



Design Science Research for the Development of an Educational Digital Game with an Ethical-Moral Focus

Michelle Nery, PUC Minas, michellenery@pucminas.br,
<https://orcid.org/0000-0002-6029-3090>

Diego Antunes, PUC Minas, dvantunes9@gmail.com,
<https://orcid.org/0009-0006-9611-8290>

Roberlei Panasiewicz, PUC Minas, roberlei@pucminas.br,
<https://orcid.org/0000-0002-5429-2649>

Lucila Ishitani, PUC Minas, lucila@pucminas.br,
<https://orcid.org/0000-0001-8565-8386>

Abstract: The gaming industry continues to grow, with an increasing number of children and young people engaging with digital games. Research shows that games can make learning more engaging and enjoyable, though few succeed in combining fun with moral and ethical growth. This article presents insights from the development of an educational game prototype for students aged 8 to 14, centered on values such as sustainability, responsible consumption, respect, and peace. Using the Design Science Research approach, the study gathered data through interviews, observation, and questionnaires. The results provide insights into what makes a game effective for ethical education and how to design such games from conception to evaluation, addressing a topic of growing global relevance.

Keywords: educational digital games; ethics and morality; sustainability; participatory design; SDGs.

Design Science Research para o Desenvolvimento de um Jogo Digital Educacional com Foco em Ética e Moral

Resumo: A indústria de jogos continua a crescer, com um número cada vez maior de crianças e jovens engajando-se com jogos digitais. Pesquisas mostram que os jogos podem tornar a aprendizagem mais envolvente e prazerosa, embora poucos consigam combinar diversão com desenvolvimento moral e ético. Este artigo apresenta insights oriundos do desenvolvimento de um protótipo de jogo educacional para estudantes de 8 a 14 anos, centrado em valores como sustentabilidade, consumo responsável, respeito e paz. Utilizando a abordagem de *Design Science Research*, o estudo coletou dados por meio de entrevistas, observação e questionários. Os resultados oferecem contribuições sobre o que torna um jogo eficaz para a educação ética e sobre como projetar esse tipo de jogo desde a concepção até a avaliação, abordando um tema de relevância global crescente.

Palavras-chave: jogos digitais educacionais; ética e moral; sustentabilidade; design participativo; ODS.

1. Introduction

The steady growth of the world's population has intensified ethical, social, and environmental challenges. Rising demands for resources, along with pollution, waste, and inequality, underscore the urgency of rethinking development strategies. Recent "nowcasting" estimates indicate that humanity's demand on nature continues to exceed what Earth can regenerate within a year, reflecting an ongoing ecological overshoot (LIN; WACKERNAGEL, 2024). This context is directly related to the United Nations Sustainable Development Goals (SDGs), particularly SDG 12 (Responsible Consumption



and Production) and SDG 13 (Climate Action), which call for broad ethical and behavioral change (NAÇÕES UNIDAS, [s.d.]).

In addition to these environmental and social crises, there are deeper moral and educational failures. The growing gap between rich and poor, the lack of decent housing, and the weakening of human bonds show just how serious this problem really is. Economic growth alone has proven unable to secure social well-being, which is why education continues to play a central role in fostering ethical reflection and critical awareness.

Even with all the progress in technology and access to information, inequality remains. The way we use and discard electronic devices, often without much thought, and the constant waste of energy, reveal how easily knowledge can drift away from responsibility in our daily lives. In this context, education cannot be limited to teaching technical skills; it must also embrace ethical, environmental, and human values. When connected to the SDGs, education grounded in values becomes key to forming citizens who think critically, act with empathy, and care about building a sustainable future.

Building on this foundation, when students play, they learn by doing, through stories, challenges, and teamwork. Games make learning feel natural and meaningful, turning abstract ideas into real experiences. They help players grow in empathy, think critically, and take responsibility for their actions. When used with care, digital games go beyond entertainment: they teach, inspire, and help shape more aware and connected people. Through narrative and interaction, they offer safe spaces to experiment, make mistakes, and reflect on the consequences of their choices.

