Periódico Eletrônico Fórum Ambiental da Alta Paulista
Electronic Journal Environmental Forum of Alta Paulista

ISSN 2966-2931 - v. 21, n. 3, 2025

# Urbania - An Educational Game to Think About Cities, Ecology, and Politics

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Submissão: 05/08/2025
Aceite: 12/10/2025
REZENDE, Wagner de Souza. Urbania - Um Jogo Educacional para Pensar Cidades, Ecologia e Política. **Periódico Eletrônico Fórum Ambiental da Alta Paulista**, *[S. l.]*, v. 21, n. 3, p. e2502, 2025.
DOI: 10.17271/1980082721320256201. Disponível em: https://publicacoes.amigosdanatureza.org.br/index.php/forum_ambiental/article/view/6201.

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# Urbania - Um Jogo Educacional para Pensar Cidades, Ecologia e Política

**RESUMO**

**Objetivo** - O estudo discute a produção de um jogo digital educacional (JDE) que estimula o engajamento social na formulação de estratégias de planejamento urbano no contexto das mudanças climáticas. A pesquisa visa desenvolver habilidades cognitivas em estudantes do ensino fundamental, capacitando-os a pensar soluções sustentáveis para as cidades brasileiras no século XXI.

**Metodologia** - A pesquisa baseia-se na concepção, validação e avaliação de um protótipo de jogo digital educacional (JDE) denominado Urbania. O jogo foi projetado para oferecer um ambiente interativo no qual os participantes exploram desafios ambientais urbanos, propõem estratégias para melhorar a qualidade de vida e interagem com outros jogadores. O protótipo foi avaliado por estudantes universitários, que reconheceram o potencial do uso de JDE como ferramenta de participação cívica no planejamento urbano.

**Originalidade/relevância** - O estudo preenche uma lacuna ao explorar o JDE como recurso didático-pedagógico voltado ao ensino de planejamento urbano e sustentabilidade. A pesquisa destaca a gamificação como uma estratégia inovadora para fomentar a participação cidadã e o pensamento crítico sobre desafios ambientais urbanos.

**Resultados** - Os achados indicam que jogos digitais educacionais podem ampliar a conscientização sobre os Objetivos de Desenvolvimento Sustentável (ODS) e fortalecer a capacidade dos estudantes de formular estratégias urbanas eficazes. O jogo demonstrou ser uma ferramenta interativa e acessível para introduzir conceitos de sustentabilidade, promovendo a reflexão sobre planejamento urbano inclusivo.

**Contribuições teóricas/metodológicas** - A pesquisa contribui ao explorar o uso da gamificação no ensino de urbanismo e sustentabilidade, demonstrando seu potencial para aprimorar metodologias de aprendizagem e engajamento cívico.

**Contribuições sociais e ambientais** - O jogo Urbania incentiva a participação ativa de estudantes e cidadãos no planejamento urbano, promovendo a sensibilização para desafios ambientais e incentivando a adoção de práticas sustentáveis. A proposta contribui para a formação de cidadãos mais conscientes e engajados na transformação das cidades.



**PALAVRAS-CHAVE**: Jogo Educacional Digital, Planejamento Urbano, Sustentabilidade, ODS.

# Urbania - An Educational Game to Think About Cities, Ecology, and Politics

**ABSTRACT**

**Objective** - The study discusses the production of an digital educational game (DEG) that stimulates social engagement in the formulation of urban planning strategies in the context of climate change. The research aims to develop cognitive skills in elementary school students, enabling them to think about sustainable solutions for Brazilian cities in the 21st century.

**Methodology** - The research is based on the design, validation and evaluation of a prototype digital educational game (DEG) called Urbania. The game was designed to offer an interactive environment in which participants explore urban environmental challenges, propose strategies to improve quality of life and interact with other players. The prototype was evaluated by university students, who recognized the potential of using JDEs as a tool for civic participation in urban planning.

**Originality/relevance** - The study fills a gap by exploring DEG as a didactic-pedagogical resource aimed at teaching urban planning and sustainability. The research highlights gamification as an innovative strategy to foster citizen participation and critical thinking about urban environmental challenges.

**Results** - The findings indicate that educational digital games can raise awareness of the Sustainable Development Goals (SDG) and strengthen students' ability to formulate effective urban strategies. The game proved to be an interactive and accessible tool to introduce sustainability concepts, promoting reflection on inclusive urban planning.

**Theoretical/methodological contributions** - The research contributes by exploring the use of gamification in the teaching of urbanism and sustainability, demonstrating its potential to improve learning methodologies and civic engagement.

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**Social and environmental contributions** - The Urbania game encourages the active participation of students and citizens in urban planning, raising awareness of environmental challenges and encouraging the adoption of sustainable practices. The proposal contributes to the formation of citizens who are more aware and engaged in the transformation of cities.

**KEYWORDS:** Digital Educational Game, Urban Planning, Sustainability, SDG.

## Urbania - Un Juego Educacional para Pensar Ciudades, Ecología y Política

**RESUMEN**

**Objetivo** - El estudio discute la creación de un juego digital educativo (JDE) que estimule el compromiso social en la formulación de estrategias de planificación urbana frente al cambio climático. La investigación tiene como objetivo desarrollar habilidades cognitivas en los estudiantes de la escuela primaria, lo que les permite pensar en soluciones sostenibles para las ciudades brasileñas en el siglo XXI.

**Metodología** - La investigación se basa en el diseño y evaluación de un prototipo de juego digital educativo (JDE) llamado Urbania. El juego fue diseñado para ofrecer un entorno interactivo en el que los participantes exploran los retos medioambientales urbanos, proponen estrategias para mejorar la calidad de vida e interactúan con otros jugadores. El prototipo fue evaluado por estudiantes universitarios, que reconocieron el potencial del uso de los JDE como herramienta de participación cívica en la planificación urbana.

**Originalidad/relevancia** - El estudio llena un vacío al explorar los JDE como recurso didáctico-pedagógico dirigido a la enseñanza del urbanismo y la sostenibilidad. La investigación destaca la gamificación como estrategia innovadora para fomentar la participación ciudadana y el pensamiento crítico sobre los retos medioambientales urbanos.

**Resultados** - Las conclusiones indican que los juegos digitales educativos pueden sensibilizar sobre los Objetivos de Desarrollo Sostenible (ODS) y reforzar la capacidad de los estudiantes para formular estrategias urbanas eficaces. El juego demostró ser una herramienta interactiva y accesible para introducir conceptos de sostenibilidad, promoviendo la reflexión sobre la planificación urbana inclusiva.

**Aportaciones teóricas/metodológicas** - La investigación contribuye explorando el uso de la gamificación en la enseñanza del urbanismo y la sostenibilidad, demostrando su potencial para mejorar las metodologías de aprendizaje y el compromiso cívico.

