

Designing VR Games for Emotional Intelligence: Participatory Design Insights from Children

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Abstract: Virtual Reality (VR) games offer promising opportunities for social and emotional learning (SEL) by simulating real-life social interactions that help children develop emotional intelligence (EI) skills (i.e., recognizing other's and one's own emotions, regulating emotions and responding appropriately to social situations). However, there is still limited research on how to design such VR games that effectively integrate SEL objectives with engaging gameplay. There are several design frameworks for non-VR games, including the Integrated Design Framework for Playful Learning (IDFPL). IDFPL provides guidance for designing learning experiences that balance engagement with educational outcomes through affective, behavioral, cognitive, and social-cultural dimensions of playful interaction. While IDFPL has been widely used for digital game-based learning contexts, its application to support EI skill development through VR games remains underexplored. To address this gap, our study explores how the IDFPL framework can inform the design of VR games that support EI development in children. We conducted 7 participatory design sessions with 20 children aged 7-14 years to design a VR game that helps the player recognize, interpret, and understand emotional cues. Following four dimensions of the IDFPL framework, we analyzed how and what type of playful learning elements children incorporated into their game designs. Our findings provide insights into how children conceptualize EI learning in VR gameplay and identify concrete design elements (i.e., multimodal emotional cues, sequential learning, guided interactions through characters and effort-based rewards) that can guide the development of immersive games for EI. Future research is required to investigate how these design elements can be incorporated into immersive VR environments and evaluate their impact on children's EI development and SEL outcomes.

Keywords: Virtual reality, Children, Participatory design, Co-design, Emotional intelligence, Games

1. Introduction and Background

Emotional intelligence (EI) involves recognizing, interpreting, and understanding emotions in oneself and others (Salovey and Mayer, 1990). It is essential for children's positive social functioning, relationship building, and long-term academic and personal well-being (LoBue and Ogren, 2022). Despite its importance, developing EI remains challenging, as these skills are inherently complex and dependent on the context. Traditional approaches are often instructional and may lack engagement, potentially leading to limited understanding (Fotaris *et al.*, 2016). Prior research suggests that interactive and engaging technologies can enhance motivation and support the development of EI skills (D'Amico, 2018).

Games are a particularly promising medium for supporting EI development (Papoutsis *et al.*, 2024). As interactive, goal-driven systems, games enable learning through engagement, allowing players to explore scenarios, make decisions, and experience consequences. In the context of EI, games can integrate learning objectives directly into core gameplay mechanics, supporting the development of emotional and social skills in an engaging manner (Alotaibi, 2024). However, existing EI-focused games often rely on 2D or non-digital formats (García *et al.*, 2015; Manda, Fajriani and Darmayanti, 2022; Muravevskaia, Kuriappan and Schrier, 2025). While these approaches can be beneficial, there is limited research on how such games can be designed to support the transfer of EI skills to real-world contexts (Alotaibi, 2024). Moreover, without careful consideration of the design elements, these approaches may lead to a lack of interest in real-life interactions or over-reliance on screens (Tarafdar, Gupta and Turel, 2013; Przybylski and Weinstein, 2019).

Virtual Reality (VR) extends the potential of games for EI learning by offering immersive and embodied experiences. VR enables users to engage with emotionally rich, first-person scenarios that simulate real-world social interactions, providing opportunities to practice these skills in safe, controlled, yet realistic environments. Prior work has explored VR-based game experiences for empathy development (Muravevskaia and Gardner-McCune, 2023), emotion regulation (Pallavicini and Bouchard, 2019) or reducing anxiety (Pallavicini and Pepe, 2020). However, despite the promise of both VR and games, there is limited research on how to design VR games that specifically integrate learning EI skills into gameplay mechanics. This presents a critical challenge: balancing

immersion and engaging gameplay with the learning of sensitive and nuanced skills such as emotional intelligence. Without careful design, such systems risk limiting both player engagement and the depth of emotional learning.

