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Systematic literature review on the use of games in high school and higher education[1]

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ABSTRACT

Games are embedded in our culture in different formats, both physical and digital. In addition to assisting in the teaching-learning relationship, they provide students with the opportunity to work as a team, solve problems and develop strategies to resolve them. The objective of this work is to investigate how games have been used in educational contexts. A systematic literature review was carried out based on the PRISMA protocol. Articles that addressed the use of games in the classroom were selected for analysis, excluding those that did not fit into this theme. The search in the Thesaurus database returned 12 articles, which were divided into two categories: board games and electronic games. Analysis of the selected material indicated that education uses games in various ways, such as introducing and reinforcing content, solving structural problems that impede practical activities, observing the pedagogical potential of these games and producing teaching resources. In addition to the different purposes for which a game can be used in the classroom, the literature review showed that careful planning on the part of the teacher is essential for the best use of this pedagogical resource.

KEYWORDS: Game. Systematic review. Teaching-learning.

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Revisão sistemática de literatura sobre o uso de jogos no Ensino Médio e Superior

RESUMO

Os jogos estão inseridos em nossa cultura em diferentes formatos, tanto físicos quanto digitais. Além de auxiliar na relação ensino-aprendizagem eles proporcionam aos estudantes a oportunidade de trabalhar em equipe, solucionar problemas e desenvolver estratégias para resolvê-los. O objetivo deste trabalho é investigar como os jogos têm sido utilizados nos contextos educacionais. Realizou-se uma revisão sistemática de literatura com base no protocolo PRISMA. Foram selecionados para análise os artigos que abordavam o uso de jogos em sala de aula, excluindo aqueles que não se enquadravam nessa temática. A busca na base de dados Thesaurus retornou 12 artigos, os quais foram divididos em duas categorias: jogos de tabuleiro e jogos eletrônicos. A análise do material selecionado indicou que a educação utiliza os jogos de várias maneiras, como introdução e reforço de conteúdos, resolução de problemas estruturais que impedem atividades práticas, observação do potencial pedagógico desses jogos e produção de recursos didáticos. Além das diferentes finalidades para as quais um jogo pode ser utilizado em sala de aula, a revisão de literatura evidenciou que um planejamento cuidadoso por parte do professor é fundamental para o melhor aproveitamento desse recurso pedagógico.

PALAVRAS-CHAVE: Jogo. Revisão sistemática. Ensino-aprendizagem.

Revisión sistemática de la literatura sobre el uso de juegos en la educación secundaria y superior

RESUMEN

Los juegos están arraigados en nuestra cultura en diferentes formatos, tanto físicos como digitales. Además de ayudar en la relación enseñanza-aprendizaje, brindan a los estudiantes la oportunidad de trabajar en equipo, resolver problemas y desarrollar estrategias para resolverlos. El objetivo de este trabajo es investigar cómo se han utilizado los juegos en contextos educativos. Se realizó una revisión sistemática de la literatura basada en el protocolo PRISMA. Se seleccionaron para el análisis artículos

que abordaban el uso de juegos en el aula, excluyendo aquellos que no encajaban en esa temática. La búsqueda en la base de datos Thesaurus arrojó 12 artículos, que se dividieron en dos categorías: juegos de mesa y juegos electrónicos. El análisis del material seleccionado indicó que la educación utiliza los juegos de diversas maneras, como introducir y reforzar contenidos, resolver problemas estructurales que impiden las actividades prácticas, observar el potencial pedagógico de estos juegos y producir recursos didácticos. Además de los diferentes propósitos para los que se puede utilizar un juego en el aula, la revisión de la literatura mostró que una planificación cuidadosa por parte del docente es esencial para el mejor uso de este recurso pedagógico.

PALABRAS CLAVE: Juego. Revisión sistemática. Enseñanza-aprendizaje.

* * *

Introduction

Games, such as chess, checkers, and Tetris, are embedded in numerous cultures (Sena; Gunça, 2005). Besides their presence in social and cultural settings, gamified strategies have been employed in several contexts, using features like levels, feedback, scores, ranking, challenges/missions, and cooperation. Gamified strategies refer to applying game elements in non-game contexts to engage, motivate, and facilitate problem-solving in the individuals targeted by these strategies (Kapp, 2012). The widespread use of games by numerous people, their presence across different societies and cultures, and the incorporation of game elements in gamified strategies suggest that games can benefit those who engage with them. In recreational contexts and other domains, such as education, the use of games can yield desirable outcomes for the participants.

Games and gamified strategies in the school context can not only enhance the teaching-learning relationship but also provide students with

learning experiences in teamwork, socialization, problem-solving, and more. Additionally, they can motivate students to participate in class actively.

The term "gamification" was introduced by the English programmer Nick Pelling in 2002 and refers to a process in which game mechanisms are used to solve problems or engage the target audience. In the case of education, the students (Vianna et al., 2013). Game mechanics are critical elements for the game operation or gamification. According to Fontoura (2019, p. 795):

> mechanics are repeatedly used by players as they play, providing behavioral patterns. The game mechanics represent the resources available for players to make their choices in the game, perform actions, and build their experience with that artifact.

Mechanics, alongside aesthetics and dynamics, are essential for game progression. Based on games' potential for the teaching-learning relationship, this study aimed to investigate how games have been utilized in educational contexts. A systematic literature review was conducted to understand how games are specifically used in classrooms, which included searching for articles on the topic and organizing the findings.

