Cogitare Enfermagem

ORIGINAL ARTICLE

CONSTRUCTION AND VALIDATION OF A VIDEO SIMULATION FOR TEACHING CARDIOPULMONARY RESUSCITATION*

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ABSTRACT

Objective: to develop Digital Educational Technology (simulation video) on Cardiopulmonary Resuscitation in adults in Basic Life Support with the use of the External Automated Defibrillator in the hospital environment.

Methodology: this is an applied technological production research study developed at the University of São Paulo, Ribeirão Preto College of Nursing, from January 2017 to March 2018. Experts in the area of Urgency and Emergency, namely 16 nurses, participated in the study. The AC1 statistics was used to assess inter-rater agreement.

Results: the script and storyboard were validated and reached 100% of the evaluation in "I agree" or "I strongly agree", classified as "Considerable agreement", with AC1=0.70 and p<0.0001, in general inter-rater agreement.

Conclusion: this study provides an exponential contribution to the teaching-learning process on the teaching of Cardiopulmonary Resuscitation in adults in Basic Life Support with the use of the Automatic External Defibrillator in the hospital environment, through the development of the validated simulation video.

DESCRIPTORS: Teaching; Educational Technology; Cardiopulmonary Resuscitation; Care to Extend Life; Simulation.

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ARTIGO ORIGINAL / ARTÍCULO ORIGINAL

CONSTRUÇÃO E VALIDAÇÃO DE SIMULAÇÃO EM VÍDEO PARA ENSINO DA RESSUSCITAÇÃO CARDIOPULMONAR

RESUMO

Objetivo: desenvolver Tecnologia Educacional Digital (vídeo de simulação) sobre Ressuscitação Cardiopulmonar no adulto em Suporte Básico de Vida com o uso do Desfibrilador Externo Automático no ambiente hospitalar.

Metodologia: trata-se de uma pesquisa de produção tecnológica, aplicada. Desenvolvida na Universidade de São Paulo, Escola de Enfermagem de Ribeirão Preto, no período de janeiro de 2017 a março de 2018. Expertises na área de Urgência e Emergência, 16 enfermeiros, participaram do estudo. Estatística AC1 foi utilizada para avaliar a concordância inter-avaliadores.

Resultados: o roteiro/script e storyboard foi validado e alcançado 100% da avaliação em "concordo" ou "concordo fortemente". Classificados em "concordância considerável", com AC1 0,70 e p<0,0001, na concordância inter-avaliadores geral.

Conclusão: este estudo proporciona contribuição exponencial no processo ensino-aprendizagem sobre o ensino de Ressuscitação Cardiopulmonar no adulto em Suporte Básico de Vida com o uso do Desfibrilador Externo Automático no ambiente hospitalar, pelo desenvolvimento do vídeo de simulação validado.

DESCRITORES: Ensino; Tecnologia Educacional; Ressuscitação Cardiopulmonar; Cuidados para Prolongar a Vida; Simulação.

CONSTRUCCIÓN Y EVALUACIÓN DE UNA SIMULACIÓN EN VIDEO PARA LA ENSEÑANZA DE RESUCITACIÓN CARDIOPULMONAR

RESUMEN:

Objetivo: desarrollar Tecnología Educativa Digital (video de simulación) sobre Resucitación Cardiopulmonar en adultos en Soporte Vital Básico con el uso del Desfibrilador Externo Automático en el entorno hospitalario.

Metodología: se trata de una investigación de producción tecnológica aplicada que se desarrolló en la Universidad de San Pablo, Facultad de Enfermería de Ribeirão Preto, durante el período de enero de 2017 a marzo de 2018. Los participantes del estudio fueron especialistas en el área de Urgencia y Emergencia, específicamente 16 profesionales de Enfermería. Se utilizó la estadística AC1 para evaluar la concordancia entre los evaluadores.

