

ENHANCING THE LEARNING ENVIRONMENT THROUGH SERIOUS GAMES: A CASE STUDY WITH PLAYCANVAS

VALORIZZARE L'AMBIENTE DI APPRENDIMENTO ATTRAVERSO I SERIOUS GAMES: UN CASO DI STUDIO CON PLAYCANVAS

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Abstract

This article is a detailed investigation into the use of Serious Games in education, with a specific focus on the optimization of spatial organization within a school. Its context is the growing problem of student disaffection with school and the urgent need to improve the educational experience. At the heart of this research is a serious game created through the PlayCanvas platform, which actively involved students in collaborating to reorganize common spaces, including libraries, canteens and classrooms. The aim was to improve the flow and functionality of these spaces. The results show that integrating serious games into the educational environment can not only increase students' attachment to school but also develop their critical and creative thinking skills (Zollo et al., 2015). This study opens the door to revolutionary new perspectives in education, driving innovation in the organization of learning environments and promoting active student involvement in decision-making (Di Tore et al., 2019).

Questo articolo è un'indagine dettagliata sull'uso dei Serious Games nell'educazione, con un focus specifico sull'ottimizzazione dell'organizzazione spaziale all'interno di una scuola. Il contesto è il crescente problema della disaffezione degli studenti nei confronti della scuola e l'urgente necessità di migliorare l'esperienza educativa. Il cuore di questa ricerca è un serious game creato attraverso la piattaforma PlayCanvas, che ha coinvolto attivamente gli studenti nella collaborazione per riorganizzare gli spazi comuni, tra cui biblioteche, mense e aule. L'obiettivo era migliorare il flusso e la funzionalità di questi spazi. I risultati dimostrano che l'integrazione dei serious games nell'ambiente educativo può non solo aumentare l'attaccamento degli studenti alla scuola, ma anche sviluppare le loro capacità di pensiero critico e creativo (Zollo et al., 2015). Questo studio apre le porte a nuove prospettive rivoluzionarie nel campo dell'istruzione, guidando l'innovazione nell'organizzazione degli ambienti di appren-



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dimento e promuovendo il coinvolgimento attivo degli studenti nel processo decisionale (Di Tore et al., 2019).

Keywords

Learning; Serious Games; environment; inclusion; spaces.
Apprendimento; serious games; ambiente; inclusione; spazi.

1. Introduction

In contemporary education, the evolution of digital technologies has led to the emergence of a powerful pedagogical resource known as 'serious games'. Serious games (Stapleton, 2004) are digital applications designed with the main objective of teaching and learning, exploiting playful elements to engage students in a virtual environment (Giacconi, 2023). These games, different from traditional digital entertainment (Corona et al., 2013), have a structure that aims to provide engaging and interactive educational experiences, transforming the learning process into an exciting and participative activity. In education, serious games have been applied in a wide range of disciplines and contexts. They represent a versatile resource that allows educators to present complex concepts (Corona et al., 2015) in an accessible and entertaining way. Through realistic simulations, challenges and interactive scenarios, students can apply their knowledge in practical contexts, developing key competencies, critical thinking and decision-making skills. These games can span different disciplines, from science and mathematics education to history, art and even social and emotional education. However, one of the most pressing and common problems in education is students' lack of attachment to school and their limited involvement in the educational environment (Di Tore, 2019). This lack of emotional attachment to school can manifest itself in disinterest, low participation and limited motivation (Alsawaier, 2018), negatively affecting students' academic performance. The underlying dilemma is how to improve students' school experience and foster a deeper sense of belonging to the place of learning. The focus of this article is therefore to explore an innovative solution to this problem through the integration of serious games into the spatial organisation of the school. In the context of education, serious games present themselves as a promising way to engage students in collaborative and decision-making activities concerning the physical structure and organisation of school spaces. In particular, we will focus on the use of the PlayCanvas platform, which offers an ideal environment for the development of engaging interactive experiences (Di Tore, 2019). Through this study, we intend to demonstrate how the gamification (Stieglitz et al., 2017; Kim et al., 2018; Toriz, 2019) of school space or-

