

Evaluation of an educational technology using augmented reality for home visiting teaching

Avaliação de uma tecnologia educacional utilizando a realidade aumentada para o ensino sobre visita domiciliar

Evaluación de una tecnología educativa que utiliza la realidad aumentada para la enseñanza de visitas domiciliarias

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ABSTRACT

Objective: to evaluate augmented reality educational games applied to home visiting teaching to university students in the health area. **Method:** descriptive research of quantitative approach and technological assessment developed at the School of Nursing of the Federal University of Alfenas, from April to June 2016, conducted with 135 undergraduate nursing, physiotherapy and medicine. The Research Ethics Committee approved the study. **Results:** the statistical analysis highlighted that 74.8% of the participants were female and the average age was 20 years. The first activity consisted of a case study to perform the family risk classification and the second dealt with the National Primary Care Policy, which provides for which professional to perform home visits. 89.6% of participants considered the games developed for home visiting teaching to be appropriate and very appropriate. **Conclusion:** augmented reality games were well evaluated by the participants, being a promising technology for teaching. **Descriptors:** Home visit; nursing education; educational technology; augmented reality.

RESUMO

Objetivo: avaliar jogos educativos com realidade aumentada aplicados ao ensino sobre visita domiciliar. **Método:** pesquisa descritiva de abordagem quantitativa e avaliação tecnológica desenvolvida na Escola de Enfermagem da Universidade Federal de Alfenas, no período de abril a junho de 2016, realizada com 135 universitários de enfermagem, fisioterapia e medicina, aprovado por Comitê de Ética em Pesquisa. **Resultados:** a análise estatística destacou que 74,8% dos participantes eram do sexo feminino e a média de idades foi de 20 anos. A primeira atividade consistiu em um estudo de caso para realizar a classificação de risco familiar e a segunda abordou a Política Nacional de Atenção Básica, que prevê a qual profissional compete realizar a visita domiciliar. 89,6% dos participantes consideraram adequado e muito adequados os jogos desenvolvidos para o ensino sobre visita domiciliar. **Conclusão:** os jogos com realidade aumentada foram bem avaliados pelos participantes, sendo uma tecnologia promissora para o ensino. **Descritores:** Visita domiciliar; educação em enfermagem; tecnologia educacional; realidade aumentada.

RESUMEN

Objetivo: evaluar los juegos educativos de realidad aumentada aplicados a la enseñanza de visitas domiciliarias a estudiantes universitarios en la área de salud. **Método:** investigación descriptiva, cuantitativa y evaluación tecnológica desarrollada en la Facultad de Enfermería de la Universidad Federal de Alfenas, de abril a junio de 2016, realizada con 135 estudiantes de pregrado en enfermería, fisioterapia y medicina, aprobada por Comité de Ética de Investigación. **Resultados:** el análisis estadístico destacó que el 74.8% de los participantes eran mujeres y la edad promedio era de 20 años. La primera actividad consistió en un estudio de caso para llevar a cabo la clasificación de riesgo familiar y la segunda abordó la Política Nacional de Atención Primaria, que establece qué profesional es responsable de llevar a cabo la visita domiciliar. El 89,6% de los participantes consideró que los juegos desarrollados para enseñar visitas a domicilio eran apropiados y muy adecuados. **Conclusión:** los juegos con realidad aumentada fueron bien evaluados por los participantes, siendo una tecnología prometedora para la enseñanza. **Descriptores:** Visita al hogar; educación de enfermería; tecnología educativa; realidad aumentada.

INTRODUÇÃO

The health area is constantly receiving several contributions from information technology in order to support its processes, which has been helping numerous practices in the area, in activities such as diagnosis, therapy, management and education, which has required the need for changes and development of new skills by professionals in the areas involved¹.

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There is a tendency to use visual strategies associated with Virtual Learning Environments (VLEs) in undergraduate courses. In this context, mobile devices such as *tablets* and *smartphones* are part of a new reality in various fields of professional activity. Such technologies have provided efficient methodologies for obtaining positive results, such as educational software which have the great capacity to arouse the student's curiosity and interest in content covered in applications. Thus, teachers and students find in these softwares a powerful tool to give a new dimension to knowledge, facilitating the learning of complex themes².