Resultados: se validaron el guion y el desarrollo secuencial (storyboard) con un 100% de las evaluaciones calificadas como "De acuerdo" o "Plenamente de acuerdo", clasificadas como "Concordancia considerable", con valores de AC1=0,70 y p<0,0001 en la concordancia general entre evaluadores.

Conclusión: este estudio proporciona un aporte exponencial en el proceso de enseñanza-aprendizaje sobre la enseñanza de Resucitación Cardiopulmonar en adultos en Soporte Vital Básico con el uso del Desfibrilador Externo Automático en el entorno hospitalario, mediante el desarrollo del video de simulación validado.

DESCRIPTORES: Enseñanza; Tecnología educativa; Resucitación Cardiopulmonar; Cuidados para prolongar la vida; Simulación.

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INTRODUCTION

Contemporaneity demands the guarantee of new possibilities for teaching and learning, and this is evident in the significant changes that have occurred in Nursing, especially in the field of education, associated with the advancement of technology and with the way in which information is being worked on for the contribution of an adequate pedagogical practice[1].

The active methodologies deserve to be highlighted, as they aim at adapting and meeting the profile recommended by the new curricular guidelines and at becoming a necessary and significant instrument in the teaching-learning process. In this way, they collaborate for the development of an ethical, critical, reflective, transformative, and qualified professional training, going beyond the limits of purely technical training, to expand the possibilities and paths of students and teachers, thus providing diversified and qualified learning opportunities[2].

The main international organizations that structure the guidelines on Cardiopulmonary Resuscitation (CPR) cite the importance of training and emphasize that it must take place in different modalities, in a way adapted to the target audience, offering multiple teaching methods, so as to ensure acquisition and retention of knowledge, skills, and attitudes in the care of Cardiorespiratory Arrest (CRA)[3]. When considering the learning objective in the CPR theme, building competence requires methods with a standard of excellence to perform it properly[4-5].

The use of CPR teaching-learning videos has the potential for excellence to be used as a tool and advancement in the training of health professionals, since it is economically viable due to the ease for their integration with other pedagogical approaches and strategies with the use of active methodologies[6].

By using videos to teach CPR, there is an increase in the acquisition of knowledge and skills and, specifically, the use of video simulation is a promising tool for CPR education, as it motivates learning and increases attention in the learners[7].

It is known that the American Heart Association (AHA) produces videos on the CPR theme and others available in YouTube; however, it is essential to build updated and validated objects that foster interest in enabling knowledge and skills, in the specific context of CPR in adults in Basic Life Support (BLS), using the Automatic External Defibrillator (AED).

Given the above, the objective of this study was to develop and produce a simulation video about CPR in adults in BLS, with the use of the AED in the hospital environment, for teaching and learning the theme.

METHOD

This study was carried out using the method of applied research, of technological production[8]. The video was developed according to the CPR guidelines by the AHA[4] and to the CRA/CPA registration according to the In-hospital Utstein Style[9] report, in Laboratory I of the Simulation and Nursing Practice Center (*Centro de Simulação e Práticas de Enfermagem*, CSPE) at the Ribeirão Preto College of Nursing of the University of São Paulo (*Escola de Enfermagem de Ribeirão Preto/Universidade de São Paulo*, EERP/USP), from January 2017 to March 2018. For the construction of the video, the methodological trajectory proposed by Fleming, Reynolds and Wallace[10] was used, as shown in Chart 1.

Chart 1 - Basics for developing the simulation video. Ribeirão Preto, SP, Brazil, 2018

