EXPERIENCE REPORT
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Serious Game – good biosafety practice in dentistry

Serious game – para boas práticas em odontologia

Maria Lúcia Bezerra Feitosa[I,*]

Márcia Maria Pereira Rendeiro[II]

Ana Emília Figueiredo de Oliveira[III]

ABSTRACT

Introduction: The use of educational technologies on biosafety can be an innovative and interactive strategy to provide knowledge concerning specific issues and work processes. **Objective:** To develop an educational quiz game on biosafety in Dentistry; to construct and validate, in a pedagogical and technical way, the 60 evaluation items to be incorporated into the system. **Method:** The study was organized in several stages: elaboration of the didactic-pedagogical project; development of the game; elaboration of 60 evaluative items; and validation of content by two professionals in the field of pedagogy and five experts in the field of biosafety. **Results:** The pedagogical evaluation results allowed us to adjust the game questions according to pedagogical criteria. The technical evaluation results were obtained by using the Content Validation Index (CVI), which exceeded 80% in the textual clarity criteria, practical relevance, adequacy to the public and response time of the questions. **Conclusions:** An open and free access instrument, the educational game can be used as a knowledge tool in biosafety, responding to the continuous demand of students and professionals in search of democratization of information.

KEYWORDS: Jogos Experimentais; Controle de Infecção; Odontologia; Riscos Ocupacionais

RESUMO

Introdução: O uso de tecnologia educacional sobre biossegurança pode constituir uma estratégia inovadora e interativa que proporciona conhecimentos a respeito de assuntos específicos e processos de trabalho. **Objetivo:** Desenvolver um jogo educacional do tipo *quiz* sobre biossegurança em odontologia; construir e validar de forma pedagógica e técnica os 60 itens avaliativos a serem incorporados ao sistema. **Método:** O estudo foi organizado em diversas etapas: elaboração do projeto didático-pedagógico, desenvolvimento do game, elaboração dos 60 itens avaliativos e validação do conteúdo por dois profissionais da área pedagógica e cinco com *expertise* na área de biossegurança. **Resultados:** Os resultados da avaliação pedagógica possibilitaram que as questões do *game* fossem ajustadas conforme critérios pedagógicos. Os resultados da avaliação técnica foram obtidos utilizando o Índice de Validação de Conteúdo (IVC), sendo superiores a 80% para os critérios de clareza textual, relevância prática, adequação ao público e tempo de resposta das questões. **Conclusões:** De acesso aberto e gratuito, o jogo educacional poderá ser utilizado como uma ferramenta do conhecimento em biossegurança, em resposta à demanda contínua de alunos e profissionais em busca da democratização da informação.

PALAVRAS-CHAVE: Experimental Games; Infection Control; Dentistry; Occupational Risks

[I] Núcleo de Telessaúde de Alagoas (SESAU), Secretaria de Estado da Saúde, Maceió, AL, Brasil

[II] Universidade do Estado do Rio de Janeiro (UERJ), Rio de Janeiro, RJ, Brasil

[III] Universidade Federal do Maranhão (UFMA)/Universidade Aberta do Sistema Único de Saúde (UNA-SUS), São Luís, MA, Brasil

* **E-mail:** luciafeitosa1@gmail.com

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INTRODUCTION

This study addresses the development of a quiz-like educational game on biosafety in dentistry and the technical and pedagogical validation of the 60 evaluated items, designed to be used in the game as tools to support education practices.

Worldwide, the provision of healthcare is always associated with a potential range of occupational safety and risk issues related to work practice.

In several studies, researchers found non-compliance with the current legislation on biosafety norms and good practices in health services. This hinders the safety of patients, dentists and dentistry teams. It also shows the need for changes in work processes[1,2,3,4] due to the loss of quality in the care that is provided because of failure in several stages of the process[2,3,4,5], in addition to the lack of protocols, monitoring tools and records[3,4,6]. This emphasizes the need for continuous training and updating of professionals in this area[2,3,4,7].

Serious games are educational games that address specific knowledge. Their objective is to teach and train new skills or raise awareness about important issues[8,9,10]. This may enable professionals and students to update and review their practices, as well as motivate them to search for more information about a given topic.

According to the guidelines for policies for mobile learning published by the United Nations Educational, Scientific and Cultural Organization in 2014, Information and Communication Technologies (ICT) are a fundamental means of access to information and the production of new knowledge, since they enable learning anytime, anywhere, when used together with mobile technologies[11].

