

Essential User Experience Principles for Programming-Oriented Role-Playing Games: An Expert-Validated Thematic Synthesis

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Abstract

This study aims to identify and validate the essential User Experience (UX) principles for the design of programming-oriented Role-Playing Games (RPG), a subgenre that requires players to navigate an interactive environment while simultaneously performing structured programming reasoning. Existing UX frameworks have been developed predominantly for general entertainment contexts or non-game applications and therefore do not fully address the dual cognitive load inherent in programming-oriented RPGs. To address this gap, this research employs a qualitative approach combining expert validation, thematic synthesis, and the Fuzzy Delphi Method (FDM), involving ten experts from the fields of UX design, game development, and programming. The analysis yielded six empirically validated UX principles, namely Usability and Learnability, Accessibility and Readability, Responsiveness and Interaction Smoothness, Consistency and Predictability, Meaningful Feedback and Guidance, and Engagement Support. The defuzzified consensus values of these principles ranged from 0,59 to 0,72, with all six principles surpassing the acceptance threshold of 0,50, indicating sufficient expert agreement. Further analysis revealed that the six principles do not operate in isolation but form a network of interdependencies that can be represented as a three-layer hierarchical framework consisting of Foundation, Communication and Responsiveness, and Engagement. This study contributes by providing a specific, coherent, and empirically validated UX framework that can serve as a design and evaluation reference for programming-oriented Role-Playing Games.

Keywords: delphi method, expert validation, programming, role-playing gamefuzzy, user experience.

1 Introduction

Role-Playing Games (RPGs) have become one of the most influential and commercially significant genres within the global digital entertainment industry, attracting growing attention from researchers in Human-Computer Interaction (HCI) and game design [1]. The genre's distinctive characteristics such as immersive narratives, persistent character progression, structured quest systems, and player-driven decision-making have positioned RPGs at the center of contemporary discussions about interactive system design and User Experience (UX) [2]. As modern RPGs continue to expand in complexity, ensuring high-quality UX has become essential, not only for sustaining player engagement but also for shaping the perceived value of the interactive experience as a whole [3]. Within this context, UX design has shifted from a peripheral concern to a primary determinant of player satisfaction, demanding more rigorous investigation into the principles that guide effective interaction in increasingly content-rich RPG environments where players must navigate multiple interaction layers simultaneously.

The growing complexity of contemporary RPGs has intensified the demand for systematic UX considerations across multiple interaction layers. As players engage with intricate menus, manage character statistics, interpret feedback systems, and make consequential decisions, the interaction layer between the player and the game system becomes increasingly consequential to overall user satisfaction. Industry-oriented frameworks have emphasized that game UX operates on principles fundamentally different from traditional software UX, while productivity software optimizes primarily for task efficiency, game UX must simultaneously balance challenge, engagement, immersion, and learnability [3]. Recent advances in HCI research have further demonstrated that even

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minor lapses in interaction quality such as inconsistent visual representation, delayed system response, or unclear feedback can significantly reduce player involvement and undermine the perceived quality of the experience [4], [5]. Such findings reinforce the view that UX is not merely a layer added on top of game design but is constitutive of the player's perception of the interactive product.

Despite this rapid expansion of RPG and game UX research, the literature reveals a fragmented understanding of UX in this genre. Existing UX frameworks have been developed primarily for general-purpose digital products or for entertainment-oriented mobile games, and they often fail to address the specific interaction demands of RPGs that integrate structured cognitive tasks within their gameplay loop [6]. Furthermore, prior studies tend to focus on isolated UX dimensions such as narrative immersion [7] or surface-level usability [8] without consolidating these dimensions into a coherent set of principles that can guide design decisions across multiple interaction layers. Designers working with programming-oriented RPGs an emerging subgenre at the intersection of interactive entertainment and structured problem-solving therefore lack a unified, expert-validated UX reference suitable for this particular context. As a result, design decisions in this space are often made through intuition or borrowed heuristics, which may not adequately capture the unique interaction demands of this domain.

The study contributes to HCI and game design research in three main ways. First, it produces a consolidated, expert-validated set of UX principles tailored specifically for programming-oriented RPGs, an area where most existing UX frameworks have only partial relevance. Second, it provides actionable design implications that can be translated directly into concrete development decisions, addressing a recurring critique that conceptual UX principles often lack clear pathways to implementation. Third, it advances methodological discussion by demonstrating how qualitative expert validation, when paired with thematic synthesis, can effectively support the development of UX frameworks for emerging or specialized interactive systems. To the best of the authors' knowledge, no prior Scopus-indexed work has systematically identified and validated essential UX principles for programming-oriented RPGs as a coherent design framework. The present research addresses this gap by offering an expert-validated thematic synthesis that consolidates the essential UX principles required to guide the design of this emerging RPG subgenre.

2 Literature Review

Eshuis et. al. [9] in a study published in *Simulation & Gaming*, conducted a preliminary investigation of player experience and enjoyment differences across video game genres including shooter games, role-playing games (RPGs), and massively multiplayer online (MMO) variants. Using the Player Experience Inventory (PXI) as the primary measurement instrument, the authors examined how experiential profiles vary across genre categories. Their findings revealed that player experience and enjoyment are not uniform across genres but instead exhibit genre-specific patterns shaped by the unique mechanics, pacing, and narrative structures of each game category. This conclusion provides empirical justification for the present study's genre-focused investigation, establishing that UX research conducted in a generalized manner risks overlooking the distinctive interaction demands of specific subgenres such as programming-oriented RPGs.

Davern et al. [10] investigated the usability of a speech agent-based RPG to determine how voice interaction shapes user experience in role-playing contexts. Through structured usability testing, the authors identified specific UX challenges associated with conversational interfaces in RPG environments, including issues of input recognition, feedback timing, and conversational pacing. Their findings highlighted that even well-designed RPGs can exhibit significant UX issues when interaction modalities introduce unfamiliar friction points. For the present study, this work provides direct evidence that systematic UX evaluation methods are essential for diagnosing interaction barriers in RPG environments and that domain-specific principles are required to capture context-dependent UX issues.