PHASE I	STAGE 1: Writing the script and storyboard	The script was structured with information related to the construction of the scenario (location, mannequin, team, materials, and equipment), description of the case and scenes. In the sequence, the narration, speeches, and actions of the actors for the execution of the simulated scenario were described. The storyboard was structured in a frame with three columns (Audio/Narration, Images/Scenes, and Photos/Text). The narration and lines were distributed in the Audio/Narration column; the details of the actions performed, in the simulation in the Images/Scenes column; the texts, images, logos and animations, in the Photos/Text column. The script and storyboard were presented with notes of the references used.
PHASE II	STAGE 2: Validation of the script by experts	For validation of the script and storyboard by the experts, the following aspects were considered: Objective, Content, Relevance, Environment, Verbal Language, and Topic Inclusion.
	STAGE 3: Validation of the storyboard by experts	
	STAGE 4: Rehearsal with the actors	Held in Laboratory I of the CSPE of EERP-USP. Conducted by the researchers, accompanied by professionals with experience in Urgency and Emergency (UE), and by technical professionals in audiovisual media, involved in filming the scenes and/or editing the video.
	STAGE 5: Footage of the scenes	The rehearsal was conducted according to the content of the validated script and storyboard. Executed according to Stage 4 – Rehearsal with the actors. After the rehearsals, the scenes were filmed.
	STAGE 6: Development of images and animations	Support from the Multimedia Creation and Production Service (*Serviço de Criação e Produção Multimídia*, SCPM) of EERP/USP was requested for the creation of animations in videos. Images of the links in the Survival Chain were inserted according to the scene. Texts have been included in the footer to reinforce concepts and/or information. Insertion of computer graphics animation using the After Effects program (representing the blood flow during External Chest Compressions).
	STAGE 7: Audio narration/ recording	Conducted by a specialized professional, trained in Journalism and with experience in presentation on radio and television, linked to the Studio School of the State University of Minas Gerais (*Universidade do Estado de Minas Gerais*, UEMG) - Passos Unit.
PHASE III	STAGE 8: Edition	Conducted by an audiovisual technician with experience in the construction of videos of the SCPM of EERP/USP, considering the definitions in Stage 6 and following the detailed information in the video storyboard. The researchers provided guidance regarding the details in the edition to comply with the storyboard.

Source: Research data, 2018.

Expert nurses in the Urgency and Emergency (UE) area participated in the evaluation and validation of the script and storyboard of the simulation video. To select them, a survey was carried out in research groups of the National Council for Scientific and Technological Development (CNPq) related to UE, searching by authors of articles/journals related to CRA/CPA published in national articles, and professors in the UE area in higher education institutions in different regions, at the discretion of the researchers. To classify them, the scoring criteria proposed by Fehring[11] were used.

Nurses with experience/training/teaching in the UE area were included, with a minimum score of five points, a minimum value to be considered an expert[11]; and those who were on vacation/leave during the data collection period and who did not conduct the assessment of the instruments in the specified period (30 days) were excluded. An invitation was sent via e-mail with the objectives of this study to 26 expert professionals; 18 answered affirmatively to participate, and 16 completed the evaluation and validation process. In order to improve the validation process by the experts, explanatory guides were structured for the validation of the simulated video, where the aspects to be considered in the validation process were presented.

The researcher selected three Nursing professionals, with experience in CPR, as assistants for the development of the simulation video scenario. Professionals linked to the SCPM of EERP/USP and to *Estúdio Escola* of UEMG - Passos Unit - participated in the recording of the simulated video; they availed the equipment, positioning it properly and with technical guidelines so that the images were optimally captured. In Laboratory I of the CSPE of EERP/USP, a simulated scenario of a Reception Room and Risk Classification of a Hospital Emergency Service (Size I) was structured, where the images were captured.

For the validation of the script and storyboard of the simulation video (Stages 2 and 3), an instrument adapted from the model developed and applied by Ferreira[12] was used, with answer options on a five-point Likert scale ("Strongly agree", "Agree", "Disagree", "Strongly disagree". and "I do not know") and items addressing the following issues: objective, content, relevance, environment, verbal language, and topic inclusion. The script and storyboard of the simulation video were considered with validated content if 80% of the experts attributed the evaluation as "Strongly agree" and "Agree" in the validation instruments.

