International Journal of Graphic Design (IJGD)
Volume 04 No. 02 October 2026
E-ISSN: 2987-9434; P-ISSN: 2988-0343, Page 20-35
DOI: https://doi.org/10.51903/ijgd.v4i2.3164
Available online at: https://journal.stekom.ac.id/index.php/ijgd

Design and Development of Adventures of Pixel Using a User-Centered Approach

Hyun-Seok Kim*[1], Amina Farhana Ismail[2]
[1,2]College of Fine Arts, Hongik University, Seoul, South Korea
Email Address: hyunseok5564.kim@naver.com (*1), aminadweenq@gmail.com (2)

Abstract. *The growing demand for more interactive and immersive computer games has led developers to adopt user-centered methods that emphasize game experience over pure aesthetic design only. While there has been a technological advancement in interactive technology, the majority of games still overlook usability and emotional engagement, thereby leading to inconsistent user satisfaction. This project aims to create Adventures of Pixel, a prototype of an iterative 2D platformer game that combines old-school pixel-art graphics with User-Centered Design (UCD) to maximize playability and enjoyment. An iterative design-based approach was utilized in this research, embracing requirement analysis, prototyping, and user evaluation phases. Thirty users participated in usability testing, and data were collected using the User Experience Questionnaire (UEQ) and the System Usability Scale (SUS). The result demonstrates significant improvement of overall user satisfaction, with the mean UX score improved from 3.4 to 4.6 and SUS score improved from 71.2 to 89.5 after iterative redesigns. Participants reported greater clarity, coherence, and aesthetic enjoyment, all testifying to the success of integrating UCD with retro-art visual aesthetics. These findings demonstrate that user input in early phases of design enhances functional performance as well as emotional engagement. The main contribution of this study is to present a hybrid model marrying nostalgic appearances and usability-oriented game design. The immediate novelty of this research is the empirical validation of principles of UCD applied to pixel-art video games, offering a systematic model for designing graphically simple but engaging interactive play.*

Keywords: *User-Centered Design, Pixel Art, Game Development, User Experience, Usability Evaluation*

INTRODUCTION

The global pixel-art games renaissance reawakened nostalgia for low-fi graphics as well as new challenges for designers to reconcile nostalgia with contemporary usability heuristics. The renaissance is a reaction against cultural nostalgia for simplicity and visual restraint, and also against User Experience (UX)-Centred interactive media. Indie game makers increasingly push the boundaries of pixel-based design as an expressive and cost-effective medium. However, maintaining artistic integrity together with playability continues to be a main motivation for ongoing research within this field.

Previous studies have focused on various aspects of visual and user-centered design principles in interactive spaces. (Younis & Fedtke, 2024) examined nostalgia and user engagement evoked by the aesthetic value of 8-bit graphics in retro video games. (Melyani et al., 2024; Younis & Fedtke, 2024) focused on iterative user testing as the core of effective UCD, whereas (Shaheen et al., 2025) demonstrated the enhancement of game interface comprehensibility through UX consistency. (Villegas et al., 2023) depicted affective responses to visual stimulus in game play, and (Jovanović & Milosavljević, 2022) researched User Interface (UI) performance in educational games. Together, these articles form the basis of an understanding of how visual aesthetics balance interactive usability in game design.

Received: October 2025; Revised: March 2026; Accepted: August 2026; Published: October 2026
*Corresponding author, hyunseok5564.kim@naver.com

Still, previous research did not include sufficient artistic visual theory in assessing UX, especially within the context of 2D pixel-art game design. While (Abukhodair et al., 2024) only focused on aesthetic nostalgia; they did not experiment with usability performance. No empirical testing of (Villada Castillo et al., 2025) UCD principles were conducted in pixel-art games, nor did (Wibowo et al., 2024) investigate visual minimalism in interaction clarity. (Valeiras-Jurado & Bernad-Mechó, 2022) addressed usability without artistic coherence being considered, whereas (Gannouni et al., 2023) addressed emotional immersion but without usability testing. This research thus aims to bridge the gap by developing and designing Adventures of Pixel through an integrative UCD that strikes a balance between aesthetic as well as functional considerations.

This study assumes that the application of UCD principles to pixel-art game design will significantly influence player satisfaction and usability perception. Research seeks to quantify how iterative design and user feedback contribute to visual coherence, natural flow, and emotional resonance. By employing qualitative user research and UX testing, this study should offer practical suggestions for future interactive design practice. Lastly, the findings should create a design paradigm that reconciles the visual nostalgia with modern user needs in online gaming environments.

LITERATURE REVIEW

A. Theoretical Foundations of Pixel-Art Design and Visual Minimalism

Pixel-arts use the canons of visual minimalism, the dictum of which is that form, i.e., simplicity, lucidity, and functional fit, is more valuable than intricate ornamentation. Minimalist visual composition, as (Fusco et al., 2025) outline, relies on reducing the visual din in a bid to maximize the authority of a viewer's attention and perception of the emphasis points. Pixel-by-pixel art in the game since each pixel is utilized with purpose to convey meaning effectively within the graphical restriction. (Rivero Moreno, 2024) also thought that the revival of pixel-art visuality is not simply nostalgia for early digital media but also a stylistic preference to construct stylistic coherence and expressiveness through visual limitation.