Supporting these observations, several studies have shown that video games can act as mediators of moral and civic learning, incorporating values such as sustainability, empathy, tolerance, and respect for diversity into meaningful and playful experiences (KHOO, 2012; McGONIGAL, 2011). The Brazilian game industry, which generated approximately US\$251 million in 2022, illustrates the growth and cultural impact of this medium, broadening the pedagogical possibilities of so-called serious games, which unite entertainment and learning (ABRAGAMES, 2023).

Despite the proven benefits of digital games for learning, integrating ethical values into education remains challenging. Schools, which unite diverse backgrounds and ideas, are responsible for meeting the needs of digital-native generations. To do this, they must connect technology and human values, aiming to make learning both engaging and transformative.

Thus, this study proposes a framework for designing educational digital games to promote the ethical and moral formation of elementary school children and adolescents. We base the proposal on the Design Science Research (DSR) methodology, which creates, evaluates, and refines artifacts, here, a digital game, as instruments of applied research. The project integrates design principles, ethical values, and motivational engagement factors to build digital experiences that foster reflection and strengthen students' civic development.

Within this context, a research problem arises: how can ethical and moral education be meaningfully integrated into technology-mediated learning, especially in elementary education for children and adolescents? Educational digital games have motivational and experiential potential. However, there is a lack of systematically designed approaches that explicitly embed ethical values in gameplay and learning objectives with methodological rigor. This study poses the research question: How can educational digital games be designed, using a structured, design-oriented approach, to foster ethical and moral learning among elementary students? The objective is to develop and evaluate an educational game artifact grounded in DSR and value-sensitive design



principles to promote ethical reflection, social responsibility, and environmental awareness among students aged 8 to 14.

2. Background

This section brings together the theoretical foundations supporting the use of digital games as educational tools, focusing on the ethical and moral formation of children and adolescents. It discusses the notions of ethics and morality in the social context, the Values at Play and DSR approaches applied to education, and studies exploring user-centered game development, emphasizing participatory practices that connect theory, human values, and meaningful learning.

2.1. Ethics and morality

The notions of ethics and morality occupy a central place in social life. From childhood, people learn what is considered right or wrong in the environments where they live, family, school, work, or cultural belonging. These experiences shape how each individual interprets the world and guide their decisions. In general, morality relates to the rules, customs, and values that regulate social coexistence, varying according to time and cultural context. Ethics, in turn, goes beyond the normative dimension: it is the reflection on those rules, questioning what is just, good, and beneficial for the collective. As noted by Kant (2005) and Aristóteles (2018), ethics is rooted in reason and virtue, expressing the human capacity to choose the good not out of obligation, but out of conscience.

In contemporary times, this reflection becomes even more urgent. Technological advancement and the accelerated pace of social change create moral dilemmas while expanding possibilities for action. Bauman (1997) and Lipovetsky (2005) highlight that individualism and the pursuit of immediate pleasure weaken solidarity bonds and erode the collective sense of ethics. In this scenario, education assumes an essential role: more than transmitting norms, it must form subjects capable of critical thinking, dialogue, and responsible decision-making. School thus becomes a privileged space to develop empathy, respect for diversity, and a sense of justice, indispensable conditions for democratic coexistence. Within this context, digital games emerge as promising pedagogical instruments. Beyond entertainment, they create symbolic environments in which the player experiences dilemmas, makes choices, and faces the consequences of actions in a safe space. When conceived with educational intentionality, such games can stimulate reflection on values, citizenship, and ethics playfully and engagingly. Playing, in this sense, is also learning to choose and to understand the meaning of one's choices.

2.2. Values at Play

Although digital games may appear to be purely recreational spaces, they express the values, beliefs, and worldviews of their creators. Flanagan and Nissenbaum (2014) defend this perspective, demonstrating that every design process involves moral decisions, conscious or not, that reflect cultural and social patterns. Based on this understanding, the authors proposed the Value-Sensitive Design methodology, known as Values at Play (VAP), which conceives the design of technologies, particularly games, as a process that must consider not only technical requirements but also their ethical and social impacts.

Flanagan and Nissenbaum (2014) structured the VAP model into three stages: discovery, translation, and verification. In the first stage, researchers identify the values



relevant to the project; in the second, they translate these values into mechanics, narratives, and visual elements; and in the third, they evaluate whether the gameplay experience effectively incorporates those values. This approach is particularly significant in educational projects, where learning and reflection must advance together.