After making the adjustments identified in the validation phase, tests (Stage 4) were carried out in the Laboratory, following the validated script, together with the research assistants, for synchronizing the actions and memorizing the scenes/speeches. During the rehearsals, which lasted approximately eight hours, the equipment was adapted, including the cameras, adjustments to the speeches and performance of the actors, training in relation to the handling of the equipment, handling to minimize noise by the staff behind the scenes, and adequacy of the tone of voice by the actors.

The filming of the scenes (Stage 5) took place on December 15th, 2017, at Laboratory I of the CSPE of EERP/USP, lasting approximately five hours. The SCPM of EERP/USP worked on the development of images and animations (Stage 6) and on the editing (PHASE III - Stage 8) of the simulation video, carried out from December 2017 to March 2018, with a dedication of approximately 40 hours. It is noteworthy that one of the items in the editing stage was performed using computer graphics with "post production" animation, using the After Effects program, representing the effect of External Chest Compression on blood flow (image of the heart at the level of the victim's chest) moving and producing systemic blood flow), as shown in Figure 1.

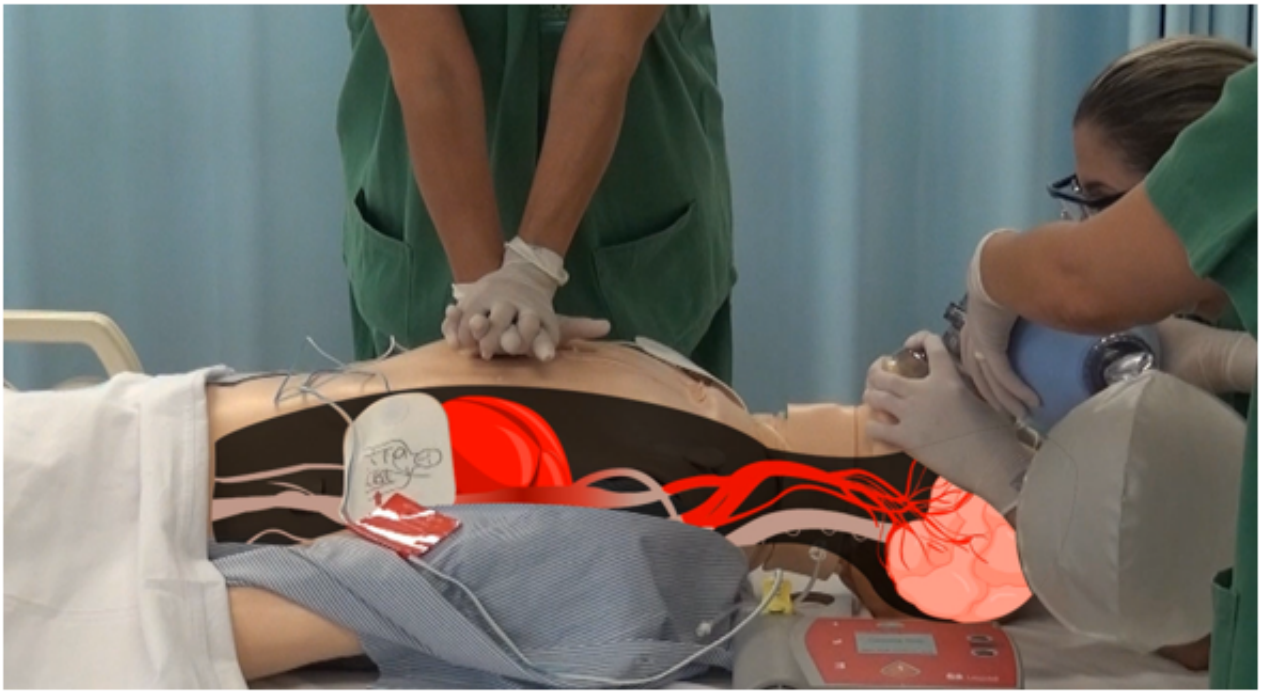

Figure 1 - Image with editing by means the After Effects program representing the blood flow during the ECCs. Ribeirão Preto, SP, Brazil, 2018

For the characterization of the experts, descriptive statistics were performed, with an indication of frequency, percentage, and position measurement (mean). In the inter-rater agreement, it was decided to use of the AC1 statistic[13]. In assessing the inter-rater agreement of the simulation video, it was applied according to the items related to the questions related to the objective, content, relevance, environment, verbal language, and topic inclusion.