**Contribuciones sociales y medioambientales** - El juego Urbania fomenta la participación activa de estudiantes y ciudadanos en la planificación urbana, sensibilizando sobre los retos medioambientales y fomentando la adopción de prácticas sostenibles. La propuesta contribuye a la formación de ciudadanos más conscientes y comprometidos con la transformación de las ciudades.

**PALABRAS CLAVE**: Juego Educativo Digital, Planificación Urbana, Sostenibilidad, ODS.

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## 1 INTRODUCTION

Thinking collectively about social innovation strategies and tactics for the future of cities through playful interactions is a transforming cognitive experience. In urban planning practice, this experience can be observed in participatory workshops, where participants discuss creative solutions to concrete urban issues, fostering collective learning and active engagement. Some authors name these practices as collaborative assemblages: agreements, partnerships, or associations among different actors, whether institutional or private, aimed at promoting political subsidiarity in relation to the interests and available resources for greater efficiency and sociotechnical synergy (Santos, Santos e Barros, 2025; Abrucio e Ramos, 2012; Lima, 2010). This is also an exercise of citizenship for children and teenagers interested in the environment, social relationships and human subjectivity. Accordingly, this action complies with solving urban issues by planning strategies focused on future scenarios. Using game-oriented pedagogical techniques (*gamification*), as shown in the following sections, highlights how this approach connects to participants' concrete reality and defines a specific context for immediate actions. At the same time, the possibility of extrapolating the present proposition to other contexts is provided and it results in methodological generalization. Thus, the aim of the present article is to introduce the outcomes from applying a Digital Educational Game (DEG) approach to teach young people topics related to the Sustainable Development Goals (SDG).

Reasoning on improvements in urban quality of life implies assessing studies deeply focused on issues related to environmental and urban processes that, in their turn, have an impact on quality of life. There are many requirements that apply to urban planning in the contemporary city, which is, in its essence, fragmented, segregated, and exclusionary. Therefore, the current research presents a tool developed to support public policies aimed at Sustainable Development (SD) from the creativity, social engagement and cognition perspectives. The campaign promoted by the UN in 2015 was driven by social innovation where the Sustainable Development Goals (SDG) was the main theme chosen to support this tool's development. This campaign challenges everyone to once again think about life relationships on planet Earth in face of climate change (UN, 2015). The methodology followed a constructivist approach supported by theoretical research associated with sustainability, participatory design processes and with using games as tools to trigger political debates. A digital board game supported by cards that represent sustainability features taken as essential for human habitats was the adopted game format. The practice of the game, called 'Urbania', proved to be quite important in encouraging the debate about human development by promoting civic engagement through its characteristic playfulness. Results have provided the first draft of a project that embodied the essential concepts of pattern language (Alexander et. al, 2013). Using this tool type can increase the quality of and help the citizen formation process since it guides discussions based on approaches focused on educating cities – it is substantiated by the International Association of Educating Cities (IAICE) (AICE, 2020).

Given the global urbanization crisis scenario, one must rely on the critical urban theory, as it was outlined by Brenner (2018), in order to highlight some approaches that either converge to and compete with each other, namely: participatory urbanism, which is an

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urbanization model adopted by neoliberal urban-governance forms; insurgent urbanism, which is featured as the way to think about cities based on radical experimentation practices that, in their turn, are more impulsive and spontaneous; and tactical urbanism, which comprises a complex set of actions based on structurally generating alternatives to the neoliberal paradigm of urban intervention -it aims at the equitable appropriation of urban spaces and on the redistributive socio-spatial justice. If, on the one hand, several scholars advocate for the relevance of local governments as agents focused on articulating public policies aimed at income redistribution, on the other hand, the leading role of social movements gets clear in several parts of the world, mainly in Brazil, where the participatory approach is relatively recent to urban projects. Currently, interdisciplinary research aimed at observing participatory practices in urban commons production has extrapolated institutionalized social movements. Civil society engagement in decision-making processes aimed at public policy elaboration is driven by three instances of social involvement in urban processes: informative, which includes manipulation practices, therapy and information; consultative, which includes using consulting and coalition strategies among groups that hold decision-making power; and deliberative, which refers to partnership, delegation and management, which are the modalities defining the shared management of local development actions (Kindon, Pain e Kesby, 2007; Arnstein, 1969). Given the setbacks in environmental policies, Batista (2021) draws attention to the need for a new approach to thinking about social inclusion and SD in Brazil in order to make sure of a national articulation to meet the goals set in the 2030 Agenda.

Urban processes comprise sets of asymmetric actions aimed at continually shaping urban landscapes by working as mediators in the process to activate socio-spatial development relations or as instruments to appropriate urban commons that serve the capital. It is known that the real possibility of imagining, confronting and deliberating on actions capable of changing the society by pointing out alternative futures for urban development is one of games' main features. Yet, these features bring these actions closer to participatory processes (Layrargues, 2014; Hillgren et al, 2011). If the outcomes of their content or duration could be previously known, the very essence of what qualifies them would be lost, namely: their imponderable and random condition. It would initially happen from a general perspective on cities' macro-scale, and more specifically, from approaching the social context on neighborhoods' micro-scale, which is the concrete reality where someone experiences the inhabited territory (Castro, Gontijo e Amabile, 2012; Steinberger, 2006; Craig, 2004).



A growing number of studies have suggested that games have been contributing to users and designers' relationship since the 1990s. These collaborative experiences involve different people: users, agents, project teams, experts, among others, as well as a wide range of experiences, responsibilities and interests. Therefore, they require the development of appropriate tools to make people engage and get involved in collaborative processes (Del Gaudio et al., 2021). Children and adolescents' citizen participation in contemporary planning practices will have an impact on the production of more inclusive cities for future generations. Thus, the essential premises for such a project include a) Social innovation - thinking of social development strategies heading towards the territory, b) Tactical urbanism - participants proposing alternatives to solve the problems they experience in their local daily lives, c) *Gamification* – using the game theory to solve concrete and immediate problems experienced

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by participants and, finally, d) Action research – performed activities can be the assessment subject from the pedagogical reflexivity perspective.

## 2 THEORETICAL ASSUMPTIONS TO THINK ABOUT CITIES, ECOLOGY, POLITICS AND GAMIFICATION

The aim of the current research is to address the scope and limits of collaborative networks through a college extension experience by combining citizenship to *gamification* practices in urban projects. On the one hand, several scholars advocate for the relevance of local governments as agents making public policy articulations aimed at income redistribution. However, on the other hand, the leading role of social movements becomes clear in several parts of the world, mainly in Brazil, where the participatory approach adopted by urban projects is relatively recent, as stated by Harvey (1997), Gohn (2006) and Rezende (2022), among others. Strategies and tactics to collectively think about sustainable ways to inhabit cities are the premises for approaches that, in their turn, advocate for social innovation through participatory urbanism, and advocacy and pluralism in urban planning (Davidoff, 1965). Accordingly, social innovation encourages the elaboration of alternatives within a world that values socio-technical cooperation network formation to play the leading role in local communities at the time to elaborate urban public policies (Manzini, 2015).

