# Board Game Design as Alternative Educational Material and Frequently Used Game Mechanics

# Alternatif Eğitsel Materyal Olarak Masa Oyunu Tasarımı ve Sık Kullanılan Oyun Mekanikleri

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## ABSTRACT

This study emphasizes the potential of board games as alternative educational materials and examines their structural features for informational communication. While game design involves aligning mechanics, narratives, and physical components with a specific theme, this article focuses on identifying and explaining board game mechanics that can be adapted to educational purposes. A comprehensive review of databases and literature identified 8,614 board games classified under the "educational games" category. Among these, 130 educational board game samples were analyzed under a secondary limitation, leading to the identification of 17 frequently used game mechanics in contemporary productions were identified. Using content analysis, both quantitative and qualitative data were examined to explore the prevalence and functions of these mechanics. The 17 mechanics identified across the 130 games were categorized based on their frequency of use and described individually in the "Findings" section, which also includes three case studies illustrating their application. Additionally, using thematic analysis, a secondary evaluation further analyzed the frequency of these mechanics in relation to the types of information they convey. This research is expected to serve as a valuable resource for prospective teachers, educators, and scholars in the development of educational materials.

**Keywords:** Educational material, board game design, game mechanics.

## ÖZ

Bu çalışma, masa oyunlarının alternatif eğitim materyalleri olarak potansiyelini vurgulamak ve bilgi iletişimi için yapısal özelliklerini incelemek üzere gerçekleştirilmiştir. Oyun tasarımı, mekanikler, anlatı ve fiziksel oyun unsurlarının belirli bir tema bağlamında uyumla işlenmesi iken, bu makale özellikle eğitim içeriğine uyarlanabilecek masa oyunu mekaniklerini tanımlamaya ve açıklamaya odaklanmaktadır. Veri tabanları ve alan yazında yapılan kapsamlı incelemede, "eğitsel oyun" etiketiyle sınıflandırılmış 8614 kutu oyunu tespit edilmiş; bunlar arasında yapılan ikincil sınırlandırmayla 130 eğitsel masa oyunu örneği incelenmiş ve güncel yapımlarda sık kullanılan 17 adet oyun mekaniği belirlenmiştir. Nicel ve nitel verilerin içerik analizi ve sonrasında tematik analiz yöntemiyle incelenip yorumlandığı çalışmada, 130 oyun arasında tematik çakışmalarla çoklu olarak uygulanmış oyun mekanikleri, kullanım sıklıklarına göre listelenmiş ve "bulgular" bölümünde tekil betimlemeler halinde açıklanmıştır. Ayrıca, eğitsel içeriğe konu olan bilginin türüne göre kullanılan mekaniklerin dağılımı ve tematik örtüşmeleri, izleyen bölümde değerlendirilmiştir. Araştırmanın, eğitsel içerikli materyal geliştirme sürecinde öğretmen adayları, eğitmenler ve alan akademisyenlerine etkili bir kaynak oluşturacağı düşünülmektedir.

**Anahtar Kelimeler:** Eğitsel materyal, masa oyunu tasarımı, oyun mekanikleri.

**INTRODUCTION**

Playing is a natural part of human behavior as a formative basic act in every society and an important factor in the creation of a common culture. However, aspects of game that are directly related to the act of education or learning derive from the most primitive forms of imitation and superiority. These two forms naturally provide empathy and understanding beside physical and cognitive development in a person. The idea that games can be effective tools in information communication, is an academically based and widely accepted approach today, among the subjects of applied scientific studies carried out by educational scientists and educational psychology experts, especially since the 1980s (Bochennek et al. 2007; Guralnick & Levy, 2010; Naik, 2014; Taşpınar, et al., 2016; Willet et al., 2018; Talan, et al., 2020; Nautiyal, et al., 2024). In accordance with the principles of Brain-Based Learning (Caine & Caine, 1990) and sociocultural theory (Vygotsky, 1978; as cited in Qian & Clark, 2016), along with experiential (Kolb, 1984, as cited in Bochennek et al. 2007) and constructivist teaching approaches, games are among the frequently utilized as tools in alternative learning environments. They provide effective medium for fostering insights through experiential processes that extend beyond mere visual and auditory comprehension (Caine & Caine, 1990, p. 60) and by establishing social contexts in which real-life experiences are simulated through reciprocal interaction, observation and modeling (Hense & Mandl, 2012, as cited in Talan, et al., 2020). From creative drama to role playing games, from physical interactive games to video games, from board games to simulations, all kind of games have many advantages on processing academic information converted into empiric records as patterns into learner's memory and sharpening the insight towards intended knowledge by incorporating authentic solutions produced by the learner from past life experiences into this experiential process (Lainema & Saarinen, 2010).

A comprehensive review of the Game-Based Learning (GBL) literature reveals that most studies evaluating the practical effects of games in educational contexts are conducted on use of digital games or those played with the assistance of computer or electronic tools. Moreover, the number of studies examining the effects of educational board games on learners, both through experimental research and by proposing framework programs, is considerable (Bochennek et al. 2007; Naik, 2014; Chiarello & Castellano, 2016; Willet et al., 2018; Cardinot et al., 2022; Nautiyal et al. 2024). A meta-analysis study conducted by Talan, Doğan and Batdı (2020), which examined studies on the use of digital and non-digital games (i.e., board games, card games and physical games), reported several cognitive benefits of games used in educational contexts, including facilitating the concretization of abstract concepts, promoting learning through discovery, enhancing inquiry and problem-solving skills, fostering critical thinking and creativity, improving visual recognition abilities, and contributing to self-expression and mathematical proficiency (p. 17).

Among the types of games used in educational environments, board games are distinguished by their three-dimensional structures which allow concrete understanding and their layered formation in which the subject can be handled with different dynamics (Chiarello & Castellano, 2016). When the contents of board games are planned purposefully, they can be used as effective communication tools where information is processed into visual, tactile and textual layers. When the educational content is subjected, unlike books that offer linear narration, board games can provide experiential, social and unconditional learning environments and trigger relational thinking abilities with their formative advantages (Huang & Levinson, 2012, p. 141-148). While many studies reveal that board gameplay enhances rational thinking, mathematical understanding, content learning and collaboration skills during ongoing computational thinking process, some of them indicates improvement on communication, negotiation and cooperation skills of and among the players (Bayeck, 2020; Talan, et al., 2020).

Board games have many advantages also in practical aspects. In comparison with digital games, design and development process is shorter and production stages are practical. They are relatively easy to prototype even with paper and everyday objects. Within the same comparison, it can be seen that board games have several advantages in terms of equality of opportunity in education, especially in the perspective of user experience. They are printed materials, just like books, so they do not need electronic providers, they are permanent and portable.

Board games are kind of designed systems and once the development stages are understood, teachers can use them to teach any informational content on an experiential dimension and even the design techniques can easily be taught to students in order to support their active learning process (Bayeck, 2020; Cooke et al., 2020). Moreover, since they are multiplayer, they also create a social learning environment. With all these mentioned advantages, board games can easily be evaluated among the production of "serious games" which are purposely created as more than games.

### 1.1. Board Games in Educational Context

The concept of a board game is based on the principle that two or more players take actions in reserved areas on a game board with the motivation of defeating their opponents in a fictional game scenario. In this system, the game board provides a visual environment that players can adapt according to a determined theme. Just like the ability of performing arts such as cinema and theater, in purpose of drawing the audience to the intended time frame and event stream, board games can also encourage their players for reasoning and making inferences to achieve a result with common goals at a common moment, by their expressively visualized game boards which is supported by the theme and game narrative. Board games are generally exemplified by abstract games such as backgammon, checkers, go and chess, having the most basic mechanics; or by games with high worldwide sales such as Monopoly, Cludo, Risk, Catan, that have original themes and are designed with different scenarios and rules.

Considering the historical development of board games, which are among first artifacts which documents the transition of people to a settled life, it can be said that they have been produced for young generations to adopt current social values, especially since their usage in Asian civilizations. In this context, they have been adopted as educational materials for many years. Since the 16th century, they have been used in school and family environments in order to gain direct moral and academic knowledge in Europe (Kaszap et al., 2013). Many board games popular in the history of modern America are considered to be produced with the purpose of teaching new norms of the industrial society to the young generation around 19th century (*Author*, 2021, p. 60 - 108). In accordance with Vygotsky's (1978) sociocultural constructivist arguments, games have played a role for the new generation to "explore social roles, form hypotheses, test new ideas, and develop skills by playing" (as cited in Qian & Clark, 2016). In contemporary game production, on the other hand, new generation of designs which create a simulation environment in line with the themes of a fictional universe offered by the board so that players can internalize the narrative, are called "Eurogames" or "Euro Style Games" and differentiate in the genre (Woods, 2012: p. 81). Especially, such thematic board games, also referred as "designer games", are being used in educational environments since they contain complex mechanics and encourage the player to develop strategies at different awareness levels (Mayer & Harris, 2010, p. 10). It is important to indicate that exactly this kind of games are the main focus of this research because of various themes that they offer from science to history, from current sociological issues to space, archaeology or local culture and their ability to support mental activity.

At the point reached today, board game design is a process of intellectual creation, in the harmony of game theme, game mechanics and game components. This triad is similar with Form-Function-Technology in industrial design (Beltrami, 2018) and shares common features

with the most known framework of digital game development, Mechanics-Dynamics-Aesthetic (Hunicke et al., 2004). While the game theme is a set of game narrative and visual expressions that are built to convey any subject to the player, game mechanics can be summarized as rules and interactions in the game system and can be considered as behaviors and attitudes that players should perform during interaction with the game (Cooke, et al., 2020). The correlation between these two is the primary starting point of game creation. Game components, on the other hand, can be described as physical elements that ensure interaction between players and the game, such as cards, dice, tokens, pawns and meeples. Usually, techniques and approaches that need to be applied during the information adaptation process are different at organisation of these three substructures, and the stages of their development can be treated as subjects of different articles. But as a general framework, for the creation of a board game that will be designed with the aim of information communication, these three substructures must be constructed in harmony in accordance with the purposed information.

### 1.2. Statement of the problem

Despite extensive academic research on the development of educational digital games—particularly within the fields of Computer and Learning Technologies—systematic studies on educational board game design remain scarce. This imbalance is often attributed to the perception that digital technologies better align with 21st-century skills (Qian & Clark, 2016), while board games are considered outdated (Talan, et al., 2020). Nevertheless, board games, with their unique advantages as being mentioned before, also possess many attributes that support the 21st-century skills, such as critical thinking, communication, collaboration, creativity, and "life and career skills" (Kay, 2010, p. XV). Therefore, it is crucial to recognize that effective learning environments should incorporate a diverse range of materials beyond just digital applications. Due to their more practical development phases, board games might be considered among those materials and after learning the basic principles even teaching the design practice to develop them offer significant potential for project-based learning settings.

Although the literature includes several proposed frameworks for integrating board games into educational settings, most focus on adapting existing games and assess their impact through limited experimental studies (Taşpınar, et al., 2016; Cardinot et al., 2022; Nautiyal et al., 2024). This suggests that practical analyses of board game design processes have either not been conducted or have provided only limited guidance on designing pedagogically structured board games. In other words, these frameworks have not been effectively utilized to develop original board games tailored to educational content.

Given these considerations, providing instructors, teachers, and prospective teachers with accessible methods and guidance on creating or facilitating the creation of educational board games is essential. To address this gap, this study aims to systematically examine and categorize frequently used game mechanics in educational board games as a foundational component of game design. By identifying mechanics that effectively facilitate information transfer within a game context, the research also seeks to provide educators with a practical resource for designing alternative instructional materials. Furthermore, the study will also offer singular descriptions and examples of the most common and frequently utilized mechanics, making it a valuable resource for instructors interested in developing experiential educational materials through board games.

The study is conducted align with this research questions:

RQ.1. What are the most frequently used game mechanics in educational board games, and how do they contribute to effective information transfer?

RQ.2. Are there any recurring patterns in combination of the use of game mechanics in educational board games and if there is, is it possible to observe a system for the practice?

RQ.3. Is it possible to categorize frequently used game mechanics in educational board games, according to the type of information they convey?

By seeking answers to this question, the research aims to establish a knowledge base for board game design, particularly for educational material development courses in teacher education programs.