2.3. Design Science Research and Elaborated Action Design Research

DSR, proposed by Hevner et al. (2004), has been consolidated as a methodological paradigm focused on creating and evaluating innovative artifacts to solve real-world problems. Unlike traditional sciences, which concentrate on describing phenomena, DSR begins with practice and experimentation, seeking to produce both applicable solutions and validated scientific knowledge.

Action Design Research (ADR), proposed by Sein et al. (2011), extends DSR by combining its methodological structure with the interventionist nature of Action Research. The method proposes continuous cycles of construction, evaluation, and reflection, enabling the researcher to act simultaneously as a designer and an agent of change. This approach aims not only to solve a practical problem but also to generate scientific knowledge from the process itself. Sein et al. (2011) organized the original ADR model into four stages: problem formulation, building–intervention–evaluation, reflection and learning, and formalization of learning.

Subsequently, Mullarkey and Hevner (2019) proposed the Elaborated Action Design Research (EADR) model, which details the ADR cycles into four distinct types: diagnosis, design, implementation, and evolution. Each of these cycles involves the activities of planning (P), artifact creation (A), evaluation (E), reflection (R), and learning (L). This approach makes the method more flexible and applicable to educational contexts, where teachers and students can take active roles in the conception and validation of artifacts.

2.4. Related works

The related works indicate that digital games can foster moral reflection and influence ethical behavior. Christen et al. (2012) introduce the concept of *Serious Moral Games* from two perspectives, games that allow players to construct morality within the ludic environment and games capable of influencing ethical behavior beyond the game, while also proposing four analytical perspectives (perception, judgment, prioritization, and action) to guide values-oriented design.

To support ethics education through games, Schrier (2015) developed the EPIC model, which defines ethical learning objectives and pedagogical strategies applicable to video games and can be used both to evaluate existing titles and to guide the creation of new ones. The author also emphasizes the importance of contextual variables, such as students' age, access to technology, and familiarity with games, even though the model still requires broader empirical validation.

In later work, Schrier (2019) expands this line of research by proposing design principles for moral learning games, arguing that ethical thinking and morality-related skills can be developed through dilemmas and social problem-solving. The study presents categories and specific principles derived from reviews and analyses, stressing that iterative cycles of development, use, and evaluation are essential to understanding real effectiveness.

Overall, these proposals converge in recognizing digital games as mediators of ethical and civic formation, but they also highlight empirical gaps. Many studies focus on analyzing already developed games without fully examining the educational artifact's life

cycle, from conception to evaluation in authentic contexts, an area that the present study seeks to advance through an integrated methodological approach.

3. Methods

The methodology adopted in this research is a mixed approach combining qualitative and quantitative procedures, with emphasis on qualitative analysis, as it involves investigating human values in the development of serious games for ethical and moral education. The study is grounded in the DSR paradigm, which focuses on the design and evaluation of innovative artifacts to address real-world problems (DRESCH et al., 2020). Building on this foundation, the research adopts ADR as an iterative and collaborative process model, integrating the intervention-oriented nature of Action Research with the rigor of DSR. In this study, the development and evaluation of the artifact were organized into iterative ADR/EADR cycles: diagnosis, design, implementation, and evolution (Figure 1).

