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GAMIFICATION OF DAIRY FARMING AS AN EXTENSION STRATEGY FOR FAMILY FARMING

GAMIFICAÇÃO DA PECUÁRIA LEITEIRA COMO ESTRATÉGIA EXTENSIONISTA PARA A AGRICULTURA FAMILIAR

GAMIFICACIÓN DE LA PRODUCCIÓN LECHERA COMO ESTRATEGIA DE EXTENSIÓN PARA LA AGRICULTURA FAMILIAR

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Abstract: This article presents the development of the educational digital game Life MOO, designed as an extension tool to promote sustainable dairy farming practices within the context of family farming. It is a 2D isometric game developed in Unity that simulates the routine of a mini-farm, encouraging players to adopt good management and sustainability practices. The proposal seeks to integrate teaching, technology, and rural extension through a playful and interactive approach, aimed especially at young people and rural educators. The game was validated with 25 technical high school students and young people involved in rural extension projects, who positively evaluated the gameplay, clarity of information, and aesthetic appeal. The results demonstrated spontaneous learning of good milking practices and sustainable management, as well as a high level of engagement with the narrative and game mechanics. The initiative reinforces the potential of digital games as innovative pedagogical strategies, contributing to the appreciation of local culture, the retention of young people in rural areas, and the strengthening of environmental education in rural areas.

Keywords: Family Farming; University Extension; Gamification; Educational Games; Dairy

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Farming; Sustainability.

Resumo: O presente artigo apresenta o desenvolvimento do jogo digital educativo Life MOO, concebido como uma ferramenta extensionista para promover práticas sustentáveis na pecuária leiteira no contexto da agricultura familiar. Trata-se de um jogo 2D isométrico desenvolvido na Unity, que simula a rotina de uma mini fazenda, incentivando o jogador a adotar boas práticas de manejo e sustentabilidade. A proposta busca integrar ensino, tecnologia e extensão rural por meio de uma abordagem lúdica e interativa, voltada especialmente a jovens e educadores do campo. O jogo foi validado com 25 estudantes do ensino médio técnico e jovens vinculados a projetos de extensão rural, que avaliaram positivamente a jogabilidade, a clareza das informações e a atratividade estética. Os resultados evidenciaram aprendizagem espontânea de boas práticas de ordenha e manejo sustentável, além de alto nível de engajamento com a narrativa e as mecânicas de jogo. A iniciativa reforça o potencial dos jogos digitais como estratégias pedagógicas inovadoras, contribuindo para a valorização da cultura local, a permanência de jovens no campo e o fortalecimento da educação ambiental no meio rural.

Palavras-chave: Agricultura Familiar; Extensão Universitária; Gamificação; Jogos Educativos; Pecuária Leiteira; Sustentabilidade.

Resumen: Este artículo presenta el desarrollo del juego digital educativo Life MOO, diseñado como herramienta de extensión para promover prácticas sostenibles de ordeño en el contexto de la agricultura familiar. Se trata de un juego isométrico 2D desarrollado en Unity que simula la rutina de una minigranja, incentivando a los jugadores a adoptar buenas prácticas de gestión y sostenibilidad. La propuesta busca integrar la docencia, la tecnología y la extensión rural mediante un enfoque lúdico e interactivo, dirigido especialmente a jóvenes y educadores rurales. El juego fue validado con 25 estudiantes de secundaria técnica y jóvenes involucrados en proyectos de extensión rural, quienes evaluaron positivamente la jugabilidad, la claridad de la información y el atractivo estético. Los resultados demostraron un aprendizaje espontáneo de buenas prácticas de ordeño y gestión sostenible, así como un alto nivel de compromiso con la narrativa y la mecánica del juego. La iniciativa refuerza el potencial de los juegos digitales como estrategias pedagógicas innovadoras, contribuyendo a la valorización de la cultura local, la retención de jóvenes en zonas rurales y el fortalecimiento de la educación ambiental en estas zonas.

Palabras clave: Agricultura familiar; Extensión universitaria; Gamificación; Juegos educativos; Ganadería lechera; Sostenibilidad.

INTROCTION

Milk production plays a strategic role in the economic and social sustainability of many Brazilian rural communities, especially those linked to family farming (FAO, 2014). However, inadequate management practices, the lack of access to technical information and the lack of interest among younger generations in rural knowledge represent significant challenges for the continuity of this activity. In this context, it is urgent to rethink educational strategies that articulate technical knowledge, cultural appreciation and social participation (ABRAMOVAY, 2007).

University extension, as a link between the university and society, has the potential to catalyze transformations through innovative methodologies, such as gamification (ABRAMOVAY, 2007). Digital games, applied pedagogically, can awaken the interest of young people, promote their protagonism and facilitate the learning of complex topics in a playful and interactive way (LOUREIRO, 2012).

