Enhancing Social Interaction and Engagement Through a Cooperative Puzzle–Platformer

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ABTRACT

Cooperative puzzle–platformers promise strategy-rich, social play, yet many titles still lean on shallow or repetitive co-op mechanics that limit meaningful teamwork and replayability. This work designs and evaluates a 3D two-character cooperative puzzle–platformer, Mizu & Hee Adventure, to address that gap by embedding interdependent roles, coordination-first level design, and progressive challenges. We implemented the game in Unreal Engine and conducted a user study with 30 participants (ages 12–30) using the Game Experience Questionnaire (GEQ) after a guided play session. Analysis focuses on cooperation, immersion, challenge, and post-game experience. Results show strong perceived cooperation (mean = 4.25), high challenge (mean = 4.40), and high immersion (mean = 4.42), with an overall positive post-game experience (mean = 4.41); participants also rated the cooperative mechanics as innovative (mean = 4.60). These findings indicate that the proposed mechanics effectively foster communication and joint problem-solving while maintaining engaging difficulty. We discuss design implications for co-op puzzle–platformers and outline future extensions to broaden content variety and scalability.

Keywords: Cooperative Gameplay; Puzzle Platformer; Unreal Engine; Game Experience Questionnaire (GEQ); User Study; 3D Game Design

INTRODUCTION

Cooperative puzzle–platformer games combine intellectual challenge with collaborative interaction, offering players opportunities to engage in teamwork and problem-solving beyond the competitive modes that dominate many multiplayer titles. Recent advances in digital game design highlight the growing importance of cooperative mechanics in sustaining player engagement, as such features not only enrich gameplay but also foster social interaction and communication among players

However, despite the increasing popularity of this genre, existing puzzle platformers frequently fall short in delivering meaningful cooperation. Many games reduce collaboration to repetitive mechanics or superficial role-sharing, limiting opportunities for strategic decision-making and diminishing replay value. This lack of integrated cooperative design undermines both player experience and long-term engagement. Therefore, the central problem addressed in this research is the absence of systematically designed cooperative mechanics that can sustain engagement through interdependence, communication, and collaborative problem-solving.

In response to this gap, this study focuses on the design and evaluation of Mizu and Hee Adventure, a 3D cooperative puzzle–platformer developed using Unreal Engine. The research pursues three key objectives: (i) to investigate cooperative game mechanics that can be effectively applied in puzzle–platformer environments, (ii)

to design and develop a prototype game that integrates such cooperative elements, and (iii) to empirically evaluate the user experience of the developed game through standardized measures such as the Game Experience Questionnaire (GEQ)

The contributions of this research are threefold:

1. Theoretical contribution: extends knowledge on cooperative game mechanics by integrating role interdependence, progressive puzzles, and communication-driven design.
2. Empirical contribution: provides quantitative evidence from user testing that demonstrates how cooperative mechanics influence immersion, enjoyment, and collaborative problem-solving.
3. Practical implication: offers design recommendations for future cooperative puzzle–platformers, highlighting mechanics that effectively balance challenge, teamwork, and engagement.

RELATED WORKS

A. Overview of Puzzle Platformer Games

Puzzle platformer games are a subset of platform games that include puzzle-solving elements in the gameplay (Zhang, 2023). These games typically require players to guide characters through various levels filled with obstacles and challenges, using both agility and intelligence. Points are fundamental elements in the majority of games (Zhang, 2023). Completing tasks or levels within a game result in an increase in a number or bar (Singh & Mohammed COMP, n.d.). The puzzles can range from simple logic exercises to complex problems that necessitate meticulous planning and execution. This combination of action and puzzle solving creates a one-of-a-kind gameplay experience that requires quick reflexes as well as strategic thinking (Hung & Eck, n.d.).

Puzzle platformers have been around since the beginning of video games. One of the earliest examples is "Pitfall!" from 1982, which combined platforming with basic puzzle elements (Minkkinen Toni, 2016). However, it wasn't until the late 1980s and early 1990s that the genre truly took shape, with titles such as "Prince of Persia" and "Lemmings." These games introduced more complex puzzles and mechanics, laying the groundwork for future development. The genre evolved in the late 1990s and early 2000s, with titles such as "Oddworld: Abe's Oddysee" and "Tomb Raider," which refined the balance between platforming action and puzzle-solving.

