

**Levelling Up for Conservation: An Examination of Player Decision-Making in a 3D
Adventure Game with Environmental Protection Objectives**

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project report video link: <https://youtu.be/w-9WPR8CZmM>

Abstract

This research examines how 3D adventure games include thematic environmental features. A conservation-themed game is examined to determine its effects on learning and player engagement. The research uses Jakob Nielsen's heuristic methods to evaluate the game's usability and efficacy in enhancing gameplay. The study technique uses a small yet diversified sample of novice and experienced gamers to provide a different viewpoint on the game's usability. A thorough review highlights the need for greater error recovery, comprehensive documentation, and system status visibility. The insights are used to improve the game experience and provide a more interesting interface. The research also examines the game's themes, revealing its instructional potential. Conservation themes improve both the game and players' environmental awareness. The game's gameplay and theme work together to raise environmental awareness, making players unwitting conservationists. The research acknowledges its shortcomings, including the small sample size and heuristic decision. The study recommends more participant inclusion, more assessment methods, and a deeper look at cultural differences in themed gaming experiences to address these limits. This research area has promising prospects for studying the enduring effects of themed 3D adventure games, using new technology, and improving assessment frameworks. This study advances themed 3D adventure game research and lays the groundwork for future studies. This study contributes to gaming and educational discovery by combining usability evaluation, thematic analysis, and a forward-looking viewpoint.

Table of Contents

1. Introduction.....	4
1.1 Background and Context.....	4
1.2 Research Objectives.....	5
2. Related Work.....	6
3. Methodology	7
4. Evaluation	9
5. Discussion	11
5.1 Implications of the research	11
5.2 Insights into the Effectiveness of Thematic Environmental Elements in Games	12
5.3 Implications for Game Developers and Educators	12
6. Limitation and Future Work.....	13
6.1 Limitations	13
6.2 Future Work	14
7. Conclusion	14
Bibliography	17
Appendix.....	20
Appendix A: Heuristic Evaluation.....	20
Appendix B: Evaluation and Priority of Heuristics	30

1. Introduction

Thematic environmental features have become a popular combination of fun and teaching in 3D adventure games. This research examines a conservation-themed 3D adventure game's usability using Jakob Nielsen's heuristics and how thematic components affect learning and player engagement.

1.1 Background and Context

A captivating genre, 3D adventure games combine immersive storytelling with interactive gameplay. These games take players to virtual worlds to complete quests, solve puzzles, and fight enemies. A conservation-focused subset has emerged in this vast gaming landscape. The intricate environmental preservation narratives in these games create a unique gaming experience that goes beyond entertainment. Players navigate intricate virtual landscapes and help protect and restore the in-game environment.

Thematic environmental features in 3D adventure games have far-reaching implications. As the gaming business grows and attracts a varied audience, the opportunity for education and awareness through games grows. Gameplay raises environmental awareness by including conservation themes in gameplay. While solving game obstacles, players learn about ecosystems, biodiversity, and human impact on the environment. This inclusion entertains and educates players about real-world ecological issues. Such thematic aspects are important not only in the gaming story but also in inspiring action and environmental responsibility.

Analysis of 3D conservation adventure games shows a nuanced design approach. The Game carefully creates virtual ecosystems that mimic reality. In pursuit of in-game goals, players subconsciously engage with ecological principles, cultivating a respect for nature's delicate balance. This integration goes beyond aesthetics to teach gamers about environmental

connection through hands-on participation. Games can smoothly include educational components without compromising entertainment. Thematic environmental components are seamlessly integrated into the story, allowing players to learn about the 3d environment. The impact of these games goes beyond virtual reality. According to Maguire (2019), gamers, especially younger ones, become more environmentally conscious and sustainable after playing such games.

3D adventure games with conservation themes go beyond pleasure to educate and raise awareness. Gameplay and conservation storylines work together to create a unique gaming experience where players become environmentalists while pursuing virtual objectives.

1.2 Research Objectives

A comprehensive study of thematic 3D adventure game learning outcomes and engagement elements is the main objective. The research examines player's cognitive and emotional responses during gameplay to achieve this. Assessing environmental knowledge and conservation concepts in the game will measure learning outcomes. Analyzing the game's design, storyline, and thematic environmental components helps determine player interest. This analysis seeks to understand how these elements maintain player interest and participation throughout the game. Highlighting the seamless integration of instructional content into gameplay is crucial. Thematic aspects are seamlessly integrated into the game. The research aims to show that learning outcomes can improve gaming by striking a balance. However, the research aims to examine how thematic 3D adventure games enhance learning and engagement, revealing the complex relationship between enjoyment, education, and player involvement in virtual conservation narratives.