Since mobile devices have become more popular and affordable, society is increasingly familiar with these technologies. Research suggests the potential of educational solutions enabled by electronic media to democratize access to knowledge in Brazilian existential extremities[12].

Students' interest in mobile technologies like mobile phones makes it clear that those who intend to educate and engage their students in the digital age have enormous challenges ahead of them, but they can use innovative methods to help dentistry students learn more[13].

Several studies have focused on the use of interactive technological tools to train and inform students in specific areas. They have been used in medical and dental education, encouraging the resetting of educational, teaching-learning processes and taking into account their potential benefits[14,15,16,17].

The serious games on biosafety in dentistry aim to validate the content of the quiz-like game in a qualitative and quantitative fashion, together with judges specialized in the area of biosafety and experts in the area of pedagogical production[18,19,20].

Faced with a scenario of occupational and environmental health risks, and given the interest in the use of mobile and interactive technologies, in addition to the requirement of continuing education of dentistry professionals, the need arose to develop and validate the educational content of a serious game. The objective was to contribute, in an interactive and game-like manner, with good biosafety practices and to encourage the professionals' commitment to the adoption of safe measures and responsible dental care.

METHOD

Design of a didactic-pedagogical project

Because it is an educational game, it was previously planned taking into account its technical-scientific and pedagogical aspects.

This stage of the project was fundamental because it enabled the definition of several aspects related to the design of the quiz-like game.

The educational game was called "biosafety in dentistry", with a total of 60 evaluated items based on the main topic and arranged in a database. This number of items enabled the random use of 20 questions every time the game was played, thus avoiding too much repetition and tiring the players with excess questions.

The subtopics are related to: physical infrastructure; standard precautions; occupational risk; work accident and conduct after exposure to biological material; hand hygiene; equipment for individual safety; flow and processing of items; surface processing; water line; health service waste management; radiation protection; biosafety in prosthesis laboratories.

We determined the intended audience with dentists, undergraduate and graduate students of dentistry.

The institutions that signed a partnership in the production and publication of the game were the Open University of the Brazilian Single Health System (UNA-SUS) of the Federal University of Maranhão (UFMA) and the University of the State of Rio de Janeiro (UERJ) through the Program of Professional Master in Telemedicine and Telehealth.

From the initial project conception to the game development and evaluation, the project lasted from February 2016 to February 2018.

The evaluated items underwent pedagogical and technical validation. Two pedagogical validators with experience in the production of educational games and five prominent professionals in the biosafety area were selected to carry out this task.

We determined the educational objectives within the category of cognitive domain. These objectives are related to what is expected of the player's performance at the end of the game,

so that users can understand and rethink their work processes, focusing on prevention and controlling risks in dental services.

Game development/motivation strategies

The educational game uses a two-dimensional 2D interface and enables a learning environment on biosafety based on a quiz-like educational game.

To create the game, we required the participation and the interaction of professionals from different areas like education, technology, health, graphic and instructional design.

We resorted to three technologies to create this tool: Unity 3D® (the game engine), Adobe Illustrator CS6® (creation tool) and Ableton Live® (for background audio creation).

The game was created in the Unity 3D game creation framework with the C# programming language (C *Sharp*). The evaluation items elaborated for the game were recorded through a support system. This system was created in the PHP, Java script, HTML5 and CSS3 programming language. The database we used was MySQL. With the JSON technology, it sends the data to the game.

The technological area, in partnership with the graphic design team, developed the game itself and linked it to the database of questions (evaluated items) produced by the health team with pedagogical and technical adaptations.

This computer system was developed and registered at the National Institute of Industrial Property (INPI), process n. 51 2017 000649 0, by the UFMA Foundation.

Five development scenes were created. They include: game home; character selection; tutorial; gameplay, in which the player can interact with the focus of the game; and conclusion or final ranking, in which we can see the score and the player's position and performance among the participants, as shown in Figures 1, 2, 3, 4 and 5.

The game features different tools and motivation strategies: tutorial, score, response time, opportunity to get tips and ranking, as well as content of texts, images and audio, with characters in motion to make it dynamic.

A total of 20 random questions are available for each game. Every time the game is played, if the player faces a question that he or she cannot answer, he or she can choose one of the four cards that are presented to him or her as a bonus. The options are: request a tip, delete two wrong alternatives, pause the game, or skip the question.

