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Gamification as a teaching and training strategy in the context of medication administration

La gamificación como estrategia de enseñanza y formación en el contexto de la administración de medicamentos

A gamificação como estratégia de ensino e capacitação sob o contexto da administração de medicamentos

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Abstract

The aim was to discuss gamification as a teaching and training strategy in the context of medication administration. This is a bibliographic review, with a descriptive and narrative character. For the search, the Google Scholar bases were pre-established and the others grouped in the Virtual Health Library and the descriptors used: "Gamification", "Games", "Teaching", "Teaching-Learning Methodologies" and "Medicine Administration", with the help of the Boolean operator "AND". The search and selection of studies took place in December 2022. Thirty-two studies were selected and analyzed under thematic content analysis, emerging the categories: Gamification: Academic and Health Context and Challenges of Active Methodologies in Teaching and Training in Health: Medication Administration. Active methodologies have become a trend in education as they support and promote interactive activities that include different intelligences and learning profiles. Especially in the health area, the active study on the use of gamification offers unparalleled advantages given the complexity of knowledge related to medication administration, consequently, training, training and updating professionals to provide safe and quality care.

Descriptors: Teaching; Health Strategies; Gamification; Organization and Administration; Tutoring.

Resumén

El objetivo fue discutir la gamificación como estrategia de enseñanza y formación en el contexto de la administración de medicamentos. Se trata de una revisión bibliográfica, con carácter descriptivo y narrativo. Para la búsqueda se preestablecieron las bases de Google Scholar y las demás agrupadas en la Biblioteca Virtual en Salud y se utilizaron los descriptores: "Gamificación", "Juegos", "Enseñanza", "Metodologías de Enseñanza-Aprendizaje" y "Administración de Medicamentos", con la ayuda del operador booleano "AND". La búsqueda y selección de estudios se realizó en diciembre de 2022. Se seleccionaron 32 estudios que fueron analizados bajo análisis de contenido temático, emergiendo las categorías: Gamificación: Contexto Académico y de Salud y Retos de las Metodologías Activas en la Enseñanza y Formación en Salud: Administración de Medicamentos. Las metodologías activas se han convertido en tendencia en educación ya que apoyan y promueven actividades interactivas que incluyen diferentes inteligencias y perfiles de aprendizaje. Especialmente en el área de la salud, el estudio activo sobre el uso de la gamificación ofrece ventajas inigualables ante la complejidad de los conocimientos relacionados con la administración de medicamentos, en consecuencia, capacitar, capacitar y actualizar a los profesionales para brindar una atención segura y de calidad.

Descriptores: Enseñando; Estrategias de Salud; Gamificación; Organización y Administración; Tutoría.

Resumo

Objetivou-se discutir sobre a gamificação como estratégia de ensino e capacitação sob o contexto da administração de medicamentos. Trata-se de uma revisão bibliográfica, de caráter descritivo e narrativo. Para a busca, foram preestabelecidas as bases *Google Scholar* e as demais agrupadas na Biblioteca Virtual em Saúde e utilizados os descritores: "Gamificação", "Games", "Ensino", "Metodologias de Ensino-Aprendizagem" e "Administração de Medicamentos", com o auxílio do operador booleano "*AND*". A busca e seleção dos estudos ocorreu em dezembro de 2022. Foram selecionados 32 estudos que foram analisados sob a análise temática de conteúdo, emergindo as categorias: Gamificação: Contexto Acadêmico e de Saúde; Ensino e Capacitação em Saúde e Treinamento em Saúde: Administração de Medicamentos. As metodologias ativas se tornaram tendência na educação por subsidiar e promover atividade interativa que contempla diferentes inteligências e perfis de aprendizado. Sobretudo na área da saúde, o estudo ativo sobre o uso da gamificação oferece vantagens inigualáveis tendo em vista a complexidade do conhecimento relacionado à administração de medicamentos, consequentemente, formando, capacitando e atualizando os profissionais a prestarem uma assistência segura e de qualidade.

Descritores: Ensino; Estratégias de Saúde; Gamificação; Organização e Administração; Tutoria.

