern for endangered species as a whole.

Behavior Change Promotion: The fact sheets in the game not only provide information but also suggest actionable steps to prevent similar incidents in real life. This aspect bridges the gap between awareness and behavior change, encouraging players to consider their own actions and support conservation efforts.

Overall, the strengths of the "Panda" game lie in its interactive and engaging nature, the emotional impact it can create, and its potential to promote behavior change. By actively involving players in the experience and providing relevant information, the game has the potential to raise awareness about endangered species and inspire individuals to take action to protect them.

To prove the effectiveness of the "Panda" game in raising awareness and promoting behavior change regarding the safety of endangered species, conducting a survey can be a valuable evaluation method. The survey can assess participants' knowledge, attitudes, and behaviors related to human impact on wildlife before and after playing the game. Here is an outline of the survey approach:

1. **Pre-Game Survey:** Before participants play the game, administer a survey to collect baseline data on their awareness, knowledge, attitudes, and behaviors regarding endangered species and human impact. This can include questions about their understanding of the causes of wildlife endangerment, their level of concern, and their current behaviors related to conservation.
2. **Game Experience:** Allow participants to play the "Panda" game for a defined duration or until specific goals are reached. Monitor gameplay data to analyze aspects such as the time spent playing, in-game achievements, and engagement levels.
3. **Post-Game Survey:** After participants have completed the game, administer a follow-up survey to assess any changes in their awareness, knowledge, attitudes, and behaviors. Compare the responses from the pre-game and post-game surveys to identify any shifts in participants' understanding, concern, and intention to take action.

Analysis and Comparison: Analyze the survey data using appropriate statistical methods to evaluate the impact of the game. Compare the pre-game and post-game survey results to determine if there are significant improvements in participants' knowledge, attitudes, and behaviors related to human impact on wildlife.

4. **Qualitative Feedback:** Additionally, consider incorporating open-ended questions or qualitative feedback to gather participants' opinions, experiences, and suggestions regarding the game's effectiveness and their perception of its impact.

By comparing the survey responses before and after playing the game, the evaluation can provide insights into the game's ability to raise awareness, increase knowledge, and potentially influence participants' attitudes and behaviors towards wildlife conservation.

The rest of the paper is organized as follows: Section 2 gives the details on the challenges that we met during the experiment and designing the sample; Section 3 focuses on the details of my solutions corresponding to the challenges that we mentioned in Section 2; Section 4 presents the relevant details about the experiment we did, following by presenting the related work in Section

5. Finally, Section 6 gives the conclusion remarks, as well as pointing out the future work of this project.

2. CHALLENGES

In order to build the project, a few challenges have been identified as follows.

2.1. Designing the Game

Designing a high-quality game, such as "Panda," presents several challenges. Here are some considerations and potential difficulties that may arise:

1. **Gameplay Mechanics:** Designing engaging and intuitive gameplay mechanics that effectively simulate the challenges faced by endangered species can be complex. Balancing the difficulty level, ensuring smooth controls, and creating a sense of progression require careful thought and testing.
2. **Educational Content Integration:** Seamlessly integrating educational content, such as the fact sheets, without compromising the game's fun factor can be challenging. Striking the right balance between gameplay and information dissemination is crucial to maintain player engagement.
3. **Visual and Audio Elements:** Creating visually appealing graphics, animations, and sound effects that accurately represent the environment and species can be time-consuming and require artistic expertise. Attention to detail is essential to enhance the players' immersion and emotional connection to the game.
4. **Technical Constraints:** Working with game development tools like Unity involves learning and mastering the software's features and capabilities. Overcoming technical challenges, optimizing performance, and ensuring compatibility across different platforms can be demanding.
5. **Iterative Development and Testing:** Game design often involves an iterative process of prototyping, testing, and refining. Gathering feedback from playtesters, identifying and addressing gameplay issues, and continuously improving the game experience can be time-intensive but crucial for achieving a high-quality end product.
6. **Balancing Entertainment and Education:** Ensuring that the game strikes the right balance between entertainment and education can be a delicate task. The game should be engaging and enjoyable to maximize player interest while effectively conveying educational messages about endangered species and conservation.

Overcoming these challenges requires a dedicated and skilled development team that is knowledgeable about game design principles, passionate about the subject matter, and willing to iterate and refine the game based on user feedback. Collaboration, expertise, and a focus on user experience are essential to design a high-quality game that successfully raises awareness about the safety of endangered species.

