**Technological innovation in teaching in neonatal nursing: possibilities from the development to the use of educational software**

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**Abstract:**

**Objective:** to describe the development process of educational software about semiology and semiotechnique of preterm newborns. **Methods:** the pedagogical framework of problem posing and Bernardo’s software development methodology were used. **Results and Discussion:** the software presents advanced, computerized and interactive technology, with simulations allowing for maximum approximation to reality, gradually presenting the complexities and specificities of preterm newborns. Using hypertext resources, media like photos, videos and sounds are presented. **Final Considerations:** this software allows professors and students to experience the inter-relationship among four aspects, the content of semiology and semiotechnique of preterm newborns, new pedagogical approaches, technological innovations in education and use of the first phase of the Nursing Process to organize the content of basic human needs.

**Key words:** Education Nursing, Software, Physical Examination, Infant Newborn, Infant Premature.

1 **INTRODUCTION**

Nowadays, the increasing evolution of information technologies has been changing society. Computers and the consequent expansion of their resources have caused profound modifications in practically all activities of modern society, such as work, education, health, art and culture, among others.

Despite knowing about the possibilities and potential of computer use in education, in many teaching and health institutions, educational material with informatics resources remains scarce.

Although technological advances have occurred, nursing teaching in Brazil is still mostly traditional, with formal classes to expose contents and little actual student participation. On the other hand, changes have already been observed in view of new guidelines for higher education. In this context, the development of educational software can contribute to more participatory teaching, offering students with contents and simulations that can be used according to their needs and learning rhythms. The curriculum reforms put in practice in nursing schools with the use of active and participatory methods change the focus
from content-based learning to significant learning, focusing on students and on the labor world.

The authors consider the clinical assessment of preterm newborns an essential technical procedure for problem identification and care planning, when the child is exposed to environmental temperature and is manipulated for quite some time, especially when performed by students, given the range of details and findings and the difficulties students are faced with, the coming and going until learning actually takes place. The teaching of these contents is impaired by the inexistence of innovations that provide for a rapid and efficient connection between theoretical and practical knowledge.

The countless possibilities of computer use in education, especially to fill existing gaps due to the lack of educational material and innovation in the teaching-learning process about semiology of preterm newborns, stimulated the authors to develop educational software to support teaching on semiotechnique and semiology of preterm newborns. The expected result is innovative technology to support nursing education and permanent training about semiotechnique and semiology of preterm newborns.

2 OBJECTIVE

To describe the development process of educational software about semiotechnique and semiology of preterm newborns.

3 METHODS

The construction of the educational software was based on the pedagogical reference framework of Paulo Freire’s problem posing education.

The problem posing pedagogy should promote a conscientization process that is at the same time a creative act capable of generating other creative acts, and an educative vehicle in which people are active beings. This problem posing education, as opposed to “banking” education, implies a constant act of unveiling reality, with a view to emerging awareness, resulting in the critical insertion of man into reality. Its goals are social transformation, experience exchange, questioning, individualization and humanization. Thus, problem posing education commits to a program, to contents, which results from the presentations of its existence, challenging the student to seek answers at the level of reflection as well as action. Thus, educator and student seek the content for study together, mediatized by the environment, by reality (1).

It is known that all living beings learn through interaction with the environment. All conducts are learned in an environment, and all environments have the capacity to educate, provided that we know how to perceive them and relate to them in a significant way.

If an environment serves as a facilitator, hence, it can be affirmed that pedagogical techniques do the same.

In the digital learning environment, students can easily interact with the content, which permits the rapid location and immediate availability of information that is wanted. Hence, depending on their interest, needs and desires, students can go deep into a text (2).

For the software development, the model proposed by Bernardo (3) was used, with four development phases: definition of scope (research and brainstorming; definition of content and scope; user characteristics; analysis of hardware and software resource availability; initial elaboration of the interface; collection of media resources; approval of the phase), planning (content organization; construction of presentation flow gram; design of the interface; chronological planning; verification of necessary and/or additional financial support and computer resources (hardware and software); prototyping; approval of the phase), production and implementation, facilitating the construction process in didactical terms.
The project was submitted to and approved by the Review Board at the University of São Paulo at Ribeirão Preto, protocol number 0334/2003.

4 RESULTS AND DISCUSSION

This research is part of a larger project that, among other areas of interest, looks at knowledge and technology production for health education to children and families, permanent education and training for nurses in care delivery to newborns, children and adolescents and their families. Thus, the use of didactical-instructional material like educative games, folders and software has been developed and analyzed. In the context of Nursing Care Systemization, the development of this educational software supports the teaching-learning process of the first phase of the Nursing Process. In continuation, another software program on learning for Nursing Diagnosis is under development.

