

The Educational Video Game: STEM Gap and Artificial Intelligence

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Abstract: Video games have become educational tools capable of radically transforming traditional educational approaches, particularly through the introduction of artificial intelligence (AI), which offers personalized and engaging learning experiences. This study analyzes how educational video games, especially those supported by AI, can become catalysts for creative, critical, and inclusive learning, providing new ways to promote STEM (Science, Technology, Engineering, and Mathematics) disciplines. The focus is to break down gender stereotypes that often limit girls and women's access to scientific professions. By analyzing projects such as "Mind the STEM Gap", this article highlights how the conscious use of avatars and engaging stories can positively shape the aspirations of young female students, promoting a more equitable and inclusive education. Additionally, the potential of gamification and cooperative learning to foster motivation and interaction among students is discussed, turning video games into educational tools that contribute to a fairer and more accessible society.

Keywords: Gamification; AI and learning; Gender equality

1. Introduction

In recent years, video games have emerged as innovative educational tools capable of revolutionizing traditional educational approaches. They are not just about introducing a new form of entertainment into classrooms but rather exploiting a powerful pedagogical tool that, through artificial intelligence (AI), offers highly personalized and engaging experiences. This article explores how video games, particularly those supported by AI, can become catalysts for critical, creative, and inclusive learning. Specifically, we will analyze the importance of these tools in promoting STEM disciplines for all students, with a focus on breaking down gender stereotypes that often limit girls and women's access to scientific careers.

This reflection begins with an analysis of concrete projects like "Mind the STEM Gap," which uses video games to bring girls closer to scientific subjects, overcoming cultural barriers and promoting inclusion. Through the use of avatars, engaging stories, and positive representations of female figures in science, this type of educational game is a powerful tool for shaping the behavior and aspirations of young female students. Moreover, the integration of AI into video games allows for personalized learning, addressing the individual needs of students by monitoring progress and difficulties to offer targeted support. This approach makes the learning process not only more effective but also more equitable.

In this context, video games are not only a means of acquiring technical skills but also serve as a place of experimentation where group dynamics, problem-solving, and



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creativity play a fundamental role. Cooperative learning and gamification, themes that will be explored in the following sections, represent further key elements that make video games powerful allies of education, capable of stimulating students' motivation and active participation. This article will explore how video games, when used consciously and accompanied by critical reflection, can transform into inclusive educational tools capable of breaking gender stereotypes and building a fairer and more accessible society for everyone.

2. The Educational Potential of Video Games

Video games offer a wide range of learning benefits due to their ability to actively engage students and stimulate both critical thinking and creativity. Through interaction and experimentation, video games allow students to learn hands-on by exploring virtual environments and solving complex problems in a safe and risk-free context. This mode of learning enables students to make mistakes, reflect on them, and improve, thus developing a growth-oriented mindset.

As highlighted by Soriani (2024), video games offer a dynamic and flexible environment where every choice a student makes leads to different consequences, stimulating the development of decision-making skills and critical thinking. Students are constantly encouraged to reflect on their actions and assess potential consequences, improving their ability to solve problems and think strategically. Learning through games is also enriched by immediate feedback, allowing students to adapt their strategies in real time and learn from their mistakes quickly and effectively.

One of the most relevant aspects of video games is their ability to present problems and challenges that require creative solutions. As emphasized by Ferro and Allodola (2023), many games present situations where students must explore various possibilities, test hypotheses, and experiment with new ideas. This approach makes the learning process more akin to research, where curiosity and exploration are central to the educational experience. Through video games, students develop skills such as logical thinking, problem-solving, and the ability to critically analyze information—all of which are essential for the world of work and everyday life.

Video games also offer the possibility of customizing the learning path based on the student's needs. Thanks to the integration of artificial intelligence, video games can adjust to students' skill levels and progress, offering a constant and appropriate challenge. This type of personalization is fundamental for maintaining high motivation and ensuring that each student can learn at their own pace. AI also allows for the monitoring of student progress, identifying areas of difficulty, and providing targeted support, contributing to more effective and inclusive learning.

3. Experiential Learning and Cooperative Learning

The value of video games also lies in their ability to offer immersive and engaging learning experiences. By simulating real-life situations and allowing the exploration of virtual worlds, students are put in a position to learn through direct experience, leading to a deeper understanding of the concepts addressed. This type of learning, known as experiential learning, is extremely effective as it allows students to apply acquired knowledge and consolidate it more meaningfully.

Experiential learning is particularly important because it allows students to experience first-hand situations that would otherwise be difficult to encounter in a traditional setting. For example, through virtual reality, students can explore distant

places, conduct complex scientific experiments, or simulate historical scenarios. These immersive experiences not only make learning more interesting and engaging but also help develop a deeper and longer-lasting understanding of the studied concepts. Experiential learning facilitated by video games also promotes the acquisition of practical skills that are difficult to develop through traditional teaching methods.

