Development of Campus Crisis a 2.5D Android Adventure Game for Emergency Response for Lyceum of Alabang

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ABSTRACT

Emergency preparedness remains a critical yet often overlooked area in student education, particularly in engaging and interactive formats. This study addresses the gap in disaster response awareness by developing Campus Crisis, a 2.5D offline single-player Android adventure game designed to educate students of Lyceum of Alabang on disaster preparedness and post-disaster response based on the institution's Emergency Response Team Manual. The objective of the study was to create an educational game that delivers disaster-related information through interactive gameplay, increasing student engagement and knowledge retention. The game was developed using the Godot Engine and its scripting language GDScript, with assets created in Aseprite (2D) and Blender (3D). Alpha and beta testing were conducted to evaluate the game's functionality, reliability, and usability, with feedback collected from IT Specialists and student end users. Evaluation data showed a general weighted mean of 4.41 ("Very Good") from IT Specialists and 4.63 ("Excellent") from end users. Testers noted the game's effective educational content, engaging design, and technical stability. The findings suggest that Campus Crisis successfully meets its objective by providing an alternative, interactive method for delivering emergency preparedness education. The results imply that gamified learning tools can be effective in improving student awareness and responsiveness to real-life disaster scenarios, paving the way for future enhancements such as crossplatform accessibility, increased replayability, and expanded game features.

Keywords: *Disaster Preparedness, Emergency Response, Lyceum of Alabang, Android Game*

INTRODUCTION

In a world increasingly affected by natural and man-made disasters, the importance of emergency preparedness has become more critical than ever. Schools, as institutions responsible for shaping not only the academic but also the practical knowledge of students, have a responsibility to equip learners with the necessary skills and understanding to respond effectively to emergencies. However, traditional methods of disaster education such as lectures, printed manuals, and drills, often fail to engage students meaningfully, leading to gaps in awareness, retention, and actual response preparedness.

In the Philippine context, where typhoons, earthquakes, volcanic eruptions, and other disasters are a frequent part of life, educational institutions play a crucial role in raising awareness about emergency response. Despite this urgency, the delivery of emergency preparedness content in many academic institutions remains static and uninspiring. Printed manuals are often overlooked, lectures may be forgotten, and drills,

while essential, provide limited opportunities for students to fully grasp the rationale behind emergency procedures. This disconnect presents a significant educational gap, one where student engagement does not match the gravity of the subject matter.

At Lyceum of Alabang, the need for a more effective, immersive, and engaging approach to disaster preparedness education was recognized. This study, therefore, addresses a critical gap: the absence of an interactive, gamified platform that allows students to learn about emergency responses in a way that encourages participation, retention, and application of knowledge. By integrating educational content with interactive game mechanics, this project aims to redefine how emergency preparedness is taught at the tertiary level.

Campus Crisis, a 2.5D offline single-player Android adventure game, was conceptualized and developed to provide students with a realistic, story-driven environment in which they could explore disaster scenarios and make critical decisions based on real-life emergency protocols. Inspired by the Emergency Response Team (ERT) Manual of Lyceum of Alabang, the game simulates five different disaster scenarios, each designed with unique characters, settings, and gameplay mechanics. The game seeks to bridge the gap between theoretical knowledge and practical application by allowing players to engage with situations that mimic real-life emergencies.

The primary objectives of this research are as follows:

1. To design and develop an educational 2.5D Android game that simulates various disaster situations using the Godot game engine, incorporating both 2D and 3D assets for enhanced visual engagement.
2. To integrate content from Lyceum of Alabang's Emergency Response Team Manual into the game's scenarios, ensuring that the educational material aligns with institution approved emergency protocols.
3. To evaluate the effectiveness of the game in educating students on emergency preparedness and response through alpha and beta testing, involving both IT professionals and student users.
4. To assess the game's software quality in terms of functionality, usability, reliability, and other ISO 25010 quality characteristics.
5. To identify areas for improvement and recommend enhancements that could increase the game's accessibility, replayability, and educational impact.

By focusing on a gamified learning approach, this research diverges from the traditional forms of emergency preparedness education. It highlights the potential of game-based learning as a more engaging and impactful method of delivering life-saving knowledge, especially to the digital-native generation of students.

