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Augmented Reality Gaming Experience: Assessing Satisfaction Level Towards Post Event Behavior for MARA 1.0

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Abstract: The proliferation of Augmented Reality (AR) technology has significantly transformed the gaming industry by merging digital content with the physical environment. This study focuses on assessing player satisfaction and subsequent behaviors in response to Mission AR Apocalypse (MARA) 1.0, an AR game designed to enhance educational engagement for Universiti Teknologi MARA (UiTM) students. Developed amidst the COVID-19 pandemic by UnBound Malaysia, this game aims to provide an enriching experience through the integration of educational content within an AR framework. This research investigates four primary factors influencing player satisfaction: immersion and visual experience, ease of use and controls, game content and storyline and technical performance. Utilizing a correlational research design, data were collected from 503 students across 15 UiTM branches via structured questionnaires. The study employs Net Promoter Score (NPS) to measure satisfaction levels and their impact on post-event behaviors, such as the intent to recommend and continue using the game. Findings indicate a high level of satisfaction with immersion and visual experience, ease of use, and game content, though technical performance showed mixed results. These results support the hypotheses that immersive, visually rich AR games with user-friendly controls and engaging content enhance player satisfaction and recommendation intentions. The study concludes that while the majority of players are satisfied, there are areas for improvement, particularly in technical performance, to ensure a more seamless and enjoyable gaming experience. These insights are crucial for developers and educators aiming to optimize AR applications for educational purposes.

Keywords: *Augmented reality (AR) games, Player satisfaction, Immersive experience, Post-event behavior, Game design and engagement*

1. Introduction and Background

The advent of Augmented Reality (AR) has revolutionized the gaming industry, offering players an immersive experience that seamlessly blends digital content with the real world. Unlike traditional video games, AR games superimpose computer-generated images on a user's view of the real world, enhancing the player's perception and interaction with their environment. This unique integration of virtual and real elements has created new possibilities for game design, player engagement, and entertainment.

One of the most notable successes in AR gaming is Pokémon Go, which launched in 2016 and quickly garnered millions of users worldwide. The game's ability to encourage physical activity, social interaction, and exploration of real-world locations highlighted the vast potential of AR technology in gaming (Paavilainen, Korhonen, Alha, Stenros, Koskinen & Mayra, 2017). Following its success, numerous AR games have emerged, each striving to provide a captivating and memorable player experience. As the AR gaming market continues to grow, understanding what drives player satisfaction and how it influences post-game behavior becomes increasingly important for developers and marketers. Satisfied players are more likely to continue playing, recommend the game to others, and participate in future releases or events. Therefore, assessing the factors that contribute to player satisfaction in AR games can provide valuable insights for optimizing game design and marketing strategies.

This research focuses on Mission AR Apocalypse (MARA) 1.0, a new AR game designed to offer an engaging and immersive experience in education for UiTM students. This game was developed by UnBound Malaysia, one of the leaders in digital technology in Malaysia. Collaborating with students from Bachelor of Event Management, UiTM, this game was launched in early 2021 amid the Covid-19 pandemic. The primary objective of this study is to evaluate the satisfaction levels of players and how this satisfaction influences their post-event behavior,

In the context of AR gaming, several factors are believed to influence player satisfaction, including the immersion and visual experience, ease of use and controls, game content and storyline, and the technical performance of the game (Zhou, Duh & Billinghurst, 2008). This study will explore these dimensions to identify which elements are most critical in shaping a positive gaming experience.

Understanding the dynamics of player satisfaction and behavior in AR gaming not only helps in improving current games but also in setting a benchmark for future AR game developments. This research aims to bridge the gap in the literature concerning the evaluation of AR gaming experiences and their subsequent impact on player behavior.

The integration of Augmented Reality (AR) technology in various domains has seen a rapid increase, particularly in the gaming industry, where it has transformed player experiences by blending digital content with the real world. Despite its global advancements, the adoption and implementation of AR technology in the educational field within Malaysia remain relatively nascent. This limited utilization presents several challenges and opportunities that need to be addressed to fully harness the potential of AR.

In the context of Malaysia, the application of AR in educational settings is still in its early stages, with few institutions exploring its capabilities for enhancing learning and engagement (Yunus, Nordin, Salehi, Sun, & Embi, 2013). This nascent stage of AR technology in education means that there is a lack of comprehensive understanding regarding its impact on user satisfaction and subsequent behaviors, such as continued usage and recommendations to peers.

