

ORIGINAL RESEARCH

Development of a learning object for caring for the sensory environment in a neonatal unit: noise, light and handling

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Abstract

Background: The environment in Neonatal Intensive Care Unit (NICU) can contribute to the occurrence of stressing situations involving the hospitalized newborn, the family and the health team, due to inappropriate sensory stimuli.

Aim: To describe the experience of constructing the Learning Object (LO) about the sensory environment (noise, light and handling) in a NICU.

Methods: A LO about the environment in a NICU was developed in Flash® for WEB, utilizing participative methodology in company with the unit's team, focusing on sensitizing the team about the effects of noise, light and handling, and about the strategies for their reduction.

Results: The participants understood the importance which attention paid to the environment of the NICU plays in the development of the newborn. The LO was organized into theoretical modules with the insertion of multimedia and a simulation module.

Conclusion: The LO is considered appropriate for use in the training of nurses and in the educating of NICU health care professionals on the neonatal unit's environment. For this teaching tool's efficacy in the education of health teams and the family to be verified, however, it will need to be applied practically.

Key words

Neonatal nursing, Health education, Environment, Educational technology, Intensive care units

1 Introduction

Neonatal intensive care units (NICU) can cause sensory stimuli which are inappropriate to the development of newborns, especially premature babies, due to the burden of events inherent to its character, principally the high level of activities with equipment sounds, alarms, telephones and voices, and the large number of workers and students. This reality of a physically and psychologically aggressive environment in neonatal units, especially when the noise, lighting or handling is

excessive, is very often far from the sensory environment which is ideal for the recuperation of hospitalized babies, for the insertion of their families or for the work of the health care team itself ^[1, 2].

Due to the negative effects which an inappropriate sensory environment has on babies, it becomes relevant to develop educational activities concerning the control of noise, lighting and handling which goes beyond taking measurements. This provides the health team with continuing education and the families which accompany the babies with health education, and focuses on developing and making people aware of attitudes which improve the environment during the care routines provided ^[3].

Thus, motivated by the need to offer educational materials which energize educational activities in neonatal units, and provoked by the possibilities which the computer presents, we felt stimulated to develop a Learning object (LO) in collaboration with the health care professionals, which might contribute to the fostering of healthy sensory environments, with a special focus on the health of babies and workers in neonatal units and, consequently, on their quality of life.

The term 'Learning Object' can be utilized as a synonym for digital educational material and educational software, and has the characteristic of being re-usable, which differs it from other materials. For teaching, LOs are fundamental tools, and are an important and viable alternative for fostering the construction of knowledge in Nursing ^[4]. The LO is an indispensable building block for nursing to have rapid access to information and to construct and update knowledge ^[5].

So, the aim of the study is to describe the experience of constructing the Learning Object (LO) about the sensory environment (noise, light and handling) in a NICU. Accordingly, this study presents the process of building a LO in collaboration with the NICU health care professionals.

2 Subjects and methods

For the development of the LO we used a model ^[6] which has four steps: scope definition, planning, production and implementation.

Scope definition: We believe that for LO being considered significant by NICU health care professionals and an effective training tool, it should be built in collaboration with them. So we decided first carry out circles of discussion ^[7], in a qualitative perspective, about noise, light and handling, and about the strategies for their reduction.

The discussion circle, according to Paulo Freire ^[7], allows people to discuss about their opinions relevance and values according to the topic. Thus, the discussion circle was used to determine the issues to be addressed in the LO. It is important to note that in this type of data collection, all contributions and statements of the subjects were valued, to ensure that individuals expressed their views freely. The discussion circles were videotaped with the permission of the subjects so that all the information and expressions could be analyzed. For the planning of the LO content, the neonatal unit's health care professionals were involved in the study because the authors believed that they should be active subjects in the process of change in the unit's levels of noise, handling and lighting. The inclusion criteria for subjects were to be working regularly in the neonatal unit. So 43 subjects participated in the study (06 nurses, 20 care assistants, 01 teaching doctor, 04 doctors working in the hospital, 03 resident physician, 01 psychologist, 02 audiologists, 01 social assistant, 04 health care assistants and 02 administrative assistants), selected randomly and who worked in rotating shifts, such that the study included health professionals who worked at different times of the day and night.