The significance of this study lies in its innovative use of educational gaming to meet a critical learning need. While various applications and simulation platforms exist globally, there is a lack of localized, culturally relevant, and institution-specific tools that combine educational content with engaging gameplay. Campus Crisis fills this void by offering a tailored learning experience based on the real-world emergency framework of Lyceum of Alabang. It not only increases student engagement but also aims to improve knowledge retention and decision-making skills in highpressure situations.

As such, this study contributes to the broader discourse on educational technology and disaster preparedness, showcasing how interactive media can be leveraged to

address serious educational gaps. Moreover, it provides a potential model for other educational institutions in the Philippines and beyond to follow in enhancing student preparedness through digital tools.

RESEARCH QUESTIONS

1. How can emergency preparedness and response information be effectively delivered to students in a way that is engaging, interactive, and memorable?
2. What game mechanics and educational content can be integrated to simulate real-world emergency scenarios specific to Lyceum of Alabang?
3. To what extent does the game meet software quality standards such as functionality, usability, reliability, and maintainability as defined by ISO/IEC 25010:2011?

METHODOLOGY

The methodology of this study adopts a quantitative research design, which is appropriate for systematically evaluating the performance and user perception of Campus Crisis: A 2.5D Android Adventure Game for Emergency Response for Lyceum of Alabang. This approach allows the researchers to collect measurable and statistically analyzable data to assess the system's functionality and user satisfaction. The target population for this study comprises high school and college students of Lyceum of Alabang, as well as Information Technology (IT) specialists. A simple random sampling method was employed to ensure each individual had an equal chance of being selected, enhancing the credibility of the results. Using a standard sample size formula, with a 90% confidence level, 10% margin of error, and a population size of 5000, the researchers determined a sample of 68 respondents, composed of 58 end users and 10 IT experts (refer to Figure 1. Sample Size Formula).

Figure 1
Sample Size Formula

$$\text{Sample size} = \frac{\frac{z^2 \times p\,(1-p)}{e^2}}{1 + \left(\frac{z^2 \times p\,(1-p)}{e^2 N}\right)}$$

N = population size • e = Margin of error (percentage in decimal form) • z = z-score (the confidence level)

Table 1
Confidence Level Conversion to Z-Score

Desired confidence level	z-score
80%	1.28
85%	1.44
90%	1.65
95%	1.96
99%	2.58

To assess the game, a standardized software evaluation instrument was used, grounded in the ISO/IEC 25010:2011 quality model. This tool measured six key software quality characteristics: functional suitability, usability, reliability, security, maintainability, and portability. A 5-point Likert scale ranging from 1 (Poor) to 5 (Excellent) ensured consistent responses (refer to Table 2. Likert scale). The evaluation instrument underwent validation through expert reviews, with revisions made to align it with the study's objectives. Prior to implementation, approval was obtained from institutional authorities. After a game demonstration, respondents completed the evaluation form either in person or digitally. Collected data were systematically recorded and analyzed using descriptive statistics, with the arithmetic mean formula used to determine the average score for each criterion (refer to Figure 2. Arithmetic Mean). A descriptive interpretation scale (e.g., 4.51– 5.00 = Excellent) was applied to contextualize the results (refer to Table 3. Scale Range and the Equivalent Descriptive Rating)

Figure 2
Arithmetic Mean

$$\bar{x} = \frac{\sum x}{n}$$

Table 2
Likert Scale

Scale	Descriptive Rating
5	Excellent
4	Very Good
3	Good
2	Fair
1	Poor

Table 3
Scale Range and the Equivalent Descriptive Rating

Scale	Descriptive Rating
4.51 to 5.00	Excellent
3.51 to 4.50	Very Good
2.51 to 3.50	Good
1.51 to 2.50	Fair
1.00 to 1.50	Poor

The testing procedure is a crucial component of software development, serving as a systematic approach to evaluate the functionality, performance, and usability of a software product. To ensure the success of the game, a series of test cases will be conducted. The developers will be using alpha and beta testing for the functional testing method for this research. In functional testing, each sprint will be checked and every sprint that is completed will be gone through test cases to ensure that it complies with all the requirements. Each test will be performed for 2 cycles for every sprint.

In alpha testing the test cases will be developed based on the software requirement and specifications and the execution of test case will be done in a controlled environment. If any issues or bugs are identified during the testing it will be documented and then the developers will collect the feedback provided by the tester. In beta testing the test case will be refined or expanded based on feedback received during alpha testing and the test cases will be distributed to a wider audience (target end users). Those beta testers will then execute the test cases in their own environment and their feedback will be collected for the improvement of the game. Each execution of the test case will be marked as either PASSED or FAILED. The test case form that will be used is shown in Table 4.

