Development and assessment of educational technology about administration of vaccines in the anterolateral thigh muscle

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ABSTRACT

Development and assessment of a course of administration of vaccines in the anterolateral thigh muscle, by the Moodle Platform. Quantitative, descriptive and cross-sectional research, carried out in 2016 and 2017, with 39 nursing students. The theory of multimedia learning and the instructional design guided the course development, which counted on three modules and teaching support material, simulated scenario video, discussion forum. The COLLES Survey was used to assess the AVA quality; 97.5% of students considered the formatting, the access, the navigation and the image as "adequate" and "very adequate". The relevance, critical reflection and comprehension items were found to obtain the best results, according the COLLES Survey; 92.3 of students said that they would like to use the AVA in other disciplines. It concluded that the educational technology developed is a powerful tool for the updating about the thematic, aiming at a safe practice of the future professional nurse in the health services.

Descriptors: Educational Technology; Education, Nursing; Vaccines.

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INTRODUCTION

The nursing has in its essence the take caring. The preparation and administration of vaccines is considered one of the main attributions of these professionals, with this reality experienced daily in the Family Health Strategy (ESF), while only can be accomplished with effectiveness through team´s work [1].

In addition, it noticed that the effectiveness in the administration of immunobiologicals has direct relation with the knowledge of the nursing team about the vaccines preparation and administration. Severe risks for patients, such as Post-Vaccination Adverse Events (EAPV), can be caused by failures in these procedures, and to promote a safe environment for the practice of immunization is of responsibility of the professional nurse [2].

Nowadays, it is observed a significant increase in the use of the anterolateral thigh muscle, being the local indicated for most vaccines of the basic calendar, particularly in children under two years of age, since in this age group this is the muscle with greater mass[3-4].

The administration of immunobiological is a complex procedure and, although its content is taught in the undergraduate nursing course and in the technical course, often in the classroom teaching, the use of technological tools present a great variety of possibilities and innovations what can assist in the teaching and in the updating of the future professional nurses´ knowledge [5].

The technological progress, including in the health area, occurred in the last decades, has led to a need to introduce innovations not only in the teaching of nursing, but has changed the teaching-learning process and pointed a new trend in education as a whole, by means of the increasing use of Information and Communication Technologies (TIC) (TIC)[6].

The TIC can create interactive, dynamic and multi-sensorial experiences, besides being a more autonomous learning, factors that can contribute to the improvement of the teaching-learning process [7-8].

In this context, there is the development of the Virtual Environment Learning (AVA), which consists of computer systems available in the *internet*, destined for support to activities mediated by the TIC. The AVA enables the integration of several medias, languages, resources and activities, with information in an organized way, the development of interactions between people and objects of knowledge and the elaboration and socialization of productions, innovating the teaching of nursing [9].

The *Modular* Platform *Object-Oriented Dynamic Learning Environment* (*Moodle*) is one of the virtual learning environments most used by the higher education institutions in Brazil, since enables the simulation of several situations in classrooms, the academic management of the participants, the elaboration of access reports and activities, and promotes the interaction between students and teachers, enabling, in this way, greater autonomy and acquisition of new skills [10].

The *Moodle* is a software of free use, that allow the teachers, tutors and students to work in an *online* learning environment password-protected, available in more than 40 idioms[11]. The teachers can conduct courses via the Internet by means of their education institution [9].

In *Moodle*, text files may be available, audio and video, counting on resources of synchronous communication such as the chat, in which the participants have a discussion between teachers and students, in real-time via the Web. Beyond the asynchronous communication, such as discussion forums, which allows the debate between the teachers, tutors and students; and *wikis*, which are texts constructed in a collaborative way [7].

In front of this, it is intended to use the AVA as resource of teaching - learning of Nursing undergraduate students from the last periods for the administration of vaccines in the anterolateral thigh muscle in children. This mechanism can provide and stimulate the knowledge update and the autonomous learning, which contributes to the formation focused on competences and a greater security for the future nurse professional and the patient in the clinical practice, in the Primary Health Care (APS).

This study had as objective to develop and evaluate an *online* course about administration of vaccines in the anterolateral thigh muscle, through the *Moodle* Platform. Thus, to promote an updating on the thematic for nursing undergraduate students from the last periods.

METHODS

Quantitative, descriptive and cross-sectional research carried out during the period from November 2016 to June 2017, with 39 nursing undergraduate students of the Federal University of Alfenas (UNIFAL-MG) from the 7th, 8th and 9th periods and with age between 20 to 40 years.