This article presents the development of the Life MOO game, an extension initiative that seeks to promote good sustainable practices in dairy production, with emphasis on environmental education and strengthening family farming. The project proposes an accessible and attractive simulation of the routine of a small farm, which challenges the player to apply correct management techniques, animal care and resource management, in accordance with the principles of rural sustainability (DETERDING et al., 2011).

Through an interdisciplinary approach, the game was conceived as a tool to support training processes in school and non-school environments, seeking to bring young people closer to the field with technological possibilities and expand the reach of educational actions promoted by educational institutions (FREIRE, 2001). By integrating teaching, research and extension, Life MOO is consolidated as an innovative pedagogical resource, committed to social transformation and the valorization of rural forms of life.

The selection of the theme seeks to highlight the importance of dairy production on the ground in terms of local sustainability, but also as an attraction for young people and aficionados of dairy production. In rural communities, especially among young people, the lack of investment and competence with imported products has a significant impact. The game seeks to raise awareness among this public about the importance of preserving the culture of dairy production, promoting sustainable and economic practices (ARROYO, 2012).

When directing the game to young people and fans of ages ranging from preadolescence to adolescence, we recognize that, if good practices can initially awaken less interest, the playful and interactive approach to content can transform learning into an extremely useful tool (WILSON, 2021). The game seeks to educate while positively shaping future cultural practices around dairy farming, which is fundamental for the development of communities dependent on family farming (SALEN; ZIMMERMAN, 2003).

In encouraging young people to remain in rural areas, the game acts as a source of inspiration and educational guidance, valuing local culture and promoting the importance of continued training in this sector, vital for sustainable development. The main objective of the digital game is to open doors for the formation of a new generation of committed and qualified leaders in cultural production, thus contributing to the strengthening of rural communities

(ABREU, 2021).

The selection of this theme contributes to raising awareness about the importance of dairy production in the local economy. Encourages the use of good management and sustainability practices. It highlights the transformative potential of cultural production in the lives of families and the community as a whole (ABRAMOVAY, 2007). Based on theoretical frameworks related to dairy production, the game « LifeMOO » seeks to inspire a positive change in the perception and practice of this activity.

By promoting good management practices and stimulating local development, the game aspires to a more optimistic future for communities dedicated to dairy production, especially activities centered on family farming. Therefore, the game on the ground is entertaining, but it also educates and raises awareness, creating an experience that transcends the virtual world and generates positive reflections and actions in real life. This work seeks to preserve the soil, as well as revitalize the milk culture and its communities, promoting a virtuous cycle of prosperity and sustainable development (DETERDING et al., 2011) .

From this perspective, the objective of this work was to develop a 2D isometric game in Unity, entitled "Life MOO", which explores the culture of milk production, encouraging players to adopt sustainable and educational practices centered on milk production. In the game, players take on the management of a mini-farm, with emphasis on sustainable development and family agricultural practices, offering a playful experience that integrates learning and environmental awareness about the importance of sustainability in rural production.

THEORETICAL FRAMEWORK

The proposal for the Life MOO game is based on an interdisciplinary approach that combines technology, environmental education, sustainable practices and university extension. To support the conception and development of the game, this theoretical framework addresses the following themes: digital games in education, gamification, environmental education and sustainability, university extension, user-centered design and the relevance of family farming.

Digital games and education

The use of digital games as a pedagogical tool has been consolidated as an effective strategy to promote participation and meaningful learning (CARROLL, 2019). According to Salen and Zimmerman (2003), games are interactive systems composed of rules and objectives that stimulate decision-making, offering the player an attractive experience. This characteristic makes games potential allies in the educational context, especially when aligned with training

objectives.

According to Abreu (2021), well-designed digital games can stimulate critical thinking, problem solving and the construction of contextualized knowledge. Furthermore, the playful nature of games contributes to increasing the intrinsic motivation of students, which is essential in the learning context of young people in rural communities (MORALES, 2020).

Gamification and flow theory

Gamification, understood as the use of game elements in non-playful contexts, is considered an innovative strategy in the educational process (NIELSEN, 2022). According to Deterding et al. (2011), gamification contributes to increasing participation and motivation by applying typical game mechanics, such as rewards, objectives, and progression to educational and social activities.

A key aspect of the Life MOO design was the application of Flow Theory, proposed by Csikszentmihalyi (1990), who highlights the importance of maintaining a balance between challenge and skill to offer an immersive experience. This theory guides the development of the mechanics and missions of the game, ensuring that the player remains engaged without frustration or boredom (PAGAN, 2020).