Important features and workings of puzzle platformers involve the seamless blending of puzzles with platforming in the level design (Minkkinen Toni, 2016). Players frequently have to interact with the surroundings, shift objects, and tackle puzzles in order to advance. (Pagulayan et al., 2009) Gameplay typically focuses on exploration, critical thinking, and movement timing. Cooperative puzzle platformers add an extra layer of complexity by requiring players to collaborate, synchronize actions, and effectively communicate in order to solve puzzles (Prof. Dr.-Ing. Rolf Jakoby, 2016). This cooperative element not only improves gameplay, but also fosters a sense of community and shared accomplishment. (Prof. Dr.-Ing. Rolf Jakoby, 2016) The progression of puzzle platformers has been characterized by growing complexity and creativity as time has passed (Zhang, 2023). Initially, games were quite basic, featuring simple puzzles and fundamental platforming elements (Minkkinen Toni, 2016). As technology progressed, the games also became more complex and deeper (Plass et al., 2015). Modern puzzle platformers such as "It Takes Two," "Overcooked," and "Portal" feature intricate puzzle designs, captivating narratives, and stunning visuals. These games often explore unique mechanics, such as physics-based puzzles in "Portal," pushing the boundaries of what the genre can achieve. The inclusion of cooperative gameplay in games such as "It Takes Two" and "Overcooked" has also broadened the genre by providing new and engaging ways for players to collaborate and solve puzzles together.

B. Cooperative Gameplay Mechanics

Cooperative gameplay mechanics are fundamental components of multiplayer gaming experiences that prioritize collaboration, teamwork, and shared goals among players. These mechanics are critical to fostering engaging and interactive gameplay dynamics, in which players must collaborate to overcome obstacles and succeed. Following sections investigate into key aspects of cooperative gameplay mechanics.

C. Mutual Benefit

In cooperative games, particularly MMORPGs like World of Warcraft and sophisticated FPS games like Team Fortress 2, character cooperation is an important design pattern that improves teamwork and strategic gameplay (Bernardo et al., 2008). This involves creating characters with distinct roles and abilities, ensuring they excel at specific tasks and complement one another within the same role(Ružic & Dumancic, 2015). For example, healers in MMORPGs may provide various types of support, whereas medics and engineers in FPS games contribute uniquely to team dynamics. This pattern not only encourages players to collaborate and coordinate effectively, but it also adds depth to gameplay by leading to careful team selection and strategy (Fabricatore, 2007).

D. Synergies Between Abilities.

Another mechanic in cooperative games is ensuring that the abilities of one character type support those of another, thus enhancing teamwork and strategy (Farah et al., 2022). This interdependence encourages players to coordinate their abilities and strategies for maximum effectiveness, resulting in a higher level of cooperation and engagement. Such synergy not only increases the impact of individual actions, but it also promotes a more connected and dynamic gameplay experience, in which team success is dependent on effective collaboration and the strategic use of unique skills (Vegt et al., 2015). For example, in Fireboy and Watergirl, Fireboy can move through lava but not water, whereas Watergirl can move through water but not lava. This complementary design requires players to collaborate to overcome obstacles, emphasizing the importance of synergy in achieving common goals (Reuter et al., 2014).

E. Game Design Principles for Cooperative Puzzle Platformers

Designing cooperative puzzle platformers requires following key principles that improve both the collaborative and gameplay experiences. These principles are based on balanced player abilities, which ensure that each participant has unique, complementary roles that are required for progress. In-game tools and intuitive visuals promote clear communication, allowing players to coordinate more effectively. Progressive difficulty is also important, beginning with simple puzzles that introduce core mechanics and gradually increasing in complexity to keep players challenged and engaged. Designers can use these elements to create immersive, dynamic experiences that promote teamwork, problem-solving, and a sense of shared accomplishment (Han Gao et al., 2023).