Furthermore, the novelty of AR technology introduces several issues related to user experience, including the ease of use, the quality of visual and immersive experiences, and the technical performance of AR applications (Billinghurst et. al, 2015). These factors are crucial in determining the effectiveness and appeal of AR games, particularly in educational environments where the primary users are students who may have varying degrees of familiarity with advanced technologies.

Given the unique challenges and potential benefits associated with AR technology in Malaysia's educational sector, there is a pressing need for empirical studies that explore these dynamics. Specifically, it is essential to understand how different aspects of AR games—such as immersion, ease of use, content quality, and technical performance—affect user satisfaction and behavior. This understanding can inform the development of more effective AR applications that enhance educational outcomes and student engagement.

This research aims to address this gap by investigating the satisfaction levels of UiTM students toward AR gaming experiences and how these experiences influence their post-event behaviors. By focusing on a representative sample from 15 UiTM branches across Malaysia, this study seeks to provide insights that can guide the future integration of AR technology in educational settings, ensuring that it meets the needs and expectations of students.

2. Literature Review

Immersion and Visual Experience: Immersion is a critical factor in AR gaming, significantly influencing player satisfaction and engagement. The immersive quality of an AR game is largely dependent on the seamless integration of digital elements with the physical world, creating a compelling and believable experience for the player. Azuma (1997) emphasizes that the essence of AR lies in its ability to augment the real world with virtual objects that appear to coexist in the same space. This enhanced perception can significantly elevate the user's sense of presence within the game, making the experience more engaging and memorable.

Recent studies have shown that visual experience is paramount in achieving this immersion. High-quality graphics, realistic animations, and effective use of spatial audio contribute to the overall sensory experience, making the digital augmentation appear more convincing and enjoyable (Billinghurst et. al, 2015). For instance, Pokémon Go's success can be attributed in part to its effective use of AR to create a visually appealing and interactive environment that encourages exploration and engagement with the real world (Paavilainen et al., 2017).

Ease of Use and Controls: The ease of use and intuitive controls are essential for ensuring a positive player experience in AR games. AR games often require players to interact with both digital and physical elements, making the design of user interfaces and control mechanisms particularly challenging. Poorly designed controls can lead to frustration and reduce the overall enjoyment of the game.

Researchers have highlighted the importance of user-friendly interfaces that require minimal learning curves. Zhou et al. (2008) argue that AR applications should prioritize simplicity and intuitiveness to accommodate a broad audience, including those who may not be technologically savvy. In the context of AR gaming, this means designing controls that are natural and responsive, allowing players to focus on the gameplay rather than struggling with the mechanics.

Ease of use also extends to the hardware required to play AR games. The proliferation of smartphones with built-in AR capabilities has made it easier for developers to reach a wide audience without requiring specialized equipment. However, ensuring that the game runs smoothly across a range of devices is a significant challenge that can impact player satisfaction (Dey et al., 2018).

Game Content and Storyline: The content and storyline of an AR gameplay a crucial role in maintaining player interest and encouraging long-term engagement. An engaging narrative can provide context and motivation for players, enhancing their emotional connection to the game and its characters. A well-crafted storyline can also facilitate a deeper immersion, as players become invested in the unfolding events and outcomes.

Studies have shown that players are more likely to return to a game and recommend it to others if they find the storyline compelling and the content rich and varied (Hunicke, LeBlanc, & Zubek, 2004). In AR games, this often involves creating a balance between scripted events and dynamic, player-driven experiences. The ability to interact with the game world in meaningful ways can enhance the sense of agency and involvement, making the experience more personal and engaging (Tutenel, Smelik, Bidarra & de Kraker, 2008).

Moreover, the integration of real-world locations and contexts into the game narrative can provide a unique and memorable experience that differentiates AR games from traditional video games. This location-based storytelling can encourage exploration and social interaction, further enhancing overall enjoyment and satisfaction (Paavilainen et al., 2017).

Technical Performance: The technical performance of an AR game is fundamental to its success and player satisfaction. Technical issues such as lag, crashes, or poor graphics can detract from the gaming experience and lead to player frustration. Ensuring smooth performance across various devices and platforms is a critical challenge for developers.