Inclusion criteria were defined such as undergraduate degree students from the 7th, 8th and 9th nursing periods, enrolled in the 1st academic semester of 2017, irrespective of gender and age, and that agreed to participate in the research through signing of the Informed Consent Form (TCLE). As to the exclusion criteria, these were: students who, even enrolled in the 7th, 8th and 9th periods of the first semester of 2017, were not available to participate in the research due to medical license, and dependence in other discipline of the same period, which made it difficult its participation in the time schedules destined to carry out of the research. Those who met the inclusion criteria established were invited to participate in the research, and the acceptance occurred through reading and signing of the TCLE.

This study was performed in two steps, in which the first was attributed to the course development about administration of vaccines in the anterolateral thigh muscle, in the AVA, and the second was intended to offer and assess this course by the participants.

The course development was based on the Theory of multimedia learning [12], which states that the learning is configured in a building process, attributing to the resources a great potential of improvement for the learning, by means of a set between textual, sounding and pictorial resources [12].

The instructional *design* process was used for the development of the course and its mediatic resources, and is configured in five different steps: analysis, in which the educational objectives are identified according to course participants; *design*, in which the appropriate mediatic resources are defined for an effective learning by means of a matrix; development, in which all elements were gathered or created for each module; implementation, on which occurs truly the educational action; and, at last, the assessment, which should count on the educational contents quality analysis and the effectiveness of the participants´ learning [13].

The videos development occurred by different steps. Initially, in the pre-production phase, a script was developed for each of them, in accordance with the guidelines of the Ministry of Health [3] as for the nurse at the vaccination room. It was also used the same reference with regard to physical structure, equipment, permanent materials, furniture and to basic supplies of the vaccination room, so that the material to be produced was as reliable as possible to the real. Thereafter the filming was conducted in the simulated scenarios produced in the

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Communication Skills Laboratory of the Medicine Course and at last, the videos edition was conducted in the studio of the Open Distance Learning Center (CEAD) of the UNIFAL-MG.

The tool used for the videos edition of the course was Sony Vegas. She counts on diverse plug-ins, and is considered, among the edition programs, one of the best, next to Adobe Premiere. It has in its repertoire professional tools, quality output and ease of operation. It presents ability to work in the different advanced resolutions and tools. In addition, the app allows making editions with ease, just learn the editions control[14].

As indicated by the instructional *design* building process [13], a matrix of cognitive, attitudinal and skills competences was elaborated, in order to guide the selection of the appropriate mediatic resources for each educational objective purposed, and then privileging the development of these competences s[15].

The Modules 1, 2 and 3 counted on videos of simulated scenarios. For the Module 3 a clinical case study was made available by means of a video, followed by a discussion forum. The tool Sony Vegas was used for the editions of the simulated scenarios videos and the simulated clinical case study video.

After the realization of the course, the students evaluated the formatting, the access, the navigation, the hypertext and the images, in addition to mediatic resources and time available for realizing the course and whether would like to use AVA in other courses and disciplines.

The Questionnaire *Constructivist On-Line Learning Environment Survey* (COLLES)[16] was applied to assess the AVA quality. It is a validated instrument to assess six different domains of courses developed in the *Moodle* platform: relevance, critical reflection, interactivity, tutor support, colleagues support and comprehension.

The COLLES questionnaire has been widely used [17-18] for the assessment of the *Moodle* platform by the students since it integrates the own Platform as "evaluation research".

The Research Ethics Committee of the Federal University of Alfenas by Opinion No. 1.817.683, CAAE, approved the study: 59543416.8.0000.5142, in accordance with the Guidelines and Standards Regulating Research involving Human Beings, Resolution of the National Health Council No. 466/12[19].

RESULTS

The videos creation preceded different meetings with the responsible for CEAD, with the aim at presenting them to the script and the simulated scenario, in which the same contributed with ideas and indicated possible adjustments in the script so that the material could be more dynamic and attractive to the participants in the research.

Before the filming, that is, the videos production, several technical trials were conducted which resulted in 12 hours of recording. In the final stage of editing, three videos were produced, being the first lasting four minutes and 56 seconds, the second with four minutes and 12 seconds and the third lasting six minutes and 45 seconds.

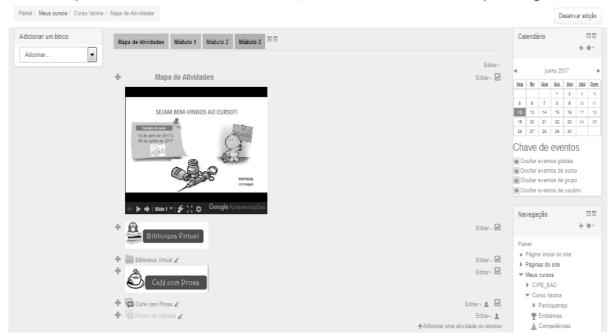Of 39 students, the female prevailed (87.2%) and mean age was 24.9 years.