Design frameworks can provide guidance in addressing this challenge. Prior work in game-based learning highlights the importance of integrating cognitive, emotional, social, and motivational aspects to support meaningful learning experiences in children (Alotaibi, 2024). The Integrated Design Framework for Playful Learning (IDFPL) (Plass, Homer and Kinzer, 2015) is one such framework that incorporates four key dimensions of engagement: affective, behavioral, cognitive, and socio-cultural. While IDFPL has been applied in both digital and non-digital game contexts, its application to immersive VR environments, particularly emotional intelligence, remains underexplored. This gap is critical, as the effectiveness of game elements are subjective to the specific learning outcome (Domoff *et al.*, 2019). Moreover, children’s understanding substantially varies across developmental stages (Piaget, 1952). Understanding how such frameworks can be adapted to VR contexts and how they inform the design of developmentally appropriate EI learning experiences is hence very critical.

To address this gap, we adopt a participatory design (PD) approach by involving children as “active design partners” (Druin, 1999) to understand how children conceptualize learning EI skills within VR games. Participatory design enables the inclusion of children’s perspectives, helping uncover how they understand emotions and what types of game mechanics they find engaging for learning these skills. We conducted 7 PD sessions with 20 children, where they designed VR games to learn about emotions. We then map the children’s design ideas onto the constructs of IDFPL to examine how different dimensions of playful learning are incorporated into their game concepts. This study specifically answers the following research question: *How can the IDFPL framework inform the design of VR games that support EI skill development in children?*

2. Methodology

We conducted participatory design (PD) sessions with seven design teams comprising 20 children. Each team included one or two adult design partners who supported the sessions by scaffolding children’s ideation and facilitating the design process.

2.1 Participants

A total of 20 children (ages 7–14) participated in the study. Participants were recruited through three channels within the United States: (1) an intergenerational design team at the University of Maryland (KidsTeam) (Teams 1-3), (2) Girl Scouts troop in Indiana (Teams 4-5), and (3) convenience sampling (Battaglia, 2008) (Teams 6-7). Participants were organized into teams, and their demographics are summarized in Table 1. Each column represents a team, with individual participants listed using their participant ID, along with age and gender (e.g., P1 (age, gender)). Each team also included one or two adult design partners (researchers), whose role was to facilitate the co-design activities, encourage discussion through open-ended prompts, and support children in expressing and developing their ideas without directing the design decisions.

Table 1: Participant demographics across teams

Team 1	Team 2	Team 3	Team 4	Team 5	Team 6	Team 7
P1 (11, M)	P3 (9, F)	P5 (12, F)	P8 (14, F)	P12 (13, F)	P16 (11, F)	P18 (13, M)
P2 (7, M)	P4 (9, F)	P6 (12, F)	P9 (10, F)	P13 (10, F)	P17 (12, F)	P19 (14, M)
		P7 (10, F)	P10 (10, F)	P14 (12, F)		P20 (12, M)
			P11 (10, F)	P15 (10, F)		

2.2 Data Collection and Analysis

Each session lasted approximately 90 minutes. Sessions were structured into three phases:

Warm-up activity (20 mins): Participants played a short game of emotional charades where they acted out and guessed emotions. Following this, they reflected upon the activity with a discussion of different strategies they currently use to understand others’ emotions.

Design activity (60 mins): Children collaboratively designed a VR game aimed at helping a fictional alien character learn about the emotions humans feel on Earth. They were encouraged to create game scenarios, mechanics, and characters that support recognizing, interpreting, and understanding emotions through PD techniques such as *Bags of Stuff* (Walsh *et al.*, 2013) and *Big Paper* (Walsh *et al.*, 2013) (see Figure 1).

Presentation and discussion (10 mins): After the design activity, each team presented their designs (see Figure 2), followed by a group reflection on the similarities and differences in ideas across all of the teams.



