



## Physical examination during prenatal care: construction and validation of educational hypermedia for nursing\*

*Exame físico no pré-natal: construção e validação de hipermedia educativa para a Enfermagem*

*Examen físico en el prenatal: construcción y validación de los mass media educativo para la Enfermería*

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### ABSTRACT

**Objective:** To describe the development and validation of an educational hypermedia for undergraduates and nurses about the technique of physical examination in the prenatal period. **Methods:** A development study, conducted between June and October 2010, following these steps: developing content, production of media, organization of student-tutor space, design, delivery and validation of hypermedia. **Results:** We developed hypertext, hyperlinks, audiovisual materials, communication spaces, assessments and support materials. The seven experts in nursing considered the consistency of the hypermedia for nursing practice and to facilitate the teaching-learning process to be fully adequate. Of the three informatics specialists, two considered the hypermedia to have fully adequate functionality. **Conclusion:** We constructed an educational hypermedia, validated by experts, using a variety of media resources that made it possible to optimize the teaching and learning process.

**Keywords:** Physical examination; Hypermedia; Prenatal care; Education, distance; Technology

### RESUMO

**Objetivo:** Descrever o processo de desenvolvimento e validação de uma hipermedia educacional para graduandos e profissionais de enfermagem a respeito da técnica de realização do exame físico no pré-natal. **Métodos:** Estudo de desenvolvimento, realizado entre junho e outubro de 2010, seguindo as etapas: levantamento do conteúdo, produção das mídias, organização do espaço aluno-tutor, elaboração, disponibilização e validação da hipermedia. **Resultados:** Foram desenvolvidos hipertextos, *hyperlinks*, recursos audiovisuais, espaços de comunicação, avaliações e material de apoio. Os sete especialistas em enfermagem consideraram totalmente adequada a coerência da hipermedia para a prática de enfermagem e para a facilitação do processo ensino-aprendizagem. Dos três especialistas em Informática, dois consideraram totalmente adequada a funcionalidade da hipermedia. **Conclusão:** Construiu-se construiu uma hipermedia, utilizando diversos recursos midiáticos que a tornam apta a otimizar o processo ensino e aprendizagem e que foi validada por especialistas.

**Descritores:** Exame físico; Hipermedia; Cuidado pré-natal; Educação a distância; Tecnologia

### RESUMEN

**Objetivo:** Describir el proceso de desarrollo y validación de los mass media educativos para graduandos y profesionales de enfermería respecto a la técnica de realización del examen físico en el prenatal. **Métodos:** Estudio de desarrollo, realizado entre junio y octubre del 2010, siguiendo las etapas: levantamiento del contenido, producción de los mass media, organización del espacio alumno-tutor, elaboración, disponibilización y validación del hiper mass media. **Resultados:** Fueron desarrollados hipertextos, *hyperlinks*, recursos audiovisuales, espacios de comunicación, evaluaciones y material de apoyo. Los siete especialistas en enfermería consideraron totalmente adecuada la coherencia de los mass media para la práctica de enfermería y facilitación del proceso enseñanza-aprendizaje. De los tres especialistas en Informática, dos consideraron totalmente adecuada la funcionalidad de la hiper mass media. **Conclusión:** Se construyó una hiper mass media, utilizando diversos recursos mediáticos que la tornan apta para optimizar el proceso enseñanza y aprendizaje y que fue validada por especialistas.

**Descritores:** Examen físico; Hipermedia; Atención prenatal; Educación a distancia; Tecnología

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## INTRODUCTION

In health area, it is highlighted the increasing requirements of the employment market in respect to the knowledge of professionals, aiming at providing a qualified assistance to users. Specifically in the Nursing area, this scenario has been constant since, when compared to other sciences, this is a recent area; however, it has developed rapidly in quantity and quality of knowledge produced. Thus, the nursing student has the difficult task of retaining large amounts of information in a short period of professional formation.