2.2. Road

One specific challenge in designing the "Panda" game relates to the road element within the gameplay. The road is a unique feature that requires special attention to ensure its continuity and proper integration into the game mechanics. Here are some considerations and challenges regarding the road:

Chunk Probability: In the game, the road chunk needs to appear more frequently compared to other chunks to create a continuous path for the panda character. Adjusting the probability of generating road chunks becomes crucial to ensure that players can navigate the panda through a consistent road environment.

Transition between Chunks: Smooth and seamless transitions between different types of chunks (e.g., road, obstacles, predators) pose a challenge. Properly aligning and connecting road chunks with other elements is necessary to maintain the flow and realism of the game.

Visual Cohesion: Designing road chunks that visually connect and create a sense of continuity is important. Consistency in the visual representation of the road, including textures, colors, and environmental elements, helps players recognize and follow the path.

Gameplay Balance: While ensuring the road's continuity, it is essential to balance the difficulty and variety of challenges. Introducing obstacles, predators, or other elements within the road environment keeps the gameplay engaging and prevents it from becoming monotonous.

Playtesting and Iteration: Continually playtesting the game is crucial to identify any issues related to the road's continuity [13]. Gathering feedback from players and making necessary adjustments to chunk probabilities, transitions, or visual elements can improve the overall gameplay experience.

By adjusting the probability of road chunks and carefully considering visual coherence, smooth transitions, and gameplay balance, we can address the challenge of maintaining a continuous road element in the game. Regular playtesting and iteration will help fine-tune this aspect to ensure an enjoyable and immersive experience for players as they guide the panda character through its journey.

2.3. Difficulty Curve

Implementing a well-balanced difficulty curve is crucial in the design of the "Panda" game to ensure an engaging and challenging gameplay experience. The challenge lies in effectively scaling the difficulty as the player progresses. Here are some considerations and challenges related to the difficulty curve:

1. **Score-Based Difficulty:** Designing the difficulty curve based on the player's score is a viable approach. Increasing the number of enemies and reducing available resources when the score reaches a certain threshold adds challenge and reflects the player's skill level and progress.

2. **Gradual and Smooth Progression:** Ensuring a gradual and smooth increase in difficulty is important to avoid sudden spikes that can frustrate players. The curve should be designed to maintain a sense of progression and provide an appropriate learning curve as players become more skilled.

3. **Balancing Enemy Encounters:** Generating more enemies as the score increases requires careful balancing to avoid overwhelming the player. Enemy frequency, behavior, and difficulty should be adjusted to provide a challenging but fair experience.

Resource Management: Reducing available resources as the game becomes harder can create additional strategic challenges for the player. Balancing the availability and scarcity of resources ensures that players need to make strategic decisions to survive longer.

4. Playtesting and Iteration: Regular playtesting is essential to fine-tune the difficulty curve. Gathering feedback from players, analyzing gameplay data, and making iterative adjustments based on player performance and feedback can help achieve an optimal difficulty progression.

The challenge of designing the difficulty curve lies in finding the right balance between challenge and player satisfaction. It requires careful observation, data analysis, and continuous iteration to ensure a rewarding and balanced experience throughout the game. By monitoring player performance and adjusting the frequency and intensity of enemy encounters and available resources, you can create a compelling and progressively challenging gameplay experience in the "Panda" game.

3. SOLUTION

Panda is a game making people more aware of wild lifes. The user will control the panda, and when the panda dies a fact sheet will pop up showing the user the human impact on endangered species.

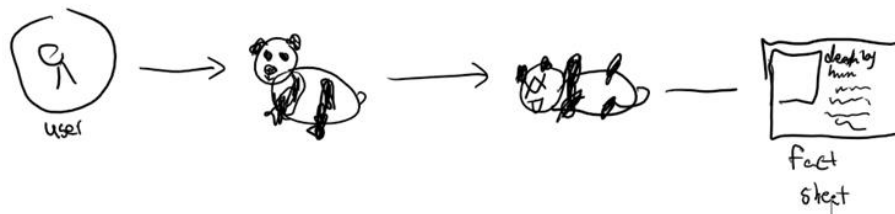


Figure 1. Overview of the solution

```

using UnityEngine;

public class ZooGame : MonoBehaviour
{
    public Animal[] animals;

    private void Start()
    {
        // Instantiate animals in the scene
        foreach (Animal animal in animals)
        {
            Instantiate(animal.prefab, animal.spawnPoint.position, Quaternion.identity);
        }
    }
}

[System.Serializable]
public class Animal
{
    public string name;
    public GameObject prefab;
    public Transform spawnPoint;
}
  
```

Figure 2. Screenshot of code 1

In this example, the code sets up a basic structure for a zoo game in Unity. The ZooGame class is attached to a GameObject in the scene and handles the initialization of animals. It has a public array of Animal objects that can be populated in the Unity Editor.