Environmental Education and Sustainability

The development of socio-environmental skills through education is fundamental for the formation of individuals who are critical and committed to the environment in which they live. For Loureiro (2012), environmental education must be transversal and emancipatory, promoting reflection on the impacts of human actions and promoting sustainable practices.

In this sense, Life MOO acts as an educational mediator, encouraging actors to internalize sustainable management practices, such as the correct use of natural resources, the care of animals and the importance of hygiene in dairy production. This approach contributes to developing ecological awareness based on everyday actions in the rural context.

University Extension and Social Technology

University extension plays an essential role in the connection between the university and society. As Freire (2001) says, it is in the dialogue between different forms of knowledge from which true transformative learning is built. The use of digital games as social extension technology represents an advance in the democratization of knowledge, bringing rural youth to interactive and innovative pedagogical practices.

According to Arroyo (2012), valuing popular knowledge and community experiences is fundamental for critical dissemination, and projects like Life MOO embody this premise by integrating academic knowledge with the reality of family farming.

User-centered design and usability

The development of the Life MOO game also follows user-centered design principles, as defined by the ISO 9241-210 (2019) standard, which emphasizes the need to understand the needs, abilities and contexts of use of users to create effective and accessible systems.

Norman (2019) and Krug (2018) emphasize the importance of usability to create intuitive, clear, and easy-to-use interfaces, especially in products aimed at different audiences. In Life MOO, I am reflecting on the creation of a pixelated visual aesthetic, the organization of accessible menus and the use of constant feedback to guide the player.

Family farming and rural youth

Family farming is one of the main contributors to food production in Brazil and is strategic for food security and sustainable development (FAO, 2014). However, this sector faces challenges related to family succession, the lack of technical assistance and the lack of interest among young people in rural areas.

The Life MOO game, by simulating the routine of a dairy farm and proposing educational practices centered on sustainability, seeks to redefine the relationship of young people with the rural environment. According to Abramovay (2007), strategies that value culture and local knowledge are fundamental to encourage young people to stay in the field.

METHODOLOGY

The development of the Life MOO game was carried out through an interdisciplinary methodological approach, based on the principles of applied research, with emphasis on university extension and pedagogical innovation. The process is structured in four main stages: collection of requirements, pedagogical planning, technical development and validation with the target audience.

Collection of requirements and extension diagnosis

The initial stage consisted of identifying the training needs of young people in rural areas and selecting good sustainable practices in dairy production, based on technical documents, expert advice and interviews with professionals in the sector. The active listening

with consultants and members of rural communities facilitates the construction of a narrative and challenges in line with the reality of family farming.

Educational planning and game design

With the collected data, the team developed the game's pedagogical plan, defining educational objectives, skills to develop and gamification strategies. The content is organized into digital books delivered to the player, with progressive missions based on real-world management practices. The concepts of flow theory , meaningful learning and intrinsic motivation sustain the mechanical and narrative design.

Technical development

The game was developed on the Unity platform, using pixel art graphics with isometric perspective to facilitate the visualization of farm areas and promote an immersive experience. The development followed a weekly schedule, with tasks divided between game design, programming, art and usability tests. Features such as inventory, a mini order game (Milk Rhythm), character customization and a progression system based on real field challenges were implemented.

Validation and tests with the target audience

The validation of the prototype was carried out with 25 participants, mostly second-year secondary students in an agricultural technical career at a public institution and young people linked to rural extension projects.

A 5-point Likert scale was applied to evaluate aspects such as performance, clarity of information, aesthetic appeal, and system usability. The Likert scale is widely used in educational and perceptual research, which allows us to measure attitudes and opinions in a simple and reliable way (LIKERT, 1932; MATTAR, 2014).

Furthermore, semi-structured interviews were carried out for the qualitative analysis of the participants' perceptions regarding learning good management and sustainability practices. This type of interview allows you to combine pre-structured questions with opening new answers, which guarantees greater depth in the analysis (MINAYO, 2012; TRIVIÑOS, 1987).

The combined methodological strategy —quantitative and qualitative instruments— allows for greater reliability in results, as data triangulation contributes to increasing the consistency of conclusions in applied research (YIN, 2015).