Method

A systematic literature review was conducted according to the procedures and phases defined in the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. Articles were searched on the Thesaurus database (Thesaurus, 2021). Thesaurus is a glossary from the National Institute for Educational Studies and Research Anísio Teixeira (INEP), which compiles terms and concepts extracted from documents at the Center for Information and Library in Education (Cibec). These terms, functioning as descriptors, are organized as an index. The following keywords

were used for searches on the platform: "game" and "games." Each searched term yielded different subcategories, resulting in various types of written works (e.g., articles, pamphlets, books, journals, research reports etc.). Only articles were extracted from these results. The term "game" resulted in the following subcategories: ludic education (n = 52), game rules (n = 2), and educational value of games (n = 8). As for "games," the following subcategories were obtained: movement games (n = 4), simulation games (n = 13), mathematical games (n = 41), and educational games (n = 143).

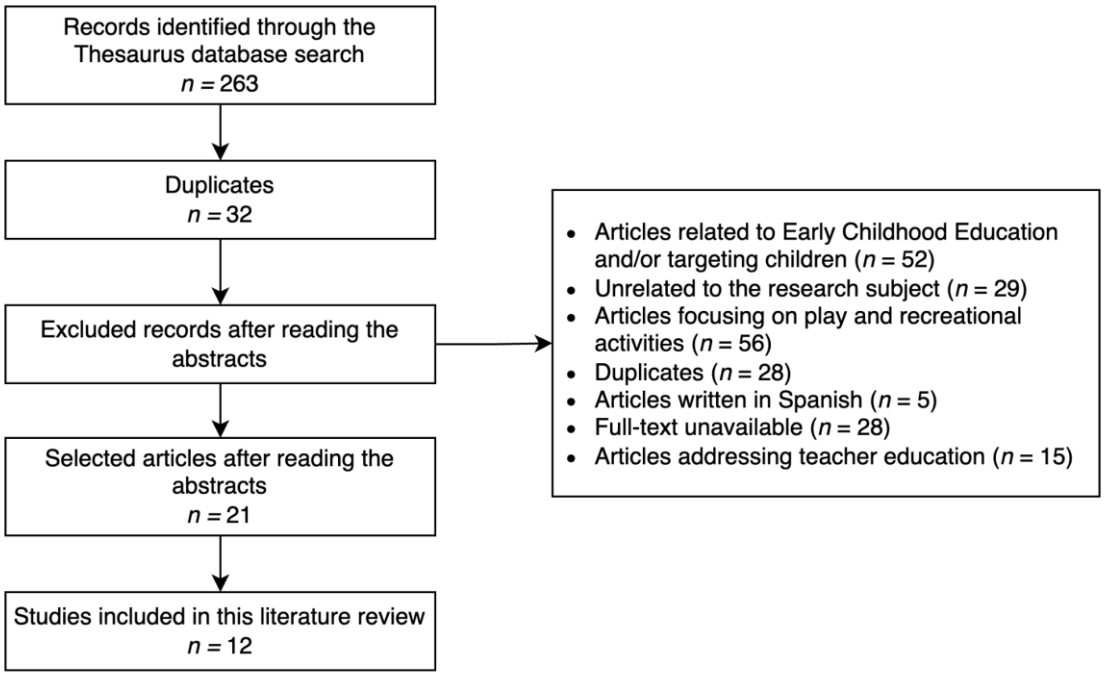
After searching for articles, titles and abstracts were read. Through this reading, studies meeting one of the following criteria were excluded: those related to Early Childhood Education and/or targeting children (n = 52); those unrelated to the research subject (n = 29); those focusing on play and recreational activities (n = 56); duplicates (n = 28); those written in Spanish (n = 5); those not available in full text (n = 28); and those addressing teacher education (n = 15).

The articles unrelated to the research subject included those focusing specifically on Indigenous education, the reading acquisition process, the significance of a game during a Physical Education class, the use of video games, game design, violence analysis, game architecture, mathematics exclusively, cognitive function assessment, particularly related to theater, libraries, and pedagogy, circus games, game quality assessment, computer-assisted teaching strategies, ethnomathematics and modeling, podcasts, business games, game mapping, specifically chess usage, board game transposition to digital media, and the use of digital games in education to enhance attention and cognitive flexibility. It was understood that these publications did not align with the aim of investigating how games have been used in educational contexts.

The remaining texts were fully read after excluding articles based on titles and abstracts (n = 21). Nine articles were excluded because they focused on gamification processes, ethnomathematics, cognoteca (collection of games

and other resources to work on emotional, social, and cognitive skills), or online math education, focused on computer science or marketing, described game suggestions for geography, or targeted children as their participants. The phases described above can be observed in Figure 1.

FIGURE 1: Flowchart of phases of selecting articles on using games in education.



Source: Authors (2022).

Results

After reading the abstracts and the full texts, 12 studies remained available for analysis. These studies addressed specifically the use of games in High School and/or Higher Education classrooms. These were distributed into two major groups, according to the type of game used in the study: board/card games (n = 8) and digital games (n = 4). The studies were analyzed according to the following categories: motivation, purpose, evaluation, function, and mechanics. The results was divided into sections dedicated to

(a) a general description of the analyzed studies and (b) a comparative analysis of the games used in each study. These sections were presented separately for each major group of games.