### 1.3. Limitations of the study

The exact focus of this study, contemporary board games which are referred as Eurogames, are not mostly known productions considering the frequency of use around the world. In general terms, although board games have a deep history in eastern culture, Eurogames is among the entertainment productions mostly adopted in Europe and America, which we can define as western societies. For instance, in regions like Turkey, professional board game production is limited, and there is a lack of educational or informational board game designs in the local context. However, a global survey, particularly conducted in Europe and America, would reveal numerous examples that are classified with the label of "educational board game". And, by examining this examples, systematic method suggestions can be developed for designing or restructuring board games with educational contents.

As mentioned before, these techniques can be systematized separately in the focus of game narrative, game mechanics, and game components, at the development process of educational board games. The primary objective of this article is to study and classify frequently used and effective game mechanics for adapting educational content to board game structures. This is the first publication of prospective three consecutive articles, by categorizing the mechanics, it is aimed to constitute a comprehensive roadmap for teachers and prospective teachers so that they can develop board games compatible with their course contents in line with their creativity. The study focuses on contemporary board games, by their use in school settings due to their variety of themes, complex game mechanics and their potential in developing strategic thinking skills.

## METHODOLOGY

This study employs a mixed-methods approach, as the frequency data of game mechanics used in educational board games is obtained through content analysis, while qualitative inferences to identify and analyze game mechanics suitable for educational purposes, based on the type of information they transfer, are interpreted by evaluating the thematic overlaps the games contain.

The primary source of data for the research was a comprehensive board game database, BoardGameGeek (www.boardgamegeek.com), which is widely recognized as the most extensive repository of board game information (Willet et al., 2018; Kosa & Yılmaz, 2020; Sousa et al., 2021; Rogerson et al., 2021) According to BoardGameGeek (2024), there are a total of 192 distinct game mechanics documented across all board games produced to date. The database lists 8,614 games under the "educational games" category. To refine the focus of the study, a secondary scan was conducted, excluding card games, mind games, and abstract strategy games. This secondary scan aimed to concentrate solely on thematic board games published after the year 2000, which had a success rating of 6.0 and higher. The success rating threshold was set to ensure the inclusion of games that might be less popular or well-known but could still offer valuable insights into game mechanics. This filtering process resulted in the identification of 130 (n=130) relevant board games.

In the study, which began as a quantitative research to catalog and examine game mechanics suitable for informational communication, a content analysis was conducted to

identify recurring mechanics. Although the content analysis method is primarily used in social sciences for interpreting qualitative information, it can also be suitable for evaluation of quantitative data to examine frequencies and trends (Ültay, Akyurt, & Ültay, 2021). In this study, the data analysis involved systematically coding and categorizing the game mechanics based on their frequency of use across the selected 130 board games. Initially, games were listed in alphabetical order and assigned a letteral code representing the type of information they conveyed. The letter 'H' was used to represent the History theme, 'G' for Geography, 'B' for Biology, the combination 'PHC' for Physics and Chemistry, 'MG' for Mathematics and Geometry, 'L' for Language and 'V' for the Various theme in the categories, thus forming the first descriptive section of the coding. Then the code was followed by a numerical section representing the game's order in the list. There were several games that carried information from different fields, as history theme was combined with biology knowledge and also supported mathematics and geometry (see the coding list in the appendix, H40/B/MG code refers to the game 'Pandemic: Fall of Rome'). For such games, the coding system consisted of four sections, first letteral code represented the game's main theme, numerical code represented its order in the list within its theme category, then the sections were divided by a "/" sign and followed with the abbreviation of the next most dominant theme. The detailed coding list of the analyzed games is provided in the appendix of the article. Each mechanic is explained in detail in the Findings section, providing insights into its function and application within educational board games.

Following the initial coding and quantitative assessment, qualitative inferences were drawn to provide a deeper understanding of the thematic distribution of game mechanics. Thematic analysis was utilized to interpret the data (Braun & Clarke, 2006), focusing on how these mechanics are employed to facilitate educational content and engagement according to the type of information they convey. The identified game mechanics were secondarily classified based on their frequency of use.

In contemporary board game productions, these game mechanics can take place in double, triple or multiple combinations. Thus, a creative and flexible space is provided for the simulation of content in game design. The discussion section in which the identified game mechanics are demonstrated over several educational board game productions, explores the practical application of the findings and questions how various type of information can be transferred through specific game mechanics. The discussion provides a conceptual framework for understanding how different mechanics can be paired to achieve educational objectives, offering practical guidance for educators and game designers interested in developing educational board games.

**FINDINGS**

### 3.1. Frequently Used Game Mechanics

It was found that 17 game mechanics were frequently matched in the scanning made of 130 educational board games. Looking at the distribution of these mechanics; *card drafting* mechanic has been seen in 50 games, *dice rolling / roll and move* mechanic in 43 games, *set collection* mechanic in 42 games, *hand management* mechanic in 37 games. These most common mechanics were followed by these others which are observed with same frequency; *area majority* mechanic with 22 games, *point to point movement* mechanic with 22 games and *variable player powers / role playing* mechanic with 22 games. While these first seven game mechanics are being listed on the top of the list (top five and additional two because of the equality), other frequently used game mechanics were recorded with the considerable number of times. These other were recorded as s*imulation* mechanic with 21 games, *tile placement* mechanic with 21 games, *worker placement* mechanic with 20 games, *area movement* mechanic

with 19 games, *action points* mechanic with 15 games and *trading mechanic* with 13 games. And, the mechanics that are seen to be used less to compared to those are *auction / bidding* with 10 games, *pick up and deliver* with 8 games, *network and route building* with 7 games and *storytelling* with 5 games (Table 1).

In the aforementioned distribution, although they were different mechanics in theory, *dice rolling* with *roll and move* mechanics, and *variable player powers* with *role playing* mechanics were seen as similar practices in terms of their contribution to the information function in the game and were evaluated together in the comparison of the frequency that they were used. In the diversity of the way the games are played, the game structures in the single player moves setup, as well as the cooperative game structures in which all the players progress as members of a single team with different skills against the game scenario, and the team-based game structures in which the players compete against each other in the teams they form are among the different design applications.

After being explained one by one, the game mechanics mentioned will be described in their usage patterns over sample game productions, most of which appear to be incorporated into game design in different combinations.

**Table 1**

*Distribution and Frequencies of Board Game Mechanics in Educational Contents*

| Mechanics | Reviewed Board Games | Frequencies | Percentage |
|---|---|---|---|
| *Card Drafting* | H3, H4, H5, H6, H7, H8, H9, H10, H12, H14, H15, V5, MG1, G8, G9, G10, B2, H21, B3, B4, MG4, H23, PHC3, H28, PHC5, G14, H31, H32, B10, V15, B11, H37, H42, H43, PHC9, B15, H44, H47, B16, V17, H48, V18, H49/PHC, H51, G16, G17, H52, H53, H54, B18 | 50 | %38.46 |
| *Dice Rolling / Roll and Move* | G1/MG, H2, V1, G9, H6, H4, H5, H8, V2, V3, G7, B1, H11, H13, H15, PHC1, H16/V, V5, MG1, H17, H18, H19, B2, H21, B5, MG4, H23, H27, G13, H31, H32, PHC7, B10, H35, H39, B14/MG, H45, H46, H48, H44, H50/PHC, H51, B18 | 43 | %33.07 |
| *Set Collection* | G2, G3, G4, G5, V3, V5, V7, B3, B4, G12, MG3, H25, H27, H28, H29, V10, PHC4, B6, G14, B8, H30, B10, G15, H36, H38, B12, PHC8, B13/MG, H40/B/MG, B14/MG, H41, H42, PHC9, V16, PHC10, PHC11, H44, PHC12, MG6, G16, G17, B18 | 42 | %32.3 |
| *Hand Management* | G2, G3, G4, G5, H4, H13, V5, H20, B3, H22, PHC2, H28, B7, PHC6, PHC7, V13, H36, H37, MG5, B13/MG, H40/B/MG, B14/MG, H42, H43, V16, B15, PHC11, H45, L3, H47, PHC12, H49/PHC, H51, G16, G17, B17, B18 | 38 | %29.23 |
| *Area Majority* | H3, H4, H5, B5, H23, PHC3, B7, PHC6, H32, H34, V12, H37, H41, H43, PHC9, H46, H47, V17, V18, H50/PHC, G18, G19 | 22 | %16.92 |
| *Point to Point Movement* | H1, H7, V2, H13, H18, MG2, B5, G12, H28, H31, H32, H33, H39, B13/MG, H40/B/MG, B14/MG, PHC10, PHC11, G16, G17, G18, G127 | 22 | %16.92 |
| *Variable Player Powers / Role Playing* | G1/MG, V1, H4, H6, H13, H16/V, V5, H17, G11, H20, H26, V10, H33, V13, H35, B13/MG, H40/B/MG, B14/MG, H45, H49/PHC, H50/PHC, H51 | 22 | %16.92 |
| *Simulation* | G1/MG, H2, V4, H11, V7, H20, B5, H23, H32, B10, V12, V13, H35, MG5, B12, H43, PHC9, H46, H47, V17, G18 | 21 | %16.15 |
| *Tile Placement* | V4, B1, V5, G9, G10, L1, V8, H25, H26, PHC5, H29, V12, B11, H37, B12, H41, H42, L3, B16, H53, H54 | 21 | %16.15 |
| *Worker Placement* | H7, V4, H9, H14, H25, H26, PHC3, B6, B8, H30, B10, V13, H36, PHC8, H39, V18, H50/PHC, B17, G19, H54 | 20 | %14.61 |
| *Area Movement* | H2, H3, H4, H5, H6, H7, V3, B1, H14, H17, H20, PHC2, V10, H32, V14, H43, H46, H47, G127 | 19 | %14.61 |
| *Action Points* | V2, H11, L1, V9, B13/MG, H40/B/MG, B14/MG, H43, H46, H47, PHC12, H48, H49/PHC, G119 | 15 | %11.53 |
| *Trading* | L1, H21, H27, PHC4, H29, G13, V11, H34, PHC7, MG5, B13/MG, B14/MG, H42 | 13 | %10 |
| *Auction / Bidding* | B1, V6, H20, H27, H28, G13, B9, V12, MG5, G18 | 10 | %7.69 |
| *Pick and Deliver* | H7, B1, H24, H29, PHC6, H33, V16, H52 | 8 | %6.15 |
| *Networking and Route Building* | H22, H24, H34, B14/MG, H49/PHC, G18, B17 | 7 | %5.38 |
| *Storytelling* | V1, H16/V, V9, G90, L3 | 5 | %3.84 |

*Card Drafting* mechanic is one of the frequently used mechanics in board games, with the function of providing randomness to the game, as well as directing the flow of moves of players. It is based on the practice that each player draws cards from the decks, which might be placed in various parts of the game board. It might be a turn base movement or might depend on a trigger of a function in the game. Players can make moves by the information or direction written on the cards they have drawn, and maybe they can earn points with these moves

(BoardGameGeek, n.d.-e). In some cases, players select a card for their hand and pass the rest of the deck to the next. In these cases, players immediately effect the game of the neighbor player. Depending on the game context, this system can be used to restrict or to accelerate the players' movements, intentionally (Engelstein & Shalev, s. 209, 536). In addition, it has been observed that cards enable the processing of textual information content into the game stream, especially in educational game productions. For instance, in a game design context with an historical teaching, game conditions which would come out of the cards can provide the player with a time lapse, or the question and answer function can be installed on the cards. It was found that this mechanic has been used in 50 educational games that were examined.

*Dice Rolling* or *Roll and Move* mechanics were evaluated together in this review and it was seen that they were used in 43 educational games in total. *Dice Rolling* movement style can be used for many purposes in a game; in some cases, it can be used in terms of providing randomness in production of resources (see. *Catan* – Designed by KlausTeuber), in other cases (especially in war games) it can be used in order to determine the ruler of an area (see. *Risk* – Design: Albert Lamorisse, Michael I. Levin, 1959) as determining superiority. In some games, players can move on the board by rolling the dice (see *Colosseum* – Designed by Wolfgang Kramer, Markus Lübke, 2007); when used with this function, the mechanic changes its name and turns into another mechanic called "roll and move" (BoardGameGeek, n.d.-f; Engelstein & Shalev, s. 435). From the most primitive board games, it is the first structure that is used to provide movement in the game stream and is the easiest game mechanic for newly players to adapt. For this reason, it seems like it is often preferred in educational games which are designed for the low age groups and in the development of games designed for target audiences who are not unfamiliar to European style games.