Rebhi et al. [11] conducted a reliability and validity assessment of the Arabic version of the Game Experience Questionnaire (GEQ) to ensure cross-cultural psychometric soundness. Their methodological process encompassed translation validation, expert consultation, and statistical reliability testing across multiple GEQ subscales. The study demonstrated that UX-related instruments

require structured validation procedures before they can be considered trustworthy across cultural and linguistic contexts. This insight provides direct methodological support for the present study, which similarly relies on structured expert validation to ensure that the identified UX principles are well-grounded, conceptually defensible, and methodologically rigorous rather than purely interpretive.

Research conducted by Pinto-Dela Cadena [12] applied the Fuzzy Delphi Method to refine and validate competency-based constructs derived from expert input. Their methodology illustrates that FDM produces measurable consensus indicators including defuzzified values, agreement percentages, and threshold-based acceptance criteria that significantly increase the rigor of qualitative consolidation. By demonstrating FDM's robustness as a validation tool across multiple iterations of expert review, this study reinforces the methodological foundation of the present research, in which expert consensus on UX principles must be empirically defensible and replicable rather than purely interpretive or subjective.

Liu et al. [13] examined the multifaceted role of curiosity in player engagement through a survey of 482 participants. The authors identified seven categories and thirteen performance dimensions of game-related curiosity, concluding that curiosity functions as a critical driver of sustained player attention. Their findings indicated that players show pronounced preferences for games offering social interaction, strategic challenges, and a delicate balance between uncertainty and the anticipation of future rewards. These insights reinforce the relevance of engagement support as a UX principle in the present study, demonstrating that cognitively meaningful design elements such as anticipated rewards, strategic challenges, and uncertainty management directly influence player retention in interactive RPG environments.

Joessel et al. [14] introduced an experimental video-game-based method to induce high and low flow states in players. Through controlled manipulation of challenge skill balance, pacing, and goal clarity, the authors demonstrated that flow can be measurably influenced by specific game design parameters. Their findings emphasized that responsiveness, challenge calibration, and continuous engagement are not abstract aspirations but design variables that can be quantitatively operationalized. This perspective strengthens the present study's framing of UX principles particularly responsiveness, interaction smoothness, and engagement support as concrete and implementable design requirements rather than vague qualitative ideals.

Chen et al. [15] conducted a comprehensive survey on the design of virtual reality (VR) interaction interfaces, analyzing 438 articles to identify recurring design challenges and priorities. Their findings emphasized accessibility, readability, multimodal interaction, and adaptive personalization as the core priorities of immersive interface design. Although their focus is on VR specifically, the conclusions are highly transferable to RPG environments, as both share the requirement to maintain user comprehension and seamless interaction within content-rich digital systems. This study reinforces the inclusion of accessibility, readability, and consistency as essential UX principles in the present research, providing strong empirical grounding for these dimensions across multiple interactive system categories.

Banks and Bowman [16] examined player mental models of videogame avatars and the player-avatar relationship. The authors argued that avatars are not singular bodies but rather functional and phenomenological assemblages internalized by players as networks of knowledge about the avatar. Their findings demonstrated that consistent mental models are central to how players form interpretive frameworks during gameplay, and that interaction patterns disrupting these mental models significantly degrade the quality of the experience. For the present study, this work provides theoretical grounding for the inclusion of consistency and predictability as UX principles, since stable interaction patterns are essential for players to construct and maintain coherent mental models across extended RPG sessions.

Bouquet et al. [17] introduced a knowledge graph and language model-based framework for personalized quest and dialogue generation in role-playing games. The study revealed that the structural quality of quests and the coherence of narrative dialogue are critical UX-defining elements that directly influence player engagement, replayability, and emotional involvement. By demonstrating that adaptive quest and dialogue systems significantly enhance perceived UX, the authors confirmed that quest design and narrative coherence are not optional embellishments but central UX components in modern RPGs. Their findings provide direct empirical support for the

inclusion of quest system, narrative relevance, and player agency as UX-relevant components in the present study's investigation of programming-oriented RPGs.

Zaini et al. [18] examined character-driven storytelling design in digital games and its influence on emotional engagement and narrative momentum. The authors mapped existing research on how protagonists' goals, psychological journeys, and interactions with players shape narrative-driven engagement. Their review concluded that character-driven narratives are increasingly recognized as central to creating emotionally resonant and meaningful experiences in digital games. For the present research, this study reinforces the importance of narrative coherence as a UX-shaping element in RPG environments and supports the inclusion of narrative relevance as a critical design consideration that should be addressed alongside other UX principles.

Taken together, recent studies show that game UX has become an important concern in HCI and interactive system design, with prior research examining genre-specific player experience, RPG usability, game experience measurement, curiosity, flow, interface readability, avatar mental models, quest design, and narrative engagement. These studies demonstrate that player experience is shaped by multiple factors, including usability, feedback, accessibility, responsiveness, narrative coherence, and engagement. However, most of these works investigate such factors separately rather than consolidating them into a unified UX framework for a specific RPG subgenre. A key limitation in the existing literature is that available UX frameworks are either too general or too narrowly focused, general game UX studies provide broad principles for player experience but do not fully address the interaction demands of programming-oriented RPGs, while more specific studies tend to focus on isolated issues such as speech-agent usability, flow induction, curiosity, avatar representation, quest generation, or storytelling. Although these studies are valuable, they do not explain how UX principles should work together when an RPG requires users to navigate gameplay systems while also performing programming-oriented reasoning, creating a gap between general game UX knowledge and the design needs of programming-oriented RPGs. This study addresses that gap by identifying and validating a coherent set of UX principles specifically for programming-oriented RPGs, namely Usability and Learnability, Accessibility and Readability, Responsiveness and Interaction Smoothness, Consistency and Predictability, Meaningful Feedback and Guidance, and Engagement Support. Derived through expert qualitative validation, thematic synthesis, and Fuzzy Delphi Method analysis, these principles provide a conceptually grounded and empirically supported framework that contributes to HCI and game UX research by offering a specific design and evaluation reference for programming-oriented RPGs, rather than relying on general UX heuristics or fragmented game design concepts.