The response time for each question depends on the question's level of difficulty and is presented in a gradual manner. For questions considered easy, medium or hard, the response time is 30, 45 and 60 sec. The scores obtained are computed and displayed on the final screen.

In Figure 4, we can see an hourglass in the lower left corner of the scene that counts the player's remaining response time so that the game stays fun, engaging and appealing.

Creation of evaluated items

The content addressed in the development of the evaluated items was obtained through: book searches[21], manuals[22,23], Resolutions of the Board of Directors of the National Agency of Health Surveillance (Anvisa)[24,25, 26,27,28,29], term paper[30], dissertation[31],

Figure 1. Entrance scene

Figure 2. Character selection scene.

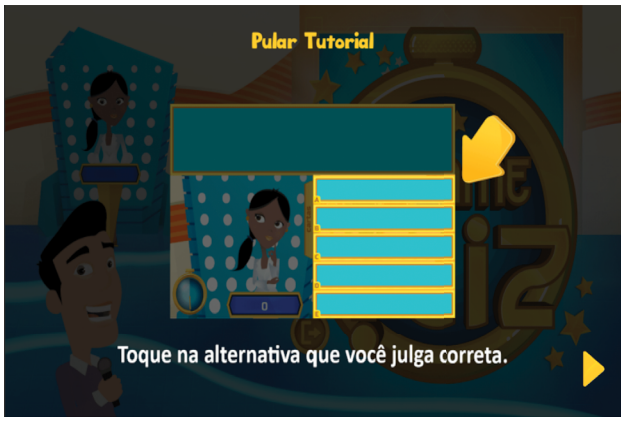

Figure 3. Tutorial scene.

thesis[32], updated articles[33,34], Ordinance[35], Ministry of Health protocol[36], in addition to regulatory norms of the Ministry of Labor and Employment[37,38] on the topics addressed. We listed only some of the authors and institutions we consulted.

For the creation of the items, we followed the recommendations described in the "*Elaboração de itens de avaliação para jogos educacionais*" manual[39]. The educational objectives were designed according to Bloom's Taxonomy[40].

The evaluated items are multiple choice and contain: one statement, five alternatives, four distractors and one plausible choice, five feedback replies or justifications for each of the options, plus a tip, bibliographical references and a supplementary link where players will have access to an article, an RDC, Ordinance, manual, poster, among other materials on the topic in question, where they can find relevant information on the matter.

Pedagogical validation

The pedagogical validation was carried out with the support of two evaluators from the UFMA's UNA-SUS Pedagogical Nucleus, one with a doctoral degree and the other with a master's degree, both with experience in the pedagogical production of educational games.

Figure 4. Gameplay scene.

This nucleus received an e-mail with the 60 evaluation items prepared by the author on biosafety in dentistry and the pedagogical evaluation tool to be filled out, with a 30-day return period, based on the criteria described in Table 1.

After analyzing the 60 evaluation items and filling out the pedagogical evaluation tool, the comments and suggestions were used so that the game questions were adjusted and followed up for a technical evaluation to be carried out by judges specialized in biosafety.

Technical validation

The game questions on biosafety in dentistry were emailed to five reference professionals in the biosafety area, with expertise in the area and credentials to perform this task. Three of these professionals were from a public university and two were from a private college.

Three of these professionals have a doctorate degree, two of them are dentists and one is a nurse with a master's degree in nursing.

In addition to the game questions, the professionals received an adapted assessment tool[18] to be filled out individually for each question (Table 2).

An (X) was marked when the question was considered adequate, partially adequate and inadequate, according to the following

Figure 5. Final ranking scene.

Table 1. Pedagogical evaluation tool.

Evaluation criteria	Comments and suggestions	Section 1	Section 2	Section 3	Section 4	Section 5	Section 6
Consistency between the educational objective and the degree of difficulty of the questions							
Clear, cohesive and objective statement							
Plausible feedback, with significant additional information							
Tip for the correct alternative without giving the answer							
Bibliographical references, following ABNT standards, with active links							

ABNT: Brazilian Association of Technical Standards.
Source: Prepared by the author. Adapted from: Carmo, Garcia and Reis (2017).

Table 2. Technical evaluation instrument.

