# The Pragmatics of Board Games in K-12 Science Classrooms

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**Abstract:** As board games are emerging as an option for learning environments, we are exploring a framework to analyze board game syntax, semantics, and pragmatics. Our approach connects game characteristics to science content and learning goals, and describes student meaning making—and potential misinterpretation—of game attributes, all to inform the development of support materials for games to help teachers effectively take advantage of a growing number of commercially available, science-themed board games as learning tools.

## Background and motivation

The last decade has brought much attention to the connection between video games and learning (e.g., Salen et al., 2011; Gee, 2003). However, there is now increasing interest in board games, which are growing in thematic range and complexity, and require long-range planning, deep strategic thinking, collaboration, and other skills. Some work has explored the cognition and activity patterns in board game play, and the idea of using board games as learning tools in different contexts (e.g., Garcia-Barrios et al., 2017; Berland & Lee, 2011; Gobet et al., 2004). Other work describes the potential for board games to be used as learning tools in K-12 settings, especially in how board games convey different science ideas and how teachers can use them in classrooms (e.g., Bricker et al., 2018; Mayer & Harris, 2010). However, others note that there continues to be a need for more research into board games and their potential educational uses (e.g., Evans, 2013; Gobet et al., 2004).

Given this backdrop, we are interested in exploring how board games might be incorporated as learning tools for science learning environments, especially considering the number of science-themed board games that are on the commercial market. The goal and challenge is to think about *how we can analyze these games* to see whether we can effectively *use, adapt, and integrate* them to support science classroom curricular activities: What aspects of board games might align with science content and learning goals, how might board games be potentially modified to better support these learning goals, and what kinds of support materials should be developed to help teachers and students use board games as learning tools?

## A framework to analyze games for classroom use

We ground this approach by applying and extending a general, multi-dimensional framework developed by Klabbers (2009). Our goal is to develop concrete examples that are lacking to illustrate how these framework dimensions might inform the use of board games as learning tools. We use this framework because it views games as social system and multimodal texts, and it provides a language that allows us to consider games as learning objects with respect to a particular learning environment. Taking a multimodal, social system view of board games in the classroom allows us to not just look at games themselves in a vacuum, but also to consider: the role that games can play within a learning environment, how games can be connected to classroom curricular goals, and possible approaches for developing or modifying the rules and resources of a game to help make more cohesive connections to classroom learning goals. This framework describes three aspects of games: the ***actors*** in the game, the ***resources*** included in the game, and the sets of ***rules*** for the game. Beyond these game aspects, the framework also describes three perspectives of a game from which we can analyze game actors, resources, and rules: the game syntax, game semantics, and game pragmatics.

***Game Syntax***. This defines the formal system of the game, or the actual game players, components, and features. We can consider the basic aspects of a game (i.e., actors, resources, rules) as follows. The *actor syntax* includes the game participants, including game players (e.g., students) and facilitators (e.g., teachers). The *resource syntax* includes the game space, game pieces, and a reference system describing game positions (e.g., a game board). The *rule set syntax* describes how the game space is manipulated, how the game pieces move over time, how different game states are evaluated, what constitutes the initial and final game positions, and game completion rules. Game syntax analysis describes the game's basic goals and structure, and potential science-related concepts and ideas in the game. This information helps make connections between the game concepts, and science content, standards, and curricular goals that could be part of a gaming session.

***Game Semantics***. This defines how game participants interpret and make meaning from the game syntax, and how the game corresponds with their conceptual frames (e.g., science concepts). Here, the *actor semantics* are the roles the game participants take during the game to provide a context for defining the resources they can use, the moves they can make to achieve their goals, the information they can access during

the game, etc. The *resource semantics* include the symbolic meaning of the game pieces in the game space, and the symbolic interpretation of the placement of pieces at any given time to define a particular state of the game system. The *rule set semantics* describe the relationships between the roles, and the manner in which roles are allowed to interact with other roles in the game. The rule set semantics also describe any other conventions, procedures, rituals, etc. beyond the formal syntactical rule sets that may emerge or be developed as different social situations are evaluated throughout the game play. Game semantics analysis describes how the game participants interpret the different game-related and science-related concepts in the game, how they may misinterpret some of those concepts, and instances when the game may introduce incorrect or misleading science ideas. This information helps identify areas where game modifications or clarifications may be needed, and where additional scaffolding could be added to the game to support the science related concepts introduced in the game and expanded upon in the classroom.

***Game Pragmatics.*** This defines the manner in which a gaming session is designed, prepared, conducted, and assessed by the game facilitator who runs the gaming session. The *actor pragmatics* describe the possible learning goals for the players and the learning approaches to be taken in the context. The *resource pragmatics* describe the physical game playing space and selected resources that are set up and distributed by the game facilitator—the formal game resources from the game syntax, along with other resources outside the game that could aid players with interpretation and meaning making during the game. The *rule set pragmatics* include the formal rule sets from the game syntax, plus possible sets of informal rules (or "house rules") developed for the game session. Describing the game pragmatics involves looking at the information from the game syntax and game semantics to help set up the game effectively within the learning context.

## Informing classroom use of board games

This framework allows us to restate our goals for using board games as learning tools in classroom environments. If we consider teachers as game facilitators, then we need to *support the game pragmatics* by developing materials, supports, and potential game modifications that can help board games become more integrated, effective learning tools for the classroom.

We can outline this larger board game analysis approach as (1) analyzing the game syntax and semantics to connect a game to science learning goals and other curricular/pedagogical resources, (2) potentially modifying the game rules and resources to develop game variants that more closely align the game with science content and learning goals, and (3) supporting teachers with the game pragmatics by developing resources for enacting game sessions and connecting those sessions to curricular goals. We have started to refine and use this approach to analyze several commercial science-themed board games (e.g., Compounded™, Pandemic™), to begin developing case studies of how we can use these games in science classrooms. Given the difficulty and challenge of designing good games from scratch, we hope to explore this approach of using well-designed, well-produced commercial board games as a base, and then determining ways of supporting and using those games as tools to support science learning.

## References


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