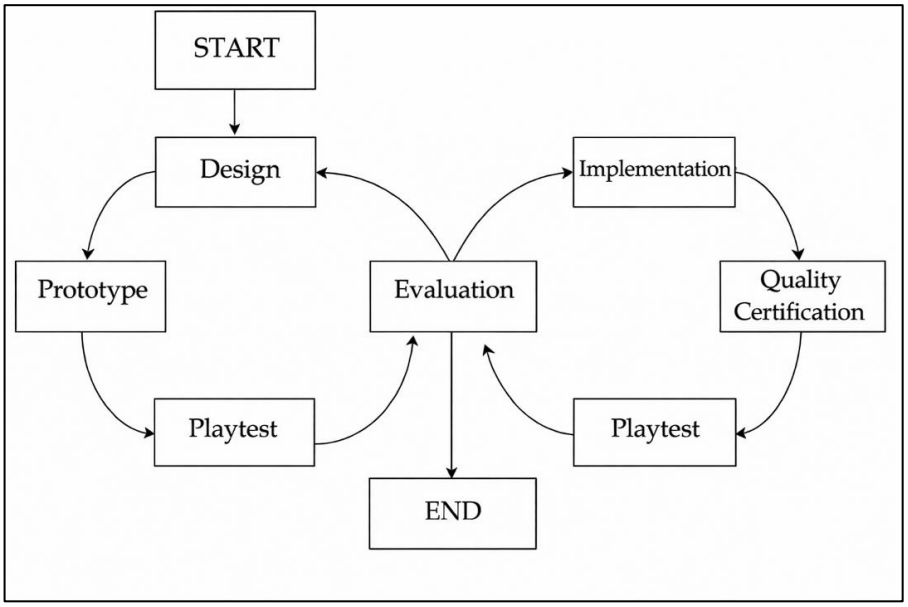

Figure 1 – Interaction cycle with rapid prototype

Source: Adapted from: <https://www.sbgames.org/sbgames2012/proceedings/papers/artedesign/AD_Full17.pdf Acesso em 04 dez.2023.>

Tools for process management

To illustrate the video game manufacturing flow model, we can consider the design process proposed by Adam and Rollings (ADAMS and ROLLINGS, 2006). This process, based on a player-centered approach, consists of three main stages: conception, where initial ideas are established; elaboration, where most of the game details are added and perfected through prototyping and playability tests; and the final stage, responsible for the final adjustments and the polishing of details, called the refinement stage.

Table 1 - Collection of requirements and technical analysis

Requirements compilation	
Identification of the target audience:	Determine the age range and level of knowledge about dairy production in family farming.
Definition of Educational Objectives:	Establish the main educational objectives that the game must achieve, such as understanding the best practices.
Content mapping:	List the main good practices in dairy production relevant to family farming that should be addressed in the game.

Source: Author's own work

When consolidating the initial validations of this project, the opportunity for feedback on the processes incorporated into the development of the game arises. New approaches will be implemented to close the cycle, incorporating the best farming practices to the maximum.

This collaborative and iterative methodology allowed the development of a product aligned with the social and educational demands of the target audience, consolidating the Life MOO game as an interactive pedagogical tool for university extension, with the potential to be used in schools, technology fairs, technical courses and training activities in rural communities.

1. DEVELOPMENT

The following section presents the conceptual, technical and pedagogical structure of the Life MOO digital game, detailing its narrative, mechanics, aesthetics, characters, game experience and usability. The objective is to highlight how the game design was planned to promote playful learning and awareness about sustainable practices in leisure production.

Plot and setting

The player assumes the role of manager of a small dairy farm located in a rural community. Faced with economic and environmental challenges, good management practices must be applied to guarantee the quality and sustainability of production. As the missions are completed, the farm evolves and positively influences the surrounding community.

The narrative unfolds through correspondence that the player receives in a virtual buzzer. These letters contain digital books with instructions, technical information and progressive missions that guide learning and skill.

Game mechanics and objectives

The main mechanics of the game include:

- Management of agricultural resources.
- Planting and harvesting food for animals.
- Genetic improvement of the herd.
- Interaction with NPC (non-playable characters).
- Complete missions based on thematic books.

One of the most outstanding aspects is the minigame "Ritmo de la Cheche", which simulates the milking process through a rhythmic challenge in which the player moves a cube (using the A and D keys) to collect drops of milk. The score obtained is converted into liters,

according to the characteristics of the milked cow.

The game's progression is guided by the achievement of educational missions, which encourage the learning of practices such as:

- Use of a dark-bottomed vessel for the diagnosis of mastitis.
- Pre and post immersion of the feet.
- Hygiene of utensils and equipment.

The score also reflects the performance and productivity of the farm, encouraging the correct application of learned techniques.

Aesthetics and Visual Arts

The visual aesthetic adopts a pixel art style with isometric perspective, creating a welcoming, nostalgic and functional environment. This choice enhances immersion and clarity in the visualization of spaces and interactive elements.

The scenes represent everyday rural life, with natural colors and visual harmony. Personages, animals, crops, stables and furniture are represented with elegance, but with attention to the fidelity of the rural context.

Characters and interactive narrative

The player can choose the name and gender of their character, starting with basic clothing that they can customize as they progress. The main character is described as hardworking, empathetic and connected to nature, which reflects the values that the game seeks to promote.