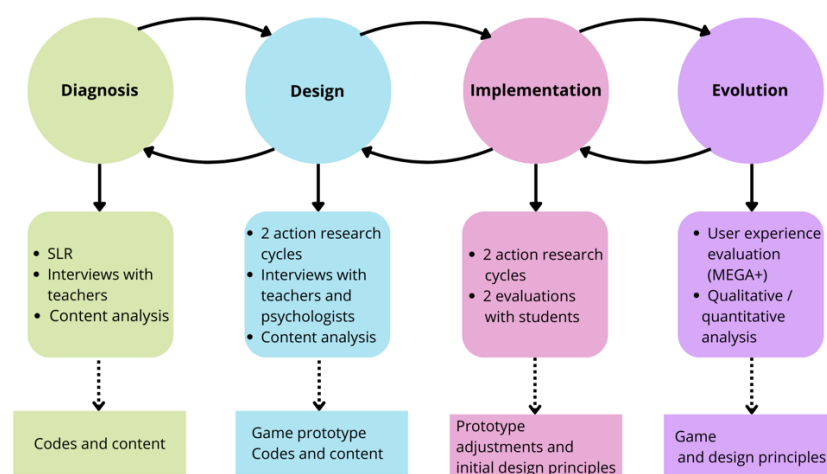


Figure 1 - Methodological stages of the research

The researchers incorporated the VAP model to explicitly identify and operationalize ethical values throughout the stages of conception, development, and verification of the digital artifact. All procedures, instruments, and data collection stages were approved by the Research Ethics Committee, ensuring compliance with ethical principles applicable to studies involving human participants.

The study began with a literature review of national and international databases (ACM, IEEE, Science Direct, Google Scholar, SBGames, Computer on the Beach, SBC), enabling the mapping of practices and challenges related to serious and moral games, as well as participatory and user-centered design methodologies. This stage provided the theoretical and methodological foundation for defining the game's initial requirements and evaluation strategies.

During the diagnosis phase, the researchers sought to understand the school context and identify the values underpinning the development of the artifact. Semi-structured interviews were conducted with elementary school teachers to elicit pedagogical, motivational, and ethical-moral aspects relevant to children aged 8 to 14. Content analysis revealed the need to balance playfulness and educational intent, highlighting values such as empathy, cooperation, respect, and sustainability. These findings were aligned with the VAP methodology, guiding their translation into the game's narrative and mechanical elements.



The design phase transformed the diagnostic findings into a digital prototype entitled *Influência*, conceived as a virtual board game aimed at teaching ethical, moral, and environmental values and inspired by SDG 12, Responsible Consumption and Production. Development occurred collaboratively, involving teachers and education specialists. The game was structured around three axes: real-world facts, direct consequences, and delayed consequences, allowing players to experience ethical dilemmas and reflect on the impacts of their choices, addressing themes such as conscious consumption, energy saving, recycling, and respect for diversity.

In the implementation phase, teachers, educators, and psychologists evaluated the prototype in terms of clarity, playability, and pedagogical coherence, resulting in recommendations related to language, accessibility, and flow. Subsequently, the game was applied to 23 elementary school students to analyze engagement, collaboration, and perceptions of learning and ethical values through observations and Likert-scale questionnaires.

The results demonstrated a high level of involvement and provided guidelines for adjustments in mechanics, interface, and narrative. A further evaluation stage is in preparation to test the enhanced version of the game and validate the improvements made, expanding the scope of analysis and strengthening the project's methodological foundations.

4. Results

This section presents the empirical results of the research, organized according to the DSR cycles: diagnosis, design, implementation, and evolution. In each cycle, the researchers summarized the evidence collected through interviews, observations, and evaluation instruments, highlighting how these data guided the conception of the artifact and the formulation of recommendations for educational games with an ethical–moral focus.

4.1. Diagnosis

The teachers reported that digital games already form part of school practices and serve as strong drivers of motivation and engagement. Visual appeal and the possibility of choice and avatar customization emerged as key points: “Students like when the game has color, action, when they can choose characters or avatars. That captures their attention, and they get more involved.” (P2)

There was explicit demand for socially relevant themes, especially sustainability and responsible consumption, with emphasis on the issue of e-waste: “It would be interesting also to address the disposal of electronic waste because that is something they experience and often do not know how to deal with.” (P2)

The social dimension was considered a structural component, promoting conversation, negotiation, and cooperation: “The game needs to encourage them to talk, agree on strategies, work together. That is essential at this age.” (P3)

Teachers also recommended balancing challenge and variety to prevent demotivation: “It cannot be repetitive and too easy, because then they lose interest. It needs something that challenges them, that makes them think.” (P3)

These insights formed the pedagogical and design requirements of the game *Influência*, motivating the adoption of three formative mechanisms: real-world facts, direct consequences, and delayed consequences, the conceptual axis that guided the subsequent cycles.



4.2. Design

The design guidelines derived directly from teachers' perceptions: a dynamic, colorful game (P2), progressive challenges (P3), and collaboration as a core element (P2).