Introduction

Information Technology (IT) resources represent significant benefits for the 21st century, especially by promoting greater access to education, considering different profiles and learning styles. In this scenario, Distance Education (EaD) stands out, which meets the desires and needs of students. Among relevant advantages, this promising modality provides new personal and professional opportunities as well as different scenarios for the teaching-learning process[1-4].

Designed to ensure compatibility with students' characteristics, EaD allows experience to be gained while educational objectives are achieved gradually, considering advances in the field of pedagogy, instructional design, mobile technologies, but especially, educational technology resources and strategies[5,6].

Discussions involving the future of distance learning include reflections, which consider that the contributions of educational technologies to the learning process should be seen as a requirement and not a choice. After a few decades of experience and analysis of results, researchers reflect that distance learning can offer the same level of academic excellence as courses taught in person. The same studies attribute this success to the different ways the student navigates through the content[7-10].

Educational technologies include interactivity methods and techniques that concentrate strategies to involve the user in a universe of study and reasoning exercises. Introducing interaction between content and students generates motivational and cognitive benefits, promoting challenges through which a change in attitude towards the study process is expected. Attitudinal changes are particularly welcome in the context of university students learning to learn[11,12].

From this perspective, gamification or educational games have attracted attention from the academic community in recent years. Known as playful activities, the use of games uses interactive techniques, whose game mechanics and design are oriented to enrich the moment of learning or entertainment. Especially the health area, where academic training and professional training permeate andragogy studies, is closely related to decision-making training. It is necessary to substantiate situations that explore the central experience and psychological effects of game mechanics[13-15].

The health sector has been positively affected by the advancement of technology and, therefore, interactive games are examples of highly sophisticated resources that

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simulate risk situations, without exposing patients and professionals. Harnessing the potential of gamification has been a particularly emerging trend for training in this area, where the main objective is to avoid errors and, consequently, promote patient safety[16,17].

Given the above, the objective is to discuss gamification as a teaching and training strategy in the context of medication administration.

Methodology

This is a bibliographical review, of a descriptive and narrative nature, which aims to encourage discussions about the relevance of new teaching and professional training strategies using technological resources, as in the case of the study on screen, gamification, and the use of games in the teaching-learning process.

To carry out this review, the Google Scholar indexing base was used, as well as the Virtual Health Library (VHL) platform, which groups together several scientific indexing bases in the areas of Health. As a search strategy for studies, the descriptors were used: "Gamification", "Games", "Teaching", "Teaching-Learning Methodologies" and "Medication Administration", with the help of the Boolean operator "AND".

As inclusion criteria, the following were pre-established: studies in the format of a complete scientific article, published between 2016 and 2021, in Portuguese and English and that answered the research question, such as: How gamification is used as a teaching strategy and training in the context of medication administration? As exclusion criteria, studies indexed in duplicate in the selected databases and that were not available completely and free of charge, by the open science movement, one of its pillars being free and free access to published studies for greater worldwide dissemination of science. One (01) study from 2011 was included for describing and conceptualizing completely and adequately, thus supporting the present object of study: gamification.

The search and selection of studies was carried out in December 2022. This review will be presented based on thematic categorization by Thematic Content Analysis[18].

Results and Discussion

Thirty-two studies were selected, and thematic categories were created: Gamification: Academic and Health Context; and Challenges of Active Methodologies in Health Education and Training: Medication Administration.

Gamification: academic and health context

Gamification was originally conceived in the digital media industry for entertainment activities, but today it is defined as "the use of game design elements in non-game contexts". In summary, gamification aims to modify behavior through motivation resulting from rich experiences that promote causes and outcomes based on the user's decision making[19].

There is evidence in the literature that demonstrates cognitive development in the use of games by stimulating different structures of the brain, in fact promoting the acquisition of knowledge. Rewards and winnings are strategies that challenge users and encourage them to stay in the game. Another relevant aspect is increasing user engagement through interaction between decision-making. Tactics and cognitive aspects add feelings and emotions, such as rivalry, satisfaction, self-esteem, and pride, with the sole objective of providing adherence to the activity[20,21].