2. Related Work

The integration of games as educational tools to effectively convey complex information has been a subject of considerable research. The study by Baturay et al. (2022), developed a mobile game-based learning practice to raise environmental awareness among English as a Foreign Language (EFL) students. This research primarily targets language learning and environmental awareness. The research of Calderón-Guerrero, et al. (2021), involved experiential learning and participatory innovation to guide teenagers in designing and implementing environmental quality sensors. However, this study focuses on experiential learning through the creation and monitoring of environmental quality sensors. This study emphasizes more on participatory innovation and hands-on learning. Furthermore, the paper by Burbano, et al. (2018) explored the use of serious games in environmental issues and aimed to highlight the impact of such games in raising awareness and educating players. The study by Ekpe and Wekpe (2023), explores the relationship between film representation and video games, particularly focusing on environmental themes in the context of Nigeria's Niger Delta. It discusses how these media forms address environmental issues while competing for attention in the entertainment landscape. However, this study explores the interplay between film and video games neglecting important aspects such as play engagement or educational effectiveness. Additionally, the study by Pires, et al. (2019) proposes games as an important tool for engaging users and using game mechanics for directed learning in developing computational thinking and environmental awareness. This paper highlights the use of game points and missions to increase player engagement and motivation while providing environmental awareness. Escudeiro, et al. (2023), proposed a game developed to enhance knowledge about extinction and biodiversity loss aiming to foster pro-sustainability

behaviors and engagements in sustainable activities, highlighting the role of games in education and motivation.

Farzandipour, Nabovati, and Sadeqi Jabali (2022) discuss usability measurement using heuristic evaluation and severity rating. Their deep grasp of user interface design assessment complements contemporary usability research. Khairat et al.'s findings improve the heuristic assessment method and help the research identify and prioritize usability concerns. Gamifying usability heuristics is another area of research, according to Maghfiroh (2020). They propose a persuasive paradigm for evaluating educational features in gaming. This methodology is useful for assessing the conservation-themed game's educational features and contextualizing the wider implications of incorporating learning objectives into gaming experiences. Kumar and Goundar (2019) emphasize the need to obtain diverse gaming study participants. This aspect suits the present study's selection of various gaming expertise participants, providing a more complete and inclusive evaluation of the conservation-themed 3D adventure game. Kumar and Goundar's (2019) emphasis on diversity deepens the findings by collecting more user experiences and preferences. Senap and Ibrahim (2019) discuss the heuristic evaluation and informed consent in serious games and human participant research. These factors are crucial to ethical gaming research, ensuring that participants are informed and safeguarded throughout the assessment process.

3. Methodology

To evaluate the usability of the project the heuristic evaluation established by Jakob Nielson has been enhanced to align with the features and the challenges of a 3D adventure game. Akula (2021), outlined that the flaws in the interface can be identified and prioritized based on heuristics. These enhanced heuristics evaluation has been used as a metric based on which

participants can make their assessment. In this usability evaluation, participants assess and evaluate the adherence of the project to the given usability principles. As identified by Khairat et al. (2022) the usability and the magnitude of the issues in the project can be identified by evaluating the 10 usability aspects outlined in the heuristic's evaluation. Performing this evaluation aims to gain actionable feedback that can aid in identifying the problems and coming up with efficient solutions.

To perform user evaluation three participants were selected with varying demographics and varying levels of gaming knowledge. As outlined by Young et al. (2022), employing diverse participants in research can aid in providing varying viewpoints and experiences which can help in the identification of patterns and themes that may fail to emerge in a more homogenous sample. Therefore, to garner various perspectives, three participants emerging from different backgrounds and varying gaming knowledge beginning from novice to expert were chosen. Xu et al. (2020), highlighted the essentiality of informed consent as it ensures that the participants have the opportunity to make an autonomous decision about their involvement. The participants involved in this research were informed of the use of the data collected from their assessment and informed consent was accumulated with the assurance of anonymity. These participants were provided with briefing sessions before the evaluation to ensure that the participants understood the goals and the scope of the evaluation. However, little to no information was provided on how to play the game or any instructions that could guide the participants. Each participant was encouraged to play the game multiple times and after the game was played the participants were provided with a list of heuristics based on which the participant provided comments.