The narrative is constructed from the interaction with the PNJ and the surrounding objects. Progress is made by reading books, which serve as level guides and contain technical content and instructions for practical activities.

Game design: level design , flow theory and feedback

The design of game levels was planned to favor progressive learning, with increasing challenges that require mastery of acquired skills. The surroundings of the farm are an open isometric world, with specific areas for different activities (ordering, gathering, selling, etc.).

The Theory of Flujo (Csikszentmihalyi , 1990) guides the organization of tasks and challenges, keeping the player in a continuous state of commitment, avoiding frustration or disinterest.

Furthermore, the game uses positive feedback (visual, auditory and narrative)

whenever the player performs correct actions, which contributes to motivation and reinforces good practices.

Scoring system and technical attributes

The scoring system is integrated into simulated milk production, based on the attributes of each animal (such as productivity, drought resistance and feed efficiency). The actions taken directly influence the quality and quantity of collected milk.

The evolution of animal attributes is linked to the performance of tasks and the correct application of the practices taught. The player is encouraged to improve the farm's performance in a sustainable and educational way.

Interaction with the Environment and Complementary Actions

In addition to the main activities, the player can:

- Fishing and collecting fish in the lakes.
- Buy and sell items with a street vendor.
- Interact with other villagers to obtain advice and carry out exchanges.
- Organize your mission books on a custom-made shelf inside your home.

The player starts after pressing the playback button inside his home, which he remembers at the beginning. Inside the house, you will find basic items and furniture, such as a bed, a stove, a table and a refrigerator, among others. The following image illustrates the surroundings:

Figure 2 - Interior reference of the player's house.

Source: https://pin.it/46ruZRX . Consulted on December 3, 2023

When leaving the residence, an alert will be sent from the buzzer. The player must access the buzzer to receive the game's main message. Next, reference images of the buzón and the book are shown:

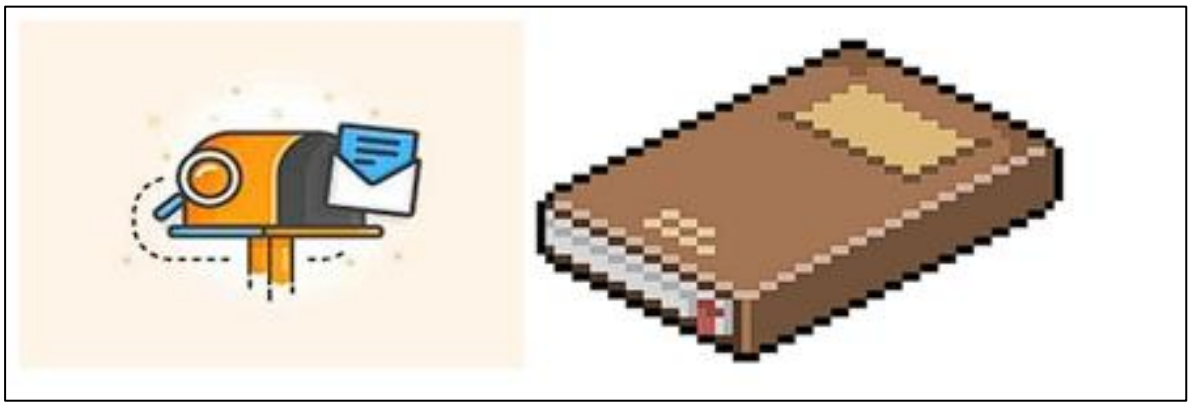

Figura 3 - Buzón and Initial Information Book and Missions.
Source: https://pin.it/34pEkIv. Consulted on December 3, 2023 / https://pin.it/5P3mJZQ . Consulted on December 3, 2023.

Mensagem no bilhete junto a correspondência

"Dear LifeMOO Friend,

I hope this letter reaches you at a good time. I have been closely following your journey on the farm and, honestly, I have felt a little concerned.

As a neighbor and friend, I am sending you a special gift: a book full of best practices in dairy farming. I believe these tips can make all the difference in the prosperity of your farm.

I am here to offer support and hoping that the information contained in this book will bring even more success to your business. With affection. Someone from the neighborhood"

After reading the contents of the note, the player can follow the instructions for the first mission of the game: cutting and collecting wooden trunks to make the furniture that will

be in your home. The objectives of this mission are:

- Illustrate the mechanics of splinting and harvesting trees;
- Create an immersive environment by interacting with the village NPC;
- Designate space to store completed mission records for future reference;
- Demonstrate the importance of attentive reading and continued strength in activities.