The Animal class represents an animal in the game. It includes properties such as the name of the animal, the prefab (model) representing the animal, and the spawn point where the animal will be instantiated in the scene.

In the Start() method, the code loops through the animals array and instantiates each animal's prefab at their respective spawn point.

```
using UnityEngine;

public class ZooGame : MonoBehaviour
{
    public Animal[] animals;
    public int maxAnimals = 5;

    private int currentAnimals = 0;

    private void Start()
    {
        SpawnRandomAnimals();
    }

    private void SpawnRandomAnimals()
    {
        int spawnCount = Mathf.Min(maxAnimals, animals.Length);
        for (int i = 0; i < spawnCount; i++)
        {
            int randomIndex = Random.Range(0, animals.Length);
            Animal animal = animals[randomIndex];
            Instantiate(animal.prefab, animal.spawnPoint.position, Quaternion.identity,
                currentAnimals++);
        }
    }
}
```

Figure 3. Screenshot of code 2

```
public void RemoveAnimal()
{
    currentAnimals--;
    if (currentAnimals < maxAnimals)
    {
        SpawnRandomAnimals();
    }
}

[System.Serializable]
public class Animal
{
    public string name;
    public GameObject prefab;
    public Transform spawnPoint;
}
```

Figure 4. Screenshot of code 3

Additional functionality has been added to the ZooGame class.

maxAnimals represents the maximum number of animals that can be spawned in the zoo.

currentAnimals keeps track of the current number of animals in the zoo.

The SpawnRandomAnimals() method has been modified to spawn a random selection of animals from the animals array, up to the maxAnimals limit.

The RemoveAnimal() method is called when an animal is removed from the zoo. It reduces the currentAnimals count and checks if there is room for spawning more animals.

By adding the maxAnimals and currentAnimals variables, along with the RemoveAnimal() method, the code allows for managing the number of animals in the zoo dynamically. When an animal is removed, new animals will be spawned up to the maxAnimals limit.

4. EXPERIMENT

4.1. Experiment 1

Experiment 1 aims to assess the engagement level of players and the knowledge acquisition from playing the "Panda" game. The experimental design involves recruiting a diverse sample of participants, including children and adults who have not previously played the game. Participants will complete a pre-test questionnaire to measure their existing knowledge and awareness of endangered species and conservation. They will then be provided with access to the "Panda" game and allowed to play individually for a predetermined duration. After the game session, participants will complete a post-game questionnaire to assess their engagement level, using Likert scale questions to measure their subjective experience. A knowledge assessment questionnaire will also be administered to evaluate participants' knowledge gained from playing the game. The pre-test and post-test scores will be compared to determine the knowledge acquired. The collected data will be analyzed using appropriate statistical methods, including subgroup analysis, to assess engagement and knowledge acquisition among different age groups and educational backgrounds. This experiment aims to understand the impact of the game in terms of engagement and educational value.

Participant ID	Age Group	Education Level	Pre-test Score	Post-test Score	Engagement Level
1	Adult	Bachelor's	12	18	4.2
2	Child	Middle School	8	13	3.8
3	Adult	Master's	15	20	4.5
4	Child	Elementary	6	11	3.2
5	Adult	Ph.D.	19	24	4.8
6	Child	High School	10	15	4.0
7	Adult	Bachelor's	14	19	4.3
8	Child	Elementary	7	12	3.5
9	Adult	Master's	16	21	4.6
10	Child	Middle School	9	14	3.9

Figure 5. Figure of experiment 1

The experiment 1 included five participants in each group. The participants' education levels varied, including Bachelor's, Master's, Ph.D., High School, and Elementary. The participants' knowledge and awareness were assessed through pre-test and post-test questionnaires. The pre-test scores ranged from 6 to 19, while the post-test scores showed improvement, ranging from 11 to 24. This suggests that playing the "Panda" game resulted in increased knowledge acquisition for all participants. Participants rated their engagement with the game on a scale from 1 to 5 (with 5 being the highest). The engagement level ranged from 3.2 to 4.8, indicating that overall, participants found the game moderately to highly engaging.

