ASSESSMENT OF THE POTENTIAL APPLICATION OF THE GAME PLAGUE INC. AS A PLAYFUL TOOL FOR TEACHING SCIENCE AND BIOLOGY

AVALIAÇÃO DO POTENCIAL DE APLICAÇÃO DO JOGO PLAGUE INC COMO FERRAMENTA LÚDICA PARA O ENSINO DE CIÊNCIAS E BIOLOGIA

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ABSTRACT: This paper explores the educational potential of the game *Plague Inc.* in the context of teaching biological sciences. It begins by highlighting the traditional approach to science education in Brazil, which often prioritizes rote memorization of complex concepts, leading to a disconnect between academic knowledge and practical understanding. The introduction also emphasizes the importance of games as dynamic and engaging educational tools, offering a means to bridge this gap. The paper then introduces *Plague Inc.*, a strategy game developed by Ndemic Creations© that simulates pandemics, placing players in the role of creators of a deadly disease with the goal of infecting and eradicating the world's population. The game's relevance during real-world pandemics, such as Covid-19, is acknowledged. The significance of Plague Inc. in the teaching of biological sciences is discussed, particularly in its potential to enhance the understanding of microbiology and the dynamics of epidemics. The game's applicability is highlighted, spanning from late middle school to university-level education. Its use is framed within Problem-Based Learning (PBL), providing challenges that promote critical thinking and questioning. The paper emphasizes the role of educational games in making learning more enjoyable and tangible, especially when faced with abstract content and limited laboratory resources. *Plague Inc.* is portrayed as a valuable pedagogical resource, enhancing the connection between students and scientific content, as well as fostering creativity, socialization, and collaborative learning. In conclusion, the paper underscores that *Plague Inc.* serves as an effective educational tool for teaching and learning in biological
sciences. It facilitates a deeper understanding of complex concepts related to microbiology and epidemics, contributing to a more comprehensive and meaningful science education. The utilization of educational games like *Plague Inc.* can make learning a dynamic and engaging experience, ultimately enhancing students' scientific literacy and critical thinking skills.

**KEYWORDS:** Educational Games, Pandemic Simulation, Biological Sciences Education.

**RESUMO:** Este artigo explora o potencial educacional do jogo *Plague Inc.*, no contexto do ensino de ciências biológicas. Inicia-se destacando a abordagem tradicional do ensino de ciências no Brasil, que muitas vezes prioriza a memorização de conceitos complexos, levando a uma desconexão entre o conhecimento acadêmico e a compreensão prática. A introdução também enfatiza a importância dos jogos como ferramentas educacionais dinâmicas e envolventes, oferecendo um meio de preencher essa lacuna. O artigo então apresenta *Plague Inc.*, um jogo de estratégia desenvolvido pela Ndemic Creations© que simula pandemias, colocando os jogadores no papel de criadores de uma doença mortal com o objetivo de infectar e erradicar a população mundial. A relevância do jogo durante pandemias do mundo real, como a Covid-19, é reconhecida. A importância da *Plague Inc.* no ensino das ciências biológicas é discutida, particularmente em seu potencial para melhorar a compreensão da microbiologia e da dinâmica das epidemias. A aplicabilidade do jogo é destacada, abrangendo desde o final do ensino médio até o ensino superior. Sua utilização está enquadra na Aprendizagem Baseada em Problemas (ABP), proporcionando desafios que promovem o pensamento crítico e o questionamento. O artigo enfatiza o papel dos jogos educativos em tornar a aprendizagem mais agradável e tangível, especialmente quando confrontados com conteúdos abstratos e recursos laboratoriais limitados. É retratada como um valioso recurso pedagógico, melhorando a conexão entre os alunos e o conteúdo científico, além de promover a criatividade, a socialização e a aprendizagem colaborativa. Em conclusão, o artigo ressalta que o Plague Inc serve como uma ferramenta educacional eficaz para o ensino e aprendizagem em ciências biológicas. Facilita uma compreensão mais profunda de conceitos complexos relacionados à microbiologia e epidemias, contribuindo para uma educação científica mais abrangente e significativa. A utilização de jogos educativos como o Plague Inc pode tornar a aprendizagem uma experiência dinâmica e envolvente, melhorando a literacia científica e as capacidades de pensamento crítico dos alunos.

**PALAVRAS-CHAVE:** Jogos Educativos, Simulação de Pandemias, Educação em Ciências Biológicas.
1. Introduction

Games play a fundamental role as educational resources, offering a dynamic and engaging educational approach that can significantly enhance the learning process. Despite some transformations, science education in Brazil still predominantly emphasizes the memorization of complex and dense scientific concepts and facts, largely neglecting the connection to everyday life and practical situations (ANDRADE et al., 2017).