Figure 1: Participatory design activity



Figure 2: Presentation and discussion

Data collected during the session included video and audio recordings, observational notes, and design artifacts (e.g., sketches, storyboards). Audio recordings were transcribed using the AI-based tool Otter.ai and subsequently reviewed and corrected manually for accuracy. During the analysis, the transcripts were coded deductively by a team of six researchers using a predefined coding scheme to identify key game design elements, including narrative, visual design, game mechanics, incentive systems, and sound (Plass, Homer and Kinzer, 2015). Each transcript was coded by two researchers as a primary and a secondary coder to ensure analytical rigor. The first author served as the secondary coder across all transcripts. Following initial coding, the analysis was further guided by the *Integrated Design Framework for Playful Learning (IDFPL)*, focusing on how children incorporated *affective, cognitive, and socio-cultural* dimensions within their game designs.

3. Findings

Our findings suggest that children's designs incorporated all four dimensions of the Integrated Design Framework for Playful Learning (IDFPL) (Plass, Homer and Kinzer, 2015). Figure 3 illustrates the key design elements organized across four dimensions of engagement: affective, behavioral, cognitive, and socio-cultural.

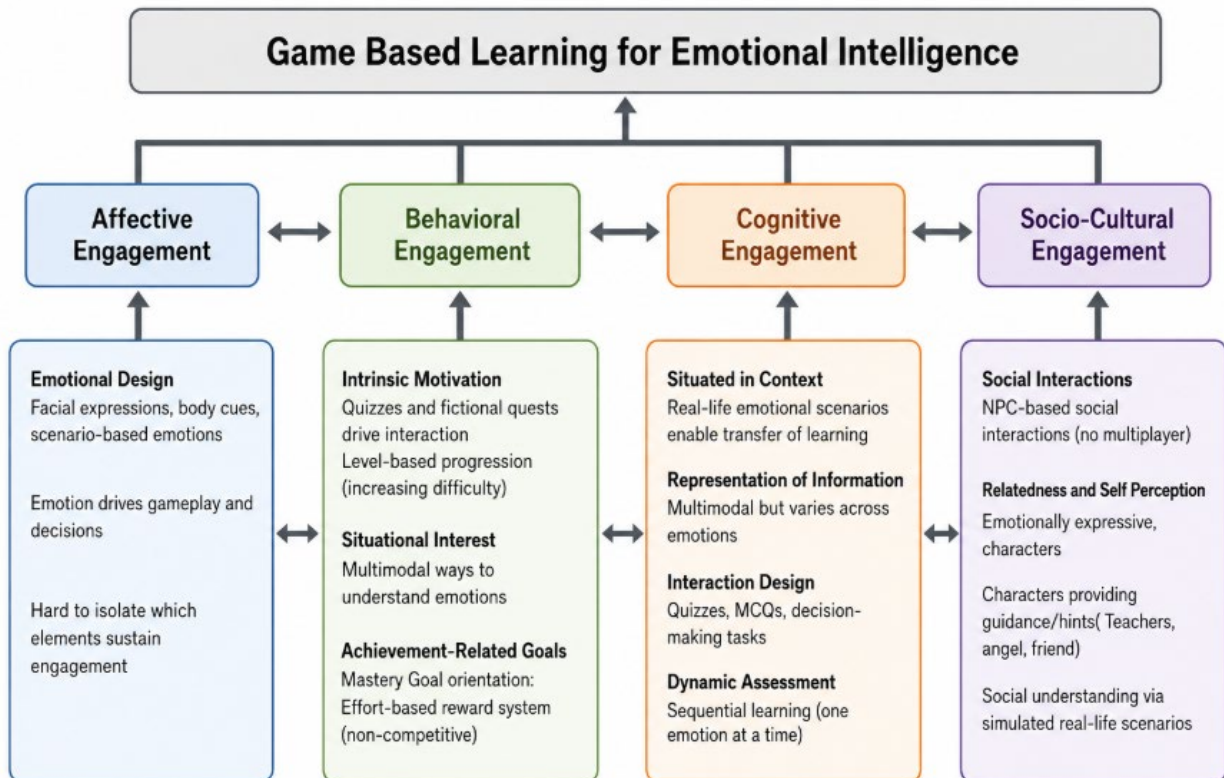


Figure 3: Mapping of the children's game design elements to the IDFPL framework (Plass, Homer and Kinzer, 2015)