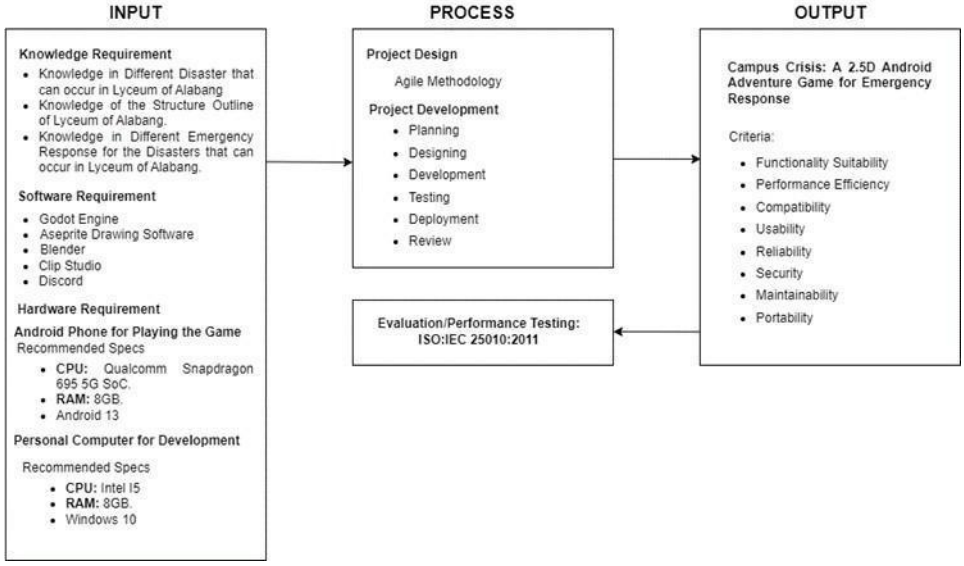
Table 4
Summary of Test Case Execution

Test Execution	Expected Result	Actual Result	
		Cycle 1	Cycle 2
No of Test cases Executed	100%		
Results of Test Cases			
Passed	100%		
Failed	0%		
No of Test Cases Not Executed	0%		

Figure 3
Agile Methodology

The development of the game followed the Agile Software Development Model, which promotes iterative progress, flexibility, and user-centered design. To organize the workflow, the team implemented development sprints that allowed the team to plan, develop, test, and refine features in cycles. Each sprint focused on specific milestones such as asset creation, level design, user interface implementation, and bug fixing.

Figure 4
Conceptual Model



Moreover, the project followed a Conceptual Model using the Input-Process-Output (IPO) framework. The input included user requirements, emergency preparedness content, and institutional guidelines. The process involved designing, coding, and testing the game using tools such as Unity and C#, while guided by Agile principles and structured into sprints. The final output was a functional, offline 2.5D Android game that educates students on how to respond effectively during emergency scenarios on campus. The separate evaluations from end users and IT professionals offered both experiential and technical insights into the game's quality and impact.

RESULTS AND DISCUSSION

The Researchers used alpha testing intended to test the game in a controlled environment and will be based on the software requirement and specifications. As table no. 6 shown below, it explains that summary of alpha testing. Refer to the test results pg. 18.

Table 6

Summary of Alpha Testing

Test Execution	Expected Result	Actual Result	
		Cycle 1	Cycle 2
No of Test cases Executed	100%	17	
Results of Test Cases			
Passed	100%	12	5
Failed	0%	5	0
No of Test Cases Not Executed	0%		

The Researchers used beta testing intended for the end users to evaluate the game and its features. The testers will execute the test cases in their own environment and their feedback will be collected for the improvement of the game. Refer to the test results pg. 27.

Table 7

Summary of Beta Testing

Test Execution	Expected Result	Actual Result	
		Cycle 1	Cycle 2
No of Test cases Executed	100%	4	
Results of Test Cases			
Passed	100%	4	0
Failed	0%	0	0
No of Test Cases Not Executed	0%		

As for the evaluation results, derived from the data collected during the evaluation process, offered significant insights into the system's performance. The results are separated into two parts evaluation results for end users and IT specialists. The analysis highlighted key findings and trends, revealing both the game's strengths and areas needing improvement. These results served as a basis for assessing the game's effectiveness in meeting its intended objectives.