Many video games require collaboration between players, thus promoting cooperative learning, a teaching approach that encourages peer interaction and cooperation. Students must work together to solve problems, make decisions, and achieve common goals, developing essential social skills such as effective communication, listening to others, and teamwork. As highlighted in the “Multidisciplinary Guide for Gender Inclusion in STEM” (2024), cooperative learning through video games is particularly useful for creating an inclusive learning environment where every student has an active and meaningful role.

The collaborative aspect of video games is crucial for developing empathy and mutual understanding. In multiplayer games, students must coordinate with their peers, learn to manage group dynamics, and develop leadership skills. This fosters learning that is not only cognitive but also social and emotional, contributing to the formation of conscious and responsible citizens. Cooperative learning through video games can also help reduce the isolation that some students may experience, promoting a sense of belonging and community.

4. Video Games and Inclusion: Mind the STEM Gap

A significant example of the use of video games to promote inclusion and overcome gender stereotypes is the “Mind the STEM Gap” project Fondazione Bracco (2022). This video game, designed on the Roblox platform, aims to bring girls closer to STEM disciplines, breaking down the prejudices and gender stereotypes that still hinder women’s access to the world of science. Through an immersive edutainment experience, the game introduces students to various female figures who have made their mark in the history of science, such as Marie Curie and Ada Lovelace, presenting them as role models.

The project represents an innovative example of how the use of video games can promote gender equality by encouraging girls to embrace educational and professional paths in scientific disciplines. Through interactive challenges and direct involvement, students are encouraged to explore complex concepts and develop confidence in their abilities, overcoming cultural barriers that often limit their aspirations. The use of inclusive visual language and the playful approach make the educational path engaging for all, helping to create an environment where learning science is perceived as accessible and stimulating.

Moreover, the approach of “Mind the STEM Gap” can be seen as an example of how video games can be designed with the explicit goal of combating stereotypes and promoting inclusion. By representing strong and successful female characters, the game not only educates but also inspires, showing girls that they can excel in fields traditionally considered “male.” This type of representation is crucial for changing perceptions and offering positive role models that can influence the future choices of young girls.

The project also addresses another key aspect of inclusion: equal access to educational resources. By using a widely accessible platform like Roblox, “Mind the STEM Gap” aims to ensure that educational resources are available to everyone, re-

ardless of socioeconomic background. This aspect is particularly important in an era when inequalities in access to education represent a significant barrier for many students. By promoting digital inclusion and ensuring that all students have access to the necessary tools, video games like “Mind the STEM Gap” can help reduce educational disparities and build a fairer society.

5. Video Games and Inclusion: Mind the STEM Gap

A significant example of using video games to promote inclusion and overcome gender stereotypes is the “Mind the STEM Gap” project. This video game, developed on the Roblox platform, aims to bring girls closer to STEM disciplines by overcoming the biases and gender stereotypes that still hinder women’s access to the world of science. Through an immersive edutainment experience, the game introduces students to various female figures who have made significant contributions to the history of science, such as Marie Curie and Ada Lovelace, presenting them as role models.

The project is an innovative example of how video games can promote gender equality by encouraging girls to pursue educational and professional paths in scientific disciplines. Through interactive challenges and direct engagement, female students are encouraged to explore complex concepts and build confidence in their abilities, overcoming cultural barriers that often limit their aspirations. The use of inclusive visual language and a playful approach makes the educational journey engaging for everyone, helping to create an environment where learning about science is perceived as accessible and stimulating.

Furthermore, the approach of “Mind the STEM Gap” can be seen as an example of how video games can be designed with the explicit goal of combating stereotypes and promoting inclusion. Through the representation of strong and successful female characters, the game not only educates but also inspires, showing girls that they can excel in fields traditionally considered “male.” This kind of representation is crucial for changing perceptions and offering positive role models that can influence young girls’ future choices.

The project also addresses another key aspect of inclusion: the equitable access to educational resources. By using a widely accessible platform like Roblox, “Mind the STEM Gap” aims to ensure that educational resources are available to everyone, regardless of socioeconomic background. This aspect is particularly important in an era where inequalities in access to education represent a significant barrier for many students. By promoting digital inclusion and ensuring that all students have access to the necessary tools, video games like “Mind the STEM Gap” can help reduce educational disparities and build a fairer society.

6. Development of Critical Thinking and Creativity

Video games are extremely effective tools for developing critical thinking. They require students to analyze complex situations, make quick and reasoned decisions, and evaluate the potential consequences of their actions. This process encourages students to think critically about their choices, thus improving their ability to solve problems effectively. Strategy games, for instance, require resource management and long-term planning, skills that are fundamental for critical and analytical thinking.