3 Research Method

This section describes the methodological approach adopted in the present study to identify and validate the essential User Experience (UX) principles for programming-oriented Role-Playing Games (RPGs). The methodology is structured to ensure that each step of the research process is transparent, replicable, and grounded in established qualitative research practice. The section is organized into five subsections covering research design, expert panel composition, the data collection instrument, the data collection procedure, and the thematic synthesis steps adopted for analysis applied to enhance the credibility of the findings.

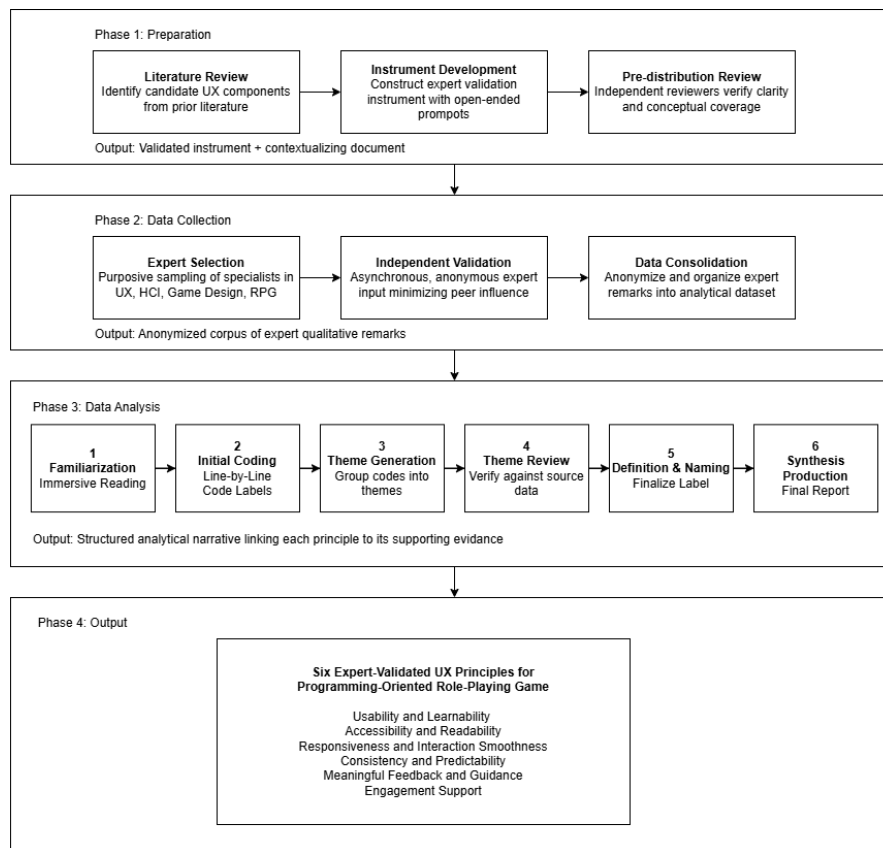


Figure 1 Research design workflow

Figure 1 illustrates the research design workflow used in this study. The workflow consists of four sequential phases which are Preparation, Data Collection, Data Analysis, and Output. Each phase produced a specific deliverable that informed the next stage, ensuring methodological traceability and a clear connection between the research process and the final UX principles. In the Preparation phase, relevant literature on game UX, HCI, and RPG design was reviewed to identify candidate UX components. These components were then used to develop an expert validation instrument, which was reviewed for clarity and conceptual coverage before distribution. In the Data Collection phase, experts were selected through purposive sampling and asked to complete the validation instrument independently. Their responses were anonymized and compiled into a single dataset for analysis.

In the Data Analysis phase, expert responses were examined using thematic synthesis through familiarization, coding, theme generation, theme review, and theme definition. The final Output phase consolidated the findings into six expert-validated UX principles: Usability and Learnability, Accessibility and Readability, Responsiveness and Interaction Smoothness, Consistency and Predictability, Meaningful Feedback and Guidance, and Engagement Support. Overall, the workflow demonstrates a transparent and systematic process for developing the validated UX framework.

3.1. Research Design

This study adopts a qualitative research design grounded in expert validation paired with thematic synthesis. The choice of a qualitative approach is consistent with the exploratory nature of the research question, which seeks to consolidate dispersed UX consideration into a coherent and conceptually defensible set of principles for an emerging RPG subgenre. Expert validation, in particular, is well-suited to this objective because it draws on the cumulative experiential knowledge of specialists who have engaged extensively with UX, HCI, and game design research and practice. Thematic synthesis complements expert validation by providing a structured analytical procedure for identifying recurring across expert input. Together, these methods enable the production of UX principles that are both empirically grounded and methodologically defensible. This combined

approach is also increasingly adopted in HCI-oriented studies that aim to generate design-relevant principles for specialized interactive systems.

3.2. Expert Panel

The expert panel for this study consisted of professionals selected based on demonstrable expertise in domains directly relevant to research focus. Eligibility criteria required that each expert hold credentials or substantial professional experience in at least one of the following areas, Human-Computer Interaction (HCI), User Experience (UX) design, game design, interactive systems or Role-Playing Game development. Additional inclusion criteria specified a minimum of five years of professional or academic experience in the relevant domain, an active publication or development record, and willingness to provide structured qualitative input. Purposive sampling was used to ensure that the panel represented a balanced range of perspectives across the targeted domains rather than reflecting a single disciplinary view. The number of experts engaged in the validation process was determined in alignment with established qualitative research practice, where saturation rather than statistical generalization is the guiding principle. The composition of the panel ensured that the resulting UX principles emerged from multidisciplinary expert insight rather than from a narrow professional segment.