To better understand the roots and evolution of these social dynamics, it is essential to draw upon the theoretical framework that underpins them. In this sense, "Assemblage Theory," proposed by DeLanda (2016), offers a perspective that illuminates the complex and fluid interactions present both in citizenship practices and urban collaborative processes. Delanda (2016) conceptualizes society as a constantly evolving network of diverse, interacting components—both human and non-human—that coalesce into dynamic, non-hierarchical formations. These assemblages are inherently fluid, continuously adapting and reconfiguring in response to local contingencies, with each element asserting its own agency to enrich the emergent whole. Consequently, collaborative assemblages arise through decentralized interactions that negotiate the delicate balance between order and chaos, underscoring the unpredictable, emergent nature of social organization. Cooperative relationships within these assemblages give rise to new forms of collective agency, challenging traditional social structures defined by fixed hierarchical power dynamics. Ultimately, the concept of collaborative assemblage reframes social form as an ongoing process, where interactions continuously contribute to the evolutionary potential of the overall structure. Such ideas not only elucidate the dynamic nature of social networks, but also underpin the search for innovative tools that expand the possibilities of participatory urban planning.

Based on discussions about collaborative networks and the understanding of assemblages as fluid and regenerative processes, the concept of a new tool for rethinking sustainable development has taken shape. This theoretical and practical approach is grounded in three interconnected perspectives: a) the role of urban planning (insurgent urbanism) in overcoming the urban crisis, b) using collaborative democratic processes to plan more just, lively and livable cities and c) games as dynamics to support the “educating city” achievement. The first perspective focused on defining insurgent urbanism in association with social movements and with the sense of on-going citizenship construction (Miraftab, 2016). The

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second one allowed mapping concepts that represent the “environmental standards” to be applied at different urban scales, as described by Alexander et al. (2013). The third perspective organized the theoretical debate, which was necessary for game prototype development, so that the quality of urban planning processes can be improved by the involved professionals.

### 2.1 Citizenship, Participation and Urban Planning

Urban processes comprise asymmetric and multi-scale actions taken on territories that continually shape urban landscapes as mediators within the process to activate socio-spatial development relationships or as instruments to appropriate urban commons in service to the capital. Based on an ecology of knowledge capable of overcoming differences between scientific and non-scientific knowledge, the aim is to achieve plural practices in (re)configuring Southern epistemologies against colonialism and heteronomous capitalist practices. These practices, in their turn, are linked to abyssal thoughts, such as that of a system of cultural differences and regulations, whether visible or invisible. This system, in its turn, allows scientific and non-scientific forms of co-existence like popular, lay, peasant or indigenous knowledge (Rezende, 2022; Santos, 2022; Huybrechts, 2016; Rosa, 2011; Lacaze, 1993).

The right to the city associates several dimensions of the herein discussed project because it regards the right of city dwellers to shape and fully access public spaces as urban commons, rather than just the right to housing. This project makes this right concrete by proposing changes that would turn these areas from neglected fields to inclusive and accessible public spaces. At the heart of Holston’s (2013) discussion about the possibility of reaching an insurgent citizenship lies the disclosing of how residents have mobilized the right to the city by claiming for and creating spaces that respond to their needs and desires. This process can be achieved by highlighting changes the project has brought about in infrastructure, as well as access to the quality of spaces, participation in urban life and decision-making about urban development.



Bezerra et al. (2023) propose knowledge sharing and interdisciplinary construction, as well as actions related to the 2030 Agenda, to help recognize challenges faced at the time to create more sustainable, healthy and inclusive spaces in school environments, and likely interventions in the territory. The Culture Circles conceived by Paulo Freire were taken as reference for the project, and they held workshops and training seminars. These events emerged as response to society's growing demands for solutions to complex issues by helping the formation of more conscious and engaged citizens, as well as of better prepared professionals to deal with current issues.

Many requirements apply to urban design if one focuses on promoting sustainable cities. These requirements derive from those inherent to activities’ environmental impact on contextual public policy-related aspects (Brenner, 2018). Currently, interdisciplinary research focused on participatory observation practices has extrapolated institutionalized social movements to promote social, technological and environmental ecologies. Thus, as we describe before, Nature-Based Solutions (NbS) systemic approach is promising in promoting SD based on conserving / regenerating ecosystem services taken as possible addition to SD strategies by providing long lasting solutions to urban challenges (Braga et al., 2024).

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### 2.2 Thinking of Educating Cities as Fair Cities

The meaning of city exceeds its urban form, content and complex range of functions. It reaches what Lefebvre (2001, p. 51) describes as “mediation between mediations”, mediating relationships between individuals and groups, as well as between groups and the social order ruled by institutions, standards and cultures. Cities rise from complex social interactions; therefore, they represent the production and reproduction of human beings by human beings, rather than the production of objects. In addition to being the gathering of social actors, cities are, fundamentally, educational agents (Vintró, 2003). They embody an educational character prior to the formal and informal educational system thanks to the educational possibilities of places, landscapes and territories. The construction from the educating city perspective, which is expressed by the memory of a place, urban furniture, art on facades, of cultivating idle spaces or even of community leaders, opens room for pedagogical paths. Knowing the urban reality does not only refer to mnemonic inventories because the act of getting to know the urban reality also affects the urban becoming (Lefebvre, 2001).

Foguel and Lopes (2024) point out the transformative potential of Smart and Immersive Education in promoting Education for Sustainable Development (ESD), by using a constructivist conceptual framework and connecting technological innovations to global sustainability demands. They argue that these technologies enhance the learning process and encourage both managers and students to take on leading roles aimed at solving socio-environmental challenges. The study provides the very basis for new empirical research and educational practices, since it takes into consideration some pedagogical alternatives to turn environmental and social challenges into opportunities for innovation and positive impacts.



Gallo (2023), in his turn, questions the role of public collective health in contemporary cities’ sustainability and advocates for healthy urban planning as strategy that can understandably and integrally help addressing the most relevant current issues. This process allows promoting more sustainable and healthy cities, mainly in Brazil, which is marked by inequality and socio-spatial segregation. In order to do so, the broadest understanding of both health as quality of life and of social health determinants enables recognizing cities and, consequently, urban politics, management and planning, as privileged *loci* for understandable actions aimed at achieving more humane, inclusive, sustainable and healthy environments and places.