From a total of 63 public servants 43 were included, excluding those who were on any kind of leave, vacation or retirement. Age varied from 25 to 55 years old, with 83.2% in the 35-39 range and predominantly women (99%). Regarding education, 90.7% had a university degree, 10.7% had high-school education. About working experience varied from 2 to 24 years.

Nine discussion circles^[7] with the neonatal unit's health care professionals developed during work time, with an average of ten participants per meeting, with the following questions being used to stimulate discussion: What is the relevancy of the LO about noise, handling and lighting, and of the strategies for their reduction? What themes and their contents should be treated in the LO?

In order to analyze data, we used the Thematic Analysis Technique from Bardin^[8], which means discovering the meaning which together makes up communication, and whose presence or frequency means something for the objective of the analysis^[8]. The discussions were grouped according to similar themes and served as a guide for researchers to develop the content of the LO based on scientific evidence. To preserve anonymity, the subjects were identified by sequence (P1, P2... P43).

Planning: After defining the content and suitability, we conducted the organization to plan how this would be arranged within the LO^[6]. Aiming at developing the LO, we chose to use Flash® for WEB, which was organized in theoretical modules with multimedia inserted (still images: photos and figures; moving images: videos, animation; sound; texts) and a simulation module. The LO has full interactivity with simulation constructed through scenarios which are typical in a neonatal unit, plus 2D animated characters.

The Flash software, developed by Macromedia, is a type of technology used in the web that allows you to create lightweight animations that take little time to load, so the program makes a smart storage of images and sounds used in your animations through libraries, to optimize the file size. This enables us to provide visual elements that give life to the program developed. This software has been used frequently to develop LO to be used in health sciences, especially in nursing and medicine.

Production: The goals of this stage were to build the project, joining in the sketches of the screens and to conclude the final layout of the screens^[6]. The media were processed in specific programs depending on their nature.

Implementation: It aimed at making the multimedia project available for use and at supervising its use^[6].

The development team conducted the first functional tests and then the LO was tested by personnel not involved in its production.

This study does not report on all stages of the implementation phase, because the final review of its post implementation period among nursing students and health care professionals is under development.

The study satisfied ethical questions linked with research and was approved by the institution's Research Ethics Committee.

3 Results

3.1 Constructing the Learning Object's content

In relation to the LO's relevancy to noise, handling and lighting which are excessive for newborns, the interviewees showed that they were involved with, and understood the importance of, this teaching material in the care of babies:

"My name is P2, I'm the nursery's assistant doctor, I want the babies' well-being at all costs, whatever the specialty, I always pursue this and hope that all should do so, with pleasure. I both want the babies' well-being and work for it, and so hope that this program will work out." (P2)

“This experiment is extremely valid, and right now we’re here in the nursery, which is our focus, and, if it works out, we’re going to take it to other sectors of the hospital. We’re here to give support and help wherever we can.”
(P15)

Most of the participants, principally the nurses, who spend the most time in the NICU, articulated that background noise also causes alterations to the health team itself, such as stress, tiredness and compromised performance, and physiological alterations such as pains, nausea, cardiac and gastric alterations and variations in arterial pressure. Thus, production of educational materials such as LO can also be a way to discuss the health of the workers, who are also exposed to noise and lighting.

The noise irritates us; we get irritated with that noise that never stops...we need to learn how to stop it... (P19)

...my stomach aches because I get agitated. (P8)

From thematic analysis the participants indicated which themes and their subthemes should be worked on in the LO: the concepts of noise, handling and lighting, what leads to excessive noise, handling and lighting in the unit, the effect of excessive noise, handling and lighting on the newborn, health professionals and family members, and strategies and mechanisms for the reduction of excessive noise, handling and lighting in the neonatal unit.

Based on the issues raised by NICU health care professionals, the researchers proposed the following contents, considering scientific evidence: reduction in the intensity of voices and light; reduction in the volume of equipment’s alarms and fixing notes on wastebaskets and incubators for careful use; placing anti-impact sticky pads on the doors of cupboards and drawers; reduction in the intensity of the telephone’s ring; group discussion of the problem of noise and attempting to spend the night shift along with other members of the nursing team, raising opinions and suggestions from the team for reduction of periodical noise; a competition for phrases for putting up on posters in the neonatal unit; periodical measuring of sound pressure levels, a reduction of the number of people in the interior of the unit, avoiding putting direct light on the baby; complying with protocols for low light levels at night; covering the incubator; grouping care actions to let the baby sleep for a set period without interruptions; keeping the premature baby in an appropriate position; using cushions and rolled-up towels around the premature baby; the families participating in the care of their child in the periods in which they are in the neonatal unit; giving the premature baby skin contact as long as he or she wants; and others.