Additionally, the participants were asked to rate the applicability of these heuristics in comparison to the game, where a score of 0 indicates that there are no changes required and 5

indicates that certain aspects should be highly prioritized when implementing changes. Based on the evaluation and the heuristics evaluation form filled as shown in Appendix A the data from their evaluation was analyzed to identify the usability issues. The issues were then categorized and prioritized based on their severity and a report of the problems and possible solutions or recommendations for each issue was created.

4. Evaluation

Based on the feedback provided by the users as shown in Appendix A, the Heuristics were ranked based on the average scores calculated derived from the scores provided by the user as demonstrated in Appendix B. For this evaluation, the heuristics illustrated in Appendix B have been rearranged based on the priority of the issue where a higher average score depicts that the heuristic should be primarily prioritized before the others. After calculating the average score of each of the heuristics it was found that the “Help Users Recognize, Diagnose, and Recover from Errors” aspect has the highest average score of 4 followed by “Help and Documentation” tallying with “Error Prevention” both consisting of an average score of 3.33 followed by “Visibility of System Status” with an average score of 3. “Aesthetic Minimalist Design” has a score of 2.67, and “User Control and Freedom” and “Consistency and Standards” both have a score of 2. “Match Between the System and the Real World” consists of an average score of 1.67 and lastly, both “Flexibility and Efficiency of Use” and “Recognition Rather than Recall” consisting of an average score of 0.67.

Based on the user evaluation it was found that almost all users found that in terms of helping users to recognize, diagnose, and recover from errors the game lacked any error recovery. Abidin, et al. (2019) highlighted that this heuristic is important as it depicts the availability and interpretability of error messages and its efficiency to prevent errors. Two of the

participants identified that the error message that emerged after collecting all the water drops was in Chinese therefore, the message was not understandable. Furthermore, all participants outlined that there was a lack of help and documentation. With no tutorials or instructions available at the beginning of the game the participants outlined that they learned the controls on their own. Error prevention was highlighted by all users again as for some participants the game ended when the water drops were collected, for some, they were directed to the next level and for others, they were unable to enter the main gaming area after exiting the main arena. Visibility of system status provides the player with appropriate feedback in a reason timeframe informing them of their state in the game (Sobrino-Duque et al., 2022).

Furthermore, some issues regarding these heuristics were provided where it was highlighted that clearer and more intuitive status indicators, especially for health and objectives should be implemented. Regarding the aesthetics and the minimalist design, it was agreed upon that the design of the game was minimal however, the removal of redundant objects such as vases or sacks could further enhance the game. It was further agreed upon that there are good user controls and freedom the accessibility of jump features can improve the game. The participants also agreed upon the consistency and standards highlighted their confusion about the points gained when accumulating various rewards. When evaluating the match between the system and the real world the participants highlighted that the game matched the real world with the presence of trees, bushes cactuses, and other elements. When assessing the flexibility and efficiency of use the users highlighted that the game accommodates both novice and professional gamers as it is easy to play however, some participants highlighted that the levels may be too easy for the professional gamers due to its simplicity. Lastly, the participants agreed that there was minimal memory load when playing the game. This

evaluation helped to identify the areas in the game that need to be modified to ensure enhanced usability and efficiency.

5. Discussion

5.1 Implications of the research

This research highlights the potential of integrating environmental protection objectives in 3D adventure games. According to Yeşilyurt, et al. (2020), environmental awareness can aid people in understanding the impact of their actions on the environment which can lead to making decisions that have a positive impact on the environment. The thematic elements involved in this game such as characters wearing clothes inspired by rare animals and the transition from a desert to an oasis, effectively engage players in environmental issues. This approach aims to create a deeper understanding and appreciation for conservation efforts among players. The purpose of this game is to inculcate educational value in gaming. The design of the game focuses on collecting water drops and avoiding monsters, which can enhance user engagement and enable users to view environmental issues on various levels therefore acting as an effective educational tool. It subtly incorporates learning about environmental stewardship and the importance of protecting rare animals, aligning with the growing trend of using games as educational platforms. The thematic environmental elements used in the game not only provide an entertaining experience but also contribute to the learning outcomes of the player. The shift in the environment of the game from a barren landscape to a flourishing oasis can serve as a metaphor for the impact of conservation efforts, which can potentially influence players' real-world attitudes and behaviors towards the environment.