Narrative case studies, avatar-driven presentation (fictional character) and tutorials make gamification engaging and motivating tasks. Furthermore, it stimulates memory, improves attention and concentration, ensures a better flow of cognitive skills, trains a critical eye and improves reasoning processing speed[20-22].

It is worth noting that one of the great advantages of games is developing problem-solving skills. Thus, the use of games aimed at professional training has been gaining ground in recent years, especially since 2010. Creating immersive games allows playful interaction for non-recreational purposes, such as training for healthcare professionals. That is, they are games designed to entertain while educating, training, or changing user behavior. This technique is particularly advantageous for this public who needs an environment that simulates risk situations without exposing those involved[22].

From this perspective, game mechanics represent the use of interactive design elements in different contexts and the healthcare sector has benefited by promoting training for doctors and nurses, for example. The interactive element of games is, therefore, a great difference when it comes to training for this audience, as it trains problem solving and exercises reasoning for decision-making, in which the user interacts with different outcomes based on their decisions[23].

Highly advanced systems were developed to promote behavioral changes, the objectives of which are to reduce errors and addictions, train protocols, demonstrate trends, reduce relationship conflicts, improve persuasive capacity, and, above all, expand the critical look at work processes[23].

In this scenario, there are digital games that are incorporated into educational processes through the Digital Game-Based Learning (DGBL) methodology. On the other hand, patients are receiving alternative forms of encouraging behavior changes, such as a healthy lifestyle and greater adherence to treatment. In this scenario, studies have shown that interactive games can promote positive effects in experiences with rehabilitation physiotherapy, for example. From the increasing adherence to training in patients after a stroke, in which exercise, difficult to maintain, can reverse damage to neuromotor function, through games that teach and monitor physical activity. The automated physical therapy Kinect® system is an example[21].

Today, the gaming industry, together with healthcare professionals, has created different approaches to monitor, support, teach, train and evaluate users who need professional support, especially in their homes. Biosensors, coupled to the Global Positioning System (GPS), for geolocation, with immediate feedback and which record

signs and symptoms in databases, represent the future of medicine in terms of home care and de-institutionalization – a term used to reduce negative effects of hospital admission prolonged[24].

Studies demonstrate that the objective of this technology is, particularly, to improve care for patients and families, increase engagement and adherence to the treatment plan, and, above all, manage the maintenance of the well-being and health of the population, called Digital Health or and -Health – an emerging field of studies, therapeutic approaches and health maintenance[20-22,24].

On the other hand, studies also report the existence of several obstacles and challenges to the success of interactive games within the scope of Digital Health, which can also be correlated to the academic environment. From this perspective, the following scenarios stand out, such as high cost for creation, implementation, and evaluation; need for highly qualified professionals; clear purpose for starting production; intuitive navigability; coherent progress; attractive layout; clear profit, loss and rules process; effective evaluation and validation process; long-term user monitoring methods; complex technological resources between software and hardware, among others[25,26].

There are many challenges, however, there are particularly important aspects that deserve greater attention: the target audience, that is, who the game is intended for, the clear objective of the activity and the development, especially, centered on the user. It is noteworthy that gamified solutions must encompass a creation and development structure, whose elements of motivation, engagement and interest must be designed, considering the characteristics and specificities of the target audience[22].

Challenges of active methodologies in health education and training: medication administration

Medication errors are particularly problematic considering the consequences that can be fatal or cause irreversible harm to patients. The trends of these failures, both in the adult and pediatric populations, vary depending on the situation, however, observational studies demonstrate high rates of prescription errors during simulated scenarios, suggesting that student training may be precarious for this practice. Medical prescriptions containing dosage errors are considered a common and recurring problem. Therefore, attention and adequate training of professionals who administer the medication are necessary to avoid the error following up[27,28].

The scientific community has been working hard to provide different initiatives and reduce errors, ensuring patient safety. In this scenario, training in university education and professional training are activities of fundamental relevance, considered the starting point from the perspective of preventing these failures. The creation of tools, techniques, methods and technologies includes a set of methodologies with the sole objective of training skills and competencies without exposing patients, students and professionals[29,30].