Researchers have also examined how minimalism supports perceptual fluency and emotional engagement in interactive environments. (Tülek et al., 2024) state that the Gestalt principles suggest users perceive order and coherence when visual objects are structured with proximity, similarity, and closure. This psychological basis accounts for why pixel-art composition feels harmonious and natural, even in simplicity. (Zou et al., 2025) further went ahead to highlight that minimalist design practices increase both aesthetic coherence and usability

and allow designers to mediate between artistic abstraction and functional use in visual communication.

B. User-Centered Design and Its Relevance in Interactive Media

UCD aims to introduce user needs, user wants and dislikes, and user habits in every step of the design process to establish a significant and natural interaction. The most characteristic aspect of UCD, according (Akello & Nabukenya, 2024), is that it is iterative with continuous measure and refinement, enabling design choices to be founded on user expectations and actual conditions. This type of framework puts users not only as passive recipients but as active participants whose input seals the destiny of the design. (Ferreira et al., 2023) further, it is argued that user-centered thinking results in higher usability, accessibility, and emotional involvement. Interactive products can deliver functional and experiential value.

UCD has emerged as the central method to enabling digital interfaces to react in kind to multiple environments and technology trends in interactive media. (Virvou, 2023) argues that the application of UCD principles in interactive systems leads to more reactive and dynamic experiences through prioritizing empathy, flexibility, and cyclic feedback. (Almusaed et al., 2024) went on to state that the application of UCD in interactive design enables end users, developers, and designers to work together and create solutions that reflect the context and are user-centered. Both arguments both emphasize how UCD enables interactive media to be an active and participatory medium that reflects human-centered values in digital design.

C. Empirical Perspectives on Visual Aesthetics and Player Emotion

As pointed out by (Dirin & Laine, 2023), emotional engagement with video games relies in a considerable measure on the visual and aesthetic elements that determine the level of immersion and enjoyment for the player. The authors clarified that environmental setting design, color palette, and graphical aesthetic produce affective states that result in motivation and investment in gaming. (Andreean et al., 2023) went a step further to mention that visual aspects such as shape, texture, and character design are the cause of the emotional context in play by reminding the player of their attachment to the game world. The above findings serve as evidence that visual attractiveness is are psychological stimulus for inducing emotional and cognitive behavior for interactive experience.

As (Zhao et al., 2025) posits, qualitative empirical work and eye-tracking suggest that video game visual signals can forecast patterns of affective resonance and attention by players as a function of emotion. In this study, researchers captured how the players' visual attention is regulated by contrast, motion, and colour intensity to steer the players' emotional experience in

the virtual game world. Similarly, (Nugroho & Wibowo, 2024; Purhita & Rudjiono, 2024; Wahyudin & Hakim, 2024) concluded that light change, animation speed, and visual density produce measurable differences in emotional states and behavioral results when playing a game. These empirical perspectives are all concerned with how visual design solves human emotion and perception, and how they enhance the experiential form of interactive media.

D. Empirical Studies on UX Evaluation and Interface Usability in Game Design

Game development UX testing is the most important aspect of the player's experience of and interaction with the interface components. (Saranya et al., 2025) emphasized that features such as visual coherence, navigation simplicity, and timely feedback play a major role in the impact on user satisfaction and interaction. Likewise, (Omar et al., 2024) discussed how game-specific heuristics allow usability issues to be identified that can compromise immersion and flow. These studies describe how UX testing exceeds functionality through emotional and perceptual responses to guide the general player experience.

Under the overall usability testing paradigm, (Zhang et al., 2024) have found that the quality of the interface directly affects user comprehension, usability, and flow of user interaction in game environments. Their study proved that using objective measures, such as usability scales, in combination with feedback from users while playing leads to more accurate assessment results. (Picardi & Caruso, 2024) further elucidated that user-centered models of evaluation enable designers to continuously improve interface elements iteratively with behavior-driven feedback from real users. A summary of previous research on UX testing and usability of interfaces in game development can be seen in Table 1.

Table 1. Comparative Analysis of UX and Usability Studies in Games

Author(s) & Year	Focus of Study	Key Findings	Identified Gap
(Saranya et al., 2025)	Interaction design and player engagement	Consistency and feedback enhance usability and satisfaction	Limited focus on aesthetic–UX integration
(Omar et al., 2024)	Heuristic evaluation in game usability	Heuristic adaptation detects usability issues effectively	Lack of empirical testing on the emotional impact
(Zhang et al., 2024)	Usability factors in educational games	Visual clarity and navigation improve learning engagement	Did not explore aesthetic influence
(Picardi & Caruso, 2024)	User experience in game evaluation	Real-time evaluation refines interface usability	Limited application in pixel-art or retro games

METHODS

A. Research Framework

This study adhered to the UCD philosophy that places users at the focal point of the design process. This process revolves around the understanding of players' needs, wants, and habits so that each design stage is aligned according to their expectations. It had four interconnected stages carried out, namely User Analysis, Concept Development, Prototyping, and Evaluation, and they form a continuous feedback loop. Each stage yielded valuable data that guided the next stage, allowing game design to evolve from UX data.