In the scope definition phase, the goal of the educational software construction was defined, which was to help undergraduate nursing students to develop the necessary knowledge and skills on semiotechnique and semiology of preterm newborns.

The need to address semiotechnique and semiology derives from the fact that this is fundamental content for undergraduate education in Pediatric and Neonatal Nursing, including comprehensive and complex contents presented through theoretical and practical classes. Initially, students are not able to evaluate the latter education strategy.

Moreover, preterm newborns can be neither exposed to environmental temperatures for extended period, nor excessively stimulated for semiotechnique and semiology teaching. Their biological fragility and specificity causes anxiety, insecurity and fear of manipulating the babies among the students, turning the software into an early approximation of the countless findings during the clinical assessment. Other factors are the need for minimum manipulation of many of these babies and the care humanization policy in neonatal units.

Some educators have attempted to add new knowledge to teaching practices and computer resources to educational practices. The importance of students’ having contact with educational software is highlighted. In this sense, the lack of computer programs developed in Portuguese represents an obstacle (4).

In developed countries, educational software development is intense. In Brazil, despite the lack of computerized educational material that can help in the rapid connection between theory and practice, the number of development initiatives has expanded, especially in the 21st century.

Hence, the decision to develop educational software originated in the intent to problematize the context of the teaching-learning process about semiotechnique and semiology of preterm newborns, in the attempt to overcome the barriers permeating this theme. This implies the constant unveiling of the reality (1) that led to reflection and action, with a view to transforming reality.

The software content was treated in a non-linear way, increasing the students’ motivation, possibility of information exchange and mutual interaction and permitting Access to knowledge according to individual interests.

Non-linear knowledge presentation was chosen because, when using the software, it allows the students to exercise their flexibility, promote intellectual freedom and creativity to navigate through different routes and construct their knowledge actively, respecting each person’s own rhythm. These are premises of problem posing education.

The opposite of problem posing education is “banking” education, based on a linear logic of knowledge adoption and reception (1).

During the software construction period, the authors accompanied students in theoretical-practical activities at neonatal units. The doubts, difficulties and anxieties they expressed in daily clinical assessment practice of preterm newborns and the observations and
suggestions they included in their course evaluation about which contents should have been better explored provided substantial support for the content and scope of the software.

Hence, the content selection was performed, among other sources, with the help of the agents involved in the teaching-learning process about the theme.

Problem posing implies the agents’ participation in the construction of their knowledge, in experience exchange and in inquiries about their reality\(^{(1)}\).

The software content was organized in four parts: 1. presentation, also including justification and goal of the software; 2. semiotecnique; 3. semiology; 4. Simulations, with questions in a random sequence, multiple choice and feedback about right or wrong answer, with a view to testing the knowledge obtained by using the software. Learning was considered adequate when the student answered at least 70% of the questions correctly. The program also contains links, references, a technical file and a gallery (media base).

The development of the simulations was based on problem posing, aiming for the critical insertion of man in his reality. The problems that exist in the students’ daily experiences are systemized and theorized with a view to a diagogic and participatory relationship, stimulating students to reflect and act\(^{(1)}\).

The educational software simulations present daily situations and users raise hypotheses and choose the alternatives they consider most adequate for the presented problems. In the simulations, feedback about what was learned is another problem posing education strategy.

Having a computer is enough to use the software, which is available on CD-ROM. Possible usage locations include classrooms, informatics rooms, hospitals and homes. It can be used at different times in undergraduate programs and in professional training, as contents will be elaborated further according to the curiosity and need of those involved in the process, with a view to greater significance.

Visual and esthetic information aims to facilitate learning and makes effective use of non-verbal communication, including emotional signals that motivate, direct or distract. Information organization can both help users to understand the message and cause an overload. The organization and presentation of the information can even affect screen functionality. Adequate lay-out is much more than merely decoration. All visual pieces of information influence one another and depend on the context they are inserted in\(^{(5)}\).

The functional structure of the screens is the same. All screens have the same icon and color distribution, with a white background and green titles; red was used for subtitles and blue and black for texts.

A neutral color is recommended for the background. This increases the visibility of other colors and makes the text more readable, as backgrounds with very dark colors increase visual fatigue. Monochromatic colors are recommended for the text whenever possible\(^{(5)}\).

To start navigating on the initial screen, the user should click on the central image, as indicated at the bottom of the screen, to access the menus, icons and tools, which is why the latter are less illuminated. If the user does not perform this interaction within 15 seconds, the program will do it automatically (Figure 1).
FIGURE 1. Initial screen of educational software *Semiotechnique and semiology of preterm newborns*, with the main menu on the right and another on the left, facilitating navigation.