Question 1	Text clarity[1]	Practical relevance[2]	Suitability to target audience[3]	Time[4]	Comments and suggestions
Adequate					
Partially adequate					
Inadequate					

[1] The question is formulated in a clear and unambiguous manner.
[2] The theoretical basis is up-to-date and relevant to the proposed theme.
[3] The content is consistent with the clinical practice of general dentists/undergraduate and graduate students in dentistry.
[4] The time is suitable for the full reading of the question.
Source: Prepared by the author. Adapted from Alexandre and Colucci (2011).

criteria: text clarity, practical relevance, public suitability and time to answer questions, with comments and suggestions.

The 60 questions were submitted to statistical data analysis. For this analysis, we used a content validity index (CVI), which informs the percentage of judges who agreed on a certain aspect of the tool.

The index score is calculated by the sum of agreement in the items marked as adequate and partially adequate by the experts and divided by the total number of questions in the game[12]. The comments and suggestions supported final adjustments and all content was proofread for grammar correction.

After pedagogical and technical validation, final adjustments and proofreading, the evaluation items were entered into a platform called *Formulário Online SigU Atividade* and incorporated into the game.

RESULTS AND DISCUSSION

Several studies surveyed in this paper point to the fact that many scholars are proposing serious games as interactive, fun, enabling and supportive learning objects[8,14,15].

Although there is a movement toward the incorporation of educational games as teaching methods outside the classroom, in response to the students' technological demands[13,16], in dentistry, games for training on specific subjects - like biosafety[41] - are still scarce, although there are many games for children that improve preventive measures of oral health.

Of 60 evaluation items on the topic of biosafety in dentistry, 10 subtopics were chosen to be addressed in the game. We sought to relate them to the daily practice of dental services so that users can acquire relevant information - regardless of whether they get the questions right or wrong - through feedback on each alternative and supplementary active links that encourage the search for other available and/or correlated references. All this information will help players with valuable subsidies and motivate them to seek further knowledge.

Some challenges were found in the design of the evaluation items, such as: creating the questions and their alternatives with different levels of difficulty; arranging alternatives of similar sizes; building feedback for all alternatives, so that they had significant additional information; and fitting the questions into the predetermined times of 30, 40 and 60 seconds.

The content validation process is an important step in assessing the reliability of what you want to build. The absence of validated and reliable tools in Brazilian research does not contribute to the consolidation of the use of learning based on digital games in educational environments, since games created without a pedagogical conception of reference and without validation can produce results different from those expected[42].

In a study on the validation of an educational game in medication administration, the items that obtained agreement rates higher than or equal to 80% between the expert judges were validated, serving as a decision criterion on the relevance and/or acceptance of the item. Similar results were found in this study[43].

An educational game called "Healthy Adventure", which deals with healthy life habits for adolescents, was designed with validated the items that obtained agreement rates between the expert judges and target public higher than or equal to 0.78[44].

It is of paramount importance that the evaluation items incorporated into the educational game be validated according to pedagogical and technical criteria, so that they can be reliably used as educational tools.

In order to measure the degree of agreement between the evaluators, we used the CVI, which measures the ratio or percentage of judges who are in agreement on certain aspects of the items.

The results of the agreement rate among the evaluators - referring to the criteria of text clarity, practical relevance, suitability to the public and response time - can be seen in Table 3.

The pedagogical and technical validations were planned to be performed by specialists in the areas. However, in the technical evaluation, which was to be done by five biosafety experts, after the return of the technical evaluation tool, one of the doctoral judges filled out only the first ten items for the first section of questions and was therefore disqualified, since the five remaining sections should have also been evaluated.

Table 3. Index of content validity among technical evaluators.

Evaluation criteria	Eval. 1 X Eval. 2	Eval. 1 X Eval. 3	Eval. 1 X Eval. 4	Eval. 2 X Eval. 3	Eval. 2 X Eval. 4	Eval. 3 X Aval.4
Textual clarity	95.0%	93.3%	91.7%	93.3%	91.7%	93.3%
Practical relevance	100.0%	90.0%	95.0%	90.0%	95.0%	85.0%
Suitability to the target audience	100.0%	88.3%	93.3%	88.3%	93.3%	81.7%
Response time	98.3%	96.7%	91.7%	95.0%	93.3%	95.0%

Source: Prepared by the author, 2017.

Although in this study there was a limitation in relation to the number of technical evaluators, which decreased from five to four, the agreement rate between them was > 80%, similar to the results found by several authors[20,42,44,45].

