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Experiential metaphor: a theoretical framework to achieve convergent design for serious games

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Abstract. This position paper introduces a theoretical framework for the design of learning games based on the concept of experiential metaphor. Grounded in experiential learning and conceptual metaphor theory, the framework offers a method for integrating educational objectives directly into game mechanics. By considering the game as an adidactic and metaphorical environment, it proposes three principles of convergent design to help designers create coherent, meaningful learning experiences that avoid superficial gamification. A concrete example illustrates the model and opens perspectives for its empirical validation.

Keywords: Game-based learning, integration, experiential learning, adidactic situation, conceptual metaphor, convergent game design

1 Introduction

In the field of educational games, a persistent and significant challenge lies in achieving a coherent integration of knowledge within these games. This difficulty is frequently illustrated by the "chocolate-covered broccoli" metaphor, which describes a scenario where educational content is merely superficially sprinkled with playful elements [1].

This observation prompts two central questions: firstly, how can an environment be designed to ensure a close articulation between educational content and the playful experience? And secondly, what theoretical foundations can be mobilized to guide the design of high-quality learning experiences delivered through games?

To address these challenges, a theoretical framework is proposed. This framework is grounded in the principles of experiential learning [2] and conceptual metaphor theory [3]. Building upon these foundations, the framework introduces the notion of the experiential metaphor. The experiential metaphor is conceived as a conceptual tool specifically intended to support convergent design, thereby unifying playful objectives with educational objectives in a cohesive manner.

2 Integration Challenges in Learning Game Design

From a non-behaviorist perspective [4], the ultimate success of an educational game is heavily dependent on its capacity to avoid creating a dissonance between the act of playing and the process of learning [5]. A strong coherence between the activities of play and the pedagogical objectives significantly enhances both the interest and effectiveness of the game as a learning tool [6, 7, 8]. This necessary coherence must extend deeply into the very mechanics of the game and not be restricted merely to its narrative universe or thematic dressing [9]. Game mechanics are understood in this context as the operational rules of the game, or rather the specific methods players use to interact with the game world [10].

Building upon this, the concept of intrinsic integration, Habgood [11] suggests a more profound connection where learning emerges directly as a result of interaction with the game mechanics. This approach seeks to circumvent the superficiality commonly found in games where educational content is simply "themed" without being deeply integrated into the gameplay itself. This approach has then inspired close concepts such as *conceptual integration* [12], *alignment* [13], and *metaphorization* [14]. Interestingly, one of the variables used to measure the quality of such intrinsic games has been the amount of time the participants *chose* to play them [15].

The central issue, therefore, is the imperative integration of pedagogical objectives within the mechanics of the game. This is presented as a necessary condition to effectively move beyond the superficial "chocolate-covered broccoli" effect, but also to make it impossible for a learner/player to play the game while avoiding the learning content [16], a strategy known as “gaming the system” [13].

Integration in serious games is under-researched and, while these authors clearly highlight the critical importance of integration, they leave unanswered the question of the specific theoretical principles that can effectively guide the design process for creating such deeply integrated learning games.

3 Games as Adidactic and Experiential Learning Settings

The concept of the adidactic situation [17] offers a foundational theoretical starting point for addressing the design challenge. In an adidactic situation, the learner engages in interaction with a designed environment -or "didactic milieu"- that generates adapted feedback in response to the learner's actions. Consequently, learning arises organically from a process of experimentation facilitated by this interaction. In such a situation, learners act based on goals and feedback, not on the teacher’s expectations.

This concept is closely aligned with the tradition of experiential learning, where knowledge is actively constructed through a process akin to active inquiry [18], involving continuous interaction with the environment and continuity of lived experiences.

Within the realm of video games, where autonomy is an intrinsic property [19], procedural rhetoric [20] serves to illustrate this perspective by describing how the rules of a game can convey meaning. In a "persuasive" game, the underlying mechanics carry a message or set of ideas that the player interprets through manipulating and testing the game's system. Thus, mirroring the dynamics of an adidactic situation, the player, when

confronted with a system of rules, formulates hypotheses, tests them through interaction, receives feedback from the system, and adjusts their strategies accordingly, all without explicit didactic intervention. Procedural rhetoric can therefore be understood as an operational mechanism of the adidactic situation as applied specifically to game design: the game itself constitutes the didactic milieu. Learning games should provide goals that require the development of the targeted knowledge [17, 21, 22].

From an experiential perspective, adidacticity is key; interaction with the environment is what provides the learner with the necessary elements for analyzing and resolving the situation at hand. A game intentionally designed for learning effectively allows the player to learn by actively interpreting a system composed of meaningful constraints. Designing learning games thus becomes the creation of structured, inquiry-based, adidactic environments.

