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THE PROCESS OF TEACHING AND LEARNING GEOGRAPHY WITH DIGITAL CITY SIMULATION GAMES

O PROCESSO DE ENSINO E APRENDIZAGEM DE GEOGRAFIA COM JOGOS DIGITAIS DE SIMULAÇÃO DE CIDADES

EL PROCESO DE ENSEÑANZA Y APRENDIZAJE DE GEOGRAFÍA CON JUEGOS DIGITALES DE SIMULACIÓN DE CIUDADES

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Abstract: City simulation games are entertainment media that allow the player to build and manage an urban space in terms of resources, demands, problems and expansion of the city. However, they can have pedagogical functions when mediated by the teacher in the didactic process. Based on this, the objective of this article is to reflect theoretically about the digital games of simulation in the teaching of school geography, in the sense of its pedagogical potentialities. For this, a mapping of the academic productions related to the theme was carried out, and its characteristics are discussed as innovative didactic resources for teaching city in Geography. The results show that the use of digital games is a reality in different areas of knowledge, with growth of research since 2000. However, the teaching of geography is still incipient. In addition, it was found that the game scenarios and the simulation possibilities of different spatial arrangements allow us to understand the urban dynamics and, being problematized in the classroom, can contribute to operate different reasoning. With this, they become a good resource for the development of the student's geographical thinking.
Keywords: cities simulation; geographic education; didactic resource; digital games; geographical thinking.

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Resumo: Jogos de simulação de cidades são meios de entretenimento que permitem ao jogador construir e administrar um espaço urbano em termos de recursos, demandas, problemas e expansão da cidade. Contudo, podem ter a função pedagógica quando mediados pelo professor no processo didático. Com base nisso, o objetivo deste artigo é refletir teoricamente sobre os jogos digitais de simulação no ensino de Geografia no sentido das suas potencialidades pedagógicas. Para tanto, foi realizado um mapeamento das produções acadêmicas referentes à temática, e discorre-se sobre suas características enquanto recursos didáticos inovadores para o ensino de cidade em Geografia. Os resultados apontam que o uso de jogos digitais é uma realidade em distintas áreas do conhecimento, com crescimento de pesquisas a partir dos anos 2000. No entanto, no ensino de Geografia ainda são incipientes. Além disso, constou-se que os cenários dos jogos e as possibilidades de simulação de diferentes arranjos espaciais permitem compreender a dinâmica urbana e, ao serem problematizados em sala de aula, podem contribuir para operar diferentes raciocínios. Com isso, tornam-se um bom recurso para o desenvolvimento do pensamento geográfico do aluno.
Palavras-chave: simulação de cidades; educação geográfica; recurso didático; jogos digitais; pensamento geográfico.

Resumen: Los juegos de simulación de ciudades son medios de entretenimiento que permiten al jugador construir y administrar un espacio urbano en términos de recursos, demandas, problemas y expansión de la ciudad. Sin embargo, pueden tener la función pedagógica cuando mediados por el profesor en el proceso didáctico. Sobre esta base, el objetivo de este artículo es reflexionar teóricamente sobre los juegos digitales de simulación en la enseñanza de Geografía escolar, en el sentido de sus potencialidades pedagógicas. Para ello, se realizó un mapeo de las producciones académicas referentes a la temática, y se discurre sobre sus características como recursos didácticos innovadores para la enseñanza de ciudad en Geografía. Los resultados indican que el uso de juegos digitales es una realidad en distintas áreas del conocimiento, con crecimiento de investigaciones a partir de la década de 2000. Sin embargo, en la enseñanza de la Geografía todavía son incipientes. Además, se constató que los escenarios de los juegos y las posibilidades de simulación de diferentes arreglos espaciales permiten comprender la dinámica urbana y, al ser problematizados en el aula, pueden contribuir a operar diferentes razonamientos. Con esto, se convierten en un buen recurso para el desarrollo del pensamiento geográfico del estudiante.
Palabras-clave: simulación de ciudad; educación geográfica; recurso didáctico; juegos digitales; pensamiento geográfico.