Studies indicate that technical stability is one of the primary factors influencing player satisfaction in AR games (Soltani & Morice, 2020). This includes not only the game's ability to run without errors but also the quality of its graphics, responsiveness of controls, and accuracy of AR interactions. Advanced algorithms for tracking and rendering are essential for maintaining a high level of realism and immersion in AR games (Billinghurst et. al, 2015).

Moreover, the hardware limitations of mobile devices can impact the performance and quality of AR games. Developers must optimize their games to balance performance with visual quality, ensuring that the game is accessible to a wide audience without compromising the experience (Dey et al., 2018). As AR technology continues to evolve, improvements in hardware and software will likely lead to more sophisticated and satisfying AR gaming experiences.

Net Promoter Score (NPS): NPS is valued for its simplicity and ability to predict business growth. A high NPS indicates a strong base of satisfied customers who are likely to recommend the product or service, leading to increased word-of-mouth referrals and potential growth (Reichheld, 2003).

Despite its popularity, NPS has faced criticism. Some argue that it oversimplifies customer sentiment and does not provide actionable insights (Fisher & Kordupleski, 2018). Others contend that NPS does not account for the

reasons behind customer satisfaction or dissatisfaction, making it difficult to address specific issues (Grisaffe, 2007). Additionally, there is debate over the statistical validity of NPS. Some studies suggest that the 11-point scale used in NPS surveys may not be as reliable as other scales (Kristensen & Eskildsen, 2014).

NPS has been applied across various industries, including retail, healthcare, finance, and technology. In retail, NPS is used to measure customer satisfaction with products and services (Lubis & Khair, 2023). In healthcare, NPS is employed to assess patient satisfaction and loyalty (Krol, de Boer, Delnoij & Rademakers, 2015). In finance, NPS helps banks and financial institutions understand customer loyalty and predict future business growth (Zaki, Kandeil, Neely & McColl-Kennedy, 2016).

The Net Promoter Score (NPS) remains a popular metric for measuring customer loyalty and satisfaction. While it has its criticisms, its simplicity and ability to predict business growth make it a valuable tool for businesses. Future research may explore ways to enhance NPS by combining it with other metrics and qualitative feedback to provide more actionable insights.

H1: Higher levels of immersion and visual experience in AR games significantly increase player satisfaction and their likelihood to recommend the game to others.

Rationale: Immersive and visually rich AR games are more likely to provide a compelling and enjoyable experience, leading to greater player satisfaction and positive word-of-mouth recommendations.

H2: The ease of use and intuitiveness of controls in AR games are positively correlated with player satisfaction and recommending intention.

Rationale: AR games that feature user-friendly interfaces and intuitive controls minimize player frustration and enhance enjoyment, thereby increasing satisfaction and the likelihood of recommending the game.

H3: Engaging game content and a compelling storyline in AR games are positively associated with higher levels of player satisfaction and increased post-event behaviors such as recommendations.

Rationale: Rich and engaging content, along with a well-crafted storyline, captivates players and enhances their overall experience, making them more likely to recommend it to others.

H4: High technical performance, characterized by minimal lag, crashes, and high-quality graphics, is positively related to player satisfaction and intention to recommend the AR game.

Rationale: Reliable technical performance ensures a smooth and enjoyable gaming experience, which is crucial for maintaining player satisfaction and encouraging them to recommend the game.

H5: Higher satisfaction levels in the overall AR game experience are positively associated with increased post-event behaviors, such as recommending the game to others.

Rationale: This hypothesis posits that engaging game experience increases player satisfaction, which in turn influences their intentions to continue playing the game and to recommend it to others.

3. Research Methodology

This study employs a correlational research design to examine the relationships between key variables influencing player satisfaction and post-event behavior in augmented reality (AR) gaming. The research targets a specific population comprising students from Universiti Teknologi MARA (UiTM) across 15 branches in Malaysia. A sample size of 503 respondents was used, representing the total distribution of participants from the different branches.

