



ORIGINALES

Educational module in a virtual learning environment on Diabetes Mellitus

Módulo educativo em ambiente virtual de aprendizagem em Diabetes Mellitus
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ABSTRACT:

Introduction: Nursing professionals need to be trained and qualified to care for people with diabetes, where one of the aspects considered as fundamental for this training is the knowledge of the technological resources indicated for the development of the teaching-learning process, such as computer science, internet, hypermedia, multimedia, besides the various tools of interaction and communication.

Objective: The objectives of this study were to develop an educational module about diabetic foot in a Virtual Learning Environment – VLE in the Moodle platform for nursing students and to submit the program to the evaluation of the students.

Method: It is a cross-sectional descriptive study, carried out with 31 students. The educational module was developed as a course distributed in four chapters dealing with diabetic foot. After the course, the students evaluated the module using a validated instrument containing pedagogical aspects (content, interaction and activities) and technical aspect (interface quality) of VLE.

Results: The characteristics that were considered favorable to learning were “content” (91.6%), “activities” (85.8%) and “interface quality” (89.7%). The “interaction” characteristic was the one that obtained the lowest rate (52.7%).

Conclusion: By considering most of the evaluated characteristics, we conclude that Moodle has proved to be an effective teaching tool. Regarding the “interaction” characteristic, it is necessary to improve the

questions that involve the scheduled activities, such as forum and chat, in order to provide a greater relationship among the participants.

Keywords: Distance education; Health education; Nursing; Diabetes Mellitus; Diabetic foot.

RESUMO:

Introdução: Os profissionais de enfermagem necessitam ser capacitados e qualificados para o atendimento às pessoas com diabetes e um dos aspectos considerado como fundamental para essa capacitação é o conhecimento dos recursos tecnológicos indicados para o desenvolvimento do processo de ensino-aprendizagem, como informática, internet, hipermídia, multimídia, e as diversas ferramentas de interação e comunicação.

Objetivos: Os objetivos deste estudo foram desenvolver um módulo educativo sobre pé diabético em Ambiente Virtual de Aprendizagem - AVA na plataforma *Moodle* para estudantes de enfermagem e submeter o programa à avaliação dos alunos.

Método: Trata-se de um estudo descritivo transversal, realizado com 31 estudantes. O módulo educativo foi desenvolvido como curso distribuído em quatro capítulos versando sobre pé diabético. Após o curso os alunos avaliaram o módulo utilizando-se instrumento validado contendo aspectos pedagógicos (conteúdo, interação e atividades) e aspecto técnico (qualidade da interface) do AVA.

Resultados: As características obtidas consideradas como favoráveis à aprendizagem foram "conteúdo" (91,6%), "atividades" (85,8%) e "qualidade da interface" (89,7%). A característica "interação" foi a que obteve menor índice (52,7%).

Conclusão: Considerando-se a maioria das características avaliadas, concluímos que o *Moodle* se mostrou uma ferramenta eficaz de ensino. Já em relação à característica "interação", torna-se necessário aprimorar as questões que envolvam as atividades programadas, tais como fórum e *chat* para propiciar uma maior relação entre os participantes.

Palavras-Chave: Educação à distância; Educação em saúde; Enfermagem; Diabetes Mellitus; Pé diabético.

RESUMEN:

Introducción: Los profesionales de enfermería necesitan ser capacitados y cualificados para atender a las personas con diabetes y uno de los aspectos considerado como fundamental para esa capacitación es el conocimiento de los recursos tecnológicos indicados para el desarrollo del proceso de enseñanza-aprendizaje, como informática, internet, hipermedia, multimedia, y las diversas herramientas de interacción y comunicación.

Objetivos: Los objetivos de este estudio fueron desarrollar un módulo educativo sobre pie diabético en Ambiente Virtual de Aprendizaje - AVA en la plataforma *Moodle* para estudiantes de enfermería y someter el programa a la evaluación de los alumnos.

Método: Se trata de un estudio descriptivo transversal, realizado con 31 estudiantes. El módulo educativo fue desarrollado como curso distribuido en cuatro capítulos versando sobre pie diabético. Después del curso los alumnos evaluaron el módulo utilizando instrumento validado conteniendo aspectos pedagógicos (contenido, interacción y actividades) y aspecto técnico (calidad de la interfaz) del AVA.