Introduction

We notice that the emergence of innovations in society creates new conditions and learning strategies, both in formal and informal contexts (Nilsson; Jakobsson, 2011). This leads us to think that we need to "[...] change our teaching methods to enhance the skills that future citizens will need in a global society" (Gros, 2007, p.23).

According to Gadotti (2000, p. 8), in this context, to think about the education of the future, it is necessary to consider the possibilities of new learning spaces and to admit that "[...] cyberspace has broken with the idea of specific time for learning. There is no specific time and space for learning. [...], the learning space is here - anywhere -, and the time to learn is always".

Our students have radically changed; they are no longer the people our educational system was designed to teach. For Prensky (2001), there has been a major discontinuity that he calls "singularity" (an event that changes things so fundamentally that there is absolutely no going back). For the author, this singularity is the arrival and rapid spread of digital technology in the last decades of the 20th century. These students (from elementary school to university) are the first generation to grow up with this new technology.

In this sense, we encounter technology daily intertwined with social relations, in the world of work, in leisure, and in the school environment, even if not always directly applied to the teaching process. We believe it is significant to reflect on technological means such as resources that can be used for learning, as well as to question the characteristics that this medium possesses, which strongly attract and immerse the current generation.

We consider it relevant to bring to the field of geographical education discussions on possible teaching resources that can contribute to student involvement and motivation in learning. Furthermore, we question how to develop teaching methodologies that consider not only the reality of the student as a starting point in terms of socio-spatial context for geographical problematization but also teaching practices that consider aspects of their interests in terms of activity, learning environment, and resources.

In this way, our goal is to advance teaching proposals that consider the technological context with which students are familiar, focusing on their appropriation for the development of geographic thinking. To achieve this, we direct our attention to digital city simulation games as potential resources that can be used to internalize concepts and, in doing so, understand urban space.

In this regard, this work aims to reflect theoretically on the methodological potential of digital simulation games for teaching Geography. To achieve this, we seek to discuss academic

research that addresses the origin and didactic application of these technological tools in school Geography.

We emphasize that this work is part of the results obtained from the doctoral thesis of the first author (Vieira, 2024), which sought to assess the didactic potential of the digital city simulation game *Cities Skylines*, with a focus on developing geographic thinking at the high school level. In this context, we recognize the importance of expanding discussions about its use in Geography education to engage and motivate students to think about urban space in a sustainable manner.

Considering this, we have organized the article into six parts, with the first being this introduction. In the second part, we discuss digital games for didactic purposes. In the third, we provide a historical context of simulation games, and the evolution of research related to their use in education in general. In the fourth, we elaborate on the research methodology employed in this article. In the fifth and sixth parts, we present, respectively, the results of the bibliographic research, in which we reflect on the use of city simulation games in school Geography, and the conclusions of the work.

Digital games in the teaching and learning process

In childhood and adolescence, play is one of the activities that most interests and entertains. It is an essential element for the development of abilities and configurations of adult personality (Marrón-Gaite, 2013), and has accompanied humans throughout history (Dubovski, 2017). Thus, in addition to being an activity that may be desired by the individual, it also serves as a fundamental agent in enhancing the learning process (Marrón-Gaite, 2013).

When appropriately used in school education, games for didactic purposes have shown to enrich learning, and their use has become a modern practice at all educational levels (Dubovski, 2017). Currently, in addition to analog formats, digital games have received attention from teachers regarding their pedagogical potential.

Digital games or games can be defined as '[...] electronic games developed on computers and/or video game devices, also called digital games, which are part of the universe of new information and communication technologies (ICTs)' (Santos; Moita, 2011, p.105).

They were driven by a generation of '[...] children who grew up since 1980 and have been exposed to video games throughout their lives' (Zyda, 2005, p.25), and although this is

not a universal reality, given the inequality of access, the democratization of the internet, and the decreasing cost of equipment and software, it has contributed to their spread.

Where they have spread, digital games are popular leisure activities among students, sparking interest, concentration, and dedication from players, which is why they increasingly attract young people (Vieira; Gomes, 2023). In such contexts, the teacher's challenge increases, in the sense of making the use of computers worthwhile for students, encouraging and helping them to blend their new lifestyle with learning (Prensky, 2012).