Table 8
IT Specialists evaluation in terms of Functional Suitability

Software Evaluation Characteristics	Weighted Mean	Interpretation
Set of functions covers all the specified tasks and user objectives **(Completeness)**	4.3	Very Good
Provides the correct results with the needed degree of precision **(Correctness)**	4.6	Excellent
Functions facilitate the accomplishment of specified tasks and objectives **(Appropriateness)**	4.3	Very Good
General Weighted Mean	**4.4**	**Very Good**

The table shows the general weighted mean of the system based on the IT Specialists evaluation in terms of functional suitability. The result for the functional suitability evaluation is 4.4 and it is for interpretation the game was rated as Very Good.

Table 9
IT Specialists evaluation in terms of Performance Efficiency

Software Evaluation Characteristics	Weighted Mean	Interpretation
Response and processing times and throughput rates of a system when performing its functions meets requirements **(Time Behavior)**	4.5	Excellent
Amounts and types of resources used by a system when performing its functions meets requirements **(Resource utilization)**	4.5	Excellent
Maximum limits of a system parameter meet requirements **(Capacity)**	4.3	Very Good
General Weighted Mean	**4.43**	**Very Good**

The table shows the general weighted mean of the system based on the IT Specialist evaluation in terms of Performance Efficiency. The result for this evaluation is 4.43 and it is for interpretation the game was rated as Very Good.

Table 10
IT Expert evaluation in terms of Compatibility

Software Evaluation Characteristics	Weighted Mean	Interpretation
Perform its required functions efficiently while sharing a common environment and resources with other system without detrimental impact on any other system **(Co - existence)**	4.5	Excellent
Two or more systems or components can exchange information and use the information that has been exchanged **(Interoperability)**	4.7	Excellent
General Weighted Mean	**4.6**	**Excellent**

The table shows the general weighted mean of the system based on the IT Specialist evaluation in terms of Compatibility. The result for this evaluation is 4.6 and it is for interpretation the game was rated as Excellent.

Table 11
IT Specialists evaluation in terms of Usability

Software Evaluation Characteristics	Weighted Mean	Interpretation
Users can recognize whether a product or system is appropriate for their needs **(Appropriateness recognizability)**	4.4	Very Good
System can be used by specified users to achieve specified goals of learning to use the system with effectiveness, efficiency, freedom from risk and satisfaction in a specified context of use **(Learnability)**	4.7	Excellent
System has attributes that make it easy to operate and control **(Operability)**	4.6	Excellent
System protects the users against making errors (User error protection)	4.4	Very Good
User interface enables pleasing and satisfying interaction for the user **(User interface aesthetics)**	4.3	Very Good
System can be used by people with the widest range of characteristics and capabilities to achieve a specified goal in a specified context of use **(Accessibility)**	4.4	Very Good
General Weighted Mean	**4.5**	**Very Good**

The table shows the general weighted mean of the system based on the IT Specialist evaluation in terms of Usability. The result for this evaluation is 4.5 and it is for interpretation the game was rated as Very Good.

Table 12
IT Specialists evaluation in terms of Reliability

Software Evaluation Characteristics	Weighted Mean	Interpretation
System meets the needs for reliability under normal operation **(Maturity)**	4.5	Excellent
System is operation and accessible when required for use **(Availability)**	4.4	Very Good
System operates as intended despite the presence of hardware or software faults **(Fault tolerance)**	4.2	Very Good
System can recover the data directly affected and re-establish the desired state of the system, in the event of an interruption or a failure **(Recoverability)**	4.2	Very Good
General Weighted Mean	**4.33**	**Very Good**

The table shows the general weighted mean of the system based on the IT Specialist evaluation in terms of Reliability. The result for this evaluation is 4.33 and it is for interpretation the game was rated as Very Good.

Table 13
IT Specialists evaluation in terms of Security

Software Evaluation Characteristics	Weighted Mean	Interpretation
System ensures that data are accessible only to those authorized to have access **(Confidentiality)**	4.4	Very Good
System prevents unauthorized access to, or modification of, computer programs or data **(Integrity)**	4.4	Very Good
Actions or events can be proven to have taken place, so that the events or actions cannot be repudiated later **(non-repudiation)**	4.2	Very Good
Actions of an entity can be traced uniquely to the entity **(Accountability)**	4.3	Very Good
Identity of a subject or resource can be proved to be the one claimed **(Authenticity)**	4.3	Very good
General Weighted Mean	**4.32**	**Very Good**

The table shows the general weighted mean of the system based on the IT Specialists evaluation in terms of Security. The result for the content's evaluation is 4.32 and it is for interpretation the game was rated as Very Good.