Health services and educational institutions are under constant pressure to provide professionals and students, respectively, with awareness about effective care and must train students capable of providing quality care. Thus, it is understood that the curricula are designed, designed, and offered by qualified and experienced educators in competent learning. Today, however, it is necessary to introduce educational strategies used in didactic-pedagogical components to influence and motivate the determination of critical thinking and the ability to make responsible and coherent decisions, above all, when guaranteeing safe assistance[29,30].

The performance of psychomotor skills, problem solving, crisis management and proactive attitudinal practices constitute the driving force of the nursing teaching-learning process and must include innovative techniques to train care, optimizing results and avoiding errors[31].

Computerized dolls, humanoids and robots constitute the basis for simulated studies and realistic simulation, however, added to methodologies such as: inverted classroom, virtual reality, games, animated infographics, podcasts, wearable technologies, augmented reality, conversation circles through peer instruction, among others, form the scenario of active learning methodologies, in which technology is both a means and a protagonist. Today, new technologies are observed such as the immersion-mediated platform.

Active methodologies have become a trend in education as they support and promote interactive activities that include different intelligences and learning profiles. Especially in the health area, active study offers unparalleled advantages given the complexity of knowledge related to medicine and nursing. Furthermore, technologies that support the use of active methodologies favor the teaching-learning process in these areas by proposing hybrid studies, in which face-to-face activities and procedures with technologies are introduced and combined at the appropriate time in the teaching plan, considering the characteristics of the student and the subject.

According to a study[32], "The last decade has been marked by efforts to reform health curricula that have emphasized the importance of active learning to improve student engagement and critical thinking skills." These authors also report that scientific events have been held to raise awareness among educators, such as the initiatives of the International Association of Educators in Medical Sciences, in which workshops are held to train teaching strategies, designed especially for the x y generation of students. millennium and neo-millennium[32-34].

It should be noted that active learning does not just include a group of expensive, complex, and sophisticated technologies. It is a methodology based on interaction, that is, the student, who was previously passive, starts to reason and make decisions based on their experiences, assuming co-responsibility for their learning. Such decisions have a network of outcomes that demonstrate the consequences of their actions. This technique represents the "abandonment" of lectures, resulting in bored students. On the other hand, they are

activities designed and implemented in a coherent way, which project students into environments maximized by collaborative learning, favoring engagement and motivation through the sense of belonging and involvement among their peers[32,35].

Known as a methodology, particularly relevant in health education, evidence-based practice is closely related to active methodologies by promoting the exchange of knowledge between students and professionals experienced in each subject. Correlating both scenarios brings encouraging results, in which students can get closer to the real situations experienced by professionals. The teaching-learning process is, therefore, centered on the student, in which adaptations based on constructivism are considered, training them to be proactive in developing skills and abilities[32,35].

Final Considerations

Authors of a recent study on gamification for medical education stated that, "games are attractive because they do something that traditional teaching methods do not do." That is, traditional teaching transmits information passively through expository classes. According to the same authors, games, in turn, "confront students with an engaging problem". By exploring the situation in a challenging way, students develop different cognitive structures and pedagogical techniques such as emotions and application of practice, respectively. Games are designed to offer mechanisms for developing professional skills and abilities, such as problem-solving, in which learning occurs through the construction and application of one's solution.

Methodological and computational strategies for health training have advanced greatly in recent decades, expanding the range of technological resources such as e-learning, simulation, virtual reality, augmented reality, game-based learning, realistic simulation, gamification, mobile learning and, more recently, the Team-Based Learning (TBL) method or Team-Based Learning.

It was found that analyzing the evidence on the effectiveness and quality of educational games is urgent and necessary, as well as recognizing games as a pedagogical strategy that contributes to the learning process, whether for professional training at the undergraduate level or for updating and professional training.

A deeper dive into this topic is necessary by carrying out more research to analyze the perspective and prospective pedagogical relationship between games and the assistance provided by these professionals who used gamification as a learning strategy in their teaching-learning process. teaching methodology.