The course was divided into three modules, 1) Hand hygiene in vaccination rooms, 2) Preparation for the administration of vaccines in the anterolateral thigh muscle in children and 3) Administration of vaccine in the anterolateral thigh muscle in children.

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As for its structure, as shown in the Activities Map (Figure 1), there is the Virtual Library, with official publications about recent updates of the National Calendar of Vaccination. The World Café was used for messages and doubts

Figure 1: Course activities map (home page).

The first module had as content the historical perspective of hand hygiene, microbiological aspects of the skin and transmission of pathogens, products, equipment and necessary supplies for the hand hygiene, its purposes, types of techniques and the one indicated for using in the vaccination room. The second module was focused on the care in vaccines storage and handling, particularities of the transport and reconstitution of immunobiologicals, a brief presentation about cold chain management and the combined pentavalent that was selected for the case study for containing five vaccines.

The third module shows the anterolateral thigh muscle and the vaccine administration technique, the PVAE, emphasizing those main related to the pentavalent vaccine, the care for the waste of the vaccination room and the vaccine recorded in the children´s health Books. A tutorial with guidelines about the course has also been elaborated, as presentation, dynamics, access and navigation.

As for the evaluation of the course by the participants, the Table 1 presents the percentage distribution about the formatting, access, navigation, hypertexts and images.

Table 1: Percentage distribution carried out by the participants in the study about the course characteristics. Alfenas, MG, Brazil, 2017.

	Inadequate	Little Adequate	Adequate	Very Adequate
	% (n)	% (n)	% (n)	% (n)
Formatting	-	2.5 (1)	43.5 (17)	54.0 (21)
Access	-	2.5 (1)	38.4 (15)	59.1 (23)
Navigation	-	2.5 (1)	38.4 (15)	59.1 (23)
Hypertexts	2.5 (1)	5.1 (2)	35.8 (14)	56.6 (22)
Images	-	2.5 (1)	33.3 (13)	64.2 (25)

Table 2 shows the percentage distribution of the participants in the study in the evaluation of the mediatic resources used in the course.

Table 2: Percentage distribution of the general evaluation of the mediatic resources by the course participants. Alfenas, MG, Brazil, 2017.

	Inadequate	Little Adequate	Adequate	Very Adequate
	% (n)	%(n)	%(n)	%(n)
Teaching support material	-	-	23.0 (9)	77.0 (30)
Simulated scenario video	-	2.5 (1)	28.2 (11)	69.3 (27)
Forum	-	-	41.0 (16)	59.0 (23)

All modules showed teaching support material that was elaborated by the authors, in PDF version, so that the student could download, save the file or print.

As for the discussion forum, a simulated scenario video was used with a clinical case study, followed by two trigger questions: question 1 – "Identify at least one procedure carried out in an inadequate way in the pentavalent vaccine administration and justify your choice"; and question 2 – "Once you´ve identified a procedure carried out in an inadequate way in the administration of the pentavalent vaccine in the anterolateral thigh muscle, describe how the technique must be carried out in an adequate way".

Two tutors, whom carried out diverse interventions in order to increase the interaction among the participants in the forum, mediated the forum.

It was noticed that all students participated in the discussion forum, with 75 comments relating to the question 1, with an average of 1.92 accesses by participant and 76 comments relating to the question 2, with an average of 1.94 accesses by participant.

As for the time available for the course realization, the participants have considered: two (5.0%) little adequate, 14 (35.9%) adequate and 23 (59.1%) very adequate.

Regarding the AVA use in other courses and disciplines, 36 (92.3%) stated that they would like to use.

The Table 3 shows the percentage distribution of the participants´ answers of the study to the COLLES Questionnaire- Actual Experience.

It can be noted that the items relevance, critical reflection and understanding got better results, according to COLLES Questionnaire. As for the items interactivity and support of colleagues were the ones who got the lowest percentages, with answers "almost never" and "rarely".

Table 3: Percentage distribution of the participants´answers to the COLLES Questionnaire. Alfenas, MG, Brazil, 2017.