*Set Collection* mechanic is a situation where the player must accumulate some of the resources in the game in order to obtain some points, privileges, or status within the game. Generally, players may collect cards (contracts, tickets ect.) or items which represents resources of the game to accomplish the contracts or lists to be completed in hand and the first player who does becomes the winner (BoardGameGeek, n.d.-l). There are endless variety of setting a collection, as numbers or abstract shapes or the arbitrary figurative items depends on the game concept (Engelstein & Shalev, s. 506-507). For instance, in a game with the concept of ecosystems, animal and plant pairs may be seek by players according to some restrictions. Another example can be given from the game of *Catan*; in order to construct some "buildings" in the game there are resources that need to be accumulated with a unique sequence, players who completes these sequences "buy" various markers in the game to improve their occupation area. It can be seen that this structure is also frequently preferred in educational games, by the observation of these 42 games examined in the review. It is clear that the *set collection* mechanic can provide an environment for players to learn conditionally and to see certain topics in different contexts. It can be used to explain the environmental conditions that need to be provided, especially in biology and chemistry issues, in cases such as elemental or cellular activation. For example, in chemistry, the ordering of the elements and their relations with each other are already taught with the sequence called "periodic table"; states of matter and interstate relations taught in the table are likely to be taught much more effectively in the learner's personal experience through a board or a card game in which *set collection* mechanic is implemented. On the other hand, it is observed that this mechanic can produce useful results in reflecting the conditions that need to mature before triggering events in history or sociology, and in cases of teaching regional agricultural products in geography.

*Hand Management* is a mechanism used in card and board game design. The player shows his cards, which he accumulated in certain sequences, to other players at a certain stage of the game and can be rewarded with extra points. Playing functions of the cards effectively can vary depending on the nature of the card strings, the position on the board where they are played, and the effects of the cards played by the opponents on the game. A "good hand management" means

getting the best value from the cards available under the given circumstances. Many cards have multiple uses in the game, requiring complex reasoning to define an "optimal" order (BoardGameGeek, n.d.-g). Games named *Pandemic* (Designed by Matt Leacock, 2008), *Pandemic Iberia* (Designed by Jesus Torres Castro and Matt Leacock, 2016) and other varieties, *Concordia* (Designed by Mac Gerdts, 2013) and many others use this mechanic in combination with many different mechanics. Among the educational games evaluated in the review, it was observed that this mechanic was used in 38 games.

*Area Majority*, also known as "area control" or "area influence" (Engelstein & Shalev, s. 485), is a game mechanic based on the idea of being superior to other players by physically owning territories and destinated properties on the game board. In this mechanism, where each player's place on the board is gauged with the miniatures that represent them, the points to be collected from a certain area on the game board are given to the player who places the most units in that area (BoardGameGeek, n.d.-b). The *area majority* mechanic, which can be encountered in all genres and game styles, can be exemplified with many well-known games, including *Go, Diplomacy* (Designed by Allan B. Calhamer, 1959) and *Scrabble* (Designed by Alfred Mosher Butts, 1948); however, it is typically associated with the game *Risk* (Designed by Albert Lamorisse, Michael I. Levin, 1959). It is important to note that none of these are considered as educational games, they are just typical examples of usage for this mechanic. *Area majority* mechanic is mostly favorable for transferring information on geographical subjects, and many interesting games can be created by using it in combination with *point-to-point movement* mechanic. It has been observed that, in 22 of the educational board games that subjected at the study, the narration and success were conveyed by associating with the *area majority* mechanic.

*Point-to-point movement* mechanic is characterized by the division of the game board into areas of variable shape and size, and the points at the intersection of these areas provide a sequence of moves for the players. In this structure, the game board is mostly in the form of a map shaped according to the game theme. All of the points defined for transportation on the map are connected by lines and movement can only take place along these lines (Engelstein & Shalev, s. 432, 521). It is not enough for two points to be side by side or close; if there is no connecting line between them, the player cannot move his pawn from one to the other (BoardGameGeek, n.d.-j). Usually, this mechanic is expected to be accompanied by *roll and move* or *card drafting* mechanics. *Point to point movement* mechanic, is often preferred in educational games that especially aim to transfer geographical information. In some cases, the points on the game board represent cities, in some cases railway or metro stations, and in some cases marked areas of the human body. This structure was observed in 22 of the games evaluated in the review.

In the study, *Variable Player Powers* and *Role-Playing* mechanics are gathered under the same roof. This is because *role playing* named mechanic have been linked mostly with Fantasy Role Playing[1] games which are positioned outside the board game genre and it has been observed that the *role-playing* mechanic is renamed as "variable player powers" when used in board games. In scan of the database, it was noticed that in board games linked with *role playing* mechanic, topics consist only of fantastic narratives, and when the topic deals with a real-life event outside the fantasy worlds, the mechanic changes its name and is referred to as "*variable player powers*". In both cases, the basic logic is that each player has special action capabilities that only he/she can perform to modify the game flow (Engelstein & Shalev, s. 106). Characters to be chosen by players structured specifically for the game scenario, and players perform not as themselves in the game but as their chosen characters who has unique skills in order to

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[1] *FRP – a kind of game that is played on a free script determined by the narrator, in a completely imaginary environment, taking on the roles of fantastic characters.*

maintain the game balance (BoardGameGeek, n.d.-k). This mechanic is used to create an asymmetric game flow in some conditions, in some cases it is used to create a more realistic simulation environment, and in some cases, it is preferred to perform the collaborative game structure in a consistent way. In the review, it was observed that this mechanic was used in a total of 22 educational board games.

Game mechanic referred to as *Simulation*, is a structure observed in games that model real events and situations, and is more suitable for historical themes (BoardGameGeek, n.d.-m). In games with *simulation* mechanic, which is usually observed in educational games or in the genre called war games, it is expected this structure to be accompanied by *role playing* or *variable player powers* and *card drafting* mechanics. In games that convey real historical events through real characters, the movement structures of the characters in the game are matched with the known features of the reference characters in order to strengthen the sense of realism. In addition, the actions that will emerge from the card decks in order to affect the game flow are chronologically associated with real historical events. The *simulation* approach was observed in 21 of the educational board games evaluated in the review.

*Tile Placement* mechanic is mainly based on the logic that players line up the areas of a game board into meaningful shapes according to their ability of pattern completion or strategical thinking, thereby earning "victory points" for each tile they place along the game boards as they progress. It is observed that *tile placement* mechanic is applied in two ways in games. The first is the structure in which the game board is not clearly set up at the beginning of the game. The player's task is to set up the playing field or expanding it with each tile drawn (BoardGameGeek, n.d.-o). The most known games of this structure are *Carcassonne* (Designed by Klaus-Jürgen Wrede, 2000), *Tsuro* (Designed by Tom McMurchie, 2004) and *Metro* (Designed by Dirk Henn, 1997) though none of them are positioned under the "educational games" category. Another way of using *tile placement* approach may consist as turning already lined up tiles downside up or placing "readable" tiles on designated areas thus changing the appearance of a game board which already has appointed tile areas. For example, in the game *Terraforming Mars* (Designed by Jacob Fryxelius, 2016), the game board is divided into a hexagonal grid, representing the as yet unexplored surface of Mars. With their moves, players create new regions on the surface of Mars, whose physical properties have been discovered by making the hexagonal tiles scattered on the surface visible. In *Tikal (*Designed by Michael Kiesling, Wolfgang Kramer, 1999), just like in *Terraforming Mars*, the game board is portrayed as a tropical forest divided into hexagonal grids. The reversal of the tiles, which are covered with green texture and placed on the corresponding areas of the board in the first place, represents the opening of new excavation sites, referring to the discovery of the ancient city of Tikal. In this approach, which is used in most cases in combination with *worker placement* and *area majority* mechanics, it is seen that each tile provides a "victory point" to the player who opens it. Because it is one of the easiest mechanics to learn and often progresses like an abstract mind game, *tile placement* mechanic can be a starting point to design educational board games that may be produced in many different disciplines, from chemistry, biology, geography to sociology; especially if a play attitude pattern compatible with the teaching can be established. In the review, this mechanic was seen in 21 games accompanied with different mechanics.

*Worker Placement* mechanic is a structure that is especially identified with European-Style board games. In this mechanic, which is observed in 20 of the reviewed educational games, there are usually multiple actions each player can take in their turns and these actions are represented with their game figures positioned on the game board (Engelstein & Shalev, s. 407). Assuming that a player is entitled to minimum of three moves within their turn, they assign each of their figures to perform different tasks in various parts of the game area. In some cases, these figures are referred to "workers" who literally work for the player (see "*Tikal*"), in some cases they change their name to farmers for the field work (see "*Vinhos*" – Designed by Vital Lacerda, 2010) or knights to protect castles own by the player (see "*Carcassonne*" – Designed by Klaus-

Jürgen Wrede, 2000), in some games these figures become members of a family belonging to the player (see "*Kolejka*" – Designed by Karol Madaj, 2011). When players place their workers in a zone on the game area, that zone is often considered as being occupied by the player and other players may not be able to enjoy the privileges of that zone unless the occupier withdraws (BoardGameGeek, n.d.-q). It is a mechanic that can be used in the process of all types of teachings, in the presentation of phenomena which require multistage realization in such areas like geography, history, sociology, physics, chemistry or biology. However, it is necessary to have a good understanding of Eurogame structures in order to use this mechanic. In the process of game design, the intended knowledge should be reduced to a progressive narrative, and the movement options that are available to all players should be as diverse as possible, consistent with the theme. When the *worker placement* mechanic is used effectively, it creates mind developing and instructive games in itself, as it forces the players to plan a few moves ahead, increases their progressive learning and environmental understanding, and pushes them to be proactive and make strategic decisions.

*Area Movement* mechanic, just as described in the "*point to point movement*" mechanic, is a structure that is mostly associated with the division of the game board into areas arranged in the form of maps and the moves that players can make between these areas (BoardGameGeek, n.d.-c). Unlike the *point-to-point movement*, in this mechanic, the game board is not marked with dots, but is divided into adjacent and irregular areas. Players can move their pawns between these areas, in condition of being adjacent or connected. Although the player does not have to follow the lines between the points to determine the direction of the movement, the adjacency relations of the separated areas have to be fallowed. Among the educational games examined, it has been observed that *area majority* mechanic was used in a total of 19 games, apart from the *point-to-point movement* mechanic.

*Action Points* mechanic, which can be seen especially in game structures based on necessity of making multiple moves in the same turn, also is a common structure for European Style game design. This mechanic basically means that player's possible actions are limited with a set of points, he/she must perform only those defined actions in each turn and most of the time spending action points for a turn is not relevant with the end-game victory points (BoardGameGeek, n.d.-a). Two types of *action points* structures are detected at the reviewed games. Fist and mostly used approach is defining the action types of all players for each turn and allow them to use all their reduced actions in any order due to their strategy. In this approach, action types are not associated with actual points, they are just determined and listed at the player aids, thus the order of actions the player chooses makes a difference in the game. This style can be seen in games named *Pax Pamir* (Designed by Cole Wehrle, 2019), *Tesla vs. Edison: War of Currents* (Designed by Dirk Knemeyer, 2015) and *Pandemic*. The other approach is to associate the choice of actions with actual points. A really good example for this approach is the *Tikal* game. In *Tikal,* player actions limited with 10 points for each turn and player can spend these points on a variety of actions. While placing pawns on a tile is coasting 1 action points, settling a camp site coasts 5 points, teleporting between camps coasts 1 point, teleporting between tiles without camps may coast more due to their link stones, excavating artefacts coasts 2 points and trading those coasts 3 point, excavating temples coasts 2 points and owning those temples coasts 5 points. Players can choose any of these actions in any order and multiple times as long as they have enough points for their turn. The diversity of action types gives a sense of freedom to the player on constituting different game experiences in each play (Engelstein & Shalev, s. 78). However, from a communicational aspect, it should also be taken into consideration that this uncertainty may also constitute unfavorable consequences for the information to be conveyed. In this state, designer should plan the possible action types meaningfully considering their impacts on the game narrative in order to support informational content. It seems likely that this mechanic may also affect the development of the user's

relational thinking and evaluation abilities in the context of the subject. *Action points* mechanic has been observed in 15 of the games evaluated in the review.