Thus, one faces the relevance of critical reasoning about the ‘educating city’ as a transdisciplinary approach. This concept gained strength and notoriety in the 1990s, after the 1st International Congress of Educating Cities, held in Barcelona (AICE, 2020). A group of cities[1] agreed on a set of principles focused on developing cities’ inhabitants. These principles have guided public administrations since then, and they were organized into the Educating Cities Act, whose final version was drafted and approved at the III International Congress in Bologna, Italy, in 1994. The movement states, in this Act, that the ‘educating city’ approach is multidisciplinary and that cities must meet their political, economic, social and cultural duties

[1] The International Association of Educating Cities (AICE) organization was officially launched in 1994 at the third congress in Bologna, Italy.

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by looking at education, and by promoting and developing all their residents. It also emphasizes this educational process' duty to primarily deal with early child education by viewing a lifelong education; it concluded that

> [...] [T]he reasons justifying this educational role are social, economic and political, above all [they] aim at an efficient cultural and educational project that promotes coexistence. These are the great challenges of the 21st century: firstly, "investing" in education, in each person, so that they are increasingly capable of reflecting, expressing, affirming and developing their own human potential, with its uniqueness, creativity and responsibility. Secondly, promoting full equality conditions so that all people feel respected and are respectful, capable of dialoguing and of active listening. Thirdly, combining all possible factors so that a true knowledge society can be built, city by city, town by town, village by village, without exclusions. Fourthly, learning and developing community awareness and the necessary skills to organize life under equality and justice conditions (AICE, 2020, p. 5).

Finally, authors such as Vygotsky (2008), Trilla (1993), Gohn (2006, 2009), Morigi (2016) and Moll (2019) highlight that environmental education should not be limited to the institutionalized school format in the Western world. It manifests itself in several dimensions, such as non-formal and informal education, which together form the citizen. These are complex and non-linear dimensions that require an understandable approach throughout individuals' lives. Thus, Andrade and Santiago (2024) argue that the right to the Educating City is based on the right to education, which should also guarantee equality, social justice and equity principles. Urban spaces influence and are influenced by social life practices when they produce social actions and relationships. The need for both the city and urban life puts social life in the mainstream. It is not a person or another who creates social relationships, since only social life practices have such power. Therefore, these authors are right when they state that thinking about the relationship between the educating city and formal education implies "(1) centering the subject within the formative process, (2) adopting a relational pedagogy between students and educators, (3) understanding the student's context, (4) establishing a network of partners to make projects viable, (5) taking the process as continuous and dynamic" (p. 14).



### 2.3 Educational Games to Think About Sustainability

Games were used in rituals to attest honor, nobility, glory and virtue in primitive societies. They were the core part of what would later be called culture. Games were agonistic combats that followed religious and political principles to set alliances between peoples (Mouffe, 2015). According to Huizinga (2019), playing is the experience players have when they play, but its meaning defines several game variations, from simple activities (tic-tac-toe and card games) to board games, cell phones and consoles, or games that simulate the world of competition. Based on Kapp and Boller (2018), games are activities that bring along a goal, a challenge (or challenges), as well as rules that define how this goal/challenge should be achieved through interactivity. There are several experience types applied to develop an educational game in compliance with the perspective of interactive learning, and they can be wrongly mixed to each other. According to this epistemological context, Brkovic et al. (2016)

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argue that teams designing games have to understand the differences between typologies arising from *gamification*, as well as to set differences between entertainment games and those designed for learning.

Using educational games can be an excellent tool to achieve the educating city because they are symbolic constructions capable of encouraging playful interactions and learning about social and urban issues through the concrete reality of their players (Fuzeto, 2017; Krek, 2005). Currently, one finds a wide range of game types at one's disposal, such as board games, cards, electronic games, sports practices, among others. In addition to the playful experience provided by games, some elements are essential to consolidate their "magic circle" in order to make them memorable for those who used to play them, namely: assertive rules, unequivocal challenges and playful interactivity (Carver, 2001). Furthermore, according to Woods (2012), playful interactivity should be defined at the very beginning of the game's project in order to set the conditions allowing the articulation of an immersive experience at different game phases.

It is necessary to introduce some concepts emerging from game theory (also known as *gamification*) to better understand this topic, mainly in the education field. Therefore, it is essential to understand some concepts raising in these fields, among them, the definition of online, educational and serious games, and their learning principles (Reis and Gomes, 2015). Online games were defined by Zyda (2005) as mental competitions played through electronic devices based on specific rules to provide entertainment, fun or competition. With regards to educational games, participants are exposed to a whole series of tools, movements, ideas and interactions generated in a synthetic or virtual world whose challenges are structured by specific goals, well-structured rules, feedback mechanisms and the necessary resources to support them (MCGONIGAL, 2012). Serious games can be understood as entertainment strategies designed for users' adaptive cognitive instrumenting, in other words, they aim at providing training and qualification to corporate, educational and institutional environments, among others.



Game theories or *gamification* have recently reached the most diverse sociocultural groups, including experts, users and all involved actors (Van Eck, 2006; Brandt et al., 2008; Poplin, 2012; Reis and Gomes, 2015; Baptista et al., 2016; Fernandes, 2017; Deliberador et al., 2020; Retondar, 2021). Collaborative teaching and learning processes based on game playing highlights this tool's potential in several science fields (Burke, 2015). Games features disclose their great potential for solving concrete problems, and this is the element used by the "*gamification* theory" to define this concept as a process based on using game thinking and dynamics to engage audiences and solve problems (Ermi e Mayra, 2005; Alves, 2014).

Neset et al. (2020) focus on assessing serious games within the climate change context, with emphasis on their potential to make the co-creation of knowledge on climate adaptation in urban zones easier. They assessed challenges associated with implementing digital serious climate-justice games to point out that, although they provide innovative engagement platforms, there are obstacles yet to be addressed in order to maximize their effectiveness.

Yaslak (2024) argues that urban games' exploration can highlight the link between SD and participatory urbanism. Results shone light on public participation as a core element in

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urban games by suggesting that individuals' involvement in these activities can increase their awareness of it and their action towards both sustainability and Sustainable Development Goals (SDG).

Hudson-Smith and Shakeri (2022) emphasize the need for architects and urban planners capable of leading the way to integrate new communication technologies to professional practices by embracing these innovations' non-linear features. They point out that adopting innovative practices linked to games and gamified systems in urban planning is closer related to conceptual understandings and professional dominating narratives than to technical limitations.

Using serious computer games and *gamified* mobile applications has been beneficial at the time to develop pro-environmental information, attitudes and behaviors. Several outcomes are targeted and some significant improvements are observed. Yet, continuous engagement in these technologies is necessary to broaden their long-term benefits (Boncu, Candel and Popa, 2022). According to Gugerell (2023), serious games can make training easier and work as a feedback mechanism in research and public policy processes. Furthermore, possible limitations can include simplifying complex real-world scenarios, variations in participants' involvement and game design influence on outcomes. These elements can lead to the biased understanding of environmental sustainability and social equality.