Items	Almost never	Rarely	Sometimes	Often	Almost always
	ƒ (%)	ƒ (%)	ƒ (%)	ƒ (%)	ƒ (%)
Relevance					
1. I focus on interesting subjects.	2 (5.1)	-	6 (15.4)	21 (53.8)	10 (25.7)
2. Important for the practice.	-	-	-	15 (38,3)	24 (61,7)
3. It improves my performance.	-	-	1 (2.5)	14 (35.8)	24 (61.7)
4. It has good connections to my activity.	-	-	1 (2.5)	20 (51.3)	18 (46.2)
Critical Reflection					
5. I criticize the contents.	1 (2.5)	-	6 (15.4)	22 (56.4)	10 (25.7)
6. I reflect on my learning.	-	-	3 (7.9)	21 (53.8)	15 (38.3)
7. I criticize my own ideas.	-	-	6 (15.4)	19 (48.8)	14 (35.8)
8. I criticize the other participants´ ideas.	1 (2.5)	2 (5.1)	15 (38.3)	16 (41.0)	5 (13.1)
Interactivity					
9. I explain my ideas.	1 (2.5)	2 (5.1)	17 (43.5)	16 (41.0)	3 (7.9)
10. I ask for explanations.	-	2 (5.1)	17 (43.5)	18 (46.3)	2 (5.1)
11. I´m asked for explanations.	1 (2.5)	4 (10.2)	15 (38.3)	12 (30.9)	7 (18.1)
12. Participants react to my ideas.	3 (7.9)	3 (7.9)	21 (53.8)	9 (22.5)	3 (7.9)
Tutor support					
13. Tutor encourages to reflect.	-	1 (2.5)	9 (23.0)	21 (53.8)	8 (20.7)
14. Tutor encourages me.	-	2 (5.1)	5 (12.8)	21 (53.8)	11 (28.3)
15. Tutor helps to improve my discourse.	-	1 (2.5)	15 (38.3)	13 (33.5)	10 (25.7)
16. Tutor helps the self-criticism.	1 (2.5)	-	13 (33.5)	16 (41.0)	9 (23.0)
17. Participants compliment me.	1 (2.5)	9 (23.0)	21 (53.8)	5 (12.8)	3 (7.9)
18. Participants estimate my contributions.	-	7 (18.0)	22 (56.4)	6 (15.4)	4 (10.2)
19. Participants show empathy.	1 (2.5)	7 (18.0)	14 (35.8)	14 (35.8)	3 (7.9)
20. Participants encourage me to participate.	3 (7.9)	7 (18.0)	13 (33.5)	12 (30.4)	4 (10.2)
Understanding					
21. I understand the participants.	-	-	7 (18.0)	22 (56.3)	10 (25.7)
22.Participants understand me.	-	-	16 (41.0)	15 (38.3)	8 (20.7)
23. I understand the tutor.	-	1 (2.5)	4 (10.2)	21 (53.8)	13 (33.5)
24. The tutor understand me.	-	1 (2.5)	8 (20.7)	20 (51.1)	10 (25.7)

DISCUSSION

The predominance of female students is in accord with a similar research, that evidences the preponderance of women on Nursing career [20]. The results of this study, which also used the *Moodle* Platform as one of the pedagogical strategies in an intensive therapy unit, evidenced that the safety in educational resources development allowed the association of different articulated learning strategies to prepare the future nurses for an actual and effective performance [20].

In another study conducted [17] that aimed to develop and evaluate a course in the *Moodle* Platform, about the International Classification for Nursing Practice and nurses professionals, the following data were found: 96.1% considered the visual formatting of the adequate page, 100% considered access to Moodle Platform page and the adequate hypertexts, 98% considered adequate the navigation on internet and the images. Hence the importance of using the instructional *design* steps to make the educational action successful, by recognizing the assessment of the tools relevance, educational objects, technological resources, structure, organization, formatting and access to AVA apart from the assessment of the own learning [13].

It is evidenced the advancement of *web* as a learning space, which allows the nursing students to obtain new ways of communication from innovative pedagogical strategies. The *Moodle* offers an increasing number of tools of teacher-student interaction, by strengthening the building of the sharing knowledge. It is a friendly

environment, of easy access and makes available interactive texts, images, graphics and educative activities that favor the reasoning about the content and the development of new learnings [5].

The use of the mediatic resources in the education in nursing presents as the main function offering support to the students for success in the teaching and learning process [21]. Among these resources, the support of didactic material is emphasized, which was the most well-assessed by the participants, counted on the combination of the matrix visual and verbal, organized in text and image, which plays an important role today in the education, either face-to-face or at distance [9,13]. The support didactic material must count on technical, graphical and pedagogical aspects [17].