Balanced player abilities in cooperative puzzle platformers ensure that each player has distinct, complementary roles that are required to progress through the game. This design principle entails assigning unique skills or abilities to each player, such as one character being able to manipulate objects while another can navigate difficult terrain. The puzzles are designed in such a way that these abilities must be used simultaneously, encouraging interdependence and ensuring that all players are actively engaged. This balance prevents any one player from dominating the game and encourages teamwork, as each player's contribution is critical to overcoming obstacles and solving puzzles. Unbalanced player abilities can cause frustration for less skilled players by making the challenge too difficult. (Mace et al., 2017). By allowing players to switch roles on occasion, the game can provide variety as well as a better understanding of cooperative dynamics.

Clear communication is essential in cooperative puzzle platformers because it allows players to efficiently coordinate their actions and strategies (Toups et al., 2014). This principle is supported by in-game tools like pings, emotes, and quick chat options, which enable nonverbal communication, particularly in online multiplayer settings. Visual and audio cues also play an important role in guiding players, providing immediate feedback and highlighting important elements without overwhelming them with explicit directions. Clear, concise tutorials and the gradual introduction of game mechanics improve communication even more, allowing players to learn and master the necessary skills over time. By creating an environment in which players can easily share information and coordinate their efforts, the game promotes a smooth and enjoyable cooperative experience.

To summarize, balanced player abilities and clear communication are key game design principles that improve the cooperative experience in puzzle platformers. Balanced player abilities encourage interdependence and teamwork by ensuring that each player possesses unique, complementary skills required for progression. This

dynamic ensures that all players are actively engaged and make meaningful contributions to solving puzzles and overcoming obstacles (Han Gao et al., 2023). While prior studies have extensively described cooperative mechanics and the evolution of puzzle platformer design, much of the literature remains descriptive rather than critically comparative. For example, although titles such as Overcooked and It Takes Two demonstrate strong role interdependence, existing reviews rarely examine how these strategies sustain engagement during extended play sessions. Similarly, although communication tools are frequently highlighted as vital, few studies investigate which modalities (verbal, non-verbal, or system-assisted) most effectively support player coordination and conflict resolution. These gaps suggest that current scholarship underrepresents critical aspects such as role negotiation, conflict management, and replayability. These elements are central to meaningful cooperative play. The present study responds to these gaps by foregrounding cooperative design principles that integrate interdependence, progressive challenges, and communication-driven mechanics.

METHODOLOGY

This chapter will go over the project methodology used in the development process, known as the Game Development Life Cycle (GDLC). This game development project's methodology makes use of the GDLC, a structured framework that guides the creation process from concept to completion in six distinct phases: initiation, pre-production, production, testing, beta and release. Each development phase is critical because it ensures systematic planning, efficient resource allocation, and iterative refinement, which all improve collaboration, risk management, and quality assurance. By adhering to the GDLC, the project maintains an organized schedule, encourages timely delivery, and ultimately results in a high-quality game that meets its goals and provides a satisfying user experience. In addition, the chapter will provide a detailed overview of the software and hardware specifications required for the project's success.