However, science plays a fundamental role in our daily lives, permeating all aspects of our existence. It manifests in many forms and influences our actions, decisions, and understanding of the world. According to Gee (2003), digital games have the ability to represent various types of concepts, worldviews, and values, conveying them to diverse audiences through interactive audiovisual elements, which enable a wide range of immersive experiences. Thus, we can validate this educational resource as an ally in encouraging the learning of complex content, as in the field of science (AMARAL; PIGATTO, 2022).

The game *Plague Inc.* is a strategy game available on various platforms, including mobile devices and computers, developed by Ndemic Creations©. It presents itself as a pandemic simulation game, with the goal of infecting and eradicating the world's population. Although originally launched as a gaming experience, it also gained attention for its relevance during real-world pandemics, such as the COVID-19 pandemic, when many people obtained it as a way to better understand the spread of infectious diseases.
In the context of science education, the use of the game *Plague Inc.* as a learning tool becomes more promising. It can be strategically incorporated into the curriculum of the Science/Biology discipline, especially when addressing topics such as the Monera Kingdom, Bacteria, and bacterioses. This allows for a more meaningful connection between academic concepts and the scientific and social context, further enhancing the educational potential of the game (NASCIMENTO; BENEDETTI; DOS SANTOS, 2022). This study explored the potential of the game *Plague Inc.* as an educational tool in the context of teaching Science and Biology, emphasizing its significance in Biological Sciences education, particularly regarding microbiology and the understanding of epidemic dynamics.

2. Games as Educational Resources in Teaching

The presence of games and play among civilizations is not new. Historical data describe the use of board games in Mesopotamia, around 3,000 BCE, and in Egypt, where a kind of board game involving two players with nine pieces each was found in the temple of Kurna, built around 1400 BCE (DELGADO NETO, 2005). Games serve as a pedagogical instrument and, since antiquity, have had a function that goes beyond entertainment, serving as a learning tool (CARNEIRO, 2015).

Teaching content through games demystifies the concept that learning only occurs through lectures, with the teacher as the holder of knowledge. However, the essence of the entire educational process lies in the practice of knowledge and not just in the mere transfer of content (COSTA, 2017). Quality education must continually seek to provide appropriate resources for differentiated learning to foster skills and competencies that make an individual well-rounded. Students should be offered opportunities for different practices in the knowledge construction process, allowing them to learn and formulate meaningful learning through playful and engaging
activities rather than simply memorization exercises. Such activities promote the development of skills in communication, interpersonal relationships, leadership, and teamwork, using the relationship between cooperation and competition in a formative context (BRASIL, 2006).

The use of games as pedagogical resources in teaching is a highly beneficial didactic tool as it helps improve learning, contributing to the development of logical reasoning. In this process of knowledge, it teaches the student to think and understand other possibilities of learning, thus developing meaningful learning. According to the National Curriculum Parameters (PCN's) guidelines, the use of games significantly aids as a pedagogical resource, as games "constitute an interesting way to pose problems because they allow them to be presented in an attractive way and encourage creativity in elaborating resolution strategies and searching for solutions" (MEC, 1998: p.47).

The use of educational games can also help fill various gaps detected in the teaching-learning process, especially because it combines knowledge construction with students' interest, involving them actively in knowledge creation (COSTA; GONZAGA; MIRANDA, 2016).

Piaget's work was essential for the conceptualization of play, as it established a "genetic classification based on the evolution of structures," highlighting expressions such as play, toy, play activity, and sport. The lines that separate games, sports, gymnastics, play, or dances are thin, serving more for didactic definition (PEREIRA, 2013).

Various didactic modalities can be used in the teaching of Biology, such as practical lessons, demonstrations, and even lectures, which have relevance for certain moments (KRASILCHIK, 2004). The use of educational games in Biology presents itself as an opportunity to create a scientific stimulus for students, allowing them to experience the reality of Sciences more closely, create hypotheses about topics, and understand methodologies.
because they are contextualized, facilitating the understanding of the discipline (ZUANON et al., 2010; SOUZA et al., 2014).

Silva and Meglhioratti (2020) state that biology textbooks, although contributing to the teaching process, still lack updates that incorporate new scientific evidence and conventions into their content. Thus, the use of educational games in various areas of Biological Sciences, with theoretical foundations, can contribute to the construction of scientific knowledge and reduce the difficulties commonly faced by students. In this sense, the major themes that make up the teaching of Biological Sciences can become easier to understand when the topic is worked on in a contextualized manner (CAMPELO et al., 2023).

Among the works in various subareas of biology, genetics (JANN and LEITE, 2010; NASCIMENTO et al., 2015; BORGES and MORAES-FILHO, 2016), botany (ABDALLA and MORAES, 2014), biochemistry (SILVA et al., 2016), embryology (CASAS and AZEVEDO, 2011), cytology (ROSSETTO, 2010), zoology (SILVA et al., 2017), anatomy/physiology (SILVA, 2016), and microbiology (LEAL et al., 2016) stand out.