The other mediatic resources used were the simulated scenario video and the discussion forum. The video is an extremely powerful media to attract and retain the attention of the ones who assist it, due to its functions of capture, storage, transmission and presentation of moving sounds and images, makes them that there are combination of the sound, visual and verbal matrixes and, also, the ease of offering contents that would have been difficult to be made available in other types of media, such as demonstration of situations and skills [13].

The use of audiovisual and sound resources in virtual learning environment is anchored in the Theory of Multimedia Learning [12] that establishes three principles: the assumption of the dual-channel mode, in which the human being has separate channels for processing of information (visual and verbal), the one of the limited skill, that is, limitation in the processing of information in each channel, and the other regarding the active learning, in which the learning requires an essential cognitive processing in both of channels.

According to this theory, people deepen more their knowledge from images and words than only isolated words. If during the learning process the content is built through words and images (hearing and vision), there will be greater success in the learning than if it will be focused only on the verbalization system.

It observes in this study that, the students used not only their visual skill, but also the sound skill, complementing its skill of learning [12-13].

Certainly, only adding images to spoken words do not ensure an educative success. It is essential that the multimedia presentation is adequate to the public to which is destined. For that, the instructional *design* with its steps orientate the production of mediatic resources to reach the educational objectives proposed to a target public with defined profile [13].

Regarding the forum, the trigger resource was the simulated scenario video of a clinical case. This resource, by presenting a situation-problem and determining factors for its resolution, when available in AVA can be enriched with audio, video and/or animation and digital contents, as conducted in the present course [13].

The discussion forum is one of most fair tools used in the *Moodle* Platform, where the students have freedom to state their opinions about the matter, to post doubts and help other participants, providing the interaction [22].

The role of tutors and teachers in online courses is of starting discussions between the students, since those have a greater knowledge about the thematic that is being approached, and its attribution is also to help the students with information for their development, with the resolution of the problem proposed in the forum and to recognize their skill of discussion and construction of new knowledges with the aid of other participants and tutors [22].

One of the main characteristics of the Education at Distance is the pedagogical flexibility, overcoming the limits of time and space through use of technological resources and, in planning a course in this modality, it´s important to make the time for its carrying out to be adequate to the available contents and to the different individuals´ needs [23].

In research conducted [7] in the same education institution alongside 25 nursing students, it was showed that 92.2% expressed the wish to use the AVA in other courses and disciplines, a fact that corroborates the findings of this present study.

With regard to the COLLES Questionnaire, it states that was an adequate choice for the AVA evaluation by the student, since this Questionnaire monitors *online* nursing practices and it verifies in which measurement these practices are effective, from the participant point of view [18].

As well as in the present research, in study that evaluated an *online* course using the *Moodle* Platform in the permanent education context about the breastfeeding for nurses, the best evaluated items of the strategy through the COLLES by the participants were relevance, critical reflection and understanding, and those with the least scores were the interactivity and the support by the colleagues [18].

The evaluation of the formation in AVA is an important tool for the verification of the competences acquaired by the students, enabling to identify which resources contributed to the final formation result. The *Moodle* Platform provides several modules that allow evaluating the different components of the formative process. In this context, studies of this nature are encouraging sources for the use of new technologies and strategies of teaching in the professional formation of future nurses.

The transformations, by which the whole world is passing, with the production and technological incorporating, have resulted in notorious benefits in several areas, including in nursing, pointing out the need for readjustment of the curriculums [24]. However, so that these technological resources can be used in an effective way, it is essential that there is a planning in the development of these tools and that these can be evaluated, in order to be incorporated in the nursing teaching and address the new demands for interactive, flexible, educational processes and that appreciate the autonomy of the learner individual, including in the immunization area, in which the role of the nurse is essential.

This study present limitation as for the population studied, since it was carried out only with students from the last periods of the nursing undergraduate course of a federal public university. It is recommended the extension of the research for students of other periods of the same institution and for this population in private universities, since the use of the AVA have been a trend in the higher education in general basis.

CONCLUSION

The course reached the educational objectives purposed, since the students´evaluation was quite satisfactory, which reinforces the importance of the use of innovative educational technologies in the nursing undergraduate course.

Among the factors responsible for the course success, the prior planning and the instructional *design* application are detached. As for the mediatic resources used, all of them were very well evaluated, with emphasis on the didactic support material and the simulated scenario video.

At last, the importance of Virtual Environment Learning as a competences updating strategy of the nursing undergraduate students about administration of vaccines in the anterolateral thigh muscle. It believes that this modality of teaching is a potent tool for the learning complementation in different themes, with a view to a safe practice of the future professional nurse in the health services.

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