3.2 The technological development of the Learning Object

With the themes listed by the participants in the study’s discussion circles, the authors elaborated the LO’s contents, based on the scientific literature and on consultation with experts in noise, lighting and handling.

Some of the multimedia implemented in the LO were captured in the NICU itself by photographing or filming, after authorization from the team and the parents of the hospitalized babies. Other media were recorded from free online data-banks specialized in images and sounds. To put the LO together, the development team also created still and moving images and sound.

For developing the LO the authors opted for using Flash® for WEB, which was organized in theoretical modules with multimedia inserted (still images: photos and figures; moving images: videos, animation; sound; texts) and a simulation module.

The justification for, and objectives of, the LO appear in the theoretical module, as well as a specific module on the neonatal unit and another on the components of the sensory environment. The NICU is represented with animation, using a photograph of a neonatal unit with all technical apparatus with, simultaneously, the next animation image, an unborn baby. In the ‘neonatal unit’ link, the authors brought back to life historical aspects of neonatal care and current

modifications. There is also a presentation of the procedures which are carried out on the baby in this unit, demonstrating the excessive lighting, noise and handling and that the care must be given in a holistic and humanized way. The authors also presented the physical structure of the unit, contextualizing its localization, the human resources who work there, and also an interactive map which depicts the physical layout of the neonatal unit and the critical points for excessive noise, light and handling (on passing the mouse over each figure, the object is identified). The components of the sensory environment: noise, light and handling (tackling conceptual aspects, definitions and measurement units, consequences from excessive noise, lighting and manipulation for the baby, the resources which they bring about, the appropriate level needed, and how to reduce lighting, handling and noise).

The simulation module has full interactivity through typical scenarios in a virtual NICU with 2D animated characters, this being a digital educational game with simulations of actions of care related to noise, handling and lighting. The user, represented by a virtual health professional, makes choices between two possible outcomes, testing the learning acquired through use of the LO.

The LO also has links: references: team and collaboration; do-it-yourself; and evaluation of the LO. In the “do-it-yourself” link, there are models of cards which may be printed by visitors to the site, to be used in their own neonatal units. These cards have pictures of preterm babies along with phrases such as *“I’m sleeping”*, *“silence is treatment too”*, *“touch me with tenderness”*, and *“wash your hands before you touch me”*, among others.

The implementation was initiated in the construction of the LO when we did a link of “do-it-yourself” where the participant can print cards for reduce noise, light and handling. We are using the LO to training the health care professionals and it will be part of future studies.

4 Discussion

During the carrying-out of this study, the authors observed that technology is being increasingly utilized in professional training, especially the development of LOs, which has intensified in the last few years, principally in teaching and research centers.

The choice of encouraging health care professionals to participate in the construction of the LO had the aim of stimulating the exchanging of experiences based on real situations experienced in NICU, as well as sensitizing them to the development and use of LOs for their own updating, in the training of the health team, and in health education activities for the community. In the hospital where the study was carried out there are more than 60 health care professionals directly involved in the care of the newborn and their families, and the authors’ attention was drawn to these people’s low involvement – a situation already demonstrated by other studies ^[9, 10].

The strategy of sensitizing for health education must contribute to individual and collective awareness of the population’s responsibilities and rights, stimulating popular participation ^[11-13]. The authors emphasize that one should welcome educational strategies which involve the multidisciplinary team, valuing the exchange of experiences and knowledge so as to promote a healthy environment in NICU and the use of new technologies, with a view to digital inclusion.

Programs for consciousness raising among health care professionals were also mentioned by interviewees from a NICU, such as an initiative for reducing sound pressure levels ^[11], while others noted the implantation of care protocols directed at the health team and NICU clients such that they should take actions to control noise and build more humanized care. The sharing of the responsibilities of the team and the institutional leaders, such as in the collective discussion for the development of this LO, is crucial for the successful reduction of factors which hinder the newborn’s development in the NICU, which requires continuous education, changes in the environment, and implementation of strategies for evaluating improvements in quality ^[11-13].

Faced with the confirmation of the presence of stressing factors, is necessary an interdisciplinary and intersectorial intervention so as to reduce and control them, including a set of actions directed at the physical infrastructure, at both human and technological resources (health professionals and the new-borns' families), many of them mentioned by the interviewees and in the literature ^[11-12, 14].