During the User Analysis phase, researchers set up players' visual preferences and playing habits to inform aesthetic and functional design decisions. The Concept Development step then focused on setting up the pixel-art visual look and gameplay rules for target markets. The Prototyping step then involved the creation of visual assets, character sprites, and interface objects with consistency being preserved across aesthetic and usability. The last Evaluation phase was user testing on the prototype and iterating the design based on user feedback to attain maximum overall playability and interaction. Figure 1 illustrates the iterative nature of the UCD approach, where analysis, concept development, prototyping, and evaluation are linked in a cycle of repeated design.

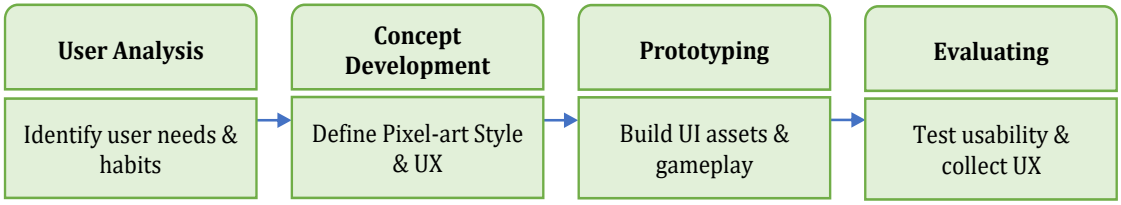


Figure 1. Diagram of the User-Centered Design Framework

B. Data Collection

Data collection was conducted through questionnaires and direct observation from 20 subjects between the ages of 15 and 25, which is representative of the pixel-art game player population. The subjects played Adventures of Pixel and later at once rated their experiences through a carefully created survey. Observations while playing the game were also performed to determine behavior patterns, usability issues, and emotional reactions towards the visual interface. This blended approach allowed the research to capture both subjective views and observable behavior amongst the users, providing a comprehensive UX evaluation.

To measure player experience consistently, a five-point Likert scale was used to rank the level of agreement with each statement concerning UX. The scale enabled the participants to rate their experiences on key usability metrics, providing measurable data for analysis. The spectrum ranged from "Strongly Disagree" to "Strongly Agree," which mapped to different levels of user

satisfaction and ease. Table 2 below shows the extensive Likert scale used in the study to guide UX assessment.

Table 2. Likert Scale for UX Evaluation

Score	Category	Descriptiont
1	Strongly Disagree	The experience was very poor
2	Disagree	The experience was very poor
3	Neutral	The interface felt uncomfortable
4	Agree	The game felt pleasant to use
5	Strongly Agree	The game felt pleasant to use

There were four key areas to score UX, each of which aligned with a significant factor in game interaction. Interface Clarity scored how easily players deciphered navigational and visual cues in gameplay. Visual Appeal measured the aesthetic quality and artistic consistency of the pixel-art world to users. Responsiveness and Overall Satisfaction, meanwhile, noted the extent to which the game responded effectively to user input and the degree to which the overall experience was pleasant for the players.

C. Data Analysis

Questionnaire and observation data were statistically and descriptively compared using quantitative methods. The study aimed to quantify satisfaction among users and evaluate usability enhancement after applying the UCD approach. Through these methods, gathered information was patterned to identify trends that reflected consistency of player feedback. This systematic process allowed the researcher to study user answers in a structured and quantifiable manner. The average value $\bar{X}$ was used to determine the average score of user satisfaction across all elements measured. This measure was also used to summarize player comments and describe the overall perception of usability and design achievement, as shown by Formula (1).

$$\bar{X} = \frac{\sum X_i}{n} \tag{1}$$

This computation gave a numerical value for the results of the user evaluation. It also served as a benchmark to compare scores across different design versions. To ascertain whether the design changes caused significant differences, a paired sample t-test was conducted. Using this statistical test, the mean scores before and after the redesign were compared to determine measurable differences in the users' perception according to Formula (2).

$$t = \frac{\bar{X}_1 - \bar{X}_2}{S_p\sqrt{\frac{2}{n}}}, S_p\sqrt{\frac{S_1^2 + S_2^2}{2}} \tag{2}$$

The statistical differences between the sets of data were established by analyzing them. Integrating descriptive and inferential methods ensured that all findings were supported by measurable data and empirical validity.

RESULTS

A. Visual Design Results

The visual design outcomes of Adventures of Pixel were delivered in an iterative loop modelled on the principles of the UCD model. User feedback translation was the core process in the design phases, aimed at making readability, emotional perception, and interface coherence better. The visual identity of the game synthesizes minimalist pixel-art ideas to produce nostalgia-boosting visuals with clarity and consistency in all aspects of the interface. The following sections reflect the final design findings of all visual components, with corresponding figures to illustrate how they are to be executed.

The first design feature is the player character, who will be a visual focal point of the entire game experience. The character attains a minimalist pixel-art appearance with high-contrast colors and a sharp silhouette to achieve good readability against varying backgrounds. The design is sympathetic to theories of visual communication, promoting shape recognition and perceptive balance in movement-based media. The result of the design can be seen in Figure 2.

