Special article

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Serious games are more than just games

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ABSTRACT

Serious games (SG) or educational games are complete games designed for a specific purpose that fulfill both their classic function of entertainment and promote the learning of specific concepts or skills and optimize health care in general. In the pediatric setting, these games combine strategies to educate about health issues, promote healthy behaviors, provide therapy or medical treatment.

SG have been shown to promote adherence to treatment in children with chronic diseases, reduce anxiety in those undergoing invasive medical procedures, and stimulate the development of cognitive, emotional, or psychomotor skills.

However, it is important to emphasize that the success of SG in pediatrics depends to a large extent on game quality, their design based on clear objectives, and their accurate adaptation to the individual needs and preferences of patients.

Keywords: *educational movies and videos; exercise video games; therapy; educational technology.*

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INTRODUCTION

Gamification is a learning strategy that uses playful elements, commonly found in games, in a strategic manner, preferred over non-game apps. Their purpose is beyond entertainment; these games are used to enhance motivation, engagement, and learning. However, serious games (SG) are complete games designed for a specific purpose, such as education, simulation, or the promotion of healthy habits.[1,2]

Beyond their common name, SG are not and need not be serious, but, when used for other purposes, they are considered in this manner. This is why many authors already call them applied games.[3]

Pediatric SG combine game mechanics and dynamics specifically designed to address the unique needs of pediatric patients. This approach transforms medical experiences into playful and educational interactions through the use of engaging narratives, playable game mechanics, engaging characters, and adaptive challenges. The number of possible game mechanics are as many as the number of existing video games. The proposal is to leverage the mechanics already present in video games and add an educational and therapeutic layer to meet the expected goals.

In the field of pediatrics, gamification and SG are increasingly being used to improve children's learning and attention.[4–6] These games may be used as valuable tools to teach patients, parents, and healthcare providers about a variety of topics, such as health, nutrition, education, and social and emotional development.[3]

SG may also be used to collect data on children's health, such as their level of physical activity, diet, and other indicators of well-being. This information may help physicians and other healthcare providers to assess patient course and make treatment decisions.

SG have proven to be an exceptionally versatile and effective tool in the field of pediatrics for treatment adherence or chronic disease management. These games make the process of following a treatment more engaging and playful, which often results in greater cooperation from young patients.

In addition, SG have proven to be an effective tool to reduce anxiety in children undergoing painful or invasive medical procedures. By providing valuable information and an engaging virtual environment, SG help children focus less on anxiety and more on fun, which may significantly decrease the distress associated with medical treatments.[7,8]

Another critical aspect is their ability to provide specific challenges that help children improve fine motor skills, concentration, problem solving, and understanding of medical concepts.

However, it is critical to emphasize that the success of SG in pediatrics depends to a large extent on game quality, their design based on clear objectives, and their accurate adaptation to the individual needs and preferences of patients. Creating effective medical games requires careful planning and collaboration between healthcare providers and game designers to ensure that they are safe, engaging, and educational at the same time and level.[3]

Nowadays some SG are taking a digital therapeutic identity as non-conventional treatments. EndeavorRx was the first SG authorized by the United States Food and Drug Administration (FDA) as a non-drug treatment. It is currently indicated for children aged 8 to 12 years with attention deficit hyperactivity disorder and has shown good results (*Figure 1*).[9]

USE IN PEDIATRICS

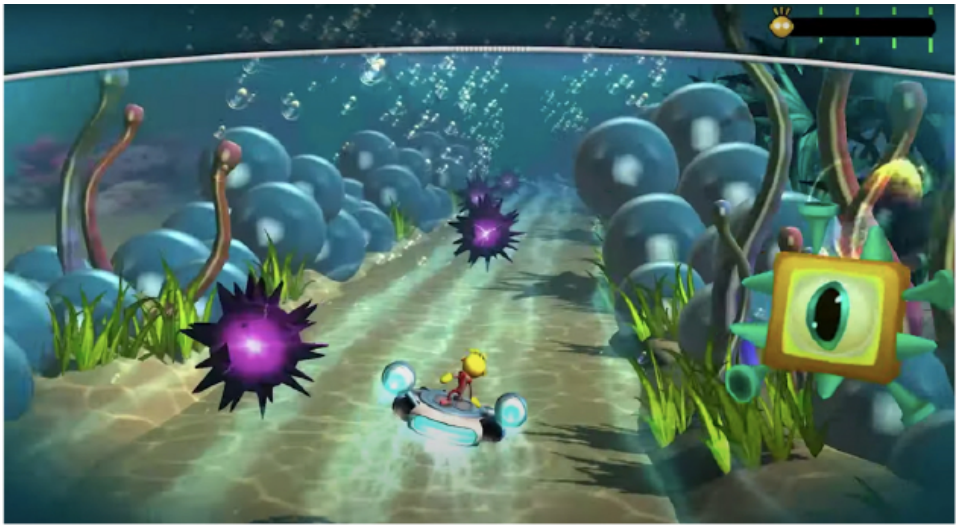
SG are developed for the purpose of improving medical care in the field of pediatrics. The following are some key areas where this type of tools stands out.