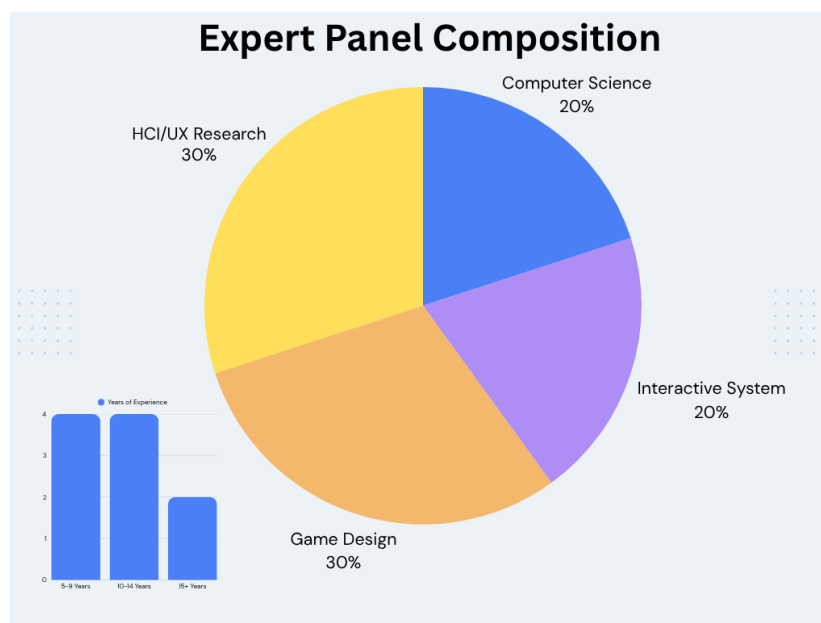


Figure 2 Expert panel composition

Figure 2 presents the composition of the expert panel involved in the validation process of the present study. The panel consisted of ten experts (N=10) selected through purposive sampling to ensure that the validation of UX principles was informed by a multidisciplinary perspective relevant to programming-oriented Role-Playing Games (RPGs). The figure consolidated two analytical dimensions of the panel, domain expertise, and years of professional or academic experience. Each dimension is visualized separately to enable a clear and transparent overview of the panel's structural diversity.

The expert panel was distributed across four domains relevant to the focus of study. Two domains, HCI/UX Research and Game Design, each represented 30% of the total panel, reflecting the central position of these fields in shaping interactive experiences in modern RPG systems. The remaining two domains, Interactive System and Computer Science, each represented 20%, providing complementary perspective on system-level interaction design and the technical foundation of game-based environments. This distribution ensure that the validation of UX principles drew on both human-centered design expertise and technical interactive system knowledge, thereby reducing the risk of disciplinary bias and supporting the credibility of the resulting findings.

The bar chart illustrates the distributions of experts according to their years of professional or academic experience. Four experts (40%) reported between 5 and 9 years of experience, four experts (40%) reported between 10 and 14 years of experience, and two experts (20%) reported 15 or more years of experience in their respective domains. This experience profile reflects a balanced combination of mid-career specialist, who are typically familiar with contemporary UX practices and emerging RPG mechanics, and senior experts, who bring broader perspectives shaped by long-term engagement with interactive system design.

Taken together, the composition presented in Figure 2 demonstrates that the expert panel was structured to satisfy two principal validity considerations in expert-driven qualitative research. First, the multidisciplinary distribution of expertise across HCI/UX Research, Game Design, Interactive Systems, and Computer Science supports the triangulation of perspectives required to produce a credible and defensible set of UX principles. Second, the heterogeneity of professional experience levels strengthens the panel's interpretive richness, ensuring that the validation outcomes are grounded in both current and accumulated expertise.

3.3. Data Collection

Data were collected using an expert validation instrument developed specifically for this study. The instrument was constructed from candidate UX components identified in prior literature on game UX, RPG design, and HCI. It consisted of open-ended prompts that asked experts to evaluate the clarity, suitability, applicability, and possible refinement of each candidate UX component. Space was also provided for experts to suggest additional UX principles considered relevant to programming-oriented RPGs. Before distribution, the instrument was reviewed to ensure clarity, conceptual coverage, and suitability for expert validation.

The data collection procedure was conducted asynchronously. Each expert received the validation instrument together with a brief contextual document explaining the study aim, key definitions, and the scope of programming-oriented RPGs. Experts completed the instrument independently to minimize peer influence and to ensure that each response reflected individual professional judgment. Completed responses were collected within the agreed period, anonymized, and consolidated into a single analytical dataset. The dataset was then used as the empirical basis for thematic synthesis and Fuzzy Delphi analysis.

3.4. Data Analysis: Thematic Synthesis Steps

Data analysis was conducted using thematic synthesis supported by the Fuzzy Delphi Method (FDM). The expert validation responses were first reviewed repeatedly to understand the overall meaning of the data. Relevant statements were then coded line by line to identify recurring UX-related ideas. Similar codes were grouped into broader themes, and each theme was reviewed to ensure that it accurately represented the expert input. Through this process, six UX principles were finalized: Usability and Learnability, Accessibility and Readability, Responsiveness and Interaction Smoothness, Consistency and Predictability, Meaningful Feedback and Guidance, and Engagement Support. To strengthen the validity of the qualitative findings, FDM was applied to determine the level of expert consensus for each principle. The experts' ratings were converted into triangular fuzzy numbers and then defuzzified to obtain a consensus value. Principles that exceeded the acceptance threshold were retained as validated UX principles. The combination of thematic synthesis and FDM enabled the study to produce findings that were both interpretively grounded and supported by expert consensus. The full procedure is summarized in Table 1 below, which serves as a transparent audit reference for the analytical process.

