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Development of an Educational Mobile App for Nuclear Medicine

Desenvolvimento de um aplicativo mobile educacional para Medicina Nuclear

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Abstract

Every learning is mediated by available technologies in their respective times, in this way, it is necessary to know how to combine the teaching objectives with the technological supports that best meet the learning objectives. In the practice of Nuclear Medicine, there are peculiarities for using ionizing radiation emitted from unsealed sources, bringing risks of exposure and contamination. It can be noted the necessity of applying new forms of technology associated with learning and teaching in the field of Nuclear Medicine. In this context, an educational app for mobile devices has been developed, initially compatible only for Android system, with the purpose of contributing to the dissemination of knowledge about Nuclear Medicine and creation of an interaction in a social network of co-authorship and trust between those interested in the theme, and which can expand the possibilities in the context of teaching and learning in the area. The system is dynamic, allowing user interaction through questionnaires, discussion forums, questions and answers, in addition to providing relevant information about Nuclear Medicine, in a reliable and organized way, serving experts in the field and beginners. In this way, the mobile app aims to contribute to the teaching area, since the application of basic science is extremely important, as radiological protection requirements and good practice requirements to achieve safe and prudent use of radioactive materials in human beings.

Keywords: Nuclear medicine. Teaching. Dissemination of information. Mobile apps.

Resumo

Toda aprendizagem é mediada pelas tecnologias disponíveis em suas respectivas épocas, dessa forma, é necessário saber aliar os objetivos de ensino com os suportes tecnológicos que melhor atendam aos objetivos da aprendizagem. Na prática da Medicina Nuclear existem peculiaridades por

utilizar radiação ionizante emitida de fontes não seladas, trazendo riscos de exposição e contaminação. Nota-se então a necessidade da aplicação de novas formas de tecnologia associadas à aprendizagem e ao ensino no campo de Medicina Nuclear. Nesse contexto foi criado um aplicativo educacional para dispositivos móveis, inicialmente compatível apenas para sistema Android, com o propósito de contribuir para a difusão do conhecimento sobre Medicina Nuclear e criação de uma interação em rede social de coautoria e confiança entre os interessados no tema, e podendo ampliar as possiblidades no contexto de ensino e aprendizagem da área. O sistema é dinâmico permitindo interação do usuário através de questionários, fóruns de discussões, perguntas e respostas, além de disponibilizar informações relevantes sobre Medicina Nuclear, de forma confiável e organizada, servindo para especialistas da área e também iniciantes. Dessa forma, o aplicativo visa contribuir para a área de ensino, visto que é de extrema importância a aplicação da ciência básica, dos requisitos de proteção radiológica e requisitos de boas práticas para alcançar uso seguro e prudente de materiais radioativos em seres humanos.

Palavras-chave: Medicina nuclear. Ensino. Disseminação de informação. Aplicativos móveis.

Introduction

Every learning process can be mediated by available technologies in their respective times, that is, it is dynamic and changes over time and according to the technological development of the period. It is necessary to know how to combine the teaching objectives with the technological supports that best meet these goals (AGUIAR, 2008).

Education and training are processes by which the knowledge, expertise and skills of one generation are passed on to the next. Today there are two forms of education and training: conventional education and distance education (MEHDIPOUR, 2013). The teaching and learning process is complex, has a dynamic character and does not happen in a linear way as just an accumulation of knowledge, it must be a task of exchange among people (MITRE, 2008).

In the health area, technological development has enabled new perspectives for the use of radiation in medicine, notably improving its safety and effectiveness. However, as in any human activity, the incorrect or inappropriate use of radioactive substances can generate health risks (AZEVEDO, 2005).

Nuclear Medicine is a medical specialty that uses ionizing radiation, as it uses radioisotopes in its routine (ZEISSMANN; O'MALLEY; THRALL, 2014). In the practice of Nuclear Medicine, for diagnosis or therapy, the risks are of exposure for the patient, worker and public, and of contamination, fundamentally for the worker. In addition, there is still a risk of contamination to the environment, through radioactive waste, if managed inappropriately (MACHADO, 2010). In this way, it is extremely important that professionals and/or students of Nuclear Medicine know how it works and are able to clearly understand all aspects, risks and particularities of the service in order to optimize practices.

