The Boardroom: Behind the Design

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1 Introduction

Game theory is often taught through abstract models, centring on rational solutions. However, the nature of real-world decision-making is unpredictable and shaped by social dynamics. *The Boardroom* is designed to capture this tension, allowing players to engage with game-theoretic concepts on both a conceptual and practical level. The design draws upon both experiential and cognitive pedagogies, embedding learning directly into the game mechanics. This essay introduces *The Boardroom's* targeted learning goals, examining how they are achieved through its mechanics and visual communication. The effectiveness of the game is evaluated through playtesting and assessment data which inform iterative design and future development.

2 Learning Objectives and Pedagogical Goals

2.1 The Learning Objectives

Of course, the objects of study in game theory are games or game-like scenarios. This makes a game-based approach to learning a very natural choice for this field of study. *The Boardroom* is designed to allow players to experience game theory first-hand, while also developing a technical understanding of the subject. The learning objectives for the game have been adapted from the module *ST234 Games and Decisions* (Touchard 2024):

- **(LO1)** Use mathematical game theory to analyse mathematical toy example games.
- **(LO2)** Understand the limits of game theory when used in real-world scenarios.
- **(LO3)** Communicate solutions to problems accurately with structured and coherent arguments.
- **(LO4)** Develop fluency with game-theoretic terminology and definitions.

2.2 An Experiential or Cognitive Approach?

Kolb (1984) advocates an experiential approach to learning. Kolb's model has been supported by many studies. In a game-based pilot for teaching the game theory underpinning sustainability ethics, Sadowski et al. argue that an "experiential pedagogy moves the learning experience . . . from predictable to surprising" (Sadowski et al. 2013, p. 1337). This is particularly relevant to **(LO2)**: while game theory often predicts closed, rational solutions, real-world scenarios are invariably more dynamic and unpredictable.

Experiential learning alone, however, is insufficient: players are left with impressions and intuition without the ability to coherently justify their decisions. To most effectively meet the stated learning objectives, a hybrid of experiential and cognitive learning is essential.

While many tabletop games incorporate game-theoretic concepts—most notably Nash's own *So Long Sucker* (Jerade 2024)—there are fewer games which are designed to directly draw out the concepts, translating experience into learning. Reber et al. (1999) make a distinction between implicit and explicit learning. They define implicit learning as the process whereby "knowledge is acquired largely independently of awareness" (Reber et al. 1999, p. 475), while explicit learning occurs at a conscious level.

Reber et al. (1999) claim that explicit learning is characterised by an ability to articulate understanding. Thus, to achieve **(LO3)**, it is crucial that the game includes modes of explicit learning.

While cognitive and experiential pedagogies are often presented in contrast, *The Boardroom* draws upon both to effectively support the given learning objectives. In the following section, we will discuss how both approaches are embedded into the game's mechanics.

3 Gameplay and Embedded Learning

3.1 Game Overview

The Boardroom casts players in the position of executive business leaders aiming to maximise profits. Across seven meetings, players divide themselves into opposing coalitions, each led by a CEO who selects the final move from a payoff matrix. Players negotiate, collude, and strategise to maximise their returns each meeting. After the final meeting, the wealthiest player wins.

Display Payoff Matrix
Thinking Time (1 minute)
Choose Coalitions
Elect CEOs
Strategise (3 minutes)
Resolve Payoff
Express Trust
Reflect

Table 1: *The Boardroom's* meeting phases (the Agenda).

3.2 Embedded Learning

The Boardroom features a protected one-minute thinking period within every meeting. Rowe (1986) describes the positive impacts of wait time in educational settings, including an increase in participation, confidence and logical reasoning.

During this protected thinking time, players are encouraged to analyse the payoff matrix, targeting **(LO1)**. Without this time, decision-making in subsequent meeting phases would likely be arbitrary, or at best intuitive. The thinking time, therefore, is designed to support progression up Bloom's Taxonomy (Krathwohl 2002); players examine the situation (analyse), which subsequently informs their strategy (create).