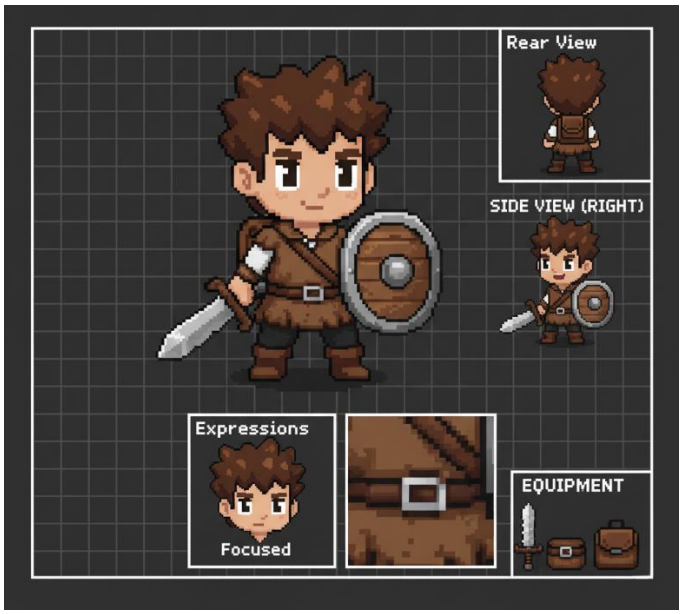


Figure 2. Player Character Design

The image shows a small pixelated figure with high contrast body to background colors, such that the figure is still legible on different game backgrounds. The participants indicated that

the simplicity and color choice reduction improved orientation and control accuracy during gameplay. Visual conformity of the design also enhances intuitive recognizability, avoiding visual ambiguity under dynamic motion. Generally, the representation effectively communicates the visual and functional properties of character legibility in pixel-gaming environments.

The next component, the main menu, emphasizes retro visual cues combined with utilitarian simplicity. It employs a balanced use of text and buttons via pixel-based typography and strong color contrast to guide player navigation. The interface layout is constructed to prioritize player familiarity while maintaining stylistic consistency with the game's nostalgic motif. The resulting interface is shown in Figure 3.

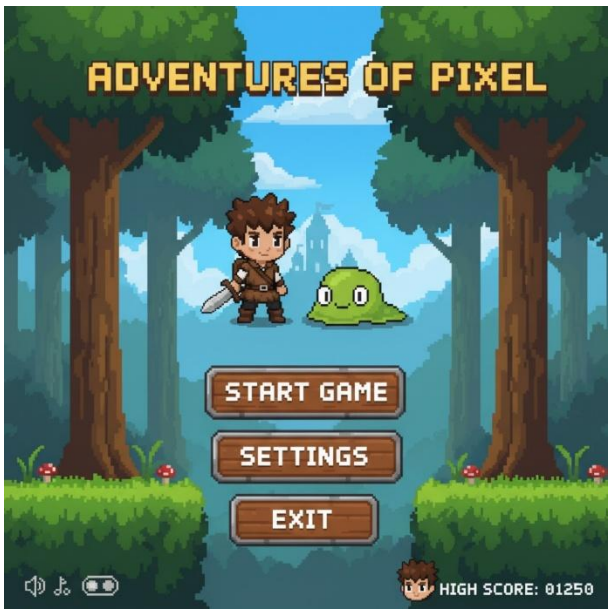


Figure 3. Main Menu Design

In this design, the middle title and navigation elements are arranged symmetrically in order to reassert visual stability as well as ease of recognition. Test participants stated that the explicit mention as well as the high-contrast background rendered the process of interaction easier, allowing for faster navigation of menus. The retro-inspired typography sufficiently evokes familiarity without sacrificing legibility at low resolutions. The design integrates functional usability with visual engagement according to the overall visual mood of the game.

The third visual component is the level layout, which also prescribes the spatial and interactive structure of the gameplay area. Each level was composed of a grid system to ensure spatial cohesion and homogeneous depth perception. Foreground and background layers with opposite colors help orient the players and distinguish interactive objects from non-interactive backgrounds. The end-level composition is depicted in Figure 4.

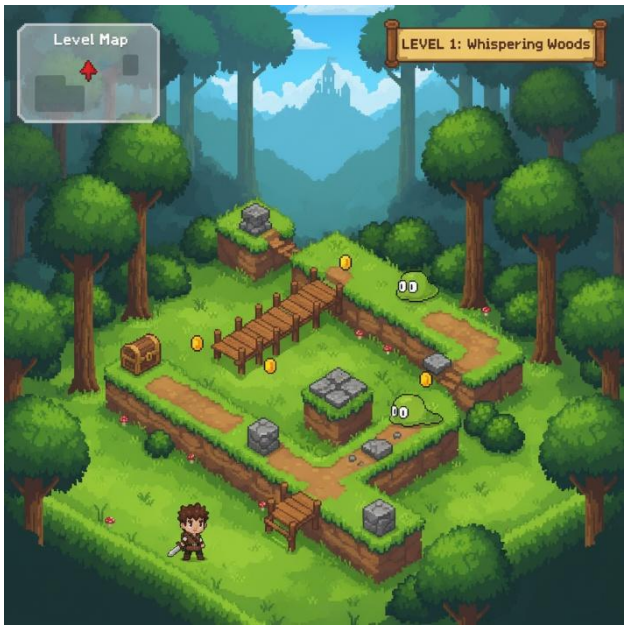


Figure 4. Level Layout Design

Figure 4 shows a balanced spatial composition where paths of movement, obstacles, and background objects are graphically distinct but stylistically unified. This interactive and ornamental object distinction improved players' situational awareness when moving through the game. Visual rhythm provided by repetitive uniform spacing helps facilitate natural gameplay flow. User feedback indicated that players liked the environment visuals without too much complexity, demonstrating effective visual hierarchy in level design.