4 Experiential Metaphor for Learning

According to Lakoff and Johnson [3], the understanding of abstract concepts is based on conceptual metaphors. These metaphors are themselves anchored in concrete, sensory experience. Metaphor, then, serves to "understand something (and to experience it) in terms of something else". Metaphor is not simply a figure of speech; it structures our understanding of the world and provides the means for us to redescribe it [23].

From the perspective of experiential learning, the process of understanding a metaphor is viewed as a process of inquiry in the experiential sense described by Dewey [18]: the recipient of the metaphor interprets the given situation by drawing upon their experience, the context, and any available clues [24]. These resources serve to formulate hypotheses, which are tested or refined until they allow the most relevant meaning.

When applied to game design, creating a metaphorical experience means deliberately structuring the playful interaction around an implicit analogy. This analogy is one that the player must actively decode and make sense of through their direct experience within the game. The metaphor thus has the potential to structure the entire playful experience in a way that supports the construction of knowledge. It effectively becomes a "subtext" that the player is required to actively interpret as they play.

A game designed as an experiential metaphor provides the player with clues embedded within the gameplay. These clues enable the player to formulate, test, and adjust their hypotheses through their direct playful interaction. This interactive process allows them to "understand and experience" the target knowledge "in terms of something else" - that "something else" being the game’s rules.

For such a metaphor to be effective in learning, the situation is characterized by three key aspects: 1) it is adidactic: the explicit goal presented to the player within the game is different from the undeclared learning objective; 2) it is experiential: the learning objectives are translated directly into the game's rules and mechanics; the learner must actively experience the game and its consequences to learn; 3) it is metaphorical: the deliberate choice of the game's objective and its mechanics forms a coherent whole that converges with the learning objectives. This convergence means the game mechanics both mobilize the target knowledge (requiring its implicit understanding or application) and reflect it (embodying its core principles metaphorically).

5 Towards a Convergent Design

Drawing upon previous work related to learning games and the theoretical foundations discussed, three principles for convergent design are proposed. These principles are considered relevant for design teams during the design phase of game development, specifically after the learning objectives have been clearly defined and prior to starting the actual development phase:

Principle of *interaction*. Learning objectives must be integrated primarily within the rules of the game, rather than being merely layered on top as narrative dressing. This principle implies that educational concepts are not simply presented, they are translated into meaningful, epistemic interactions that embody the target knowledge.

Principle of *adidacticity*. The educational objectives are not explicitly stated to the player. Instead, the design of the game is approached as the elaboration of an adidactic situation where the player's success depends on their development and leveraging of the targeted knowledge. This principle implies that learning game design teams should start the ideation process by considering the question: "Which goal will require the player to elaborate and harness the concepts whose understanding is targeted?".

Principle of *coherence*. Putting the first two principles into practice requires metaphorizing the targeted knowledge. All the various dimensions of the game – including its mechanics, graphics, narration, and other elements – must consistently adhere to the selected metaphor. The metaphor itself is chosen based on its relevance to the specific learning objectives, the context of use, and the intended players. This ensures a fundamental coherence between the metaphor created within the game (the source domain) and the learning objectives (the target domain).

These principles support *convergent design*, where play and learning mutually reinforce each other, avoiding both direct instruction and shallow gamification. Put together, these principles imply that the game system itself functions as a metaphor: the actions required from the players, the consequences they face, and the strategies they must develop all mirror the structure and logic of the concepts to be learned. Learning emerges as players engage with a system that reflects real-world dynamics of the knowledge domain. In doing so, the game transforms abstract content into experiential and interactive learning, rooted in the logic of metaphor.

6 *Odyssée*: A Convergent Game Design for Experiential Learning in Ecological Transition

The game *Odyssée* (French for Odyssey), which we designed within our research lab, illustrates the concept of convergent design. *Odyssée* is a board game designed for the training of environmental professionals in the principles of ecological transition and change management. In the game, players form teams of navigators tasked with rescuing stranded passengers from various islands and transporting them to safety (Fig. 1). While several routes are available, players quickly learn that the seemingly fastest paths

come with challenges, such as storms or pirate attacks, whereas slower, more thoughtful strategies lead to more sustainable success. The goal is to rescue as many passengers as possible, but also to experience and reflect on the dynamics of change management.