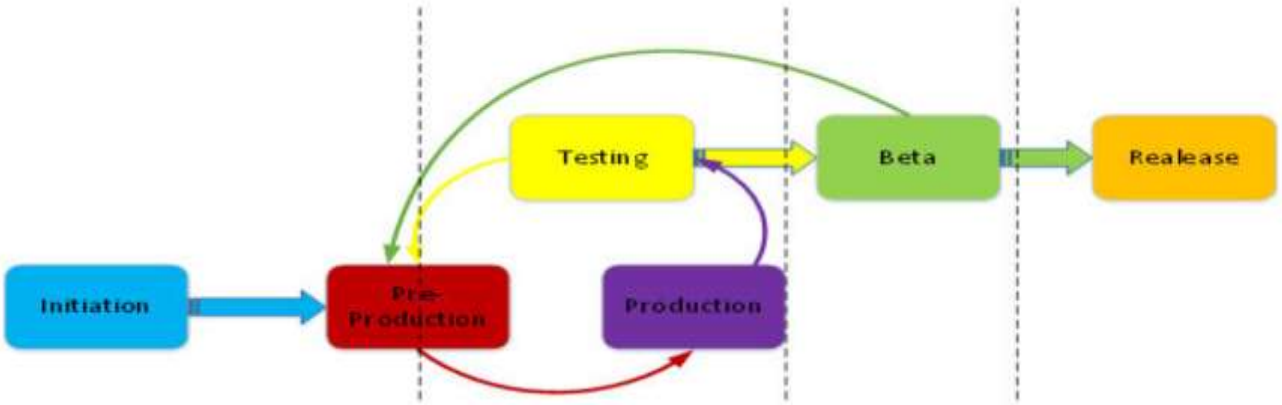

Fig 1: GDLC methodology

A. Initiation

The initial game concept and idea generation phase consists of brainstorming and defining the game's core vision, with a focus on innovative ideas that will engage players and distinguish the game. This phase is followed by the design of the game mechanics and cooperative elements, which include the specific gameplay features, rules, and interactions. The emphasis is on developing mechanics that promote teamwork and collaboration, ensuring that each player's actions are interdependent and contribute to achieving common goals. This planning stage is critical for laying the groundwork for the game's development, ensuring that the cooperative aspects are seamlessly integrated and improve the overall player experience.

B. Pre-Production

The pre-production phase of game development is critical, as it involves meticulous planning and design of the game's foundational elements. This phase involves the creation of detailed game design documents that outline the game's mechanics, story, characters, and levels. This stage entails creating prototypes to test and refine core gameplay concepts and cooperative elements, ensuring that they work as intended. Key decisions are made about the game's art style, sound design, and technology stack, as well as the allocation of necessary resources such as

team members and tools. Pre-production lays the groundwork for efficient production by addressing potential issues early on, ensuring that the game has a clear direction, and creating a solid blueprint for subsequent development phases. Figure 2 shows the flow board of game development.

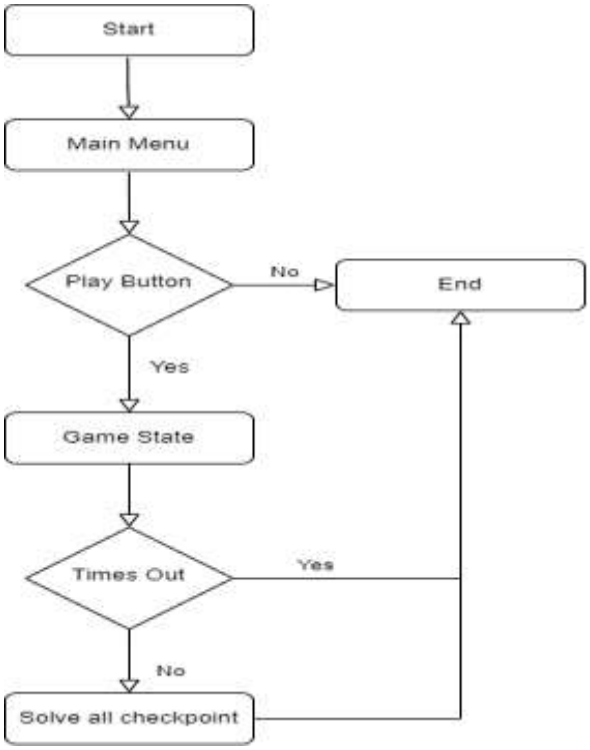

Fig 2: Flowboard of Mizu and Hee Adventure

C. Production

The production phase of game development is where the game's core elements, which were designed and planned during pre-production, come to life. This phase entails the active creation of game assets such as coding, modeling, animation, sound design, and level creation. Developers and artists collaborate to integrate these components, ensuring that gameplay mechanics and cooperative elements run smoothly. Continuous testing and iteration are necessary during production to identify and fix bugs, refine gameplay, and improve the overall player experience. This phase is highly dynamic and resource-intensive, with the primary goal of building the game to the design specifications and preparing it for testing. The production phase is critical because it turns conceptual designs into playable and engaging games, laying the groundwork for the later stages of development. Figure 3 shows the in-game camera perspectives of the two playable characters, Hee and Mizu, demonstrating how the cooperative mechanics require simultaneous navigation and coordination within the game environment.