A caveat must be made for countries with high inequality, such as Brazil, as a significant number of families do not have the resources to own electronic devices at home, let alone for children and young people to play, nor can they afford this type of entertainment in services such as internet cafés (Lan Houses). For groups where friends have the equipment, it is common for them to gather to play, but this is not something that can be generalized. Access to electronic media and the internet was widely exposed as a social divide in the country during the social isolation caused by the Covid-19 pandemic, which led schools to combine online activities with analog, printed activities sent to families (Gomes et al., 2020). Nonetheless, there is a significant number of children and young people who have access to digital media, and the popularization of mobile phones in Brazilian families, even those with low income, may bring digital games within reach of lower-income groups.

Therefore, the discussion presented here does not intend to ignore the exclusion or precarious inclusion of the digital medium in Brazilian society, but rather to discuss the pedagogical possibilities of a medium, particularly those that focus on objects of interest in Geography education.

Adolescents aged 12 to 17, who have a significant level of interaction with new media, especially electronic games, are referred to as 'digital natives' (Prensky, 2001), the Net generation, among other terms (Annetta, 2009; Alves, 2010). Prensky (2001) refers to the rest of us as 'digital immigrants,' who were socialized in a way very different from that of their children, who are learning this new 'language.' Digital immigrants are outdated and struggle to teach a generation that speaks an entirely new language (Ibidem). According to the author, digital natives are accustomed to receiving information very quickly, enjoy parallel processes and multitasking, prefer graphics to texts, work better in networks, and prefer games over traditional tasks. Immigrants need to value these new skills that natives have acquired and refined through years of interaction and practice (Ibidem).

On the other hand, the generation that only read '[...] static books does not have the same intellectual agility as the generation that engages in reading games, which require a readiness for difficult challenges and also teach complex concepts' (Santos; Moita, 2011, p. 114).

This *Net* generation is being exposed to materials used in the past forty years, rather than the digital media they are accustomed to (Annetta, 2009). According to the author, it is essential to expose and challenge them in environments that engage them, motivate them to explore, experiment, and build their own knowledge; after all, games are not only played, but also talked about, read, fantasized, altered, and become models for everyday life, for the formation of subjectivity and intersubjectivity.

It is necessary to go beyond the usual didactic resources and methodologies with which we were educated; technological development cannot be excluded from schools, but it needs to be problematized, questioned, and, at times, used in the classroom. We believe that the role of Geography is to empower students to read the world in which they are inserted, which also implies making full use of tools that can contribute to this.

Games, with their power to capture attention, transform a simple activity into a form of cognitive power for the user-student (Voges, 2009). They aim to challenge and motivate the learner, engaging them in competition with the machine and with peers; *in school Geography, they can be important resources for working on students spatial perception (Ibidem)*. Moreover, the value of the game as an immersive environment motivates and engages students to learn and apply scientific content and investigative skills (Clark et al., 2009).

Spatial perception is fundamental to Geography education. Among digital simulation games, Cities Skylines presents itself as a visual tool that contributes to a broader understanding of the elements that make up urban space. This is because the game involves a set of actions related to building a city, with the player taking on the role of a mayor who makes decisions on how to plan and manage the simulated urban space. This process includes spatial arrangement, the shapes and functions of urban infrastructure, as well as the dynamics and processes that occur in the simulated city. The decisions made by the player foster their critical development, reasoning, and reflective learning arising from the responses and challenges presented in the digital game (Bandera, 2012).

Digital technologies allow teachers and students to generate new information not only in terms of content but also in the way it is made available in the spaces of networks (Kenski, 2005). It is necessary to identify the best ways to use these innovations to approach a specific topic in a particular project, to align the specificities of the technological 'medium' with the

broader goal of providing quality education (Ibidem). In digital society, the role of the teacher expands rather than disappears (Ibidem).

As teachers, we need to create pedagogical situations that help students analyze the world represented in digital media critically, comparing it with the real world. This is because technological advances, news and misinformation arrive at the same speed, distorted views of reality are constructed, digital content expands, and critical thinking does not always keep pace.