3.1 Affective Engagement

Affective engagement refers to the role of emotions in shaping player experience, including how emotional responses are elicited and how they influence gameplay and decision-making. Across teams, children consistently grounded their designs in helping players both *feel* and *understand* a wide range of emotions. These included basic emotions such as *happiness*, *sadness*, *surprise*, *anger*, and *disgust*, as well as more complex emotions such as *anxiety*, *fear*, *frustration*, *confusion*, *embarrassment*, and *bubblyness*. Participants frequently employed a multimodal approach, incorporating cues such as facial expressions, body language, voice, and situational cues. For instance, emotions were conveyed using emojis to depict facial expressions, audio cues to indicate tone (see Figure 4), and contextual scenarios illustrating when emotions are experienced (e.g., "happy-getting an A+ on a test," "sad-losing a pet"). Children also embedded emotions directly into *gameplay mechanics*, where the player's actions led to the elicitation of different emotional states. For example, one team designed a maze game in which the player navigates to find missing spaceship parts. Successfully locating a part resulted in feelings of happiness, while losing a part triggered frustration or anger (see Figure 5).

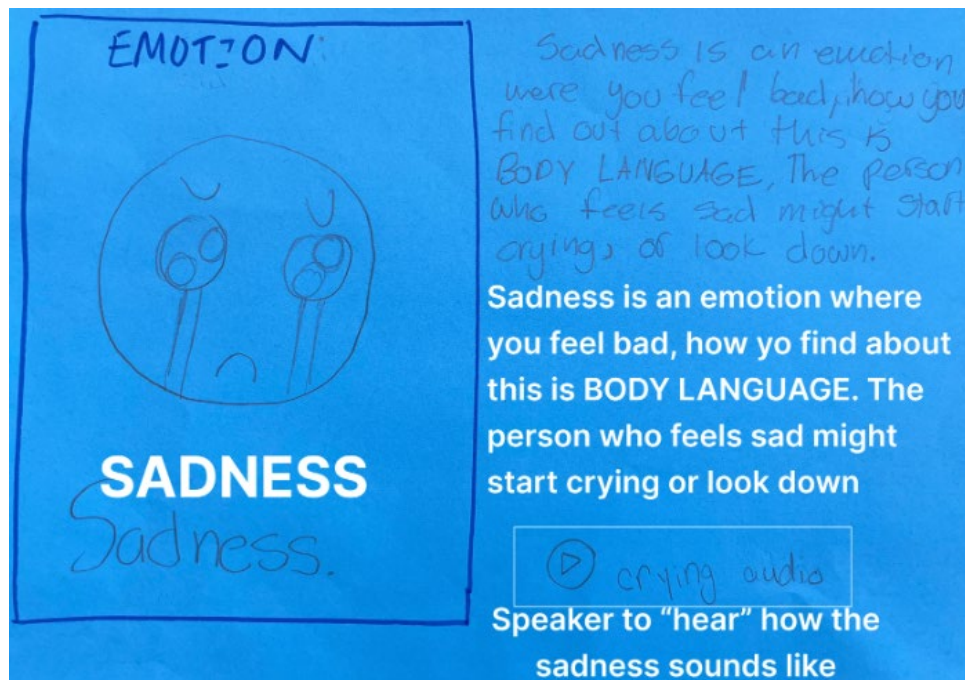


Figure 4: Understanding emotions through facial expression, body language, and sound



Figure 5: Understanding emotions through situational contexts and quests

However, because these emotional elements were often tightly coupled with the learning objectives, it remains unclear whether they would independently sustain affective engagement or primarily function as instructional cues, rather than drivers of player engagement.