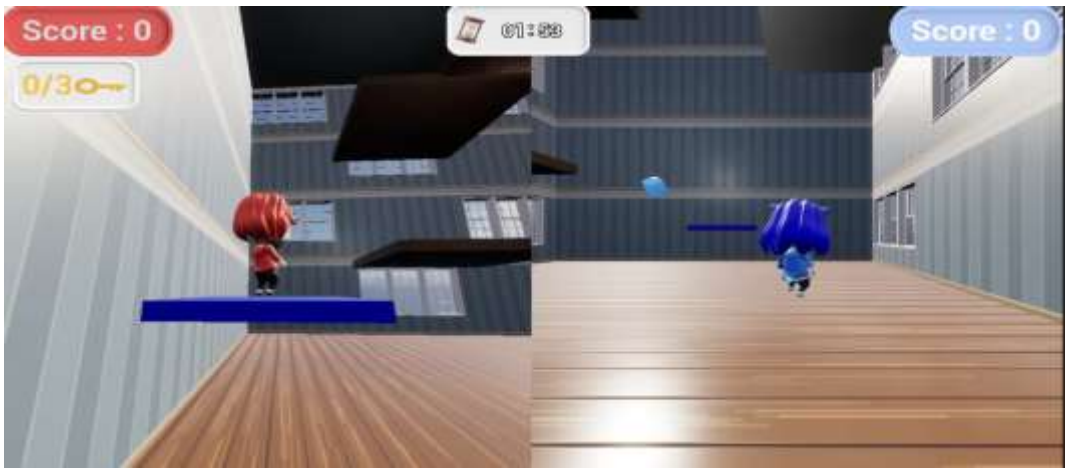

Fig 3: Camera Perspective in Mizu and Hee Adventure

D. Testing

The testing phase of game development is an important stage in which the game is closely evaluated to identify and correct any issues or bugs that may affect gameplay, performance, or the user experience. To ensure complete coverage of all game aspects, a variety of testing methods are used, including manual testing by quality assurance teams and automated testing tools. This phase includes functional testing to ensure that game features and mechanics work properly, as well as compatibility testing to ensure the game runs smoothly. In addition, usability testing is carried out to collect player feedback and refine the game's interface and controls for the best possible user experience. The testing phase is iterative, with numerous rounds of testing and bug fixing to ensure the game meets quality standards and is ready for release.

E. Beta

The beta phase in game development is a significant milestone where a near-final version of the game is released to a select group of testers, known as beta testers, for extensive playtesting and feedback. This phase allows developers to gain valuable information about the game's performance, balance, and overall player experience in real-world scenarios. Beta testers provide feedback on gameplay mechanics, level design, bugs, and other issues that occur during gameplay. Developers use this feedback to make final adjustments and refinements before releasing the game to a larger audience. The beta phase is critical for identifying and resolving any outstanding issues, ensuring that the game meets quality standards and provides an engaging and polished experience to players upon release.

F. Release

The release phase of game development is the culmination of the development process, during which the final version of the game is prepared for distribution and made public. During this phase, developers complete any remaining tasks, such as bug fixes, optimization, and game packaging for distribution across multiple platforms and storefronts. Following the game's release, developers closely monitor player feedback and address any post-launch issues via updates and patches. The release phase is a critical stage where developers hope to deliver a polished and engaging gaming experience to players.

ANALYSIS

A. Technical Requirement

To ensure a positive user experience, specific requirements and standards must be met. These include accessibility, usability, performance, and safety. Accessibility ensures inclusivity for players of various abilities, whereas usability focuses on intuitive interface design and responsive controls. Performance requirements ensure that gameplay runs smoothly across multiple devices, while safety measures protect user data and online interactions. Adherence to these standards ensures a positive gaming experience for all players.

B. Software Requirements

1. Unreal Engine 5.0 is a powerful and adaptable game development platform that offers a diverse set of tools and features for creating immersive and interactive gaming experiences. It provides advanced graphics rendering capabilities, robust physics simulation, and an easy-to-use interface for game design and prototyping. Unreal Engine 5.0 enables developers to create high-quality 3D environments, implement complex gameplay mechanics, and optimize performance across multiple platforms.