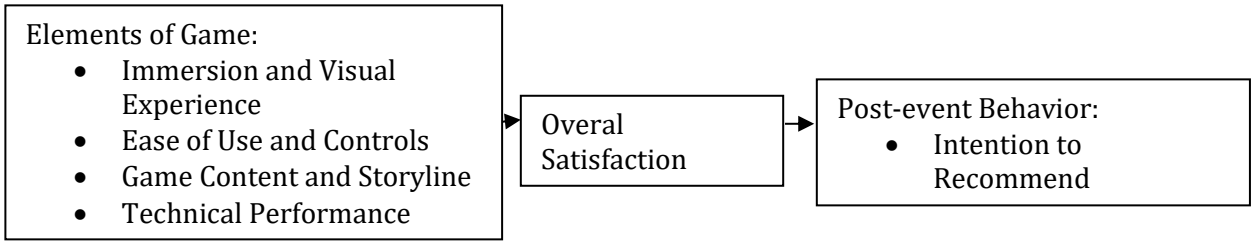
Data collection was conducted using a structured questionnaire that included items measured on a 5-point Likert scale. This scale was chosen to capture the nuances in participants' perceptions and attitudes towards the AR gaming experience, including factors such as immersion and visual experience, ease of use and controls, game content and storyline, and technical performance.

The collected data were analyzed using Net Promoter Score (NPS) to investigate the relationships between the independent variables (immersion and visual experience, ease of use and controls, game content and storyline, and technical performance) and the dependent variables (player satisfaction and post-event behavior).

Theoretical Framework: Building upon previous studies on motivation and behavioral outcomes (Severt, Chen, & Breiter, 2007; Bauer, Tse, & Weber, 2008), this research will thoroughly investigate four key dimensions: immersion and visual experience, ease of use and controls, game content and storyline, and

technical performance. By synthesizing existing literature and refining conceptual models, the study aims to offer a nuanced exploration of how satisfaction with these aspects of an AR game influences subsequent behavioral outcomes.

Figure 1: Motivation and Behavioral Outcomes



In examining the post-event behavior, the researchers used Net Promoter Score (NPS), a common metric used to gauge the willingness of customers to recommend a product or service to others developed by Fred Reichheld, a consultant and author, in a 2003 Harvard Business Review article titled The One Number You Need to Grow (Reichheld, 2003). Respondents give a rating between 1 (not at all likely) and 5 (extremely likely) and, depending on their response, customers fall into one of 3 categories to establish an NPS score:

- **Promoters** respond with a score of 4 or 5 and are typically loyal and enthusiastic customers.
- **Passives** respond with a score of 3. They are satisfied with your service but not happy enough to be considered promoters.
- **Detractors** respond with a score of 1 to 2. These are unhappy customers who are unlikely to recommend and may even discourage others from you.

By subtracting the percentage of Detractors from the percentage of Promoters, the NPS will be achieved. An NPS of 40% is considered good.

4. Results and Discussion

Gender Distribution: The gender distribution data reveals that out of 503 respondents, 319 are male, constituting 63.4% of the total sample. Meanwhile, 184 respondents are female, making up 36.6% of the sample. This indicates a significant gender disparity among the participants, with males being almost twice as numerous as females. Such a disparity may reflect the demographic composition of the sampled population or may indicate a higher interest or participation rate among male students in activities related to AR gaming.

Table 1: Gender Distribution

Gender	Frequency	Percent	Valid Percent	Cumulative Percent
Male	319	63.4	63.4	63.4
Female	184	36.6	36.6	100.0
Total	503	100.0	100.0	100.0

Education Level Distribution: The education level distribution shows that 186 respondents, or 37.0% of the total sample, are diploma students. In contrast, the remaining 317 respondents, accounting for 63.0%, are degree students. This distribution highlights a higher representation of degree students in the sample. The data suggests that degree students may have greater access to or interest in participating in AR gaming studies, or it may simply reflect the larger population of degree students at the university.

Table 2: Education Level Distribution

Education Level	Frequency	Percent	Valid Percent	Cumulative Percent
Diploma	186	37.0	37.0	37.0
Degree	317	63.0	63.0	100.0
Total	503	100.0	100.0	100.0

Satisfaction

Immersion and Visual Experience: Based on the data from 503 respondents regarding their Immersion and Visual Experience, the majority expressed positive perceptions, with 40% rating it as Excellent and 35% as Good. Conversely, a smaller proportion rated their experience as Poor (7%) or Very Poor (3%). This distribution highlights a generally favorable outlook among respondents, indicating that most viewed their Immersion and Visual Experience positively, while a minority reported less satisfactory experiences. These findings underscore the importance of enhancing visual and immersive elements to maintain high levels of user satisfaction in related contexts.