Table 1 Thematic synthesis procedure

No	Name	Process Description	Output
1	Familiarization	Repeated reading of expert validation forms to gain immersion in the dataset; recording of initial impressions and analytical memos	Annotated dataset and preliminary analytical notes
2	Initial Coding	Line-by-line coding of expert remarks, assigning concise codes to each meaningful unit of expert insight	Comprehensive code list reflecting recurring concepts
3	Theme Generation	Grouping related codes into candidate themes that represent broader UX-relevant concepts	Initial set of candidate themes

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4	Theme Review	Reviewing candidate themes against the original dataset to verify representational accuracy	Refined and validated themes
5	Theme Definition and Naming	Defining each theme's scope, label, and analytical boundary; ensuring each theme reflects a distinct UX dimension	Six finalized UX principles with operational definitions
6	Synthesis Production	Production a structured synthesis report linking each principle to its supporting evidence, design implications, and expected contributions	Final core UX components for the framework

As presented in Table 1, the thematic synthesis procedure followed a sequential but iterative process. The analysis began with familiarization, where expert responses were read repeatedly to understand the overall meaning of the data. This was followed by initial coding, in which meaningful expert remarks were assigned concise codes. Related codes were then grouped into candidate themes, and each theme was reviewed to ensure that it accurately represented the expert input and reflected a distinct UX dimension.

After the themes were reviewed, each theme was clearly defined and named to establish its conceptual boundary. The final step involved producing a synthesis that linked each validated UX principle to its supporting expert evidence, design implication, and contribution to the framework. Overall, the procedure ensured that the six UX principles reported in Section 4 were developed through a transparent, systematic, and evidence-based analytical process.

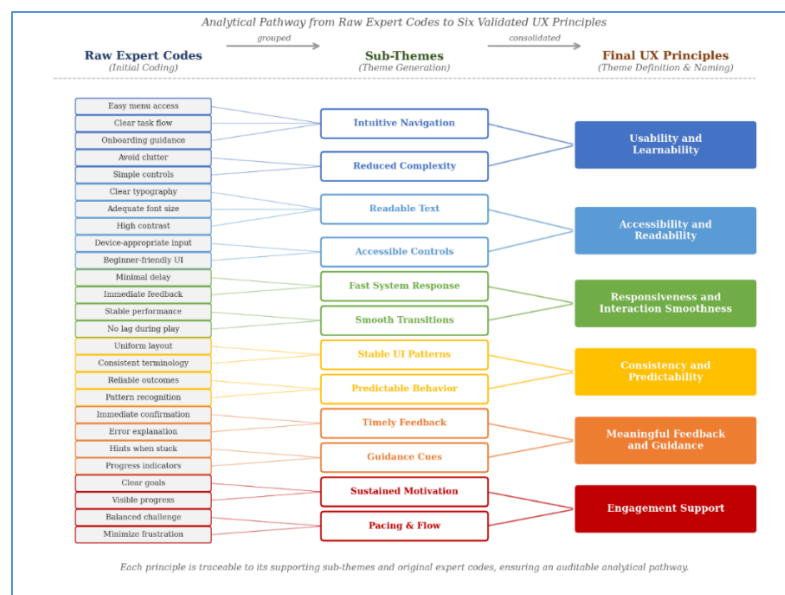


Figure 3 Coding to theme mapping diagram

Figure 3 presents the analytical pathway through which raw expert codes were progressively consolidated into the six finalized UX principles, providing a visual operationalization of the thematic synthesis procedure summarized in table 2. The diagram is organized into three sequential analytical layers that correspond directly to the methodological stages of the analysis. The left layer displays the raw expert codes generated during the initial coding step, including granular descriptors such as easy menu access, clear task flow, minimal delay. Immediate feedback, consistent terminology, and clear goals, each of which represents a meaningful unit of expert input extracted line-by-line from the validated dataset. The middle layer presents the sub-themes produced during theme generation, in which semantically related codes were grouped into broader interpretive categories such as Intuitive Navigation, Readable Text, Fast System Response, Stable UI Patterns, Timely Feedback, and Sustained Motivation. The right layer presents the finalized UX principles produced at the theme definition and naming step, namely Usability and Learnability, Accessibility and Readability, Responsiveness and Interaction Smoothness, Consistency and Predictability, Meaningful Feedback and Guidance, and Engagement Support. The directional connections between the three layers make the analytical pathway explicit, demonstrating that each finalized principle is traceable to a

determinate set of supporting sub-themes, which in turn are traceable to specific expert codes drawn from the original dataset. This traceability is methodologically significant because it ensures that the validated framework is not the product of interpretive abstraction alone but is anchored in identifiable expert input throughout every stage of the synthesis.

4 Results and Analysis

The findings are derived from the thematic synthesis of expert qualitative validation data, in which expert contributed substantive remarks regarding the suitability, clarity, and applicability of candidate UX components. Through systematic coding and theme consolidation, six core UX principles emerged consistently across expert input. The six principles are Usability and Learnability, Accessibility and Readability, Responsiveness and Interaction Smoothness, Consistency and Predictability, Meaningful Feedback and Guidance, and Engagement Support. Each principle is presented below using a uniform analytical structure that includes its definition in the study context, expert rationale, design implications, and expected contribution to user experience. The section concludes with a synthesis table consolidating all six principles, followed by a visual representation of their interrelationships.