Another technology that has stood out in the health area, associated with virtual reality, is Augmented Reality (AR), which has been subject of research studies in recent years. Several works have been developed with the objective of implementing visualization systems with AR to provide accessible and easy-to-use interfaces that support medical interventions and present patient information^{3,4}.

AR is defined as the enrichment of the real world with virtual objects and information viewed through a technological device, which enter this context as an additional element to promote motivation and engagement and allow new forms of interaction in the educational process. It provides intuitive interactions in the three-dimensional environment and expands the educational elements by joining the real with the virtual, bringing a new dimension to education⁴.

Thus, the application of AR in the health area or even for human development has been evaluated intensively in recent years and deserves attention since it represents new challenges and potentialities, with the insertion of complementary and relevant information to the real scenario¹.

An online educational game with AR must have the following characteristics: contain clear and explicit rules; present objectives, challenges, obstacles, conflicts and rewards; present feedbacks; allow for repetition; be dynamic and motivating; provide fun; be easy to learn; be easy to use; be intuitive; explore space and interactions with virtual objects; have separation of structure and content; be able to be developed or adapted by non-specialists; be knowledge-based; be rich in media; be independent of special devices; have different stages of learning and playing; allow for self-assessment on learning the topic; have help elements selected by the user; and have tutorials and training courses. With this, it is expected that the educational game will provide fun learning and motivate students to learn outside the classroom^{4,5}.

In the context of the family health strategy, the home visit stands out among the tools of qualified care. It constitutes a set of health actions aimed at both educational and assistance service, in addition to being an activity used in order to subsidize the intervention in the health-disease process of individuals or in the planning of actions, aiming at the prevention and promotion of the health of the community^{6,7}.

In isolation, technological innovations do not achieve the expected goals of the complex task of teaching and learning. However, they can be seen as didactic support tools or even as strategic means to complement face-to-face education⁸.

Thus, this study aimed to evaluate AR educational games applied to teaching home visits to university students in the health area.

LITERATURE REVIEW

The technology of virtual reality originated in the 60s, gaining strength from the 90s, with technological advances for the execution of interactive computer graphics in real time, in which it was necessary to use special equipment, such as a helmet, gloves, stereoscopic glasses, and 3D mouse, among others, so that the user could interact with the virtual environment⁹.

In that decade AR emerged, which allowed the overlapping of virtual objects and environments with the physical setting through some technological device, but without using any special equipment, which made its use easier, natural and universal. From a conceptual point of view, virtual reality is an advanced interface for computational applications, which allows the user to navigate and interact, in real time, with a three-dimensional computer-generated environment, using multi-sensory devices⁹.

AR can be defined as a system that supplements the real world with computer-generated virtual objects, seeming to coexist in the same space and presenting the following properties: it combines real and virtual objects in the real environment; it runs interactively in real time; and it aligns real and virtual objects with each other⁹.

Thus, AR is a way of adding virtual elements that can contribute to the understanding of reality and can bring benefits to the teaching-learning process, considering the wide possibility of its application. For this reason, it has been

widely used as a technological resource in educational environments and has brought important contributions to the educational context, since it stimulates student engagement and helps learning in several areas of knowledge¹⁰.

In view of the growing availability of educational technologies, it is important to stimulate the students' desire to learn through tools with dynamic and interactive content, allowing for a better assimilation of the concepts studied¹¹.

These technologies produce creative and innovative experiences, which facilitate the development of competences, which are relevant to the educational curriculum and to the achievement of significant learning by students¹¹.

METHODOLOGY

This is a descriptive research with a quantitative approach and technological evaluation with students from the Nursing School of the Federal University of Alfenas, Minas Gerais. This type of research was adopted because it is the process of developing/creating a new product¹².

This work covers the teaching activities on home visits in AR and student assessment.

Together with the home visit course in the family health strategy, the activities with AR were developed with students from the first and third periods of the nursing, physiotherapy and medicine courses, from April to June 2016.

Simple random sampling was adopted, without replacement, considering 2% of sampling error and 95% of confidence¹³. The student's participation was defined according to the enrollment number in each course, a procedure maintained for both genders. The first student was considered the starting point followed by the other participants; they were randomly drawn until completing the number established to compose the sample, per course.