3.2 Behavioral Engagement

Behavioral engagement refers to the degree of participation, motivation, and persistence in gameplay, supported through goals, challenges, and reward systems (Plass, Homer and Kinzer, 2015).

Intrinsic Motivation. Children designed interactive mechanics such as quizzes, multiple-choice questions, and narrative-driven quests that required active engagement in solving challenges to develop their EI skills. These interactions positioned players as active participants navigating the gameplay, rather than passive recipients of information.

Situational Interest. Children frequently used multimodal methods to understand emotions situated either in real-world or fictional scenarios. These methods allowed players to maintain attention while combining visuals, text, and situational context to create richer experiences that support understanding.

Achievement-Related Goals. A consistent pattern across designs was the inclusion of progression systems where players advanced through levels or stages of learning. Reward systems were typically effort-based and non-competitive, emphasizing encouragement and mastery rather than performance. For example, even for incorrect responses (e.g., the wrong interpretation of an emotion for a given task), children suggested providing partial credit (“quarter points for trying”) or supportive feedback, such as using phrases like “at least you tried,” instead of “better luck next time,” reflecting a preference for sensitivity towards the players.

3.3 Cognitive Engagement

Cognitive engagement refers to the mental processes involved in interpreting, reasoning, and understanding emotional information within gameplay (Plass, Homer and Kinzer, 2015).

Situated in Context. Children sustained engagement by embedding emotional learning within relatable and interactive scenarios, such as “classroom environments” (see Figure 6), “movie theatres”, and everyday social conflicts. These scenarios enabled players to connect in-game experiences with real-life contexts, supporting the potential transfer of emotional understanding in real-life social interactions.

Representation of Information. Information about emotions was conveyed using various cues, which varied depending on the complexity of the emotion. For instance, more complex emotions, such as anxiety or fear, required multiple modalities, while simpler emotions, such as happiness, relied on fewer cues. This suggests that children intuitively adapted their representations based on emotional complexity.

Interaction Design. Children structured gameplay around decision-making tasks (e.g., answering quizzes about what they learned), matching emotions to scenarios through multiple choice questions. One team also incorporated an emotion finding quest, where the player first learns what each emotion means and then goes on a quest to find these emotions. These interactions required active reasoning and interpretation, positioning players as decision-makers rather than observers.

Dynamic Assessment. A consistent pattern across designs was the inclusion of progression systems, where players advanced through levels or stages of emotional learning. Children often structured gameplay sequentially, where players focused on one emotion at a time and progressed to more complex emotions as they advanced. For example, players moved through different rooms or levels with each representing learning and evaluating the understanding of specific emotions (see Figure 5 and Figure 6). This trend reflects the children’s incremental approach to learning.