Resultados: Las características obtenidas consideradas como favorables al aprendizaje fueron "contenido" (91,6%), "actividades" (85,8%) y "calidad de la interfaz" (89,7%). La característica "interacción" fue la que obtuvo menor índice (52,7%).

Conclusión: Considerando la mayoría de las características evaluadas, concluimos que Moodle se mostró una herramienta eficaz de enseñanza. En cuanto a la característica "interacción", es necesario perfeccionar las cuestiones que afectan a las actividades programadas, estas son el foro y chat para propiciar una mayor relación entre los participantes.

Palabras-clave: Educación a distancia; Educación en salud; enfermería; Diabetes Mellitus; Pie diabético.

INTRODUCTION

The use of Virtual Learning Environments (VLEs) in higher education has been increasingly frequent, where collaborative learning is fundamental for the success of

the work, of the group and of each person individually, thereby configuring themselves as systematic and organized tools in Distance Education (DE) in the current days.

In these environments, the student develops learning through his/her self-management, self-learning and self-evaluation in the aspects of time, space, speed and systematicity of his/her studies from the material made available by teachers or facilitators, with remote monitoring and supervision^(1,2).

In order to meet the demands of the new professional profile, many higher education institutions are adopting active teaching-learning methods through Information and Communication Technologies (ICTs), where the Internet is one of their tools for accessing information and sharing educational resources, both by attendance or at a distance.

Information technology has the potential to facilitate the teaching-learning process in the health field, offering students and teachers greater accessibility without the existence of geographic limits⁽³⁾. Currently, technological development and easy access to information have enabled students to expand their knowledge beyond traditional family and school environments.

Nevertheless, we should emphasize that, for the application of ICTs to be effective in professional training, it is important that the tools to be used awaken the interest of users, allow interaction and that quality information is made available through them.

In this sense, the elaboration of a proposal for technical training in view of the great demand for scientific and technical knowledge of undergraduate students and nursing professionals in the actions related to promotion, prevention and protection in health constitutes a challenge.

Among these resources, the Moodle environment (Modular Object-Oriented Dynamic Learning Environment) has been configured as an important tool for the training of health professionals, as it enables the updating of knowledge and practices in fields in constant technical-scientific evolution. Moodle is a virtual learning environment composed of several features that allow the execution of distance learning through the Web, thereby enabling communication among its participants and assisting in the organization of contents^(4,5).

In the current health scenario in Brazil, one of the biggest problems that affects the population in general has been the coping with Chronic Non-communicable Diseases (CNCD) and the limitations and disabilities resulting from this illness process. One of the objectives for the control of these diseases is to promote the development and implementation of effective, integrated and sustainable actions based on evidence, whether in primary care or in the prevention of their complications⁽⁶⁾.

Among CNCD, Diabetes Mellitus (DM) is today a worldwide epidemic, translating into a major challenge for health systems around the world due to the high prevalence and incidence, as well as in relation to human, social and economic consequences that it entails⁽⁷⁾.

DM is growing in importance due to its increasing prevalence and association with dyslipidemia, arterial hypertension and endothelial dysfunction. It is a health problem considered a Condition Sensitive to Primary Care, that is, evidence demonstrates that

the good management of this problem even in Primary Care prevents hospitalizations and deaths from cardiovascular and cerebrovascular complications, such as blindness, kidney failure and limb amputations, being responsible for expressive health expenditures, in addition to substantial decrease in work capacity and life expectancy^(8,9).

Among the chronic complications of DM, foot ulcers, also known as diabetic foot, and amputation of extremities are the most serious and generate the greatest socioeconomic impact. Foot ulcers have an annual incidence of 2%, where a person with diabetes have a 25% risk of developing foot ulcers throughout life⁽¹⁰⁻¹²⁾.

Nursing professionals need to be trained and qualified to care for people with diabetes, where one of the aspects considered as fundamental for this training is the knowledge of the technological resources indicated for the development of the teaching-learning process, such as computer science, internet, hypermedia, multimedia, besides the various interaction and communication tools.