To achieve this, the teacher can use illustrative situations that, through the geovisualization of the landscape, enhance perception, reasoning, and, consequently, develop geographic thinking that helps students understand and act in the world. The digital simulation game Cities Skylines, due to its immersive, interactive, and visual nature, allows virtual issues to be addressed by comparing them with real ones, to question, analyze, and form concepts that support the worldview constructed by the student.

Geographical research with simulation games in the didactic process

It was in Anglo-Saxon countries that the trend of creating and researching the use of simulation games in schools began, even in analog formats. In Geography, the first of this kind was the “Royal Geographical Amusement” in London in 1787, a board game in which players simulate business trips (in this game, the player learns not only the location but also the characteristics of the main European cities) (Marrón-Gaite, 2013). In Spain, the reference for using games as a didactic resource in Geography education dates to 1889, with Father Manjón, who was considered a pedagogical innovation in the learning process of the time (Marrón-Gaite, 2013).

In this way, it can be said that the origin of simulation games dates to the great European states in the late 19th century, with war games (Marrón-Gaite, 2013). Thus, simulation games entered education through the military, as a form of training with a military nature and to simulate various possibilities of hypothetical battles, which saw their educational use intensified in the 20th century (Zyda, 2005). In addition to these, business simulation games emerged almost simultaneously with war games, to train executives and company managers (Marrón-Gaite, 2013).

Regarding the production of digital games and video games, they began primarily in the 1960s, as shown in Table 1. However, it was only in the 1970s that university research on the subject emerged. In the 1980s and 1990s, in Europe and the United States, investigations related

to their use in learning began (Alves, 2011). In this sense, we can affirm that the use of digital games in education is recent.

Table 1 - Origin of Virtual Games

Origin of Electronic Games	
1958	Attempt to produce video games (tennis game by Wily Higinbotham)
1961	Creation of Spacewar (space war)
1962	Steve Russell created the first computer video game
1971	Highlights for the Atari game
1970-1980	Peak of the arcade machines
1990-2000	Milestones of electronic games: PlayStation (Sony Corporation)
2000...	Portable electronic games and internet-based games

Source: own elaboration, based on the research of Pereira et al. (2011) and Alves (2011).

Simulations, until recently, were confined to scientists and the military (Prensky, 2012). After 1945, with the development of simulation techniques in education, psychologists began to suggest experience as a methodology for the development of learning. In this way, future possibilities for the applicability of simulation games in the field of education were outlined.

In Brazil, it was from 2003 onwards that research gained momentum, when games ceased to be seen only as objects of entertainment and began to be studied and understood as a social phenomenon that requires a multifaceted view, with heterogeneity in the production of knowledge (Alves, 2010). Since then, scientific production on them began to develop (Table 2), but in Geography, there is still little production. According to a survey conducted by Alves (2010) in theses and dissertations related to the use of digital games in Geography, the author found only one study developed between 2000 and 2008.

Table 2 - History of Research on Digital Games in Brazil

Research on Digital Games in Brazil	
1994	1st Research – Master's level
2000-2008	87 studies (highlights: education 13 dissertations; communication 16 dissertations and 5 theses; 11 dissertations in computing; among others)
2009	The Foundation for Research Support of the State of Bahia (FAPESB) created the Game Cluster to link research and the gaming industry
2002	The largest event in Latin America related to games: 'Brazilian Symposium on Computer Games and Digital Entertainment' (SBGAMES)

Source: own elaboration, based on Alves (2011).

In this context, Annetta (2009, p. 230) highlights that it was in 2003 that a movement began for the use of video games in education. This initiative became known as 'serious games', which changed the way the generation of young people socializes and perceives entertainment. According to the author, although “video games have existed for more than 30 years, it was

only recently that technology allowed the metamorphosis of video games into descriptive narratives and storylines".

Regarding the pedagogical use in school Geography, Alvarenga (2007) argues that video games themselves are very diverse, therefore, studies should be conducted with the aim of understanding the spatiality and spatial discourses represented by the various styles of video games. According to the author, more research needs to be developed to outline the construction of a more complete and complex theory about video games in Geography.