The participation of the expert judges of the pedagogical and technical areas enabled the adaptation and improvement of the game content, thus adding value to the final version.

It is worth emphasizing the relevance of the multidisciplinary work, which enabled the development of the game system technology with the integration of knowledge from several areas, such as technology, education and health.

Our intention is to continue this study and submit it to the validation of our target audience (dentists, undergraduate and graduate students of dentistry) and of information and communication technology professionals. With that, we hope to verify its level of acceptance among the stakeholders.

This quiz-like educational game on biosafety in dentistry was developed for use on desktop computers and also as an application in both iOS® and Android® versions.

In the future, we might consider using the feedback from game users regarding app reviews and/or question updates. This could contribute to improving the game and to the prevention of risks associated with the care practice.

An interesting aspect of this tool that uses ICT resources, like the serious game, lies in the fact that the game can contribute to the continuing education of dental professionals, by enabling the revision of work processes, prevention and good practices in the work environment, including in areas where access to training is still limited.

CONCLUSIONS

At the end of this work, we concluded that the objectives of developing a quiz-like educational game on biosafety for the dental area and validating the 60 questions in a pedagogical and technical manner were attained, with values above 80% for all criteria analyzed.

Because of its free and open access, this game can be used as a tool to spread knowledge on biosafety among students and dentists in response to the continuous demand for and in search of more interactive and free education, thus contributing to the democratization of knowledge.

REFERENCES

1. Devnani M, Kumar R, Sharma RK, Gupta AK. A survey of hand-washing facilities in the outpatient department of a tertiary care teaching hospital in India. J Infect Dev Ctries. 2011;5(2):114-8. https://doi.org/10.3855/jidc.1003
2. Reisdorfer N, Araújo GM, Silva LAA, Soder RM, Santos AM. Segurança do paciente: embalagens, acondicionamento e tempo de guarda de materiais esterilizados na atenção básica. Ciênc Cuid Saúde. 2016;15(4):662-8. https://doi.org/10.4025/cienccuidsaude.v15i4.29925
3. Berlet LJ, Ascari RA, Silva OM, Trindade LL, Krauzer IM, Jacoby AM. Factors that influence the quality of the sterilisation process. J Nurs UFPE. 2014;8(7):1997-2003. https://doi.org/10.5205/reuol.5963-51246-1-RV.0807201422
4. Mendonça ACC, Bezerra ALQ, Tipple AFV, Tobias GC. Indicadores de qualidade de processamento de produtos para a saúde em autoclaves a vapor. Rev Enferm UFPE. 2017;11(Supl 2):906-14. https://doi.org/10.5205/reuol.10263-91568-1-RV.1102sup201705
5. Roseira CE, Silva DM, Passos IPBD, Orlandi FS, Padoveze MC, Figueiredo RM. Diagnosis of compliance of health care product processing in Primary Health Care. Rev Latino-Am Enfermagem. 2016;24:e2820. https://doi.org/10.1590/1518-8345.1439.2820
6. Alvarenga CF, Reis C, Tipple AFV, Paiva EMM, Sasamoto SAA. Efetividade de um protocolo de reprocessamento na esterilização de canetas de alta-rotação em autoclave gravitacional. Rev Eletr Enf. 2011;13(3):560-5.
7. Maldaner C, Berlet LJ, Ascari RA, Klein ML, Savian BA, Silva OM. Invólucros para esterilização de materiais odonto-médico-hospitalares. Rev Saúde Públ Santa Cat. 2013;6(3):61-70.
8. Morais AM, Machado LS, Valença AMG. Planejamento de um *Serious game* voltado para saúde bucal em bebês. Rev Inf Teor Apl. 2011;18(1):158-75. https://doi.org/10.22456/2175-2745.17679