Given the importance of this theme, we believe in the need to develop the cognitive competency of the undergraduate student about the nursing care provided to people with DM for subsequent clinical practice.

Accordingly, we are concerned about the feasibility of performing an educational module with undergraduate nursing students through a Virtual Learning Environment (VLE), Moodle, in order to offer specific training to the student on Diabetes Mellitus and its complications, especially regarding the feet of people with DM.

Seen in these terms, we believe that these students will be able to obtain subsidies for a greater awareness of the importance of recognizing the steps to carry out the evaluation of the risk of developing foot ulcers in people with DM.

Therefore, this study aimed to develop an educational module on the Virtual Learning Environment (VLE) on the Moodle platform with nursing students on the theme "Prevention of complications and foot care of people with DM" and submit the program to the evaluation of these students.

METHOD

Ethical aspects

The research project was submitted to the Research Ethics Committee of the university and was approved under Opinion nº 443.679, dated November 8th, 2013.

Design, place of study and period

It is a cross-sectional descriptive study, which was carried out in the first half of 2014, in a Nursing course at a university in the city of São Paulo.

We invited 42 undergraduate students regularly enrolled in the undergraduate nursing course between the 2nd and 4th year of graduation to participate in the research, by adopting as inclusion criterion the fact of belonging to the Academic League of Wounds and/or to the University Extension Project "*Cuidar-te*" of this university, which

offers free care to people with skin abnormalities and chronic wounds, where orientation actions, clinical follow-up are carried out, in addition to specific interventions such as dressing by undergraduate and graduate students, under the supervision of their teachers.

Sample, inclusion and exclusion criteria

The sample consisted of 31 students who met the inclusion criteria and agreed to participate in the educational moment of VLE of the Moodle, by signing the Free and Informed Consent Form (FICF).

Study protocol

The general objective of the module was to develop knowledge about the prevention of complications and foot care of people with DM. The contents were divided into four chapters, namely: Chapter 1 – Introduction to the Moodle environment (distance education) and to popular education; Chapter 2 – Basic notions and pathophysiology of Diabetes Mellitus; Chapter 3 – The foot of the person with DM; and Chapter 4 – Practical approach (Figure 1).

The expected workload for the course was 20 hours, and the duration period was from April 7th, 2014, to May 9th, 2014. The entire workload was destined to access and read the content of the chapters, complementary readings, visualization of videos, participation in discussion forums and chats on the covered topic in the fifth screen elaborated on the Moodle Platform.

Figure 1: Screens created on the Moodle platform on the theme “Prevention of complications and foot care of people with DM” for the development of the educational module. São Paulo Brazil. 2017.



Source: Research data

In order to collect data, we used as a reference an instrument originally developed and validated in a master's research, carried out at a public university in São Paulo in the year 2006, which had as one of its objectives to evaluate aspects of a Virtual Learning Environment in the field of Nursing Administration, made up by researchers containing elements related to pedagogical aspects (such as content, activities and interaction) and technical aspects (interface quality and response time)⁽¹³⁾.

It is worth underlining that we also used as a reference another research published in 2011 on the adequacy of VLE in the teaching of Endocrine Physiology for nursing students at a public institution in the countryside of São Paulo, which used the same validated instrument⁽¹⁴⁾.

Analysis of results and statistics

We analyzed the pedagogical characteristics related to the content covered on VLE, with regard to its pertinence, clarity, applicability, quantity and consistency.

In relation to interaction, we evaluated aspects related to the relationship established between student-student, student-machine, student-group, student-teacher. As for the activities developed during the learning process, we found characteristics related to relevance, clarity, applicability, quantity, consistency and educational evaluation.

We should underline that, in relation to technical characteristics, only the element "interface quality" was evaluated in relation to the employed colors, the screen space, the letters, figures and sound. The element "response time" cannot be evaluated due to technical difficulties related to the access of the students to the system.

For each of these elements, the student should assign a value, (+1), meaning that the characteristic was fully met, (0) if the characteristic was partially met and (-1) if the characteristic was not met. When choosing values (0) and (-1), students should include one comment and one justification⁽¹³⁾.