Accordingly, new strategies for teaching and learning are being incorporated in nursing, including the methodologies which may provide students with greater autonomy in the learning process. The features of Information Technology are emphasized here, which allows the user to receive information by computer and interpret them, enabling the process of knowledge construction <sup>(1)</sup>.

Given the development of Information Technologies (IT) resources, Distance Education/Learning (DE or DL) emerges as a means of promoting knowledge for its participants, through which the informatic is used to promote education. DE presents itself, among other ways, through hypermedia, which may be provided in two main forms: software and Virtual Learning Environments (VLEs). The software consists of a computer program on CD-ROM format, although its availability is limited to individuals who owns it, software can be used in places where Internet access is impossible or limited. VLEs, object of this study, are presented in the form of websites so their range power is considerably higher, since anyone with Internet access can use such materials.

Through the expansion of construction and use of these resources in numerous areas of knowledge, including in health, it is expected that the teaching and learning process for nursing students is facilitated in a variety of relevant topics to human care, including the pregnant-puerperal period. During this period, nurses have a fundamental role in prenatal care, which aims at ensuring the health of both mother and child during pregnancy and childbirth; therefore it is essential to recognize the pregnancy risks in each woman, taking into account the most prevalent diseases and available scientific evidences <sup>(2)</sup>.

The identification of clinical signs which indicate risk, occur, among other methods, through an adequate and complete physical examination, which covers the heart, lungs, breasts, abdomen, extremities, as well as obstetric inspection, palpation and obstetric auscultation <sup>(3)</sup>. For a physical examination to be considered satisfactory, it is necessary for the health professional

who is performing the exam to be properly trained and up to date on the issue. Thus, the importance of facilitating the process of teaching and learning of this content is essential, from the period of professional formation to professional practice itself, seeking the assistance to women during their pregnancy.

In this context, this study is relevant to enable, through the development of a hypermedia on physical examination during prenatal care, nursing students and professionals have access to the material produced, by that they may easily master the content related to techniques and findings involving the procedure. Bearing this in mind, the aim is to contribute to better prenatal care and therefore a reduction in rates of maternal and perinatal mortality.

The present study aimed at describing the process of development and validation of an educational hypermedia for undergraduate students and nursing professionals on the technique of physical examination in the prenatal period.

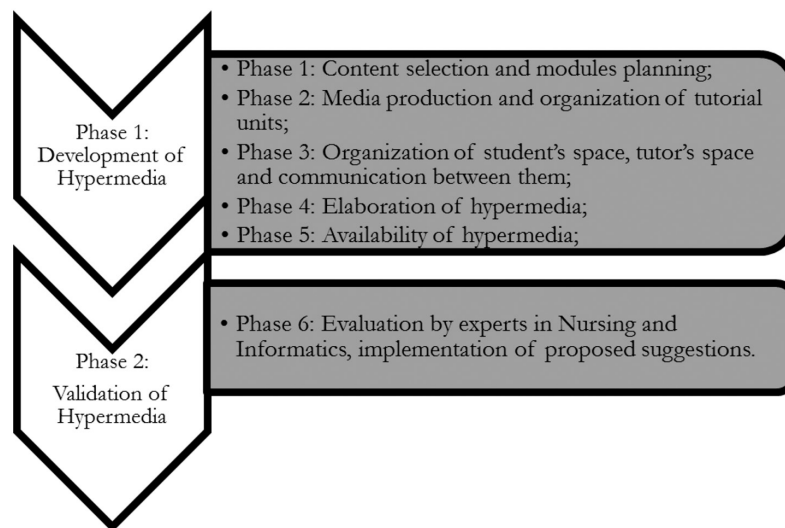
## METHODS

This is a study of development, which consists of the development and construction of software and other technologic strategies <sup>(4)</sup>. It refers to the development of an educational hypermedia, seeking its virtual use in the subject Nursing in the Care Process of Sexual and Reproductive Health, offered by the Nursing Department of the Federal University of Ceara (UFC) to Nursing undergraduate students in the seventh semester.