The data were organized with double typing in Microsoft Excel 2010® spreadsheets, with subsequent validation of data reliability. The R program, version 3.4.1, was applied for concordance analysis, and a significance level of 5% was chosen ($p<0.05$). The values defined by Landis and Kock[14] were adopted to categorize the inter-rater agreement, according to Chart 2.

Chart 2 - Categorization of the inter-rater agreement classification. Ribeirão Preto, SP, Brazil, 2018

Agreement classification	AC1 coefficient
Deficient	<0.00
Slight	0.00 – 0.20
Acceptable	0.21 – 0.40
Moderate	0.41 – 0.60
Considerable	0.61 – 0.80
Almost perfect	0.81 – 1.00

Source: Landis and Kock[14].

Agreement is considered satisfactory for indexes with values greater than 0.60, thus offering useful benchmarks for the discussion of results[14].

The project was approved by the Research Ethics Committee of EERP-USP, number 2,002,839. The study observed Resolution 466/2012 of the National Health Council. Authorization was requested for the use and adaptation of the validation instruments, the musical arrangement used in the video was also authorized by the composer.

The professionals participating as actors in the videos were given the Authorization Term for the use of images and voice; after they signed it, the images were captured. The experienced professionals who agreed to participate were sent the Free and Informed Consent Form (FICF) via electronic or printed mail, according to the experts' preference.

RESULTS

The experts who participated in the validation of the script and storyboard of the simulation video were 13 (81.25%) women and three (18.75%) men. Their age ranged between 29 and 55 years old (mean 36.56 ± 7.33) and their training time, between four and 32 years (mean 12.93 ± 7.51). Regarding academic degrees, 13 (81.25%) have some specialization, 15 (93.75%) are MSs, 10 (62.50%) are PhDs, and three (18.75%) have a Post-Doctorate degree. It is noteworthy that eight (50%) work in higher education teaching.

The participating professionals are from different Brazilian states: seven (43.75%) from São Paulo, four (25%) from Minas Gerais, two (12.50%) from Rio Grande do Norte, one (6.25%) from Pernambuco, one (6.25%) from Alagoas, and one (6.25%) from Mato Grosso do Sul. In relation to the classification of the scoring of the experts[11], an excellent classification was observed, highlighting the majority of the experts with a score greater than or equal to ten (62.5%) and four (25%) with a maximum score: 14 points.

It is also worth mentioning that 15 (93.75%) have at least one year of clinical practice in UE in adults, 10 (62.50%) have published an article in a reference journal on the UE theme, and eight (50%) are PhDs in the UE area. The data collected in the validation of the script and storyboard of the simulation video were analyzed and are shown in Table 1.

Table 1 - Distribution of the experts' answers (n=16) for evaluating the Script and Storyboard of the simulation video. Ribeirão Preto, SP, Brazil, 2018 (continues)

Variables	Strongly Agree		Agree		Disagree		Strongly Disagree		I do not know	
	n	%	n	%	n	%	n	%	n	%
Objectives										
The objectives are coherent with the practice in CPR	15	(93.25)	1	(6.25)	0		0		0	
The objectives are coherent with the objectives proposed in the research	15	(93.25)	1	(6.25)	0		0		0	
The objectives are adequate to be effective	14	(87.5)	2	(12.5)	0		0		0	
Content										