The continuation shows a reference to the surroundings, the establishment, as previously described:

Figure 4 – Stable the corral

Source: Author's own work (2024)

After accessing the new scene inside the stable or corral, the player sees an environment with a cow, which is contained, and furniture like a grocery store, a closet and some containers that illustrate the orderly area. At the patron, an arrow indicates that the player must approach and interact. Then, a dialogue system opens that describes all the details of the next mission. For more details, consult the breakdown table, which contains a description of each mission that makes up the game's initial mechanics.

Inside the closet, there are some objects that the player must retrieve and add to his inventory to justify their use. This action does not constitute a simulated use of objects, as described in dialogues to which the person has access while washing hands. The list of dialogues is continued:

Table 2 – Contents of Information Dialogues on Good Ordinary Practices.

Dialogues	**Clean milk cube:**
1	Instructions for the player: "Let's start milking. This is the clean cube for the milk. Remember that proper hygiene is essential to guarantee the quality of the milk."
2	**Previous and subsequent immersion for cleaning the ceiling:**
	sealed products . Important to keep the cows' udders free from bacteria. Ensure safe and healthy order."
3	**Dark-bottomed cup**
	Instructions for the player: «This is the dark bottom can. We will use the first three streams of milk to visually check if there is formation of granules, bleed the excessively watery liquid. This will help us to identify any irregularities in the quality of milk».

Source: Author's own work (2024)

As shown in the previous table, the informative content is subject to a consultancy analysis to resolve any inconsistencies with the objectives of this work. Other sections contain tests to consolidate the mechanics planned for this stage.

The mechanics of the "Milk Rhythms" minigame consist of a rhythm game that

consists of collecting drops of milk that fall from the screen, as shown in the illustrative image:

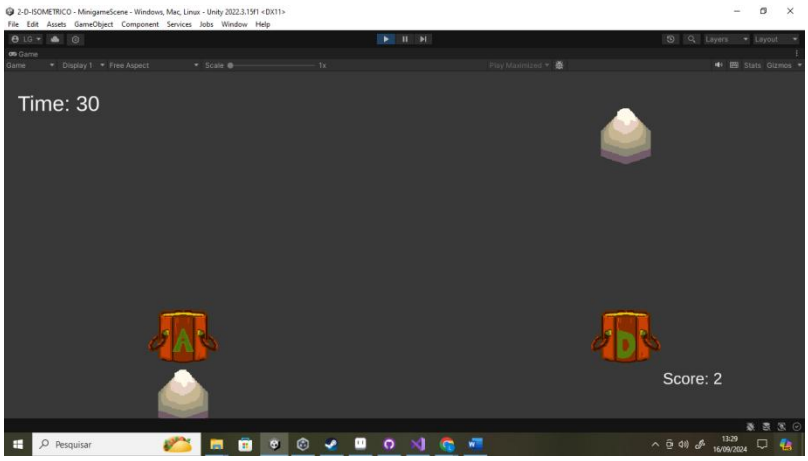

Figura 5 – Representação do Mini Game Ritmos do Leite

Source: Author's own work (2024)

Screen opens (a visual or graphical area where the game is presented, that is, the space where the visual elements of the game are displayed, such as graphics, characters, objects and user interfaces), which presents a detailed graphical interface.

The player takes approximately 45 seconds to collect as many drops of milk as possible that fall from the top of the screen to the bottom edge.

To collect the drops of milk, the player controls a cube, moving it left and right with the [A] key and right with the [D] key. The movement of the cube adjusts according to the player's actions in the direction of the drop. If a drop is left, the player moves the cube to the left, and vice versa.

The maximum score is achieved by collecting all drops of milk before the allotted time expires. Each drop collected adds points to the general score.

If the player fails and fails to capture a drop, it is not counted as a point. The recorded points and the player's final score are counted, without penalties such as the loss of lives or the player's state.

The following table shows a list of different attributes for each cow with different levels of productivity. The objective of this mechanic is to allow players to observe the possibility of improving their animal to reach its maximum potential, according to its attributes.

Table 3 - Cow attributes

Attribute 1 (Bad Cow):		
Description of each attribute of the cow.	**Description**	**Indicative**
milk productivity	Down	
Resistance to drought	High	
DM conversion to milk	Down	
Attribute 2 (Medium cow):		
Description of the attribute	**Description**	**Indicative**
milk productivity	Average	
Resistance to drought	Moderate	
DM conversion to milk	Average	
Attribute 3 (Good cow):		
Description of the attribute	**Description**	**Indicative**
milk productivity	High	
Resistance to drought	Moderate	
DM conversion to milk	High	
Attribute 4 (Excellent cow):		
Description of the attribute	**Description**	**Indicative**
milk productivity	Very high	

Resistance to drought	High	
DM conversion to milk	Very high	

Source: Author's own work (2024)

Therefore, in future systems, we will be able to create a mechanism to improve each attribute so that the cow can change category, and that is to say, move from one attribute to the other attribute, and thus successively, until reaching the maximum improvement of the attribute.