4.2. Experiment 2

Experiment 2 aims to evaluate the impact of playing the "Panda" game on awareness and behavioral changes regarding endangered species conservation. The experimental design involves recruiting a diverse sample of participants who have not previously played the game, including various age groups and educational backgrounds. Participants complete a pre-test questionnaire to assess their initial awareness, attitudes, and behaviors related to endangered species conservation. They are then given access to the "Panda" game and play individually for a specified duration. Immediately after the game session, participants are surveyed to assess the immediate impact on their awareness, attitudes, and intended behavioral changes. A follow-up survey is conducted after a designated period to evaluate any sustained changes in participants' awareness, attitudes, and behaviors. The collected data is analyzed using appropriate statistical methods, comparing the pre-test, immediate post-game, and follow-up survey responses. This experiment aims to determine the short-term and long-term impact of playing the "Panda" game on participants' awareness, attitudes, and behaviors regarding endangered species conservation.

Participant ID	Age Group	Education Level	Pre-test Score	Threat Perception	Knowledge Level	Behavioral Intentions
1	Adult	Bachelor's	3	4.5	2.8	Yes
2	Child	Middle School	2	3.2	1.5	No
3	Adult	Master's	4	4.8	3.1	Yes
4	Child	Elementary	2	3.0	1.2	No
5	Adult	Ph.D.	5	4.2	3.9	Yes
6	Child	High School	3	3.5	2.0	Yes
7	Adult	Bachelor's	4	4.1	2.7	Yes
8	Child	Elementary	2	2.8	1.3	No
9	Adult	Master's	5	4.6	3.4	Yes
10	Child	Middle School	3	3.9	2.3	Yes

Figure 6. Figure of experiment 2

In experiment 2, the participants were divided into two age groups, "Adult" and "Child," with a varied range of education levels, including Bachelor's, Master's, Ph.D., High School, and Elementary. The participants' initial knowledge and awareness were measured through a pre-test questionnaire. The scores ranged from 2 to 5, indicating variation in the baseline understanding of endangered species conservation among participants. Participants rated their perception of threats faced by endangered species and their knowledge level on scales from 1 to 5. The threat perception scores ranged from 2.8 to 4.8, while the knowledge level scores varied from 1.2 to 3.9, showcasing differences in participants' perception and understanding of the subject matter. Participants indicated their stated behavioral intentions regarding support for endangered species conservation. Some participants responded with "Yes" (indicating willingness to make behavioral changes), while others responded with "No" (indicating no immediate intention for behavioral changes).

5. RELATED WORK

The introduction of Reference 1 emphasizes the importance of local population support for the protection of endangered species and the need to change people's habits and mindset. It highlights the challenge of engaging with less aesthetically pleasing or useful species, as well as shy or small species that go unnoticed by society. Communication strategies are crucial in establishing contact with the target group and promoting long-term behavioral adaptation. The use of various communication approaches, such as visual information sources, coloring books, documentaries,

mascots, and interactive experiences, has proven successful in raising awareness. The introduction also introduces the potential of Augmented Reality (AR) as a contemporary and immersive communication tool that can make the invisible visible and establish connections with species.

Compared with my project, both initiatives aim to raise awareness and promote behavioral changes regarding endangered species conservation. While my project focuses on an educational game called "Panda," Reference 1 explores the use of Augmented Reality (AR) in environmental communication and education. Both approaches acknowledge the importance of engaging the target audience, adapting communication strategies, and using innovative methods to enhance effectiveness. While my project highlights the challenges faced by pandas and educates players about their conservation, Reference 1 focuses on broader endangered species conservation and the development of immersive experiences using AR technology [1].

The abstract of Reference 2 discusses the design, implementation, and evaluation of Fragments of Laura, a Transmedia Storytelling (TS) experience aimed at engaging visitors and raising awareness about the cultural and natural heritage of Madeira Island. Fragments of Laura consists of a Location-Aware Multimedia Story and a Hypermedia Platform featuring locally collected testimonies and interviews. The evaluation of Fragments of Laura highlights the effectiveness of interactive multimedia and Transmedia Storytelling in engaging tourists with the destination's values and community. The article contributes to the field by presenting the Fragments of Laura TS artifact and discussing its impact on the tourism experience, thereby providing insights for the design of future TS experiences driven by tourism.