Therefore, despite their pedagogical potential, digital serious games used in urban planning education can present several limitations and biases capable of affecting their effectiveness in assessing environmental sustainability and social equity. Some important considerations to understand these challenges must be evaluated. They rise from games' design and from the context they are applied in, namely: a) although modern simulations aim at mirroring integrated urban systems, they can oversimplify complex interactions and lead to erroneous conclusions about sustainability outcomes (Stephens, 2015), b) developing and implementing serious games often require significant resources that may not be available, and it limits their accessibility and effectiveness in several urban contexts (Chen, Miao, Chen, Zhang, 2024), c) many urban planners lack experience with participatory methodologies, and it can hinder serious games effective use in planning processes (Ampatzidou et al., 2018); d) players can bring their own biases to the game, which can distort decision-making and outcomes. This process is particularly relevant when it comes to serious games designed to train decision-making skills (Shaw et al., 2017), e) serious games effectiveness can be compromised by the skepticism of adult audiences that may not fully engage in game mechanics or goals (Ampatzidou et al., 2018). These limitations should not stop research and digital serious games development, but rather guide the careful analysis of designs.



## 3 METHODOLOGY

Urbania game is a proposition for immersion in urban issues based on citizen participation. It aims for teams of teachers willing to innovate in the right to city-related methodologies. This project complies with the constructivist pedagogy perspective based on planning strategies focused on future scenarios. Game-oriented pedagogical approaches (*gamification*) were followed to develop a game connected to participants' daily lives in order to define concrete action contexts. Simultaneously, it opens room for replicating its

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propositions in similar contexts, which results in likely extrapolations. The project was divided into four stages, which will be described in the next section.

Participatory action research is among the approaches guiding the current study. This strategy aims at transforming concrete reality through collaboration set between researchers and affected populations. Urbania is a Digital Educational Game (DEG) that changes this perspective by translating it into confrontations and integration between academic and local knowledge. It is done by mapping vulnerable community residents' demand for developing game scenarios, among other factors (Thiollent, 2011). Accordingly, by bearing in mind that action research implies the transformative agency of involved social groups, the proposition lies in bringing it closer to the "advocacy planning" practice by Davidoff (1965). Thus, the advocacy practice in socio-environmental vulnerability practices is crucial for the (re)territorializing and social inclusion processes. Furthermore, it concerns a pedagogy guided by insurgent citizenship, besides informing about rights, building knowledge and triggering reflections on plural cities.

### 3.1 Urbania Game Development

Urbania DEG is the outcome of an urban design course from 2020. It was a challenge for Architecture and Urbanism students who had to think about cities by prioritizing environmental and social sustainability concepts. The game's conceptual foundation was based on principles by Alexander et al. (2013) and on research about the 20230 SDGs (UN, 2015). The idea was to incorporate sustainability challenges and goals to the game development process. The question guiding the study was 'how is spatial justice being represented in the game and how does it actually connect to the 2030 SDGs? All of these historical references were addressed in the game's questions and used to name it 'Urbania', so that the game would be immediately associated with the spatial justice topic. The explanation about how the 253 "patterns" developed by Alexander et al. (2013) were adapted in order to achieve Urbania's development. It is important to disclose how these concepts were applied in game development. What exactly was taken from his work to be incorporated into the game? How does this process affect gameplay and players' learning experience?



The name Urbania gathers the concept of *urbe* (from Latin, urbs, which means cities' social and cultural organization) and suffix *ania*, which suggests a territory or place of origin. Thus, Urbania calls to a city that, although fictional, reflects urban life, contemporary challenges and values. It points towards a *territorializing* process, although fictional or imagined, focuses on both urban life and on its environmental challenges. This name combines concrete (the city as physical and social space) to abstract elements (urbanity values, challenges and possibilities), a fact that makes this name ideal for an educational game aimed at spatial justice. By targeting a city that is both imaginary and real, the aim was to create a game that mixes reflection and learning about urban planning by having players building or (re)imagining fairer territories.

Chart 1 – Urbania DEG Organization and Development

| Urbania DEG Organization and Development | | |
|---|---|---|
| **Stages** | **Activities/Products** | **Actors** |

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| | | |
|---|---|---|
| Strategic Practices.<br><br>Proposes the development of new learning technologies mediated by the use of educational games | a) Structuring, reviewing and producing the Urbania DEG | Actors |
| | b) Preparing the Urbania DEG manual | Students of the Architecture and Urban Planning course |
| | c) Monitoring the augmented reality (AR) application | Graphic Designer |
| | d) Producing narratives in the RPG mode for Urbania DEG challenges | Students enrolled in the Architecture and Urban Planning course |
| It aims at expanding the technical-scientific repertoire of students enrolled in the public education system on sustainable development, based on the urban, ecological and political dimensions. | e) Testing the gameplay dynamics of the Urbania DEG | Students of the Architecture and Urban Planning course |
| | f) Training to students and teachers in the municipal education network | Actors |
| | g) Urbania collaborative experimental game workshop | Authors, Architecture and Urban Planning students, elementary school students, teachers |
| Experimental Practice.<br><br>Will organize gaming tournaments focused on thinking about contemporary cities | h) Urbania DEG Competitive Workshop | Elementary school students, teachers |
| | i) Urbania DEG Collaborative Workshop | Elementary school students, teachers |
| | j) Urbania DEG Competitive Workshop | Students enrolled in the Architecture and Urban Planning course |
| Expressive Practice: Fostering connections between project participants (teachers and public school students), and urban and rural issues experienced in small towns in Goiás State | k) Producing the Traveling Exhibition | Actors |
| | l) Support to hold a Seminar (solution diagrams) | Authors and students enrolled in the Architecture and Urban Planning course |
| | m) Regional Tournament involving students from Goiás State Education Network | Authors, Architecture and Urban Planning students, elementary school students and teachers |

Source: Elaborated by the author (2024).

The online Urbania DEG was developed based on adapting collaborative design experiences to social innovation in order to accomplish the aforementioned goal. The game's collaborative dynamics allows picturing likely future cities in Brazil. Participants are challenged to think of strategies and tactics to solve problems associated with different topics related to the 2030 SDG through the game, mainly about goals 11 (Sustainable Cities and Communities), 12 (Responsible Consumption and Production) and 15 (Climate Action). This educational game results from a methodology that was developed to encourage critical thinking in vulnerable communities by allowing children and adolescents to develop skills to design uncertain future scenarios. Workshop dynamics and teaching material were developed based on the target audience's reality, which includes an activity book and an educational game.

### 3.2 Urbania Game Elements

The Urbania DEG is not available for public access because it remains as a prototype. It can be played by one single player or by groups of 3 (three) players. Its final version is expected to allow its access in Desktops, Notebooks and mobile devices. The game is divided into three phases and presents specific challenges in each one of them. A ranking is displayed

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at the end of each phase to classify players according to the most effective solution found to the proposed challenges.