References

1. Lochner L, Wieser H, Waldboth S, Mischo-Kelling M. Combining traditional anatomy lectures with e-learning activities: how do students perceive their learning experience? Int J Med Educ. 2016;7:69-74. doi: 10.5116/ijme.56b5.0369
2. Druce M, Howden S. New perspectives on health professions students' e-learning: Looking through the lens of the "visitor and resident" model. Med Teach. 2017;39:704-709. doi: 10.1080/0142159X.2017.1301657
3. Burgess A, Roberts C, Van Diggele C, Mellis C. Programa de treinamento de professores por pares (PTT) para estudantes de saúde: aprendizado interprofissional e invertido. BMC Med Educ. 2017;17(1):e239. doi: 1186/s12909-017-1068-z
4. Bogossian T. A importância da inclusão social das crianças e adultos menos favorecidos à educação à distância. Glob Clin Res. 2022;2(2):e39. https://doi.org/10.5935/2763-8847.20220039
5. Stamps A, Opton LL. Utilizing VoiceThread Technology to Foster Community Learning in the Virtual Classroom. J Nurs Educ. 2019;58(3):e185. doi: 10.3928/01484834-20190221-12
6. Cohen SS, Madsen S, Touchan G, et al. Neural engagement with online educational videos predicts learning performance for individual students. Neurobiol Learn Mem. 2018;155:60-64. doi: 10.1016/j.nlm.2018.06.011
7. Pennington KM, Dong Y, Coville HH, et al. Evaluation of TEAM dynamics before and after remote simulation training utilizing CERTAIN platform. Med Educ Online. 2018;23(1):1485431. doi: 10.1080/10872981.2018.1485431
8. Casida D, Vandermolen J. Using Storyboarding Pedagogy to Promote Learning in a Distance Education Program. J Nurs Educ. 2018;57(5):e319. doi: 10.3928/01484834-20180420-14
9. Tobase L, Peres HHC, Almeida DM, et al. Instructional design in the development of an online course on Basic Life Support. Rev Esc Enferm USP. 2018;26(51):e03288. doi: 10.1590/S1980-220X2016043303288
10. Wozniak H, Ellaway RH, Jong PG. What have we learnt about using digital technologies in health professional education? Med J Aust. 2018;209(10):431-433. doi: 10.5694/mja18.00152
11. Drummond D, Delval P, Abdenouri S, et al. Serious game versus online course for pretraining medical students before a simulation-based mastery learning course on cardiopulmonary resuscitation: A randomised controlled study. Eur J Anaesthesiol. 2017;34(12):836-844. doi: 10.1097/EJA.0000000000000675
12. Cook DA, Blachman MJ, Price DW, et al. Educational Technologies for Physician Continuous Professional Development: A National Survey. J Assoc Am Med Coll. 2018;93(1):104-112. doi: 10.1097/ACM.0000000000001817
13. Johnson D, Deterding S, Kuhn KA, et al. Gamification for health and wellbeing: a systematic review of the literature. Internet Interventions. 2016;2(6):89-106. doi: 10.1016/j.invent.2016.10.002
14. Sardi L, Idri A, Fernández-Alemán JL. A systematic review of gamification in e-Health. J Biomed Inform. 2017;71:31-48. doi: 10.1016/j.jbi.2017.05.011
15. Kelders SM, Sommers-Spijkerman M, Goldberg J. Investigating the Direct Impact of a Gamified Versus Nongamified Well-Being Intervention: An Exploratory Experiment. J Med Internet Res. 2018;20(7):e247. doi: 10.2196/jmir.9923

16. Lumsden J, Edwards EA, Lawrence NS, Coyle D, Munafò MR. Gamification of Cognitive Assessment and Cognitive Training: A Systematic Review of Applications and Efficacy. JMIR Serious Games. 2016;4(2):e11. doi: 10.2196/games.5888

17. Rodrigues LF, Oliveira A, Rodrigues H. Main gamification concepts: a systematic mapping study. Heliyon. 2019;5(7):e01993. doi: 10.1016/j.heliyon.2019.e01993

18. Bardin L. Análise temática de conteúdo. Lisboa: Edições 70; 2011.

19. Deterding S, Dixon D, Khaled R, Nacke L. From game design elements to gamefulness: Defining "gamification". Proceedings of the 15th International Academic MindTrek Conference. New York: ACM Press; 2011.