The current scenario in the learning process in the area of Nuclear Medicine is restricted to common teaching materials, such as books and scientific articles, leaving some gaps in specific areas and for some professionals in the field. Before the advancement of new technologies and their availability, there is a need for new forms

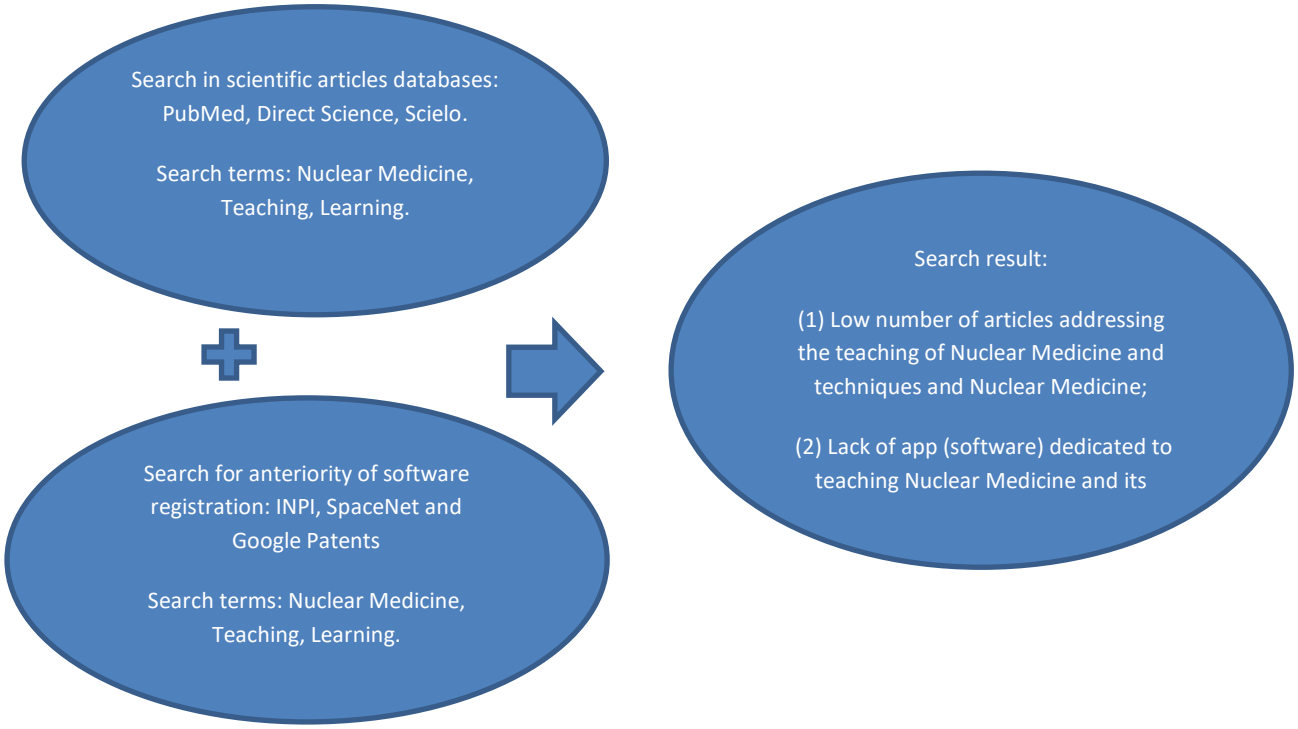
of learning and teaching related to Nuclear Medicine, thus increasing the possibilities of educational methods.

In this context, the aim of this work was the development of an educational app for mobile devices, with the purpose of contributing to the dissemination of knowledge about Nuclear Medicine, from the point of view of basic concepts and radiological protection, and the creation of an interaction in a social network of co-authorship and trust between those interested in the subject. The software has as a target audience preferably, students, professors and professionals of Nuclear Medicine, being able to reach others interested in the thematic area. The system is dynamic, allowing user interaction through questionnaires, discussion forums, questions and answers, in addition to providing relevant information about Nuclear Medicine, in a reliable and organized way, serving experts in the field and beginners alike, and being able to expand the possibilities in the context of teaching and learning in the area.