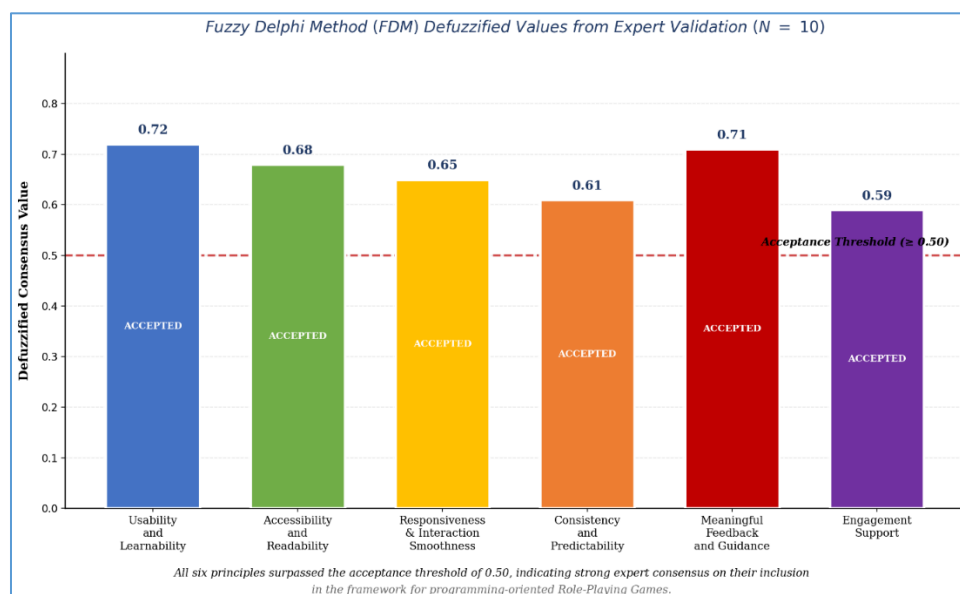


Figure 4 Bar chart of expert consensus

Figure 4 presents the defuzzified consensus values obtained from the Fuzzy Delphi Method (FDM) based on expert validation data (N = 10). All six UX principles exceeded the acceptance threshold of 0.50, indicating sufficient expert consensus for their inclusion in the validated framework. The highest values were obtained by Usability and Learnability (0.72) and Meaningful Feedback and Guidance (0.71), followed by Accessibility and Readability (0.68), Responsiveness and Interaction Smoothness (0.65), Consistency and Predictability (0.61), and Engagement Support (0.59).

These results show that experts strongly emphasized ease of use and clear feedback as central design requirements for programming-oriented RPGs. Although Engagement Support received the lowest value, it still exceeded the acceptance threshold, confirming its relevance within the framework. Overall, Figure 4 provides empirical support for retaining all six principles while also showing their relative strength based on expert consensus.

4.1. Usability and Learnability

Usability and Learnability emerged as a foundational UX principle for programming-oriented RPGs. In this study, usability refers to the ease with which players can navigate the interface, access core functions, and complete gameplay tasks without unnecessary confusion. Learnability refers to how quickly first-time users can understand the game mechanics and become familiar with the

interaction flow. Expert input emphasized that these qualities are essential because programming-oriented RPGs require players to manage two forms of cognitive activity simultaneously: interacting with the game system and reasoning through programming-related challenges. Therefore, unclear navigation, complex task flows, or weak onboarding may increase cognitive load and distract players from the intended problem-solving experience.

From a design perspective, this principle requires clear menu structures, predictable task sequences, and gradual onboarding when introducing new mechanics. Core functions should be easy to locate, and players should not need to spend excessive effort learning how to operate the system before engaging with the actual game challenges. By reducing interface-related friction, Usability and Learnability allow players to focus on meaningful in-game tasks rather than on understanding how the system works. This makes the principle a structural foundation for the other UX principles in the framework.

This principle also has an important relationship with the other UX principles in the framework. A usable and learnable interface supports accessibility, strengthens consistency, and enables feedback to be understood more effectively by players. When players can operate the system with confidence, they are more likely to remain engaged and persist through more complex programming-oriented challenges. For this reason, Usability and Learnability function as the structural foundation upon which the remaining UX principles depend.

4.2. Accessibility and Readability

Accessibility and Readability emerged as the second UX principle from expert input. In this study, accessibility refers to the extent to which the game interface accommodates different user needs, device conditions, and interaction preferences. Readability refers to the clarity of textual and visual information presented in the game, including task instructions, feedback messages, dialogue, typography, font size, visual hierarchy, and color contrast.

Expert input emphasized that programming-oriented RPGs often contain dense information, such as task descriptions, system responses, and narrative dialogue. If these elements are not clearly presented, players may misunderstand the task or experience difficulty not because of the programming challenge itself, but because of avoidable presentation barriers. Therefore, accessibility and readability should be treated as structural UX requirements rather than secondary design considerations.

From a design perspective, this principle requires readable typography, sufficient contrast, clear instructional language, accessible controls, and consistent visual presentation across screens and devices. By ensuring that game information is perceivable and understandable, Accessibility and Readability reduce unnecessary barriers, support a broader range of players, and strengthen the usability foundation of the programming-oriented RPG framework.

4.3. Responsiveness and Interaction Smoothness

Responsiveness and Interaction Smoothness emerged as the third UX principle. Responsiveness refers to the speed and consistency of the system in reacting to player actions, while interaction smoothness refers to the continuity of interaction across screens, transitions, and feedback events. Expert input showed that both qualities are important because they shape the player's perception of system reliability and overall interaction quality.

In programming-oriented RPGs, players often engage in repeated cycles of action, observation, correction, and revision. Any delay, lag, or discontinuity may interrupt this cycle and reduce player focus. Experts emphasized that system response is especially critical during important gameplay moments, such as task submission, feedback delivery, and progression updates, where slow or unclear responses may create frustration and weaken player trust in the system.

From a design perspective, this principle requires minimal delay in core actions, smooth screen transitions, clear loading indicators, and immediate confirmation after player input. By maintaining fluid interaction, Responsiveness and Interaction Smoothness reduce frustration, support continuous engagement, and strengthen the effectiveness of feedback and progression systems within the programming-oriented RPG framework.

4.4. Consistency and Predictability

Consistency and Predictability emerged as the fourth UX principle from expert validation. Consistency refers to the uniform use of interface behavior, layout, icons, buttons, and terminology across the game, while predictability refers to the player's ability to anticipate system responses based on previous interaction patterns.

Expert input emphasized that this principle is important because programming-oriented RPGs require players to build stable mental models while completing gameplay and programming-related tasks. When interface patterns change unexpectedly, players must spend additional cognitive effort relearning how the system works. This may reduce confidence, interrupt problem-solving, and weaken the player's sense of control.

From a design perspective, this principle requires standardized UI elements, consistent terminology, and predictable cause-and-effect logic across tasks and screens. By maintaining stable interaction patterns, Consistency and Predictability help players focus on the game's substantive challenges rather than adapting to inconsistent interface behavior. This strengthens usability, supports confidence, and contributes to a more coherent user experience.