The following table shows how many liters of milk can be collected in total by order.

Table 4 - Conversion of minigame score to liters of milk

Mini-game scoring	Milk quantity per attribute 1	Quantity of milk per attribute 2	Qnt Leite per attribute 3	Quantity of milk per attribute 4
1 to 10	2	3	5	8
11 to 15	5	8	10	15
16 to 20	8	10	15	20
21 to 30	12	15	20	30

Source: Author's own work (2024)

The score of the minigame reflects the milk production potential, according to the animal's attributes. For example, if the player reaches the maximum score in the minigame and his cow is in attribute category 1 (one), his score is converted into liters of milk, which, according to the previous table, is equivalent to 12 (sweet) liters of milk per order per day. Technically, the milk can be measured in kilograms, but for simplicity, we will opt for the most common method and express the amount in liters.

As previously reported, the game's main mechanics involve receiving a sequence of books that ... If you hang around the player's property buzzer. That is to say, each book will correspond to a level of specific missions and information, being the one level (01), the one level (02), and so on, until completing the series of books. The continuation shows the

calculation sheet that details the one level of books and missions.

Table 5 – Breakdown of level (one) of the initial book of the Libros series.

LEVEL	BOOK	MISSIONS
Level 1	**Introduction**	1. See the field where the "Pinos" trees are and cut them to obtain six wooden blocks.
		2. Collect the wooden blocks and add them to your inventory.
		3. Go to the carpentry and ask the carpenter to give you a piece of furniture (shelf) to store the books.
		4. When you return, check whether the furniture is in the residence.
		5. In the stable, upon entering the scene, you will find a cow (Mimosa) waiting to be milked. Go to the toilet or lavatory.
		6. You must always have items in inventory before ordering. The cube, the previous and subsequent supplies to the bathroom, the dark bottom vase and, at least once every 10 days, you must use the "palette" probe.
		7. Direct towards the mimosa tree to activate the "milk rhythms" minigame.
		8. Before collecting the milk, you must deliver your production to the refrigerator within the time limit.

Source: Author's own work (2024)

The remaining books will be developed based on the tests and validation of previous mechanics. However, the player can explore the local environment and interact with the PNJ in the region. You can also buy and sell items at the local store or at a street vendor known as

"Peddler", who will visit the village every 10 (ten) days of the game. You can also fish and collect fish in the lakes with a fishing rod.

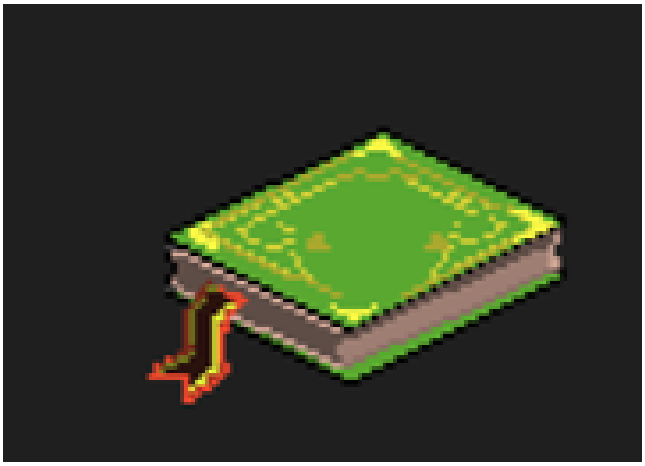

Figure 6 – Reference to game books

Source: Author's own work (2024)

Figure 7 – Reference to the “Shelf” unit to store the books that contain the Missions.

Source: https://pin.it/2bZM46S . Consulted on December 3, 2023.

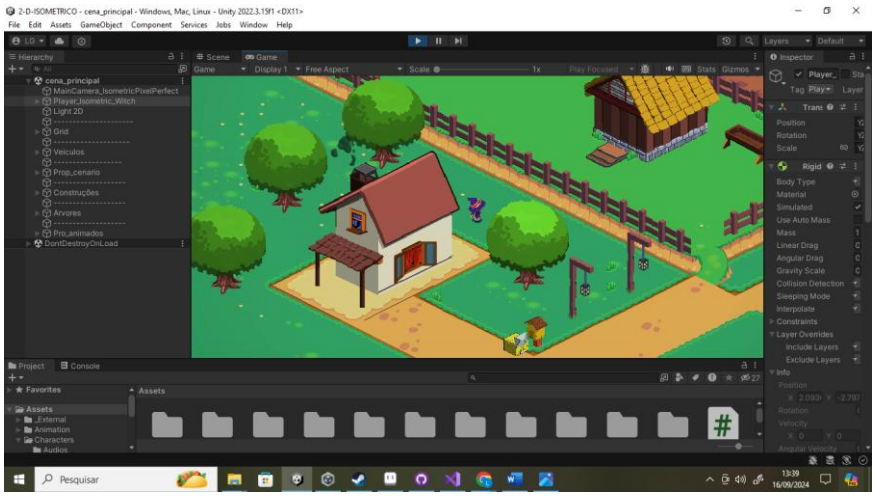

Figure 8 – General description of the Life MOO game

Source: Author's own work (2024)