Methodology

The app development was structured according to the diagram shown in Figure 1. It began with a wide-ranging bibliographic review, addressing Technologies associated with teaching and learning and Nuclear Medicine and a search for anteriority in the INPI and Google Patents databases. Later, it was decided to create a mobile app in the area of Nuclear Medicine, ensuring the dissemination of knowledge.

Figure 1: Search Methodology



Source: Own elaboration

After analyzing the search results, the development of an initially compatible app was started, only for the Android system, available for download from the Play Store. It can also be accessed via web through Blogger (only written content such as texts and articles). The app basically has the following features:

(i). Subjects posts about Nuclear Medicine
(ii). Quizzes
(iii). Questions and Answers/ Comments
(iv). Discussion of cases (Discussion Forum)
(v). Invitation to experts in the field

The app was built on the development platform *Android Studio*. Mostly using as programming languages *JAVA™* and *XML.* The *Firebase* used for communication between the app on the Android device and the database. The *Android Studio* and the *Firebase* are free.

For content postings, two free platforms were also used, which are accessible and easy to use. *Blogspot* was used for posts and Google Form was used for questionnaires. When posted on the following platforms, they are already directly directed to the application and are available for access by the registered user.

The app also has a system that contributes to a network of co-authorship and trust, as it allows those interested in the topic to be indicated, by invitation, to contribute with information in the app.

In the bibliographic review, we detected the lack/inexistence of practical content and discussion forums in the area of Nuclear Medicine. In this area, we have two noteworthy factors in the issue of teaching and learning, as it deals with intervening factors of a health service and also with the referents, the practice with the use of ionizing radiation.

Among the documents analyzed in the search for anteriority, one stands out from the point of view of radiological protection and continuing education as a quality assurance tool in the transmission of knowledge to different audiences. This document summarizes the Bonn conference recommendations for radiological protection in medicine. According to IAEA (2012, p. 2).

> [...] there is no doubt that the application of ionizing radiation and radioactive elements in diagnostic, intervention, or therapeutic procedures in medicine is beneficial to hundreds of millions of people every year. However, the use of radiation in medicine must strike a balance between the benefits of improving human well-being and health, as well as the risks related to the exposure of individuals to radiation. There is a need for a holistic approach that includes partnerships with national governments, civil society, international agencies, researchers, educators, institutions and professional associations to identify, advocate and implement solutions to address existing and emerging challenges, and lead, harmonize and coordinate activities and procedures at the international level

The Bonn conference published ten actions for the next decade. Among them, we highlight the following:

> Action 04: Strengthen education and training of health professionals in radiological protection.
>
> Continue to develop the use of the most recent platforms, such as the applications available on the internet dedicated to training, which reach broader professional groups for training purposes.
>
> Action 08: Strengthen the radiological safety culture in the health area.
>
> Improve peer-to-peer information exchange on radiological protection and safety-related issues using advances in information technologies.
>
> Action 09: Foster a better dialogue on the risk-benefit of using radiation.
>
> Raise awareness of the benefits and risks of using radiation among healthcare professionals, patients and the general public (IAEA, 2012; p. 6:10-11).

All these important actions are contemplated in the proposal of this work, as evidenced in the topics available in the educational app.

New technologies and the teaching and learning process

Learning does not have to be just a process of acquiring and mastering knowledge. It can take place in a collective and integrated way, articulating information and people who are in different places and who are age, gender, physical conditions, areas and different levels of training (KENSKI, 2003).

As is easy to see, the availability of software and digital educational resources has increased considerably. (RAMOS, 2001). Current digital communication and information technologies guide us towards new learning, which are characterized as creative, fluid, changeable constructions, that contributing so that people and society can experience creative and innovative thoughts, behaviors and actions, leading them to new socially valid advances in the current stage of human development (KENSKI, 2003). Integrated and comprehensive teaching and learning environments and systems are capable of promoting user engagement (AGUIAR, 2008).