5.2 Insights into the Effectiveness of Thematic Environmental Elements in Games

Player engagement and continuity can be enhanced with the use of thematic environmental elements which can add more depth and meaning to this game. According to Junnila, et al. (2019), thematic elements have the potential to affect all aspects of a game including the audio-visual presentation, narrative, and the player. To enhance the immersive experience of the player, this game has employed the use of diverse backgrounds and animal-inspired clothing which adds to the aesthetic appeal as well. The thematic elements amplify the player experience which significantly accumulates the focus of the player to pay more attention to environmental issues embedded in the game. The primary purpose of this game is to encourage players to actively think about resource management and environmental conservation in a fun and interactive way. The design of the game aims to change the perspective of the players towards the environment to influence the real-world behavior and attitudes of players.

5.3 Implications for Game Developers and Educators

The research for this 3D adventure game provides significant implications for both game developers and educators. About game developers, this research emphasizes the importance of incorporating educational elements into the gameplay which can aid in enhancing the message while providing entertainment. The game has enormous potential to cater to a wide range of players including environmentalists as the design of the game focuses on environmental conservation. The user evaluation conducted during this research acts as a guide for refining the game by highlighting issues such as error messages, game instructions, and interface design. The issues outlined necessitate attention to enhancing the player

experience and provide a guide on the areas that need to be improved upon. Furthermore, this game, with its focus on environmental conservation, offers a platform for educators to teach about sustainability and conservation interactively. The research presents valuable insights into the integration of environmental themes in game design, the educational potential of such games, and the implications for both game developers and educators in leveraging games as a tool for engagement and learning.

6. Limitation and Future Work

6.1 Limitations

This study has significantly improved understanding of thematic 3D adventure games although it has limits. This usability evaluation sample size is modest, with only three participants. They may not represent the different perspectives and experiences needed for a complete analysis, limiting the finding's generalizability. The evaluation also included beginner to expert gamers. The differences in gaming interests and experiences across a wider user base were not examined. To further understand user opinions, future studies should include more participants and be more diverse. Heuristic evaluation was the main usability test of the study. This method can detect usability flaws, but it may not capture user experience complexity and context. Think-aloud techniques and user interviews may reveal more about the player's game experience. Also limited are the brief briefings participants get before the evaluation. Unspecific game instructions may have affected the initial user experience. Further study should provide more detailed information to players to standardize and manage the gaming environment.

Despite these restrictions, the evaluation findings shed light on usability and player viewpoints. Future studies can improve research methods based on the stated constraints.

Critics can claim that the modest sample size was meant to ensure scientific rigor and variable control. They may argue that a larger sample introduces confounding factors that delay data analysis and interpretation. In response, representative samples are crucial, especially for user experience ratings. While a bigger sample size increases variability, it also increases external validity, making the results more applicable to a wider player population.

6.2 Future Work

Future research can build on this study's findings in various ways. First, thematic 3D adventure game's long-term effects on player behavior outside the game can be studied. Understanding if these games lead to real-world conservation or environmental awareness could help explain their influence. VR and AR in thematic 3D adventure games could expand immersive gameplay. How these technologies improve player experience and learning outcomes could help educational gaming evolve. The research could also examine cultural differences in game theme reception and efficacy. Understanding how cultural origins affect player perceptions and interactions with conservation tales might help create more culturally sensitive and globally resonant games. Future research could refine and enhance this study's heuristic evaluation framework. Usability assessments could be improved by adding heuristics or tailoring evaluation criteria to thematic 3D adventure games. Expanding sample sizes, adopting varied approaches, and exploring new territories can help comprehend thematic 3D adventure games and their potential as educational and engaging tools.

7. Conclusion

This research has shown a complex terrain of insights, obstacles, and opportunities in thematic 3D adventure games focused on environmental conservation. The findings illustrate the complex relationship between gaming, education, and environmental consciousness and

suggest further research and development. The game's usability review, driven by Jakob Nielsen's heuristics, revealed user experiences and perceptions. The small but diversified sample included newbie players learning the ropes and seasoned specialists seeking complex challenges. Though helpful in identifying usability concerns, the heuristic evaluation revealed error recovery, documentation, and system status visibility issues. These findings highlight the need for clearer feedback, better tutorials, and careful user assistance.