The content presented in the script corresponds to the proposed objectives	12	(75)	4	(25)	0	0	0
The content facilitates the teaching-learning process on the theme	10	(62.50)	6	(37.50)	0	0	0
The content enables the understanding of the theme	13	(81.25)	3	(18.75)	0	0	0
The content follows a logical sequence	15	(93.25)	1	(6.25)	0	0	0
The content incorporates all the necessary steps to perform CPR in BLS with the use of the AED by professionals in an in-hospital environment in an orderly manner	14	(87.50)	2	(12.5)	0	0	0
The content has all the necessary materials for CPR in the BLS with the use of AED in an in-hospital environment	11	(68.75)	5	(31.25)	0	0	0
The list of information that the script presents is correct	12	(75)	4	(25)	0	0	0
Relevance							
The images, scenes and photos illustrate important aspects for the practice of CPR in BLS with the use of the AED by professionals in the hospital environment.	14	(87.50)	2	(12.50)	0	0	0
The images, scenes and photos are relevant so that CPR in BLS using the AED by professionals in the hospital environment is of high quality	14	(87.50)	2	(12.50)	0	0	0
The images, scenes and photos allow for the transfer of content learned to the professional practice	14	(87.50)	2	(12.50)	0	0	0
Environment							
The setting is suitable for the transmission of the video class	13	(81.25)	3	(18.75)	0	0	0
The scenario is adequate for learning the theme	13	(81.25)	3	(18.75)	0	0	0
Verbal language							
The verbal language used in the script is accessible to the target audience	14	(87.50)	2	(12.50)	0	0	0
The verbal language is easy to assimilate	13	(81.25)	3	(18.75)	0	0	0
Topic inclusion							
Objective of the video lesson	15	(93.75)	1	(6.25)	0	0	0
Concepts of CPA, CPR, and BLS	14	(87.50)	2	(12.50)	0	0	0
Stages in the Chain of Survival for the in-hospital environment	15	(93.75)	1	(6.25)	0	0	0
CPA/CPR registration	15	(93.75)	1	(6.25)	0	0	0

Source: Research data, 2018.

In all the items, a 100% evaluation was evidenced in "Strongly agree" or "Agree". The inter-rater agreement is shown in Table 2.

Table 2 - Inter-rater agreement measure (n=16), related to the validation of the Script and Storyboard of the simulation video. Ribeirão Preto, SP, Brazil, 2018

Variables	AC1	EP _ AC1	p-value*
Objective	0.81	0.0504	0.0039
Content	0.47	0.1126	0.0061
Relevance	0.70	0.0000	<0.0001
Environment	0.53	0.0000	<0.0001
Verbal language	0.62	0.0844	0.0860
Topic inclusion	0.82	0.0371	0.0002
General	0.70	0.0414	<0.0001

Source: Research data, 2018.
*Significance level of 5% ($p < 0.05$)

"Almost perfect agreement" is evidenced in the questions related to the objective and topic inclusion, with AC1 being 0.81 and 0.82, respectively. "Considerable agreement" is achieved in relevance, with AC1=0.70, and in verbal language, with AC1=0.62. Content and environment are classified as "Moderate agreement", with AC1 values of 0.47 and 0.53. The overall inter-rater agreement, including all items in the simulation video, is classified as "Considerable agreement", with AC1=0.70 and p<0.0001.

The simulation video was completed with a duration of 14 minutes and 19 seconds, entitled "Cardiopulmonary Resuscitation in adults with the use of the Automatic External Defibrillator in Basic Life Support in the hospital environment"[15], freely accessible on a video sharing platform (Figure 2), targeting students and health professionals.

Figure 2 - QR-CODE for accessing the video entitled "Cardiopulmonary Resuscitation in adults using the Automatic External Defibrillator in Basic Life Support in the hospital environment". Ribeirão Preto, SP, Brazil, 2018

DISCUSSION

In health, technology increases the opportunities for projecting, testing, and implementing tools that enable preparation for decision-making. It should be noted that, in educational processes related to Health Sciences, the use of videos in the teaching-learning process does not eliminate the need for guidelines and practices monitored in person by a teacher/tutor[2].