The FICF and the data collection instrument were sent to the research participants via e-mail. After receiving the response from the instrument and the knowledge and agreement, the personal password for accessing the course was made available.

After coding and elaborating a data glossary, we used the validation process of the collected information, by double checking the data available in a spreadsheet automatically formulated by the Google.docs website after organizing and applying the online form.

The obtained data were analyzed using simple descriptive statistics, showing the results in absolute frequency and percentages, presented in the form of tables.

RESULTS

Regarding the content, we can observe that the totality of the responses obtained in the evaluation of the students was favorable, with no response regarding the non-compliance with the characteristic.

The questions concerning the characteristics relevance, clarity and applicability showed higher rates of service, with 93 (60%) responses, and the characteristics with the lowest rates were quantity and consistency, with 62 (40%) responses (Table 1).

Table 1 – Distribution of the responses of the students to the content, according to compliance with the characteristics on relevance, clarity, applicability, quantity and consistency. São Paulo, Brazil 2017.

CONTENT	Characteristics Met		Characteristics Partially Met		Characteristics Not Met		Total	
	n°	%	n°	%	n°	%	n°	%
Relevance	30	96.8	1	3.2	-	-	31	100
Clarity	30	96.8	1	3.2	-	-	31	100
Applicability	29	93.5	2	6.5	-	-	31	100
Quantity	25	80.6	6	19.4	-	-	31	100
Consistency	26	83.9	5	16.1	-	-	31	100
Total	142	91.6	13	8.4	-	-	155	100

Source: Research data, 2017.

The results of the evaluations classified the responses as met, partially met and not met. Those classified as partially met, in the characteristic “pertinence”, the justification of the students indicated that the content is very extensive. Regarding clarity, the students justify that the text had parts that are difficult to understand.

Regarding the applicability, the justifications presented were related to the extension of the content and the lack of knowledge about how to apply the contents in view of the current health reality.

As for the characteristics “Quantity and Consistency”, the responses indicated the reduction of the content as the main point of disagreement and difficult understanding of the presented content.

With regard to interaction, the characteristic that obtained the highest rate of compliance was the student-machine interaction. Nonetheless, the fact that the characteristics related to the student-student interaction (58.0%) and student-teacher (64.5%) were mostly identified as partially met or not met (Table 2).

Table 2 – Distribution of responses on interaction, according to the student-student, student-machine and student-teacher characteristics. São Paulo, Brazil. 2017.

INTERACTION	Characteristics Met		Characteristics Partially Met		Characteristics Not Met		Total	
	n°	%	n°	%	n°	%	n°	%
Student-student	13	41.9	17	54.8	1	3.3	31	100
Student-machine	25	80.6	6	19.4	-	-	31	100
Student-teacher	11	35.5	17	54.7	3	9.8	31	100
Total	49	52.7	13	43	4	-	93	100

Source: Research data, 2017.

Of the characteristics partially met, most of the responses were related to the student-student characteristics, with the justification that, because it is an online course, there is no incentive to interact or reported not having perceived an effective participation

among students, despite the availability of resources for this purpose in the system. There was also emphasis on the need for the practical interaction to be more effective, citing that they knew about the availability of the teacher, but did not perceive any effective interaction or proximity.

Of the unmet characteristics related to the student-student interaction, one student (3.3%) highlighted the lack of activities that could encourage this interaction; and, in the student-teacher category, three (9.8%) students considered that there was no interaction. In the evaluation of the students regarding the developed activities, the characteristics on relevance, clarity and applicability were highlighted, with more than 90% of positive responses.

Table 3 – Responses of the evaluation on the developed activities, according to relevance, clarity, applicability, quantity and educational evaluation. São Paulo, Brazil. 2017.

ACTIVITIES	Characteristics Met		Characteristics Partially Met		Characteristics Not Met		Total	
	nº	%	nº	%	nº	%	nº	%
Relevance	30	96.8	1	3.2	-	-	31	100
Clarity	30	96.8	1	3.2	-	-	31	100
Applicability	29	93.5	2	6.5	-	-	31	100
Quantity	19	61.3	12	38.7	-	-	31	100
Educational evaluation	25	80.6	6	19.4	-	-	31	100
Total	133	85.8	22	43	-	-	155	100

Source: Research data, 2017.