The main Urbania DEG elements are game environment, objects included in it, game rules, challenges and players. The game focuses on a 2D abstract environment that requires players' imagination - It depicts a circle formed by hexagons (figure 2). The game comprises static and dynamic objects that have a direct influence on game mechanics. The board's graphic elements have an impact on gameplay since they point out difficulty levels for the challenges. Static objects include real-world buildings that cannot be manipulated or moved, graphic elements on the board that define the game's starting and ending points, and strategic locations, depending on the challenges chosen by players. Dynamic objects are the manipulating and changed ones, which can be removed and ruled out by the player. The final version of the game might include a whole variety of pieces that would allow the modes to interact with dynamic objects that, in their turn, would help learning and problem-solving.

The advisor character is another dynamic object. The advisor was designed to interact with players and to make suggestions on how to solve the challenges and to point out the game's features. He was also designed to encourage and guide players, and to communicate with them while they play, as well as to add a playful dimension to the game environment. Players can choose among five characters: the mayor, the resident, the teacher, the child or the police officer. All the playful characters perform the same tasks in a slightly different way. Their language depends on the character itself, but their help and how they approach users depend on the selected help level. Help suggestions pop up as texts - a little helper can be turned on or off depending on players' needs and desires. What exactly does he suggest? How does he provide "help" to players in specific situations? Examples of it would make the descriptions clearer. Explanations about how their language and approach change depending on the help level could be more accurate. If the help level changes the approach of each character, it would be interesting to clarify how this process takes place. Can the player select among different help levels (low, medium, high)? Or does it vary throughout the game? Urbania DEG is a challenging experience aimed at creating a sustainable city by meeting the challenges proposed by the 2030 SDG. The game is divided into three phases, and a ranking is displayed at the end of each one of them based on the effectiveness of solutions proposed by players. Players face urban challenges related to sustainability at each phase, such as pollution and social inequality; they must find viable solutions by balancing environmental, social and economic aspects.



Players choose a character (mayor, resident, teacher, child or police officer). The game adapts the language and approaches the tips provided by the chosen character. The game takes place in a 2D environment formed by hexagons. Players can manipulate dynamic objects (such as resources and buildings) to solve urban issues related to challenges included in the 2030 SDGs: culture/leisure/sports, health, nature, tourism, security, sanitation, housing, urban mobility, city for children, gender equality, education and economy. Every decision made has a direct impact on the city's progress and on the outcomes of each phase. Players must take into consideration their actions' immediate and long-term consequences. The game also includes a chat that allows players to discuss their strategies with other participants or urban planning experts, and it promotes collaboration and idea-exchanging.

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The game can be played solo or in competitive mode, according to which, players are scored based on their sustainability and innovation solutions. They can be awarded with five stars, and the final ranking is determined by the mean number of stars awarded by other players. The game provides three help levels: basic, intermediate and advanced, and they allow players to choose the amount of guidance provided over the game. Players get feedback on their choices and strategies at the end of each level. If they do not reach a minimum score or are unable to satisfactorily solve the challenges, they can restart the level and try new solutions. Furthermore, the game simulates a collaborative environment where players can share ideas and learn from others, and it makes the experience richer and more interactive.

The main game goal is to create a strategy that would lead to the most sustainable alternative to meet the specific demands of sustainable city challenges (see table x). Other interests and motivations have been added to the game, such as competition among different suggested strategies, according to which, players can award up to five stars to the best alternatives. The number of stars given to each design is calculated based on the mean value recorded for all votes. Thus, players' goal can also be to win a design competition. A chat section was added to the game in order to encourage debate and brainstorming. Players can communicate or discuss likely market solutions with experts and urban planners, or simply chat with residents or other players interested in the city's development.

Player: all players officially register on Urbania DEG and choose a name and password, which is repeated twice for security and consistency purposes. Players enter their email address, postal code, year of birth and gender. They accept the Urbania DEG terms and conditions, and start playing. Once registered, players can use their password whenever they want to start playing the game. Although the game is designed for a single player, it allows collaboration through the chat session, where players can share ideas and discuss strategies with other participants or experts.



Figure 1 – Urbania DEG elements. The first version of it comprises 45 tactics.

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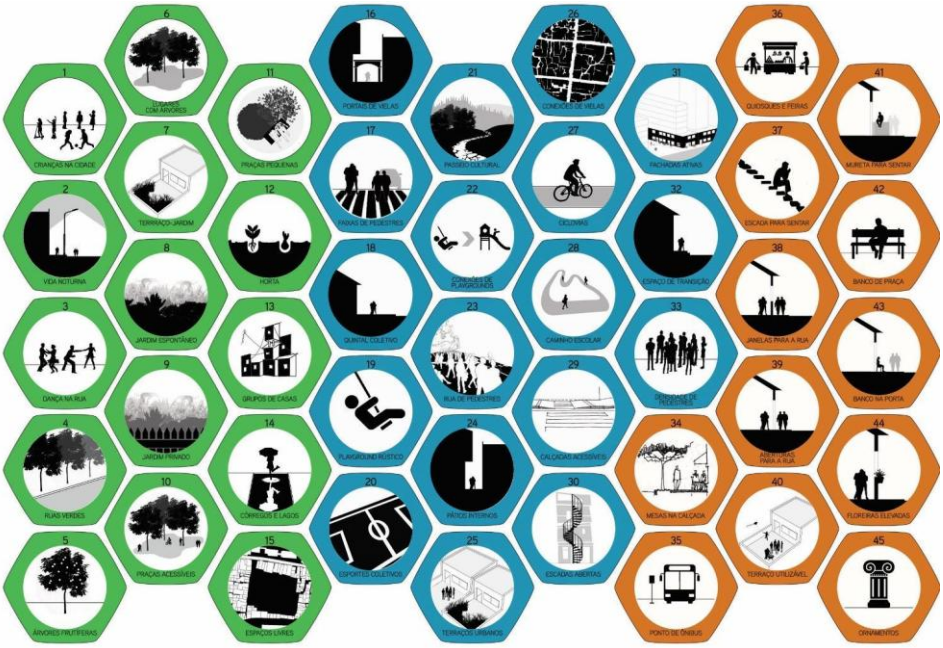

Source: Elaborated by the author (2021).

### 3.3 Urbania Game Application

Urbania game's theoretical basis is anchored in debate about spatial justice. It required prior application of such a basis in its prototypical version in order to find out how students awaken their sensitivity and relate to the content coming from urban planning, given climate changes. This is the way for them to perceive the need for enhancing their skills at this training stage. Such an activity involves interaction with human beings; therefore, the research was submitted to the Ethics Committee at "Plataforma Brasil" and was approved without restrictions (CAAE: 98599718.7.0000.0084).