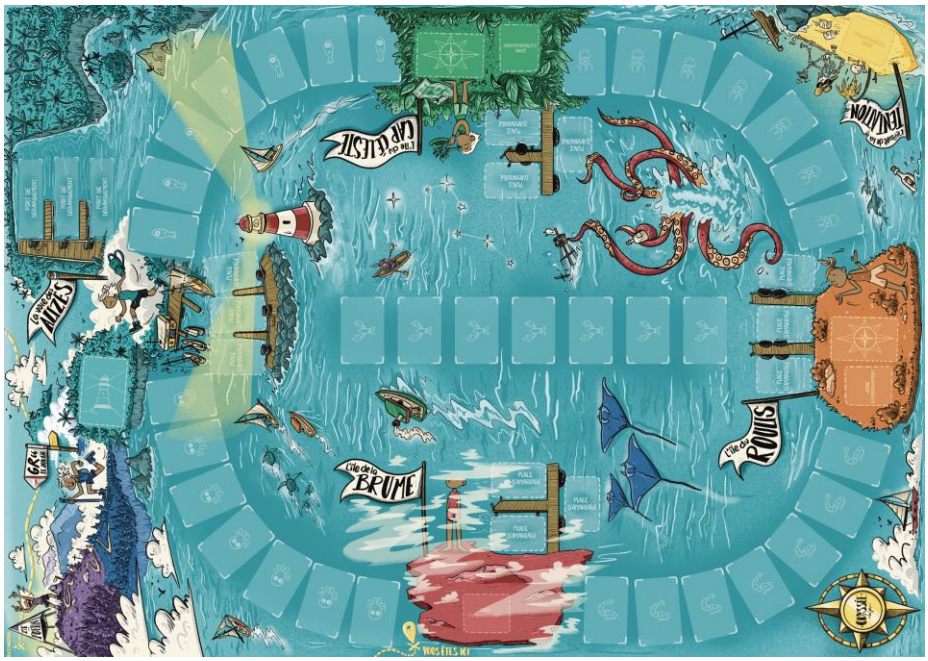

Fig. 1. The *Odyssée* game board (illustration: Oriane Masserey)

The game exemplifies convergent design by embedding its learning objectives within the gameplay itself, fulfilling the principle of interaction: players learn directly from their actions and the system's feedback. It also follows the principle of adidacticity, as it avoids overt instruction and instead creates a learning environment where players must mobilize or discover key concepts to succeed. Finally, it achieves coherence by using a consistent and meaningful metaphor, the rescue voyage, to reflect the Trans-Theoretical Model of Behavioral Change (TTM) [25].

In *Odyssée*, the islands linking the sea routes represent the stages of change described by the TTM. Thus, attempting to reach the trade winds way (*action stage*) from the island of the roll (*contemplation stage*) without passing through the celestial cape (*preparation stage*) exposes the player to cards such as "the sea turtles whisper a shortcut to you. You pass through the forbidden cave, but the Kraken lives there. It takes you by surprise and snatches all your passengers". The "route cards" are metaphors for actual obstacles along each way. The designers sought to use the rescue voyage metaphor in the design of the various elements of the game (gameplay, content, graphics) to ensure that the gameplay experience remains fully aligned with the intended learning outcomes. By playing *Odyssée*, participants experience firsthand that change is a gradual, step-by-step process. Attempting to bypass stages risks losing people along the way.

7 Conclusion, Perspectives and Limitations

This paper makes three main contributions to the field of learning game design. First, it introduces the original concept of experiential metaphor as a theoretical construct that links the foundations of experiential learning with conceptual metaphor theory. This concept provides a new lens through which to understand how abstract educational objectives can be grounded in concrete, meaningful gameplay experiences.

In addition, the paper formulates a framework for convergent design built on three core principles: interaction, adidacticity, and coherence. Unlike existing approaches that often treat learning and play as separate layers [26], this framework offers actionable criteria to ensure that educational content is deeply embedded within the structure of the game itself. These principles serve as analytical tools for evaluating existing games, and as practical design guidelines for developers and instructional designers.

The paper also illustrates the framework through a concrete example: the Odyssée board game. This case shows how the principles of convergent design can be operationalized in a training context to support professional learning around ecological transition. It demonstrates the framework's potential to produce learning environments where success in the game directly depends on harnessing the targeted knowledge.

While the primary theoretical basis of the framework is now established, it is important to note that the principles introduced here are still the subject of ongoing analysis and development. In addition, future work should focus on the framework's empirical validation. This includes systematic analysis of existing learning games, as well as studies involving design teams and educators using the framework in practice. Evaluating its effect on the quality of serious game design will be key to confirming its value and refining its use.

A second limitation of this work lies in the fact that the playing experience alone is not sufficient to ensure effective learning. A carefully structured debriefing phase is essential to help players reflect on their gameplay and connect it to real-world contexts [27]. This is particularly important when the game relies on metaphor, as learners must be explicitly guided to interpret and transfer their in-game experiences into applicable knowledge. Without such support, the learning remains largely implicit, and the game's educational potential may not fully materialize. This highlights a broader point: rather than learning through games, we often learn through reflecting on games—an important distinction for both designers and educators.

Thus, this article provides a conceptual and methodological foundation for advancing the design of learning games. By treating games as experiential metaphors, and by suggesting principles for achieving convergence between play and learning, it offers a new path forward for designing serious games that are meaningfully playful and pedagogically relevant.

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