2. Blender is a popular free and open-source 3D modeling and animation software for game development. It provides a comprehensive set of tools for creating and editing 3D models, textures, and animations. Blender's user-friendly interface and extensive feature set make it ideal for creating assets like characters, props, and environments for Unreal Engine 5.0. Furthermore, Blender supports a variety of file formats, making it compatible with other software tools and game engines.

3. Audacity is a free, open-source audio editing and recording software used to create and edit sound effects, music, and voiceovers for games. Audacity allows developers to record, edit, and mix audio tracks, add effects and filters, and export files in a variety of formats. Audacity's user-friendly interface and powerful editing capabilities make it an invaluable tool for improving the audio experience of games built with Unreal Engine 5.0.

C. Hardware Requirements

1. Laptop: A laptop is the primary computing device for game development, providing the processing power, memory, and storage required to run development software and compile game code. The laptop should meet or exceed the system requirements for the development software in use, such as Unreal Engine 5.0, Blender, and Audacity. Furthermore, a laptop with a dedicated graphics card is recommended for handling the demands of 3D game development and rendering.

2. Hard Disk: A hard disk drive (HDD) or solid state drive (SSD) is required for storing project files, game assets, and development tools. The hard disk should have enough storage space to hold large files like 3D models, textures, audio files, and project backups. An SSD is recommended for faster read/write speeds, which can boost overall system performance and shorten load times when accessing project files and running development tools. Furthermore, regular backups of project files should be kept to avoid data loss and ensure the continuity of development efforts.

TESTING

The primary goal of the testing phase for this project is to evaluate the user experience of a platformer puzzle game with cooperative features. This phase is critical for understanding how players interact with the game, particularly with the cooperative elements that are central to the gameplay. The goal is to ensure that the game not only works properly, but also provides a smooth and enjoyable experience for players who work together.

A. Testing Plan

Table1: Table of Testing Plan for Mizu and Hee Adventure

PLAN TESTING (Mizu and Hee Adventure) Developer: Aiman Firdaus	
Testing Objective	To evaluate the user experience and cooperative gameplay mechanics
Participants	• 30 participants, aged 12 to 30 • An expert (lecturer)
Equipment	Laptop (HP Victus 16)
Test Task and Duration	Duration 15-20 minutes per person for target audiences, and 35-40 minutes per person for the game designer and expert. • Players complete a full gameplay session • Players answer a post-game questionnaire
Location and Dates	Dates: 11 of August 2024 until 25th August 2023 Duration: 2 weeks Location: Selangor (Rawang), Melaka (Durian Tunggal), and online.
Procedure Testing	1. Participants will have 5 minutes to receive a brief explanation of the game and testing process.

	2. Participants have 10 minutes to play the game and explore its features. 3. 30 target audiences were given 5 minutes to fill out a questionnaire about their experience. 4. Conduct detailed interviews with the game designer and expert, each lasting 15-20 minutes.

B. Pre-testing

During the pre-testing phase, participants meet in person to prepare for the upcoming game session. This phase begins with setting up the necessary equipment, such as a laptop, to ensure that the game runs smoothly and that all technical aspects work properly. Participants are then informed about the purpose of the test, the game's objectives, and the specific features being evaluated, with a focus on cooperative gameplay and puzzle-solving mechanics. This brief introduction ensures that participants understand the test's context and goals, preparing them for the session and encouraging them to focus on their interactions with the game.

C. Testing

During the testing phase, participants are given specific instructions on what to do during the session. They are encouraged to explore and play the game independently for about ten minutes. During this time, participants interact with the game's core mechanics, with a particular emphasis on the cooperative elements that require Hee and Mizu to coordinate their actions. The goal is to see how players respond to the challenges, how well they adapt to the controls, and how effectively they communicate and strategize to overcome obstacles. By allowing players to interact with the game naturally, this phase highlights potential usability issues, level difficulty, and the effectiveness of cooperative features.