4.5. Meaningful Feedback and Guidance

Meaningful Feedback and Guidance emerged as the fifth UX principle from expert synthesis. Feedback refers to the system's response to player actions, such as confirmations, error messages, and outcome indicators. Guidance refers to cues, hints, and instructional prompts that help players make decisions during gameplay. Together, these elements form the communicative layer between the player and the game system.

Expert input emphasized that feedback and guidance must be timely, clear, and interpretable. In programming-oriented RPGs, players often depend on feedback to understand whether their actions are correct and what should be revised. Delayed, vague, or overly complex feedback may disrupt the action-revision cycle, while excessive guidance may reduce player autonomy. Therefore, the system must balance support with player independence.

From a design perspective, this principle requires immediate feedback after task attempts, clear explanations of outcomes, actionable revision suggestions, and context-aware guidance at key decision points. By making system responses understandable and supportive, Meaningful Feedback and Guidance strengthen player confidence, sustain iterative engagement, and help players continue progressing through programming-oriented challenges.

4.6. Engagement Support

Engagement Support emerged as the sixth UX principle and refers to design qualities that sustain player participation throughout gameplay. In this study, engagement support is understood as the combination of clear goals, visible progress, appropriate challenge pacing, and reduced frustration that helps players remain motivated during programming-oriented RPG activities.

Expert input emphasized that programming-oriented RPGs require sustained engagement because meaningful player experience depends on repeated interaction, narrative continuity, and ongoing involvement with programming-related challenges. Engagement is therefore not only influenced by content quality, but also by how clearly the game communicates objectives, guides progression, and manages difficulty.

From a design perspective, this principle requires clear next-step cues, observable progress indicators, well-paced challenges, and supportive feedback during difficult moments. By maintaining motivation and reducing disengagement triggers, Engagement Support helps players persist across multiple gameplay sessions and ensures that the programming-oriented content receives sufficient attention within the RPG experience.

4.7. Synthesis of the Six UX Principles

Table 2 consolidates the six expert-validated UX principles identified through thematic synthesis. The table presents each principle alongside its definition in the study context, its design implication for the framework, and its expected contribution to user experience. The consolidated structure illustrated in the table is intended to function as a practical design reference, each row articulates the

conceptual scope of a principle while simultaneously translating it into observable design implications that can guide implementation. The synthesis also reveals that the six principles are not isolated heuristics but interconnected design conditions. For example, Consistency and Predictability strengthens the effects of Usability and Learnability, while Engagement Support depends on Meaningful Feedback and Guidance for its sustained operation.

Table 2 Synthesis of six expert-validated UX principles for programming-oriented RPGs

No.	UX Principle	Definition in Study Context	Design Implication for the Framework	Expected Contribution to UX
1	Usability and Learnability	The interface is easy to navigate and learn so that players can engage with programming tasks without cognitive overhead from operating the system	Provide clear menus, transparent task flow, and onboarding guidance for first-time users	Reduces interface-related cognitive load, allowing players to direct attention to programming reasoning
2	Accessibility and Readability	Game information and controls are perceivable, readable, and accessible across target devices and players.	Use readable typography, clear visual hierarchy, accessible controls, and novice-friendly input design.	Prevents avoidable usability barriers that interrupt task completion and degrade player experience.
3	Responsiveness and Interaction Smoothness	The system reacts promptly and transitions smoothly, preserving uninterrupted interaction during gameplay.	Minimize delays for core actions, ensure smooth transitions between screens, and maintain stable performance.	Maintains engagement and reduces frustration, supporting sustained practice on programming tasks.
4	Consistency and Predictability	Interface patterns, terminology, and system behavior remain stable across screens and tasks.	Standardize UI elements, maintain consistent terminology, and ensure predictable task logic.	Supports mental-model formation and helps players focus on problem-solving rather than re-learning interaction patterns.
5	Meaningful Feedback and Guidance	Feedback explains outcomes and guides improvement, supporting players to correct errors and proceed.	Provide immediate, interpretable feedback after task attempts and novice-friendly guidance when errors occur.	Supports learning through feedback loops and strengthens debugging and problem-solving skills.
6	Engagement Support	The UX sustains participation and persistence necessary for repeated practice and skill development.	Provide clear goals and next-step cues, make progress visible, and minimize frustration triggers.	Sustains motivation and ensures repeated engagement with programming tasks across multiple sessions.

Table 2 presents a synthesis of the six expert-validated UX principles for programming-oriented RPGs by connecting each principle with its definition, design implication, and expected contribution to user experience. The table indicates that UX in this context is not limited to visual interface design, but also includes how players understand information, interact with the system, receive feedback, and remain engaged during gameplay. The first group of principles, including Usability and Learnability, Accessibility and Readability, and Responsiveness and Interaction Smoothness, focuses on reducing interaction barriers. These principles help ensure that players can navigate the game, access information clearly, and perform actions without unnecessary delay or confusion. This is important because programming-oriented RPGs require players to focus on programming reasoning rather than struggling with the interface.

The remaining principles, namely Consistency and Predictability, Meaningful Feedback and Guidance, and Engagement Support, strengthen the continuity of the player experience. They support stable mental models, provide clear responses to player actions, and sustain motivation across repeated gameplay sessions. Overall, Table 2 demonstrates that the six principles form a coherent UX framework that can guide the design and evaluation of programming-oriented RPGs in a systematic and practical manner.



Figure 5 Six expert-validated UX principles for programming-oriented RPG

Figure 5 presents the consolidated representation of the six expert-validated UX principles identified in this study which are Usability and Learnability, Accessibility and Readability, Responsiveness and Interaction Smoothness, Consistency and Predictability, Meaningful Feedback and Guidance, and Engagement Support. The figure shows that these principles should be understood as interconnected design components rather than separate or isolated heuristic. As visual synthesis, figure 5 summarizes the main findings and provides a unified reference for researchers and designers. It also highlights the multidimensional nature of UX in programming-oriented Role-Playing Games, covering structural, communicative, and motivational aspects of interaction. When read together with table 3, the figure confirms that the validated principles form a coherent framework for guiding the design of programming-oriented Role-Playing Games.