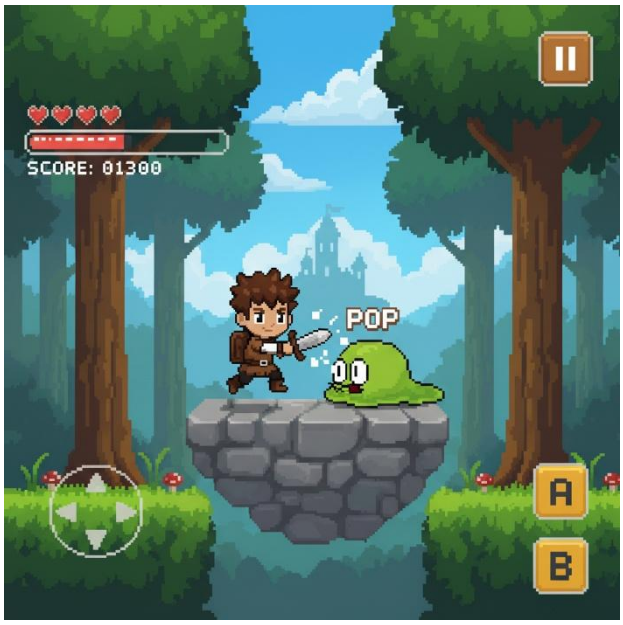


Figure 5. Gameplay Interface Design

The gameplay interface integrates all in-game information in a compact yet unobtrusive manner. Key elements such as health bars, scores, and interactive prompts are strategically placed at the edges of the screen to maintain full visibility of the play area. The design prioritizes usability and quick information retrieval without interrupting the immersive experience. The resulting configuration is displayed in Figure 5.

The layout maintains a clear visual balance between action space and interface elements, minimizing visual overload during gameplay. Players noted that the positioning of icons and indicators facilitated faster reaction times and improved situational focus. The consistent color scheme and minimal visual noise reinforced cognitive ease, supporting continuous engagement throughout the game. As a result, the interface effectively integrates both function and aesthetics within the pixel-art context.

The pause screen was designed to provide cognitive relief during gameplay while maintaining stylistic cohesion with the main interface. It features a centered layout with minimal text and subdued color contrast to reduce visual strain. The use of negative space directs user attention to the primary action choices, creating a calm and balanced visual composition. The resulting visual arrangement is presented in Figure 6.

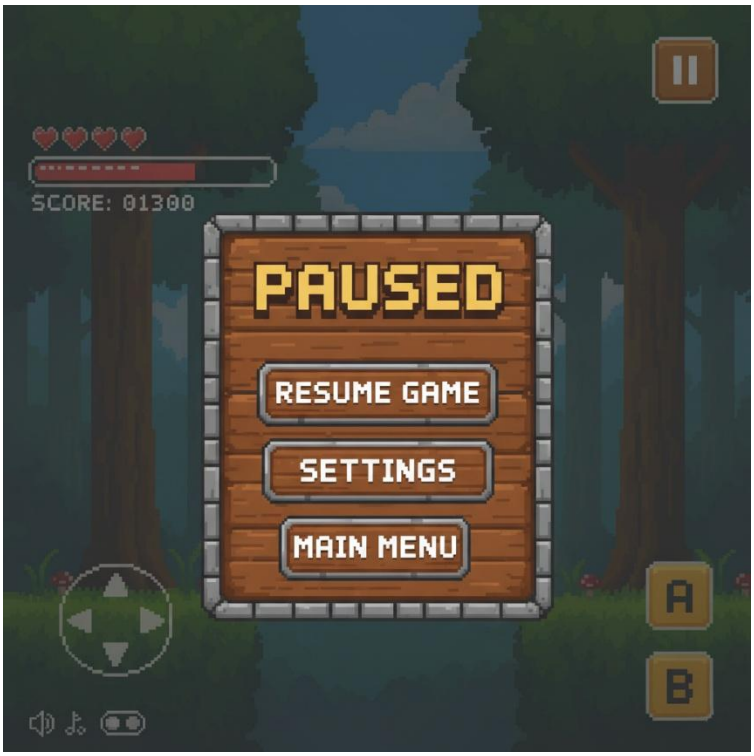


Figure 6. Pause Screen Design

In this layout, restrained use of color and simplified graphical structure produce a visual pause consistent with the game's rhythm. Users reported that the reduced contrast and isolated focus on essential options decreased fatigue and improved usability perception. The interface provides a temporary disengagement point without disrupting overall visual harmony. This careful balance reflects the principle of cognitive recovery central to user-centered interaction design.

The final design element is the game-over screen, intended to deliver strong visual feedback and emotional resonance. The layout uses dominant red hues to convey failure and urgency while maintaining legibility and consistency with other screens. Large, centered typography reinforces message clarity and emotional impact without overwhelming the user. The completed layout is shown in Figure 7.