The use of videos demonstrating realistic environments is a promising method, as it shows the demonstration of actions and techniques with the possibility of greater knowledge retention and skill development[16]. The development of simulated high-fidelity scenarios, available for viewing on portable devices, offers great opportunities for teaching and learning[2].

In this study, it was decided to use Laboratory I of the CSPE of EERP/USP, as it has a high-fidelity mannequin (SimMan®), allowing the simulation video to show a simulated scenario, but compatible with the real practice environment. The concern about the development of the scenario was diligent, in order to guarantee a simulated scenario that really reflected a context of real clinical practice, appropriate to the target audience.

In the video produced in this study, the exhibition time was 14 minutes and 19 seconds, in line with the guideline of another study[12]. It is noteworthy that frequent viewing of short videos increases learning and self-efficiency during CPR and, in addition, video production is a low-cost material that generates cognitive productivity compared to other teaching materials[17]. Partnerships can and should be carried out in order to minimize the costs related to video production. In this study, partnerships were made with the CSPE and the SCPM of EERP/USP, as well as with *Estúdio Escola* of the UEMG.

When looking for quality, studies determine that the validity of the content must be established, determining the validation and the construct in accordance with the evaluation of different specialists and the stability of a test being repeatedly evaluated under different circumstances in which it should produce similar results, inter-rater reliability[18].

The method for assessing inter-rater agreement must be carefully selected by the researchers, in order to ensure that the statistics fit the design and objective of the study, as well as to use them appropriately[19]. Thus, it was decided to determine the inter-rater agreement in this study using the AC1 statistic[13], as there is strong evidence that this test is superior for inter-rater reliability analysis, when compared to another statistical test (Kappa)[20].

The statistical properties of AC1[13] are high, due to their supposed ability to correct the agreement of percentages determined by random assessments. It is developed so that the propensity to evaluate at random is proportional to the part of the classifications that can lead to an evaluation by chance[13]. A good level of agreement is important, as it determines confidence in the items evaluated[20]. In the assessment of the inter-rater agreement of the simulation video, a mean of 0.70[14] was obtained, reflecting "inter-rater agreement" with a statistically significant difference ($p<0.0001$). It is noteworthy that 100% of the items in the simulation video were assessed as "Strongly agree" or as "Agree".

Despite advances in science in relation to CPR, BLS remains a critical factor in determining results, and it is necessary to incorporate the scientific evidence recently published to teach this theme[5]. It is essential to teach CPR in adults in BLS with the use of the AED in a contemporary, appealing, relevant, and convenient way, promoting changes in behavior by means of teaching sustained in updated scientific evidence. The publication of the latest AHA update on BLS took place in January 2018, and provided relevant information regarding the level of evidence. It should be noted that there has been no change in technical guidelines and/or operational conduct[5], which ensures that the content produced in this study is based on updated scientific evidence with an international repertoire.

Virtual objects represent a powerful tool, especially for new generations and, by associating virtual objects with the traditional teaching model, better results in CPR learning can be achieved[21].

CONCLUSION

The use of appropriate videos in the teaching-learning process is a challenge. It is necessary that the applied content is updated, and that the evaluation strategies really make it possible to identify the retention of knowledge, skills, and attitudes. The need for video production is evidenced by the transformation in the profile of the staff, and it is evident that there is a relationship between the teaching-learning process and the technological resources.

The application of the video, carrying out clinical validation, will be conducted in a later study, with implementation with students and health professionals, so as to identify the effectiveness and impact on the teaching-learning process. In addition, the revalidation (test-retest) by experts after changes made through the accepted suggestions and failure to validate the finished video after editing is pointed out as a limitation.

This study represents an important contribution to the teaching-learning on teaching CPR in adults in BLS with the use of the AED in the hospital environment, through the development of simulation video.

By means of the object developed, it will be possible to disseminate the possibility of teaching and learning on the theme herein discussed, enabling to conduct teaching, research, and extension strategies in a contemporary, updated, and validated manner.

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