The game was conceived as a multiplayer digital board game, featuring pixel art avatar selection and turn-based progression, as shown in Figure 2. The ludic economy articulates three resources, influence, disposition, and waste, to connect individual choices with collective effects. Cards based on daily life (dilemmas with explicit trade-offs), quizzes (sustainability and conscious consumption), and thematic minigames serve as the primary triggers for reflection and action.

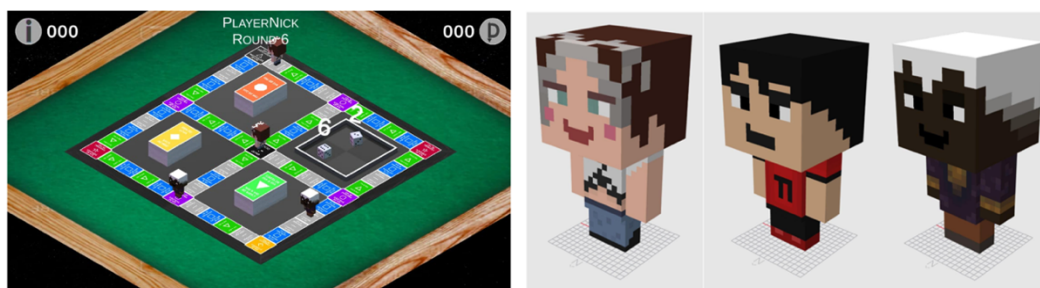


Figure 2 – Game board and avatar

Among the minigames, Home Watcher (responsible use of energy and water) and Trash Basketball (selective waste collection), shown in Figure 3, materialize the learning by doing principle and support the linkage between values and mechanics. The design preserved the potential for pedagogical transfer to the classroom (debates, projects, curriculum integration), maintaining coherence with the SDGs and the formative intent of the project.

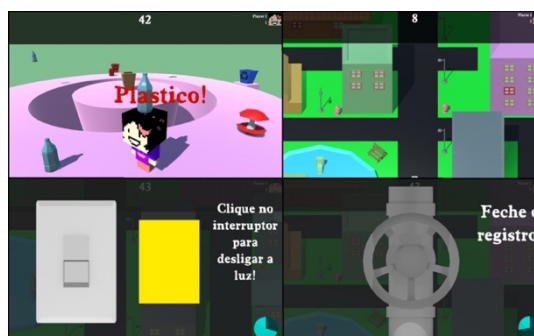


Figure 3 – Minigames

4.3. Implementation

The prototype was examined by six education professionals (teachers, pedagogues, and psychologists) through interactive sessions and semi-structured interviews, following a script addressing purpose/mechanics, engagement/usability, clarity of values (empathy, solidarity, respect, responsibility, environmental care), conditions for school use, improvement suggestions, and evaluation strategies. The content analysis organized findings into six axes:

- **Positive feedback on the game.** Testimonies emphasized its dynamism and low entry barrier ("It does not require much prior knowledge to play," P6), the value of simultaneous multiplayer interaction ("All four were playing at the same time. I think that

motivates them.”, P3), and its proximity to youth leisure repertoires (references to Minecraft and Kahoot).

- **Age suitability.** Although the prototype targets students aged 8 to 14, evaluators mostly reported stronger initial adherence among ages 8–12, recognizing students’ technological familiarity (“digital natives,” P3) and the potential for sustainability work at that stage (P5); therefore, the 13–14 range is treated as a refinement opportunity, requiring adjustments in challenge level, language, and pacing.

- **Educational tool.** Games were viewed as highly appealing and pedagogically relevant resources (“A meaningful resource to work on ethical and moral values,” P2), serving as a starting point for discussions and knowledge consolidation (P4).

- **Transmission of values.** Participants perceived the game’s mechanics and narratives as promoting reflection (“thinking about the environment... personal responsibility,” P6; critique of individualism versus collectivism, P5).

- **Learning assessment.** Suggestions included discussion circles, creative outputs (posters), quizzes, and guided syntheses as evaluation means (P3, P4, P6).

- **Suggestions.** Adjustments to gameplay, quiz customization by age/theme (P4, P5), a final ranking for healthy competition (P6), and attention to infrastructure barriers (P1, P6), with emphasis on mobile use to increase viability (P1) and teacher collaboration (P2).