In this line, Backlund and Hendrix (2013) conducted a search of studies that empirically assessed the effect of learning with serious games[1] in school environments, in international scientific journals from 2002 to 2012. They found that out of the forty studies identified, thirteen were in mathematics, a leading area for game-based learning, and only three were in Geography.

The field of digital game research is not well established globally. According to Gros (2007), even though progress has been made, researchers still struggle for acceptance and academic credibility regarding digital games and education. The author states that there is a lack of a common language for research, few basic and theoretical discussions, and limited funding for research due to the negative perception of games and their distance from the educational field. According to Lux and Budke (2020), in Geography classes, little has been utilized due to a lack of knowledge about the specific relevance of digital games in the subject.

Current technological resources bring new ways of reading, writing, thinking, and acting. Specifically, with digital simulation, it is possible to reproduce and control processes, as various parameters can be modified, verified, and discussed to analyze the results and consequences of the variations (Di Maio; Seltzer, 2011).

Andrade, Poplin, and Sena (2020) analyzed the digital simulation *game Minecraft* as a tool to engage students in the urban planning process. The authors concluded that the game could motivate, inspire, and engage students in active participation, generating ideas for the future of cities due to the possibility of participating in the simulated planning process.

According to Oliveira (2006, p.120): "It is in this [virtual] environment that the student is allowed to manipulate variables and observe immediate results, arising from the modification of situations and conditions".

The theory of game-based learning considers learning as an interactive process with high involvement. Prensky (2012) clarifies the three main reasons for this theory: a) it aligns with the needs and learning styles of the current generation; b) it is fun, versatile, and; c) it can

be adapted to almost all subjects. According to the author, the premise lies in the union between educational content and computer games, whose combination seeks to achieve good results. This type of learning works for three reasons: involvement (learning should be placed in the context of a game); the interactive learning process; and the union of both in a contextual manner (Prensky, 2012).

In Geography education, the use of the game "allows the student, through rules and methods, to build discovery, knowledge, and energize the class, since the game is an activity 'for pleasure'" (Breda, 2018, p. 56). They enable the development of creativity, critical thinking, initiative, imagination, encourage research to understand the contexts proposed in the game, and allow students to represent places and act on them in a selective and agile manner (Aguiar, 2010; Marrón-Gaite, 1995).

Thus, we seek to identify the research that has been developed in Geography education regarding the educational use of digital simulation games. To do so, we based our searches on important journals as well as Brazilian theses and dissertations, as outlined below.

Methodology

In this qualitative research, we aim to contribute to the state of the art on this topic, based on the guidelines of Romanowski and Ens (2006), with the goal of providing an overview of what has been produced in the field. We investigated in the journals of the CAPES platform[1], Scopus[2], Web of Science (WOS)[3], and Scielo[4] from 2001[5] to March 2024, using the keywords "digital games in Geography education" and "simulation games in Geography education". We found twenty-seven articles on the CAPES platform, and a total of seven studies related to the use of digital games in Geography education in the other databases.

We also conducted a search in the thesis and dissertation catalogs of CAPES[1] and the Digital Libraries of Theses and Dissertations (BDTD)[2] using the keywords, without a defined date, including publications on the site until March 2024.

The choice of these periods, both national and international, and the CAPES thesis catalog was made because they are reliable sources that provide scientific articles and academic research recognized in Brazil and/or worldwide. However, we acknowledge that we have not exhausted the survey of the productions, but rather provided indications of the evolution of research that focused on this teaching resource applied to Geography education. Thus, we can