9. Alves E. Jogos sérios para ensino de engenharia de software [dissertação]. Porto: Faculdade de Engenharia da Universidade do Porto; 2013.
10. Domingues AN. Desenvolvimento e avaliação do Serious Game Cuidando Bem: Simulação por computador sobre segurança do paciente [dissertação]. São Carlos, SP: Universidade Federal de São Carlos; 2017.
11. United Nations Educational, Scientific and Cultural Organization - Unesco. Diretrizes de políticas da UNESCO para a aprendizagem móvel. Paris: UNESCO; 2014[acesso 12 jul 2017]. Disponível em: https://unesdoc.unesco.org/images/0022/002277/227770por.pdf
12. Farias AB, Pereira MX, Henrique MS, Almeida RA. Educação em saúde no brasil: Uma revisão sobre aprendizagem móvel e desafios na promoção de saúde no Brasil. In: Anais do XXI Workshop de Informática na Escola; Maceió, Brasil. Maceió, AL: SBC; 2015. p. 614-23.
13. Rung A, Warnke F, Mattheos N. Investigating the use of smartphones for learning purposes by Australian dental students. JMIR mHealth and uHealth. 2014;2(2):e20. https://doi.org/10.2196/mhealth.3120
14. Zyda M. From visual simulation to virtual reality to games. IEE Computer Society. 2005;38(9):25-32. https://doi.org/10.1109/MC.2005.297
15. Almeida LR, Silva ATMC, Machado LS. Jogos para capacitação de profissionais de saúde na atenção à violência de gênero. Rev Bras Educ Med. 2013;37(1):110-9. https://doi.org/10.1590/S0100-55022013000100016
16. Machado LS, Valença AMG, Morais AM. A serious game for education about oral health in babies. Tempus, Actas Saúde Colet. 2016;10(2):167-88. https://doi.org/10.18569/tempus.v10i2.1657
17. Deguirmendjian SC, Miranda FM, Zem-Mascarenhas SH. *Serious game* desenvolvidos na Saúde: Revisão Integrativa da Literatura. J Health Inform. 2016;8(3):110-6.
18. Alexandre NMC, Colucci MZO. Validade de conteúdo nos processos de construção e adaptação de instrumentos de medidas. Cien Saúde Coletiva. 2011;16(7):3061-8. https://doi.org/10.1590/S1413-81232011000800006
19. Rondon S, Sassi FC, Andrade CRF. Computer game-based and traditional learning method: A comparison regarding students' knowledge retention. BMC Med Educ. 2013;13:30. https://doi.org/10.1186/1472-6920-13-30
20. Polit D, Beck CT. Fundamentos de pesquisa em enfermagem: métodos, avaliação e utilização. 7a ed. Porto Alegre: Artmed; 2011.
21. Silva ASF, Risso M, Ribeiro MC. Biossegurança em odontologia e ambientes de saúde. 2a. ed. São Paulo: Ícone; 2009.
22. Agência Nacional de Vigilância Sanitária - Anvisa. Manual de prevenção e controle de riscos em serviços odontológicos. Brasília, DF: Anvisa; 2006.
23. World Health Organization, Pan American Health Organization. Decontamination and reprocessing of medical devices for Healthcare facilities. Geneva: WHO/PAHO; 2016[acesso 15 fev 2018]. Disponível em: https://apps.who.int/iris/bitstream/10665/250232/1/9789241549851-eng.pdf.
24. Agência Nacional de Vigilância Sanitária- Anvisa. Higienização das mãos em serviços de saúde. Brasília, DF: Anvisa; 2007.
25. Agência Nacional de Vigilância Sanitária- Anvisa. Resolução RDC N° 50, de 21 de fevereiro de 2002. Dispõe sobre o Regulamento Técnico para planejamento, programação, elaboração e avaliação de projetos físicos de estabelecimentos assistenciais de saúde. Diário Oficial União. 19 mar 2002.
26. Agência Nacional de Vigilância Sanitária- Anvisa. Resolução – RDC N° 222, de 28 de março de 2018. Regulamenta as Boas Práticas de Gerenciamento dos Resíduos de Serviços de Saúde e dá outras providências. Diário Oficial União. 29 mar 2018.
27. Agência Nacional de Vigilância Sanitária- Anvisa. Resolução – RDC N° 306, de 7 de dezembro de 2004. Dispõe sobre o Regulamento Técnico para o gerenciamento de resíduos de serviços de saúde. Diário Oficial União. 10 dez 2004.
28. Agência Nacional de Vigilância Sanitária- Anvisa. Resolução - RDC N° 63, de 25 de novembro de 2011. Dispõe sobre os Requisitos de Boas Práticas de Funcionamento para os Serviços de Saúde. Diário Oficial União. 28 nov 2011.
29. Agência Nacional de Vigilância Sanitária- Anvisa. Resolução – RDC N° 15, de 15 de março de 2012. Dispõe sobre requisitos de boas práticas para o processamento de produtos para saúde e dá outras providências. Diário Oficial União. 19 mar 2012.
30. Agência Nacional de Vigilância Sanitária- Anvisa. Segurança do paciente em serviços de saúde: limpeza e desinfecção de superfícies/ Brasília, DF: Anvisa; 2010.
31. Barbosa MS. Controle de infecções cruzadas em radiologia odontológica digital – proposta de um protocolo [trabalho de conclusão de curso]. Belo Horizonte: Faculdade de Odontologia da Universidade Federal de Minas Gerais; 2012.
32. Batista KCO. Colonização nasal de cirurgiões-dentistas em atividade docente por bactérias gram-negativas: interfaces com as medidas de prevenção e controle [dissertação]. Goiânia: Universidade Federal de Goiás; 2016.
33. Lal S. Investigating contamination of dental-unit waterline systems and microbial biofilm ecology [tesis]. Lancashire, UK: University of Central Lancashire; 2016.
34. Oliveira AC, Mati ML. Indicações e limitações dos diferentes detergentes utilizados no processamento de produtos para a saúde. Revista Sobecc. 2017;22(2):106-14. https://doi.org/10.5327/Z1414-4425201700020008
35. Bezerra ALD, Sousa MNA, Feitosa ANA, Assis EV, Barros CMB, Carolino ECA. Biossegurança na odontologia: artigo de revisão. ABCS Health Sciences. 2014;39(1):29-33. https://doi.org/10.7322/abcshs.v39i1.251