Another game mechanic to be mentioned is *Trading*. Players exchange their earned resources or the products that they produce in the game (agricultural products, animals, wood, stone, coal, oil, stock, neutron, protein, etc.), with each other or with game market to a fixed value. *Trading* mechanic is often used in combination with *set collection* mechanic to allow the player to complete a set, or basically allows the player to increase his/her savings in order to exchange with more comprehensive items on sale in the game market (BoardGameGeek, n.d.-p). Thus, players can communicate with each other in order to activate different functions in the game scenario, and they can turn their resources into value, again triggering relational learning. It would be appropriate to state that this structure can provide new perspectives on gaming experience, especially in multiplayer versions. *Trading* mechanic has been observed in 13 of the educational games that were examined.

*Auction/Bidding* mechanic, which were relatively rare in the educational board games that were reviewed, are based on the principle that the player's resources are given to other players "in exchange for payment" in order to improve their position in the game, but the price is determined by the bids submitted by other players (BoardGameGeek, n.d.-d). In this structure, which is often confused with *trading* mechanic, the prices of the products on sale in the game are not determined, their market values vary and they find value with the bids of other players in the game. All of the players can make offers on the featured product, and the player with the highest bid gets the item. This item can be the keystone of a set that the player is building in order to advance to the next level in the game; in this case, other players may choose to increase their bids in terms of blocking this function. *Auction/Bidding* mechanic is mostly encountered in competitive, "market" and industrethemed games with high competition. The things that will be auctioned can be products produced by the players in the game, as well as industrial facilities that require offers to be established. For example, in the game *Power Grid* (Designed by Friedemann Friese, 2004), players are power companies trying to build power stations in areas marked with dots on the game map, and make open bids to all players to build each power station. This situation also mirrors the real-life "tender" system. Another way of processing *auction* mechanic is to apply it together with *trading* mechanic, such can be seen in *Catan* and *Colosseum* games, and exchange the resources owned. In this structure, the players add other products they have to the game to get the products they request from the game board, the value of the added products may change according to the bids of the players. *Auction/bidding* mechanic has been observed in 10 of the games evaluated in the review.

*Pick up and Deliver* mechanic is also one of the relatively rare ones, based on the principle that players pick up an item or product and take it to another targeted place on the game board. The initial placement of the item may be predetermined or random. As a result of the delivery of goods, players usually increase their resources in the game, and this allows them to make different moves. In most cases, there is a game rule or other mechanic that determines where the item should go (BoardGameGeek, n.d.-h). In the scan, it was observed that this mechanic was used combined with *area movement* or *point to point movement* mechanics. It can be applied in games produced with the backgrounds of geography or history, as well as in games that aim to convey information about trade networks or sectoral processes. For instance, in a game that intercity railroads are built, it is possible for players to move their trains on tracks shown on given contracts (probably tasks for several routes written on their lists established due to *set collection* mechanic) in order to deliver products of certain cities to other cities on the game board and collect game currency in return. One of the games where this mechanic is actively used is *Freedom: The Underground Railroad* (Designed by Brian Mayer, 2012). This is a game about the abolitionist movement which took place in America in the early 1800s, and in the game, the players try to transport slaves they rescued from the South American cities to the North American border without being caught by "slave catchers" which works against the

players in the game system. In each city, the number of fugitive slaves that each player can relocate is determined, and by working cooperatively against the game system, players leave the slaves aimed to be rescued in cities with suitable capacities and carry on their path. It has been observed that the *pick up and deliver* mechanic is used in 8 educational games evaluated in the study.

The mechanic, called *Network and Route Building*, is based on the fact that players can reach various target locations on the game board by building connection paths. In this structure, players can claim "the connection points" that they pass through while reaching the aforementioned positions, they can use these locations as check points in ownership relations in the game. Additionally, players may have to pay a fee in order to pass through the "stations" that belong to the other players in games which does not have a cooperative game structure (BoardGameGeek, n.d.-i). It is possible that this mechanic may be used with the *point-to-point movement* and the *pick-up and deliver* mechanics. This mechanic was used in 7 of the educational board games that examined.

The last mechanic that needs to be mentioned is *Storytelling*. In the games where this mechanic is used, the players are provided with conceptual, written or pictorial stimuli that they need to include in the story they will create at the beginning of the game. These can be words, as well as symbols and time markers that will be determined in a random order using the *card drafting* or *dice rolling* mechanics (BoardGameGeek, n.d.-n). In some games, such as *Above and Below* (Designed by Ryan Laukat, 2015) and *Sleeping Gods* (Designed by Ryan Laukat, 2021), *storytelling* mechanic is introduced with a "narrative book", just like in FRP games. In fact, some situations in the game are activated with a roll of the dice and a story is read from the narrative book to the player according to the number they roll. In the story flow, the player is presented with two options, and depending on the outcome of their choices, the flow of the game scenario can change or progress with various gains and losses. In such structures, there is a map that visualizes the universe of the game scenario in the narrative book. The player needs to perform some missions in some locations on this map, which can be achieved with character cards with different skills in the game using *worker placement* mechanic. Since the games that use the *storytelling* mechanic lead the players to communicate, it is not surprising that the 5 games found to be used in the survey come from the backgrounds of philosophy and psychology. For instance, one of these games, *Arete: The Philosophy Board Game* (Designed by Winston Diep, 2015), is about different schools of philosophy that emerged in the Hellenistic period. As being pioneer philosophers of the philosophy schools, the players meet at various points on the game map and start to discuss the events that are added to the game with the cards they draw from the deck, in line with their own approaches. While the outcome of the discussion is determined by the dice thrown, the superior characteristics of each philosopher that the players take on can also increase or decrease the value of this dice. At the end of the game, the player with the highest "virtue points" wins. *Storytelling* mechanic can be used in games with philosophy or personal development approach that contains such discussions, as well as in games based on language learning effectively.
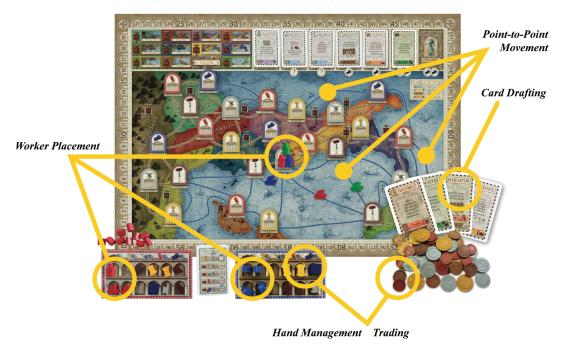
### 3.2. Reviewed Game Mechanics in Practice

After explaining the game mechanics to which the information content can be adapted, it would be appropriate to embody these mechanics through three board game examples. The first game to be discussed is Concordia, designed by Mac Gerdts, which won the "Best Game" award in 2013 at the Essen Game Fair. Set in the time periods of BCs, when the Roman Empire existed as colonies established in the Mediterranean area, players, as colony leaders, reach the surrounding cities from the capital Rome and try to develop the empire's trade networks (BoardGameGeek, 2013).

In the game, each player has two types of colonists; while trying to reach the city states on land with the game pawn shaped like a standing man, overseas cities can be colonized with the game pawn shaped like a ship. While doing this, the player who provides the most active trade, who produces the most resources and creates the wealthiest colony cities with products such as bricks, wheat, tools, wine and fabrics will be the winner of the game. The game also has cards where different emperors and politicians can influence the flow of the game with their historical profiles. Each player has some of these cards from the very beginning of the game. With the resources they gather during the game, they can buy new cards from the areas on the board to provide themselves with bureaucratic powers or new advantages, so that they can strengthen their hands and try to get ahead of other players (RioGrandeGames, n.d.). (Figure 1)

**Figure 1**

*Concordia Board Game Plan. Game Design by Mac Gerdts. Game Art by Mac Gerdts, Marina Fahrenbach, Dominic Mayer. Schematic Presentation by Author*



All the cities available for player actions on the game board are marked in points and connected by route lines, so that they can be associated with today's map of Italy. As is seen, the first mechanic that is encountered in this game is *point-to-point movement*. In addition, as can be noticed from the narration of the game, the mechanics of *card drafting, set collection, hand management, worker placement, and trading* are also accompanied by the *point-to-point movement* mechanic to enhance the player's experience of the theme and support the transmitted information content. Through the flashcards in the game, the players can learn the characteristics of politicians of the Roman Empire and the bureaucratic relations between them while they are trying to strengthen their game strategies. In addition, they can get information about what production is being done in which region of Italy by seeing it on the map with iconically visualized resources. Again, the fact that it has a theme that allows players to explore the history of the empire due to its theme also strengthens the instructive nature of the game.

By taking the design of *Concordia* as an example, it is possible to create game designs about daily lives of ancient civilizations or their international relations, similar mechanics can also be used in game designs subjected geographical information. Thus, the game board and

cards which learners observe with curiosity at their game adventure, will allow them to discover the intended information in their own experiences, much more effectively than books.

Another game that will be the subjected of this review, among many educational games that can be shown as an example when examining game mechanics, is *Trekking the World*, designed by Charlie Bink and produced by Underdog Games in 2020. *Trekking the World* is essentially a travel themed educational game with a game board marked with must-see sights on a world map. Between the continents marked with six different colors, players can travel between airports, collect "memories" from connected locations on the map, which are signed due to the *point-to-point movement* mechanic, and complete their lists on the player cards, which are visualized as suitcases, according to the *set collection* mechanic (BoardGameGeek, 2020).

**Figure 2**

*Trekking the World Board Game. Game Design by Charlie Bink. Game Art by Csaba Bernath, Marta Danecka, Sebastian Koziner, Alexey Shirokikh. Schematic Presentation by Author*
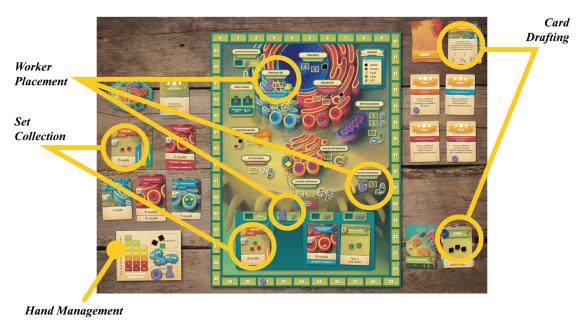


The "memories" listed to be completed on the metaphoric suitcase cards, which symbolizes the personal portfolios of the players, are souvenirs, monuments, clothes and postcards, in variation according to the characteristics of the area reached on the game board. The monuments, which are counted among the aforementioned "memories", are processed in the form of 48 world wonder cards (The Pyramids of Ghiza, The Temple of Athens, the Iguaza Waterfalls, the Temple of Petra, the Sydney Opera House, Ha Long Bay, the Serengeti National Park, Sagrada Famillia, etc.). Front side of these cards, which are designed like a polaroid photograph, is reserved for the name tags and visual representations of the touristic and valuable structures of the locations indicated on the map. Also, icons that represent the wonder of which continent they are and how they can be obtained in exchange for resources are placed at the same side. On the other side of the cards, an explanatory text describing the features of these wonders or the region is placed. In order to get ahead of their opponents by earning high victory points in the game, players need to accumulate these cards in exchange for some resources at their disposal. All the elements players collect about the regions earn them victory points, and at the end of the game, the player who reaches different points in the world and collects the most "memories" can be the winner of the game with the information acquired. (Figure2).

Described as a "successful transition game" due to its easy learning, *Trekking the World* provides a multidimensional learning environment to its players with the scope of information it offers through its cards and high quality graphics (BoardGameGeek, 2020). The first mechanic that is encountered in the game is the *point-to-point movement*. In addition, *card drafting*, *hand management*, *set collection*, *resource management* and *worker placement* mechanics are also used. Although it is not a very difficult game to comprehend, the game process compels the players to develop strategy and follow the moves of their opponents during the game flow, thus keeping their strategies constantly updated. Because of these features, it is an effective learning experience about world wonders and local cultures for learners who pay attention in an environment under the right dose of tension.