3. The Game *Plague Inc.*

Ndemic is a game studio based in Bristol, United Kingdom. After the release of its first game, *Plague Inc.*, the company achieved extreme success worldwide. The game has over 180 million players and is one of the top five paid mobile games of all time.

*Plague Inc.* is a unique blend of high strategy and a terrifyingly realistic simulation. Your pathogen has just infected 'Patient Zero.' Now, you must bring about the end of human history by evolving a deadly, global plague and adapting to all countermeasures humanity can take. Brilliantly executed with innovative gameplay, *Plague Inc.* evolves the strategy genre and pushes you (and your skills) to new levels (Ndemic Creations, 2012). The main
objective of the game is to infect and eliminate the global population with a pathogenic agent, initially a bacterium, but as the game progresses, other types of pathogens such as viruses, fungi, parasites, and even prions can be unleashed.

The game also presents scenarios in which the player can enslave the global population with the "Neurax Worm" or turn the entire population into zombies with the "Necroa Virus." However, the goal is not limited to the extermination of humanity using the pathogen; strategies must be devised because there is a time pressure to complete the game before humans (the opponent) develop a cure for the plague.

After choosing the pathogen and the level of difficulty, gameplay begins. Initially, the player must select the country where the pandemic will start, and from there, bubbles will appear on the map. Popping them will earn the player points, which can be used to enhance the pathogen's characteristics such as symptoms, transmission, and resistance. After infecting patient zero, the pathogen will begin to spread around the world with speed and severity depending on the player's choices. When the first infected individuals die, humanity (the opponent) will begin working on a cure. If the cure reaches 100%, the game's primary objective will not be achieved, and the match will end with the "game over" message. If the cure is not developed in time and all of humanity succumbs to the pathogen, the player will win the match and earn points to unlock new pathogens or improvements for existing ones.

4. The Importance of *Plague Inc.* in Biological Sciences Education

In the realm of Biological Sciences, *Plague Inc.* emerges as an alternative means to explain microbiology and enable students to comprehend the dynamics of epidemics in a practical and entirely playful
manner. It can be widely utilized, from the later years of middle school to university-level students.

Within this context, the use of *Plague Inc.* in the classroom aligns with Problem-Based Learning (PBL) since the game facilitates teaching and learning through challenges that promote questioning (SALIDO LÓPEZ, 2020; MARIN, GÜLLICH, 2015). With the advent of technology, teaching has become an ongoing competition with distractions, making it imperative to transform learning into a more playful and tangible endeavor (DO CANTO et al., 2021).

Considering the abstract nature of the content associated with the lack of laboratory infrastructure in schools, delivering microbiology-related content becomes a challenge. Educational games like *Plague Inc.* have emerged as an alternative to rigid, traditional teaching methods by promoting the transmission of content in a fun, simplified, and more appealing manner (DO CANTO et al., 2021).

Therefore, the utilization of *Plague Inc.* as a playful activity is a pedagogical resource that facilitates learning (Kiya, 2014), enhancing engagement with tangible content. Another aspect is the dynamization of the class, aiming to captivate the student's attention while also stimulating creative development, socialization, and the exchange of ideas among game participants.

5. Conclusions

Overall, the use of educational games like Plague Inc. not only makes learning more enjoyable but also deepens students' understanding of scientific concepts, ultimately contributing to a more comprehensive and meaningful education in the biological sciences.

*Plague Inc.* demonstrates significant potential in the realm of Biological Sciences education, offering an innovative and engaging approach to
understanding microbiology and the dynamics of epidemics. Its applicability spans from late middle school to university-level education, making it a versatile tool. Incorporating Plague Inc. into the classroom aligns with Problem-Based Learning (PBL) as it presents challenges that encourage questioning and critical thinking, enhancing the learning experience. In an era where teaching competes with constant distractions, transforming learning into a more enjoyable and tangible endeavor has become essential.

Considering the abstract nature of microbiology content and the limitations of laboratory infrastructure in schools, Plague Inc. provides a valuable alternative to rigid, traditional teaching methods. It simplifies complex content and makes studying more attractive, ultimately enhancing the educational experience. It not only connects students with tangible content but also invigorates lessons by capturing students' attention, fostering creativity, encouraging socialization, and facilitating the exchange of ideas among participants.

In conclusion, Plague Inc. serves as a dynamic and effective educational tool for Biological Sciences. It promotes a deeper understanding of complex concepts, making learning more enjoyable and accessible. By incorporating educational games like Plague Inc., educators can enhance students' scientific literacy and critical thinking skills, ultimately contributing to a more comprehensive and meaningful science education.
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