Expert Validation of an Empathic Design Thinking Framework: For Digital Serious Game Development

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Abstract: The design and development of serious games is a multifaceted process that often lacks a comprehensive, user-centered approach despite the availability of numerous design frameworks. The systematic review of current serious game design frameworks reveals a focus on technical and instructional aspects. This paper introduces Empathic Design Thinking Framework (EDTF), a novel framework tailored to support educational designers, researchers, developers, and practitioners in creating digital serious games, that pretends to address this gap by integrating co-design and iterative user research throughout the entire process, ensuring alignment with end-user needs. A key innovation is its focus on co-design and co-development, where learners and instructors collaborate with designers and developers throughout the whole process. This approach contrasts with traditional methods, where user research is often limited to specific phases after the initial game concept is proposed. By integrating user research into every phase, from ideation and concept development to prototyping, testing, and deployment, it ensures that the final product aligns closely with the needs and preferences of its target audience. The EDTF was developed and refined through a design science research approach, incorporating literature review, concept mapping, and theory development. It was further validated and iteratively revised by 18 experts and practitioners in the field of serious games with focus on comprehensibility, feasibility, usability and limitations of the framework. Experts acknowledge the framework's elaborateness, but highlight its depth and practical value in structuring the game design process, particularly for educational and training games. The step-by-step approach provides clarity, reduces uncertainty, and supports both novice and experienced designers and developers. While few suggestions for streamlining were noted, the framework's emphasis on continuous iterative testing, systematic user-driven progression was praised for enhancing project outcomes. In conclusion, the EDTF's consistent focus on users needs and its ability to balance complexity with practical utility make it a robust tool for creating impactful, efficient, useful, desirable well-structured serious games. This study underscores the framework's potential to address real-world design challenges and improve the usability and effectiveness of serious games in educational and training contexts.

Keywords: Empathic design thinking framework, Serious games framework, User experience in serious games, Artificial intelligence in game design, Educational games

1. Introduction

Digital serious games have become a powerful instrument for blending education with digital interactive experiences, enabling learners to acquire knowledge, develop skills, and shape attitudes through engaging gameplay (Lamarti et al., 2014). While many frameworks for serious game development exist, they often focus on instructional or technical elements, overlooking the deeper emotional and experiential needs of users (Plass et al., 2016). This gap has prompted a growing interest in more human-centered approaches, particularly those that embed empathic design principles. Empathic design, rooted in understanding users' feelings, motivations, and cognitive states, offers a promising direction for creating games that not only teach but also resonate with users on a personal level (Kouprie & Visser, 2009). To address this gap, this paper introduces the *Empathic Design Thinking Framework (EDTF)*, a novel framework designed to support the creation of digital serious games through a co-design and co-iterative user research process. Unlike traditional frameworks, which tend to involve user input only in later stages, EDTF integrates empathic and user-centered principles across all phases of design and development, from initial ideation, prototyping, and testing, to continuous post-development assessment. Created using a design science research approach and validated by 18 experts in digital serious game design, EDTF aims to provide a structured and practical methodology that centers real user needs throughout the entire game design and development process. Its step-by-step guidance helps reduce uncertainty, support collaboration between learners, instructors, designers, and developers, and enhance the relevance and impact of digital serious games in educational and training contexts. By bridging the gap between academic theory and design practice, this work offers both researchers and practitioners a framework for integrating empathic design principles in complex, user-centered creative processes.

2. Digital Serious Game Design

Digital serious games represent a unique category of interactive experiences designed not just for entertainment but for education, training, health, and strong social impact. By mixing the gameplay with purposeful goals, they facilitate skill development, knowledge retention, and behavioral change (Michael & Chen, 2006; Laamarti et al.,

2014). Examples range from simulation-based training in fields like medicine and aviation to educational games that teach subjects like mathematics, chemistry, languages or history, as well as health-focused games that encourage physical activity or disease management. Persuasive games extend this further, aiming to influence social attitudes toward issues like environmental conservation or justice (Alvarez & Michaud, 2008; Connolly et al., 2012; Sitzmann, 2011; Baranowski et al., 2016; Janakiraman, 2021). Despite their potential, the success of digital serious games depends heavily on how well they connect with users, not just functionally but emotionally and experientially. Therefore, they should be carefully designed with focus on both educators and learners' needs and motivations.