Game thematic analysis showed that gaming can be used for environmental education. The addition of conservation elements to games enhanced the experience and taught ecological knowledge. Immersed in virtual missions, participants unwittingly promoted environmental problems, creating a unique blend of fun and knowledge. This synergy was highlighted by post-engagement behavioral changes in participants, especially younger ones, showing improved environmental awareness and sustainable actions. The research narrative's problems must be acknowledged despite its successes. While purposeful for control, the small sample size requires care when generalizing the findings. To capture the complexity of gaming experiences across a spectrum of users, future research should stress inclusion and draw insights from a larger and more diverse participant pool. While robust, heuristic evaluation may benefit from user interviews or think-aloud techniques to gain deeper user experience insights.

Future research in this field might lead to significant advances. Limitations are not obstacles but opportunities to improve methods and broaden research. Thematic 3D adventure games' effects on real-world behavior and attitudes might be studied in the future. The incorporation of cutting-edge technology like virtual reality or augmented reality opens new avenues for game immersion and educational effects. However, the cultural aspects of themed games are understudied. Future research might reveal how varied cultural backgrounds affect player

perceptions and interactions with environmental narratives, creating internationally relevant game material. Future research might refine and customize the heuristic evaluation methodology for thematic 3D adventure games to better measure usability.

This research indicates a turning point in thematic 3D adventure game discourse. It honors progress in understanding the complex link between gaming, education, and environmental consciousness and provides the framework for a bright future. The convergence of thematic elements and gameplay is ripe for research and innovation as the gaming landscape evolves and the potential for transformational influence grows.

Bibliography

Abidin S.R.Z., Noor S.F.M. and Ashaari N.S. (2019). Heuristic Evaluation of Serious Game Application for Slow-reading Students. *International Journal of Advanced Computer Science and Applications*, 10(7). DOI: [10.14569/IJACSA.2019.0100764](https://doi.org/10.14569/IJACSA.2019.0100764)

Akula S. P. (2021). A critical evaluation on SRK STORE APP by using the Heuristic Principles of Usability. *Faculty of Computing, Blekinge Institute of Technology*, 371 79 Karlskrona, Sweden. diva2:1573586

Baturay M. H., Yastibaş A. E., Yangin Ekşi G. and Çınar C. A. (2022). A Game-Based Content and Language-Integrated Learning Practice for Environmental Awareness (ENVglish): User Perceptions. In C. Lane (Ed.), *Handbook of Research on Acquiring 21st Century Literacy Skills Through Game-Based Learning* pp. 510-531. IGI Global. <https://doi.org/10.4018/978-1-7998-7271-9.ch027>

Burban J.A.S., Mera J.M.F, Caicedo M.I.V., Ojeda M.C.C. and Alvarez M.C.G. (2018). Exploration of serious games on environmental issues. In *International Congress of Telematics and Computing*. pp. 223-233 . Cham: Springer International Publishing. https://doi.org/10.1007/978-3-030-03763-5_19

Calderón-Guerrero C., Núñez M.M., Merino S.S. and Marchamalo M. (2021). Pilot experience to increase the environmental awareness of young students (12-18 years) through innovating formation by UPM researchers in the classroom. In *INTED2021 Proceedings*. pp. 8815-8823. IATED. DOI: [10.21125/inted.2021.1839](https://doi.org/10.21125/inted.2021.1839)

Ekpe B., and Wekpe I. (2023). Interactivity and Ecomedia in the Digital Age: A Comparative Study of Black November and Niger Delta Commando. *Interactive Film & Media Journal*, 3(1), pp. 126–131. <https://doi.org/10.32920/ifmj.v3i1.1696>

Escudeiro P., Gouveia M.C. and Escudeiro N. (2023). ZooLector: Raising Awareness of Biodiversity Loss to all. In *2023 IEEE Global Engineering Education Conference (EDUCON)* pp. 1-5. IEEE. DOI: 10.1109/EDUCON54358.2023.10125247.