The Theory of Social Interaction of Vygotsky was adopted as a theoretical framework for the development of hypermedia <sup>(5)</sup>. Three graduate Nursing students took part in the process of constructing hypermedia, who compiled the contents on the subject and produced the media, three Computer Science graduate students produced the diagramming and layout of the hypermedia, and a PhD in Nursing reviewed the hypermedia before it was evaluated by the judges.

The methodological approach for the development of hypermedia followed the phases outlined in Figure 1.

Hypermedia was built during the months of June to October of 2010, its content was divided into the following topics: Presentation, Introduction, Vital Signs (pulse, respiration, blood pressure and temperature); Anthropometric data (weight, height and Body Mass Index), head and neck (inspection and palpation), breast (inspection and palpation), respiratory system (inspection, palpation and auscultation), cardiovascular system (auscultation); abdominal examination (inspection, palpation and auscultation) Pelvic examination (inspection and palpation) extremities (inspection and palpation), musculoskeletal system (inspection) and bibliography.



**Figure 1.** Phases to be followed in hypermedia development, Nursing Graduate Program/Masters/UFC, 2010

The types of media which composed this educational technology were taken from public domain materials or built during the Nursing consultations performed during prenatal at the Center for Natural Childbirth *Ligia Barros Costa*, from UFC.

Subsequently, the hypermedia was provided at the Online Learning System - SOLAR. This VLE was developed by the Virtual Institute UFC in order to enable the DL for the various courses of the institution by non-face-to-face interaction between students and professors. The Virtual Institute UFC was originated based on work done in the form of distance education. In 1997, the Research Group on Distance Education launched the project EDUCADI, which aimed at applying the resources of the Information and Communication Technologies (ICT) in DE to assist in building projects within schools. In 2001, the group of DE at the Federal University of Ceara joined UNIREDE - Public Virtual University of Brazil. Similar to other free learning platforms (AulaNet, Moodle and TeleEduc), SOLAR brings interactivity, resource integration, didactic services and communication.

After developing this hypermedia, the validation process began by experts in the areas of Nursing and Informatics. In order to choose the number of experts, the Pasquali<sup>(6)</sup> recommendations were taken into account, which suggests from six to twenty individuals, requiring at least three individuals in each group of selected professionals.

It should be noted here the difficulty in capturing the experts. During the development of this hypermedia, 25 experts from Nursing and 7 from Informatics area were invited, among which only 15 and five experts, respectively, agreed to participate, but only seven (from Nursing) and three (from informatics) experts responded to the questionnaire sent. Thus, hypermedia has

been validated by seven experts in nursing and three in Informatics, which is a limitation of the study.

Nursing experts were represented by seven professionals from the area of Obstetrics, these nurses also have a teaching experience in women's health, especially in regard to prenatal care, practical experience in the theme or both. The search for these nurses took place by author's indication or selected experts. These, on the other hand, were selected as they would reach five points, according to the items of data presented below in Table 1, based on Barbosa criteria<sup>(7)</sup>.

**Table 1.** Selection criteria for Nursing experts, Nursing Graduate Program/Masters/UFC, 2010

Expert	Score
Thesis or dissertation on prenatal topic	2 points/work
Final paper work of graduation or specialization	1 points/work
Participation in groups / research projects involving prenatal care	1 point
Teaching experience in prenatal care	0.5 point/year
Practice experience in prenatal care	0.5 point/year
Guidance in papers on the theme prenatal care	0.5 point/work
Authorship of two papers about prenatal published in journals	0.25 point/work
Participation on examination of academic papers in prenatal care.	0.25 point/work

The experts in informatics were represented by three IT professionals with experience in programming and practical experience in producing websites, or both. The search for these professionals took place by indication; they were selected as they achieved three points according to the criteria cited in Table 2.