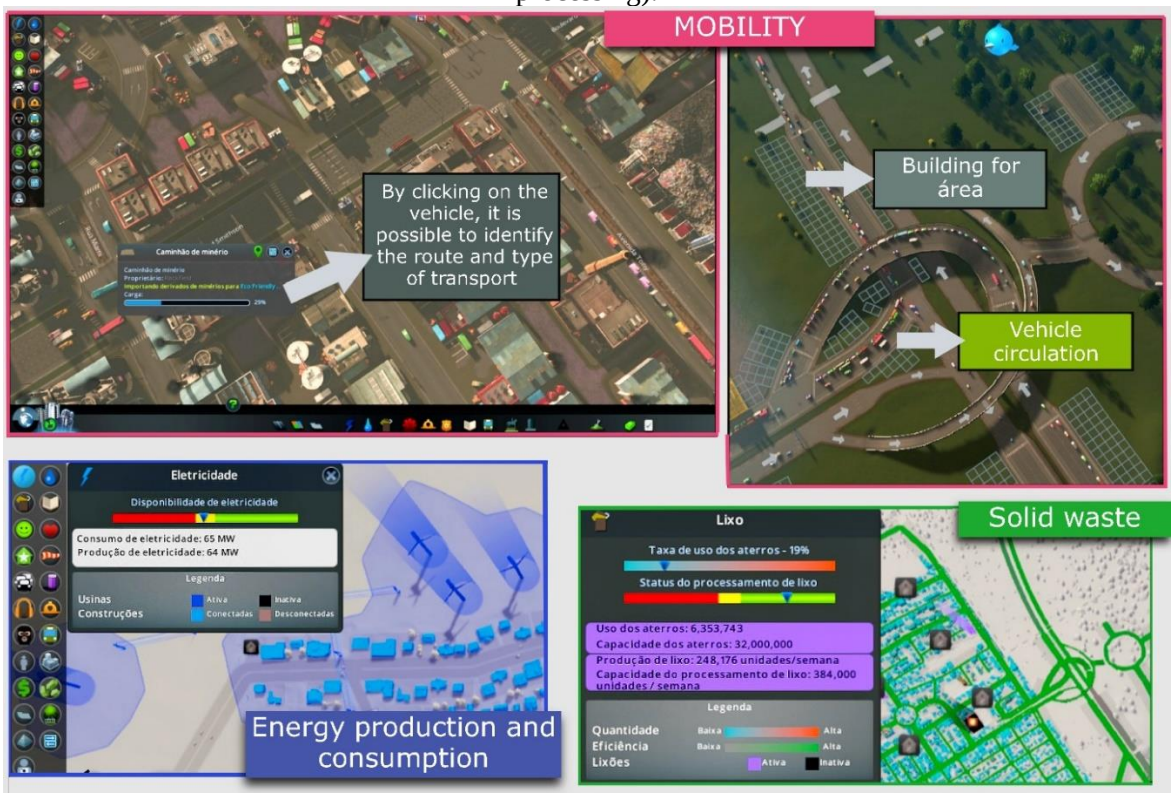
observe the potential paths that can still be explored in future investigations regarding the use of simulation games in Geography.

Results and discussion

We direct our focus to digital city simulation games, as we believe they represent important aspects of urban arrangement and could be used in Geography classes as a means of problematizing the theme, introducing concepts, and even as a reflective possibility to simulate, design, and visualize important aspects of a sustainable city.

We consider it important to highlight that dynamic teaching and learning processes tend to be more engaging, as is the case with the use of the simulation game Cities Skylines. With it, students take on the role of builder, manager, and city administrator, meaning they develop proactive attitudes to solve the population's demands, manage budgets, and address the urban problems that this type of game tends to present (Figure 1).

Figure 1 - Composition of images from the game (mobility, zoning, energy production, solid waste processing).



Source: Cities Skylines, own elaboration.

In the Capes platform (Table 3), as highlighted earlier, we searched with the keywords "digital games in geography teaching" and "simulation games in geography teaching", and we found twenty-seven (27) works. Of these, nine (9)[1] were related to the use of digital games in teaching geography, and only three (3) specifically referred to simulation games in geography teaching. One of them involved the use of a digital simulation game of cities (Sim City 4), and the research was conducted with high school teachers (Cruz; Ilha, 2008); Aguiar (2010)[2] conducted a documentary study on the types of digital simulation games available, but without practical application with teachers or students; and Vieira and Gomes (2023) conducted research using a simulation game for teaching cities, specifically about urban planning.

When we expanded this search to the Scopus, Web of Science (WOS), and Scielo databases (Table 3), we found seven (7) studies, but only one paper related to the use of digital simulation games in Geography teaching (in Brazil), written in English, in which the authors (Sena; Jordão, 2021) highlight the results of applying the Minecraft game to teach cartography.