The last example that can be given among educational board games would be *Cytosis*, where a difficult biology subject is turned into a game scenario. *Cytosis: A Cell Biology Board Game* designed by John Coveyou and published by Genius Games in 2017, is able to teach the mechanism of cytosis, which is known as intracellular transportation system of molecules and hormones, on a game board where the cell is represented with all its structural features. This is a game experience in which the *card drafting, set collection*, *hand management* and *worker placement* mechanics are used together. Players must perform the tasks that specified in the cards they draw from the deck, by collecting "resources" from the stations on the board, and in return, they become winner of the game by being the healthiest working cell with the health points they collect[2] (BoardGameGeek, 2017).

**Figure 3**

*Cytosis: A Cell Biology Board Game. Game Design by John Coveyou. Game Art by Tomasz Bogusz, John Coveyou. Schematic Presentation by Author.*



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[2] *For instance, a player who has the game card which is located at the bottom left of the game board presented in Figure 4, will first produce mRNA at the "nucleus" station on the game board, convert this source into protein in the free ribosome area, as well as produce 1 fat cell in the smooth ER area, convert it into carbohydrates in the Golgi apparatus, and synthesize all of it in the cytoplasm on the way of learning that the phosphatase enzyme will be produced by synthesizing two proteins and one carbohydrate content in the cytoplasm. At the end of this entire process, the player earns 4 health points in exchange for "performing" this card.*

The *Cytosis* game board is a microscopic view of a human cell; all subunits from the cell, nucleus to the mitochondria, from the Golgi particle to the ribosomes can be clearly seen on the board (Figure 4). In the upper part of the game board there is a nucleus, hard and smooth endoplasmic reticulations (ER) around it; mitochondria and Golgi apparatus towards the lower parts of the board; and in the lowest part there is a plasmic membrane in which enzymes, hormones and proteins will be secreted outside the cell. In this game which is based on *worker placement* mechanic, the mentioned areas on the board are stations where players will activate different game functions (resource collection, transformation and set collection) by placing their pawns (Figure 3). So much so that in these sections, rectangular shaped fields with yellow stripes are the baseline dimensions of the players' pawns, and the numbers written in the rectangles indicate the resources produced by these stations. Some stations produce mRNA (black cubes), some stations produce intracellular energy carrier ATP (refered to Adenozin trifosfat) discs; some stations are ribosome and Golgi apparatus structures where these two sources are converted to carbohydrates (green cubes), lipids (yellow cubes) and proteins (red cubes), or cell membrane and cytoplasm regions where enzyme syntheses can be formed and transported out of the cell.

Players can collect lipid cells from Smooth ER, mRNA molecules from Hard ER and transport them to the Golgi Apparatus in the middle part of the board with intracellular carrier sacs called "Vesicles", where they can convert their lipids into carbohydrates or their carbohydrates into lipids. In addition, on the board (realistically), the "free ribosome" area where mRNAs can be translated into proteins, the "cytoplasm" area where enzymes are synthesized, the ATP producing mitochondria, the exocytosis area in the plasma membrane where waste materials are secreted out of the cell, and the area that ATP discs can be converted into carbohydrates, where the glucose carrying property of the plasma membrane is emphasized, can be clearly seen. After the players complete the protein, hormone and enzyme sets on the cards they are dealt (*card drafting* mechanic) during the intracellular journey (*set collection* mechanic), they naturally move to the bottom row of the board and in this way, they will be able to successfully secrete their intracellular production out of the cell. Players gain the "health point" of the card that they have completed and continue the game by taking one of the new compound cards that are located face up on the bottom row of the board. Players who can carry intracellular enzymes, hormones and proteins out of the cell by completing the most compound cards and managing their resources correctly (*hand management* mechanic) will reach the highest score on the way to victory points and become the winner of the game.

### 3.3. Game Mechanics Used by Information Type

Looking at the frequency of use and the possibilities of using them together according to the type of educational content, it has been observed that the game mechanics listed in Table 1 do not repeat any patterns. Nevertheless, when the 130 (n=130) examined board games are categorized according to the types of information they cover, it was observed that certain mechanics are used more frequently for specific types of information.

As shown in Table 2, among the 130 educational games, 54 are designed to convey historical information, 19 to convey geographical information, 19 to convey biological information, and 14 to convey information on physics and chemistry. 10 of the examined board games support mathematical and geometry practices, while 3 are designed to improve language knowledge and language skills. It was also noted that 14 of the listed games are designed to convey information on various social topics or to develop attitudes and behaviors beyond various areas. In this distribution, it is also noted that the seven most frequently used game mechanics—*Card Drafting, Dice Rolling / Roll and Move, Set Collection, Hand Management, Area Majority, Point-to-Point Movement, and Variable Player Powers / Role Playing*—which

are observed as the most frequent and shown in Table 1, were intensively used in various combinations with other mechanics across a total of 115 games (see Table 2).

**Table 2**

*Distribution of The Educational Board Games with The Context of Game Mechanics and Type Of Information*

| Mechanics | Type of Information | | | | | | |
|---|---|---|---|---|---|---|---|
| | History | Geography | Biology | Physics, Chemistry | Mathematics and Geometry | Language | Various Social Themes |
| Card Drafting | H3, H4, H5, H6, H7, H8, H9, H10, H12, H14, H15, H21, H23, H28, H31, H32, H37, H42, H43, H44, H47, H48, H49/PHC, H51, H52, H53, H54 | G8, G9, G10, G14, G16, G17 | B2, B3, B4, B10, B11, B14/MG, B15, B16, B18 | PHC3, PHC5, PHC9, H49/PHC | MG1, MG4, B14/MG | - | V5, V15, V17, V18 |
| Dice Rolling / Roll and Move | H2, H4, H5, H6, H8, H11, H13, H15, H16/V, H17, H18, H19, H21, H23, H27, H31, H32, H35, H39, H44, H45, H46, H48, H50/PHC | G1/MG, G6, G7, G13 | B1, B2, B5, B10, B18 | PHC1, PHC7, H50/PHC | G1/MG, MG1, MG4 | - | V1, V2, V3, H16/V, V5 |
| Set Collection | H25, H27, H28, H29, H30, H36, H38, H40/B/MG, H41, H42, H44 | G2, G3, G4, G5, G12, G14, G15, G16, G17 | B3, B4, B6, B8, B10, B12, B13/MG, H40/B/MG, B14/MG, B18 | PHC4, PHC8, PHC9, PHC10, PHC11, PHC12 | MG3, MG6, B13/MG, H40/B/MG, B14/MG | - | V3, V5, V7, V10, V16 |
| Hand Management | H4, H13, H20, H22, H28, H36, H37, H40/B/MG, H42, H43, H45, H47, H49/PHC, H51 | G2, G3, G3, G4, G5, G16, G17 | B3, B7, B13/MG, H40/B/MG, B14/MG, B15, B17, B18 | PHC2, PHC6, PHC7, PHC11, PHC12, H49/PHC | B13/MG, H40/B/MG, B14/MG, MG5 | L3 | V5, V13, V16 |
| Area Majority | H3, H4, H5, H23, H32, H34, H37, H41, H43, H46, H47, H50/PHC | G18, G19 | B5, B7 | PHC3, PHC6, PHC9, H50/PHC | - | - | V12, V17, V18 |
| Point-to-Point Movement | H1, H7, H13, H18, H28, H31, H32, H33, H39, H40/B/MG, H52 | G12, G16, G17, G18 | B5, B13/MG, H40/B/MG, B14/MG | PHC10, PHC11 | MG2, B13/MG, H40/B/MG, B14/MG | - | V2, |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Variable Player Powers / Role Playing | H4, H6, H13, H16/V, H17, H20, H26, H33, H35, H40/B/MG, H45, H49/PHC, H50/PHC, H51 | G1/MG, G11 | B13/MG, H40/B/MG, B14/MG | H49/PHC, H50/PHC | G1/MG, B13/MG, H40/B/MG, B14/MG | - | V1, H16/V, V5, V10, V13 |
| Simulation | H2, H11, H20, H23, H32, H35, H43, H46, H47 | G1/MG, G18 | B5, B10, B12 | PHC9 | G1/MG, MG5 | - | V4, V7, V12, V13, V17 |
| Tile Placement | H25, H26, H29, H37, H41, H42, H53, H54 | G9, G10 | B1, B11, B12, B16 | PHC5 | - | L1, L3 | V4, V5, V8, V12, V13 |
| Worker Placement | H7, H9, H14, H25, H26, H30, H36, H39, H50/PHC, H54 | G19 | B6, B8, B10, B17 | PHC3, PHC8, H50/PHC | | - | V4, V18 |
| Area Movement | H2, H3, H4, H5, H6, H7, H14, H17, H20, H32, H43, H46, H47, H52 | - | B1 | PHC2 | - | - | V3, V10, V14 |
| Action Points | H11, H40/B/MG, H43, H46, H47, H48, H49/PHC, H50/PHC, H52 | - | B13/MG, H40/B/MG, B14/MG | PHC12, H49/PHC, H50/PHC | B13/MG, H40/B/MG, B14/MG | L1 | V2, V9 |
| Trading | H21, H27, H29, H34, H40/B/MG, H42 | G13 | B13/MG, H40/B/MG, B14/MG | PHC4, PHC7 | MG5, B13/MG, H40/B/MG, B14/MG | L1 | V11 |
| Auction / Bidding | H20, H27, H28 | G13, G18 | B1, B9 | - | MG5 | - | V6, V12 |
| Pick and Deliver | H7, H24, H29, H33, H52 | - | B1 | PHC6 | - | - | V16 |
| Networking and Route Building | H22, H24, H34, H40/B/MG, H49/PHC | G18 | B13/MG, H40/B/MG, B14/MG, B17 | H49/PHC | B13/MG, H40/B/MG, B14/MG | - | - |
| Storytelling | H16/V | - | - | - | - | L2, L3 | V1, H16/V, V9 |

Accordingly, out of 54 games with historical content, *card drafting (n=25)*, *dice rolling / roll and move (n=22)* and *hand management (n=14)* are commonly used game mechanics that has been preferred by game designers. Due to the frequency, it is possible to define that these mechanics are suitable for conveying the information in historical themes. Beyond that, 12 games were designed with *area majority*, while 10 games were designed with *set collection* and 10 others were designed with *point-t-point movement*. All of the 17 frequently used game mechanics mentioned have been used with various distributions and overlaps across all the reviewed history-themed board game productions.

The list indicates that out of 19 games with geographic information content, 8 were designed based on *set collection*, 6 on *hand management*, 6 on *card drafting*, 4 on *point-to-point*

*movement*, 3 on *dice rolling/roll-and-move* mechanics and other 3 on *tile placement*. The distribution of game mechanics suggests that *set collection*, *hand management*, and *card drafting* are particularly suitable for conveying geographical information. Additionally, the analysis reveals that in geography-themed board games, the *hand management* mechanic is always used in conjunction with *set collection*, implying that these two mechanics work efficiently together to facilitate the transmission of geographical knowledge. The list also highlights that certain game mechanics, such as *area movement, action points, pick and deliver, and storytelling*, were not used at all in the design of board games incorporating geographical information.

In the field of science education, 18 games convey biological information. Among them, *card drafting* and *set collection* mechanics were each used 9 times, while *hand management* was employed in 8 games. *Dice rolling/roll-and-move* mechanics appeared in 5 games, whereas *point-to-point movement* and *worker placement* were utilized in 4 games. *Variable player powers/role-playing* and *tile placement mechanics* were found in 3 games. Additionally, *auction bidding, simulation,* and *area majority* mechanics were used twice, while *pick-and-deliver, networking* and *route building*, and *area movement* mechanics appeared only once. Notably, *action points, trading*, and st*orytelling* mechanics were never used in biology-themed board games. It has been determined that among 14 games containing information on physics and chemistry, *set collection* and *hand management* mechanics were each used six times in 10 of the games. *Card drafting* and *area majority* mechanics appeared four times, while *dice rolling/roll-and-move, action points,* and *worker placement* mechanics were used in three games. Additionally, *point-to-point movement, variable player powers*, and *trading* mechanics were each used twice. Notably, *auction/bidding* and *storytelling* mechanics were not utilized in any of the reviewed physics and chemistry-themed board games.