In that regard, frameworks play a fundamental role in structuring the design process, offering systematic ways to analyze and address complex challenges. Their effectiveness hinges on key attributes such as clarity, coherence, simplicity, and generalizability, ensuring they serve as reliable guides for research, design and development (Bunt et al., 2024). A well-constructed framework must balance accessibility with rigor, simple enough to be intuitive yet robust enough to withstand empirical testing and adapt to varied contexts. These qualities are especially critical in the design of digital serious games, where structured approaches are needed to merge engagement with real-world objectives.

This is where many existing digital serious game design frameworks fall short. While they often emphasize functionality and user-centered design, according to the current academic literature, summarized in different reviews, they frequently overlook the deeper, more nuanced aspects of empathic design, understanding players' emotions, motivations, and lived experiences (Maxim & Arnedo-Moreno, 2025; Bijl et al. 2024; Avila Pesantez et al., 2017). Empathic design shifts the focus from mere usability to meaningful engagement, ensuring games resonate on a personal and emotional level. Without this, even well-structured games may fail to sustain interest or drive lasting impact. The difference lies in recognizing that learning and behavioral change are not just cognitive processes but emotional ones, requiring designs that foster immersion rather than just efficiency.

The principles of empathic design align closely with broader user-centered approaches, prioritizing the user's needs alongside functional requirements. This involves iterative collaboration with end-users, leveraging methods like interviews and usability testing to refine designs based on real feedback. The goal is to create experiences that are not only educationally sound but also immersive and emotionally compelling (Kouprie & Visser, 2009). The key aspects include intuitive interfaces that reduce friction, progression systems that instill a sense of achievement, and aesthetics that evoke emotional responses, all of which deepen engagement and enhance learning outcomes. The potential of an empathic design thinking approach in enhancing the development of digital serious games has been increasingly recognized by educators and researchers (Maxim & Arnedo-Moreno, 2021). Current practices in serious game development often relegate user experience considerations to later stages, such as prototype testing or post-production evaluations. While agile methodologies have improved flexibility, they tend to treat user feedback as a final checkpoint rather than an integral part of the entire design process (Cano et al., 2015). This limits opportunities to iteratively refine games based on empathic design principles. A more holistic approach would embed empathic design approach at every phase, from initial conceptualization to final evaluation, ensuring that experiential needs inform decisions early and consistently.

Addressing this gap, a novel framework that integrates empathic design principles systematically across all stages of game development.

3. Empathic Design Thinking Framework (EDTF)

The Empathic Design Thinking Framework (EDTF) was developed through an integrative review of existing literature, drawing from both digital serious game (DSG) and entertainment game design (DEG) frameworks (Maxim & Arnedo-Moreno, 2025). The primary objective of EDTF is to support the complete design and development cycle of serious games, with a strong emphasis on understanding and addressing user needs. This user-centric focus was woven into every stage of the framework. By centering the needs and experiences of both educators and learner-players, it ensures that DSGs achieve more than just functional goals, they create meaningful, memorable interactions that drive engagement and lasting impact.

EDTF is grounded on Empathic Design (ED) and Design Thinking (DT) principles, as well as core Human Computer Interaction methods like empathy mapping, journey maps, and personas (Cai, 2009; Kouprie & Visser, 2009; Gibbons, 2018; Campoverde-Durán et al., 2023). ED focuses on emotional immersion, uncovering latent needs, and co-creating with learners and educators (Battarbee & Koskinen, 2005; Afroogh et al., 2021). DT adds iterative cycles of ideation, prototyping, and testing, supporting rapid feedback and continuous refinement of learning

mechanics and engagement (Brown, 2009; Doorley et al., 2018). EDTF introduces several novel contributions for digital serious games. It embeds emotional and learner-centered needs from the very first phase, rather than addressing them only during testing after design or development are done. The framework systematically integrates co-design and co-participation of end users approach in every phase, lightweight instructional tools, and iterative low-to-high-fidelity prototyping, making it feasible for resource-constrained educational contexts. Additionally, EDTF aligns game mechanics explicitly with learning outcomes based on real users' involvement, ensuring a balance of engagement, usability, and instructional effectiveness throughout all phases.