The inclusion criteria were the following: nursing, medicine and physiotherapy students enrolled in the 1st and 3rd periods, from the first academic semester of 2016, regardless of gender and age. The exclusion criteria were the following: students who although enrolled in the 1st and 3rd periods, in the first semester of 2016, were not available to participate in the research due to sick leave and dependence in another subject that would make it difficult for them to participate in the hours allocated to the research.

After collected, the data were stored in a database created using the *SPSS for Windows* software, version 17.0. The quantitative data on the characterization of the participants and the evaluation of the educational games with AR were presented by means of a percentage analysis of the responses found.

The FLARAS tool was used for the creation of Online Educational Applications with Augmented Reality, which is an open source free software, available on the Internet on a website with vast support material, which includes versions of the tool for download; tutorials based on texts and videos; common questions; e-book; repository with several online applications, accompanied by their respective open projects, with license for adaptation and generation of derived applications⁴.

The FLARAS software is part of a family of tools that started with ARToolKit, which required programming to develop applications. Thus, the SACRA tool was developed, which separated the application into structure and content, using folders and files. The FLARAS tool was then generated, which allowed for the development of online educational applications by teachers and students, being an appropriate tool for desktops and notebooks. FLARAS can be used with a single marker, a card with a drawn frame and a symbol inside it, and is based on the concept of spatial points with stacked virtual scenes, containing images, sounds, 3D objects and videos¹⁴.

The design of this study was submitted to the Research Ethics Committee of the Federal University of Alfenas-MG and approved by opinion number 1,092,492 on June 3rd, 2015¹⁵.

RESULTS AND DISCUSSION

Characterization of the subjects

135 university students participated in the study, 18 and 15 from the 1st and 3rd periods of nursing, 13 and 17 from the 1st and 3rd periods of physiotherapy, and 42 and 30 from the 1st and 3rd periods of medicine, respectively. Regarding the general characteristics of the participants, 74.8% were female and 25.2% male; the mean age was 20 years old (sd=2.66), and with a minimum of 16 years old and a maximum of 33 years old; 91.9% had a notebook, 99.3% had a cell phone and 100% had Internet access at their homes.

Classification of family risk

Two activities were developed using AR-based games. The first consisted of a case study to carry out the classification of family risk. This classification is a tool that aims to identify the risk factors that justify the prioritization of service to families, assisting in the planning of home visits. The classifications by degree of risk made by the health team, based on the data collected, can be the following: no risk, low risk, medium risk and high risk¹⁶.

After listening to and reading the case study, the participant would have to select the clinical criteria found (presence of conditions or pathologies) to cross with the socioeconomic risk factors and, thus, obtain the correct answer. When clicking on the degree of risk, if correct, the student received a voice message stating that he/she had answered correctly, as shown in Figure 1.