As for the characteristics partially met in this table, the categories on quantity and educational evaluation stand out, with a total of 18 (58%) responses. Regarding the quantity, the students justified the shortage of activities, suggesting a greater number of activities that could favor professional understanding and applicability. With regard to educational evaluation, they pointed out that a practical evaluation would be interesting in the sense of having feedback.

The interface quality was favorably evaluated in all characteristics (89.7%), indicating that the characteristics: colors, screen space, letters, figures and sound were met.

Table 4 – Responses of the evaluation on interface quality, according to the compliance with the characteristics on colors, screen space, letters, figures and animations. São Paulo, Brazil. 2017.

INTERFACE QUALITY	Characteristics Met		Characteristics Partially Me		Characteristics Not Met		Total	
	nº	%	nº	%	nº	%	nº	%
Colors	28	90.3	3	9.7	-	-	31	100
Screen space	29	93.5	2	6.5	-	-	31	100
Letters	26	83.9	5	16.1	-	-	31	100
Figures	30	96.8	1	3.2	-	-	31	100
Sound	26	83.9	5	16.1	-	-	31	100
Total	139	89.7	16	10.3	-	-	155	100

Source: Research data, 2017.

Of the characteristics partially met, the justification was that the environment could present more vivid colors, increasing the size and changing the format of the letters and/or animation, as well as using the sound, which was not used.

DISCUSSION

Contemporary society has demanded a new type of professional, who has the capacity to develop multiple competencies, working as a team and learning and adapting to new situations. In order to achieve these competencies, one needs knowledge to use the new information and communication technologies, not only as a means of improving the efficiency of systems, but mainly as pedagogical tools effectively at the service of health professionals⁽¹⁵⁾.

In view of the need for changes in the teaching/learning process, it is necessary to consider if the processes of interaction and, the Information and Communication Technologies (ICTs), the Distance Education (DE) and the Active Learning Methodologies respond to this need and drive transformations in the most diverse fields of knowledge, causing a significant impact on teaching and learning⁽¹⁶⁾.

As an essential characteristic of DE, the student should be involved in the learning activity in a place where the teacher is not physically present. In view of this physical distance between teacher and student, DE needs to rely on means and use of technologies that allow the exchange of information between teacher and student⁽¹⁷⁻¹⁹⁾. Studies highlight that students who feel independent in their school relationships present positive results in relation to various aspects such as motivation, engagement, development, learning, improved performance in grades, in activities, in standardized test results and in their psychological status⁽²⁰⁻²²⁾.

Accordingly, the teacher should respect the individuality of the student and his/her points of view, accept his/her previous experiences, his/her actions, and consider his/her feelings, thereby supporting his/her development in relation to his/her motivation and self-management ability⁽²³⁾.

In this study, the educational module was considered, in general, as adequate, requiring adjustments in some aspects in relation to the characteristic on interaction. Regarding the applied content, the obtained results coincide with similar studies, showing that, although extensive, it is adequate and well structured, distributed in four chapters encompassing texts, images and videos, necessary to achieve the proposed objectives^(14,19,24).

As for the element related to interaction, the evaluations of the undergraduate students indicated that the tools proposed in the educational module did not favor the interrelationship among the students and between the student and the teacher. We can infer that one of the reasons for this lack of interaction was the non-use of forum resources and virtual chats at any time during the execution of the course. Chats have been considered as an important means of interaction, as it can allow virtual meetings among VLE participants, thereby minimizing the distance between teacher and students⁽¹⁴⁾.

The pertinent literature also highlights that it is necessary that, in a course held on VLE, the interaction is effective so that it will supply the physical and geographic

distances between student and teacher. Accordingly, communication becomes an essential element in this process, where the teacher should mediate the construction of the knowledge of the student, and the student needs to develop skills in order to obtain autonomy in this process⁽¹³⁾.