EDTF, represented in Figure 1, unfolds through ten iterative and structured phases, each guiding the development of engaging and effective learning games: (1) Empathize focuses on understanding users' needs, motivations, and challenges to ensure a user-centered design. (2) Co-Design Scenario maps the learning journey and creates user personas, promoting cross-stakeholder collaboration with lecturers and learners. (3) Co-Design Instructional Content aligns educational content with learner needs and instructional strategies to support defined learning goals. (4) UX Evaluation (Storyboard) assesses and refines the visual and narrative structure to maintain engagement and support learning objectives. (5) Low-Fidelity Prototype develops sketches or wireframes to test concept engagement and resonance before digital development. (6) Iterative UX Evaluation conducts early usability testing on low-fidelity prototypes, focusing on navigation, task understanding, and flow to refine concept comprehension and structure. (7) High-Fidelity Prototype builds an interactive version for advanced testing, analyzing engagement and learning outcomes. (8) Development finalizes the game collaboratively across design, development, and content teams to align all components with educational goals. (9) Evaluation and Assessment measures effectiveness and long-term learning impact, identifying areas for further iteration. (10) Deployment & Change Management implements the game in real contexts with strategies for scalability, sustainability, and continuous updates.

<table>
<tr>
<td>Phase 1: Empathize
Context: Game conceptualization and foundational mechanics
UX Focus: Evaluating user needs, motivations, pain points, behaviors, and emotional responses
Opportunity Potential: Assessing the solution's visionary potential for addressing real user challenges
Goals & Tasks:
• Identify and segment target users (learners, instructors, stakeholders)
• Understand user values, attitudes, and behaviors through qualitative research
• Develop deep empathy for user experiences
Artifact: Empathy Maps (visualizing user thoughts, feelings, and behaviors)</td>
<td>Phase 2: Co-Design Scenario
Context: Learning journey and narrative structure
UX Focus: Story mapping to align gameplay with educational progression
Opportunity Potential: Paradigm Shift – Encouraging new perspectives in learning through interactive storytelling
Goals & Tasks:
• Map critical decision points in the user journey
• Refine user personas based on real-world insights
• Facilitate co-design workshops with educators and learners
Artifact: Journey Map (illustrating key interactions and learning milestones)</td>
</tr>
<tr>
<td>Phase 3: Co-Design Instructional Content
Context: Alignment of game mechanics with learning objectives
UX Focus: Ensuring content meets learner needs while supporting instructional strategies
Opportunity Potential: Technically Challenging – Innovating in learning technology integration
Goals & Tasks:
• Define measurable learning objectives
• Structure content to balance engagement and pedagogy
• Collaborate with subject-matter experts for accuracy
Artifact: Instructional Design Document (detailing learning outcomes and content flow)</td>
<td>Phase 4: UX Evaluation (Storyboard)
Context: Visual and narrative coherence of the game
UX Focus: Assessing storytelling effectiveness and engagement
Opportunity Potential: Multidisciplinary Collaboration – Bridging gaps between designers, educators, and developers
Goals & Tasks:
• Validate narrative flow with stakeholders
• Identify and resolve potential disconnects between story and learning
• Refine storyboard based on feedback
Artifact: Storyboard (visualizing scenes, interactions, and transitions)</td>
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<tr>
<td>Phase 5: Low-Fidelity Prototype
Context: Early-stage concept validation
UX Focus: Testing core mechanics and usability with minimal investment
Opportunity Potential: Actionable – Rapid iteration based on real user feedback
Goals & Tasks:
• Develop wireframes or paper prototypes
• Conduct usability tests with target users
• Identify key pain points and areas for improvement
Artifact: Low-Fidelity Prototype (sketches, paper models, or digital wireframes)</td>
<td>Phase 6: Iterative UX Evaluation
Context: Usability refinement and interaction design
UX Focus: Enhancing user interface and experience through continuous testing
Opportunity Potential: Continuous Improvement – Ensuring adaptability based on user data
Goals & Tasks:
• Conduct structured usability tests
• Gather and analyze qualitative and quantitative feedback
• Refine UI/UX before high-fidelity development
Artifact: Usability Test Reports (documenting findings and recommended changes)</td>
</tr>
<tr>
<td>Phase 7: High-Fidelity Prototype
Context: Advanced gameplay and engagement testing
UX Focus: Refining interactivity, aesthetics, and learning impact
Opportunity Potential: Technically Challenging – Solving complex development hurdles
Goals & Tasks:
• Develop a near-final interactive prototype
• Assess engagement, learning retention, and technical performance
• Optimize before full production
Artifact: High-Fidelity Prototype (polished, functional demo)</td>
<td>Phase 8: Development
Context: Full-scale game production
UX Focus: Ensuring final product aligns with tested prototypes
Opportunity Potential: Multidisciplinary Execution – Coordinating designers, developers, and educators
Goals & Tasks:
• Implement final game mechanics, assets, and content
• Conduct quality assurance (QA) testing
• Prepare for deployment
Artifact: Final Game Solution (complete, deployable product)</td>
</tr>
<tr>
<td>Phase 9: Evaluation and Assessment
Context: Measuring learning outcomes and engagement
UX Focus: Summative assessment of educational and experiential impact
Opportunity Potential: Far-Reaching – Evaluating long-term effectiveness
Goals & Tasks:
• Conduct post-deployment assessments
• Measure knowledge retention and skill development
• Identify areas for future iteration
Artifact: Evaluation Reports (quantitative and qualitative findings)</td>
<td>Phase 10: Deployment & Change Management
Context: Real-world implementation and scaling
UX Focus: Monitoring performance and adapting to user feedback
Opportunity Potential: Actionable – Ensuring scalability and sustainability
Goals & Tasks:
• Roll out the game in target environments
• Gather live user feedback
• Release updates and improvement.
Artifact: System Updates & Release Notes (documenting changes and fixes)</td>
</tr>
</table>