**Table 2.** Selection Criteria for informatics experts, Nursing Graduate Program / Master / UFC 2010

Expert	Pontuação
<i>Professional or Expert in the development of websites</i>	0,5 ponto/ <i>website websites</i>
Professional experience in the development of VLEs	0,5 ponto/AVA
<i>Specialization in the development area of web</i>	1 ponto

In regard to the instrument used for data collection, Clunie<sup>(8)</sup> developed a form which approached the theme how to perform the evaluation of a hypermedia properly. Lopes<sup>(9)</sup> and Lopes<sup>(10)</sup> adapted the Clunie's<sup>(8)</sup> instrument and, for the present study, an instrument was developed based on earlier ones in a way to adapt it to the study problem.

Nursing experts evaluated objectives, content, relevance and environment, and the experts in informatics, functionality, usability and efficiency of hypermedia. In each evaluation, criteria was attributed to both, Nursing and Informatics experts, a concept arranged in a Likert scale, namely: (1) Totally inadequate, (2) Moderately inadequate, (3) Moderately appropriate, (4) Totally appropriate and (NA) not applicable.

For the validation of hypermedia, it was considered validated a particular item, when it obtained the rank of "Totally Adequate" for at least half plus one of the experts and other experts did not consider it "Totally Inadequate"<sup>(10)</sup>. The item was also considered validated when the experts considered it inappropriate, but presented suggestions for improvement and these were implemented.

The standard norms established by Resolution No. 196/96 from the National Health Council were followed as they relate to the realization of researches with humans. The study was approved by the Ethics Committee of the UFC, Protocol No. 145/10. The Consent Term was signed by the experts and pregnant women who authorized us to take pictures and make videos during their prenatal visits. The images and videos which could identify the women were modified in order to preserve their identities, to comply with the ethical aspects of research involving human beings.

## RESULTS

### Building a hypermedia

The use of hypermedia was possible through the registration of a login and password, performed by the user on the home page of the VLE. At first, the registration must be requested by the student and accepted by the editor of the course in which the student wishes to enroll. SOLAR base provides its users with three

types of accesses: Editor, Professor and Student. Each of these types allows the user to specific functions, so that depending on the activities wished to perform, the user should opt for a specific type of access.

Editor access is the broadest, it enables to create a course structure, post lectures, forums and chat rooms, the editor can also provide support material; allow registration of professors and students, among other activities. The Professor login and password allows them to view the aspects related to the group/class, such as marks, activities posted by students as well as to release new tasks. If the professor wishes to provide new classes or materials, they should prepare and forward them to the Editor, so that the Editor can make this material available in the VLE. Student's entrance in hypermedia allows them to access only classes and other types of materials and interactive tools to be viewed and used.

In order to build the hypermedia, the researchers were registered in the three types of user, so that content was posted and seen in other types of access, always aiming at improving the quality of the VLE.

Concerning to the presentation of menus, the first screen presents the hypermedia hyperlinks on the left to access various functions: classes (access to available classes), Course Information (Subject program), Calendar (space where the deadlines for the tasks were, and participation in forums and chats), Bibliography and Support material (adding to the available content in the hypermedia).

There is also the tool Participants (which provides a list of links to access the profile of participants, as well as their performance throughout the course), Portfolio (which allows access to the material produced by students), Group Portfolio (in case there is any group assignment, this hyperlink allows access to the material produced), Forum, Chat and Messaging (access functions that were previously described).

The student can also access the available courses (if enrolled in more than one), Enrolment (Registration of their data to see), Change personal details and password (if the student wishes to change the profile or password previously registered in the SOLAR) and Register Photo (to promote greater interaction among participants). The Changing Profile tool was developed for professors and editors of the course, since they have more than one profile in VLE. To quit surfing on the VLE, the user must click Exit.

On the topic Presentation, students are given a warm welcome and available content is anticipated in the hypermedia. Some explanations about the operation of the VLE are also included, making hypermedia self-explanatory so that the student can freely manipulate it during their studies.