Among the 10 games designed for teaching mathematics and geometry, *dice rolling/roll-and-move* and *trading* mechanics were each observed three times, while *card drafting, set collection,* and *simulation* mechanics appeared twice. Additionally, *hand management, point-to-point movement, variable player powers/role-playing, auction/bidding,* and *networking/route building* mechanics were each used once. Notably, other commonly used game mechanics were not present in mathematics and geometry-themed games.

In the group titled as "Various Social Themes" in Table 2, games with various topics that range from psychology to philosophy, religious education to politics, archaeology to general culture are located. In addition to the use of the first five mechanics in Table1, in 8 of the 14 games examined in this group, since their subjects are generally based on communication practices, it was observed that *auction (guessing and bidding)* and *storytelling* mechanics were also applied. Latsly it can be seen from the table that mechanisms other than *storytelling, trading, action points* and *tile placement* were not suitable for the use in language skills themed board games.

## RESULTS AND RECOMMENDATIONS

This study systematically examined and categorized frequently used game mechanics in educational board games to provide educators with a practical resource for designing alternative instructional materials. By analyzing the most commonly utilized mechanics and their patterns of use, the research aimed to bridge the gap in the literature, where educational board game design practice remains underexplored compared to digital game-based learning.

By analyzing 130 educational board games, this study identified 17 frequently used game mechanics. Among them, card drafting, dice rolling/roll and move, set collection, hand

management, area majority, and point-to-point movement emerged as the most prevalent. These mechanics appeared in a significant number of games, highlighting their widespread use and adaptability across different educational contexts.

The findings indicate that certain game mechanics, such as *card drafting, dice rolling*, *set collection*, and *hand management*, are more frequently employed in educational board games, particularly in history and geography themed games, in which the subjects that require structured knowledge retention and strategic thinking to foster cultural literacy. Additionally, recurring patterns in the combination of mechanics suggest that some mechanics, such as *set collection*, *hand management*, and *card drafting,* complement each other in facilitating effective information transfer, as observed in science-theme board games. These insights contribute to a more structured understanding of board game design for pedagogical purposes and provide a foundation for future studies exploring the effectiveness of specific mechanics in different learning contexts.

In the distribution presented in Table 1, it has been determined that the most frequently used game mechanic in educational game design is *card drafting*. This is one of the convenient structures in which literary knowledge can be directly adapted into game systems. Cards, in this mechanic, which support the state of "unpredictability", one of the essential elements of games, can be planned as "event cards" that bring information processed events to the game flow, where players need to make spontaneous decisions. Or, in case of they designed as question cards, contents at the cards may trigger the perception of the player and it can also establish an effective stimulus in the information flow of the game.

Another mechanic that has been observed to be used frequently is *dice rolling* or *roll and move* mechanism. In addition to be a kind of structure that triggers the continuity of the game flow, it stands out in the design process as it has been used since ancient games, and it can be embraced even by players who are not familiar with the board game system. *Set collection* mechanic, on the other hand, ranks third (n=42) in the frequency of use and provides a structure that will directly support the narrative in information content that requires cumulative or conditional advances. So that it can be utilized as the main mechanic of different game designs, compatible with a wide range of content from a geometry game about polygons whose interior angles need to be completed with various values, to a biology game about animal species and evolution, from a game scenario about a historical war to a board game about sustainable energy sources. *Hand management* mechanic (n=38) follows in the fourth place, and afterwards *area majority* and *point-to-point movement* mechanics, which were detected to be applied in the same number of games, can also be considered as prominent mechanics in terms of frequency of use. Notably, mechanics such as *area movement*, *action points*, *pick and deliver* and *storytelling* were either underutilized or absent in games designed for specific types of information, such as geography and language skills.

These findings highlight that despite the variety of game mechanics available, their application is not uniform across all educational themes. The variation suggests that some mechanics are better suited to certain content areas, while others may require adaptation or additional development to be effectively used in different contexts.

While this study provides valuable insights, certain limitations remain, such as the scope of the analyzed games and the absence of empirical testing of the proposed categorizations in

real classroom settings. Future research could be built upon these findings through experimental studies that assess the learning outcomes linked to different game mechanics and their combinations.

Mastering game design requires understanding the mechanics, but this alone is insufficient. However, the mathematical infrastructure of games may require different types of reasoning. The processes and condition patterns of the moves in the game can provide various associations about the information intended for the player, especially when supported by the game's narrative. The distribution of the game points to be earned for moves can also strengthens these associations. The information to be conveyed should be evaluated from a holistic perspective and processed through the interactions of various game elements, providing the player with a meaningful, comprehensive experience. These elements fall under the concept of "game narrative," and the successful adaptation of information to the narrative depends on managing the game mechanics properly. The techniques of creating informational game narratives should be processed, studied and systematized separately in the context of a different study related to this article.

Building on the insights presented, further research is encouraged on the development and application of educational board game mechanics. Such studies could deepen the understanding of how specific mechanics influence learning outcomes and inform future game design practices. Making this design knowledge accessible to teachers and prospective educators will aid the development of innovative teaching materials across diverse disciplines with varying instructional designs. By integrating professional expertise from multiple fields, board games can be designed to foster alternative, effective learning environments. This approach acknowledges that, in addition to skill development, students can acquire substantial knowledge in project-based learning contexts. Through these recommendations, the field of educational board games can overcome existing limitations, providing educators with more effective tools to enhance student learning across a range of subjects. Ultimately, this study is expected to serve as a foundation for further reviews, action research, and case studies that redefine board games as structured educational tools.

In conclusion, this research highlights the educational value of board games and underscores the need for a more systematic approach to their design. By categorizing game mechanics and their instructional applications, this study provides a foundational resource for educators, game designers, and researchers interested in developing innovative, game-based learning materials beyond the digital domain.

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## GENİŞLETİLMİŞ ÖZET

### Giriş

Oyun, her toplumda biçimlendirici temel bir eylem olarak insan davranışının doğal bir parçasıdır ve ortak kültürün gelişimi sırasında özellikle nesiller arası bilgi iletişiminde işlevseldir. Oyunun eğitim veya öğrenme eylemiyle doğrudan ilişkili yönleri, en primitif halleri olan taklit ve rekabet yapılarından kaynak bulur. Bu iki form insanda fiziksel ve bilişsel gelişimin yanında doğal olarak empati ve anlayış sağlar. Oyunların bilgi iletişiminde etkili araçlar olabileceği fikri, özellikle 1980'li yıllardan itibaren eğitim bilimciler ve psikologlar tarafından akademik olarak kabul görmüştür (Bochennek et al., 2007; Guralnick & Levy, 2010; Naik, 2014; Taşpınar et al., 2016; Willet et al., 2018; Talan et al., 2020; Nautiyal et al., 2024). Beyin Temelli Öğrenme (Caine & Caine, 1990), sosyokültürel teori (Vygotsky, 1978; aktaran Qian & Clark, 2016), deneyimsel (Kolb, 1984; aktaran Bochennek et al., 2007) ve yapılandırmacı öğretim yaklaşımlarına uygun olarak oyunlar, görsel ve işitsel kavrayıştan çıkış bulan deneyim süreçleriyle, kullanıcılarında iç görü yaratmaya elverişli ortamlar olduklarından, alternatif öğretim ortamlarında sık kullanılan araçlardandır (Caine & Caine, 1990, s. 60). Oyunların, yaşamsal kayıtlara dönüştürülen akademik bilgiyi öğrenicinin belleğine örüntüler

halinde işlemek ve öğrenicinin geçmiş yaşam deneyimlerinden ürettiği çözümleri oyun sürecine dahil etmesiyle hedef bilgiye yönelik iç görüyü keskinleştirmek gibi avantajları bulunmaktadır (Lainema & Saarinen, 2010).

Eğitimde oyun temelli öğrenme (GBL) üzerine yapılan çalışmalar büyük oranda dijital veya elektronik oyunların kullanımına odaklanmaktadır. Öte yandan, eğitsel masa oyunlarının etkilerini deneysel araştırmalarla inceleyen ve uygulama önerilerini çerçeveleyen çalışmalara da rastlanmaktadır (Bochennek et al., 2007; Naik, 2014; Chiarello & Castellano, 2016; Willet et al., 2018; Cardinot et al., 2022; Nautiyal et al., 2024). Talan, Doğan ve Batdı (2020) tarafından yürütülen bir meta-analiz çalışması, hem dijital hem de dijital olmayan oyunların (kutu, kart ve fiziksel oyunlar) eğitimde soyut kavramları somutlaştırma, keşif yoluyla öğrenme, eleştirel düşünme, görsel tanıma ve matematik becerilerini geliştirme gibi birçok bilişsel fayda sağladığını ortaya koymuştur. Masa oyunlarının bilişsel ve sosyal becerilere katkıda bulunduğu, rasyonel düşünme, iş birliği ve müzakere yeteneklerini geliştirdiği çeşitli araştırmalarda işlenmiştir (Bayeck, 2020; Talan et al., 2020).

Masa oyunları, üç boyutlu yapıları ve çok katmanlı kurguları sayesinde öğrenme sürecini somutlaştıran eğitsel araçlar olarak ela alınabilirken (Chiarello & Castellano, 2016); kitapların doğrusal anlatımına kıyasla, dokunsal ve metinsel katmanlar aracılığıyla deneyimsel ve sosyal bir öğrenme ortamı sağlayabilirler (Huang & Levinson, 2012, s. 141-148). Dijital oyunlara kıyasla masa oyunlarının tasarım ve üretim süreçleri daha kısa ve pratiktir. Prototipleme için yalnızca kâğıt ve basit malzemeler yeterlidir. Elektronik bir altyapıya ihtiyaç duymamaları, taşınabilir ve kalıcı olmaları, eğitimde fırsat eşitliği sağlamaları açısından avantajlıdır. Öğretmenler, ders içeriklerine uygun masa oyunları geliştirebileceği gibi, eğitsel içerik aktarmak için öğrencilere oyun tasarım sürecini öğreterek, masa oyunlarını aktif ve proje-tabanlı öğrenme ortamlarına dahil edebilir (Bayeck, 2020; Cooke et al., 2020). Ayrıca çok oyunculu yapıları sayesinde sosyal öğrenmeyi teşvik ederler ve "ciddi oyunlar" kategorisine dâhil edilebilirler.

İnsanın yerleşik hayata geçtiğini belgeleyen ilk artefektler arasında da rastlanan masa oyunlarının tarihsel süreçte gelişimine bakıldığında, özellikle eski Asya medeniyetlerinde kullanımlarından itibaren, genç nesile güncel toplumsal değerleri benimsetmek amacıyla üretildikleri, bu bağlamda birer eğitim materyali olarak uzun yıllar benimsendikleri görülebilir. Çağdaş oyun üretimlerinde ise, oyun tahtasının sunduğu canlandırma evrenle, temaları doğrultusunda birer simülasyon ortamı oluşturan, böylece oyuncuların anlatıyı içselleştirebildiği yeni nesil tasarımlar, "Avrupa Stili" olarak adlandırılıp ayrışmaktadır (Woods, 2012, s. 81). "Tasarımcı oyunları" olarak da anılan bu tür tematik masa oyunları, fen bilimlerinden tarihe, güncel sosyolojik konulardan uzay, arkeoloji ve yerel kültür temalarına kadar çeşitli içeriklerde üretilmeleri yanında, karmaşık mekanikler barındırıp oyuncusunu farklı dikkat seviyelerinde strateji geliştirmeye teşvik ettiğinden, zeka geliştirici aktiviteler olarak da eğitim ortamlarında kullanılmaktadır (Harris & Mayer, 2010, s. 10).

Masa oyunu tasarımı, tema, mekanikler ve bileşenler arasında bir uyum gerektirir. Tema, oyunun anlatısını ve görsel dilini belirlerken, oyun mekanikleri oyuncuların etkileşim biçimlerini şekillendirir (Cooke et al., 2020). Oyun bileşenleri ise kartlar, zarlar, figürler gibi fiziksel unsurlardır. Eğitsel bir masa oyunu tasarlanırken bu üç yapı, aktarılacak bilgiye uygun olarak bütünlük içinde inşa edilmelidir.