Moreover, Kolb's Experiential Learning Cycle (Kolb 1984) is embedded into the game's structure. Indeed, this cycle encapsulates the implicit and explicit modes of learning (as in §2.2). During the reflect phase, the matrix card is flipped to reveal typically two questions. One of these is designed to draw out the technical concepts present in the matrix, targeting **(LO1)** and **(LO4)**. The other encourages discussion of the players' experience in playing the matrix compared to the rational game-theoretic solution of the game, targeting **(LO3)**. Moreover, CEO bonuses and open negotiation incentivise risky, non-rational solutions, highlighting why game-theoretic predictions may fail **(LO3)**.

Kolb's Learning Stages	**Boardroom Meeting Phase**
Active Experimentation	Strategise
Concrete Experience	Resolve Payoff
Reflective Observation	Reflect
Idea Development	Thinking Time

Table 2: Kolb's Experiential Learning Cycle embedded into *The Boardroom's* meeting phases.

The Boardroom extends beyond the limits of Kolb's experiential model through the teaching element within the reflective discussion. Players are not assumed to have any prior exposure to game theory. As such, no amount of reflection will elicit from players a formal understanding of key concepts and terms, such as Nash equilibrium, Pareto optimality and Iterated Strict Dominance. Here, the facilitator is essential: they explain concepts upon first exposure, but encourage player-led explanations when concepts reappear. To support this and **(LO4)**, players are given a *Key Lingo* card, which defines important terminology.

New meetings begin with a payoff matrix being displayed. Drawing upon the Flow Theory of learning (Csikszentmihalyi 1990), these matrices are tiered by difficulty. This increases challenge as the game progresses, so that players neither experience anxiety nor boredom. The facilitator gauges the players' confidence with the concepts and chooses a suitable matrix card.

Together, the mechanics of the *The Boardroom* couple experiential modes of learning with cognitive scaffolding to allow players to encounter and explicitly articulate game-theoretic concepts.

Tier	Dim.	Concepts	Other
Tier I	2x2	Nash equilibrium, Pareto optimality, Dominant Moves	Canonical 2-player games
Tier II	3x3	Iterated Strict Dominance	
Tier III	3x3		Altered game mechanics

Table 3: The tiers of matrix cards in *The Boardroom*.

4 Prototyping and Visual Communication

Dual coding theory proposes that learning is most effective when information is encoded both verbally and visually (Clark & Paivio 1991). Thus, the visual design choices made in *The Boardroom* are not merely aesthetic; they reduce friction and cognitive load during learning.

The matrix cards present players with the mathematical basis of each meeting; they are a significant source of cognitive load. Mayer & Moreno (2003) explore how the incidental processing of extraneous material can lead to cognitive overload. The matrix card design is therefore purposefully minimal, featuring a plain background and generous white space.

The inclusion of the Agenda on the game board also reduces cognitive load (Sweller 1988). Players, rather than focusing on procedural elements, are liberated to engage more deeply with the game's strategic and conceptual content.

Figure 1: *The Boardroom* game board and matrix card in greyscale.

The Boardroom has also been designed to be colour-blind accessible, with colour never used as an exclusive means of communicating information. Consequently, the game remains functional in greyscale (See Figure 1). These design choices lower the participation threshold for colour-blind players, while enhancing clarity and usability for the wider learner population.

5 Playtesting and Iterative Design

The game was playtested three times, across different player counts. Participants typically had little to no prior exposure to game theory, but possessed a baseline of mathematical maturity, having studied mathematics up to A-level standard or equivalent. Each game was followed by post-game feedback, including written comments.

In general, participants found that the game was well-aligned with the learning objectives, supporting meaningful interaction with unfamiliar concepts. Players reported that they were comfortably able to "understand the key concepts", attributing this in part to the sequencing of tiered matrices, which "gradually introduc[ed] concepts." In response to this feedback, the diversity and range of tiered matrix cards were expanded.