In the Capes thesis and dissertation catalogs (Table 3), regarding "digital games in Geography teaching", we found only one dissertation highlighting gamification strategies in Geography teaching in 2023, using games that are not simulation games. On the other hand, when searching for "simulation games in Geography teaching", there is also a paper, but it was published before being made available on the platform and is related to mathematics education. We decided to broaden the search with the keywords "simulation games and Geography", which yielded seven papers, but none were related to application in Geography. In the Digital Libraries of Theses and Dissertations (BDTD), when searching with the keywords 'simulation games in Geography teaching,' we found seven publications, but only one dissertation related to the use of the simulation game SimCity in Geography teaching, with an emphasis on environmental education for seventh-grade students (Silvestre, 2023)."

Table 3 - Publications related to simulation games in Geography teaching (2001 to 03/2024)

Authors and year of the research	City simulation game	Approach	Database
Cruz e Ilha (2008)	SimCity 4	The research was conducted with high school teachers	Capes Journals
Aguiar (2010)	None specific	Documentary research	Journals Capes
Sena e Jordão (2021)	Minecraft	Application of the game for teaching cartography	Scopus
Vieira e Gomes (2023)	Cities Skylines	Use of simulation game for teaching city (urban planning).	Journals Capes
Silvestre (2023)	SimCity	Geography teaching with an emphasis on environmental education for seventh-grade elementary school students.	BDTD

Source: own elaboration, based on research from the journals.

We found that research related to the use of simulation games in Geography teaching is recent, and there are few didactic proposals regarding their use in school Geography. Therefore, there are gaps and a need for reflection on the feasibility of using them in Geography teaching (Vieira, 2022), especially in basic education.

Thus, we noticed that research related to the use of simulation games in Geography teaching in basic education is still, as a rule, scarce. In general, the field of digital game research is not well-established worldwide. As an international example, during my doctoral internship (September 2022 to August 2023) at the University of Valencia (Spain), where we conducted a systematic literature review to compare the use of simulation games in Geography teaching between Brazil and Spain, we found that there is still much to be researched about this didactic tool. We observed that in Spain, the use of simulation games is mainly with board games, which began in an incipient way in the 1980s, reaching its peak in the 2000s.

Regarding the didactic potential of using simulation games in city teaching in Geography, it is important to highlight the situations generated by this technological medium. "The simulator is rightly recognized as a revolution in learning and training" (Prensky, 2012, p. 294). For the author, simulators allow the experience of all types of "what if" situations, and when combined with objectives, rules, and challenges, the simulation becomes a game. The objectives can either be incorporated into the game or formulated by the teacher, which tends to generate engagement and encourage trying options that would not be possible in the real world (Ibidem). In the case of cities, simulation is a good exercise for planning and checking the consequences of changes made in the game that could occur in real cities (Table 4).

Table 4 – Interactive possibilities with the digital city simulation game Cities Skylines.

City simulation game Cities Skylines	
Intuitive and fun interface	See each element of the city grow or decline
	It allows building buildings, roads, and services by dragging icons
	Track changes in the city's dynamics
Geovisualization	See the roads with heavy or light traffic
	Check the growth or decline of industries
	See the emergence of problems when services are insufficient
	Observe urban dynamics (zoning, circulation, construction, problems)

Source: own elaboration.

For Marrón-Gaite (2013, p. 48), simulation games show "typical situations from real life in which the participants" decisions, ingenuity, and strategies condition the unfolding of events and the outcome of the created situations".

Simulation games allow for a deeper reflection and understanding of the basic concepts of a city, enabling more analytical and critical thinking about the best forms of a city and its creation (Minnery; Searle, 2014).

We highlight that the use of simulation games in city education has great potential to problematize urban reality (Vieira; Gomes, 2024). This is because managing this space requires solving problems in context, as is the case with the game Cities Skylines, in which demands for housing, industries, and commerce tied to a population, which are manipulated through the game, can also be correlated with real-life situations in a concrete city.