20. Cheng VWS, Vennport T, Johnson D, et al. Gamification in Apps and Technologies for Improving Mental Health and Well-Being: Systematic Review. JMIR Ment Health. 2019;6(6):e13717. doi: 10.2196/13717

21. Rajani NB, Weth D, Mastellos N, Filippidis FT. Use of gamification strategies and tactics in mobile applications for smoking cessation: a review of the UK mobile app market. BMJ Open. 2019;9(6):e027883. doi: 10.1136/bmjopen-2018-027883

22. Deterding S. Gamification in Management: Between Choice Architecture and Humanistic Design. J Manag Inq. 2019;28(2):131-136. doi: 10.1177/1056492618790912

23. Gentry SV, Gauthier A, Ehrstrom BL, et al. Serious Gaming and Gamification Education in Health Professions: Systematic Review. J Med Internet Res. 2019;21(3):e12994. doi: 10.2196/12994

24. Lopes S, Pereira A, Magalhães P, Oliveira A, Rosário P. Gamification: focus on the strategies being implemented in interventions: a systematic review protocol. BMC Res Notes. 2019;12:e100. doi: 10.1186/s13104-019-4139-x

25. Ahn SJ, Johnsen K, Ball C. Points-Based Reward Systems in Gamification Impact Children's Physical Activity Strategies and Psychological Needs. Health Educ Behav. 2019;46(3):417–425. doi: 10.1177/1090198118818241

26. Jessen S, Mirkovic J, Ruland CM. Creating Gameful Design in mHealth: A Participatory Co-Design Approach. JMIR Ment Health. 2018;6(12):e11579. doi: 10.2196/11579

27. Van der Kuil MN, Visser-Meily J, Evers AW, Van der Ham IJ. A usability study of a serious game in cognitive rehabilitation: A compensatory navigation training in acquired brain injury patients. Front Psychol. 2018;9:846. doi: 10.3389/fpsyg.2018.00846

28. Wu X, Wu C, Zhang K, Wei D. Residents' numeric inputting error in computerized physician order entry prescription. Int J Med Inform. 2016;88:25-33. doi: 10.1016/j.ijmedinf.2016.01.002

29. Terzioğlu F, Yücel Ç, Koç G, et al. A new strategy in nursing education: From hybrid simulation to clinical practice. Nurse Educ Today. 2016;39:104-108. doi: 10.1016/j.nedt.2016.01.009

30. Ross JG, Bruderle E, Meakim CH, Willens JS, Holmwood JA. Development of Formative Capstone Simulations to Prepare Novice Students for Initial Clinical Practicum. J Nurs Educ. 2016;55(10):587-589. doi: 10.3928/01484834-20160914-09

31. Durham CF, Alden KR. Enhancing Patient Safety in Nursing Education Through Patient Simulation. In: Hughes RG, editor. Patient Safety and Quality: An Evidence-Based Handbook for Nurses. Rockville (MD): Agency for Healthcare Research and Quality (US); 2008 Apr. Chapter 51.

32. McCoy L, Lewis JH, Dalton D. Gamification and Multimedia for Medical Education: A Landscape Review. J Am Osteopath Assoc. 2016;116(1). doi: 10.7556/jaoa.2016.003

33. Fornari A, Poznanski A. Guia de instruções para aprendizagem ativa. Huntington: IAMSE; 2017.

34. Tricio JA, Montt JE, Ormeño AP, Del Real AJ, Naranjo CA. Impact of Faculty Development Workshops in Student-Centered Teaching Methodologies on Faculty Members' Teaching and Their Students' Perceptions. J Dent Educ. 2017;81(6):675-684. doi: 10.21815/JDE.017.014

35. Merritt C, Munzer BW, Wolff M, Santen SA. Not Another Bedside Lecture: Active Learning Techniques for Clinical Instruction. AEM Educ Train. 2017;2(1):48-50. doi: 10.1002/aet2.10069