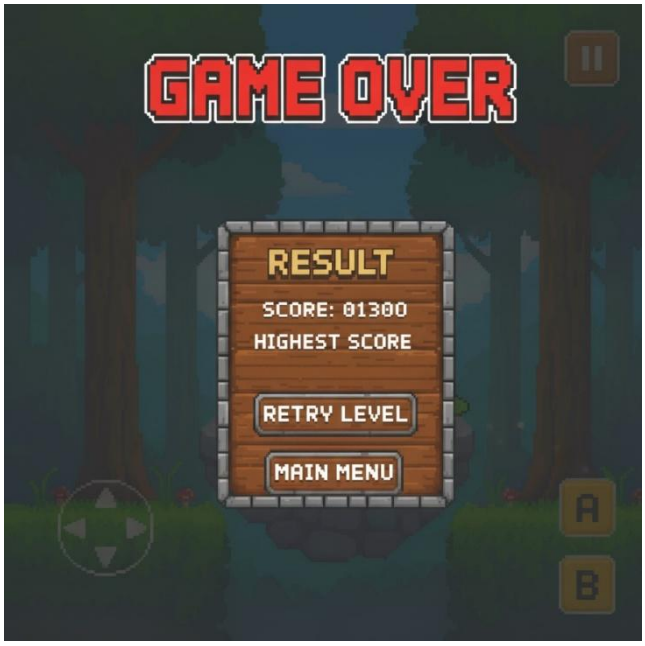


Figure 7. Game Over Screen Design

This design effectively combines emotional expressiveness with visual simplicity to create a clear and memorable end-state UI. The dominant color tone captured attention immediately and was constantly associated by players with emotional emphasis. The form's simplicity ensured immediate cognitive processing, supporting feedback clarity design principles for game UI. Users recognized this screen as an emotionally potent but functionally clear terminus point for the gameplay sequence.

B. UX Evaluation Results

The usability and overall experience of the game were evaluated through a user test involving 20 participants aged 15–25 years. The evaluation compared user ratings before and after the design refinement, revealing notable improvements in all four assessed aspects. Table 4 summarizes the UX evaluation results, showing that the average UX score increased from 3.4 to 4.6 following the iterative redesign process. The structured assessment demonstrates how visual and interaction enhancements improved player perception of usability and aesthetic satisfaction.

Table 3. User Experience Evaluation Results

UX Aspect	Before Revision	After Revision	Change	Interpretation
Visual Appeal	3.5	4.7	+1.2	Colors and contrast were optimized
Interface Clarity	3.3	4.6	+1.3	Navigation simplified
Responsiveness	3.4	4.5	+1.1	Faster visual feedback
Overall Satisfaction	3.5	4.6	+1.1	More consistent design

The numbers in Table 4 give numeric improvements in user ratings in all categories. Visual appeal and simplicity of interface showed the greatest improvement, in line with positive response to more effective layout and color harmony. Figures 2–7 above show the resulting design improvements influencing these UX scores. Overall, the results validate the iterative nature of UCD since incremental improvement led to successive quality increases in the gameplay experience.

DISCUSSION

The outcomes of the research confirm that applying UCD principles to design pixel-art games significantly enhances UX and quality of interaction. The measurable UX score increase, from 3.4 to 4.6, indicates considerable enhancement of visual appeal, interface simplicity, and responsiveness. These results substantiate iterative user feedback and evaluation cycles as determinants leading to the optimization of usability, in favor of the argument of (Shaheen et al., 2025; Stewart et al., 2025) that user testing is a determining factor for achieving clarity and consistency in interactive systems. Implications of this research are that nostalgic visual design can be combined with modern usability principles by being guided by a structured and user-centered process.

In comparison to previous studies, findings from the present study affirm the belief that emotional engagement and usability simplicity can be blended harmoniously through visual minimalism. This aligns with the results of (Fusco et al., 2025; Zou et al., 2025), who suggested visual reduction enhances cognitive focus and perceptual smoothness. The satisfaction improvement also resonates with (Ferreira et al., 2023) conclusion, where they pointed out that UCD cultivates empathy and adaptability in interactive products. However, the results are

contrary to the limited perspective taken by (Abukhodair et al., 2024), who prioritized aesthetic nostalgia without considering usability performance, which suggests aesthetic design should be balanced with functional validation to uphold interaction.

An interesting observation comes from user reactions to the emotional appeal of pixel-art graphics, with some users describing them as "familiar yet far-away." The response of surprise shows a tension between nostalgia and newness, where visual familiarity does not automatically translate into emotional connection. The phenomenon confirms the argument of (Dirin & Laine, 2023) that affective engagement depends not only on visual aesthetics but also on contextual interaction patterns. The subtle detachment observed in some of the aesthetic elements also relates to (Tülek et al., 2024), who argued that perceptual harmony requires coherent alignment between form, meaning, and player expectation.

Theoretically and practically, this study contributes to the understanding of how user-centered iteration and visual minimalism can, in combination, heighten experiential and aesthetic quality in game design. The findings confirm that user-driven iteration perfects not only visual balance but also perceptual clarity, supporting the theoretical relationship between UCD and emotional design formulated by (Akello & Nabukenya, 2024; Virvou, 2023). Practically, the results highlight the merit of integrating usability testing in the initial phases of design in fostering coherence between artistic intent and functional performance. However, this research identifies some limitations, particularly the small sample size of participants and narrow demographic range, which may have potential implications for the generalizability of the results.