Table 3: Immersion and Visual Experience

Category	***Frequency***	***Percentage***
Excellent	201	40.0%
Good	176	35.0%
Average	75	15.0%
Poor	35	7.0%
Very Poor	16	3.0%
Total	**503**	**100.0%**

Ease of Use and Controls: Regarding "Ease of Use and Control," the data reveals a predominantly positive sentiment. A significant 70% of respondents rated the experience either as Excellent (30%) or Good (40%), indicating a strong satisfaction with the usability and control aspects. Another 20% rated it as Average, suggesting a moderate level of satisfaction. However, there were indications of room for improvement, with 7% expressing dissatisfaction (Poor) and 3% reporting very low satisfaction (Very Poor). While these percentages represent smaller segments, they highlight areas where enhancements could potentially elevate overall user satisfaction. Overall, the majority of respondents found the Ease of Use and Control to be satisfactory, emphasizing its importance in user experience design while also acknowledging opportunities for refinement to address the concerns of the minority of dissatisfied users.

Table 4: Ease of Use and Controls

Category	***Frequency***	***Percentage***
Excellent	151	30.0%
Good	201	40.0%
Average	101	20.0%
Poor	35	7.0%
Very Poor	16	3.0%
Total	**503**	**100.0%**

Game Content and Storyline: Table 5 provides a clear overview of how respondents rated the "Game Content and Storyline," highlighting the frequencies and percentages for each category from Excellent to Very Poor. A substantial 75% rated the content and storyline positively, with 35% describing it as Excellent and 40% as Good. This indicates a strong overall satisfaction with the game's narrative aspects. However, 15% found it to be Average, suggesting a moderate level of satisfaction, while 7% rated it as Poor and 3% as Very Poor, representing smaller segments dissatisfied with the content and storyline. These findings underscore the critical role of narrative quality in gaming experiences, as the majority of respondents viewed it favorably.

Nonetheless, addressing the concerns of the minority dissatisfied users could further enhance overall player enjoyment and engagement with the game.

Table 5: Game Content and Storyline

Category	*Frequency*	*Percentage*
Excellent	176	35.0%
Good	201	40.0%
Average	76	15%
Poor	35	7.0%
Very Poor	15	3.0%
Total	**503**	**100.0%**

Technical Performance: Table 6 provides a breakdown of how respondents rated the "Technical Performance" of a product or service, illustrating both the frequencies and percentages for each level from Excellent to Very Poor.

Table 6: Technical Performance

Category	*Frequency*	*Percentage*
Excellent	126	25.0%
Good	176	35.0%
Average	126	25.0%
Poor	50	10.0%
Very Poor	25	5.0%
Total	**503**	**100.0%**

The majority of respondents rated the performance positively, with 60% (25% Excellent and 35% Good) indicating satisfaction. Another 25% found the technical performance to be Average, suggesting a neutral stance. However, there were notable concerns among some respondents, with 10% rating it as Poor and 5% as Very Poor. These ratings highlight areas where improvements in technical aspects could potentially enhance overall user satisfaction and perception. Overall, while a significant portion of users were satisfied with the technical performance, addressing the issues raised by dissatisfied users could lead to improved customer experiences and product competitiveness.

Overall Satisfaction: The table reveals that a majority of respondents expressed positive sentiments towards their overall satisfaction levels, with 35% indicating they were "Very satisfied" and 45% stating they were "Satisfied." Collectively, this reflects a high satisfaction rate of 80%. However, there is also a notable portion of respondents who are either neutral (10%), dissatisfied (7%), or very dissatisfied (3%). These groups highlight areas where improvements or adjustments could potentially enhance overall satisfaction. Addressing concerns raised by dissatisfied users and maintaining positive experiences for the majority could lead to higher overall satisfaction and continued customer loyalty.

Table 7: Overall Satisfaction

Category	*Frequency*	*Percentage*
Very satisfied	176	35.0%
Satisfied	226	45.0%
Neutral	50	10.0%
Dissatisfied	35	7.0%
Very dissatisfied	15	3.0%
Total	**503**	**100.0%**

Intention to Recommend: Referring to Table 8, out of 503 respondents, 30% are extremely likely to recommend the game, and 40% are very likely to do so. Another 20% are somewhat likely to recommend it, while 7% are not very likely and 3% are not likely at all to recommend the game. Overall, the majority of respondents (70%) have a strong inclination to recommend the game.