The information made available in digital form is flexible, adaptable, subject to change and allows the performance of various activities, aimed at the development of new learning skills, attitudes and personal and social values. Thus creating new times and educational spaces, being new forms of teaching anywhere, anytime, they are developed from the need to offer educational updates for everyone. In a time of quick changes, "scientific-technological knowledge plays an increasingly central role as a factor of change and of economic and social dynamism" and requires that the entire society be placed in a continuous process of learning (KENSKI, 2003).

Mobile learning is any type of learning that takes place when the student is not at a fixed predetermined location, or learning that takes place when the student takes advantage of the learning opportunities offered by mobile technologies. That is, using

mobile devices, students can learn anywhere and anytime. Mobile learning is considered the ability to use mobile devices to teach and learn (MEHDIPOUR, 2013).

Mobile learning is emerging as one of the solutions to the challenges facing education. With a variety of tools and resources always available, mobile learning provides increased options for personalizing learning (MEHDIPOUR, 2013).

New Technologies applied to the teaching and learning of health professionals

In the training of health professionals, the educational process must aim at the development of both general capacities, identified with the large area of health, and those that constitute the specificities of each profession (ALBUQUERQUE, 2008). Expertise and skills need to be developed by health professionals, during and after training, so that they are individuals committed to the search for equity in care, access and citizenship (CHIESA, 2007).

The educational practice in health refers as well to the health education activities, aimed at the development of individual and collective capacities aimed at improving the quality of life and health; as the permanent education activities, aimed at health workers through continuous professional training (PEREIRA, 2003).

Mobile technologies are an attractive and easy way to maintain teaching and learning skills as they allow quick access to information. They are accessible, can be easily distributed, and therefore have great potential to reach diverse users by providing them with access to further learning and development. Mobile technologies can facilitate distance learning in situations where access to education is difficult or interrupted by geographic location, and can be accessed at preferable or necessary time. (MEHDIPOUR, 2013).

In this way, it makes it possible for health professionals to have access both during their training and during the service when there is any doubt about a procedure, making access faster and more dynamic, thus optimizing the service (CHIESA, 2007).

Ionizing radiation in the medical area

The radiations that have enough energy to ionize atoms are called ionizing radiations, as is the case of X-rays and radiation from radioactive elements, which are of nuclear origin, such as alpha, beta and gamma radiation. Ionizing radiation comes from natural or artificial sources (NAVARRO, 2008). Throughout life, humans are daily exposed to

the effects of ionizing radiation. These radiations can be of natural or artificial origin. (AZEVEDO, 2005).

In medicine, the use of ionizing radiation has applications both in diagnosis and in therapy. The main areas of application are: nuclear medicine, radiotherapy and radiodiagnosis (AZEVEDO, 2005).

The application of ionizing radiation and radioactive elements in diagnostic, intervention or therapeutic procedures in medicine is beneficial to many people. However, the use of radiation in medicine must strike a balance between the benefits of improving human well-being and health, as well as the risks related to the exposure of individuals to radiation (SOARES; PEREIRA; FLÔR, 2011). Thereby, radiological protection seeks a greater effective benefit to users, professionals and the environment, without limiting the practice (MACHADO, 2010).

The use of ionizing radiation in the medical field has been expanding and bringing more benefits, as well as enabling the detection of tumors and fractures (in conventional radiography, computed tomography, mammography), the treatment of diseases (radiotherapy and nuclear medicine), checking the physiology of the organs and systems of the human body (nuclear medicine). However, the interaction of radiation with human tissue can generate biological effects, which were noticed right after the discovery of X radiation, when skin diseases of people exposed to X-rays appeared, leading scientists to research the possible causes (AZEVEDO, 2005).

The effects caused by the interactions of ionizing radiation with cells can occur directly or indirectly. In the direct, a macromolecule (DNA, proteins, enzymes and others) are damaged, in the indirect, this radiation interacts with the environment and produces free radicals. These cell modifications can be repaired through the action of enzymes, but if this does not occur, biochemical lesions will appear that can cause damage (NAVARRO, 2008).