General Description of Studies on Board/Card Games

Within the board/card games group, Fujiwara and Marques (2017) developed an original game titled "A Day in the Forest," aimed at increasing student engagement with specific subject matter. The game simulated natural processes and anthropogenic interferences occurring in forests. It featured pieces representing various stages of tree development, which could topple other pieces or be toppled by them, akin to dominoes. This mechanism was designed to simulate the natural formation of clearings. The game also included cards representing natural processes and anthropogenic interferences, such as illegal deforestation cards, which removed an opponent's piece, and seedling bank cards, which added pieces to the board. Additionally, "bee" and "bird" pieces provided pollination and seed dispersal mechanics. The game concluded when one of the boards was completely filled with plant pieces, with the winner being the player who accumulated the most points from their pieces.

Students who participated in the study completed pre-game and post-game questionnaires to evaluate the game. The pre-game questionnaire assessed their previous use of educational resources, the subjects they felt most comfortable discussing, and the frequency with which they typically played card games, video games, and board games. The post-game questionnaire evaluated the students' level of attention while playing and their interest in the subject matter during the game. All questions were open-ended and required written responses. According to the responses, students reported that the game increased their interest in the subject matter and changed the teaching process.

To address the challenges 8th and 9th-grade students face in learning about food's chemical composition, Della Antonia et al. (2017) developed an original board game titled “San San.” The game included two decks of cards and ten game boards. Each deck contained 80 cards organized into 20 sets, with each set corresponding to a regulatory nutrient. Each set comprised four cards, each detailing one of the following aspects of the nutrient: name, function, foods in which it is found, and interesting facts. Each game board featured a table with four rows and four columns, where the rows represented different nutrients, and the columns represented their respective characteristics. The game's objective was to correctly complete the board by placing the cards in the appropriate rows and columns corresponding to each nutrient.

To assess the game's effectiveness, the authors administered two questionnaires, one prior to and one following gameplay. The pre-game questionnaire comprised two objective questions: the first asked which nutrient causes anemia, and the second queried about the difficulty of seeing in low-light environments (i.e., night blindness). The post-game questionnaire included an objective question regarding the cause of difficulty in seeing (i.e., vitamin deficiency) and an open-ended question inviting respondents to share their opinions about the lesson. The correct responses in the post-game questionnaire, concerning the content addressed, doubled compared to the pre-game questionnaire. Students indicated that the game was an engaging learning method. According to the authors, the game effectively facilitated the teaching-learning process and empowered students to participate in their education actively.

Silva Junior et al. (2019) aimed to promote the production of educational materials, providing theoretical and practical experience for future teachers. To this end, they utilized the "San San" game developed by Della Antonia et al. (2017) as a foundation, altering the theme to focus on health and diseases while retaining the original gameplay mechanics. A post-

game questionnaire was administered to evaluate the game's acceptance, gather suggestions for improvements, assess the effectiveness of learning through the game, and collect opinions on its use in the classroom. Based on the responses, the authors concluded that the game effectively facilitated the teaching-learning process and was well received by both students and the instructor.

Medeiros and Diógenes (2018), Rizzo et al. (2014), and Silva et al. (2019) also based their adaptations on existing games. The original games are popular and widely available commercially. Medeiros and Diógenes (2018) modified the game "Banco Imobiliário" by Estrela based on classroom contents. These adaptations were developed in collaboration with third-year Integrated High School Administration program students. The modifications (e.g., a giant board with players acting as the game pieces, two participants at a time, etc.) were designed to address topics in the Introduction to Financial Administration course. The game was implemented with elementary school students as part of an outreach project. A post-game questionnaire with open-ended questions was administered to evaluate the game's acceptance, content assimilation, and potential difficulties. According to the authors, the game facilitated participant interaction during both the production and application phases, as students actively engaged and contributed to their own learning process with interest and involvement.

Rizzo et al. (2014) adapted the game "Pictionary" by GROW, one of the most popular board game brands in Brazil, to create "Exploring the Invisible World - Challenges of Signs." This modified version aimed to help elementary school deaf students learn about diseases caused by microorganisms through drawings and body expressions, altering the original game's content and rules. The board featured a number of spaces corresponding to the authors' suggested game duration of 30 to 50 minutes. The game comprised fifty cards categorized into five themes: human body, curiosities, challenges, prevention, and symptoms. Each card presented the theme on the front and, on the back,

included the final answer with the name of the disease, the type of microorganism, and a clue to facilitate miming or drawing. The game also had two dice (the first to determine the theme and the second to establish the starting order and the number of spaces the team would advance upon a correct answer), an hourglass, two drawing pads, and an instruction booklet detailing the rules.

According to the authors, the game is an effective tool for presenting content in an engaging and concrete manner, thereby making abstract concepts more accessible. Additionally, it aligns with the Science curriculum outlined in the National Curriculum Parameters. The game also contributed to the teaching and learning process by enhancing scientific literacy and developing relevant competencies and skills.

Silva et al. (2019) developed the game "Playing with Chemistry," inspired by the game "*Cuca Legal*" (Cool Brain) by Pais e Filhos, to facilitate the teaching of electrochemistry concepts, a subject known for its complexity and difficulty. The game's objectives were also to stimulate interest in electrochemistry and support educators in teaching key topics, such as batteries and electrolysis, to 10th-grade students. The game board was structured into three levels of complexity: novice (green), intermediate (yellow), and expert (red). It featured four types of spaces: regular, bonus, surprise, and hazard, with regular spaces requiring players to answer questions. The game set included six pawns and an hourglass and was designed for play in pairs or groups.