ganisation can not only improve logistical efficiency but also strengthen students' emotional connection to their educational environment. A serious game created on PlayCanvas could allow students to collaborate in the design of school layouts, optimise the use of common spaces and even propose improvements (Kirillov et al., 2016). This approach would not only promote active involvement but could also help shape a space that better reflects the needs and desires of students. In the remainder of the article, we will examine in detail the methodology used to develop the serious game (Stapleton, 2004), the results that emerged from its implementation, and the implications of this study for education and the design of future game-based educational activities. We aim to contribute to an innovative vision of education in which serious games are a key tool for enhancing the school experience and promoting deeper and more engaging learning (Aini et al., 2019) through simplex didactics (Sibilio, 2012).

2. Methodology

The methodology adopted for this research embraced a comprehensive, multi-sectoral approach, which synergistically combined qualitative and quantitative aspects to obtain a comprehensive overview of the impact of the serious game on the spatial organisation of the school and the attraction of students to the educational institution.

Active involvement of students: The pivotal element of this study was the direct involvement of students in the entire serious game development process. In the first phase, a preliminary survey was conducted through detailed interviews and questionnaires to gain a deep understanding of the students' perspectives and expectations regarding the organisation of the school spaces. This valuable information then formed the basis on which the structure of the game was built. Subsequently, interactive workshops were organised, where students actively contributed to defining the dynamics and challenges within the serious game.

Creation of the Serious Game: The core of our study was the serious game developed on PlayCanvas, a web-based development platform that allowed the creation of a highly interactive three-dimensional (3D) environment, easily accessible from any device connected to the Internet. The game was structured to allow students to take an active part in the organisation of school spaces, allowing them to make virtual changes to shared spaces such as classrooms (Di Tore et al., 2014), the library and the canteen. Students were able to propose and vote on change ideas, collaborate in groups and face challenges related to space optimisation.

Evaluation Metrics: To comprehensively evaluate the effectiveness (Ritterfeld et al., 2009) of the serious game, several metrics were implemented, including:

Active Student Participation: Constant monitoring was conducted to assess students' involvement and frequency of participation in the game.

Student Feedback: Regular feedback was collected through structured questionnaires and in-depth interviews to analyse students' perceptions and satisfaction with the game experience.

Suggestions for Improvement: All changes proposed by the students regarding the spatial organisation were carefully recorded and evaluated in terms of feasibility and possibility of implementation.

3. *Serious Game Design*

Our serious game, created on PlayCanvas, is a virtual setting based on the school context, offering students a unique opportunity to improve the spatial organisation of the school while developing a deep attachment to their educational environment. This game was packaged with clear and specific objectives, including actively involving students in the reformulation of school spaces and decision-making. At the same time, it aims to consolidate a stronger emotional bond between students and their place of learning, addressing the problem of low affection towards school and transforming active participation into a rewarding and meaningful experience within this virtual world. The game, based on PlayCanvas, consisted of several key phases:

- **Character Creation:** Students had the opportunity to create and customise their own virtual avatar, thus representing themselves within the virtual world of the game.

Within our serious game design approach, one of the key stages was 'Character Creation'. This phase offered students a unique and engaging opportunity to express their individuality and identity within the virtual world of the game. Students had the privilege of shaping and customising their virtual avatar in detail. This customisation process allowed them to reflect their true personality and style, allowing for authentic representation within the game. Customisation options included elements such as physical appearance, clothing, accessories and even attitudes or facial expressions. Character creation triggered an emotional involvement from the very beginning of the game. Students were able to identify more deeply with their avatar and felt involved in the story and the virtual environment they were exploring. This emotional connection helped to make the game experience more engaging and meaningful for the students, fostering greater investment in the virtual context of the school's spatial organisation. In addition, the ability to customise one's avatar

stimulated the students' creativity, allowing them to express their individuality and contribute to the sense of belonging within the game. This aspect of the serious game design (Dörner, 2016) underlined our commitment to creating an authentic and engaging experience that reflected and respected the identities and preferences of the students, thus contributing to the overall success of the game and the achievement of the set educational objectives (Fig.1).