The conceptual and methodological bases behind the construction of the LO developed have, as a reference, the contemporaneous debate about health promotion and prevention of harm to the newborn, aligned with the vision of health education in the context of popular education ^[7]. As for the technological development of the LO, the attention to the recommendations for the functional structure of the screens contributed to the appropriate evaluation of the interface ^[15].

The visual information and esthetics have the objective of facilitating learning and using non-verbal communication effectively, including emotional signals which motivate, encourage or distract. The organization of information can as easily help the users to understand the message as leave them overloaded. Depending on the organization and presentation of the information, even the functionality of the screen can be affected. An appropriate layout has a function far greater than simply being decorative, as all the visual pieces of information influence each other and depend on the context in which they are inserted ^[15]. A neutral color is recommended for use as background, as it increases the visibility of the other colours and makes the text more legible, just as a background with darker colors increases visual tiredness. The use of colors such as blue for the texts is justified by the physiological characteristics of human vision, which uses fewer photoreceptor cones for this color, thus not causing visual fatigue ^[17].

The kind of content in the pages was organized such as to avoid a scroll bar ^[18]. This option offers a better special orientation and there is reference to the content (citing the page), while the scroll bar on a single page causes the guidance in relation to the content to be weakened. In the light of this, it was decided to use forward/backward buttons on the graphical user interface, as recommended, to aid navigation between different screens.

The use of a LO should allow the user to establish her learning rhythm, that is, she should have the right to choose where she studies, to establish her study rhythm and to have access to coherent information and interactivity ^[9]. Thus, the authors believe that the LO presented in this study, being available on the Internet, meets these criteria. Apart from this, the fact that the LO is not constructed in a linear form permits the user to interact as they see fit, following their own learning style.

In this aspect, the interactivity motivates the user of the technology; the multimedia has a key role in this scenario ^[9, 16, 18-19].

The construction of the simulations in the present LO - the creation of the environment and of the objects there - was developed based on a model of the real world, obtained by digital photographs of the NICU in the university hospital which had been used for data collection for this study, which is the practice location for undergraduate and post-graduate courses, extension projects and research, permitting greater realism.

The simulation consists of the creation of dynamic models of the real world, which present as a benefit the reproduction of phenomena from reality, such as experiments. With access to Virtual Reality, computer simulations can be utilized in the teaching of nursing procedures, making it possible to reproduce procedures involving nursing care with far greater realism, thus allowing the demonstration and carrying-out of aspects of technique which are not possible with traditional simulation ^[20].

A systematic revision on the use of simulations in teaching, however, demonstrated that further research is needed to prove the efficacy of the use of simulations as a teaching tool ^[21]. Simulations which are up to the job are difficult to develop due to the computational complexity and the sound and graphics resources which make the simulated situation as close to reality as possible. Despite the problems involved in the implementation of simulations with these characteristics, the authors believe in the potential and possibilities offered by the use of this technology for permanent education about the

NICU environment, for professionals and students who work in neonatal intensive care and therapy units, with a view to improving the quality of life for babies who are hospitalized and for their relatives who stay there ^[21].

5 Conclusion

Currently, there are a large number of innovative technologies, and an almost unbridgeable distance between them and nurses' daily practice. With this initiative, the authors intend to help with digital inclusion, encouraging the health team to utilize the new technologies. Thus, it is hoped that the frequent use of the computer as an instrument fit for using in educational activities may encourage the health team and promote new ways of learning and teaching, inducing the team to create and use LOs and, what is more, use active and participative methodologies in their daily routines.

This being so, the authors emphasize the importance of educative strategies bringing together the multidisciplinary team, valuing its potential in the exchange of experiences and knowledge in support of a healthy environment for new-borns undergoing therapeutic processes in the NICU.

By making it possible for the health team to be involved in the construction of the LO, they are widening the vision of hospital care beyond the illness and the acquisition of knowledge and values, contributing to continuous education and stimulating creativity and – by presenting these new ways of caring, learning and teaching – they are making it possible to experience more critical and reflexive care. The LO is appropriate for use in training nurses and educating NICU health care professionals about the environment in NICU.

Its relevancy is shown by the creative and innovative proposal for interventions in attention to the specialized health of newborns, contributing to the training of human resources in health and to the process of the construction of reflexive, holistic and humanized care.

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