Farzandipour M., Nabovati E. and Sadeqi Jabali M. (2022). Comparison of usability evaluation methods for a health information system: heuristic evaluation versus cognitive walkthrough method. *BMC Medical Informatics and Decision Making*, 22(1), pp.1-11. <http://dx.doi.org/10.1186/s12911-022-01905-7>

Junnila M., Reunanen M. and Heikkinen T. (2019). The Interplay of Thematic and Ludological Elements in Western-Themed Games. *Kinephanos* , special issue May 2019, pp. 40-73. <http://urn.fi/URN:NBN:fi:aalto-201906203858>

Khairat M.I., Priyadi Y., and Adrian, M. (2022). Usability Measurement in User Interface Design Using Heuristic Evaluation & Severity Rating (Case Study: Mobile TA Application based on MVVM). *2022 IEEE 12th Annual Computing and Communication Workshop and Conference (CCWC)*, 0974-0979. DOI: 10.1109/CCWC54503.2022.9720876

Kumar B.A. and Goundar M.S. (2019). Usability heuristics for mobile learning applications. *Education and Information Technologies*, 24, pp.1819-1833. <https://link.springer.com/article/10.1007/s10639-019-09860-z>

Maghfiroh L.R. (2020). Observation and heuristics evaluation of student web-based application of SIPADU-STIS. In *Journal of Physics: Conference Series* 1511(1), p. 012019. IOP Publishing. <http://dx.doi.org/10.1088/1742-6596/1511/1/012019>

Maguire M. (2019). Development of a heuristic evaluation tool for voice user interfaces. In *Design, User Experience, and Usability. Practice and Case Studies: 8th International Conference, DUXU 2019, Held as Part of the 21st HCI International Conference, HCII 2019,*

Orlando, FL, USA, July 26–31, 2019, *Proceedings, Part IV* 21 (pp. 212-225). Springer International Publishing. https://doi.org/10.1007/978-3-030-23535-2_16

Pires F., Honda F.F., Silva G., Melo R., de Freitas R. and Pessoa, M. (2019). A game proposal to develop computational thinking and environmental awareness. *Journal on Computational Thinking (JCThink)*, 3(1), p.111. DOI: <https://doi.org/10.14210/jcthink.v3.n1.p111>

Senap N.M.V. and Ibrahim R. (2019). A review of heuristics evaluation component for mobile educational games. *Procedia Computer Science*, 161, pp.1028-1035. <http://dx.doi.org/10.1109/ICIC53490.2021.9693022>

Sobrino-Duque R., Martínez-Rojo N., Carrillo-de-Gea J.M., López-Jiménez J.J., Nicolás J. and Fernández-Alemán J.L. (2022). Evaluating a gamification proposal for learning usability heuristics: Heureka. *International Journal of Human-Computer Studies*, 161, p.102774. <https://doi.org/10.1016/j.ijhcs.2022.102774>

Xu A., Baysari M.T., Stocker S.L., Leow L.J., Day R.O. and Carland J.E. (2020). Researchers' views on, and experiences with, the requirement to obtain informed consent in research involving human participants: a qualitative study. *BMC medical ethics*, 21(1), pp.1-11. <https://doi.org/10.1186/s12910-020-00538-7>

Yeşilyurt M., Özdemir Balakoğlu M., and Erol M. (2020). The Impact of Environmental Education Activities on Primary School Students' Environmental Awareness and Visual Expressions. *Qualitative Research in Education*, 9(2), 188-216. doi:10.17583/qre.2020.5115

Young J. L., Halley M. C., Anguiano B., Fernandez L., Bernstein J. A., Wheeler M. T., Tabor H. K., and Undiagnosed Diseases Network Consortium (2022). Beyond race: Recruitment of diverse participants in clinical genomics research for rare disease. *Frontiers in genetics*, 13, 949422. <https://doi.org/10.3389/fgene.2022.949422>

Appendix

Appendix A: Heuristic Evaluation

User 1

Table 1: Heuristic Evaluation by User 1

N i e l s e n ' s Heuristic	Aspects to Evaluate in Game Development	User Input	Issue (0-5)
1. Visibility of System Status	<ul style="list-style-type: none">- The game provides feedback in response to player actions.- Status indicators for health, score, level, etc., are clear and easily understood.	No health indicator not there for the monster and player but shows the prize collected and unclear status indicators in some case	3
2 . M a t c h Between the System and the Real World	<ul style="list-style-type: none">- The game uses familiar terms and icons.- Real-world conventions are followed where applicable, enhancing immersion and understanding.	I used candies to represent the prize collected when I collected water drops. There is a match between the system as there are trees, cactuses, and bushes	1