Fig.1 Example of Educational Layout on Play Canvas

- **Exploration of Spaces:** Students were able to move around within the virtual game environment, exploring the various school spaces, including corridors, classrooms, library and canteen, through their avatar. A key element in the experience of our serious game was 'Space Exploration'. This feature allowed the students to move freely within a detailed virtual environment, accurately representing the physical spaces of their school, including corridors, classrooms, the library and the canteen. Students were able to navigate this virtual world using their customised avatars. This aspect of the game offered participants an immersive and engaging perspective (Di Tore et al., 2014) of their educational institution. Students had the feeling of being 'inside' the school, being able to explore and familiarise themselves with the environment dynamically and interactively, just as if they were physically in the school facility. While exploring the spaces, students were able to discover hidden details, interact with virtual objects and embark on journeys of discovery through familiar school corridors and environments. This approach fostered experiential

learning, allowing students to gain a deeper understanding of the physical structure of the school in a safe and educational virtual context. In addition, the exploration of spaces promoted students' sense of discovery and curiosity, prompting them to investigate and deepen their knowledge of the school environment. This level of active involvement helped consolidate the importance of spatial organisation within the game, encouraging students to reflect and propose improvements (Kirillov et al., 2016) based on their direct experiences within the virtual world. Ultimately, the 'Spatial Exploration' was a key element in creating an engaging and informative game experience, fostering a deeper connection between students and their educational environment and facilitating the serious game's overall goal of improving spatial organisation and affection towards the school.

- **Proposals for Changes:** One of the key components of the game was the possibility for students to make proposals for virtual changes to school spaces. This could include suggestions for new classroom layouts or the introduction of new features for the library, for example. A crucial component of our serious game was the "Ability to Make Proposals for Changes". This feature allowed students to take an active part in the process of improving the spatial organisation within the virtual school. Students had the freedom to propose virtual changes to spaces such as classrooms, the library, the canteen and other areas, offering innovative suggestions to improve the efficiency and functionality of these spaces. Suggestions for modifications could range from ideas for a better arrangement of furniture in the classrooms, to the creation of new study areas in the library, to the implementation of recreation or entertainment (Corona et al., 2013) areas. Students were encouraged to think creatively and imagine solutions that could improve the overall quality of the virtual school environment. This feature had several advantages. First of all, it stimulated the student's active participation, allowing them to have a direct impact on the configuration of the spaces where they spend most of their time. It also encouraged the activation of critical thinking and decision-making, as students had to evaluate the consequences of their proposals on the experiences of other players. The proposed changes also promoted collaboration among students, encouraging them to work together to refine ideas and projects. This helped cultivate communication and teamwork skills that were transferable to real-world situations. Finally, this feature made the game an effective vehicle for gathering

innovative ideas and practical solutions to improve the school's spatial organisation. The participants' proposals were carefully evaluated, and the most relevant and feasible ones were considered for implementation in the virtual world of the game (Fig.2)



Fig.2 Design of Educational Space in Play Canvas

- **Collaboration:** The game promoted collaboration among students, encouraging them to work together to find optimal solutions and make collective decisions regarding the organisation of spaces. Within the game, students not only had the opportunity to make proposals for changes but were also invited to discuss them with their fellow players. This discussion phase played a crucial role in activating the collective decision-making process. The students had to examine the different proposals, weigh their pros and cons and seek consensus for changes to the virtual spaces. Collaboration was made even more meaningful through specific challenges and objectives within the game. Students had to join forces to tackle these challenges, solving complex problems and making collective decisions to achieve the set goals. These challenges required the coordination of efforts between group members and the sharing of ideas and strategies. Promoting collaboration among students helped develop several crucial skills, including effective communication, negotiation, conflict management and teamwork. These skills are transferable to various aspects of daily life and are essential for success in the real world, as well as enhancing the student's overall experience in the game. In addition, collaboration strengthened the sense of community within the game, with students experiencing the value of teamwork and

collective contribution to achieving shared goals. This helped consolidate their sense of belonging to the virtual school and made the game experience even more satisfying.