However, playtesting also exposed mechanics which hindered learning. In early playtests, the game featured an additional win condition based on trust, leading to an unbalanced and unsatisfying final round, where players completely determined the winner through their final allocation of trust. This rendered strategic analysis redundant and limited learning, conflicting with **(LO1)**. Following playtester feedback, the trust-based win condition was removed while both money and trust became hidden resources. This improved the game's tension arc, while sustaining learning through to the game's conclusion.

6 Assessing the Learning Objectives

Each playtest, participants were given identical pre- and post-game tests, designed to track progress with learning objectives. Questions were constructively aligned with specific learning objectives (Biggs et al. 2022).

The results are summarised in Figure 2. Clearly, playing *The Boardroom* produced meaningful improvement in understanding and technical competence, with particularly significant improvements in **(LO1)** and **(LO4)**. Improvement in **(LO2)** was marginal, though this was largely due to high pre-game scores. It was interesting, however, to note a shift in answers towards social dynamics like "grudges" or "mis-judg[ing] other people's decisions" as the source of game-theoretic predictions failing. This demonstrates that players' gameplay experience foregrounded social dynamics as a fundamental source of game theory limitations.

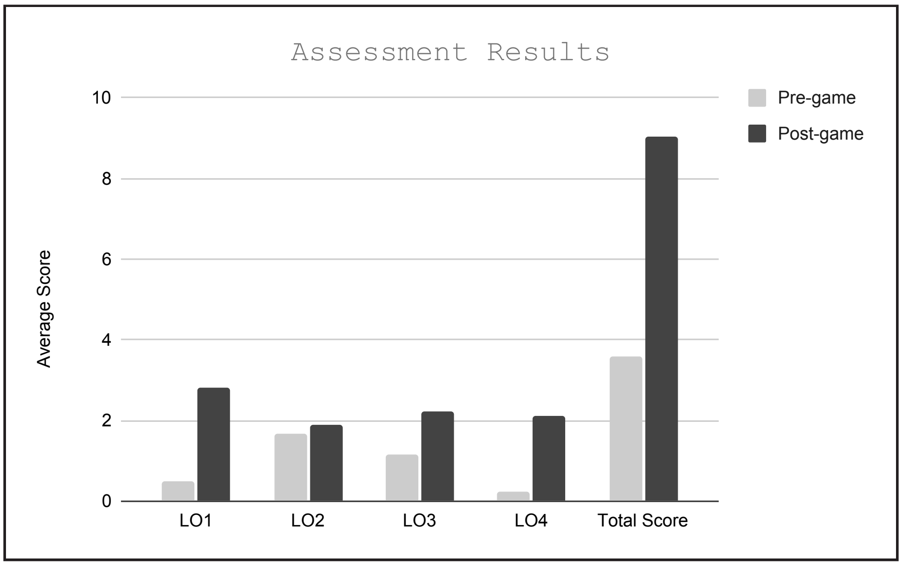

Figure 2: A comparison of pre-game and post-game test scores.

7 Future Direction

Here, we discuss future developments for *The Boardroom*, informed by playtesting feedback.

Facilitator observation indicated that an unrepresentative sample of matrix cards could lead to neglected concepts. The introduction of concept icons on matrix cards could enable more deliberate facilitation, ensuring even coverage of the targeted concepts, while strengthening alignment with **(LO1)** and **(LO4)**.

Playtesting also revealed a perceived sense of powerlessness among non-CEO coalition members, leading to occasional redundancy in strategy. This exemplifies the argument of Csikszentmihalyi (1990): tasks viewed as unachievable inhibit learning. One possible refinement to resolve this is the introduction of a 'secretary' role, who eliminates one choice from the matrix before the CEO selects their move. The secretary would not receive CEO bonuses and would therefore act in the interests of the wider coalition, restoring strategic agency.

8 Conclusion

By embedding learning objectives directly into the game's mechanics, visual design and pedagogical structure, *The Boardroom* allows players to experience game theory and its limitations through play, while strengthening technical understanding. Playtesting and assessment data evidence meaningful progress towards learning objectives, indicating clear alignment between the game's design and purpose. *The Boardroom* demonstrates potential for serious games as effective tools for teaching mathematical concepts.

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