Figure 1: Summary of the Phrases in Empathic Design Thinking Framework (EDTF)

Most current frameworks prioritize instructional design, technical functionality, or gamification mechanics. They often treat the user as a reactive participant, only considering their needs at specific checkpoints like late-stage usability testing. This can lead to superficial understanding of the user's emotional and cognitive experience. In contrast, EDTF proposes direct engaging with users to uncover their unspoken motivations, frustrations, and desires. This approach embeds user insights from the very beginning, ensuring the final product is not just functional and educational, but also emotionally resonant and personally meaningful.

Overall, EDTF distinguishes itself from existing serious game design frameworks in one important way: its systematic and deep integration of empathy throughout the entire development process. EDTF makes this commitment actionable by weaving empathic principles into every single phase, from initial ideation to final deployment. This creates a process that is emotionally intelligent, responsive, and genuinely inclusive. For educational and training contexts, this means building digital games that respect learners' lived experiences, effectively bridging the gap between pedagogical goals and genuine, long-term engagement.

4. Expert Evaluation

This section outlines the expert-based evaluation method used to assess the Empathic Design Thinking Framework (EDTF), a widely applied approach in Human-Computer Interaction (HCI) studies (Waljas, 2009; Lallemand et al., 2014). The evaluation aimed to validate the framework's effectiveness in guiding the design of DSGs by examining its comprehensibility, usability, feasibility, usefulness, and ease of use.

When evaluating the EDTF framework for designing serious games, *comprehensibility* refers to how easily game designers and stakeholders can understand the framework's steps, principles, and how to apply it to serious game development. *Usability* measures how effectively and efficiently designers can follow the EDTF process to create engaging, educational games without unnecessary complexity (Panach et al. 2008, Maxim & Arnedo-Moreno, 2024). *Feasibility* assesses whether using EDTF is realistic within project constraints like time, budget, technology, and team skills. *Usefulness* evaluates whether the framework genuinely helps designers build games that meet educational and empathic goals, ensuring the final product addresses real user needs. Finally, *ease of use* focuses on how intuitive and straightforward it is for designers (especially those new to the framework) to apply the EDTF method without extensive training or frustration (Davis, 1989; Bark et al., 2005; Boland et al., 2014; Nie et al. 2022).

4.1 Method

The expert evaluation was designed to assess the EDTF framework using a mixed-method approach, combining both quantitative and qualitative data collection through cognitive walkthrough design (step-by-step evaluation) and semi-structured interview protocols. A total of 18 experts participated, recruited through Usertesting.com. The group included 12 instructional game developers and 6 instructional game designers, with varied levels of experience: 50% had 1-3 years, 28% had 3-5 years, and 22% had more than 5 years. The participants were predominantly 30% female and 70% male, and most had experience with Unity, Unreal Engine, and GameMaker.

Experts participated in 1-hour evaluation sessions, during which they were introduced to the 10 phases of EDTF, including its context, goals, and intended outcomes. After the exploration, experts completed a semi-structured interview protocol and rated the framework on five key dimensions: comprehensibility, usefulness, usability, feasibility, and ease of use. Each dimension was measured using a single Likert-scale item with the following wording: e.g., *"The framework is comprehensible: 1 (Strongly Disagree) – 5 (Strongly Agree)."* Quantitative ratings were analyzed by calculating mean scores for each dimension, providing an overview of expert perceptions. Qualitative feedback, including first impressions and comments on clarity, usefulness, and overall evaluation, was collected via Zoom and manually coded in Excel.