These contributions guided the redesign of the game and the evolution of the artifact into a new version, seeking to enhance player engagement, strengthen the pedagogical approach, and optimize system usability. The researchers redesigned the board, as shown in Figure 4, and added new mechanics, such as events and additional minigames, to increase engagement and stimulate player reflection.

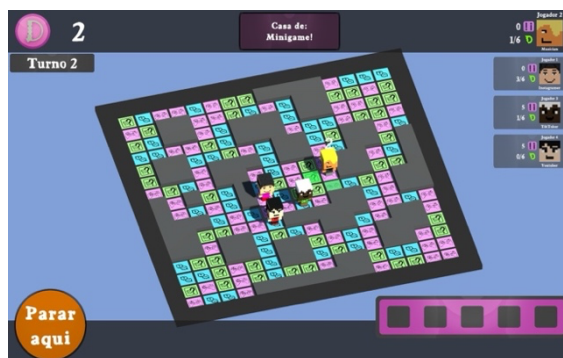


Figure 4 – Redesigned game board

We conducted a new evaluation phase with 23 students aged 8 to 14, organized in quartets and accompanied by the research team. The analysis of student feedback, collected through observations and a 27-item Likert-scale questionnaire with three open-ended questions, indicated that the game was well received, with children demonstrating interest in both entertainment and learning aspects (Table 1).

Table 1- Student assessment results

Statement	Mean	Median
I found the game fun.	4.7	5
I liked the game.	4.6	5
I would play this game again.	4.6	5
I understood the game and its objective.	4.6	5
After playing, I better understand the game’s theme.	4.6	5



The game's content was so creative that it was easy to stay focused on it.	4.5	5
Something in the game caught my attention and sparked my interest.	4.4	4
I felt that, over time, I got better at playing.	4.4	5
I tried hard to achieve good results in the game.	4.4	5
I was so immersed in the game that I lost track of time.	4.3	5
The game kept me motivated to keep playing.	4.3	5
I enjoyed using the game as a way to learn.	4.3	5
After playing, I feel I can act better on sustainability and environmental issues.	4.3	4
I feel that I achieved the game's goals (accumulating Influence and avoiding Waste).	4.3	4
After playing, I feel I increased my knowledge of the game's theme.	4.3	5
After playing, I can remember more information related to the game's theme.	4.3	4
The game's content aroused my curiosity.	4.2	4
Using the game to learn was so enjoyable that it made me interested in exploring other topics through games.	4.1	4
The game sparked my interest and enthusiasm for learning.	4.1	4
The game provided different and interesting learning experiences.	4.1	4
The game's tasks were neither too easy nor too difficult for me.	4.0	4
Finishing the game's activities gave me a sense of achievement.	4.0	4
The game's content will be useful to me.	3.9	4
The game was easier to play than I expected.	3.9	4
I realized that what I learned in the game helps me interact and cooperate better with others and with the world around me.	3.7	4
I was so immersed that I forgot about my surroundings.	3.5	4
I can relate the game's content to experiences or ideas I already had.	3.5	3

We observed that some students initially had difficulty interacting due to the lack of touch-screen support, which required greater familiarity with mouse and keyboard use. On the other hand, the researchers observed strengthened collaboration among participants as they realized that success depended on collective effort. Based on these observations, the researchers improved the game by incorporating more explicit rules, a better balance between competition and cooperation, new minigames, moral dilemmas, and a more intuitive interface, along with optimization for multiple devices. These insights guided the redesign of the game and led to the development of an improved version of the artifact, as shown in Figure 5, based on the challenges identified and the changes suggested by the students. The modifications aimed to increase player engagement, strengthen the pedagogical approach, and enhance the system's usability.

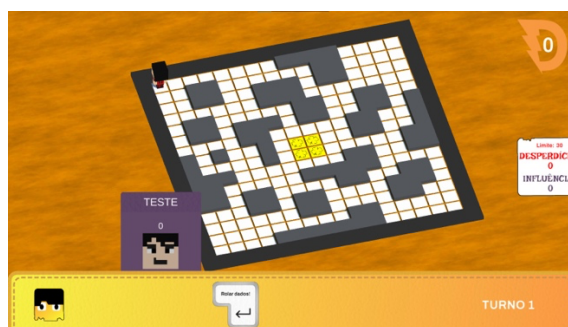


Figure 5 – Game board



4.4. Recommendations for the design of educational games with an ethical-moral focus

Based on the results and observations from the game's application, recommendations were developed for designing educational games that address ethical, moral, and sustainability themes. These guidelines complement, rather than replace, the general design principles described by Schell (2008), which include clear objectives, immediate feedback, and a balance between challenge and skill.