The manifestation of biological effects occurs in two ways: the deterministic effect, caused by high doses of radiation in a short period of time, and the stochastic effect, caused by small doses received over a long period (SOARES; PEREIRA; FLÔR, 2011).

The first protection recommendations for workers were published just 20 years after the discovery of X-rays, by the Rontgen Society, in view of the countless damages caused in the early years to professionals who used it. This was the beginning of the field of study known as radiological protection (NAVARRO, 2008).

Radiological Protection aims to establish adequate safety and protection standards for human beings without unduly limiting the benefits of practices involving exposure to radiation (AZEVEDO, 2005).

Nuclear Medicine

Nuclear Medicine is defined by the WHO - World Health Organization as a specialty that deals with the diagnosis, treatment and medical investigation through the use of radioisotopes (BRASIL, 2015). In Nuclear Medicine , radiopharmaceuticals are used, which are chemical molecules linked to a radioactive element so that they can be used as tracers to diagnose dysfunctions or pathologies of the organism. They have the advantage of not disrupting function when administered intravascularly, unlike other diagnostic drugs. The radioactivity emitted by the patient is detected by equipment called a gamma camera, and the image is obtained through the conversion of ionizing radiation into electrical energy, which is processed and recorded by computers (ZEISSMANN; O'MALLEY; THRALL, 2014).

There are sealed and unsealed radioactive sources; sealed sources only present the risk of exposure, since the radioactive material contained in the container cannot be extracted. Radiological protection practices, in this case, include necessary shielding and being stored in a specific location. On the other hand, unsealed or open sources, which are used in Nuclear Medicine, in addition to exposure risks, also involve a risk of contamination for the team, since the sources are handled by the worker (MACHADO, 2010).

By handling unsealed sources, accidental spills can occur, which are classified into categories of minor and major importance, depending on the quantity and radionuclide, and will require different containment measures.

Since all incidents must be reported to the control and inspection institutions (ZEISSMANN; O'MALLEY; THRALL, 2014). The continuous contact of professionals with ionizing radiation makes them more susceptible to greater exposure, which raises concerns about protection as they end up being exposed to radiation for a long time, even with small doses, and these can be harmful in the long term (stochastic effect) (SOARES; PEREIRA; FLÔR, 2011).

As it is an area where the risk of exposure is high, due to the use of unsealed sources, there is great attention to the implementation of radiological protection measures aimed at minimizing unnecessary exposure to patients, the public, and occupationally exposed individuals (OEI) and the environment. The amount and type of radioactivity administered to the patient must be measured and documented, and the work areas must be monitored to maintain the safety of patients and the work team (ZEISSMANN; O'MALLEY; THRALL, 2014).

The (OEI) must receive initial training in good radiological protection practices in nuclear medicine and periodic training in radiological protection that must be provided by the service (BRASIL, 2013), which is fundamental for the reduction of risks and the prevention of incidents and accidents with unsealed sources (MENDES; FONSECA; CARVALHO, 2004).

New teaching technologies in nuclear medicine

Among the points addressed at the "International Conference on Radiation Protection in Medicine" held in Bonn - Germany, are: Prioritizing the education and training of all health professionals in radiation protection, paying particular attention to professionals who use radiation in medicine and dentistry and raising awareness of the benefits and

risks of using radiation among healthcare professionals, patients and the general public (AZEVEDO, 2005).

The current scenario in the learning process in the area of Nuclear Medicine is restricted to common teaching materials such as books and scientific articles. Since most are focused on the area of medicine or medical physics, thus leaving a gap with other professionals in the area (HARAMITA, 2011).

Thus, there is a need to cover Nuclear Medicine in an objective and clear way for all professionals in the area. Combining several ideas in a single product, which is characterized as innovation, as highlighted by Baron and Shane (2010) when saying that "What is new is the combination, not the components that are part of it" and by Roger and Schoemaker (1971) stated "that innovation is an idea, a practice or an object perceived as new by the individual".