**Yöntem**

Bilgi iletişimine uygun oyun mekaniklerini belirlemek amacıyla nicel bir araştırma olarak başlanan çalışmada, tematik dağılımı fark edilen verilerden tematik analiz yöntemiyle nitel çıkarımlara ulaşılmıştır. Alan yazında yapılan taramada "eğitsel oyun" etiketiyle sınıflandırılmış 8614 kutu oyunu olduğu görülmüş, bunlar arasında yapılan ikincil sınırlandırmayla örneklem 130 eğitsel masa oyununa daraltılmış, verilerin kodlanmasının ardından içerik analizi

yöntemiyle güncel üretimlerde sık kullanılan 17 oyun mekaniği tespit edilmiştir. Ayrıca, oyunlarda işlenen bilgi türüne göre bu mekaniklerin nasıl bir dağılım gösterdiği, tematik analiz yöntemi kullanılarak yapılan ikincil değerlendirme daha ayrıntılı olarak incelemiştir.

**Bulgular**

Eğitsel masa oyunlarının analizinden edinilen sonuçlara göre, 5o oyunda *kart çekme* (ing. "card drafting"), 43 oyunda *zar atma / zar ile ilerleme* (ing. "dice rolling" / "roll and move"), *42* oyunda koleksiyon/dizi oluşturma (ing. "set collection"), 38 oyunda *el yönetimi* (ing. "hand management"), 22 oyunda alan üstünlüğü (ing. "area majority"), 22 oyunda *noktalar arası hareket* (ing. "point to point movemenet"), 22 oyunda *değişken oyuncu güçleri / rol yapma* (ing. "variable player Powers" / "role playing), 21 oyunda *simülasyon* (ing. "simulation"), *21* oyunda *karo dizme* (ing. "tile placement"), 20 oyunda *işçi yerleştirme* (ing. "worker placement"), 19 oyunda *alan hareketi* (ing. "area movement"), 15 oyunda aksiyon puanları (ing "action points"), 13 oyunda ticaret yapma (ing. "trading"), 10 oyunda *açık arttırma* (ing. "autciton/bidding), 8 oyunda *al ve ulaştır* (ing. "pick up and deliver"), 7 oyunda *ağ kurma ve rota oluşturma* (ing. "network and route building") ve 5 oyunda *hikaye anlatıcılığı* (ing. Story telling) mekanikleri olmak üzere toplam 17 oyun mekaniğinin eğitsel içerikli masa oyunlarında sıklıkla uygulandığı görülmüştür.

Çalışmanın bulgular bölümünde taramadan ulaşılan oyun mekanikleri tekil betimlemeler halinde açıklanmış ve listelenen mekaniklerin farklı oyun üretimleri üzerinde kullanım biçimlerini örneklemek üzere vaka çalışmalarına yer verilmiştir. Ayrıca aynı bölümde, üçüncül bir başlık olarak, söz konusu oyun mekaniklerin kullanım sıklıkları ve sundukları bilgi içeriklerinin türüne göre dağılımları da işlenmektedir.

**Sonuç ve Tartışma**

Çalışma, eğitim fakültelerinin öğretim planlarında yer alan eğitsel materyal geliştirme derslerine alternatif bir kaynak oluşturacak şekilde kurgulanmıştır ve özellikle orta öğretim düzeyinde ders kazanımlarının oyunlaştırılmasında öğretmen adayları ve öğretmenlerin yaratıcılıkları doğrultusunda kullanabilecekleri yol haritasına etkili bir başlangıç oluşturmaktadır. Bulgular bölümünde yer verilen oyun mekaniklerinin açıklamaları ve değerlendirilen bilgi türü ile oyun tasarımı eşleşmelerinin, gelecekte gerçekleştirilecek eğitsel masa oyunu üretimlerine ve bu üretimlerin hedef kitle özelinde bilgi iletişimi açısından tutarlılıklarını değerlendirecek araştırma çalışmalarına alan açması olasıdır.

**APPENDIX**

**Table 3**

*List of Coded Board Games*

| Given Codes | Educational Board Game | Year | Designer | Access Link |
|---|---|---|---|---|
| H1 | 7 Days of Westerplatte | 2013 | Lukasz Wozniak | https://boardgamegeek.com/boardgame/145103/7-days-of-westerplatte |
| G1/MG | 7 Summits: A Mountaineering Challenge | 2015 | Kevin Fowler | https://boardgamegeek.com/boardgame/182947/7-summits-a-mountaineering-challenge |
| H2 | 7: The Defense of Lwów | 2015 | Karol Madaj | https://boardgamegeek.com/boardgame/170043/7-the-defense-of-lwow |
| G2 | 10 Days in Asia | 2007 | Alan R. Moon, Aaron Weissblum | https://boardgamegeek.com/boardgame/22398/10-days-in-asia |
| G3 | 10 Days in Europe | 2002 | Alan R. Moon, Aaron Weissblum | https://boardgamegeek.com/boardgame/5867/10-days-in-europe |

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|---|---|---|---|---|
| G4 | 10 Days in The Americas | 2010 | Alan R. Moon, Aaron Weissblum | https://boardgamegeek.com/boardgame/64956/10-days-in-the-americas |
| G5 | 10 Days in USA | 2003 | Alan R. Moon, Aaron Weissblum | https://boardgamegeek.com/boardgame/7866/10-days-in-the-usa |
| V1 | 14 Days | 2015 | Hannah Shaffer | https://boardgamegeek.com/boardgame/180627/14-days |
| G6 | 100 Syytä Liikkua Säkylässä | 2013 | Säkylän Urheilijatry | https://boardgamegeek.com/boardgame/278198/100-syyta-liikkua-sakylassa |
| H3 | 878 Vikings: Invasions of England | 2017 | Beau Beckett, et. Al. | https://boardgamegeek.com/boardgame/204516/878-vikings-invasions-of-england |
| H4 | 1754: Conquest – The French and Indian War | 2017 | Beau Beckett, Jeph Stahl | https://boardgamegeek.com/boardgame/206150/1754-conquest-the-french-and-indian-war |
| H5 | 1775: Rebellion | 2013 | Beau Beckett, Jeph Stahl | https://boardgamegeek.com/boardgame/128996/1775-rebellion |
| H6 | 1812: The Invasion of Canada | 2012 | Beau Beckett, Jeph Stahl | https://boardgamegeek.com/boardgame/94246/1812-the-invasion-of-canada |
| H7 | 1886 Loures | 2009 | Gil d'Orey | https://boardgamegeek.com/boardgame/56257/1886-loures |
| H8 | About Time | 2007 | Joe Gill, et. Al. | https://boardgamegeek.com/boardgame/32337/about-time |
| V2 | A.D. 30 | 2012 | Tom Decker | https://boardgamegeek.com/boardgame/126426/ad-30 |
| V3 | Adventurer's Kit | 2015 | Chi Wei Lin | https://boardgamegeek.com/boardgame/185334/adventurers-kit |
| G7 | Afriqu'enjeux: The Africa Memory Game | 2011 | Paulette Mpouma | https://boardgamegeek.com/boardgame/122529/afriquenjeux-the-africa-memory-game |
| V4 | Aftershock: A Humanitarian Crisis Game | 2015 | Rex Brynen, Thomas Fisher | https://boardgamegeek.com/boardgame/180994/aftershock-a-humanitarian-crisis-game |
| H9 | Agents in Time | 2018 | Alex Bardy | https://boardgamegeek.com/boardgame/240349/agents-in-time |
| B1 | Age of Steam Expansion: Human Body/Synapses | 2015 | Alband Viard | https://boardgamegeek.com/boardgame/173628/age-of-steam-expansion-human-bodysynapses |
| H10 | Aikamatka: Suomi | 2017 | Heikki Hyhkö | https://boardgamegeek.com/boardgame/233070/aikamatka-suomi |
| H11 | Alarm: Escape From Alcatraz | 2017 | Jimmy Treehorn | https://boardgamegeek.com/boardgame/292019/alarm-22-escape-from-alcatraz |
| H12 | Ale Historia! | 2016 | Filip Milunski | https://boardgamegeek.com/boardgame/200218/ale-historia |
| H13 | Alexander's Campaign | 2017 | Alexander Boucharelis, et. Al. | https://boardgamegeek.com/boardgame/134069/alexanders-campaign |
| H14 | Aljubarrota | 2009 | Gil d'Orey | https://boardgamegeek.com/boardgame/42470/aljubarrota |
| H15 | Alles, Alles Über Deutschland | 2005 | Stephan Schützler | https://boardgamegeek.com/boardgame/110004/alles-alles-uber-deutschland |
| PHC1 | Apollo: The Game of Our First Voyages to the Moon | 2019 | Andrew Hayes | https://boardgamegeek.com/boardgame/267419/apollo-the-game-of-our-first-voyages-to-the-moon |
| H16/V | Arete: The Philosophy Board Game | 2015 | Winston Diep | https://boardgamegeek.com/boardgame/190224/arete-the-philosophy-board-game |
| V5 | Ark Nova | 2021 | Mathias Wigge | https://boardgamegeek.com/boardgame/342942/ark-nova |
| V6 | Ars Universalis | 2015 | Manuel D. Cruz Díaz, Antonio J. Dionisio | https://boardgamegeek.com/boardgame/151683/ars-universalis |
| V7 | Art Attack! | 2012 | Michael C Lohr | https://boardgamegeek.com/boardgame/123812/art-attack |
| MG1 | As Seen In The Sky | 2009 | Jonathan Geruntho | https://boardgamegeek.com/boardgame/204845/as-seen-in-the-sky/ratings |
| G8 | Ausgerechnet Hamburg | 2011 | Bernhard Lach, Uwe Rapp | https://boardgamegeek.com/boardgame/130055/ausgerechnet-hamburg |

| G9 | Ausgerechnet Köln | 2011 | Bernhard Lach, Uwe Rapp | https://boardgamegeek.com/boardgame/122670/ausgerechnet-koln |
| G10 | Ausgerechnet Uppsala | 2006 | Bernhard Lach, Uwe Rapp | https://boardgamegeek.com/boardgame/26156/ausgerechnet-uppsala |
| H17 | Baba Yaga | 2010 | Richard Hopkins-Lutz, Thaddeus Papke | https://boardgamegeek.com/boardgame/73756/baba-yaga |
| G11 | Backpackers Race | 2019 | Ángel Lapuente Ibáñez | https://boardgamegeek.com/boardgame/286315/backpackers-race |
| H18 | Bagan Journey | 2018 | Jean Curci | https://boardgamegeek.com/boardgame/265382/bagan-journey |
| L1 | Bagolytanoda | 2019 | Komzák Adrienn | https://boardgamegeek.com/boardgame/290055/bagolytanoda |
| H19 | Bartnicy w Lesie | 2015 | Pawel Olander | https://boardgamegeek.com/boardgame/181195/bartnicy-w-lesie |
| MG2 | Baseball Tivitz | 2006 | Steve Scully | https://boardgamegeek.com/boardgame/27679/baseball-tivitz |
| H20 | Battle Baghdad | 2009 | Michael Anderson, et. Al. | https://boardgamegeek.com/boardgame/29848/battle-for-baghdad |
| V8 | Berrymandering | 2021 | Eliot Aretskin-Hariton | https://boardgamegeek.com/boardgame/295295/berrymandering |
| V9 | Better Me | 2015 | N/A | https://boardgamegeek.com/boardgame/188520/better-me-the-game-of-growth-and-friendship/credits |
| B2 | Big Catch | 2016 | N/A | https://boardgamegeek.com/boardgame/212566/big-catch |
| H21 | Billions Below | 2019 | N/A | https://boardgamegeek.com/boardgame/283875/billions-below |
| B3 | Biomos | 2023 | Gricha German | https://boardgamegeek.com/boardgame/362700/biomos |
| B4 | Biota: North Atlantic | 2018 | Tamas Feigel | https://boardgamegeek.com/boardgame/236441/biota-north-atlantic |
| B5 | Black Death | 2008 | Greg Porter | https://boardgamegeek.com/boardgame/35047/black-death-v101 |
| G12 | Boso przez świat: Gra Planszowa | 2020 | Wojciech Cejrowski, Agnieszka Rajczak-Kucińska | https://boardgamegeek.com/boardgame/304231/boso-przez-swiat-gra-planszowa |
| MG3 | Brain Race | 2010 | Francesco Berardi, Ennio Peres | https://boardgamegeek.com/boardgame/89577/brain-race-la-grande-sfida-delle-menti |
| H22 | Brass: Birmingham | 2018 | Gavan Brown, et. Al. | https://boardgamegeek.com/boardgame/224517/brass-birmingham |
| PHC2 | Brave New Worlds | 2020 | Mickey McDonald | https://boardgamegeek.com/boardgame/271851/brave-new-worlds |
| MG4 | BunneeBank | 2018 | N/A | https://boardgamegeek.com/boardgame/261679/bunneebank |
| H23 | Campaign Manager 2008 | 2009 | Christian Leonhard, Jason Matthews | https://boardgamegeek.com/boardgame/46255/campaign-manager-2008 |
| H24 | Caravelas | 2010 | Gil d'Orey, Joao Menezes | https://boardgamegeek.com/boardgame/72131/caravelas |
| H25 | Castellum: Maastricht | 2018 | Erik Scheele | https://boardgamegeek.com/boardgame/210660/castellum-maastricht |
| H26 | City of the Big Shoulders | 2019 | Raymond Chandler III | https://boardgamegeek.com/boardgame/214880/city-of-the-big-shoulders |
| PHC3 | CO2 | 2012 | Vital Lacerda | https://boardgamegeek.com/boardgame/72225/co2 |
| H27 | Colosseum | 2007 | Wolfgang Kramer, Markus Lübke | https://boardgamegeek.com/boardgame/27746/colosseum |
| V10 | Commissioned | 2016 | Patrick Lysaght | https://boardgamegeek.com/boardgame/171479/commissioned |