- **Challenges and Objectives:** Within the game, several challenges and objectives related to the optimisation of school spaces were presented. These playful elements stimulated students' critical and creative thinking, thus contributing to active and engaging learning. Within the context of our serious game, key elements known as 'Challenges and Goals' were incorporated. These elements played a significant role in enriching the student's experience. The "Challenges" presented within the game represent complex tasks that require the active involvement of students. These challenges were designed to promote critical and creative thinking. For example, students were faced with situations in which they had to optimise the layout of virtual school spaces, taking into account various factors such as functionality and efficiency. Alongside these challenges, "Formative Objectives" were defined. These objectives were outlined to represent the skills and knowledge that the students would acquire through solving the challenges. They encompassed skills such as critical thinking, strategic planning, effective communication and the ability to make informed decisions. The presence of challenges and objectives made learning an active and focused process within the game. Students were significantly involved in achieving the objectives, making learning engaging and rewarding. Furthermore, the challenges were structured progressively, progressively increasing in complexity as the students progressed through the game. This progression maintained a high level of motivation (Alsawaier, 2018) as students were constantly exposed to new challenges that required increasingly advanced skills.

Within our serious game, the "Feedback and Evaluation" system has been carefully designed to play a central role in the student experience. This system not only actively encourages students to participate in optimizing virtual school spaces, but also serves as a vehicle for meaningful learning. Providing detailed feedback on proposed changes is a crucial aspect of this process. Students are encouraged to communicate their opinions thoroughly, highlight strengths and weaknesses in proposals, and formulate valid arguments. This not only challenges them to express their opinions but also develops their critical communication skills. Furthermore, the discussions constitute fertile ground for the exchange of ideas. Here, students can critically examine and evaluate proposals made by their peers, promoting analytical

thinking and collaborative dialogue. These discussions are designed to be an environment in which divergent opinions can coexist, thus contributing to a more complete understanding of the complexities involved in organizing school spaces (Corona et al., 2015). A distinctive element of our game is the tracking of proposed and implemented changes. This allows students to directly visualize how their decisions affect the appearance and functionality of virtual spaces. This transparency offers an immediate perspective on the effectiveness of their proposals and fosters a sense of responsibility towards improving spaces. This process of feedback, discussion and implementation not only provides an engaging and interactive experience but also stimulates the development of key decision-making skills. Students learn to objectively evaluate different options, negotiate with their peers, and make informed decisions based on data and feedback. These skills not only apply in the context of gaming but are transferable to real-world situations where collaborative and informed decision-making is required.

The design of our serious game was strongly oriented towards creating an engaging experience that was not only educational but also entertaining (Nah et al., 2013; 2014; Dicheva et al., 2015). We recognized that the key to maximizing the impact of learning was to make it engaging and fun for students. We therefore placed great emphasis on the integration of playful elements that would stimulate the active participation of students. The game aspects were not just a simple side dish, but an essential element for learning. These playful elements have been carefully designed to be engaging, challenging and rewarding. Students experienced deeper emotional involvement thanks to the playful elements included in the game. They were pushed to fully immerse themselves in the virtual world of the school's spatial organization. This emotional involvement helped create a stronger bond between students and the virtual learning place, subsequently transferring this affection to their real school. Another crucial aspect was the attention to detail in the design of the games. The scenarios, challenges and activities were developed to be engaging and challenging, but also relevant to the educational objective. This ensured that the game was effective in encouraging students to think critically, solve problems and make informed decisions, all while having fun. In summary, the design of the serious game was aimed at creating an overall experience that was educational, engaging and fun. The playful elements were integrated in a strategic way to stimulate the active participation of students, encourage deep emotional involvement and improve students' affection for the learning place.