4.2 General Results

The expert evaluation of the Empathic Design Thinking Framework (EDTF) revealed valuable insights across five key dimensions: comprehensibility, usefulness, usability, feasibility, and ease of use.

For **comprehensibility**, 89% of experts rated the framework 4 or 5, resulting in a mean score of 4.2/5. The remaining 11% indicate minor suggestions for simplification. Experts highlighted that the phased approach, guiding stakeholders from conceptualization to deployment with co-involvement of the real users, was well-structured and logically sequenced.

For **usefulness**, the framework received a mean of 4.5/5, with 83% of experts rating it 4 or 5. The remaining 17% expressed potential objection about aligning EDTF with agile development timelines, reflecting the potential

challenge for teams under tight deadlines. **Usability** scored 4.0/5, with 78% of experts rating it positively (4 or 5). The remaining 22% indicated that the testing-intensive phases might be resource-demanding, especially for smaller teams.

Feasibility had a mean of 3.8/5. While 80% of experts felt implementation was achievable with sufficient resources, 20% highlighted that multidisciplinary skills would be necessary to fully adopt the framework in real-world educational game projects. Finally, **ease of use** scored 4.3/5, with 94% of experts rating it 4 or 5. The remaining 6% noted potential complexity in later, technical phases, which could challenge teams less familiar with advanced game development processes.

4.3 Phase-by-Phase Evaluation

The framework's clarity, practicality, and usability were also reflected in the expert evaluations of its individual phases. Each phase was assessed for its contribution to the overall process and its real-world applicability in educational game development.

1. *Empathize:* experts unanimously found this phase valuable for setting a human-centered tone from the outset. All evaluators emphasized the importance of deeply understanding user needs, motivations, and challenges. *"Understanding user pain points isn't just a box to check—it's the compass for everything that follows"* (P12). While some noted that this phase's abstract nature could be challenging for novices, there was broad agreement that it lays a strong foundation for all subsequent design work and ensures that the final product resonates with users.
2. *Co-Design scenario:* this phase, which focuses on mapping the learning journey and creating personas, was valued for encouraging collaborative shifts in mindset. Experts recognized its role in aligning stakeholders from different disciplines early in the process. *"It forces subject-matter experts and designers to speak the same language early on"* (P9). Some experts suggested including scenario-building templates to guide less experienced teams in structuring their thoughts.
3. *Co-Design instructional content:* experts emphasized this phase's critical role in ensuring that instructional strategies are closely aligned with learner needs. Most experts agreed that this alignment is crucial for creating meaningful and effective learning experiences. "*Without this step, you risk creating a fun game that teaches nothing—or a lesson nobody wants to play*" (P7). However, a few noted challenges in integrating educators, learners and instructional designers consistently, especially in resource-limited settings. For this phase they need role-specific guidelines to improve the interdisciplinary collaboration. *"Teachers and developers often have wildly different priorities, so we need clearer mediation strategies"* (P2).
4. *UX evaluation (storyboard):* the clarity and actionability of this phase were praised, particularly for its ability to align game design with educational objectives early on. Experts highlighted the usefulness of storyboards in communicating ideas to stakeholders, especially non-technical team members. *"Storyboards turn vague ideas into something everyone can critique, even non-technical stakeholders"* (P11) This phase was also appreciated for its low-risk nature, allowing for early iterations and reducing the likelihood of costly rework later. *"Catching flaws on paper saves months of coding dead-ends"* (P17).
5. *Low-fidelity prototype:* the introduction of basic prototypes received strong support for transforming abstract ideas into testable models. Experts saw this phase as a valuable tool for gathering early feedback. However, some experts pointed out the resource-intensive nature of creating prototypes, particularly for small teams. The use of rapid prototyping tools and templates was suggested to alleviate this burden.
6. *Iterative UX evaluation:* experts hailed this phase for its role in collecting real user feedback to refine the design. It was recognized as one of the framework's strongest phases, supporting evidence-based design. However, the phase was also seen as demanding, requiring time, user access, and analytical expertise. Experts expect to have clear checklists and protocols to streamline the process.
7. *High-fidelity prototype:* at this stage, the framework transitions from abstract concepts to detailed, experiential products. Experts noted that the high-fidelity prototype provides valuable insights into user engagement and learning alignment. However, the increased technical demands of this phase raised concerns about feasibility for smaller teams without specialized skills.
8. *Development:* experts expressed positive but cautious feedback about this phase. While they appreciated the integration of visual, narrative, and functional elements into a cohesive product, they also noted that this phase often presents challenges related to time and budget constraints. Clear role

definitions and agile development plans were identified as key factors for success. "*This is where interdisciplinary teams often fracture without strong project management*" (P13).