CONCLUSION

The study concludes that applying the UCD model when designing Adventures of Pixel significantly enhanced the usability, visual appeal, and satisfaction of the game. The process of prototyping with repeated assessment and feedback from the users resulted in significant UX performance gain, with an indication that player involvement during the design process has a direct effect on visual clarity and interest. The blending of retro pixel-art aesthetics with contemporary interaction design principles illustrates that functionality and simplicity can actually thrive together in today's game environments. In conclusion, the results are evident to affirm that user-centric design can enhance the emotional as well as the functional value of interactive digital experiences.

For future research, larger populations of participants would facilitate a better explanation of cultural backgrounds and age differences in understanding pixel-art aesthetics. Exploring adaptive feedback mechanisms further could streamline user interaction and emotional

engagement with play. Cross-study comparisons across various genres of design could also facilitate an explanation of how UCD principles function under various artistic constraints and play styles. By responding to these guidelines, future research can help build more inclusive, context-sensitive, and emotionally resonant frameworks for user-centered game design.

ACKNOWLEDGEMENT

The authors declare that artificial intelligence tools, including ChatGPT, were used exclusively to support language editing and manuscript refinement. Their use was limited to improving grammar, readability, wording, and the overall clarity of the text. AI tools played no role in the research itself. All research-related activities, including study conception, experimental design, data acquisition, methodological development, data analysis, interpretation of results, and formulation of conclusions, were performed entirely by the authors. The authors accept full responsibility for the manuscript and its contents, including its accuracy, validity, integrity, authenticity, and overall quality.

REFERENCES

Abukhodair, N., Song, M., Pekçetin, S., & DiPaola, S. (2024). Designing a Wheel-Based Assessment Tool to Measure Visual Aesthetic Emotions. *Cognitive Systems Research*, *84*, 101196. https://doi.org/10.1016/j.cogsys.2023.101196

Akello, C. K., & Nabukenya, J. (2024). UCD–CE Integration: A Hybrid Approach to Reinforcing User Involvement in Systems Requirements Elicitation and Analysis Tasks. *Group Decision and Negotiation*, *33*(6), 1355–1403. https://doi.org/10.1007/s10726-024-09897-7

Almusaed, A., Yitmen, I., Almssad, A., & Myhren, J. A. (2024). Construction 5.0 and Sustainable Neuro-Responsive Habitats: Integrating the Brain–Computer Interface and Building Information Modeling in Smart Residential Spaces. *Sustainability (Switzerland)*, *16*(21), 9393. https://doi.org/10.3390/su16219393

Andreean, A. F. F., Anugrah, M. F., & Tho, C. (2023). Exploring of Emotional Character in Online Games Toward Player. *Procedia Computer Science*, *227*, 743–752. https://doi.org/10.1016/j.procs.2023.10.579

Dirin, A., & Laine, T. H. (2023). The Influence of Virtual Character Design on Emotional Engagement in Immersive Virtual Reality: The Case of Feelings of Being. *Electronics*, *12*(10), 2321. https://doi.org/10.3390/electronics12102321

Ferreira, M. S., Antão, J., Pereira, R., Bianchi, I. S., Tovma, N., & Shurenov, N. (2023). Improving Real Estate CRM User Experience and Satisfaction: A User-Centered Design Approach. *Journal of Open Innovation: Technology, Market, and Complexity*, *9*(2), 100076. https://doi.org/10.1016/j.joitmc.2023.100076

Fusco, R., Granata, V., Setola, S. V., Pupo, D., Petrosino, T., Lamanna, C. P., Castaldo, M., Riga, M. G., Karaboue, M. A., Izzo, F., & Petrillo, A. (2025). Visual Perception and Pre-Attentive

Attributes in Oncological Data Visualisation. *Bioengineering*, *12*(7), 782. https://doi.org/10.3390/bioengineering12070782

Gannouni, S., Belwafi, K., Aledaily, A., Aboalsamh, H., & Belghith, A. (2023). Software Usability Testing Using EEG-Based Emotion Detection and Deep Learning. *Sensors*, *23*(11), 5147. https://doi.org/10.3390/s23115147

Jovanović, A., & Milosavljević, A. (2022). VoRtex Metaverse Platform for Gamified Collaborative Learning. *Electronics*, *11*(3), 317. https://doi.org/10.3390/electronics11030317

Melyani, M., Ramadhani, A., Sudrajat, A., Rosmiati, M., Yusuf, F., Roni, F., Budihartanti, C., & Palupi, M. E. (2024). The Games Design Accesbility For Gamer With Neurological Disorder. *Journal of Technology Informatics and Engineering*, *3*(1), 26–38. https://doi.org/10.51903/JTIE.V3I2.177

Nugroho, A. S., & Wibowo, M. C. (2024). Design and Implementation of Animated Stickers as an Educational Tool for Adolescent Drug Awareness Using the MDLC Method. *International Journal of Graphic Design*, *2*(2), 195–206. https://doi.org/10.51903/ijgd.v2i2.2114