D. Post-testing

Following the gameplay session, participants are asked to fill out a questionnaire designed to collect quantitative and qualitative information about their experience with the game. This feedback aids in determining factors such as control ease, enjoyment of cooperative mechanics, and level of difficulty. In addition to the questionnaire, detailed interviews with key participants, including a game design expert, are conducted to gather additional feedback. These interviews allow participants to talk about specific gameplay elements, suggest improvements, and share their overall thoughts. Any questions the participants may have about the game are answered, ensuring they have a thorough understanding of its mechanics. Finally, the session concludes by thanking all participants for their valuable time and input, emphasizing their role in shaping the game's development.

TESTING RESULTS

The Game Experience Questionnaire (GEQ) was used as the testing methodology to take measurements from respondents. The GEQ is a standardized measure of the player's experience regarding several dimensions, such as competence, immersion, flow, tension, challenge, and both positive and negative emotions. It has a five-point Likert scale that taps from strongly agree to strongly disagree responses from participants. The feedback taken from all the participants shall be taken into consideration for improvement soon.

A. Psychological Involvement – Empathy

Table 2: Mean and Sd Empathy Social Presence Module

	Psychological Involvement – Empathy	**Mean**	**SD**
1	I enjoy playing cooperative games.	4.33	0.71
2	I like playing cooperative games with friends.	4.43	0.56

3	Cooperative games help me develop better social skills	4.47	0.681
Empathy score		4.41	

The data for the Psychological Involvement Empathy dimension represent in Table 2 shows that respondents place a high value on cooperative games, with mean scores exceeding 4.0 for enjoyment, playing with friends, and improving social skills. The low standard deviations (0.56 to 0.71) indicate that participants generally agree. This suggests that cooperative games are widely valued for their entertainment value, social interaction benefits, and contribution to social skill development.

B. Immersion (In-Game)

Table 3: Mean and Sd In-game(Immersion)

	In-game "Mizu and Hee" Experience (GEQ) (Immersion)	**Mean**	**SD**
1	I felt fully immersed in the game while playing.	4.40	0.77
2	I enjoyed the game's graphics and visual design while playing.	4.40	0.621
3	The game’s sound and music added to the overall experience.	4.47	0.730
In-game (Immersion) Mean Score		4.42	

The immersion experience in "Mizu and Hee" is highly rated by players, with an average score of 4.42 shown in Table 3. Participants were fully immersed in the game, enjoying the graphics and visual design, both of which received high ratings of 4.40. The game's sound and music also contributed significantly to the overall experience, with an average score of 4.47. This demonstrates a consistent positive response to the game's immersive aspects, emphasizing its effectiveness in engaging players through visual and auditory elements.

C. Positive Experience (Post-Game)

Table 4: Mean and Sd Post-game (Positive Experience)

	Post-game (Positive Experience)	**Mean**	**SD**
1.	I feel satisfied with my overall experience of the game.	4.47	0.73
2.	The game met my expectations for a cooperative puzzle platformer.	4.30	0.83
3.	I felt a sense of accomplishment after finishing the game.	4.50	0.77
4..	I would like to play more levels or similar games in the future.	4.30	0.65
5.	The cooperative mechanics in the game enhanced my enjoyment.	4.33	0.71
6.	I found the cooperative mechanics innovative and refreshing.	4.60	0.62
Post-game (Positive Experience) mean score		4.41	

Although the Game Experience Questionnaire (GEQ) provides reliable insights into immersion, cooperation, and challenge, it does not capture the more nuanced aspects of cooperative dynamics. Elements such as conflict resolution, role negotiation, and sustained engagement over repeated sessions fall outside the scope of the GEQ, which limits the comprehensiveness of the current evaluation. As cooperative play often requires negotiation of roles and the management of interpersonal dynamics, relying solely on GEQ scores risks overlooking these important dimensions. Future evaluations could therefore incorporate complementary approaches, such as observational coding, video-based interaction analysis, or dyadic performance metrics, to more holistically assess the quality of cooperation.

DISCUSSION

This chapter on testing provides a comprehensive evaluation of "Mizu and Hee," focusing on the game's ability to deliver an engaging and enjoyable experience across multiple dimensions. The results show strong performance in key areas such as immersion, flow, competence, challenge, and cooperation. Players reported a high level of immersion, with consistent feedback on the game's graphics, sound, and overall engagement. Flow was effectively maintained throughout the gameplay, resulting in a longer attention span. The game demonstrated competence with its smooth controls and satisfying sense of accomplishment. The challenge was well received, with players enjoying the intellectual stimulation and problem-solving opportunities provided.