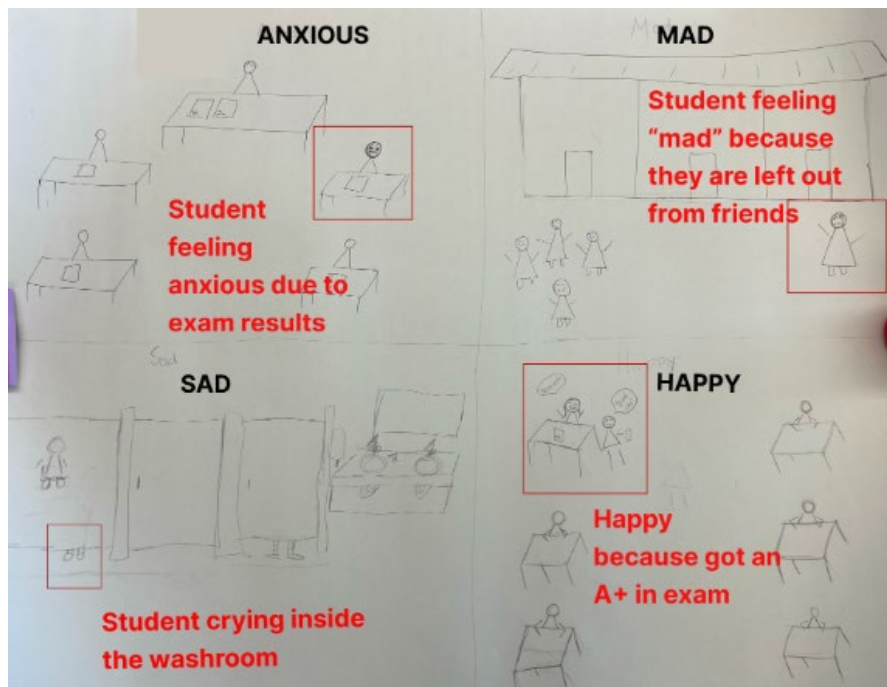


Figure 6: Classroom environment where emotion is learned in different rooms

3.4 Socio-cultural Engagement

Socio-cultural engagement refers to how learning is shaped through social interaction, relationships, and contextual understanding (Plass, Homer and Kinzer, 2015).

Social Interactions. Children primarily designed for social interaction through non-player characters (NPCs), rather than multiplayer systems. These NPCs played a variety of roles, including guiding the player, presenting emotional scenarios, and providing hints.

Relatedness and Self-Perception. Children emphasized the importance of relatable and expressive characters, often including customizable player avatars with variations in gender and race to support inclusivity. Participants also incorporated accessibility features, such as combining text and audio instructions. In addition, children designed guided interactions where characters such as teachers, friends, or angels were used to explain emotions and support player understanding. Social understanding was further supported through simulated real-life scenarios, enabling players to practice interpreting and responding to emotions in a specific context.

4. Design Implications

Our findings suggest that VR game-based learning experiences for emotional intelligence should integrate emotions directly into gameplay while supporting children's developmental needs. Children consistently relied on multimodal cues such as facial expressions, body language, voice, and situational context to understand emotions. However, these representations varied by emotions, indicating that designers should use layered but carefully selected cues to support clarity without overwhelming users. Emotional learning should be embedded within core gameplay mechanics, where player actions lead to learning about emotions, enabling learning through interaction rather than instruction. Additionally, the children structured the understanding of emotions as a sequential process, suggesting the importance of scaffolded progression (e.g., levels or environments focused on individual emotions) that gradually increased in complexity. Grounding these experiences in relatable, real-world scenarios further supports children's ability to connect in-game learning to everyday social contexts. At the same time, children's designs highlight the importance of guided learning experiences. Participants consistently incorporated non-player characters (NPCs) to explain emotions, provide feedback, and guide for decision-making, suggesting that fully exploratory systems may be less effective for supporting emotional understanding. Designers may therefore incorporate structured guidance through characters while maintaining opportunities for interaction and reflection. Furthermore, children emphasized inclusive and supportive design, including customizable avatars, multimodal communication, and non-competitive reward systems that prioritize effort and encouragement over performance.

5. Limitations and Future Work

While interpreting the findings, the limitations of the study should be considered. First, the results are based on participatory design sessions rather than evaluations of fully implemented VR systems. Therefore, the findings reflect children's conceptualizations of developing EI skills through games, which may differ from how they engage with or learn from actual VR experiences. Future work should implement and empirically evaluate these design concepts to assess their effectiveness in supporting emotional intelligence outcomes. Second, the study was conducted within specific cultural and geographic contexts in the United States, which may limit the generalizability of the findings to other populations. Future research should investigate how cultural differences influence emotional understanding and design preferences.

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Ethics Declaration: Ethical clearance was obtained from the university's Institutional Review Board (IRB), and the study followed all the protocols approved by the review board. The IRB approval number is IRB: #24864.

AI Declaration: The paper was not written using any AI tools. Generative AI tools were only used for grammar and spelling checks.

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