Health education. SG may be used to teach children and adolescents about important health topics, such as nutrition, hygiene, disease prevention, stress management, the importance of exercise, and other aspects related to their well-being.[10,11] Yu Go! is a video game developed in Mexico that fights childhood obesity by motivating children to exercise and eat healthy.

Therapy and rehabilitation. This type of SG, also called exergames, is used in the assessment and rehabilitation of pediatric patients with physical disabilities or neurological disorders. For example, virtual reality games may be used in rehabilitation after orthopedic surgery.[12,13]

Chronic disease management. Games may also be effective tools to help children understand and manage chronic diseases, such as diabetes or asthma. They can teach patients to manage their symptoms and make informed decisions about their health.[14] GlucoZor is a game for diabetes patients developed in France. It allows children to learn about diabetes and how to monitor their blood sugar level. Théo is a game for children with psoriasis developed in France in collaboration with dermatologists. It allows

Figure 1. ***EndeavorRx***



First video game authorized by the United States Food and Drug Administration (FDA) for the digital management of attention deficit hyperactivity disorder.
Source: https://www.endeavorrx.com/

children to approach psoriasis in a playful and immersive manner through the story of Théo, a child with this disease. Wee Willie Wheezie is an interactive computer game that teaches children about asthma. Players avoid triggers and collect medications.

Treatment adherence. Several studies found that SG, or the gamification of specific apps, may favor pediatric patients' adherence to their medical treatments, especially in chronic diseases.[5,6,15] Following a dosage schedule may be funnier and more motivating through games. Re-Mission is a game designed for cancer patients that provides and disseminates information about actual strategies where the player is armed with chemotherapy, antibiotics, and immune cells to fight tumor cells. Patients learn what is going on in their body and gain a sense of power and control over their disease that helps them become more involved in their treatment.[3]

Anxiety reduction. SG designed to reduce anxiety in children prior to invasive medical procedures, such as surgeries, have proven to be effective. Le Héros, c'est toi! is a game developed in France that helps children to better experience each stage of the surgical process. It allows children to take on the role of a superhero who must overcome challenges to save their sick friend. CliniPup, developed in Belgium, takes place in the operating room and helps children become familiar with the hospital environment.[7,8] Operation Quest was developed in Argentina and is intended to reduce anxiety before a surgery (*Figure 2*).

Skill development. SG are used for the development of motor, cognitive, and social skills in children with disabilities or developmental delay.[16,17] ShopAut 2.0 is used to improve daily living skills in pediatric patients with autism spectrum disorder. This game was developed in Italy.[8]