A pre-game discussion session was conducted to gauge students' prior knowledge. Following gameplay, a discussion, and written evaluation were performed to assess the game's effectiveness and feasibility. The results indicated that the game significantly enhanced students' understanding of electrochemistry concepts. The interaction between the teacher/facilitator and the students was pivotal in the learning process, helping to identify areas where students struggled the most. The authors highlighted that post-game,

38% of the 10th-grade students improved their scores on a recovery test, demonstrating a notable enhancement in their academic performance.

Carvalho and Oliveira (2014) and Viana and Barreto (2011) incorporated established and patented games into their research. Specifically, Carvalho and Oliveira (2014) utilized the "Set Game" to explore its pedagogical implications for students experiencing learning difficulties. The game's objective was to identify the largest number of correct sets of three cards from twelve cards displayed on the table, with the player forming the most correct sets declared the winner. The cards varied in shape, color, number of figures, and shading. The authors designed problem scenarios to investigate how the game could facilitate cognitive change and new elaborations. Four distinct problem scenarios were presented, each offering various solution possibilities, and students were required to explain their resolution strategies. This approach allowed for the observation of the strategies employed by the students.

To form a set, three possibilities were defined: first, all cards could have the same color, shape, and number of figures, but different fill patterns; second, all cards could have different colors, shapes, and numbers of figures, but the same fill pattern; third, all cards could have different colors, shapes, numbers, and fill pattern. The pedagogical implications identified in the game included self-awareness of actions, recognition and analysis of errors, cognitive conflict, strategy formation, recognition of personal strategies, and action planning.

Lastly, Viana and Barreto (2011) employed the game "Snakes and Ladders" to examine the impact of using games to teach mathematical concepts such as counting, addition, and subtraction to deaf students. The game aimed to help students explore and reinforce these mathematical concepts. Players navigated a board with 100 squares, encountering snakes and ladders based on their dice rolls. Landing on a ladder square allowed players to advance, while landing on a snake's head forced them to slide back

to the tail, moving several squares backward. Students were prompted to perform mathematical operations to determine the number of squares gained or lost.

The study was conducted over eight sessions. In the initial session, students were given free access to the game without the requirement to perform mathematical operations, allowing them to learn the rules. Initially, most students preferred printed activities over the game. However, as they continued to play, they became more engaged, losing their fear of making mistakes and demonstrating increased interest, autonomy, creativity, and interaction. They also became more determined to overcome challenges and achieve positive results.

Through participant observation—a method where the researcher observes from the perspective of a member while also influencing the observation through participation—the authors concluded that the game enabled students to recognize their correct and incorrect answers and understand the reasoning behind them. Consequently, players could correct their mistakes and review their responses, enhancing their learning experience.

Comparative Analysis of the Use of Board/Card Games

The comparative analysis of the games was conducted based on the following aspects of each study: motivation, purpose, evaluation, function, and mechanics. Chart 1 summarizes this analysis, detailing the first four categories.

Chart 1: Board Game's motivation, purpose, evaluation, function, and authorship.

Motivation	Purpose	Evaluation	Function	Game Authorship
The San San game as didatic resource of support in the discussions about regulatory nutrients in Elementary Education (DELLA ANTONIA et al., 2017)				
Challenges faced by	Addressing students'	Pre and post-	Review a	• Original

students with specific subject matter.	challenges in comprehending specific subject matter.	game questionnaire.	subject.	• Developed by authors.
When the game at school is more than a game: possibilities of pedagogical intervention in the game of rules Set Game (CARVALHO; OLIVEIRA, 2014)				
Challenges faced by students in mastering subject matter.	Addressing students' challenges in comprehending specific subject matter.	No information available.	Review a subject.	• Already existing (no brand mentioned) • No information about the game developers.
The learning potential of games in teaching Agricultural and Forest Engineering (FUJIWARA; MARQUES, 2017)				
Scarcity of games focused on a specific theme.	Enhance the resources available for addressing specific content.	Pre and post-game questionnaire.	Review a subject.	• Original • Developed by authors.
A differentiated approach to health education in high school (SILVA JUNIOR et al., 2019)				
Promote teaching materials development, fostering theoretical and practical experience for future educators.	Enhance the resources available for addressing specific content.	Post-game questionnaire.	Review a subject.	• Adaptation of the San San game by Della Antonia et al. (2017) • Adapted by the authors.
The learning teaching of the Administration through the game Monopoly in a context of technical education (MEDEIROS; DIÓGENES, 2018)				
Address specific subject matter content.	Address content typically explored in specific academic subjects.	Post-game questionnaire.	Facilitate the comprehension of a subject.	• Adaptation of the Monopoly game (by Estrela) • Adapted by the third-year students of the Integrated High School Administration program, IFAM – São Gabriel da Cachoeira Campus
Playing with the chemistry: A learning tool in the electrochemistry teaching (SILVA et al., 2019)				
Address complex concepts within a specific subject.	Address complex concepts with a high level of difficulty.	Sharing circle.	Practice a subject.	• Adaptation of the *Cuca Legal* (Cool Brain) game by Pais e Filhos • No information about the game developers, but it can be inferred that it was developed by the authors
The construction of mathematical concepts in education of deaf students: The role of games in learning (VIANA; BARRETO, 2011)				
Investigate the significance of using games for specific subjects with deaf individuals.	Examine the significance of using games in the education of individuals with disabilities.	No information available.	Review a subject.	• Already existing • No information about the game developers.
Microbial diseases in the teaching-learning process of deaf people: A possible dialogue (RIZZO et al., 2014)				
Education of deaf	Examine the significance	No	Introduce a	• Adaptation of

students.	of using games in the education of individuals with disabilities.	information available.	new subject.	the game Pictionary by GROW • No information about the game developers.