9. *Evaluation and assessment:* this phase was recognized as essential for validating learning outcomes and measuring long-term impact. Experts appreciated the framework's inclusion of both formative and summative evaluations. "*Most frameworks stop at deployment, but measuring actual learning impact is revolutionary*" (P5). However, they emphasized the need for appropriate metrics and tools to measure learning gains, particularly in behavioral and cognitive domains.
10. *Deployment & change management:* the final phase of the EDTF was praised for its focus on the long-term success and scalability of the educational game. Experts acknowledged the importance of sustainability, stakeholder adoption, and ongoing improvements post-launch. *"Launching is just the beginning—this phase ensures the game evolves with user needs"* (P16). Several evaluators suggested incorporating ongoing feedback loops and monitoring tools to ensure effective change management.

4.4 Discussion

The expert evaluation of the Empathic Design Thinking Framework (EDTF) highlighted its strengths and areas for improvement. Overall, experts found the framework clear and logically structured, with its phased approach making educational game design more accessible. The early *"Empathize"* phase was especially praised for its user-centered focus, though some noted that phases like *"Co-Design Scenario"* might be challenging for beginners. A simplified terminology or additional guidance, such as templates, could help.

Experts agreed the EDTF is highly useful, particularly its iterative testing process, which ensures games are both engaging and educationally effective. However, some raised concerns about aligning the framework with agile workflows, suggesting that adaptable guidelines could help teams working under tight deadlines. While the framework's step-by-step structure was seen as useful and feasible, resource-intensive phases like usability testing and prototyping could strain smaller teams. Experts also suggested that some automated tools or streamlined checklists might ease this burden. Additionally, the EDTF's multidisciplinary nature makes it best suited for teams with diverse expertise. For solo developers or small teams, scaled-down versions with core principles could improve feasibility.

The later phases, namely evaluation, deployment, and long-term monitoring, were recognized as important for sustainability. Experts recommended enhancing post-launch data collection to support ongoing improvements. Finally, although AI can automate tasks such as documentation, analyze user data, generate design suggestions, and assist in rapid prototyping, experts emphasized that human cognitive judgment remains essential for interpreting insights, understanding nuanced user needs, and making user-centered design and development decisions.

5. Conclusion

In conclusion, the expert evaluation of the EDTF highlights its strengths in clarity, usability, and practicality, particularly in its power to guide designers and developers through each phase of the digital serious game design and development process. The EDTF bridges a critical gap in serious game design by uniting design thinking, empathic design principles research, and participatory principles in a structured, actionable format. It offers a scalable, adaptable, and robust instrument that supports the creation of serious games that are desirable, useful, usable, and impactful. By anchoring the process in continuous collaboration with users, the EDTF stands to significantly improve the relevance, effectiveness, and success of DSG in real-world educational and training environments.

Since the EDTF has undergone validation through expert assessment, the next step is to move towards its real-world application. With the framework now validated for its structure, clarity, and usefulness, it will be applied in actual digital educational game development projects. This transition marks a critical step in the evolution of EDTF, allowing it to be tested for its ability to genuinely include users' perspectives throughout the entire design process, from initial concept to final deployment. Through hands-on application, the framework's adaptability and effectiveness will be further substantiated, providing evidence of its practical value for educational game designers and developers. At the same time, expert feedback highlighted resource challenges, particularly for small teams with limited time or multidisciplinary expertise. To address this, an EDTF toolkit version to be adapted will be created, combining certain phases and employing lighter-weight tools for empathy research, co-design, and prototyping. These adaptations would preserve the framework's core principles of user inclusion and iterative refinement, while making it feasible for smaller teams to implement it effectively.

Ethics Declaration: This study did not require formal ethical clearance. All participants provided informed consent prior to their involvement, and all data were collected and handled in accordance with standard ethical research practices.

AI Declaration: No AI tools were used in the development, writing, or analysis of this paper.

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