Omar, K., Fakhouri, H., Zraqou, J., & Marx Gómez, J. (2024). Usability Heuristics for Metaverse. *Computers 2024, Vol. 13, Page 222*, *13*(9), 222. https://doi.org/10.3390/computers13090222

Picardi, A., & Caruso, G. (2024). User-Centered Evaluation Framework to Support the Interaction Design for Augmented Reality Applications. *Multimodal Technologies and Interaction*, *8*(5), 41. https://doi.org/10.3390/mti8050041

Purhita, E. J., & Rudjiono, D. (2024). Evaluating the Effectiveness of Interactive Multimedia in Boosting Brand Equity: A Case Study of Visual Communication Design Programs. *International Journal of Graphic Design*, *2*(2), 144–160. https://doi.org/10.51903/ijgd.v2i2.2109

Rivero Moreno, L. D. (2024). Art on the Chain? On the Possibilities of New Media Art Preservation on the Web3. *Digital Creativity*, *35*(3), 221–233. https://doi.org/10.1080/14626268.2024.2348035

Saranya, K. N., Bhandari, M., Borad, N., Reddy, P. V. P., & Kumar, S. (2025). Surveying the Impact of Rarely Investigated Design Components on User Engagement. *International Journal of Graphic Design*, *3*(1), 39–52. https://doi.org/10.51903/ijgd.v3i1.2752

Shaheen, A., Alkhatib, A., Farfoura, M., & Albustanji, R. (2025). Developing a User-Centric Quality Model for Gaming as a Service (GaaS): Enhancing User Satisfaction Through Key Quality Factors. *IET Software*, *2025*(1), 6662968. https://doi.org/10.1049/sfw2/6662968

Stewart, B. T., Menge, K., Kurien, T. V., Orton, C., Estrada, R., Carrougher, G., Thompson, C., Hsieh, G., & Pham, T. N. (2025). Optimizing the User-Experience (UX) and −Interface (UI) of a mHealth Application to Aid Recovery from Burn Injury (BurnCORE) Through a User-Centered Design Approach. *Burns Open*, *11*, 100409. https://doi.org/10.1016/j.burnso.2025.100409

Tülek, B., Timur, Ö. B., Karaca, E., & Timur, U. P. (2024). Investigation of Meaning and Centrality Relationship in the Statues Used in Çankırı Urban Landscape. *Ain Shams Engineering Journal*, *15*(4), 102619. https://doi.org/10.1016/j.asej.2023.102619

Valeiras-Jurado, J., & Bernad-Mechó, E. (2022). Modal Density and Coherence in Science Dissemination: Orchestrating Multimodal Ensembles in Online TED Talks and Youtube Science Videos. *Journal of English for Academic Purposes*, *58*, 101118. https://doi.org/10.1016/j.jeap.2022.101118

Villada Castillo, J. F., Bohorquez Santiago, L., & Martínez García, S. (2025). Optimization of Physics Learning Through Immersive Virtual Reality: A Study on the Efficacy of Serious Games. *Applied Sciences*, *15*(6), 3405. https://doi.org/10.3390/app15063405

Villegas, E., Fonts, E., Fernández, M., & Fernández-Guinea, S. (2023). Visual Attention and Emotion Analysis Based on Qualitative Assessment and Eyetracking Metrics—The Perception of a Video Game Trailer. *Sensors*, *23*(23), 9573. https://doi.org/10.3390/s23239573

Virvou, M. (2023). Artificial Intelligence and User Experience in reciprocity: Contributions and state of the art. *Intelligent Decision Technologies*, *17*(1), 73–125. https://doi.org/10.3233/idt-230092

Wahyudin, A., & Hakim, F. N. (2024). Company Profile Design Based Interactive Multimedia as Information Media: Case study: CV. Rizka Multti Dimensi Semarang Regency. *International Journal of Graphic Design*, *2*(1), 20–31.

Wibowo, M. C., Zainudin, A., & Sugiarto, S. (2024). The Influence of Minimalist Design Elements on Visual Preferences of Generation Z: A Quantitative Study. *International Journal of Graphic Design*, *2*(2), 236–247. https://doi.org/10.51903/ijgd.v2i2.2133

Younis, A., & Fedtke, J. (2024). "You've Been Living Here For as Long as You Can Remember": Trauma in OMORI's Environmental Design. *Games and Culture*, *19*(3), 309–336. https://doi.org/10.1177/15554120231162982

Zhang, Y., Zhang, B., Jang, W., & Pan, Y. (2024). Enhancing Spatial Cognition in Online Virtual Museum Environments: Integrating Game-Based Navigation Strategies for Improved User Experience. *Applied Sciences*, *14*(10), 4163. https://doi.org/10.3390/app14104163

Zhao, J., Ma, Y., Zhang, X., Lin, H., Lu, Y., Wu, R., Zhang, Z., & Zou, F. (2025). An Empirical Study on the Impact of Different Interaction Methods on User Emotional Experience in Cultural Digital Design. *Sensors*, *25*(17), 5273. https://doi.org/10.3390/s25175273

Zou, X., Zhang, W., & Zhao, N. (2025). From Fragment to One Piece: A Review on AI-Driven Graphic Design. *Journal of Imaging*, *11*(9), 289. https://doi.org/10.3390/jimaging11090289