3. User Control and Freedom	<ul style="list-style-type: none"> - Players have control over actions, with options to undo/redo. - Flexibility in gameplay choices and paths. 	<p>Good gameplay choices and paths and there is flexibility. Once outside the map can not enter again</p>	1
4. Consistency and Standards	<ul style="list-style-type: none"> - Consistent use of controls and terminology - Game mechanics and interface elements are uniform throughout. 	<p>Good controls. Terminology problem 'boots' and 'knife'; no description. If the description box is available when hovering it is helpful</p>	3
5. Error Prevention	<ul style="list-style-type: none"> - Design minimizes the chance of player errors. - Clear instructions and feedback to prevent user mistakes. 	<p>No instruction or feedback. I went outside the map and there was no restriction but I couldn't enter.</p>	2

6. Recognition Rather than Recall	<ul style="list-style-type: none"> - Objects, actions, and options are visible. - Minimal memory load on players by keeping information accessible. 	No issues at all	0
7. Flexibility and Efficient of Use	<ul style="list-style-type: none"> - The game accommodates both novice and expert players. - Customizable controls and interfaces for different player preferences. 	Yes. But the game is mostly for beginners as it doesn't have the complexity expert players want.	0
8. Aesthetic Minimalist Design	<ul style="list-style-type: none"> - Visual design is not cluttered; focuses on relevant information. - Game aesthetics enhance the play experience without overwhelming the player. 	Good aesthetic however, some objects have no use such as the vase.	2
9. Help Users Recognize, Diagnose and Recover From Errors	<ul style="list-style-type: none"> - Clear error messages and guidance for recovery. - Feedback on incorrect actions or puzzles. 	No guidance for recovery. No understandability due to the error message being in Chinese.	4

10. Help and Documentation	<ul style="list-style-type: none"> - Accessible tutorials and help features. - Documentation (in-game or external) supports player understanding and progression. 	No help guidance or documentation.	4
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User 2

Table 2: Heuristic Evaluation by User 2

N i e l s e n ' s Heuristic	Aspects to Evaluate in Game Development	User Input	Rank (0-5)
1. Visibility of System Status	<ul style="list-style-type: none"> - The game provides feedback in response to player actions. - Status indicators for health, score, level, etc., are clear and easily understood. 	<p>Only one status indicator is efficient.</p> <p>Unclear about all statuses and not easily understandable.</p>	3

<p>2 . M a t c h Between the System and the Real World</p>	<ul style="list-style-type: none"> - The game uses familiar terms and icons. - Real-world conventions are followed where applicable, enhancing immersion and understanding. 	<p>I can enter trees rather than becoming obstacles however I can go through them.</p> <p>Unclear about why I can go through a bush and also a tree.</p> <p>When a user fires into the bush it should light up on fire</p>	<p>2</p>
<p>3. User Control and Freedom</p>	<ul style="list-style-type: none"> - Players have control over actions, with options to undo/redo. - Flexibility in gameplay choices and paths. 	<p>The flexible and joystick option is there however, no option to jump.</p>	<p>2</p>

4. Consistency and Standards	<ul style="list-style-type: none"> - Consistent use of controls and terminology - Game mechanics and interface elements are uniform throughout. 	<p>Game interface elements are consistent. No consistency in prizes different prizes and both prizes give the same point. Enemies in different levels have the same strength</p>	<p>2</p>
5. Error Prevention	<ul style="list-style-type: none"> - Design minimizes the chance of player errors. - Clear instructions and feedback to prevent user mistakes. 	<p>No error prevention or instructions. The game ended once prizes were collected and one time I reached another level.</p>	<p>4</p>
6. Recognition Rather than Recall	<ul style="list-style-type: none"> - Objects, actions, and options are visible. - Minimal memory load on players by keeping information accessible. 	<p>Minimal memory load. Just need to remember how many power-ups I have.</p>	<p>2</p>