Table 14
IT Specialists evaluation in terms of Maintainability

Software Evaluation Characteristics	Weighted Mean	Interpretation
System is composed of discrete components such that a change to one component has minimal impact on other components **(Modularity)**	4.3	Very Good
Asset can be used in more than one system, or in building other assets **(Reusability)**	4.4	Very Good
Degree of effectiveness and efficiency in which it is possible to assess the impact on system of an intended change to one or more of its parts, or to diagnose a system for deficiencies or causes of failures, or to identify parts to be modified **(Analyzability)**	4.5	Excellent
System can be effectively and efficiently modified without introducing defects or degrading existing product quality **(Modifiability)**	4.1	Very Good
Degree of effectiveness and efficiency in which test criteria can be established for a system, product or component and tests can be performed to determine whether those criteria have been met **(Testability)**	4.3	Very Good
General Weighted Mean	**4.32**	**Very Good**

The table shows the general weighted mean of the system based on the IT Specialists evaluation in terms of Maintainability. The result for the content's evaluation is 4.32 and it is for interpretation the game was rated as Very Good.

Table 15
IT Specialists evaluation in terms of Portability

Software Evaluation Characteristics	Weighted Mean	Interpretation
System can effectively and efficiently be adapted for different or evolving hardware, software or other operational or usage environments **(Adaptability)**	4.4	Very Good
Degree of effectiveness and efficiency in which system can be successfully installed and/or uninstalled in a specified environment **(Installability)**	4.6	Excellent
System can replace another specified software product for the same purpose in the same environment **(Replaceability)**	4.2	Very Good
General Weighted Mean	**4.4**	**Very Good**

The Table shows the general weighted mean of the system based on the IT Specialists evaluation in terms of portability. The result for the content's evaluation is 4.4 and it is for interpretation the game was rated as Very Good.

Table 16
End Users evaluation in terms of Functional Suitability

Software Evaluation Characteristics	Weighted Mean	Interpretation
Set of functions covers all the specified tasks and user objectives **(Completeness)**	4.6	Excellent
Provides the correct results with the needed degree of precision **(Correctness)**	4.6	Excellent
Functions facilitate the accomplishment of specified tasks and objectives **(Appropriateness)**	4.7	Excellent
General Weighted Mean	**4.63**	**Excellent**

The table shows the general weighted mean of the system based on the end user's evaluation in terms of functional suitability. The result for the functional suitability evaluation is 4.63 and it is for interpretation the game was rated as Excellent.

Table 17
End Users evaluation in terms of Reliability

Software Evaluation Characteristics	Weighted Mean	Interpretation
System meets the needs for reliability under normal operation **(Maturity)**	4.7	Excellent
System is operation and accessible when required for use **(Availability)**	4.7	Excellent
System operates as intended despite the presence of hardware or software faults **(Fault tolerance)**	4.55	Excellent
System can recover the data directly affected and re-establish the desired state of the system, in the event of an interruption or a failure **(Recoverability)**	4.6	Excellent
General Weighted Mean	**4.64**	**Excellent**

The table shows the general weighted mean of the system based on the end user's evaluation in terms of Reliability. The result for this evaluation is 4.64 and it is for interpretation the game was rated as Excellent.

Table 18
End Users evaluation in terms of Usability

Software Evaluation Characteristics	Weighted Mean	Interpretation
Users can recognize whether a product or system is appropriate for their needs **(Appropriateness recognizability)**	4.6	Excellent
System can be used by specified users to achieve specified goals of learning to use the system with effectiveness, efficiency, freedom from risk and satisfaction in a specified context of use **(Learnability)**	4.7	Excellent
System has attributes that make it easy to operate and control (Operability)	4.7	Excellent
System protects the users against making errors **(User error protection)**	4.6	Excellent
User interface enables pleasing and satisfying interaction for the user **(User interface aesthetics)**	4.6	Excellent
System can be used by people with the widest range of characteristics and capabilities to achieve a specified goal in a specified context of use **(Accessibility)**	4.6	Excellent
General Weighted Mean	**4.63**	**Excellent**

The table shows the general weighted mean of the system based on the end user's evaluation in terms of Usability. The result for this evaluation is 4.63 and it is for interpretation the game was rated as Excellent.