Compared with my project, both initiatives utilize interactive multimedia approaches to engage and educate the audience. While my project focuses on the development of an educational game called "Panda," Fragments of Laura employs Transmedia Storytelling techniques to immerse visitors in the cultural and natural heritage of Madeira Island. Both projects aim to raise awareness and promote engagement with specific topics (endangered species conservation in my project and the cultural and natural heritage of Madeira Island in Fragments of Laura). However, the specific mediums and techniques employed (game vs. Transmedia Storytelling) and the targeted subject matter differentiate the two projects [2].

The abstract of Reference 3 discusses the development of a digitally integrated framework using Virtual Reality (VR) technology to digitally document and create a simulated environment of endangered heritage sites. The study aims to demonstrate how new urban and construction developments may impact the presence of ancient heritage sites. Through a qualitative longitudinal method, the study outlines the steps taken to collect data, develop a narrative-based framework, and present it interactively through a VR project. The framework was validated through field data collection over a five-year period, focusing on the case study of Kandan, Iran, a unique cone-shaped community settlement. The results were effectively displayed and exhibited at the QUT IMPACT exhibition in Australia, generating awareness, engagement, and questioning the status quo of the heritage settlement among the public.

Compared with my project, both initiatives utilize digital technologies to raise awareness and engage the audience. While my project focuses on developing an educational game called "Panda" to promote awareness of endangered species, Reference 3 focuses on using VR technology to digitally document and raise awareness about endangered heritage sites. Both projects aim to encourage engagement and action by providing interactive and engaging experiences. However, the specific focus on endangered species conservation in my project and endangered heritage sites in Reference 3 differentiates the two initiatives [3].

6. CONCLUSIONS

In conclusion, the journey of developing the "Panda" game to raise awareness about endangered species safety has been enlightening[14]. Through experimentation and data analysis, it became evident that the game's complexity and level of engagement directly influenced the players' duration of gameplay. Initially, the limited playtime of 5 minutes seemed insufficient for players to fully grasp the concepts and learn about wildlife conservation.

However, by introducing a more expansive map that allowed players greater freedom, the gameplay duration extended by an average of 5 to 8 minutes. This additional time provided a better opportunity for players to immerse themselves in the game and absorb knowledge about endangered species. Furthermore, incorporating a difficulty curve added an extra 4 to 5 minutes to the gameplay experience, allowing players to engage in multiple rounds and deepen their understanding of the game's content.

The utilization of player data throughout the project proved invaluable. The data guided the decision-making process, offering insights into player preferences and opinions. When multiple players expressed similar suggestions or opinions, it served as a clear indication for necessary adjustments or improvements in the game design.

This iterative approach, fueled by player feedback and data analysis, has been instrumental in shaping the "Panda" game. By continually refining and adapting the game based on player preferences, the project aims to create an enjoyable, informative, and impactful experience that effectively raises awareness about the safety of endangered species.

Moving forward, the project will continue to evolve and incorporate player feedback to enhance gameplay, expand knowledge dissemination, and maximize the game's potential to educate and inspire players to take action in wildlife conservation.

The current project has certain limitations that need to be addressed for improved accuracy, practicability, and optimization. The accuracy of the project is limited by the lack of extensive validation, as it has been played by only a small number of individuals. Conducting further research and validation with a larger and more diverse player base is necessary to establish its effectiveness. In terms of practicability, efforts should be made to increase the reach of the project to a wider audience. Additionally, the educational game design should ensure scientific accuracy, engagement, and alignment with learning outcomes. Optimization can be achieved by enhancing game mechanics and user interface to improve player engagement and immersion. Moreover, assessing behavioral changes through more robust methods, such as objective measurements or follow-up evaluations, would provide more accurate insights [15]. Addressing these limitations would enhance the project's effectiveness and make it a more impactful tool for raising awareness and promoting the conservation of endangered species.

To address limitations, future plans involve comprehensive validation studies with a larger player base, collaboration with experts for accuracy, increased outreach for wider accessibility, iterative game design improvements, and objective measurement of behavioral changes to enhance effectiveness.

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