The Absent Teacher in Eco-Games: A Theoretical Framework for Teacher Integration in Eco-Games

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INTRODUCTION

Digital games have been increasingly deployed to address the complexities of sustainability, aiming to foster both systems thinking and empathy towards non-human actors (Weixelbraun et al., 2024). However, a tension exists in the design of these eco-games, defined as interactive simulations that model ecological systems

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and human-nature relations (Chang, 2019), specifically regarding the dichotomy between the game as a self-contained pedagogical tool and the game as a component of a broader instructional system. While game studies often focus on the procedural rhetoric of the software itself (Bogost, 2007), the material reality of its implementation, specifically the role of the teacher in professional development and classroom integration, remains underexplored (Mahmud et al., 2020). This paper is grounded in the Okanagan WaterFutures project, situated within a watershed whose governance reflects a long history of Indigenous stewardship and colonial restructuring of water systems (Sam, 2008; Dulic et al., 2023).

Drawing on our recent systematic literature review (SLR) of 175 empirical studies (Xu et al., 2026a), this extended abstract examines a critical anomaly in the data: the absent teacher. We argue that current design trends reveal a paradox of automation: by designing for seamless flow, games systematically eliminate the productive friction that teachers provide. This results in shallow engagement; systems thinking requires human facilitation to translate gameplay experience into epistemic understanding (Lin et al., 2024). We term this alternative state resilient flow: sustained engagement achieved not by eliminating difficulty, but by scaffolding it.

METHODOLOGY

To understand how educational intent translates into impact, we performed a theoretical re-analysis of the dataset established in our comprehensive review (Xu et al., 2026a). While the primary review mapped general learning outcomes, this analysis applied a specific theoretical lens derived from our parallel research into resilient flow, a state where engagement is maintained through meaningful struggle rather than friction-free ease (Sun et al., 2026).

We recoded the dataset to examine the structural function of the teacher. Instead of merely noting the teacher's presence, we classified mediation based on whether it provided the necessary scaffolding (Wood et al., 1976) to transform frustration into resilience. We defined the teacher's roles as follows:

Gatekeeper: An instructor who filters content and sets boundaries to induce constructive friction.

Facilitator: An active mediator who bridges game logic with real-world context through assessment strategies (Ferreira-Santos & Pombo, 2025).

Absent: No pedagogical intervention recorded.

We visualized these coded relationships using a comparative matrix (Table 1). The analysis consistently revealed two failure modes—emotional overwhelm without transfer, and procedural complexity without legitimacy—each arising directly from the absence of teacher mediation at a different point in the learning arc.

FINDINGS

These two failure modes manifested differently across the dominant design archetypes, as Table 1 details.

1. The Empathy Trap: Grief without Guidance

In the Mechanics & Empathy cluster, games induced vulnerability. Our player perception analysis indicated that players experienced deep ecological grief (Xu et al., 2026b). However, without a teacher to frame this loss, the experience often stalled at emotional overwhelm. While narrative design aims to evoke empathy (Sinclear et al., 2022), the game simulates the pain of nature but often does not provide the agency to resolve it.

2. The Simulation Trap: Complexity without Purpose

In the Systems cluster, the absence of a teacher led to a degradation of play. While designers intended to teach systems thinking (Xu et al., 2026a), players often perceived the mechanics as social friction or labor (Xu et al., 2026b). This is corroborated by independent research on Eco, which found that teacher-researcher moderation was essential for students to understand the game's cooperative governance mechanics as educational rather than arbitrary (Fjællingsdal & Klöckner, 2019). The absent teacher represented a missing fairness gatekeeper; without an arbiter to legitimize the struggle, the difficulty of managing a virtual climate crisis felt arbitrary rather than educational. This reflects the core challenge of Triadic Game Design, where the tension between maintaining high-fidelity realism and ensuring educational meaning often results in a loss of playability if not carefully mediated (Harteveld, 2011).

Table 1. The Disconnect Matrix: Synthesizing Design Intent, Player Experience, and Pedagogical Gaps.

Design Archetype Source: (Xu et al., 2026a)	**Dominant Mechanic**	**Observed Player Affect Source: (Xu et al., 2026b)**	**The Pedagogical Gap (The absent teacher effect)**
1. Mechanics & Empathy (e.g., WolfQuest, Shelter)	Embodied Survival: Vulnerable avatars; permadeath; animal perspectives.	Ecological Grief: Players report intense sadness over loss (e.g., death of pups) but often feel helpless.	Trauma without Transfer: Without debriefing, the grief remains a personal negative emotion rather than a motivator for systemic action.
2. Systems & Simulation (e.g., Eco, Civilization)	Resource Management: Optimizing variables; voting; pollution metrics.	Social Friction: Players report frustration with "bureaucracy," "griefing," and arbitrary rule breaking.	Friction without Fairness: Without a "Game Master" to enforce fairness, the complexity feels like tedious labor rather than a meaningful challenge.

DISCUSSION

These findings reframe teacher integration not as a logistical concern but as a fundamental design requirement. The absent teacher is not a funding gap—it is a theory gap: eco-game research has theorized player experience extensively while neglecting the pedagogical infrastructure that makes that experience transferable. Two design interventions follow directly from this analysis.

1. Trade-offs as Constructive Friction

Unlike entertainment games which often empower players, eco-games must simulate the constraints of reality. Our prior research suggests that appropriate frustration can be essential for deep learning (Sun et al., 2026). In this context, the teacher acts as a pedagogical gatekeeper, introducing constructive friction through complex trade-offs, such as sacrificing economic growth for biodiversity or energy sustainability (Serrano et al., 2023). Instead of reducing these difficulties, the teacher frames them as necessary cognitive hurdles, prompting students to engage in consensus processes to resolve the dilemma (Xu et al., 2026a).

2. Simulating Nature: Randomness and Scripted Loss

Authentic environmental education often requires confronting the unpredictability of nature. Our semantic network analysis of player perceptions reveals that while players felt grief over in-game losses (e.g., the death of a wolf pup), this emotion could be transformative if properly scaffolded (Xu et al., 2026b). We propose that stochastic events (e.g., random droughts) and scripted ecological failures are not punishments, but high-fidelity simulations of natural systems. The teacher's role is to convert this resilient flow—the struggle against an indifferent system—into epistemic insight through structured debriefing (Kioupi et al., 2022), ensuring that social friction is understood as a systemic feature rather than a design flaw.

CONCLUSION

The implication for eco-game design is clear: the screen is not the boundary of the system. Game designers who theorize only player experience are building half a pedagogy. The teacher HUD—the set of scaffolding tools, debriefing protocols, and contextual interventions that surround gameplay—is as much a design artifact as the game itself. As Gee (2003) argued, we must shift from designing for teachers to designing with teachers, treating them not as end-users of a product but as essential co-processors of the game experience. Resilient flow does not emerge from the code; it emerges from the classroom.

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