RESULTS AND DISCUSSION

The development of the Life MOO game results in an interactive digital tool capable of integrating environmental education, sustainable practices in reading production and gamification strategies aimed at young people. The tests carried out with 25 participants — high school students in agricultural technology programs and young people participating in rural extension projects — allowed us to analyze the ability, the clarity of information, the aesthetic appeal and the perception of learning.

Commitment and usability

The results of the questionnaire indicated that 88% of participants positively evaluated the playability and clarity of the gaming instructions, rating them between "good" and "excellent". The pixel art environment and isometric perspective are mentioned as factors that facilitate immersion in the scene, promoting emotional interaction with the narrative. These data corroborate the idea that the game contributes to greater intrinsic motivation (ABREU, 2021; SALEN; ZIMMERMAN, 2003).

Furthermore, 84% of participants stated that the system of progressive missions contributed to giving meaning to the actions of the game, which is aligned with the Theory of Flow (CSIKSZENTMIHALYI, 1990), and that the balance between challenges and rewards keeps players committed, avoiding frustration or you are disinterested.

Perception of technical learning

Regarding technical content, 76% of those surveyed stated that they had learned new handling practices, especially the use of a dark-bottomed pot, the importance of submerging food before and after cooking, and hygiene precautions for utensils. The interviews reinforced this perception: the young people stated that the playful approach facilitated the understanding of concepts and their least tired ones in comparison with traditional theoretical classes. This result highlights the potential of the game to promote meaningful learning (LOUREIRO, 2012) by contextualizing technical knowledge in practical and interactive situations.

Key aspects according to participants

In the interviews, the aspects most valued by the participants were:

- The clarity of guidelines in digital mission books;
- The possibility of putting knowledge to practice in a practical way in the minigame of the order;
- An aesthetic immersion in the daily routine of a dairy farm;
- The feeling of ownership and responsibility in the management of simulated production.

These elements connect with the literature on critical university extension (FREIRE, 2001; ARROYO, 2012), which emphasizes the importance of valuing local knowledge and the collective construction of knowledge.

Connection to youth retention in rural areas

A recurring theme in the debates was the recognition of the game as an instrument capable of valuing rural culture and, at the same time, bringing young people closer to technology. This combination reinforces the relevance of initiatives that encourage young people to remain in the field (ABRAMOVAY, 2007; FAO, 2014), demonstrating that dairy production can be experimented in a modern, sustainable and technically qualified way.

Social and outreach

In general, the results demonstrate that Life MOO:

- Involve participants according to the principles of flow theory;
- Promoted significant learning of good management practices;
- Value local culture, from a critical and promotional perspective;

- It has demonstrated potential as an environmental education and sustainability strategy in rural areas.

Therefore, the experience validates the hypothesis that gamification applied to dairy production can be an innovative educational resource, capable of raising awareness among young people about the importance of activity and for the adoption of more sustainable practices.

FINAL CONSIDERATIONS AND FUTURE PERSPECTIVES

The development of the Life MOO game represents an innovative initiative within the scope of environmental education and sustainable practices applied to dairy farming. The proposal combines elements of game design with technical and extension content, facilitating meaningful learning for young people and students linked to the rural environment, in an accessible, playful and contextualized way.

Through a user-centered methodology, based on community listening and validation with the objective public, we managed to create a game that is entertaining on the ground, which also instructs, inspires and promotes reflection on the importance of sustainability, the value of family farming and the permanence of young people in rural areas. The simulation of the production routine, the minigames and the challenges based on educational missions result in effectiveness for participation and retention of technical content.

Life MOO highlights the strategic role of university extension as a promoter of social technologies and pedagogical innovation. By connecting academic knowledge with the realities of the field through the language of digital games, the project strengthens the links between the university and the community, contributing to the territorial development and civic formation of its participants.

Looking forward to the future, the game seeks to expand its thematic content, adapt it to other platforms (such as mobile devices) and establish alliances with schools, cooperatives and public bodies. It is expected that Life MOO will become a pedagogical tool for continued use in extension, technical education and training programs for rural youth, reinforcing the commitment of education to social and environmental transformation.

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