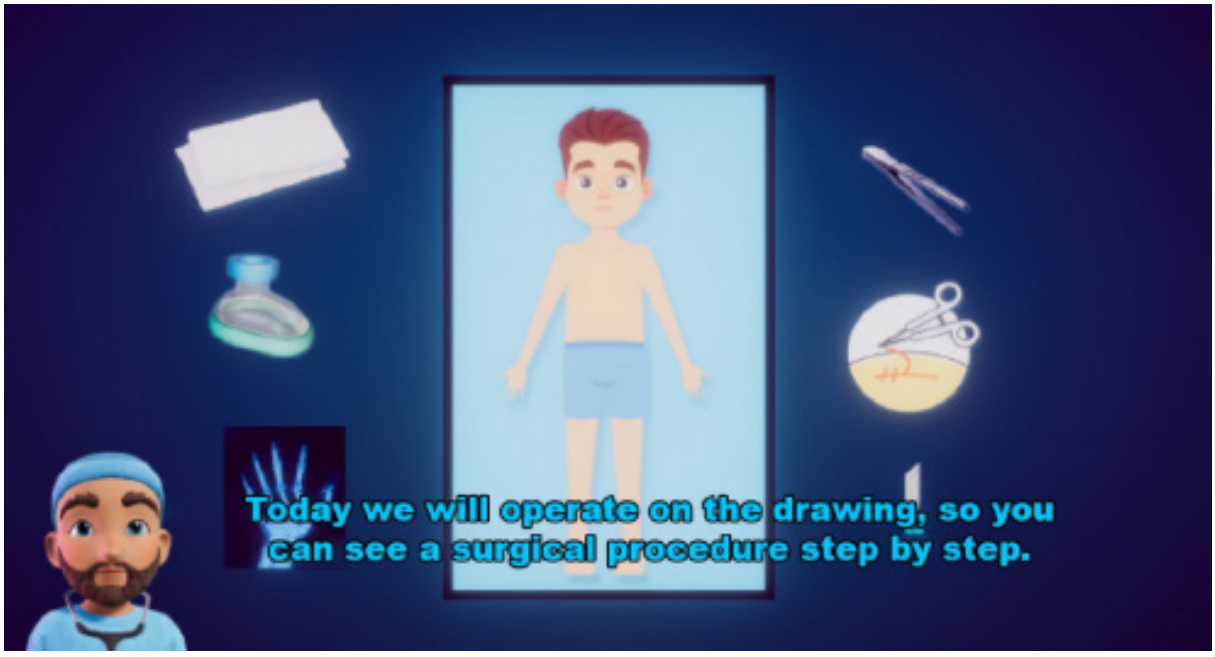
Although the use of SG in pediatrics has become increasingly widespread, there is no full consensus regarding their effectiveness. Despite the expectations and potential attributed to SG as a therapeutic and educational tool, studies conducted to date have not always yielded consistently favorable results and are highly dependent on game design and implementation.

The effectiveness of SG in the pediatric setting remains a challenging area of research, and a deeper and more detailed analysis is required to fully understand their impact on the health and well-being of younger patients.[18]

CONCLUSION

SG in pediatrics are an effective and appealing manner to educate and motivate children and adolescents. SG improve health care, provide support for medical conditions, and promote healthy habits and healthcare empowerment in children. The use of SG in pediatrics has the potential to cause a significant impact on patient experience and health outcomes.[19]

Figure 2. ***Operation Quest***



It is designed to accompany children during a surgery.
Source: Santiago de Matos Lima.

Further studies and ongoing development in this field are required to maximize the potential of SG in pediatric care, along with an assessment of patient outcomes. ■

Table 1. Serious games in pediatrics

Game	Type	Objective	Origin	Developer
Yu Go!	Platform	Overweight	Mexico	Hun-Ixe
Rehametrics	Varied	Cognitive and motor rehabilitation	Spain	Rehametrics
GlucoZor	Virtual pets	Education in diabetes care	France	Ar Liquide
Théo	Adventure	Education in psoriasis care	France	Interaction Healthcare
Re-Mission	Third-person shooter	Cancer treatment adherence	United States of America	Pam Omidyar
Le Héros, c'est toi	Mini games	Surgical psychoprophylaxis	France	Niji/Les P'tits Doudous
Operation Quest: An Adventure in the Hospital	Point and click graphic adventure	Surgical psychoprophylaxis	Argentina	Santiago de Matos Lima, Hospital Italiano de Buenos Aires
ShopAut	Adventure	Improved skills in patients with autism	Italy	Ersilia Vallefuoco
Lungtropolis	Mini games, quiz, puzzle	Education in asthma care	United States of America	Orcas
Flu Busters	Mini games	Flu prevention	United States of America	Troycammock
EndeavorRX	Adventure and mini games	Attention deficit hyperactivity disorder	United States of America	Akili Interactive
El viaje de Mangols	Platform	Overweight and obesity	Spain	OsakidetzaEJGV
Playmancer	Strategy	Impulse control disorders (bulimia and pathological gambling)	Spain	Hospital Universitario de Bellvitge
Autcraft	Building	Socialization	Canada	Stuart Duncan

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