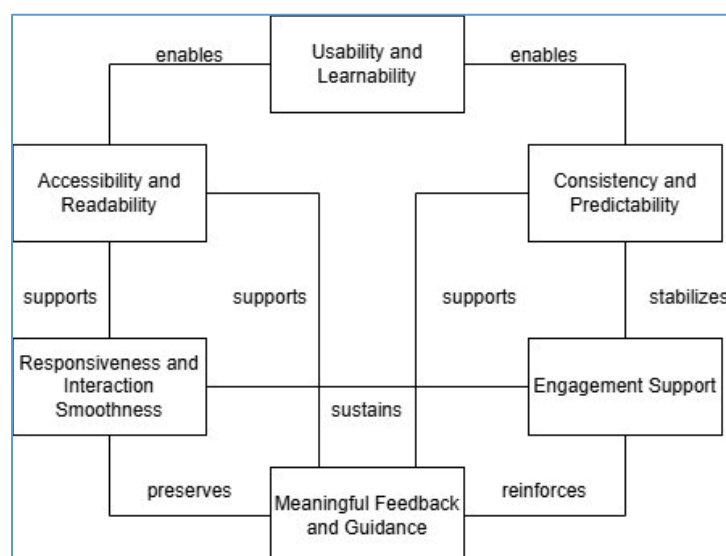


Figure 6 Interrelationship among the six expert-validated UX principles

Figure 6 illustrates the conceptual relationships among the six expert-validated UX principles and shows how they operate as an integrated design system. Usability and Learnability functions as the main enabling principle because ease of use supports Accessibility and Readability, as well as Consistency and Predictability. The foundational principles help stabilize the player's interaction with

the game system. The figure also shows that Responsiveness and Interaction Smoothness, Engagement Support, and Meaningful Feedback and Guidance are closely connected within the interaction process. Smooth system responses help maintain the action–feedback cycle, while engagement support sustains player motivation during repeated gameplay. Overall, Figure 6 indicates that the six principles are mutually dependent, meaning that weaknesses in one principle may affect the coherence of the overall user experience.

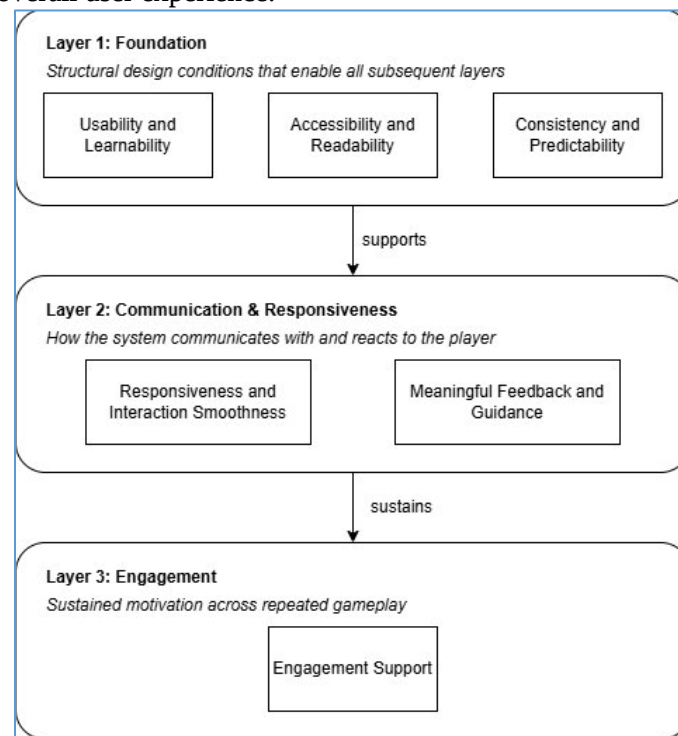


Figure 7 Layered conceptual framework of expert-validated UX principles for programming-oriented rpgs

Figure 7 presents the six expert-validated UX principles as a layered conceptual framework for programming-oriented RPG design. The framework consists of three layers which are Foundation, Communication and Responsiveness, and Engagement. The Foundation layer includes Usability and Learnability, Accessibility and Readability, and Consistency and Predictability, which serve as the structural conditions required for effective player interaction. The second layer, Communication and Responsiveness, consists of Responsiveness and Interaction Smoothness together with Meaningful Feedback and Guidance. These principles explain how the system responds to player actions and communicates outcomes during gameplay. The third layer, Engagement, represents Engagement Support, which sustains player motivation and continued participation.

Overall, Figure 7 shows that the six UX principles are not independent elements but interrelated design conditions. A strong foundation supports effective communication, while effective communication sustains engagement. This layered structure provides a practical prioritization guide for designers and reinforces the need to implement the framework holistically rather than selectively.

5 Conclusion

This study identified and validated six essential User Experience (UX) principles for programming-oriented Role-Playing Games: Usability and Learnability, Accessibility and Readability, Responsiveness and Interaction Smoothness, Consistency and Predictability, Meaningful Feedback and Guidance, and Engagement Support. Through expert qualitative validation, thematic synthesis, and the Fuzzy Delphi Method, all six principles achieved defuzzified consensus values ranging from 0.59 to 0.72, exceeding the acceptance threshold of 0.50. This indicates that the proposed principles are supported by expert agreement and are methodologically defensible. The findings further show that the six principles do not function as isolated design elements, but as an

interrelated UX system organized into three layers: Foundation, Communication and Responsiveness, and Engagement. This layered structure demonstrates that effective engagement depends on clear system communication, while system communication depends on a stable usability foundation.

The main contribution of this study is the development of a coherent and empirically grounded UX framework for programming-oriented RPGs. The framework can guide developers in designing more effective interactive systems and support researchers in evaluating UX within this emerging game subgenre. Future research should test the framework in real development contexts and examine its impact on player experience, sustained engagement, and programming-related interaction outcomes.

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