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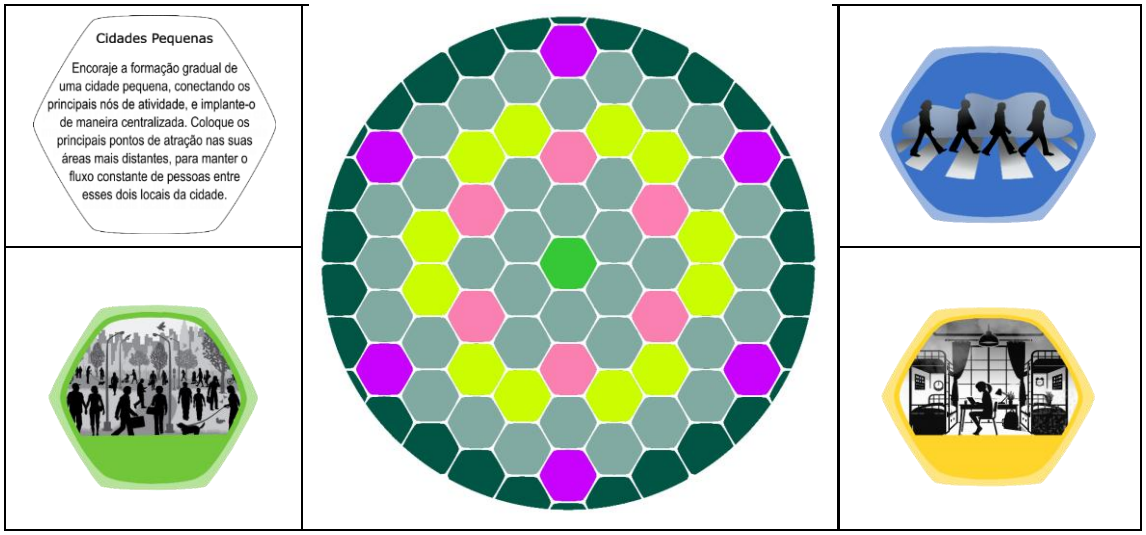
Figure 2 – Main Urbania DEG elements. The second version comprises 90 tactics[2].




Source: Elaborated by the author (2024).

The user interface on the Urbania DEG was designed on the "Tabletopia" platform (https://tabletopia.com/). The home page introduces the game. The description on the following pages takes into consideration the Urbania DEG in its functional form. Efforts are currently being made to implement the game's prototype. The text in the top right corner describes the game's main focus, which lies on proposing SD alternatives for cities and invites players to start the game. The icon below, to the left, invites players to watch the video about 2030 SDGs. If players need additional information about the market, they can find it in the green button, placed below the icon (with the video). The icon (gray arrow) to the right provides instructions on how to use the game (another video). This section explains the game's basic structure, rules and main features. Players can keep on playing because each version can be saved, separately. Yet, they suggest that other players are participating in the game and making their contributions, a fact that allows online access to the city's future vision.



The central part of the game environment holds an empty platform/space ready to be designed by the player. The tool above the central space represents the game tactics and it is a drag and drop tool that allows players to choose the element in the image and to drag it to the empty space in the city. The drag and drop tool comprised different elements, such as trees and vegetation, kindergarten elements, water features, benches, lights and other street furniture. There is a whole variety of designs for each specific element behind each icon. Players can choose an element or accessory, and place it on the market, wherever they want to, just by clicking on the preferred design. They can select elements that have already been placed on and move them to other locations. Players can change the direction of the placed elements by rotating them until finding the urban element's location and the orientation they like best. This activity can be repeated for as long as players want. The game goal is to achieve

[2] Small Cities: Encourage the slow formation of a small city by connecting the main sets of activity, implement it in a centralized manner. Place the main attraction points in its farthest areas in order to keep the constant flow of people between these two locations in the city.

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a design that is liked and preferred by game players and that can be published in the Urbania DEG.

Figure 3 –Urbania DEG being played by Architecture students.

Source: Elaborated by the authors (2024).



Once all elements are placed on the board, players can save the drawing, not submit it yet, or save and submit it later. The submitted drawing is checked by the Urbania DEG moderator and published online. All published drawings can be viewed and commented on by the registered community. Registered players can vote.

## 4 RESULTS AND DISCUSSION

Developing the tool is one the research aims and its main result was observed. Based on the literature review, games are very important for the citizenship education of children and adolescents. Accordingly, the initial part of the results section provides information about the run tests. The game usability test was carried out at two stages. The game story and the sketches of users' interface design were tested at the first stage. These tests and informal discussions were conducted with the aid of a group of UFG students. The recorded contributions from these discussions and unstructured tests led to the games' best concept and design. FAU students tested the game at the second stage and gave feedback to adjust the game's design and experience (Fullerton, 2008).

The following expectations derived from the results: a) broadening participants' repertoire on the role of participatory/tactical urbanism in improving quality of life based on questionnaires applied before and after the game sessions, b) outspreading *gamification* strategies to achieve a sustainable teaching development measured based on the number of teachers who adopt Urbania DEG in their pedagogical practices, and, finally, c) guiding a strategic approach to future scenarios set for urban studies monitored by the qualitative

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analysis of diagrams and proposals developed during the sessions. The products were included: a) online game prototype aimed at students and teachers interested in participatory urbanism practices based on cards and on a board to simulate urban scenarios, b) an instruction handbook for teachers. It provides detailed guidelines on how to organize and conduct the game sessions, c) applying an augmented reality (AR) developed to enhance participants' experience through interactive features that simulate urban transformations - the game is mainly aimed at youngsters and students, and d) showing the diagrams resulting from the game sessions. These elements aim at sharing the learning and proposals generated along with the community to encourage experience sharing and collective reflection on the right to the city.

The pilot study developed for the testing methodology was carried out in an elementary school in the city of Sao Paulo. After the pilot study was over, some additional changes were made to the game in order to improve the testing methodology based on a fifteen-question questionnaire. Participants answered a questionnaire after these two tasks were complete. Participants needed 30 minutes, on average, to listen to the introduction, complete the two tasks in the computer game interaction and answer the questions in the paper questionnaire.

The questionnaire comprised 15 questions to be answered through a five-level Likert scale, according to which, 1 is "totally disagree" and 5 is "totally agree": 1) instructions provided during the game were clear and useful, 2) game rules contributed to a fun and educational experience, 3) game mechanics (interaction with objects, pieces' displacement, among others) were intuitive, 4) the game's response time was satisfactory and it did not detract from the experience, 5) elements and interactions were easy to be used and they did not cause any frustration, 6) game design (interface and visuals) was attractive and made the experience easy, 7) the game was accessible and performed well on the used device, 8) the game's characters were interesting and contributed to the game's story and goals, 9) I felt connected to the character I chose, and it had impact on my gaming experience, 10) the game's challenges were interesting and provided a good learning experience, 11) the game effectively addressed important issues, such as spatial justice and SD, 12) game elements, such as using "advisors" and voting on alternatives, added value to the experience, 13) the game encouraged me to reflect on real urban planning issues and on how they affect life in cities, 14) interactivity level with other players or experts was useful in learning more about the game and its issues, 15) the game experience was enjoyable and I would like to play it again to explore more possibilities.