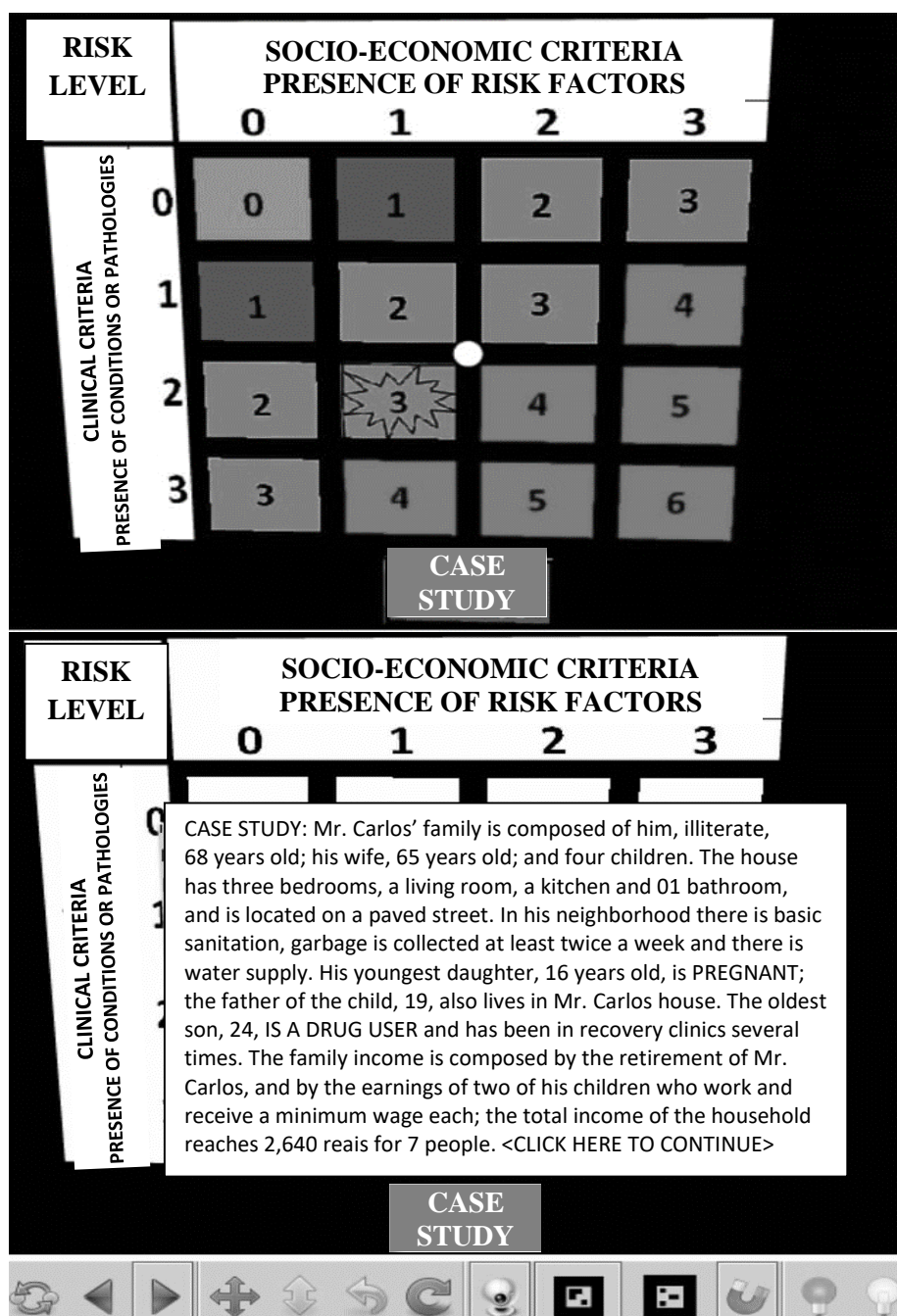


FIGURE 1: Classification of family risk

Professional competence: home visit

For the second activity of the course, the National Policy of Primary Care was addressed, which envisages the competent professional to perform the home visit. In this case, this professional is the community health agent, an important professional of the family health team, with his/her assignment being the monitoring through home visits of all the families and individuals under his/her responsibility¹⁷. The participant would have to listen to the instructions, which asked to drag the professional responsible for the home visit to the figure of the house. The figure of the professional that corresponded to the correct answer would enter the house, the other professionals would be repelled and would not enter the figure of the house, according to Figure 2.