In general, in the use of VLEs, we can observe the development of didactic relationships in an expository way that determines the prejudice of the interaction and the collaboration of the student in the construction of his/her knowledge. However diverse these environments may be, such as virtual rooms, videoconferences, teaching softwares, simulation, among others, the way in which these environments have been used does not favor the active participation of the student in the organization and direction of his/her learning⁽²⁵⁾.

Seen in these terms, VLEs are configured as spaces that provide exchange through communication between teacher and student, which goes beyond the traditional interaction established between these subjects in the classroom.

In this environment, the use of technological resources becomes essential for the development of nursing education through systematic and joint actions, using the Internet, media and other didactic support and tutoring tools, which allow flexible and autonomous learning⁽²⁶⁾.

As for the fact that the activities were well evaluated by the students, we found that the didactic materials offered in the form of complementary activities allowed the compliance with the academic needs for the use of VLE. This data coincides with studies that highlight that the association of several media allows the student to create practical situations similar to those experienced in reality, thereby enabling decision making, identification of problems and priority situations, as well as the development of the investigative spirit^(14,19,27).

Regarding the undergraduate students who evaluated this topic as partially met, some suggestions were made about the need to hold a face-to-face meeting so that a practical activity could be developed, which would facilitate the understanding of the content. Another group of undergraduate students also mentioned that the offer of a greater number of activities would assist in the applicability of the content.

Studies indicate that learning process becomes more significant when the learner checks the possibility of practical application in the everyday activities. In the training of nursing professionals, this happens when the theoretical contents are developed through theoretical-practical activities and practices in the field^(28,29). In this sense, the lack of practical actions associated with the content developed through VLE was configured as one of the limits of our study, making it a challenge to be overcome through other investigations on this theme.

As for the element related to interface quality, the responses of the students indicated that the categories on color, screen space, letters, figures and sound were met, data that coincide with a study that describes design as a fundamental function in the production of interaction systems in VLEs, as it shows that the presentation of a user-centered interface will make its use more pleasant⁽³⁰⁾.

A study on the evaluation of VLE by undergraduate students observes that the design should be pleasant to guide the student and hold his/her attention. Regarding

navigability, the information inserted in the interface should allow the student to obtain information in a clear way, through indicative links on the page ⁽¹³⁾. This same study highlights the need for the use of light colors, as a backdrop for the screen, which do not distract users, as well as appropriately-sized fonts, in order to facilitate viewing and reading, besides the fact that images, figures and/or animations used are in line with the objects that they represent, thereby offering a pleasant, creative and interactive way of introducing concepts⁽¹³⁾.

Study limitations

This study is limited to the knowledge of the importance of the development of information and communication technologies for health education in Diabetes only with nursing students and from the methodological point of view of the quantitative approach. In this sense, in order to understand the experience of diabetic people in educational programs and to check the effectiveness of these programs with these subjects, it is necessary to carry out other studies on this theme that are developed from qualitative methodological approaches or from controlled studies capable of demonstrating its importance.

Contributions to the fields of nursing, health or public policy

The results obtained in this investigation allowed us to understand the effectiveness of the educational activity through the Moodle platform developed on the issue of Diabetes Mellitus with undergraduate nursing students. Accordingly, we believe that strategies based on information and communication technologies can contribute significantly to the development of academic activities in nursing education, as well as in health educational actions developed by nurses with people with chronic conditions such as, for example, Diabetes Mellitus.

CONCLUSION

In view of the presented results, we believe that the objective proposed for this study was achieved because the educational module on the theme: "Prevention of complications and foot care of people with DM" was developed by means of VLE and, subsequently, evaluated by nursing students, where we observed that most subjects considered the use of this teaching strategy as favorable.

Information technology offers us resources that enable the planning and development of educational materials with the use of various media, allowing online browsing, aiming to offer students dynamic and accessible content, in different formats and sequences, with a view to favoring the teaching-learning process, which are not limited in themselves, but in the need to develop practical face-to-face activities that will consolidate the obtained knowledge.

We can also observe that the student should improve the use of activities programmed on VLE, in order to provide greater interaction, through the use of discussion forums and chats, so that he/she has the opportunity to discuss, argue, reflect and understand this teaching reality.

Promotion

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