Simulation is a good exercise for Geography, on which Marrón-Gaite (2013, p. 46) clarifies that it is for 'Geography and for the social sciences in general, what laboratory experiments are for experimental sciences. The geographer, unable to reproduce in a laboratory the facts and phenomena they study, reproduces them through simulation". The author emphasizes that it is possible to reproduce different realities, abstract the essentials of each situation, and isolate or connect them as appropriate to the teaching and learning process (Ibidem).

In digital city simulation games[1], students can manipulate tools that allow them to build a city from scratch, with urban zoning of different types (including industries, residences, commercial areas, and offices), offering various services (basic sanitation, access to education, healthcare, security, and leisure), implementing public policies (recycling, free public transport...), and managing the city (taxes, demands, investments, urban problems). This enables them to geovisualize aspects of the landscape and urban dynamics that can be used as contexts for geographical learning, as seen in the game Cities Skylines (Table 5).

Table 5 - Potentials of Using Cities Skylines in School Geography

Potentials of Simulation Games	**Authors**	**Teaching and learning Geography with the digital city simulation game Cities Skylines**
Experiencing real-life situations	Prensky (2012)	Direct contact with urban planning.
Intuitive and fun interface	Prensky (2012)	Track the growth of a city and the outcomes of choices, which would otherwise be difficult.
Real-life scenarios	Marrón-Gaite (2013)	In a simplified way, it reproduces the urban space and its problems.
Deeper understanding of basic city concepts	Minnery and Searle (2014)	Manipulating urban variables with the inclusion of geographical knowledge tends to generate meaningful learning.
Reproduce phenomena or facts	Marrón-Gaite (2013)	Reproduces urban forms, functions, structure, and processes.
Ensino do espaço urbano	Vieira (2022)	Simulates urban dynamics and environmental issues in the city.
Address sustainable urban planning	Vieira and Gomes (2023)	Organization of urban space in a sustainable way.
Problem-solving regarding urban mobility	Vieira and Gomes (2024)	Problematization of urban space regarding alternative means of transportation in the city.
Simulation of sustainable cities	Vieira (2024)	Construction of a city with sustainable social conditions and environmental preservation.

Source: own elaboration, based on the studies cited and the empirical data from the application with Cities Skylines.

The city simulation game can be used at different moments in pedagogical planning. It is up to the geography teacher, when appropriate material conditions and teaching autonomy are available, to make use of this resource didactically and use it for: geographic problematizations, content review, knowledge consolidation, introduction of new topics, or internalization of concepts.

The teacher is considered in this context as a mediator, who can add pedagogical value to the technological environment. We emphasize that digital games by themselves do not teach, but they can be used didactically according to the objectives, planning, and teaching goals of the educator. In turn, the student plays an active role, as they immerse themselves in the virtual environment and manipulate the game tools, which closely resemble the real world.

Conclusion

The theoretical evidence regarding the use of digital simulation games in education exists; however, it is important to expand their use through didactic sequences, evaluating their

contribution to school Geography. Many of the works with digital games, as well as those specifically related to city simulations, such as the example given with Cities Skylines, have been developed with undergraduate students to reflect on urban planning, city management, and urban architecture, but research applied to city teaching with basic education students is rare.

In the few studies identified in this review, we were able to perceive the didactic potential of these resources, which can be considered for application in the classroom. It is undeniable that the familiarity with digital games, the engagement, motivation, and attention of students while playing can be didactically utilized by the geography teacher. With city simulation, beyond the appeal of the games, there is also the representation of urban space, which portrays many aspects of the real world that can be used as learning situations.

These contents emerge from problems presented in Cities Skylines that allow for the development of skills and reasoning that structure the way of thinking with Geography. Thus, one way to address the environmental issues of cities through the simulation game is by discussing topics such as basic sanitation, deforestation along riverbanks, solid waste production, urban mobility, among others.

The geovisualization of cities through simulation games, like Cities Skylines, allows for the spatial graphic representation of the urban environment, enabling students to visualize elements, relationships, and materializations of the city, which would otherwise be difficult to manipulate. By simulating urban space, students actively build a city, and through teacher mediation, geographical issues can be addressed, problematized, introduced, or debated there are didactic potentials to be explored.

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