In terms of cooperation, the game successfully encouraged collaborative play, which improved the overall experience. Post-game feedback reinforces a positive experience, with players expressing satisfaction, a sense of accomplishment, and appreciation for the innovative cooperative mechanics. The high ratings in these categories indicate that "Mizu and Hee" not only met but exceeded expectations for a cooperative puzzle platformer, providing players with an engaging and enjoyable gaming experience. The findings suggest a high potential for future expansions and similar game developments, reflecting the game's success in engaging and satisfying its audience.

Strength of the Project - The project demonstrated several key strengths, including its innovative cooperative gameplay mechanics, which required teamwork and differentiated it from traditional platformers. User engagement was high, with players appreciating the controls' simplicity and the importance of collaboration. Technically, the game was well executed, with consistent performance, appealing visuals, and responsive controls. The project met its goals, creating a challenging and engaging cooperative platformer that was well received by both users and experts. Positive feedback validated the game's design and cooperative elements, highlighting its success in connecting with the intended audience.

Weaknesses of the Project: The project had some limitations because it lacked features such as a health system, checkpoints, and a story, making the game less engaging and challenging. Without a health system, players had no reason to be cautious, making the game less interesting and requiring less strategy. Due to the lack of checkpoints, players had to restart entire levels after making a single mistake, which caused frustration and made puzzle-solving less enjoyable. Furthermore, without a story or background, players were unable to form a strong emotional connection with the game, making it less immersive and engaging. Including these features in future versions could significantly improve the game, making it more challenging, reducing frustration, and more engaging experience for players. Another limitation concerns the scalability of the game design. The prototype was evaluated in a single play session with one level set, which restricts conclusions about replay value and sustained engagement. Cooperative puzzle platformers rely heavily on progressive challenges, variety, and adaptive content to maintain player interest. Therefore, extended testing across multiple level sets and longer play sessions is necessary to establish whether the mechanics can sustain long-term engagement. Furthermore, this study did not include direct comparative testing with existing cooperative puzzle platformers such as It Takes Two or Portal 2. While the present findings indicate positive outcomes, comparative benchmarking would strengthen the claim of novelty and provide a clearer assessment of relative effectiveness. Future research should therefore explore comparative evaluations alongside scalability testing to better situate the proposed mechanics within the broader cooperative puzzle platformer landscape.

Proposition for Improvement:

1. Implement a Health System**:** Each character will have a health bar. This addition would increase the sense of challenge and urgency, requiring players to be more strategic and cautious in their actions. It would also add a new layer of depth to the gameplay by requiring players to consider both their own and their partner's health while navigating levels.
2. Add Checkpoints: Include checkpoints throughout the levels to allow players to save their progress at different points. This would reduce the frustration of having to restart entire levels after a single mistake, making the game less punishing. Checkpoints would allow players to focus more on puzzle solving and cooperative gameplay without fear of losing significant progress.

CONCLUSION

This study examined the design and evaluation of Mizu and Hee Adventure, a 3D cooperative puzzle–platformer developed to address the lack of meaningful collaboration in existing titles. Findings from a user study with 30 participants indicate that the game successfully fostered cooperation, immersion, and challenge, with GEQ results showing high scores across these dimensions. While the absence of features such as checkpoints, health systems, and narrative depth limited long-term engagement, the research contributes theoretical, empirical, and practical insights into how cooperative mechanics can be systematically integrated to enrich player experience. Future work will expand testing with broader participant groups and explore additional features to further enhance engagement and replayability. In conclusion, although the study demonstrates that the proposed mechanics successfully fostered cooperation, immersion, and challenge, further validation is necessary to confirm scalability and comparative effectiveness. Extending the evaluation to multi-level play sessions and benchmarking against established cooperative puzzle platformers will not only substantiate the robustness of the design but also refine theoretical insights into role interdependence, communication tools, and progressive challenge structures. These directions will help strengthen both the academic and practical contributions of future cooperative puzzle platformer research.

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