Table 19
IT Specialist Results of Overall Evaluation

Software Evaluation Characteristics	Weighted Mean	Interpretation
Functional Suitability	4.4	Very Good
Performance Efficiency	4.43	Very Good
Compatibility	4.6	Excellent
Usability	4.5	Very Good
Reliability	4.33	Very Good
Security	4.32	Very Good
Maintainability	4.32	Very Good
Portability	4.4	Very Good
General Weighted Mean	**4.41**	**Very Good**

The result of IT Specialist's overall evaluation of the game based on the software evaluation characteristics is 4.41 and interpreted as Very Good.

Table 20
End User Results of Overall Evaluation

Software Evaluation Characteristics	Weighted Mean	Interpretation
Functional Suitability	4.63	Excellent
Reliability	4.64	Excellent
Usability	4.63	Excellent
General Weighted Mean	**4.63**	**Excellent**

The result of end user's overall evaluation of the game based on the software evaluation characteristics is 4.63 and interpreted as Excellent.

The evaluation results reveal a significant difference between the assessments of IT Specialists and End Users. The General Weighted Mean for IT Specialists is 4.41, interpreted as "Very Good," while the General Weighted Mean for End Users is 4.63, interpreted as "Excellent." This indicates that End Users rated the game more favorably across various software evaluation characteristics compared to IT Specialists.

In terms of Functional Suitability, IT Specialists gave a rating of 4.4 ("Very Good"), while End Users rated it 4.63 ("Excellent"), suggesting that End Users found the game more suitable for its intended purpose. For Reliability, IT Specialists provided a rating of 4.33 ("Very Good"), whereas End Users rated it 4.64 ("Excellent"), indicating a higher perception of stability and dependability among End Users. Similarly, for Usability, IT Specialists gave a rating of 4.5 ("Very Good"), while End Users rated it 4.63 ("Excellent"), reflecting a more favorable view of the game's userfriendliness by the End Users. The IT Specialists also evaluated additional technical aspects such as Performance Efficiency, Compatibility, Security, Maintainability, and Portability, providing a more comprehensive analysis of the game's technical quality. These ratings ranged from 4.32 to 4.6, all interpreted as "Very Good" or "Excellent".

The difference in evaluations reflects the differing perspectives of the two groups. IT Specialists focused on technical and developmental aspects, leading to more critical assessments, while End Users prioritized their overall experience and satisfaction, resulting in higher ratings.

CONCLUSION

Based on the evaluation results, Campus Crisis: A 2.5D Android Adventure Game for Emergency Response for Lyceum of Alabang achieved its intended purpose of educating students about disaster preparedness through an engaging and interactive medium. The overall evaluation from IT Specialists yielded a general weighted mean of 4.41, interpreted as "Very Good," while the End Users gave a higher general weighted mean of 4.63, interpreted as "Excellent." These findings indicate that while IT Specialists viewed the system favorably from a technical standpoint, End Users experienced a higher level of satisfaction and perceived effectiveness in gameplay and educational value. The disparity in ratings reflects the different evaluation perspectives: IT Specialists emphasized system performance and technical compliance, whereas End Users focused on usability and overall experience.

The game's integration of disaster response protocols and its narrative-driven structure effectively conveyed essential emergency preparedness concepts. It offered

five chapters, each showcasing different disasters, characters, and gameplay mechanics aligned with the Emergency Response Manual of Lyceum of Alabang. The results validate the game as a valuable supplementary learning tool for disaster education within academic environments.

In light of these findings, several enhancements are recommended to improve the game further.

Developers should consider expanding the game's accessibility through cross-platform availability to reach a wider audience. Increasing the game's replayability by introducing features such as achievement systems and random scenarios is encouraged to maintain user engagement. The inclusion of voice acting for characters and sound effects for character expressions (e.g., grunts, sighs) would improve immersion and emotional connection. Additionally, offering character customization features could enhance personalization, leading to greater user satisfaction. These recommendations aim to elevate both the technical and experiential quality of the game, ensuring its continued relevance and effectiveness as an educational tool.

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