Result interpretations were based on pre-test and post-test questionnaires comprising questions about participants' profile identification, students' knowledge on educational games as teaching tools and the environmental justice/racism topic. Eighteen students participated in the game (Figure 3). The post-test questionnaire was prepared based on a Likert scale to measure attitudes. It enabled assessing participants' perceptions about urban sustainability and their understanding of participatory urbanism dynamics.

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Chart 2 – Critical Approaches and Result Analysis Categories

| Urbania DEG Critical Approaches and Result Analysis Categories | | | |
|---|---|---|---|
| **Critical Approaches** | **Urbania DEG Features** | | |
| | **Gameplay / Interactivity** | **Graphics / Visual** | **Elements / Rules** |
| Cognitive Plan | The game helps and encourages participants' teaching-learning process | The game presented itself as resource capable of producing knowledge and triggering reflections among participants | Learning about 2030 SDGs, environmental risks, climate change |
| Scientific Plan | The game helps improve the teacher's teaching methods, so that content related to citizenship, spatial justice and sustainability is better understood. | The game can make urban planning teaching easier at adaptive complexity levels (elementary, high school and higher education) | Learning about topics related to full citizenship exercise, socio-environmental issues and public policy issues for sustainable development |
| Aesthetic Plan | Difficulty degree in accessing and playing by taking into account the used technology | The game has aesthetic appeal, and its presentation is pleasant to users. | Analysis of technological difficulty degree and aesthetic attractiveness |

Source: Elaborated by the author (2024).

Serious digital games are an emerging research field in urban planning and civic engagement. They have gained increasing attention in recent years and their value in comparison to other information and communication technologies lies on their potential for playful interactivity, which meets humans' desire to play (Poplin, 2011; Gordon and Manosevitch, 2010; Falkembach, 2006; Habraken and Gross, 1987). During the experience of developing the Urbania DEG, it was possible to face the challenge of designing a fun game, with playful elements, capable of producing useful results to help thinking about urban planning. The test proved the usability of the suggested concept of serious digital game and its sympathy by most participants. Game effectiveness was assessed through questionnaires applied before and after the interaction with the game, and it allowed comparing participants' perceptions about it.



Digital serious games benefits to urban planning should be investigated in future research in order to define development parameters that allow their use in different participatory and citizen education processes. Urbania game's main advantage lies on its core concept, namely: it can be used in any city that needs local development actions. Thus, its main advantage is its ability to be adjusted to different urban realities with minimal effort and cost, and these features turn this game into a valuable resource for civic participation in urban planning projects.

## 5 CONCLUSIONS

In the call for attention to the role of sociotechnical networks, new forms of social innovation and collaborative assemblages in the articulation of open source code creative environments, the current research reinforces the relevance of interactive educational tools for elementary education. These tools must be capable of introducing urban, ecological and political processes that have been marking the 21st century. Creating playful and collaborative practices, such as the Urbania DEG, significantly contributes to urban studies and to strengthen public policies aimed at sustainable development.

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Developing an innovative and creative tool focused on reflections about the future of cities was the study's main achievement. The game's collaborative approach encouraged the expression of creative ideas and in-depth discussions on sustainability, which promoted a fertile collective engagement environment. Furthermore, this tool broadened participants' repertoire of conceptual terms and their perception about citizenship, social justice and relationship with nature. This learning process reinforces the game's pedagogical potential and makes it comply with educating city principles by preparing students for participatory political decision-making processes.

Urbania DEG development validated the research's core hypothesis, according to which, interactive educational practices can promote broader and more adaptive citizenship development. The game allowed participants to experience fundamental sustainability, spatial justice and citizenship concepts by simulating urban scenarios and problem-solving challenges in compliance with the 2030 SDG. Furthermore, the tool's collaborative and creative nature encouraged critical reflections and showed that educational games can encourage participants' active engagement in complex issues such as social inequality, climate change and territorial organization. Interaction with real problems and the need for making integrated decisions proved the tool not only to be a way to make the understanding of urban concepts easier, but also to be capable of helping to internalize values related to participatory planning and social equity.

The research also set close connections among educating city concepts, spatial justice and citizenship. The educating city approach is capable of transforming urban spaces into continuous learning environments where citizenship development takes place, both in schools and in daily life. Urbania DEG embodies these principles by creating a playful experience that simulates dilemmas faced by contemporary cities and that encourages participants to critically think about how to build more inclusive and sustainable communities. Spatial justice, as a guiding principle, emerges in the game through the need for taking into consideration the social and territorial impact of players' choices. This approach reinforces the idea that cities are political spaces where planning decisions have a direct impact on the distribution of resources and opportunities. The game promotes active citizenship by engaging players in participatory processes; therefore, participants end up understanding their role in building fairer territories, reinforcing the sense that urban life is a learning field and a transformative action.



Although Urbania has shown great potential as an educational tool, some of its limitations need to be taken into consideration. The game remains in the prototype phase, which limits its application to a limited number of participants and contexts. Broader testing in different age groups and audiences is necessary to validate its large-scale impact. In addition, it could be improved to include elements to address the cultural and territorial specificities of different regions in order to make sure of its greater adaptation to local realities.

Integrating Urbania into broader pedagogical strategies also represents an important step towards strengthening its effectiveness as an educational tool. Its application in schools, community associations and informal learning spaces can increase its positive impact on citizenship development. Finally, the game's interdisciplinary nature allows its use not only in basic education, but also in professional training and participatory planning processes.

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By connecting education to urban practice, Urbania DEG has the potential to change the way to teach about cities and sustainability. Its contribution to building a new generation of conscious citizens, who are empowered to face socio-environmental challenges, shows that interactive tools can be agents of significant change in the way to achieve more just, resilient and inclusive cities.

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**DECLARAÇÃO DE CONFLITOS DE INTERESSE**

Eu, **Wagner de Souza Rezende**, declaro que o manuscrito intitulado "**Urbania: Um Jogo Educacional para Pensar Cidades, Ecologia e Política**":

1. **Vínculos Financeiros**: Não possui vínculos financeiros que possam influenciar os resultados ou interpretação do trabalho. Este trabalho foi parcialmente financiado pela Universidade Federal de Goiás, com bolsa de extensão PROBEC cedida pela Pró-Reitoria de Extensão e Cultura.
2. **Relações Profissionais**: Não possui relações profissionais que possam impactar na análise, interpretação ou apresentação dos resultados. "Eu mantenho vínculo empregatício com a Universidade Federal de Goiás.
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