The student may take as much time as he or she wishes in the hypermedia and the resources available can also be freely used. This freedom of time is important for the student to respect their time learning on hypermedia.

On the topic Introduction, it is included the health care that the women should have during the prenatal period, the policies governing the health care at this stage of her life and the aspects related to physical examination of the pregnant woman. This allows the student to understand the aspects of prenatal care, before specific presented content on physical examination.

To promote greater interaction between the participant and learning platform, it was inserted a sequence of five videos available on the Internet, on fetal development during the nine months of pregnancy, as well as the moment of labour and delivery. The videos were selected because they are in agreement with the literature on the theme and also because they seem to be didactically effective in the learning process of the participant.

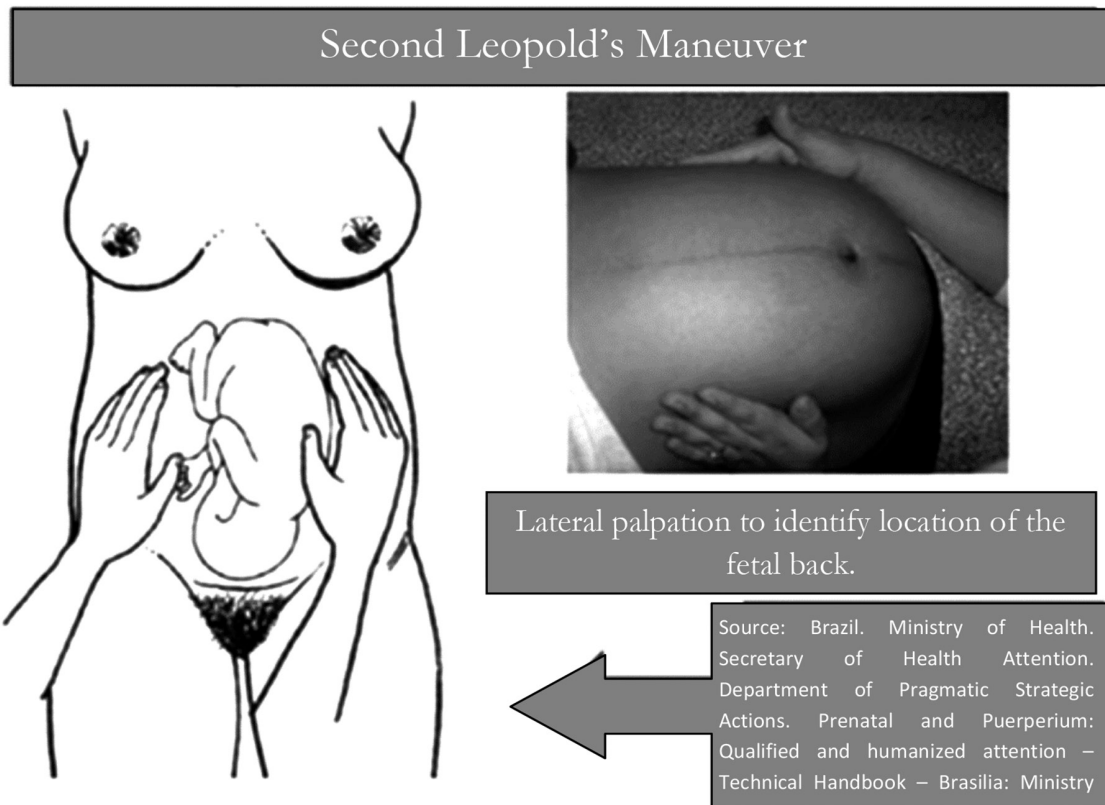
After the presentation of the subject and acquiring greater familiarity with the VLE, the student has two ways to access the contents of the classes: first, classes

reading, according to the numerical sequence; second, building their own sequence study, alternating topics of study according to their desire and need, the classes which were already been viewed were highlighted for the student's knowledge. This facilitates the participant to go directly to the lessons that have not been studied.