Source: Authors (2023).

Motivation was defined as the context described by the authors for developing the game, specifically what motivated them to consider using the game in the classroom. Della Antonia et al. (2017) and Carvalho and Oliveira (2014) employed games after identifying that students struggled to comprehend specific subjects, such as chemistry (Antonia et al., 2017). Fujiwara and Marques (2017) created a game because, according to them, there is a scarcity of games in the field of forestry engineering, their area of expertise. Silva Junior et al. (2019) aimed to encourage the production of educational materials through games, providing theoretical and practical experiences for future teachers. Medeiros and Diógenes (2018) adapted the game Banco Imobiliário to teach content in the Introduction to Administration course. Silva et al. (2019) developed a game to teach electrochemistry concepts, which are considered complex and challenging to understand. Viana and Barreto (2011) investigated the significance of using games to teach mathematical concepts such as counting, addition, and subtraction to deaf students. Finally, Rizzo et al. (2014) used the game as an alternative method for teachers to instruct deaf students about microbial diseases.

Regarding the purposes of using the game, the following were identified: addressing students' comprehension difficulties related to the covered content (Della e Antonia et al., 2017; Ccarvalho; Oliveira, 2014); enhancing available resources to work on specific content (Fujiwara; Marques, 2017; Silva Junior et al., 2019); addressing content typically explored in specific academic subjects (Medeiros; Diógenes, 2018); addressing complex concepts with a high level of difficulty (Silva et al., 2019); and

examining the significance of using games in the education of individuals with disabilities (e.g., Viana; Barreto, 2011; Rizzo et al., 2014).

About evaluation measures, the methods utilized by the authors to assess the effectiveness of the game's implementation were identified. The evaluation measures included the use of post-game questionnaires (Medeiros; Diógenes, 2018; Silva Junior et al., 2019); the administration of pre and post-game questionnaires (e.g., Della Antonia et al., 2017; Fujiwara; Marques, 2017); and a sharing circle session conducted before and after the game's implementation (e.g., Silva et al., 2019). Some authors did not report using evaluation measures in their research (Carvalho; Oliveira, 2014; Viana; Barreto, 2011; Rizzo et al., 2014).

Finally, concerning the function of the game, which relates to how the game was utilized, the following functions were identified: reviewing content (e.g., Della Antonia Et Al., 2017; Carvalho; Oliveira, 2014; Fujiwara; Marques, 2017; Silva Junior Et Al., 2019; Viana; Barreto, 2011), facilitating the comprehension of a subject (Medeiros; Diógenes, 2018), practicing a content (Silva et al., 2019), and introducing a new content (Rizzo et al., 2014).

The penultimate category of analysis pertains to the mechanics present in the games. The study by Rizzo et al. (2014) was the only one to identify the competition mechanic, whereas Fujiwara and Marques (2017) recognized the presence of mechanics without specification. Despite many authors either briefly mentioning the term "mechanic" or omitting it altogether, a detailed examination of the game descriptions in the studies allowed for identifying certain game mechanics. The study by Cunegato et al. (2016) and the BoardGameGeek database (Alden; Solko, 2022) were utilized to identify the mechanics featured in each game. Chart 2 consolidates these identified mechanics.

Chart 2: Mechanics present in board/card games.

Mechanics	**Board/Card Games**
Acting: Games with the Acting mechanic require players to	Pictionary (RIZO et. al., 2014)

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use some form of mime or mimicry to communicate with the other players (ALDEN; SOLKO, 2022 s.p.).	
Bidding: This mechanic requires you to place a bid, usually monetary, on items in an auction of goods in order to enhance your position in the game. These goods allow players to take future actions or improve positions (ALDEN; SOLKO, 2022 s.p.).	Monopoly (MEDEIROS; DIÓGENES, 2018)
Competition: These elements are what drive a player to compete against and seek to win over another player or the computer (CUNEGATO et al., 2016).	San San (DELLA ANTONIA et al., 2017; SILVA JUNIOR et al., 2019)
Cooperative Game: Players coordinate their actions to achieve a common win condition or conditions. Players all win or lose the game together (ALDEN; SOLKO, 2022 s.p.).	Pictionary (RIZO et. al., 2014) *Cuca Legal* (Cool Brain; SILVA et al., 2019)
Events: Actions occur outside the control of players that cause an immediate effect, change the state of the game, or impact subsequent actions (ALDEN; SOLKO, 2022 s.p.).	Snakes and Ladders (VIANA; BARRETO, 2011)
Income: Players gain resources at defined times (ALDEN; SOLKO, 2022 s.p.).	Monopoly (MEDEIROS; DIÓGENES, 2018)
Loans: Players may take a Loan from the bank to get more money (ALDEN; SOLKO, 2022 s.p.).	Monopoly (MEDEIROS; DIÓGENES, 2018)
Lose a Turn: This is a meta-mechanism that can be applied to a variety of turn structures. A player who "Loses a Turn" must skip their next opportunity for a turn, and will go to the next round, or the next time their turn arises (ALDEN; SOLKO, 2022 s.p.).	Monopoly (MEDEIROS; DIÓGENES, 2018)
Ownership: Players own entities, and perform actions for those entities, or collect benefits if others use them (ALDEN; SOLKO, 2022 s.p.).	Monopoly (MEDEIROS; DIÓGENES, 2018)
Paper-And-Pencil: The game is developed using paper and pen to mark and save responses or attributes that, at the end of the game, are used to score points and determine the winner. A game that merely keeps track of score on a sheet of paper does not use a paper-and-pencil mechanism (ALDEN; SOLKO, 2022 s.p.).	*Cuca Legal* (Cool Brain; SILVA et al., 2019)
Player Elimination: A player can be removed from the game, no longer participating (ALDEN; SOLKO, 2022 s.p.).	Monopoly (MEDEIROS; DIÓGENES, 2018)
Race: Typically this is expressed as the winner being the first player to reach the end of a track, but any type of fixed goal also qualifies as a Race mechanism (ALDEN; SOLKO, 2022 s.p.).	*Cuca Legal* (Cool Brain; SILVA et al., 2019) Snakes and Ladders (VIANA; BARRETO, 2011) A Day in the Forest (FUJIWARA and MARQUES, 2017)
Roll / Spin and Move: Roll / Spin and move games are games where players roll dice or spin spinners and move playing pieces in accordance with the roll (ALDEN; SOLKO, 2022 s.p.).	Monopoly (MEDEIROS; DIÓGENES, 2018) Pictionary (RIZO et. al., 2014) *Cuca Legal* (Cool Brain; SILVA et al.,