In addition to critical thinking, video games can also stimulate students’ creativity. Games like “Minecraft” allow students to build and create freely, developing divergent thinking and the ability to find innovative solutions. The opportunity to ex-

periment and explore new ways of doing things helps students develop an open mindset and cultivate their creativity, a skill increasingly in demand in today's world.

Creativity developed through video games is not limited to building virtual objects but extends to the ability to devise strategies and tactics to overcome challenges and obstacles. In games with complex narratives, students are pushed to imagine alternative scenarios and explore different solutions, which helps develop a flexible and adaptable vision. This type of creative thinking is particularly useful in a work environment where the required skills are increasingly oriented toward solving complex problems and innovation.

Moreover, creativity in video games is often stimulated by the ability to experiment without the fear of failure. In a traditional school environment, failure is often seen as a negative outcome, whereas in video games, it is an integral part of the learning process. Students are encouraged to try new strategies, fail, and try again, thus developing a resilient and experimental mindset. This approach is particularly important for developing a creative and innovative mindset, which is crucial for addressing the challenges of the contemporary world.

7. Gamification and Student Motivation

Gamification, or the use of game elements in non-game contexts, represents an extremely effective approach to motivating students and making learning more engaging and stimulating. The introduction of game mechanics such as challenges, levels, and rewards makes educational activities more dynamic and can help students develop specific skills in a more interactive and enjoyable way. This approach is particularly useful for engaging students who may struggle with traditional teaching methods, fostering greater inclusion and participation.

Through gamification, students are motivated to actively participate in educational activities because learning becomes a rewarding and fun experience. For example, using educational platforms that reward students' progress with points, badges, or recognitions can encourage commitment and perseverance, making the learning process more engaging and satisfying.

The effectiveness of gamification also lies in its ability to transform activities that may be perceived as boring or difficult into positive and stimulating experiences. Friendly competition, level progression, and symbolic rewards can make learning more accessible and help reduce performance anxiety in school settings. Additionally, gamification allows students to set personal goals and monitor their progress, promoting self-regulation and responsibility toward their own learning journey.

Another important aspect of gamification is the possibility of using the game to promote positive behaviors and teach cross-disciplinary skills. For example, many educational games include narrative elements that encourage empathy, collaboration, and mutual respect. These elements help students develop not only academic skills but also social and emotional abilities that are crucial for their overall development. Gamification, therefore, not only makes learning more enjoyable but also helps shape more well-rounded individuals who are aware of their social responsibilities.

8. Artificial Intelligence in Educational Video Games

The introduction of artificial intelligence (AI) in educational video games represents another step forward in educational innovation. AI can be used to create personalized learning experiences, adapting the game content to the needs and abili-

ties of each individual student. Through machine learning algorithms, AI can monitor student progress, identify areas that need improvement, and propose specific exercises to address these gaps. This approach makes learning more effective, as the educational path is adjusted in real-time based on individual performance.

A practical example of the use of AI in educational video games is the implementation of virtual tutors that guide the student through different stages of the game, providing tips and explanations whenever they encounter difficulties. These virtual tutors can adjust the difficulty level of exercises based on the student's performance, ensuring that each individual is challenged at their own level without feeling overwhelmed. AI can also analyze how a student responds to certain situations and tailor the learning path to make the experience more meaningful and relevant.

AI can also play an important role in addressing gender issues within educational video games. By analyzing data, AI can identify gender disparities in student performance and suggest adjustments to ensure equal opportunities for success. For instance, AI can monitor whether female students tend to avoid certain types of challenges, such as those related to mathematics or technology, and propose exercises that encourage them to participate actively, breaking down barriers and gender stereotypes. This type of approach contributes to promoting a more equitable and inclusive learning environment where every student has the opportunity to express their potential.

AI in educational video games can also enhance accessibility for students with disabilities. For example, AI algorithms can be used to adapt the game interface to the needs of students with motor or visual impairments, making learning more inclusive. Additionally, AI can help identify and overcome barriers that students with special educational needs may encounter, offering personalized support and ensuring that every student has the same learning opportunities.

9. Conclusion

Video games represent an educational tool with enormous potential for education and the promotion of gender equality. However, it is essential that their use is accompanied by critical reflection and integrated into a conscious and inclusive educational context. Only in this way can the full potential of video games be harnessed to promote active and participatory learning that helps overcome gender stereotypes and build a fairer and more just society. The challenge for educators is to use these tools mindfully, promoting a gaming culture that is inclusive and respectful of diversity and that values the potential of every individual, regardless of gender.

Creating an educational context that uses video games as a teaching tool requires specific training for teachers, so they can fully understand the dynamics of games and the educational potential they offer. Additionally, it is crucial that educators are aware of the risks associated with gender stereotypes and are able to use video games critically, taking advantage of the opportunities these tools offer to promote inclusion and equality. Only through the conscious and critical use of video games is it possible to create a learning environment that is truly inclusive and that values the diversity and potential of every student.

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