Therefore, in the training of professionals in the area of Nuclear Medicine and even in the continuing education of professionals, there is a need to use innovative mechanisms that allow easy access and understanding in a dynamic way so that they are technically prepared to know how to deal with the routine of the work. Therefore, it is necessary, in addition to safe working conditions, to have specific training and skills for the exercise of their functions.

Educational mobile app for nuclear medicine

The mobile educational application developed has the following configuration, as shown in Figures 2 to 3.

Source: Own elaboration

Source: Own elaboration

Source: Own elaboration

This tool has the general objective of contributing to the dissemination of knowledge about Nuclear Medicine and creating an interaction in a social network among those interested in the subject. As specific goals:

I. Provide relevant information about Nuclear Medicine, in a reliable and organized way, serving both specialists in the field and people who are starting to be interested in the area.
II. Ensure integration among users about Nuclear Medicine, using a social network of co-authorship and trust.
III. Be a dynamic app, through quizzes, discussion forums and questions and answers related to the themes. Its target audience is students, professors, professionals and others interested in the field of Nuclear Medicine.

Among the main features available in the application, we can mention:

I. Posts of subjects about Nuclear Medicine

The posts made in the application are organized according to the subdivision shown below, as a way of organization and ease for the user to find what he is looking for in a more targeted way. All have clear and objective concepts, so that they can be understood by different audiences, with different levels of prior knowledge, as they will have users with different needs. In addition, the subjects are divided by level of depth, always aiming at good professional practices.

II. Questionnaires

The app has questionnaires designed with questions about the topics to test acquired knowledge about the topics covered. In addition, it also presents a questionnaire to request authorization to contribute to the app, that is, the user answers the questions and if he reaches the minimum score required, the user is authorized to contribute to the application.

III. Questions and Answers/Comments

The user can ask or answer any doubt or question regarding the topics covered. This field is available at the end of each subject post. Authorized users can answer the questionnaires.

IV. Case discussion

In order to promote interaction between users, one of the tools available refers to the discussion forum between users, presenting cases about Nuclear Medicine by authorized users, and then promoting a discussion about the post.

V. Invitation to area Experts

The indication of another user can contribute to a social network of co-authorship and trust, seeking a differential in the application, allowing interaction in an innovative way between users.

Final considerations

The teaching and learning process requires new means of innovation, in order to keep up with the new technologies of the times. The accelerated technological development has been emerging in several areas, and even modifying the processes in health and education.

In the health area, it is extremely important that professionals know the rules and the functioning they are dealing with. The area of Nuclear Medicine involves the use of ionizing radiation, both in diagnosis and in therapy, and uses unsealed sources, thus bringing the risk of exposure and contamination, especially for professionals and the environment. Appropriate use of radiological protection factors are powerful tools in reducing the dose of occupational exposure.

Considering that the entire system is vulnerable to failure, which makes training and continuing education of professionals necessary, especially those who are in contact with radioactive material, in order to minimize the risk of accidents and increase occupational exposure, highlights the need for new possibilities of contact with the knowledge and educational practices that aim to contribute to the teaching area on this topic, in addition to patients and the environment. Therefore, it is necessary that all professionals involved in the routine in the health area know the risks which they are exposed and how they function, in order to know how to deal in the event of an accident and/or unforeseen events.

In the area of Nuclear Medicine, we have two important factors in the issue of teaching and learning for those involved, as it deals with the factors for dealing with a health service and also with the factors when dealing with ionizing radiation.

Therefore, there is a need to use existing technologies to support the teaching and learning process in the area of Nuclear Medicine. Of course, the future of mobile learning depends to a large extent on the level of social acceptance it receives and the use that users make of such technology. It is important that technology is always used in association with other means already available, and consciously, in all areas, including teaching and learning.

In this way, it is believed that the application can contribute to the dissemination of knowledge related to the thematic, since it is extremely important to apply basic science, radiological protection requirements and good habits requirements to achieve safe and prudent use of materials radioactive substances in humans. Future studies will evaluate the application of this tool in different contexts and thus, its potential, contributions and limitations will be evaluated.