As from this screen, the user can see the main menu on the right side. On all screens, the left side contains a menu with buttons to make navigation easier, such as previous and next section; previous and next page; menu; home; search; help and exit. The bottom part of the screens displays a toolbar to access additional contents, among others (Figure 2).

FIGURE 2. At the bottom, the screens display the toolbar to access additional contents.

One of the icons (magnifying glass) in the left menu represents search, which contains a database. It leads to a window in which the user can type a word to visualize all screens on the CD-ROM containing that word and how to access them, if requested (Figure 3).

FIGURE 3. The menu on the left offers a search tool by key words.

The authors found that all software programs found in literature presented a distinctive characteristic. Some use only one type, others a set of different media. Some are not integrated with a pedagogical reference framework, while others used different frameworks.

Although the programs found were developed and validated for nursing students, they do not offer easy and fast access to the program, as they are not self-extracting. Some program structures are not flexible, not allowing users to navigate freely. Instead, they have to go through a module and do the exercises. It is only when they get 70% of answers right that they can move on to the next module, and so on.

To advance in this respect, *Semiotechnique and semiology of preterm newborns* is self-extractable, differently from previous software that demanded installation. This can cause feelings of impotence and lack of knowledge about technology among users. The menus on the software screens were constructed with a view to free navigation, in a non-linear and flexible structure. The authors believe that, if they are able to move wherever they want in the software, this will increase users’ interest and stimulate their learning.

The authorship software Authorware® consists of 390 Mb: 50 Mb for the text module; 30 Mb for simulations; 6 Mb for gallery; 140 Mb picture; 24 Mb figures; 135 Mb, videos and 5 Mb for sound. The estimated duration is 25 hours of navigation.

The implementation phase aimed to make the software available for use and supervise its functioning. The content and face validation of the software, which were part of this phase,
were described in an earlier study \(^6\). Validation involved technological and nursing specialists, which considered most of the items under analysis as good and very good.

In the implementation phase, implantation, post-implantation review and distribution were not part of this study and will be discussed in the future. However, for these technological resources to be made available in academic activities, they need to be in line with a renewed Political Pedagogical Project, within a competency-based and integrated curriculum. Education needs to be articulated with the labor world, using the pedagogical framework of critical-reflexive education, based on problem posing and, hence, on significant learning, in which students play an active role in constructing their knowledge.

Technology use in the teaching-learning process is totally justified when considering that one of the basic goals of education is to prepare students to be citizens in a plural, democratic and technologically advanced society \(^7\).

Hence, technology needs to be used in education on a constant basis. Nowadays, technology is closely linked with and undistinguishable from education. Its use is in line with new educational proposals, as traditional teaching, hardly dynamic, does not always offer the real experience and the connection between theory and practice computers permit.

The enormous growth in demands for specialized skills and knowledge in nursing, the trend towards greater use of sophisticated medical technologies and the lack of sufficiently experienced professionals in these new areas have influenced changes in nursing education in recent decades \(^8\).

Active learning methods aim to replace memorization and simple information and skills transference by knowledge construction based on the experience of real or simulated situations in professional practice, stimulating critical analysis and reflection skills and learning how to learn. The software developed works in this direction.

5 FINAL CONSIDERATIONS

Developing educational software demands educational, technological and scientific efforts, which requires long-term commitment.

Although the main users of this educational software are undergraduate nursing students and nurses in training and permanent education programs, it can also be used by students and professionals from related areas who perform clinical assessment in their professional practice.

The authors consider that the developed product is adequate for use in nursing teaching about semiotics and pediatria of infants and semiology of premature infants. Further studies will evaluate how it is put in practice. Moreover, contents will be updated and other media resources will be added, according to the evaluators’ suggestions.

As a result of the problem posing strategies, the software does not follow a strict sequence, it is not linear. The content selection prioritized the statements of agents involved in the teaching-learning process of the theme under analysis, and the simulations present students’ daily experiences, enabling them to make choices and get feedback on their learning.

The authors consider that this educational software allows for innovative teaching about the pediatria of premature infants, based on the use of informatics resources, active methods and new pedagogical approaches, favoring the teaching-learning process and individualizing learning.

Existing experiences in educational technology development and use in the health area and particularly in Nursing reveal the need to assess not only the technological products that were constructed, but also to what extent these have contributed to the teaching-learning process, focusing on their impact.
There is a need to go beyond the development of educational material. Hence, in continuation of this study, as researchers of the Research Group on Nursing in Care for Children and Adolescents (GPECCA) at the University of São Paulo at Ribeirão Preto College of Nursing, WHO Collaborating Centre for Nursing Research Development, Brazil, the authors assume the responsibility and commitment to validate the educational software *Semiotechnique and semiology of preterm newborns* in the main target population, and to assess the impact of its use in the teaching-learning process, within the approach of problem posing education.

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