Table 8: Post-event Behavior

Category	*Frequency*	*Percentage*
Extremely likely	151	30.0%
Very likely	201	40.0%
Somewhat likely	101	20.0%
Not very likely	35	7.0%
Not likely at all	15	3.0%
Total	**503**	**100.0%**

NPS Results: The Net Promoter Score (NPS) is traditionally calculated based on a 0-10 scale. However, in this case, the data is given on a 5-point Likert scale. For this research, we will define the categories as follows:
Promoters: "Extremely likely" and "Very likely"
Passives: "Somewhat likely"
Detractors: "Not very likely" and "Not likely at all"

Next, we calculate the percentages of promoters, passives, and detractors among the total respondents. The NPS is then calculated as follows:

$$\text{NPS} = \%\text{Promoters} - \%\text{Detractors}$$

Promoters (Extremely likely + Very likely): *n*352 (70%)
Passives (Somewhat likely): *n*101 (20%)
Detractors (Not very likely + Not likely at all): *n*50 (10%)

NPS = %Promoters − %Detractors = 70% − 10% = **60**

Thus, the NPS for the game is **60**. This indicates a strong likelihood of recommendation, as a higher NPS generally reflects greater respondent satisfaction and loyalty.

Discussion

The results reveal that the game is highly regarded in terms of immersion and visual experience, with 75% of respondents rating it as either Excellent or Good. This indicates that the game's visual and immersive elements are effective, although a small percentage (10%) found their experience less satisfactory, suggesting potential areas for improvement. Therefore, H1 is supported by this result.

Ease of use and controls also received predominantly positive feedback, with 70% of respondents rating it as Excellent or Good. While 20% rated it as Average, a minor segment (10%) expressed dissatisfaction, highlighting opportunities for enhancing the usability and control aspects to cater to all users. This proves that the H2 is true.

Regarding game content and storyline, 75% of respondents expressed high satisfaction, rating it positively. However, 15% rated it as Average and a smaller group (10%) as Poor or Very Poor. This underscores the importance of maintaining high narrative quality while addressing the concerns of the dissatisfied minority to improve overall player engagement. In essence, H3 is supported.

The technical performance received mixed feedback, with 60% rating it positively and 25% neutrally. Notably, 15% of respondents were dissatisfied, pointing to specific technical issues that need to be addressed to enhance the overall user experience and satisfaction. With 60% positive feedback, H4 is also supported.

Overall satisfaction with the game is high, with 80% of respondents feeling satisfied or very satisfied. However, 20% of respondents were neutral or dissatisfied, indicating that while the majority are pleased with the game, there is room for improvement to elevate the experience for all users and ensure continued customer loyalty. This also validates the H5.

5. Conclusion and Recommendations

Some recommendations are posited below:

Enhance Immersion and Visual Experience:

- Continue investing in high-quality graphics and immersive elements.
- Conduct user testing to identify specific visual aspects that may need refinement to convert the 10% less satisfied users into advocates.

Improve Usability and Controls:

- Simplify and streamline game controls based on user feedback.
- Offer customizable control settings to cater to a wider range of player preferences.

Maintain and Elevate Narrative Quality:

- Regularly update and expand the game content and storyline to keep players engaged.
- Address specific feedback from the 10% who rated the storyline as Poor or Very Poor to ensure the narrative remains compelling.

Address Technical Issues:

- Prioritize fixing bugs and optimizing the game's performance.
- Implement regular updates and patches to resolve technical issues promptly.

Boost Overall User Satisfaction:

- Engage with the community to gather detailed feedback on areas of dissatisfaction.
- Offer exceptional customer support to address player concerns swiftly.
- Introduce new features and improvements based on user suggestions to enhance the overall gaming experience.

By focusing on these recommendations, the game can build on its strengths and address areas of concern, ultimately leading to higher satisfaction and loyalty among the players.

Conclusion

The survey results indicate that the game is generally well-received, with strong performance in key areas such as immersion, visual experience, ease of use, controls, game content, and storyline. A significant majority of respondents rated these aspects as Excellent or Good, confirming the hypotheses (H1, H2, and H3). Despite these positive outcomes, there are notable areas for improvement, particularly in technical performance and overall satisfaction, where some respondents reported neutral or negative experiences. This mixed feedback on technical performance (H4) and overall satisfaction (H5) highlights the necessity for targeted enhancements.

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