36. Ministério da Saúde (BR). Portaria N° 453 de 1º de junho de 1998. Aprova o regulamento técnico que estabelece as diretrizes básicas de Proteção Radiológica em radiodiagnóstico médico e odontológico, dispõe sobre o uso dos raios-x diagnósticos em todo território nacional e dá outras providências. Diário Oficial União. 02 jun 1998.

37. Ministério da Saúde (BR), Secretaria de Vigilância em Saúde, Departamento de DST, Aids e Hepatites Virais. Protocolo clínico e diretrizes terapêuticas para profilaxia antirretroviral pós-exposição de risco à infecção pelo HIV. Brasília (DF): MS; 2015.

38. Ministério do Trabalho e Emprego (BR), Secretaria de Inspeção do Trabalho, Departamento de Segurança de Saúde no Trabalho. Portaria GM N° 3.214 de 8 de junho de 1978. Norma Reguladora 6. NR6. Diário Oficial União. 06 jul 1978.

39. Ministério do Trabalho e Emprego (BR). Portaria N° 485 de 11 de novembro de 2005. Aprova a Norma Regulamentadora N° 32 -Segurança e Saúde no Trabalho em Estabelecimentos de Saúde. Diário Oficial União. 16 nov 2005.

40. Carmo CDS, Garcia PT, Reis RS. Elaboração de itens de avaliação para jogos educacionais. São Luís: EDUFMA; 2017.

41. Ferraz APCM, Belhot RV. Taxonomia de Bloom: revisão teórica e apresentação das adequações do instrumento para definição de objetivos instrucionais. Gest Prod. 2010;17(2):421-31. https://doi.org/10.1590/S0104-530X2010000200015

42. Paiva PVF, Machado LS, Valença AMG, Moraes RM. Uma proposta de serious game para o ensino de biossegurança em odontologia. Pesq Bras Odontop Clin Integr. 2013;13(2):135-39. https://doi.org/10.4034/pboci.2013.132.00

43. Ribeiro JR, Silva Júnior N, Frasson AC, Pilattl LA, Silva SCR. Teorias da aprendizagem em jogos digitais: um panorama brasileiro. Novas Tecnol Educ. 2015;13(1):1-10. https://doi.org/10.22456/1679-1916.57589

44. Moreira APA, Sabóia VM, Camacho ACLF, Daher DV, Teixeira E. Jogo educacional de administração de medicamentos: um estudo de validação. Rev Bras Enferm. 2014;67(4):528-34. https://doi.org/10.1590/0034-7167.2014670405

45. Moura TNB. Elaboração e validação de um jogo educativo sobre hábitos de vida saudáveis para adolescentes [dissertação]. Teresina, MA: Universidade Federal do Piauí; 2016.

46. Silva AKC. Development and validation of educational game for adolescents about breastfeeding. Rev Baiana Enferm. 2017;32(1):e16476. http://doi.org/10.18471/rbe.v31i1.16476

Conflict of Interest

Authors have no potential conflict of interest to declare, related to this study's political or financial peers and institutions.