Hypermedia consisted of topics like 'branched', in which users can jump directly to the main study of interest, likewise links are provided to allow the user to return to previous screens in order to facilitate their navigation. In addition, the participant had access to a glossary in the form of hyperlinks from terms that are judged as necessary.

In order for the classes to be more attractive, VLE offers audiovisual resources which allow greater student interaction with the environment (Figure 2). The content was illustrated with 70 images taken in a real situation, ten figures of textbook and 20 from websites. Moreover, hypermedia has three videos addressing the contents: Leopold maneuvers, check fundal height and waddling gait, all produced by the researchers.

Hypermedia also features audio recordings to illustrate the sounds contained in the abdominal auscultation: fetal heart rate, funic souffle and uterine



**Figure 2.** Assemblage of figure from books, photographs and inherent information, composed of Physical examination in prenatal care, SOLAR, 2010.

souffle. On the topic where these sounds are defined, its title was released in the form of a hyperlink, and when clicked, a new window pops up which displays the audio file available. With this, it is expected that the student, when performing the physical examination of a pregnant woman, can easily identify the sounds found on abdominal auscultation.

As an important way of recording professionals and students' information, the portfolio was made available to students and professors, so that during the process of teaching and learning they can make records that facilitate the retention of relevant information, students can also register their doubts which may be discussed with the professor. Access to the portfolio, both for tutors and students occur through individual links, which allow access to their material. As a professor, he or she has access to all students' portfolios, while students can only visualize their own portfolio.

Hypermedia, which was built, has two forms of assessment: first, after each module, done with prepared questions by the researcher which covers the content studied in a specific class, and second, at the end of all content, questions are drawn from Brazilian selection tests for public positions about the theme.

To access the evaluation after each class, a hyperlink was released after references used in each content. By clicking on the hyperlink, the assessment is released, which was composed of three to five questions relevant to the subject. The questions are of multiple-choice and they provide four or five answer choices. As they finish the assessment, the user should click on the link - "CORRECT", when a new window with the assessment results appear, with how many answers were correct and how many were wrong. By clicking on this link, the user can compare the correct answers with their own answer, making sure the two coincide. It is emphasized that the student may perform both types of assessments as often as desired.

Furthermore, in order to provide an environment for discussion, debate and free expression for the student on the content studied, discussion forums are available (Figure 3) and chats, believing that this way there will be greater enrichment of VLE for communication between tutors and these participants and each other.

The VLE also provides a feature that enables the exchange of messages between professor and students or between students. This type of messaging is characterized by being as a private mail, so that students and professors can exchange messages privately.

In order to complement the content available for the classes, the VLE provides other materials in the form of a hyperlink. Through this tool, students can have access to scientific articles, manuals and other sources of knowledge.



Figure 3. Discussion Forum in the hypermedia Physical Examination in Prenatal care, SOLAR, 2010

### Validation of hypermedia

Hypermedia has been validated by technical and content experts in order to prove the effectiveness of its applicability as a teaching tool.

From the seven content experts, there were three PhDs, two with a master's degree and two of them were developing their masters in nursing.

The nurses experts considered as validated all items related to the objectives of VLEs. All seven experts considered totally appropriate hypermedia as coherent for nursing practice and to enhance the teaching and learning process. As for content, all seven experts considered it totally appropriate to the suitability of the content of hypermedia approach to the subject, for nursing students and nursing practice in prenatal care. Four experts considered the relevance of activities and forums totally appropriate so that students can complement their knowledge. The VLE was perceived as totally appropriate for the presentation of the contents of five experts, and the adequacy of resources for learning the considered topic totally appropriate by four experts and for three experts moderately appropriate.