The study's findings suggest incorporating interaction mechanics that sustain player engagement and promote active learning through practical, dynamic activities, encouraging sustained participation and meaningful involvement. Furthermore, it is essential to promote ethical reflection through meaningful decision-making moments that prompt players to consider the consequences of their actions in contexts that are close to real life.

Another fundamental guideline is to balance competition and collaboration by creating experiences that value both teamwork and individual achievement, thereby avoiding frustration caused by skill imbalances. The study's findings suggest diversifying interaction with the content by incorporating different mechanics, such as quizzes, challenges, and simulations, to broaden engagement and enhance pedagogical effectiveness.

The importance of considering players' varying technological skill levels is also emphasized, with the adoption of simple, intuitive, and accessible controls to ensure inclusion for all user profiles. Finally, it is essential to contextualize game content to students' realities, exploring everyday situations that make the experience more meaningful and encourage the transfer of learning to real life.

These recommendations aim to guide the development of more inclusive and engaging educational games that align with the ethical and moral values they seek to promote, thereby strengthening the role of digital games as formative and transformative tools in the school context.

5. Evaluation

The evaluations with professionals and students confirmed the potential of games as a pedagogical tool capable of engaging, educating, and forming more conscious and critical citizens. The game *Influência* encouraged reflection on everyday attitudes and ethical values, demonstrating that interactive activities can meaningfully complement school learning.

Some barriers were identified, such as the lack of school infrastructure and differences in students' technological skills, indicating the need for greater accessibility, the use of multiple devices, and more intuitive controls. The analysis highlighted the importance of balancing competition and cooperation: a collaborative spirit increased enthusiasm and a sense of community, whereas excessive competition generated frustration.

The minigames, such as those on recycling and energy saving, were the most appreciated, demonstrating the effectiveness of mechanics that require direct action. However, the study highlighted the need to improve content contextualization and expand opportunities for ethical decision-making, making the relationship between the game and real life clearer.

The analysis concluded that balancing fun, reflection, and moral values is essential for educational games to fulfill their formative role, promoting not only engagement but also the internalization of ethical and sustainable attitudes.



6. Conclusions

This article presents the development and evaluation of an educational digital game for students aged 8 to 14, designed to address ethical and moral values such as conscious consumption, recycling, and sustainability, with the participation of schools in the metropolitan region of Belo Horizonte. The results indicate that, when intentionally integrated into educational settings, digital games can serve as practical tools to promote reflection on personal responsibility, environmental care, and collective awareness, combining cognitive learning with moral formation.

Applying Design Science Research (DSR), the study shows that playful, interactive experiences can foster the internalization of ethical and moral values by turning them into concrete, meaningful experiences connected to students' daily lives. At the same time, the process revealed limitations, including difficulties some players had in linking the game's content to their own life experiences, underscoring the challenge of balancing entertainment and ethical depth. The small number of participants further constrained the scope of conclusions, pointing to the need for additional iterations and expanded samples.

From these findings, the study recommends promoting meaningful decisions, balancing cooperation and competition, diversifying mechanics, and contextualizing content to players' realities as key guidelines for ethical-moral educational game design. Future work will focus on improving the game, conducting new evaluations with a broader audience, and applying more specific methods to assess moral engagement, such as decision-analysis instruments and reflective interviews.

Despite positive outcomes, limitations must be considered when interpreting the results: the relatively small evaluation sample limits generalizability, and variations in technological infrastructure and students' digital literacy influenced initial interactions with the artifact. Although these issues were partially mitigated through researcher mediation, iterative interface adjustments, and triangulation of observations, questionnaires, and qualitative analysis, they reinforce the need for larger, more diverse samples and longitudinal evaluations to further validate the proposed approach's educational and ethical impact.

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