7. Flexibility and Efficient of Use	<ul style="list-style-type: none"> - The game accommodates both novice and expert players. - Customizable controls and interfaces for different player preferences. 	<p>Yes easy to play and suitable for both but too easy for expert players.</p>	<p>1</p>
8. Aesthetic Minimalist Design	<ul style="list-style-type: none"> - Visual design is not cluttered; focuses on relevant information. - Game aesthetics enhance the play experience without overwhelming the player. 	<p>No purpose for some items. The color remains the same after changing the levels and only the color of the enemy changes. However, the design was minimal and aesthetic.</p>	<p>3</p>
9. Help Users Recognize, Diagnose and Recover From Errors	<p>Clear error messages and guidance for recovery.</p> <ul style="list-style-type: none"> - Feedback on incorrect actions or puzzles. 	<p>Language barrier couldn't understand the error message. I couldn't go to the next level.</p>	<p>5</p>

10. Help and Documentation	<ul style="list-style-type: none"> - Accessible tutorials and help features. - Documentation (in-game or external) supports player understanding and progression. 	No tutorial or help and had to learn on my own.	4
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User 3

Table 3: Heuristic Evaluation by User 3

N i e l s e n ' s Heuristic	Aspects to Evaluate in Game Development	User Input	Rank (0-5)
1. Visibility of System Status	<ul style="list-style-type: none"> - The game provides feedback in response to player actions. - Status indicators for health, score, level, etc., are clear and easily understood. 	Unclear and not understandable	3
2. Match Between the System and the Real World	<ul style="list-style-type: none"> - The game uses familiar terms and icons. - Real-world conventions are followed where applicable, enhancing immersion and understanding. 	Some matches between the system and the real world.	2

3. User Control and Freedom	<ul style="list-style-type: none"> - Players have control over actions, with options to undo/redo. - Flexibility in gameplay choices and paths. 	Room for improvement, hindered movement	3
4. Consistency and Standards	<ul style="list-style-type: none"> - Consistent use of controls and terminology - Game mechanics and interface elements are uniform throughout. 	All good	1
5. Error Prevention	<ul style="list-style-type: none"> - Design minimizes the chance of player errors. - Clear instructions and feedback to prevent user mistakes. 	No proper timing of error messages and it is in Chinese	4
6. Recognition Rather than Recall	<ul style="list-style-type: none"> - Objects, actions, and options are visible. - Minimal memory load on players by keeping information accessible. 	Minimal memory load	0

7. Flexibility and Efficient of Use	<ul style="list-style-type: none"> - The game accommodates both novice and expert players. - Customizable controls and interfaces for different player preferences. 	<p>It accommodated both professionals and beginners.</p> <p>Professionals may be bored with the initial levels</p>	<p>1</p>
8. Aesthetic Minimalist Design	<ul style="list-style-type: none"> - Visual design is not cluttered; focuses on relevant information. - Game aesthetics enhance the play experience without overwhelming the player. 	<p>Medium aesthetics.</p> <p>Would be nice to customize the character.</p>	<p>3</p>
9. Help Users Recognize, Diagnose and Recover From Errors	<p>Clear error messages and guidance for recovery.</p> <ul style="list-style-type: none"> - Feedback on incorrect actions or puzzles. 	<p>I am Chinese so I could understand the error message however others may fail to. (The target user is a Chinese player)</p>	<p>3</p>

10. Help and Documentation	<ul style="list-style-type: none"> - Accessible tutorials and help features. - Documentation (in-game or external) supports player understanding and progression. 	No tutorial however I learned it after testing a few things.	2
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Appendix B: Evaluation and Priority of Heuristics

Help Users Recognize, Diagnose, and Recover from Errors

User 1: 4

User 2: 5

User 3: 3

Average Score: 4

Help and Documentation

User 1: 4

User 2: 4

User 3: 2

Average Score: 3.33

Error Prevention

User 1: 2

User 2: 4

User 3: 4

Average Score: 3.33

Visibility of System Status

User 1: 3

User 2: 3

User 3: 3

Average Score: 3.0

Aesthetic Minimalist Design

User 1: 2

User 2: 3

User 3: 3

Average Score: 2.67

User Control and Freedom

User 1: 1

User 2: 2

User 3: 3

Average Score: 2.0

Consistency and Standards

User 1: 3

User 2: 2

User 3: 1

Average Score: 2.0

Match Between the System and the Real World

User 1: 1

User 2: 2

User 3: 2

Average Score: 1.67

Flexibility and Efficiency of Use

User 1: 0

User 2: 1

User 3: 1

Average Score: 0.67

Recognition Rather than Recall

User 1: 0

User 2: 2

User 3: 0

Average Score: 0.67