As for IT experts, all three participants had experience in developing websites and developing VLE. It is therefore, confirmed by the experts the ability to judge the technical quality of the material produced. The functionality of hypermedia was positively evaluated by experts in Computer Informatics and it was considered totally appropriate for two of them, the other expert has recommended that there should be a better standardization and resolution of the images used. All items for usability (easy to use, learn concepts and control activities presented) were validated with at least two experts chose the option "totally appropriate", one of the experts stressed the fact that there are different ways for the students to ask for help by VLE (messages, forum, chat), so it is necessary to clarify in the hypermedia which is the fastest way to get this help in different moments. The resources used were also

considered efficient to two experts who considered it totally appropriate; the other expert did not express the reason why he rated the item as moderately appropriate.

## DISCUSSION

During the construction of hypermedia, there was a concern to provide different types of accesses to students, professors and editor, giving each of them autonomy and tools which could get the best of the educational technology.

The menu item should follow a didactic order, with the intention of assisting the understanding of information <sup>(11)</sup>. Thus, in order to meet this indication, it was part of our concern to provide the menus on the home page of the VLE presentation in an organized and easy view.

Before the student could interact with the VLE, it was necessary to explain its operation and to clarify the goals which were pursued to achieve <sup>(11)</sup>. Thus, there was the concern to build the topics Presentation and Introduction, in order to provide students with greater safety in handling hypermedia and greater familiarity with the content being presented, respectively.

The Virtual Learning Environment is as a mediator between the student and the real world, so that though its simulations, the person may see the reality and act on it, and it provides an exciting new opportunity for learning <sup>(12)</sup>. It is noteworthy that this hypermedia used a variety of visual aids to make the student closer to the reality, illustrating and fixing information provided. The language used sought to maintain the clarity, objectivity and accessibility, important aspects of language teaching in the VLE <sup>(13)</sup>.

The spaces of communication between professors and students are quite relevant, given the need and the richness of human interactions for the teaching and learning. The forums and chat rooms allowed greater interaction between professors and students and among students, therefore, characterized by greater interaction among the participants of DE proposal, allowing a better and easier way for the learning process, as proposed by the Theory of Social Interaction of Vygotsky. The quality of the pedagogical tools of DE involves the richness of interactive tools and a methodological approach that promotes meetings and discussions, beyond the simple replacement of traditional methods of information transmission <sup>(14,15)</sup>.

The assessment consists of a method of review and assessment of knowledge <sup>(16)</sup>. Thus, hypermedia sought

to provide tools so that the student had a feedback regarding the learning gained.

After examination by experts of hypermedia in Nursing and Informatics, some adjustment points considered relevant to improve the built hypermedia, these points were fixed so that the product has a better use and performance. Implemented the requested changes, this hypermedia has been validated by experts, who were able to validate it with the target audience for which it was built for.

Considering these aspects, the present VLE meets the recommendations described by other authors, so that it allows the optimization of study time, and the awakening of the student for autonomy in their learning, problem solving and discussion in the question regarding this topic <sup>(17)</sup>.

## CONCLUSION

Hypermedia "Physical Examination of Prenatal Care" was built, using various media resources that made it possible to optimize the teaching and learning processes, it was validated by competent experts in the areas of Nursing and Informatics.

In order for this hypermedia to be widely used in nursing education in the prenatal period, further studies are necessary so that it can be validated along with its usage for our target population. This will verify its real suitability for nursing students and professors, it may be also used in educational institutions in subjects related to Women's Health in order to facilitate the learning of students with regard to care in the prenatal period.

As the main limitation of this study, the fact is presented that hypermedia built is just concerned to prenatal care, physical examination, which aims at identifying the presence of physiological and pathological signals that can be detected. However, hypermedia did not address to possible conducts future professionals could make in the presence of found signs, requiring another technological tool that could fill in this gap.

It is also understood there is a necessity for new studies which could provide improvements and verify requirements of adaptations made in hypermedia, in order to obtain specific technical assessments.

It is recommended that there should be among the professors of Nursing an interest in promoting distance learning and building materials similar to hypermedia to complement and not replace the traditional system of education.

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