References

AGUIAR, E. V. B. As novas tecnologias e o ensino-aprendizagem. **Vértices**, v. 10, n. 1/3, jan./dec. 2008.

ALBUQUERQUE, V. S., et al. A Integração Ensino-serviço no Contexto dos Processos de Mudança na Formação Superior dos Profissionais da Saúde. **Revista Brasileira de Educação Médica.** v. 32, n. 3 p. 356-362, Sept. 2008.

AZEVEDO, A. C. P. Radioproteção em Serviços de Saúde. Programa de Radioproteção e Dosimetria da FIOCRUZ. SP, **Instituto De Pesquisas Energéticas e Nucleares – IPEN**, 2007.

BRASIL. Comissão Nacional de Energia Nuclear - Ministério Da Ciência, Tecnologia e Inovação. Available in: http://www.cnen.gov.br/ Accessed in: September 18th, 2021.

BRASIL. Norma Nuclear CNEN NN 3.05. Requisitos de segurança e proteção radiológica para serviços de medicina nuclear. **Diário Oficial da União**, Brasília, 2013.

CHIESA, A. M., et al. A Formação de Profissionais da Saúde: aprendizagem significativa à luz da promoção da Saúde. **CogitareEnferm**. 2007 Apr/June; v.12, n.2,p.236-40.

HARAMITA, T. Aplicação dos princípios de radioproteção em medicina nuclear Tamara Haramita. - Botucatu. Trabalho de conclusão de curso (bacharelado – Física Médica) - **Instituto de Biociências de Botucatu, Universidade Estadual Paulista**, 2011.

IAEA. **10 Actions to Improve Radiation Protection in Medicine in the Next Decade**.*[s.l.]*,2012. Available in https://www.iaea.org/sites/default/files/17/12/bonncall-for-action_por.pdf. Accessed in: May 5th, 2021.

KENSKI, V. M. Aprendizagem mediada pela tecnologia. **Revista Diálogo Educacional**, Curitiba, v. 4, n.10, p.47-56, sept./dec. 2003.

MACHADO, M. A. D., et al. Revisão: Radioproteção aplicada à Medicina Nuclear. **Revista Brasileira de Física Médica**. v.4, n.3, p. 47-52, 2011. Available in: https://www.rbfm.org.br/rbfm/article/view/9. Accessed in: May 5th, 2021.

MEHDIPOUR, Y.; ZEREHKAFI, H. Mobile Learning for Education: Benefits and Challenges.**International Journal of Computational Engineering Research**, Vol,03. Edition 6, 2013.

MITRE, S. M. Metodologias ativas de ensino-aprendizagem na formação profissional em saúde: debates atuais. **Ciência & Saúde Coletiva**, v. 13(Sup 2):2133-2144, 2008.

MENDES, L. C. G; et al. Proposta de método de inspeção de radioproteção aplicada em instalações de medicina nuclear. **Revista Radiologia Brasileira**, vol. 37 (2): 115– 23, 2004.

NAVARRO, Marcus Vinicius Teixeira et al. Controle de riscos à saúde em radiodiagnóstico: uma perspectiva histórica. **Hist. cienc. saude**-Manguinhos, Rio de Janeiro , v. 15, n. 4, p. 1039-1047, 2008.

SOARES, F. A. P; PEREIRA, A. L; FLÔR, R. C. Utilização de vestimentas de proteção radiológica para redução de dose absorvida: uma revisão integrativa da literatura. **Revista Radiologia Brasileira**, vol. 44(2): 97–103, 2011.

PEREIRA, A. L. F. As tendências pedagógicas e a prática educativa nas ciências da saúde. **Cad. Saúde Pública**, Rio de Janeiro, 19(5):1527-1534, sept-oct, 2003.

RAMOS, et al. Recursos educativos digitais: reflexões sobre a prática. Papert, 2001.

THRALL, J. H.; ZIESSMAN, H. A. Medicina Nuclear. 2ª edição. Rio de Janeiro: **Guanabara-Koogan**, 2006.

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