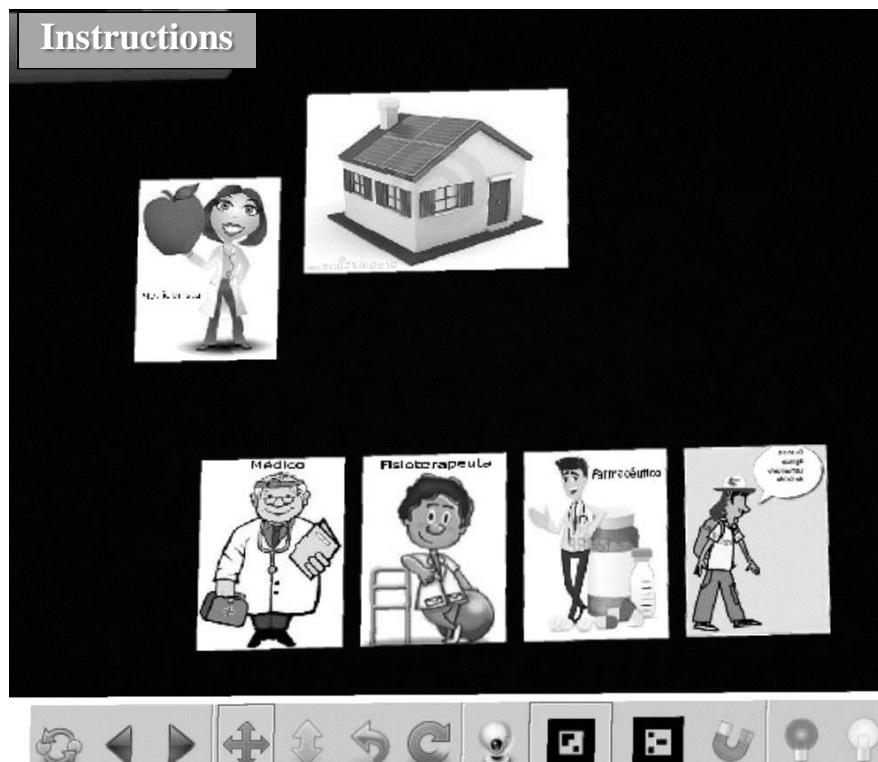


FIGURE 2: Activity with the professional responsible for carrying out the home visit

The students participating in the course evaluated the use of VLE activities by using AR games and 89.6% of them considered this technological resource to be appropriate and very suitable for teaching home visits. Those who reported that it was inadequate (10.4%) justified their answers stating that they had difficulty carrying out the activities due to lack of skill in handling the device (marker).

Although this technology has never been used as a teaching strategy in undergraduate health courses, the results were positive at the higher education institution where the research was conducted.

The applications of AR in the health area are evolving, mainly in the sectors of procedural training and teaching in medicine and in rehabilitation therapy.

In a study, which aimed to identify and analyze scientific publications on the applications of AR in the health area, 76 papers presenting research studies focused on the application of AR were found. The results indicated that the specialties that most exploit this technology were physiotherapy and rehabilitation, radiology, anatomy, orthopedics and cardiology, in order to improve the design of the information, which are commonly represented by image examination reports, with three-dimensional representations superimposed on the user's body and that the main challenges were related to the problem of realism and registration of virtual objects inserted into the real environment³.

AR technology was also used in other research to favor the use of the strategy of assembling metabolic pathways as an aid in the teaching of metabolism. A paper puzzle of glycolysis has been used as a strategy for traditional teaching; this kind of paper game demands a large number of instructors and limits the monitoring of the difficulties presented by the students. With AR, letters with molecular structures are read by an application installed on mobile devices that

display information such as the 3D structure of the molecules, clues for assembling the correct sequence of the metabolic pathway and results of progression in the activity. In this study it was found that the use of AR allowed students greater autonomy to solve the proposed exercises and to provide performance evaluation data that allow to understand and, later, to solve the difficulties presented by the students².

Applied to biomedical engineering, AR has been widely studied in recent years. The simulation of prostheses for upper limbs is a wide subject and field of many applications. In a study, computational techniques that allow for the creation of a virtual AR environment were investigated, expanding the flexibility and independence of the amputee patient to access the rehabilitation process. It was found that, to move from a desktop architecture to the web is not an easy task, and the proposed system with AR has demonstrated that such migration applied to the virtual simulation of the upper limb is possible. Despite the difficulties, solutions were developed and put into practice in order to simplify the work, both for the user and for the professional who will lead the patient's recovery¹⁸.

In view of the above, the importance is recognized of using new educational technologies, including games for educational purposes. The use of this technology stimulates and facilitates the acquisition of knowledge by the student, helps the teacher in the educational practices, in addition to enabling different ways of teaching¹⁹.

Computer technologies are powerful tools that can make life easier for academics and promote better pedagogical quality when proposing greater flexibility, interactivity and autonomy in educational processes. In this context, the teacher can no longer rely only on books or traditional teaching-learning methods; thus, the computer and new technologies are increasingly gaining space in schools, especially in higher education in the health area²⁰.

The innovation process is complex and requires interaction among professionals, institutions and managers. The incorporation of new technologies directly contributes to the quality of teaching, enabling new demands, especially in the way of teaching and learning, increasing the intensity of work and requiring multidisciplinary knowledge and complementary specialties^{21,22}.

CONCLUSION

The profile of the researched student is characterized by a mean age of 20 years old, mostly female, with a notebook and cell phone and Internet access at home. The games with AR were well evaluated, showing that this innovative technological resource can be easily incorporated into higher education in different areas of knowledge.

AR is an expanding technology, with a wide field of exploration, making a significant contribution to the educational area. It guarantees a great potential in the creation of games, allowing for a natural interaction that is easy to adapt and free of special devices.

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