	2019) Snakes and Ladders (VIANA; BARRETO, 2011)
Set Collection: Players need to collect a set of assignments/items that grant them a variety of scores or scorable objectives based on the difficulty level set by the game (ALDEN; SOLKO, 2022 s.p.).	Monopoly (MEDEIROS; DIÓGENES, 2018) Set Game (CARVALHO; OLIVEIRA, 2014) A Day in the Forest (FUJIWARA; MARQUES, 2017)
Simulation: Simulation games attempt to create a realistic model of actual events or situations. It's possible for a simulation to simulate hypothetical or fictional events—as long as there is enough information to create a model that would be realistic in that situation (ALDEN; SOLKO, 2022 s.p.).	A Day in the Forest (FUJIWARA; MARQUES, 2017)
Stock Holding: Stock Holding is a subcategory of Investment, in which players may buy and sell (or retain) defined interests in a shared asset, such as a company, commodity or nation. This will often grant certain privileges of Ownership (ALDEN; SOLKO, 2022 s.p.).	Monopoly (MEDEIROS; DIÓGENES, 2018)
Team-Based Game: In team-based games, teams of players compete with one another to obtain victory. There are a variety of possible team structures, including symmetrical teams like 2v2 and 3v3, multiple sides like 2v2v2, and even One vs. All (ALDEN; SOLKO, 2022 s.p.).	Pictionary (RIZZO et. al., 2014)
Track Movement: Pieces are moved along a linear track (not necessarily straight - it may turn, curve, or loop) (ALDEN; SOLKO, 2022 s.p.).	Monopoly (MEDEIROS; DIÓGENES, 2018) Snakes and Ladders (VIANA; BARRETO, 2011)
Trading: Players may Trade assets directly with each other, rather than via a Market (ALDEN; SOLKO, 2022 s.p.).	Monopoly (MEDEIROS; DIÓGENES, 2018)

Source: Authors (2023).

General Description of Studies on Digital Games

Concerning to the digital games group, Ramos et al. (2017) and Ramos et al. (2020) utilized original games in their studies. Ramos et al. (2017) selected the game "*Saga dos Conselhos*," (Saga Game of the Councils[3]) developed by the Federal University of Santa Catarina (UFSC), aiming to

[3] In Brazilian education, these councils (i.e., class council) comprise a group of teachers and a coordinator and/or school director. At the end of a predetermined period, typically a bimester or semester, they convene to evaluate and discuss each student's progress.

review content and bring adults closer to the gaming world, recognizing them within their professional contexts. The game focused on the theme of class councils, starting with the character João, a student present in all minigames. João interacted with players based on their successes or failures in the minigames. As players progressed and succeeded, additional characters such as the teacher, secretary, principal, and student's mother were unlocked. Based on interviews with participants, the authors noted empathy and identification with the characters, attributing this to the game's realistic portrayal of class councils. This highlighted the critical role of game elements and visual identification in engaging the audience and aiding players in understanding the game's rules, functionalities, and other features.

Ramos et al. (2020) developed the game "Farm 3D, version 2.0" to create a simulation environment due to the Federal Institute of Amazonas (IFAM) lacking a permanent space for field practices, particularly for raising large animals. The first phase focused on understanding the needs of consumers to develop a product that addressed these needs and enhanced learning. The second phase involved creating 3D models of animals and other relevant structures. In the third phase, the models were painted, incorporating realistic elements such as wood and grass. The fourth phase added motion effects to the game. In the fifth phase, the game was installed on institutional computers, where both teachers and students played to identify and rectify any issues. The game featured various missions, which the authors found to be motivating for students, serving as an excellent teaching-learning tool for educators, being both practical and engaging. While the authors did not specify any evaluation metrics, they concluded that the game facilitated interaction with farm structures, promoting a teaching-learning dynamic by providing a playful learning experience. Through the game, players could gain an understanding of farm management. Consequently, the game mitigated learning challenges in animal production

and the limitations posed by the institution's infrastructure, while also aiding in future practical lessons for students.