4. Results

An in-depth analysis of the data collected within our serious game revealed intriguing and promising results. First of all, it has unequivocally emerged that involving students actively in the organization of school spaces, through the medium of an engaging game, has a notable impact on increasing affection for the place of learning. This is a fundamental aspect considering the persistent problem of students' low affinity towards school. Students, immersed in a virtual environment where they can shape their educational environment, develop a deeper emotional attachment, thus strengthening the bond between students and school. Furthermore, the data collected clearly reflects the effectiveness of serious games (Ritterfeld et al., 2009) in promoting critical and creative thinking among students. The challenges presented within the game require a thoughtful approach and careful analysis of the various options. Students were encouraged to evaluate the consequences of their decisions and develop innovative solutions to improve spatial organization. These critical thinking skills are transferable and can have a positive impact on other areas of students' learning and daily lives.

The results highlight the importance of serious games as a tool for improving the school experience (Di Tore et al., 2014) and promoting affection for the place of learning. The active involvement of students in the configuration of school spaces has proven to be an effective strategy to combat school disaffection. This suggests that serious games can be used as an integral part of a broader approach to creating more stimulating and inviting educational environments. Furthermore, the ability of serious games to promote critical and creative thinking among students has notable implications for the design of future educational activities. We should consider how to integrate playful and interactive elements into our educational programs to support the development of these key skills. Learning through play can make education more engaging and effective, preparing students for real-world challenges that require flexible and innovative thinking (Zabelina, 2010). In summary, our results underline the importance of serious games as a tool for improving (Di Tore et al., 2014) the school experience and promoting affection for the place of learning. These games have proven to be effective in promoting students' critical and creative thinking (Zollo et al., 2015), suggesting new directions for the design of future educational programs. Our work paves the way for further research to fully exploit the potential of serious games in education (Nah et al., 2013; 2014; Dicheva et al., 2015).

5. Conclusions

Within this study, we have shed light on an educational approach that presents itself as a real turning point in the learning landscape. Serious games, with their potential to deeply engage students (Dörner et al., 2016), are breaking new ground in education. Learning can become an intrinsically engaging experience, a process in which students become active participants in creating their own learning journey.

One of the most significant results of our study concerns the concept of affection for the place of learning. Disaffection with school is a challenge that often challenges educators, but what we found suggests that serious games may be a valid response. Through the ability to virtually shape school spaces, students developed a sense of belonging and responsibility towards their educational environment. This is not just a response to disaffection, but a step forward in creating an education that truly reflects the needs and desires of students.

In addition to the emotional aspect, our study demonstrated the effectiveness of serious games (Dörner et al., 2016), in cultivating critical and creative thinking (Zollo et al., 2015). In a world where complexity and rapidity of change require flexible cognitive abilities (Zabelina, 2010), this is a key achievement. Students were not only challenged to carefully evaluate their choices but also to devise innovative solutions to improve virtual school spaces. These skills are not confined to gaming but can be applied in a wide range of situations in everyday life. Our study is not just an exploration of the body potential (Sibilio et al., 2022) of serious games (Dörner, et al., 2016), but a promise for the future of education. It pushes us to consider an education in which learning is not a mere transmission of knowledge, but an interactive and engaging experience. This challenges us to reconsider the design of our educational programs, embrace innovation and fully exploit the potential of serious games in a wide range of educational contexts (Caponetto et al., 2014). In conclusion, our study represents a starting point for a revolution in learning, where education becomes an engaging and meaningful challenge for every student, preparing them for a future that requires creativity, critical thinking and a strong sense of belonging to the community (Aini et al., 2019).

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