| PHC4 | Compounded | 2013 | Darrell Lauder | https://boardgamegeek.com/boardgame/118174/compounded |
| H28 | Concordia | 2013 | Mac Gerdts | https://boardgamegeek.com/boardgame/124361/concordia |
| PHC5 | Covalence: A Molecule Building Game | 2016 | John Coveyou | https://boardgamegeek.com/boardgame/184663/covalence-a-molecule-building-game |
| H29 | Curators | 2021 | Tove Jomer, et. Al. | https://boardgamegeek.com/boardgame/264212/curators |
| B6 | Cytosis: A Cell Biology Board Game | 2017 | John Coveyou, et. Al. | https://boardgamegeek.com/boardgame/202977/cytosis-a-cell-biology-board-game |
| B7 | Darwin's Choice | 2019 | Marc Dür, et. Al. | https://boardgamegeek.com/boardgame/250309/darwins-choice |
| PHC6 | Destination Neptune | 2014 | Ian Brody | https://boardgamegeek.com/boardgame/157135/destination-neptune |
| G13 | Det Store Spil om København | 2009 | Erik Bergholm | https://boardgamegeek.com/boardgame/61927/det-store-spil-om-kobenhavn |
| G14 | Deutschland: Finden Sie Minden | 2007 | Günter Burkhardt | https://boardgamegeek.com/boardgame/28436/deutschland-finden-sie-minden |
| B8 | Dino Detektive | 2008 | Dominique Ehrhard | https://boardgamegeek.com/boardgame/34692/dino-detektive |
| H30 | Encyclopedia | 2022 | Eric Dubus, Oliver Melison | https://boardgamegeek.com/boardgame/351526/encyclopedia |
| V11 | European Union: The Board Game | 2015 | Alex Tseng | https://boardgamegeek.com/boardgame/181083/european-union-the-board-game |
| B9 | Fauna | 2008 | Friedemann Friese | https://boardgamegeek.com/boardgame/35497/fauna |
| H31 | First to Fight | 2014 | Adam Kwapiński, Michał Sieńko | https://boardgamegeek.com/boardgame/160773/first-to-fight |
| H32 | Fitna: The Global War in the Middle East | 2020 | Pierre Razoux | https://boardgamegeek.com/boardgame/253696/fitna-the-global-war-in-the-middle-east |
| H33 | Freedom: The Underground Railroad | 2013 | Brian Mayer | https://boardgamegeek.com/boardgame/119506/freedom-the-underground-railroad |
| H34 | Fujian Trader | 2016 | Robert Batchelor, Sari Gilbert | https://boardgamegeek.com/boardgame/169855/fujian-trader |
| PHC7 | Galactic Space Exploration: Level 1 | 2019 | Josh Vojtisek | https://boardgamegeek.com/boardgame/279264/galactic-space-exploration-the-ultimate-space-expl |
| B10 | Genotype: A Mendelian Genetics Game | 2021 | John Coveyou, et. Al. | https://boardgamegeek.com/boardgame/252752/genotype-a-mendelian-genetics-game |
| V12 | Green Deal | 2014 | Juma Al-Jou-Jou | https://boardgamegeek.com/boardgame/153870/green-deal |
| V13 | Hegemony: Lead Your Class to Victory | 2023 | Vangelis Bagiartakis, Varnavas Timotheou | https://boardgamegeek.com/boardgame/321608/hegemony-lead-your-class-to-victory |
| V14 | Hero of Weehawken | 2011 | Robert Leonhard | https://boardgamegeek.com/boardgame/100169/hero-of-weehawken-the-aaron-burr-conspiracy-1805-1 |
| V15 | I Know It All | 2019 | N/A | https://boardgamegeek.com/boardgame/283321/i-know-it-all/credits |
| G15 | I Love Portugal | 2016 | Nuno Bizarro Sentieiro, Paulo Soledade | https://boardgamegeek.com/boardgame/190828/i-love-portugal |
| B11 | In The Footsteps of Darvin | 2023 | Grégory Grard, Matthieu Verdier | https://boardgamegeek.com/boardgame/376683/in-the-footsteps-of-darwin |
| H35 | John Company | 2017 | Cole Wehrle | https://boardgamegeek.com/boardgame/211716/john-company |
| H36 | Kolejka | 2011 | Karol Madaj | https://boardgamegeek.com/boardgame/85325/kolejka/ratings |
| L2 | Kutu Buku: A Game of Nerdy Talks | 2019 | Yusak Arief Jatmiko, Arya Wirahadi | https://boardgamegeek.com/boardgame/290797/kutu-buku-a-game-of-nerdy-talks |

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|---|---|---|---|---|
| H37 | Lisboa | 2017 | Vital Lacerda | https://boardgamegeek.com/boardgame/161533/lisboa |
| MG5 | Master of Economy | 2010 | Andrzej Kurek | https://boardgamegeek.com/boardgame/75441/master-of-economy |
| H38 | Museum: Pictura | 2022 | Eric Dubus, Oliver Melison | https://boardgamegeek.com/boardgame/301019/museum-pictura |
| B12 | Octopus' Garden | 2011 | Roberta Taylor | https://boardgamegeek.com/boardgame/85800/octopus-garden |
| PHC8 | One Small Step | 2020 | James DuMond, et. Al. | https://boardgamegeek.com/boardgame/282227/one-small-step |
| H39 | Paleolithic | 2018 | Chih-Fan Chen, Chi Wei Lin | https://boardgamegeek.com/boardgame/250525/paleolithic |
| B13/MG | Pandemic | 2008 | Matt Leacock | https://boardgamegeek.com/boardgame/30549/pandemic |
| H40/B/MG | Pandemic: Fall of Rome | 2018 | Matt Leacock, Paolo Mori | https://boardgamegeek.com/boardgame/260428/fall-of-rome |
| B14/MG/ | Pandemic: Iberia | 2016 | Matt Leacock, Jesus Torres Castro | https://boardgamegeek.com/boardgame/198928/iberia |
| H41 | Paris | 2020 | Michael Kiesling, Wolfgang Kramer | https://boardgamegeek.com/boardgame/282954/paris |
| H42 | Pastiche | 2011 | Sean MacDonald | https://boardgamegeek.com/boardgame/91620/pastiche |
| H43 | Pax Pamir: Second Edition | 2019 | Cole Wehrle | https://boardgamegeek.com/boardgame/256960/pax-pamir-second-edition |
| PHC9 | Peak Oil | 2017 | Tobias Gohrbandt, Heiko Günther | https://boardgamegeek.com/boardgame/169215/peak-oil |
| V16 | Pedalar em Segurança | 2019 | João Quintela Martins | https://boardgamegeek.com/boardgame/294475/pedalar-em-seguranca |
| B15 | Peptide: A Protein Building Game | 2014 | John Coveyou | https://boardgamegeek.com/boardgame/166298/peptide-a-protein-building-game |
| PHC10 | Periodic: A Game of The Elements | 2019 | John Coveyou, Paul Salomon | https://boardgamegeek.com/boardgame/257582/periodic-a-game-of-the-elements |
| PHC11 | Planetarium | 2017 | Dann May, Stéphane Vachon | https://boardgamegeek.com/boardgame/200454/planetarium |
| H44 | Quinto Imperio | 2013 | David M Santos-Mendes | https://boardgamegeek.com/boardgame/139842/quinto-imperio |
| H45 | Robespierre: The Game of French Revolution | 2024 | Firmino Martínez | https://boardgamegeek.com/boardgame/148086/a-new-dawn-the-french-1789-revolution |
| L3 | Roots: A Game of Inventing Words | 2015 | James Pianka | https://boardgamegeek.com/boardgame/168055/roots-a-game-of-inventing-words |
| H46 | Saigon 75 | 2023 | Jean-Philippe Barcus, Pascal Toupy | https://boardgamegeek.com/boardgame/232461/saigon-75 |
| H47 | Semper Fidelis: Bitwa o Lwów 1918-1919 | 2017 | Lukasz Wrona | https://boardgamegeek.com/boardgame/238012/semper-fidelis-bitwa-o-lwow-1918-1919 |
| B16 | Skogen | 2017 | Daniel Thorell | https://boardgamegeek.com/boardgame/235865/skogen |
| V17 | Sola Fide: The Reformation | 2016 | Christian Leonhard, Jason Matthews | https://boardgamegeek.com/boardgame/200834/sola-fide-the-reformation |
| PHC12 | Subatomic: An Atom Building Game | 2018 | John Coveyou | https://boardgamegeek.com/boardgame/207910/subatomic-an-atom-building-game |
| H48 | Swing States 2012 | 2012 | Alan Emrich, et. Al. | https://boardgamegeek.com/boardgame/125936/swing-states-2012 |
| V18 | Terra | 2014 | Friedemann Friese | https://boardgamegeek.com/boardgame/153507/terra |
| H49/PHC | Tesla vs. Edison: War of Currents | 2015 | Dirk Knemeyer | https://boardgamegeek.com/boardgame/132544/tesla-vs-edison-war-of-currents |
| H50/PHC | The New Science | 2013 | Dirk Knemeyer | https://boardgamegeek.com/boardgame/114667/the-new-science |

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| MG6 | The Prestel New York Architecture Game | 2002 | Thomas Fackler | https://boardgamegeek.com/boardgame/4620/the-prestel-new-york-architecture-game |
| H51 | The Shores of Tripoli | 2020 | Kevin Bertram | https://boardgamegeek.com/boardgame/237860/the-shores-of-tripoli |
| GG16 | Trekking the National Parks | 2014 | Charlie Bink | https://boardgamegeek.com/boardgame/154428/trekking-the-national-parks |
| GG17 | Trekking the World | 2020 | Charlie Bink | https://boardgamegeek.com/boardgame/300442/trekking-the-world |
| GG18 | Tokyo Metro | 2018 | Jordan Draper | https://boardgamegeek.com/boardgame/235344/tokyo-metro |
| B17 | Underwater Cities | 2018 | Vladimir Suchy | https://boardgamegeek.com/boardgame/247763/underwater-cities |
| GG19 | Vinhos | 2010 | Vital Lacerda | https://boardgamegeek.com/boardgame/42052/vinhos |
| H52 | Vintage | 2011 | Gil d'Orey | https://boardgamegeek.com/boardgame/87120/vintage |
| H53 | Warsaw: City of Ruins | 2016 | Filip Milunski | https://boardgamegeek.com/boardgame/206803/warsaw-city-of-ruins |
| H54 | Warsaw Rising Up 1945-1980 | 2016 | Piotr Grzymisławski, Łukasz Szopka | https://boardgamegeek.com/boardgame/167404/warsaw-rising-up-1945-1980 |
| B18 | Wingspan | 2019 | Elizabeth Hargrave | https://boardgamegeek.com/boardgame/266192/wingspan |