Mendes and Grando (2008) and Moreira and Cruz (2019) utilized existing digital games in their studies. Mendes and Grando (2008) employed the game "SimCity 4" to explore its pedagogical potential in mathematics education, specifically concerning the role of the teacher. Their study also aimed to analyze the effectiveness of digital games in addressing mathematical content and facilitating the conceptualization of mathematical objects. "SimCity 4" incorporates explicit mathematical concepts, including the use of graphs, tables, spatial awareness, time, movement, estimation, and unit recognition. The game enables players to simulate, construct, and manage a city, involving activities such as building mountains, designing riverbeds, and planning budgets and taxes. To succeed in the game, players must develop the city in "God mode" and manage it in "mayor mode." Failure results in the player/mayor facing an impeachment process.

Based on the authors' observations and written records, it was concluded that the students were actively engaged in resolving the problem situations generated by the game and facilitated by the researcher's actions and mediation. Additionally, the study demonstrated the pedagogical potential of using games in mathematics education, as evidenced by the students' appropriation of mathematical concepts and the generation of meaningful understanding of mathematical objects.

Moreira and Cruz (2019) analyzed the educational possibilities present in narratives and digital games. In the first phase of their study, they conducted a review of digital media and cyberculture to understand the gaming world and its narratives, including the specific vocabulary used. Following a group experiment, the researchers identified spatial, temporal, and character elements within the games played by the students.

The first task assigned to the students was to describe the games, focusing on the identification of narrative elements and storylines.

Subsequently, students engaged in a detailed analysis of the games to observe and document character traits. Following this analysis, the students were tasked with creating their own characters or narrators. The participants produced texts ranging from one to ten pages, covering various themes such as game descriptions, narrative elements, character traits, and examples of narrative texts. The games selected for this study included *Crash Bandicoot, The Sims, Super Mario, and Tibia*.

Comparative Analysis of the Use of Digital Games

The comparative analysis (Chart 3) of the studies on digital games, conducted using the predefined categories employed for the analysis of board/card games, identified four types of motivation. These motivations included: an investigation into the pedagogical potential of a specific game (MENDES; GRANDO, 2008), the educational possibilities inherent in narratives and digital games (MOREIRA; CRUZ, 2009), the integration of students into the gaming world and their recognition within their professional environment (RAMOS et al., 2017), and the lack of infrastructure needed for implementing learning practices.

Chart 3: Digital Game's motivation, purpose, evaluation, function, and authorship.

Motivation	Purpose	Evaluation	Function	Game Authorship
The computational game Simcity 4 and its pedagogical potentialities for math classes (MENDES; GRANDO, 2008)				
Investigation into the pedagogical potential of a specific game use in class, concerning the role of the teacher.	Assessing the pedagogical potential of the game Simcity 4.	Observations and written records from authors and problem-solving tasks for students.	Practice a specific subjects..	• Already existing (no brand mentioned) • No information about the game developers.
Electronic games narratives and their educational possibilities (MOREIRA; CRUZ, 2009)				
Investigation into the educational possibilities inherent in narratives and digital games.	Conducting an exploratory survey of the educational opportunities offered by games	No evaluation measure applied.	Practice a specific subjects..	• Already existing (no brand mentioned) • No information about the

				game developers.
The function of the narrative and the characters in a digital educational game: analysis of the Saga Game of the Councils (RAMOS et al., 2017)				
Integration of students into the gaming world and identification of game components within adults professional environment.	Reviewing content, integrating students into the gaming world, and recognizing games' components in their professional context.	Post-game interview.	Review a subject.	• Original • Developed by the UFSC
Development of a serious game about animal production applied to the Agriculture and Livestock technical course (RAMOS et al., 2020)				
Lack of infrastructure at the educational institution.	Developing a simulation to enable students to engage in practical lessons.	No information available.	Facilitating practical experiences.	• Original • Mentor teachers and mentored students

Source: Authors (2023).

The analysis also identified four distinct purposes: assessing the pedagogical potential of a specific game (Mendes; Grando, 2008); conducting an exploratory survey of the educational opportunities offered by games (Moreira; Cruz, 2009); reviewing content, integrating students into the gaming world, and recognizing games' components in their professional context (Ramos et al., 2017); and developing a simulation to enable students to engage in practical lessons and enhance their learning, given the lack of such opportunities at their educational institution (Ramos et al., 2020). The evaluations implemented in these studies included problem-solving tasks (Mendes; Grando, 2008) and post-game interviews (Ramos et al., 2017). Several articles either did not provide this information or did not employ any evaluation measures (Ramos et al., 2020; Moreira; Cruz, 2009).

Ultimately, the functions identified encompassed addressing specific content areas (Mendes, Grando, 2008; Moreira, Cruz, 2009); reviewing subject contents (Ramos et al., 2017); and facilitating practical experiences (Ramos et al., 2020).

The analysis identified four distinct types of game mechanics employed across the studied games. Detailed descriptions of these mechanics, along with the corresponding games that utilized them, are presented in Chart 4.

Chart 4: Mechanics present in digital games.

Mechanics	Digital Game
Leaderboard: Refers to the visual representation of players' progress and achievements (CUNEGATO et al., 2016).	Saga Game of the Councils (RAMOS et al., 2017)
Missions: These indicate predetermined challenges that include specific objectives and rewards (CUNEGATO et al., 2016).	Simcity 4 (MENDES; GRANDO, 2008)
Narrative: A coherent and continuous narrative (SANTOS ; FREITAS, 2017).	Crash Bandicoot, The Sims, Super Mario e Tibia (MOREIRA; CRUZ, 2009) Saga Game of the Councils (RAMOS et al., 2017)
Feedback: Feedback is important as it enables players to identify their mistakes and consider alternative actions (GEE, 2008 apud RAMOS et al., 2017). It pertains to player performance information (SANTOS; FREITAS, 2017).	Simcity 4 (MENDES; GRANDO, 2008) Saga Game of the Councils (RAMOS et al., 2017) Farm 3D, version 2.0 (RAMOS et al., 2020)

Source: Authors (2023).

Discussion

This systematic review aimed to elucidate the utilization of games within the classroom setting. Specifically, the review sought to understand the means of introduction to students and the timing and manner in which teachers implement these games during instruction. The subsequent sections present key considerations derived from the findings.

Despite Fujiwara and Marques (2017) developing a game based on the argument that few exist in their field, their published study fails to provide a detailed description of how to play the produced game. This omission prevents other educators and students from utilizing the game effectively and contributes to the ongoing scarcity of accessible educational games in the field.

Another significant aspect pertains to students' acceptance of the proposal to play games in the classroom. It is often assumed that games will be well-received due to their familiarity among students, as most individuals, particularly younger ones, have played games at some point in their lives.

However, Viana and Barreto (2011) found that the game was not initially well-received by students. Similarly, in Silva et al. (2019), 11th-grade students were initially unmotivated by the game proposal but became more engaged as the game progressed. Conversely, 12th-grade students were motivated from the beginning with the game's proposal. Effective planning by the teacher is critical, as emphasized by Carvalho and Oliveira (2014) in their conclusions.

The evaluative measures employed in the analyzed studies warrant attention. To comprehensively understand how educational practices integrate games and their potential benefits for student learning, it is imperative to utilize clear and objective measures. Predominantly, the evaluation measures consisted of questionnaires addressing the content covered by the games and capturing the students' feedback and opinions.

While students' opinions about the game are essential for identifying necessary adjustments, they should not be the sole measures of its effectiveness. For instance, if a game's purpose is to review existing content or introduce new ones, it is critical to assess whether this goal has been met. Opinion questionnaires alone do not suffice. Silva et al. (2019) reported that, following gameplay, 38% of 11th-grade students successfully recovered their partial grades for the term, thereby enhancing their overall performance. This outcome suggests that the game played a relevant role in the learning process, as evaluated through the makeup exam. Thus, objective content-related measures should be integrated alongside students' subjective feedback.

Additionally, similar evaluations should be applied both before and after the use of the game. Della Antonia et al. (2017) applied a pre-game questionnaire containing two questions and a post-game questionnaire that repeated only one of the initial questions. Consequently, it is not possible to determine the effects of the game concerning the question that was not

repeated, as consistent evaluations were not conducted before and after gameplay.

Furthermore, diversifying evaluation methods enables the observation of various dimensions of learning. Some authors have utilized written records and observations during gameplay. These methods facilitated the observation of enhancements in student learning. Although not commonly employed in classroom settings, such observations and written records are valid evaluation techniques. According to Rodrigues et al. (2016):

> Observations and evaluative records are undeniably valid and effective when aligned with a formative assessment framework and grounded in robust theoretical foundations. From this perspective, it is imperative to reconsider our criteria, methods, purposes, and conceptions of evaluation. Moreover, it is essential to first reevaluate our broader perspectives on society, education, knowledge, and learning.

Board games were more prevalent than digital games in the studies reviewed. Digital games often necessitate computers with appropriate configurations and reliable internet connections. Unfortunately, many schools lack the necessary infrastructure, including suitable spaces for computer use. Furthermore, some students may not have access to the internet or mobile data, rendering digital games impractical. As Kenski (2015) states: "In the Brazilian digital reality, the evident issue is the inequality in access to and use of available internet resources and devices."
All the articles analyzed in the present study concluded that the game successfully met their respective objectives. This suggests that the game played a significant role in the teaching-learning process and its application in education proved to be relevant.

Conclusion

This systematic review examined studies where games were employed in educational settings. In general, it was found that the use of board games was more prevalent than that of digital games. The search for studies generated twice as many results for board games compared to digital games. Most of the board games were specifically designed for classroom use or adapted from other commercially available games. The use of commercially available games was also founded. This discrepancy may be attributed to a lack of technological resources for the development and implementation of digital games.

The present systematic review demonstrates that teachers utilize games in the classroom as a tool to introduce new content, reinforce and consolidate existing knowledge, and address adverse situations such as limited space. This is applicable to both physical and digital games.

Although games are employed for various motivations and purposes, the assessments proposed are often insufficient to verify if the objectives have been achieved. Additionally, it is recommended that teachers carefully plan the integration of games into the classroom and avoid assuming that students will inherently engage. Studies reviewed in this analysis highlighted that in some cases, student motivation did not occur spontaneously and had to be actively encouraged.

Finally, it was observed that commercial games featured a greater number of mechanics compared to original games. Based on this finding, it is recommended that both teachers and students engage in the study of existing game mechanics to diversify their game design strategies, thereby potentially enhancing student engagement.

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